Bank Resolution Regimes and Systemic Risk*

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Abstract

Using a novel and comprehensive database on bank resolution regimes in 22 member countries of the Financial Stability Board, we analyze how systemic risk at bank level changes in response to system-wide and bank-specific shocks, depending on the prevailing bank resolution regimes. We find that systemic risk increases more for banks in countries with more comprehensive bank resolution frameworks after negative system-wide shocks, such as Lehman Brothers' default, while it decreases more after positive system-wide shocks, such as Draghi's "Whatever it takes" speech. In contrast, systemic risk increases less in countries with more comprehensive bank resolution regimes in the case of bank-specific negative shocks, such as Deutsche Bank's loss announcement in 2016. These results suggest that bank resolution rules are effective in dealing with bank-specific shocks, while they may exacerbate the effect of system-wide shocks.

JEL classification: G01, G21, G28

Keywords: Bank resolution regimes, bail-in, systemic risk.

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1 Introduction

Lehman Brothers' collapse and the subsequent widespread bailout of financial institutions on both sides of the Atlantic laid bare the inadequacy of bank resolution regimes worldwide. In the absence of effective tools to manage bank failures, governments preferred to bail out banks to avoid the contagion effects of a disorderly bank default on the financial system rather than risking "another Lehman". This bailout activity put a strain on public finances, contributing to the sovereign debt crisis in the euro area.

For effective bank resolution, general insolvency regimes are too slow and they fail to take into account systemic repercussions that propagate fragility shocks through the overall financial system. The experience of the Global Financial Crisis has therefore led to a major overhaul of bank resolution frameworks across the globe, and especially in the member countries of the Financial Stability Board (FSB), based on a number of global best practices aimed at providing authorities with sufficient powers and control over the resolution of banks (FSB, 2011). However, it is unclear whether more advanced resolution regimes are indeed able to contain systemic risk in a crisis. We therefore exploit the variation in resolution regimes across countries in order to analyze how bank resolution regimes affect systemic risk after fragility shocks. To this end we compile a database on bank resolution frameworks across 22 advanced and emerging countries (FSB members) and empirically analyze the effectiveness of these frameworks in containing system-wide and bank-specific fragility shocks. Our results suggest that more comprehensive bank resolution frameworks help to prevent risk spillovers from bank-specific shocks, while pointing to their limitations in containing system-wide fragility shocks.

Academic and policy studies argue that a special bank resolution regime may improve financial stability and lower fiscal costs, compared to ordinary corporate liquidation procedures (see, for instance, Čihák and Nier, 2009, BIS, 2011, and Avgouleas et al., 2013). For instance, a "bail-in" clause allows recapitalizing banks at the expense of creditors rather than taxpayers while protecting depositors. At the same time, a bail-in is supposed to reduce systemic risk by reducing ex-ante risk-taking incentives, which in turn can reduce the probability of financial crises and hence systemic risk. However, bail-in clauses might also make banks more vulnerable to adverse events and thus destabilize the

financial system in the middle of a crisis. Such a destabilizing effect may occur through direct interlinkages, when banks are holding each others' claims, but it may also arise due to information effects: When a bail-in occurs at one bank, this may contain information about the probability of a bail-in at other banks. Such expectations may become self-fulfilling and give rise to or reinforce a systemic crisis. Which of these opposing effects dominates is an empirical question.

This paper compiles a novel database on bank resolution regimes across 22 advanced and emerging markets, including the tools and powers of resolution authorities for the period 2000 till 2015. We gauge the change in systemic risk contributions of 760 banks, as measured by the change in the conditional value at risk (ΔCoVaR, Adrian and Brunnermeier, 2016), after eight different shocks to the financial system, depending on the comprehensiveness of bank resolution frameworks. The analyzed events include negative system-wide shocks (such as Lehman Brother's collapse in 2008), positive system-wide shocks (such as Draghi's "whatever it takes" speech in 2012), as well as negative bank-specific shocks (such as the failure of the Portuguese Banco Espírito Santo in 2014). An analysis of the relationship between the occurrence of systemic crises and resolution regimes may suffer from endogeneity bias because bank resolution legislation might have a higher chance of being adopted in countries that are more likely to suffer from financial distress. We employ a difference-in-difference estimation framework in the spirit of an event study, which allows us to address such concerns by focusing on the differential effect of largely exogenous shocks on banks' contributions to systemic risk across countries with different resolution frameworks, while controlling for other differences across banks and countries.

Our results suggest important differences in the role of bank resolution regimes for systemic risk, depending on the type of shock – *system-wide* or *idiosyncratic* – and on the direction of the shock – positive or negative. Specifically, we find that in countries with more comprehensive bank resolution frameworks systemic risk increases more after negative system-wide shocks and decreases more after positive system-wide shocks. In the case of idiosyncratic negative events, however, we find that systemic risk increases *less* in countries with more comprehensive bank resolution legislation. These results suggest

that bank resolution rules are effective in dealing with bank-specific events, while they exacerbate system-wide events. These findings point to the limitations of bank resolution frameworks in dealing with system-wide shocks.

Our paper relates to several strands of literature. First, there is a small but growing literature on bank resolution, which has gained momentum after the Global Financial Crisis. One important strand of this literature contains regulatory reform proposals that attempt to address the externalities caused by implicit government bailout guarantees (e. g., BIS, 2011; Acharya, 2009; FSB, 2011, 2013; Beck, 2011). In their core, these reform proposals have similar features: reducing the complexity of systemically important banks, developing a framework for efficient burden sharing in case of bank default, and making the resolution regimes across different countries compatible, such that they provide common rules for the resolution of cross-border banks (Avgouleas et al., 2013). The more recent literature contains simulations of bail-in events with different magnitudes of severity (e. g., Hüser et al., 2017), empirical studies based on specific bail-in events (e. g., Schäfer et al., 2017; Beck et al., 2018), and bank resolution case studies (e. g., World Bank, 2016). Our paper is the first study to gather cross-country data on the changes in bank resolution legislation and to relate these to systemic risk in the banking sector, based on a large sample of banks.

Second, our paper relates to the literature on systemic risk and its drivers. After the failure of Lehman Brothers in 2008, which most observers see as the trigger for the Global Financial Crisis, it became clear that not only was there no single definition of systemic risk, but that there was also no single way to measure it. A number of systemic risk measures have gained traction and are now widely used by researchers, such as the Conditional Value at Risk (ΔCoVaR, Adrian and Brunnermeier, 2016), the Marginal and Systemic Expected Shortfalls (MES and SES, Acharya et al., 2012), and the Capital Shortfall (SRISK, Brownlees and Engle, 2012). While many papers have used systemic risk indicators as explanatory variables to proxy for systemic risk (see, e. g., Barth and Schnabel, 2013, and Beck and De Jonghe, 2013), there is also a growing literature on the determinants of systemic risk. Brownlees and Engle (2012) find that, in addition to market-to-book ratio, SRISK depends on maturity mismatch and return to equity.

Huang et al. (2012) find strong evidence that the MES of 19 big US banks depends on the bank's probability of default as well as its correlation with the other banks in the sample. Brunnermeier et al. (2012) find that systemic risk (proxied by CoVaR and SES) depends on the bank's market-to-book ratio, leverage, total size and the size of non-core business. Brunnermeier et al. (2019) analyze the relationship between asset price bubbles and systemic risk at bank level (CoVaR and SES), stressing the role of bank balance sheet characteristics in the build-up of systemic risk. Our contribution to this literature is to use the resolution legislation and its interaction with system-wide events as identification devices to systematically analyze the effect of bank resolution regimes on systemic risk.

It is important to note the contribution but also the limitations of our analysis. This paper assesses the effectiveness of bank resolution frameworks in containing or propagating fragility shocks across banks in a crisis. It does not study the ex-ante incentive effects of resolution regimes on banks' risk-taking and their impact on the probability of financial crises. Hence, it cannot provide a full evaluation of bank resolution regimes. Rather, our paper *warns against too high expectations* of the power of resolution regimes of containing system-wide crises. If spillovers to the financial system in crisis times cannot be avoided, this may, however, also put in question the positive ex-ante effects because bail-in might no longer be a credible strategy during systemic distress episodes. A second important contribution of our paper is that it presents a *broad database* on the characteristics of bank resolution regimes in FSB member countries over an extended time period, compiled on the basis of national legal texts and accompanying documents, and complemented by a broad-based survey among central banks and supervisory authorities. This database is interesting in itself because it provides a comprehensive view of the evolution of bank resolution regimes across countries since 2000.

The remainder of the paper is organized as follows. Section 2 discusses the institutional details regarding bank resolution and defines our bank resolution index. Section 3 outlines the empirical strategy and briefly describes the data, while Section 4 presents our results. Section 5 concludes.

2 Bank Resolution Regimes

2.1 Corporate Insolvency vs. Bank Resolution

Bank resolution can be defined as the orderly wind-up or restructuring of a bank in contrast to a (potentially disorderly) liquidation or a bailout using taxpayer resources for recapitalization. Overall, there are two types of regimes to deal with bank failure: regimes based on corporate insolvency law where proceedings are court-based, and regimes based on a special bank resolution regime where proceedings are handled by a resolution authority. Čihák and Nier (2009) argue that special bank resolution frameworks lead to gains in efficiency in terms of the trade-off between fiscal costs and financial stability impact. This trade-off is presented in Figure 1.

General corporate insolvency (GCI) focuses exclusively on the failed institution and aims at satisfying creditors, thus not taking into account the impact of a bank failure on the stability of the financial system (e. g., through negative externalities for other financial institutions). It ignores the fact that the banking system is based on confidence and that its loss can trigger bank runs and contagion via the interbank market and cross-exposures. Neither does GCI take into account a bank's importance in its functions of providing funds to firms and consumers, deposit-taking, settlement of payments, or transmission of monetary policy. And most critically, GCI generally applies too late, namely when the bank is already no longer viable. Timelier action may, however, be legally problematic as it interferes with creditor and shareholder rights. The procedures under GCI are lengthy also because the authorities lack specific tools to wind up banks.

In contrast, a special bank resolution regime takes spill-over and macroprudential concerns into account by taking a systemic perspective. It may override shareholder and creditor rights based on an ex-ante legal foundation (bail-in), and it reacts in a timely manner. Moreover, it provides special resolution tools to deal with complex banking institutions. Thereby it can minimize fiscal costs (through bail-in) and help preserve critical functions of financial institutions. Figure 2 presents an example of a resolution of a bank under a hypothetical and well-designed bank resolution regime.

Before the global financial crisis, bank resolution legislation across the globe varied

in terms of intensity and scope, depending on national experiences with banking crises. Figure 3 shows that the United States had the lead in bank resolution reforms in the early 2000s, mostly due to the reforms implemented after the savings and loan crisis of the late 1980s and early 1990s. After Lehman's collapse, the Federal Deposit Insurance Corporation (FDIC) had at its disposal a receivership regime for failed banks where it could sell their good assets and wind down their bad assets. Currently, there exist distinct resolution regimes for systemically important financial companies (Title II of Dodd-Frank Act, DFA) and for insured depository institutions (FDI Act, FDIA). Europe was lagging behind in that respect, as can be seen in Figure 3, which depict the resolution index by country group.[1] For instance, the main legislative documents that established a separate bank resolution framework in the United Kingdom (the Banking Act) and Germany (the Bank Restructuring Act) were only implemented in July 2009 and December 2010, respectively, and were amended several times thereafter.

Until that point, bank resolution legislation had been implemented exclusively at national level. The Financial Stability Board (FSB) attempted to harmonize global efforts and, in 2009, was commissioned by the Basel Committee and the G20 to prepare guidelines for good resolution regimes. In 2011, the Financial Stability Board issued a set of 12 Key Attributes (KAs), regarding, for example, the scope of resolution, the powers of the resolution authorities, and recovery and resolution planning (FSB, 2011). Since then, the FSB follows the implementation of the KAs in its 24 member jurisdictions and regularly issues peer reviews that record the progress of each country. Table 1 lists the FSB's key attributes and their definitions. The Bank Resolution Index, the core of our analysis and described in detail in the next subsection, builds on these key attributes.

The 12 KAs served as a blueprint for the Bank Recovery and Resolution Directive (BRRD) of the European Union (EU). The BRRD harmonises the tools used in the recovery and resolution of credit institutions in the EU. Should a bank fail, its shareholders and creditors, following the credit hierarchy, should normally be first in line to absorb any risks and losses. For the Eurozone, the overall resolution framework includes the Single Resolution Mechanism (Regulation (EU) No 806/2014) based on the tools from

[1] A higher index number refers to a more advanced resolution regime, as explained in more detail below.

the BRRD, as well as a Single Resolution Fund (SRF) to be built up over 8 years from 2016 on. Bank resolution responsibilities are divided between the Single Resolution Board (SRB) and the respective national resolution authority.

2.2 Bank Resolution Index

Data on resolution regimes. The main variable in our analysis is the Bank Resolution Index, which summarizes the comprehensiveness of bank resolution regimes and is based on detailed data on the implementation of reforms to bank resolution regimes in a broad set of countries. Our data collection starts from FSB (2013), which gives information on whether the laws in the 24 FSB member countries include certain resolution powers, tools or provisions at the time of the FSB report. Subsequently, we use the FSB's country Peer Reviews as well as IMF country reports to identify the dates when the respective powers or tools have been introduced into national law. We complement the IMF's series "Safety Net, Bank Resolution, and Crisis Management Framework – Technical Notes" with other IMF country reports or documents in the scope of the Financial Sector Assessment Program (FSAP). We further analyze annual reports by central banks, supervisors or resolution authorities as well as secondary literature and industry reports. Often, we consider the original legal texts, identifying the relevant paragraphs and attempting to find out when a particular feature comes into force. Finally and in order to verify the list of reforms that we collected, we undertook a broad-based survey among the official national authorities responsible for the resolution of banks in our sample of countries between September 2015 and June 2016.[2] The representatives at the resolution authorities were asked to verify the information from our independent data-gathering work (i. e., whether the particular features are present in the country and since when) and complement it when we could not find the data.[3] Our country sample is similar to that in the FSB report. However, due to a lack of data for Argentina and Saudi Arabia, we drop these two countries, yielding a sample of 22 countries.[4]

[2]The list of responsible institutions is available in FSB (2013)

[3]After two reminders, we managed to achieve a 60% response rate, which helped us to improve data quality.

[4]The included countries are Australia, Brazil, Canada, China, France, Hong Kong, Germany, India, Indonesia, Italy, Japan, Mexico, Netherlands, Republic of Korea, the Russian Federation, Singapore, South Africa, Spain, Switzerland, Turkey, the United Kingdom, and the United States of America.

Resolution indices. We construct five subindices that capture the different dimensions of an effective bank resolution framework according to the FSB: *general framework*, *powers*, *tools*, *bail-in framework*, and *support measures*. The subindices are defined as follows:

1. **General framework for bank resolution:** This subindex ranges from one to three, adding one if (i) there is a specific bank resolution framework, (ii) there is a specifically designated resolution authority, and (iii) there is another authority that has the powers to restructure or resolve banks. A higher index of the *General framework* thus suggests a more complete framework.

2. **Powers available to the resolution authority:** This subindex ranges from zero to eight adding one if the resolution authority has the authority to (i) remove and replace bank management, (ii) appoint an administrator, (iii) operate and resolve the bank, (iv) ensure continuity of essential services and functions of the bank, (v) override shareholder rights when applying resolution powers, (vi) temporarily stay the exercise of early termination rights, (vii) impose a moratorium on payments to unsecured creditors and customers, and (viii) liquidate the bank without court decision. Higher values of *Resolution Powers* indicate more wide-ranging powers of the resolution authorities.

3. **Tools available to the resolution authority:** This subindex ranges from zero to four, adding one if the following resolution techniques and tools are available: (i) a transfer or sale of assets and liabilities, legal rights and obligations, (ii) the establishment of a bridge institution, (iii) the establishment of an asset management vehicle, and (iv) a bail-in tool. Higher values of *Resolution Tools* indicate a wider variety of options to resolve a failing bank.[5]

4. **Framework to conduct a bail-in:** This subindex ranges from zero to three, adding one if the following provisions are available in the bank resolution legislation: (i) a minimum requirement of eligible liabilities that can be bailed in, (ii) respect for the hierarchy of claims while providing flexibility to depart from the general principle of equal

[5] As we distinguish between powers and tools, we only include the four explicit resolution tools (transfer of assets and liabilities, bridge bank, asset management company and bail-in) in the category "tools", whereas, for instance, the IMF also includes the power to override shareholders' rights in a resolution authority's toolset. The latter we subsume under "powers". Other characteristics of the resolution framework that we consider important but do not fall in the categories above are designated as supporting measures.

(pari passu) treatment of creditors of the same class, and (iii) public resources may only be used if private ones are not available and a bail-in was conducted. Higher values of *Bail-in Framework* indicate a more complete bail-in framework in the country.

5. **Supporting measures:** This subindex ranges from zero to five, adding one if (i) Basel III has been implemented, (ii) no court decision is needed to resolve a bank, (iii) there is a mandatory development of resolution and recovery plans, and (iv) there is a resolution fund.

We construct the main variable in our analysis, the Bank Resolution Index, by counting all available resolution features across the five categories for each country and year, yielding an index ranging from 0 to 22:

$$Resolution\ Index_{c,t} = \sum_{m=1}^{22} I_{m,c,t}, \tag{1}$$

where $I_{m,c,t}$ takes the value of one if a particular resolution measure m exists in country c at time t, and zero otherwise. Table 2 lists the full set of resolution features considered in our analysis.

Bank Resolution Reforms Across the World. Figure 3 presents the dynamics of resolution reforms for the U.S. and averaged across three groups of countries: Europe, Asia and the remaining countries. As discussed above, we notice a much more advanced bank resolution infrastructure in the US at the beginning of our period period of examination. Also, while the main improvements after the financial crisis in the US are accomplished with major and comprehensive legislative measures, like the Dodd-Franck Act mentioned above, changes in most other countries are implemented in much smaller increments, never reaching the US level within our sample period. This trend is particularly evident in Panels 2 and 4 of Figure 3 that compares the seven European countries in our sample (Panel 2) with the US (Panel 4).

The incremental changes are also evident in the average bank resolution index, depicted in Figure 4. On average, the index rises steadily from below 7 in the beginning of the period to above 15 at the end of 2015. The increase in specific bank resolution features in national insolvency regimes is accelerated by two major events: the global

financial crisis in 2008/2009 and the aftermath of the euro area sovereign debt crisis in 2012 and beyond. Overall, this picture suggests substantial cross-country variation in the implementation of resolution features across countries, often driven by the specifics of the legal and political system of the countries involved.

3 Empirical Strategy and Data

Assessing the relationship between reforms of the bank resolution framework and systemic risk may be subject to an endogeneity bias. Countries that are more likely to experience a financial crisis might be more likely to adopt such reforms. There might also be confounding factors that drive both the reform of bank resolution frameworks and systemic risks, such as macroeconomic developments as well as other regulatory policies and reforms. We therefore focus on shocks that can be considered largely exogenous from a bank's (and country's) perspective and analyze the changes in the contribution of individual financial institutions to systemic risk in response to such shocks, depending on a country's bank resolution framework and distinguishing between system-wide and idiosyncratic events.

Specifically, we employ a panel difference-in-differences methodology and estimate a model where the bank-level systemic risk measure is regressed on an event dummy (the "treatment"), interacted with the index of bank resolution reforms, as well as bank-level and macroeconomic control variables. This approach allows for a heterogenous treatment effect across banks and countries, depending on the cumulative reform steps the respective country has undertaken until this point. This differs from conventional difference-in-differences analyses of reforms, which consider the reforms themselves as the treatment. In contrast, we are looking at banks' differential reaction to different shocks that are not directly related to a particular country's resolution regime and the timing of reform implementation, controlling for bank and country characteristics. The treatment effect depends on whether a particular aspect of the bank resolution legislation is applicable in a particular country in a given time period or not. Furthermore we examine different components of the resolution index to gauge the importance of different elements of the bank resolution framework. This section will present the methodology, introduce the

systemic risk measure and discuss the considered events.

3.1 Empirical Model

Our estimation model can be described as a panel difference-in-differences model at a daily frequency. Similar to event studies, we focus on a period of 80 days before the event (normal times) and 7 days after the event. We drop *(t-1)* to remove anticipatory effects. The event dummy takes the value of one for the period between t and t+6, and zero for the period t-81 to t-2. Then, we regress $\Delta CoVaR$ on the event dummy and its interactions with the resolution index as well as bank and macroeconomic variables. The empirical model is as follows:

$$\begin{aligned} \Delta CoVaR_{i,c,t} = \gamma_i &+ \beta_1 \cdot Event_t \\ &+ \beta_2 \cdot Resolution\ Index_{c,pre-estimation\ period} * Event_t \\ &+ \beta_3 \cdot Bank\ Controls_{i,c,year-1} * Event_t \\ &+ \beta_4 \cdot Macro\ Controls_{i,c,year-1} * Event_t + \epsilon_{i,c,t}, \end{aligned} \tag{2}$$

where $\Delta CoVaR_{i,c,t}$ is $\Delta CoVaR$ of bank i in country c on day t. As we include bank fixed effects γ_i and fix the resolution index and the control variables at their values in the previous year or the pre-estimation period, we can only estimate the interaction terms of the *Event* dummy with the country and bank-level variables; the level effects are captured by the fixed effects. The vector of bank controls includes total assets as a measure of size (the natural logarithm of total dollar-denominated bank assets) and leverage (the ratio of total bank assets and total bank common equity) for the year before the event. The macroeconomic variables comprise GDP growth, domestic credit to GDP and inflation for the year before the event to control for country heterogeneity. We apply two-way clustering of standard errors at the bank and day levels. This captures potential autocorrelation and takes account of the clustering of events at certain points in time. All variables are demeaned; therefore, the regression coefficient of the *Event* dummy represents the increase in systemic risk contributions for the average bank.

We expect β_1 to be positive (negative) if systemic risk increases (decreases) after an

event. The main coefficient of interest, β_2, gauges the sensitivity of banks' contributions to systemic risk in response to system-wide events or idiosyncratic events to the comprehensiveness of their bank resolution framework. It is positive (negative) if systemic risk increases more (less) in the presence of a more advanced resolution regime.

3.2 $\Delta CoVaR$ as Measure of Systemic Risk Contributions

As mentioned above, there is no single measure of systemic risk contribution in the literature, but considering its prominence and wide application, we choose the $\Delta CoVaR$ (Adrian and Brunnermeier, 2016) to gauge the relationship between system-wide and idiosyncratic fragility shocks and banks' contribution to systemic risk. $\Delta CoVaR$ is the difference between the value at risk (VaR) of the financial system conditional on a particular institution experiencing extreme losses and the value at risk of the financial system conditional on the same institution's asset returns being at their median level. One advantage of this measure is that it captures not only risk spillovers within the financial system due to "individually systemic" financial intermediaries but also of institutions that are "systemic as a part of a herd" (Adrian and Brunnermeier, 2016).

VaR_q^i is defined as the q%-quantile of X^i where X^i is the growth rate of the market value of a bank's assets, i. e.,

$$Pr\left(X^i \leq VaR_q^i\right) = q\%.$$

$CoVaR_q^{j|i}$ is the VaR of institution j, conditional on $X^i = VaR_q^i$ of institution i:

$$Pr\left(X^j \leq CoVaR_q^{j|i} | X^i = VaR_q^i\right) = q\%$$

Institution i's contribution to the risk of the *system* is defined as

$$\Delta CoVaR_q^{system|i} = CoVaR_q^{system|X^i=VaR_q^i} - CoVaR_q^{system|X^i=median^i}.$$

Intuitively, $\Delta CoVaR$ represents the marginal contribution of a specific bank to the total risk of the financial system. We apply a stress level of $q = 99\%$ in our regressions.

The main estimation tool in the CoVaR approach is quantile regression, developed by

Koenker and Bassett (1978). Deriving a time-variant CoVaR involves quantile regressions that include lagged state variables M_{t-1} (e. g., VIX, repo rates, T-bill rates, slope of yield curve):

$$CoVaR_{q,t}^{system|i} = \hat{\alpha}_q^{system|i} + \hat{\gamma}_q^{system|i} M_{t-1} + \hat{\beta}_q^{system|i} VaR_{q,t}^{i}.$$

Then, our systemic risk contributions measure, the time-varying $\Delta CoVaR$, is derived as:

$$\Delta CoVaR_{q,t}^{system|i} = CoVaR_{q,t}^{system|X^i=VaR_{q,t}^i} - CoVaR_{q,t}^{system|X^i=median^i}$$

The frequency of $\Delta CoVaR$ is daily, and it is estimated at the country level. The descriptive statistics in Table 3 show that $\Delta CoVaR$ varies substantially across banks and over time, from -3.79 (the Korean Busan Bank on September 18, 2008) up to 23.41 (the Turkish Finansbank A.S. on September 18, 2008). The mean of $\Delta CoVaR$ equals 2.35, which means that, on average, a distress at one institution is associated with an increase in the conditional value at risk of the respective country's banking system by 2.35 daily percentage points. Figures 5 and 6 show the evolution of $\Delta CoVaR$ over time, overall and for different regions. The spikes in $\Delta CoVaR$ tend to coincide with the events that we identify in the next section.

3.3 System-Wide and Idiosyncratic Shocks

In order to test the hypotheses discussed above, we identify both "negative" and "positive" shocks to the banking systems, i. e., surprising events that either signal increasing fragility for the banking system or a reduction in fragility. Further, we differentiate between system-wide shocks that affect the whole banking system (though their effects might vary across banks and countries) and idiosyncratic (i. e., bank-specific) shocks that primarily affect one bank but might cause spill-over effects across banks and countries.

Negative System-Wide Shocks

Outbreak of the subprime crisis: August 9, 2007. The first event is the date when the French investment bank BNP Paribas suspended three investment funds that had invested in subprime mortgage debt, citing a lack of liquidity in the market. The bank's announcement was the first of many credit-loss and write-down announcements by banks, mortgage lenders and other institutional investors. This event is often considered as the outbreak of the subprime crisis. The announcement led to the intervention of the European Central Bank, which injected 95 billion euros into the European banking market.

Bear Stearns' collapse: March 14-17, 2008. March 17 was the first working day after the sale of Bear Stearns to JPMorgan Chase, after the former's stock price collapsed due to losses stemming from subprime market exposures. On March 16, Bear Stearns was acquired for 2 dollars per share by JPMorgan Chase in a fire sale avoiding bankruptcy. The deal was backed by the Federal Reserve, which provided up to 30 billion dollars to cover possible Bear Stearn losses.

Lehman Brothers' collapse: September 15, 2008. Our third significant event is the filing for bankruptcy by Lehman Brothers, which deepened the Global Financial Crisis. Beginning with the bankruptcy announcement on September 15, 2008, the financial crisis entered an acute phase marked by failures of prominent American and European banks and efforts by the governments around the world to rescue distressed financial institutions.

Greece's bailout: May 5, 2010. In late 2009, the newly elected Greek government announced that a recalculation of the national statistics revealed a higher than previously expected fiscal deficit. Despite this new information, the auctions for Greek government debt in January and March 2010 were overbooked – although requesting higher yields, investors did not expect a euro area country to default. In late April 2010, the Greek government requested an international bailout, which was announced by the

Troika (the European Commission, the European Central Bank and the International Monetary Fund) on May 2. The bailout entailed an extensive list of austerity measures that Greece had to fulfill and led to anti-austerity riots in Greece starting on March 5. We choose the latter date as the onset of our fourth event, as it marked the start of a period of political and economic uncertainty within and beyond the euro area.

Positive System-Wide Shocks

Greece's sovereign debt swap (PSI): March 9, 2012. In late February 2012, the Troika agreed on a restructuring of Greek sovereign debt, where private investors were offered to swap their bonds for newly issued bonds with a significant haircut. This swap was called Private Sector Involvement (PSI) and entailed a haircut of 53.5%, leading to a 100 billion euro debt reduction for Greece. On 9 March 2012, the International Swaps and Derivatives Association (ISDA) issued a communiqué calling the debt restructuring deal a "Restructuring Credit Event" that triggers payment of credit default swaps. In case not enough bondholders would agree to a voluntary bond swap, the Greek government threatened to and did introduce a retroactive collective action clause to enforce participation. The restructuring avoided disorderly default of Greece and was therefore met with positive reactions by market participants.

Draghi's "Whatever it takes" announcement: July 26, 2012. At the height of the euro area crisis, at a speech in London on July 26, 2012, ECB president Mario Draghi gave a speech on the eurozone economy and made the famous remark: "Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough." A week after his speech, the ECB announced a program that would allow the ECB to buy the bonds of distressed euro area countries under certain strict conditions, known as Outright Monetary Transactions (OMT). Although the ECB has never actually used this program, the promise was enough to calm investors and bring down bond yields across the euro area.

Idiosyncratic Shocks

Resolution of Portugal's Banco Espírito Santo: August 4, 2014. In the first six months of 2014, Banco Espírito Santo lost the equivalent of 4.8 billion dollars due to bad loans to companies held by the family-controlled Espírito Santo Financial Group, raising concerns about the health of the bank. On Sunday, August 3, 2014, the Portuguese government announced state aid of 4.4 billion euro for the transfer of certain BES assets to a bridge bank – Novo Banco –, which was to be created on the following day. To support the recapitalization of the bridge bank, BES shareholders and subordinated debt holders contributed almost 7 billion euro, limiting the amount of state capital needed by the bridge bank. The toxic assets remained in the existing bank, which was subsequently liquidated.

Deutsche Bank's announcement of €6.8 billion losses: January 21, 2016. In a surprise earnings announcement in the evening of January 20, 2016, Deutsche Bank declared a net loss of 6.8 billion euro due to rising restructuring and litigation costs. The next day saw a decline of 7% in Deutsche Bank's stock price. This was the first annual loss for the bank since 2008.

3.4 Descriptive Statistics

Table 3 provides a description of the variables used in our regression analysis, while Table 4 presents the descriptive statistics. The bank-specific balance sheet data covers 760 banks (with some variation for the different events) in 22 FSB member countries.[6] The balance sheet data are collected from Bankscope, while the macroeconomic data are from the World Bank's World Development Indicators database. The frequency is annual for the balance sheet and macroeconomic data.

Banks vary significantly in terms of assets (from 1.65 million dollars to 3.8 trillion dollars) and leverage (from 1, or virtually no leverage, to 61.5). The average annual

[6]The original dataset contained 1350 banks, from which about 750 were from the United States and 150 from Japan. To avoid skewing the results towards representing a particular country, we cap the number of banks to the top 100 per country.

GDP growth and inflation are positive in our sample, they range from -8% to 15% and from -4% to 13%, respectively. Although comprising mainly OECD members, our sample of countries also varies substantially in terms of financial development, as measured by domestic credit to GDP, ranging from 12.5 to 169, with the mean and median at 93 and 100, respectively.

4 Results

4.1 Bank Resolution and Systemic Risk after System-Wide Shocks

Let us first give a visual impression of our results. Figure 7 depicts the dynamics of systemic risk after a negative system-wide event, the default of Lehman Brothers. The figure suggests that banks in countries with more advanced resolution regimes experienced a larger increase in systemic risk in response to a negative system-wide event. In panel A, the banks are split into banks in countries with an above median (red) and below median (blue) value of the Bank Resolution Index. Banks in countries with above-median regimes have, on average, higher $\Delta CoVaR$, even though panel A clearly shows a parallel trend before Lehman Brothers' collapse.[7] After the event, we observe a clear divergence between the two bank groups, which is even more evident in panel B, where we depict the difference between the two groups. This difference becomes even larger beyond the 7-day event window used in our regression analysis.

The results in Tables 5 and 6 confirm that systemic risk increases more strongly after negative system-wide shocks for banks in countries with more comprehensive bank resolution frameworks. In these tables, we present the baseline results for the four negative system-wide shocks in our study: the outbreak of the subprime crisis, Bear Stearns' resolution, Lehman Brothers' bankruptcy, and the turmoil after the Greek bailout (columns 1 to 4). Table 5 includes interactions of the event dummy with bank size and leverage as control variables, while Table 6 further adds interactions with the macroeconomic control variables. We find a positive and significant coefficient estimate for the event dummy itself, which confirms that these events increased systemic risk. The

[7] The bank fixed effects in our estimation model will pick up this difference in levels, so cross-sectional variations in systemic risk levels due to unobserved factors are not an endogeneity concern here.

coefficient of the interaction of the event dummy with the resolution index is positive and strongly significant in most cases (apart from Bear Stearns when macroeconomic controls are included). Therefore, on average, the more comprehensive the bank resolution legislation, the higher the increase in systemic risk in response to a negative system-wide shock. Bigger banks show higher systemic risk contribution after the event, while, somewhat surprisingly, higher leverage is associated with a smaller increase in systemic risk. Columns 5 and 6 in both tables exclude Bear Stearns and Lehman Brothers from the respective estimation, which leaves the results virtually unchanged.

The results are not only statistically but also economically significant. Take the example of the Greek bailout in 2010 (column 4 of Table 6). Banks in the country at the 75th percentile of the Bank Resolution Index (Korea, index value of 12) experience an increase in $\Delta CoVaR$ that is on average by 0.22 larger than that of banks in the country at the 25th percentile of the Index (Spain, index value of 8), which equals one third of the base effect and 15.58% of one standard deviation of $\Delta CoVaR$ in the event period.

The results in Table 7 show that the opposite happens in positive system-wide events: Systemic risk decreases more strongly after positive system-wide shocks for banks in countries with more comprehensive bank resolution frameworks. Here we focus on two "positive" system-wide shocks during our sample period: the Greek restructuring and Draghi's "Whatever it takes". We find a negative and strongly significant coefficient for the event dummy for the former event and the effect for the 7 days following Draghi's speech is also significant at the 5% level. The coefficient of the interaction turns strongly significant and increases in absolute size when a longer event window of 30 days is used (columns 5 and 6). All other signs are also reversed: a higher level of the bank resolution index goes along with a stronger decrease in systemic risk after the positive shock, so the effect appears to be symmetric for positive and negative events. This is plausible if the previous increase was also more pronounced in countries with more advanced bank resolution regimes. The effects of bank size and leverage are also symmetric to the results for negative events, with reversed signs.

To sum up, after a *negative system-wide shock*, systemic risk *increases*, and it increases *more* in the presence of a more advanced resolution regime (after controlling for bank

and country characteristics). After a *positive system-wide shock*, systemic risk *decreases*, and it decreases *more* in the presence of a more advanced resolution regime. Overall, these results suggest that bank resolution regimes have *amplifiying* effects for system-wide events: they increase rather than dampen the swings in systemic risk in response to financial shocks.

4.2 Bank Resolution and Systemic Risk after Idiosyncratic Shocks

The results for idiosyncratic shocks contrast with the findings so far, as illustrated by Figure 8, which depicts the dynamics of systemic risk after a negative bank-specific event (Deutsche Bank's loss announcement). The figure suggests that banks in countries with more advanced resolution regimes tend to experience a smaller increase in systemic risk after a *negative idiosyncratic* shock. In this case, we analyze European banks only because bank-specific events are unlikely to spread globally. In panel A, banks are again split into those in countries with a Bank Resolution Index above the median (red) and those with an index value below the median (blue). Once again, banks in countries with above-median regimes have, on average, higher $\Delta CoVaR$, and again we observe a parallel trend in Panel A before the event. After the event, $\Delta CoVaR$ continues the pre-shock trends for both groups, but the gap narrows as time passes. The overall negative trend is clearly visible in panel B, where the difference between the two groups is shown. Therefore, the graphical analysis suggests that banks in countries with more advanced resolution regimes tend to experience a *smaller* increase in systemic risk after a negative idiosyncratic shock and this effect again persists after the 7-day event window of our regression analysis.

Table 8 confirms this conclusion with regression analysis. Here, we present the regression results for the overall index for the two bank-specific events, Banco Espírito Santo's restructuring in 2014 and Deutsche Bank's loss announcement in 2016. As in Figure 8, we restrict our sample to European banks in both cases. For both events, systemic risk contributions of banks increase in response to the shock. In the case of the restructuring of Banco Espírito Santo, the increase in systemic risk is not significantly related to the bank resolution regime. In contrast, there is a significantly risk-decreasing effect of reso-

lution regimes in the case of Deutsche Bank. Turning to the economic effect, we find that the effect of the bank resolution regime on systemic risk is comparable to the economic effect in the case of systemic risk shocks. If we consider Deutsche Bank's shock, banks in the country at the 75th percentile of the Bank Resolution Index (Spain, index value of 19) experience a *decrease* in $\Delta CoVaR$ that is on average by 0.10 larger than that of banks in the country at the 25th percentile of the Index (Italy, index value of 14), which equals one fourth of the base effect and 9% of one standard deviation of $\Delta CoVaR$ in the event period. Hence, resolution regimes do not appear to be procyclical in the case of idiosyncratic events. On the contrary, a more comprehensive resolution regime may help to contain the increase in systemic risk.

Other than for the negative system-wide events studied in the previous section, we find that a more comprehensive bank resolution regime has either no effect or it even reduces systemic risk for negative *idiosyncratic* events, controlling for bank and country characteristics. Hence, we find evidence for the existence of a *stabilizing* effect of bank resolution regimes after idiosyncratic events.

4.3 Features of the Resolution Regime and Systemic Risk

To gain more insights as to which features of the resolution framework drive the results in the previous section, we perform the same regression analysis using the subindices from Table 2, instead of the overall resolution index. Tables 9 and 10 present the results for the negative system-wide events, with and without macroeconomic controls. In Table 9, we run separate regressions for each subcategory and present only the coefficient of the interaction of the subindex with the event, while the regressions in Table 10 include all subindices simultaneously.

The results in Table 9 show that the existence of a separate bank resolution framework actually reduces systemic risk in many cases.[8] In contrast, enhancing the resolution authority's set of powers, tools and support measures tends to increase systemic risk in response to a shock. The results on the bail-in framework are mixed. They should, however, be taken with caution, since during that time period only Canada had implemented

[8]Note that the coefficient in each cell of the table stems from a separate regression.

bail-in framework features.

Given the high correlation across the different bank resolution indices, we include all subindices simultaneously in a regression model, to identify ceteris paribus effects. Table 10 presents the results for the model where all subcategories and their interactions with the events enter as independent variables.[9] The results from Table 9 are largely confirmed, but the risk-increasing effect now appears to be driven especially by the tools and the support measures, whereas the effect of resolution powers now becomes statistically insignificant.

Tables 11 and 12 present the same analysis for the positive system-wide events. The results for the individual subindices in Table 11 tell a very consistent story: All subcategories tend to strengthen the decrease in systemic risk. When we add the subindices simultaneously in Table 12, several coefficient lose significance, while maintaining their signs in most cases.

Tables 13 and 14 show the results regarding different resolution features for idiosyncratic events. We find that a separate bank resolution framework and powers may increase systemic risk contributions of bank-specific events. The stabilizing effect of bank resolution regimes in our main regression appears to be driven mainly by the existence of a better resolution toolkit, and partly by additional support measures.

These preliminary results suggest that having a separate bank resolution framework tends to reduce systemic risk, regardless of the direction of the shock, in system-wide events. The destabilizing effect in negative system-wide events is related mostly to the resolution tools and support measures, which, however, tend to have a stabilizing effect in idiosyncratic events. This suggests that having alternative tools to liquidation, such as transfer of assets/liabilities, the creation of a bridge bank or the creation of a bad bank can limit the repercussions of idiosyncratic bank failures. This is in line with evidence provided by Beck et al. (2018) for the case of Banco Espirito Santo. On the other hand, as pointed out by Beck (2011) and DeYoung et al. (2013), the diseconomies of scale in bank resolution makes the use of such instruments difficult if not impossible in the case of systemic fragility. Put differently, tying a regulator's hands in the case of wide-spread distress can have negative repercussions as suggested by our results.

[9]Note that now each *column* stems from a separate regression.

5 Conclusion

A credible and comprehensive bank resolution regime is an important pillar in dealing with bank defaults and in breaking the link between sovereigns and banks caused by large-scale bailouts. In this paper, we analyze how the presence of bank resolution regimes affects the evolution of systemic risk at times when the financial system is hit by either system-wide or idiosyncratic shocks.

We find that a more comprehensive bank resolution regime may indeed further *increase* systemic risk in a crisis. While resolution procedures appear to have a stabilizing effect in *idiosyncratic crises*, they may reinforce systemic risk in *system-wide crises*, where we find strong amplifying effects. This casts doubt on whether bank resolution regimes will be able to solve the time inconsistency problem inherent in bank rescues.

It has to be acknowledged that the time period that we are considering featured resolution regimes, which were less sophisticated than they are today. But we have seen in recent years that bail-in is politically difficult even in non-crisis times. Our paper suggests that it will be even harder in crisis times because resolution measures like bail-in may reinforce uncertainty in the middle of a crisis and may give rise to contagion effects. Therefore, it seems that more efforts are needed to improve the macroprudential scope of bank resolution regimes, to be able to contain systemic risk in a crisis. Otherwise, resolution regimes cannot be credible.

Overall, our results should be seen as a warning against too high expectations regarding the power of resolution regimes in system-wide crises. Instead, they have to be complemented by additional regulatory measures. For instance, we find that bank size matters greatly for systemic repercussions, which underlines the importance of the ongoing structural reforms in the banking industry. In contrast, a lower leverage by itself cannot solve the problem of systemic crises according to our results. In the end, the analysis gives rise to an uncomfortable question for both policymakers and academics: Will we ever be able to do without bailouts in a system-wide crisis?

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A Figures and Tables

A.1 Figures

Figure 1: Fiscal Costs vs. Systemic Impact of Resolution Options. This figure depicts the trade-off between fiscal costs and the impact on financial stability of the different options of ordinary resolution (bailout or disorderly bankruptcy) and special resolution regimes. Source: Čihák and Nier (2009).

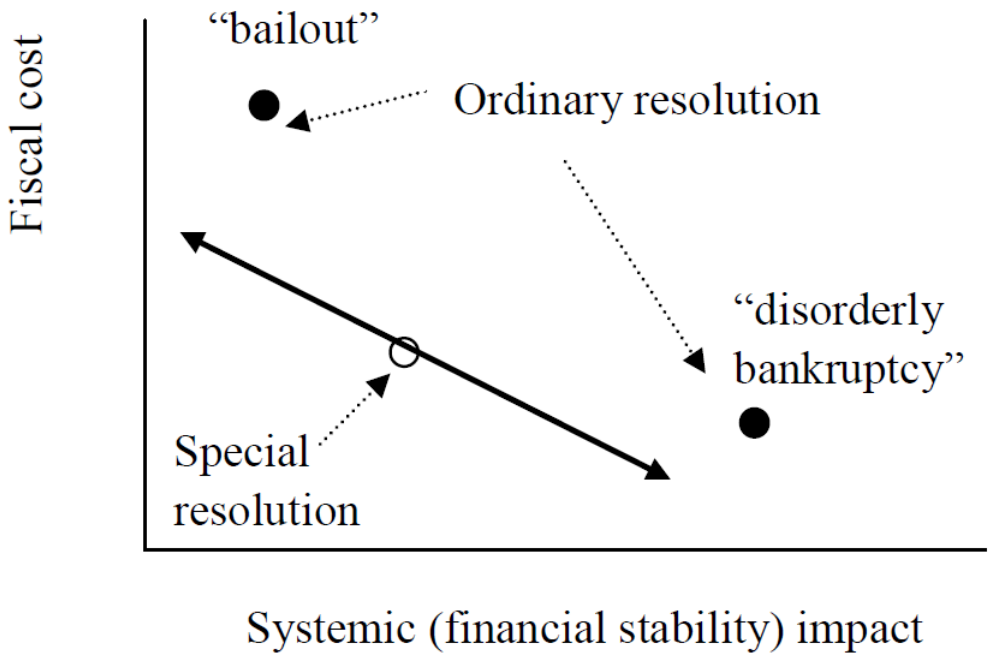


Figure 2: Example of a Bank Resolution Procedure. This figure presents an example of the different steps involved in a bank resolution procedure and lists some of the possible tools that authorities could use. The stabilisation phase should ideally last up to 2 days between two business weeks (informally referred to as a "resolution weekend"). Source: Huertas (2016).

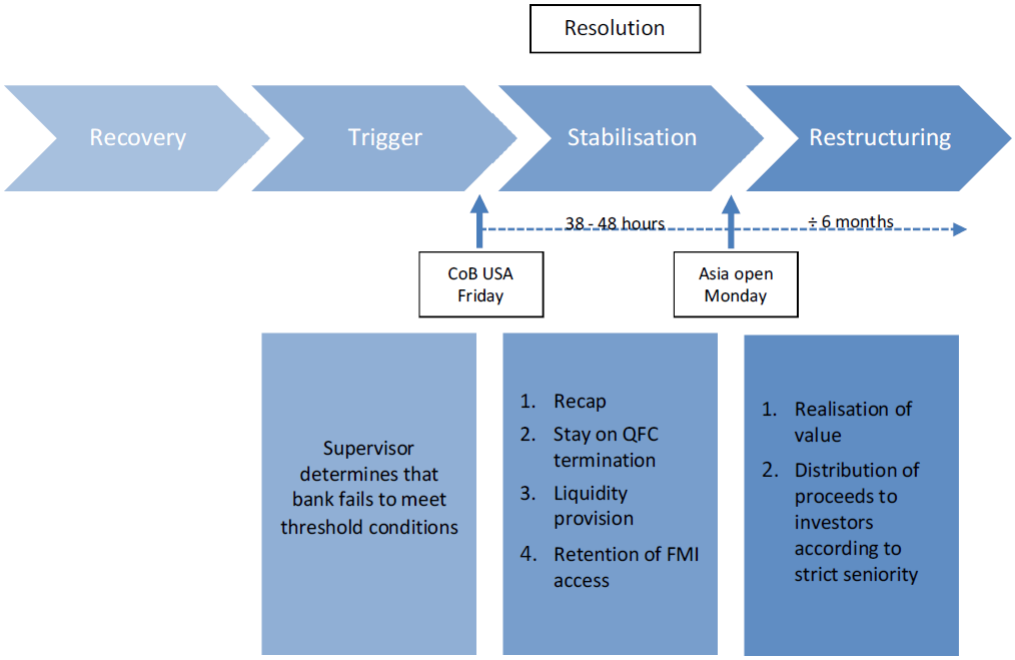


Figure 3: Resolution Index: Average per country group. This figure depicts the average dynamics of the Resolution Index for Europe (France, Germany, Italy, Netherlands, Spain, Switzerland and the United Kingdom), Asia (China, Hong Kong, India, Indonesia, Japan, Republic of Korea, Singapore), the United States of America and the rest of the sample (Australia, Brazil, Mexico, the Russian Federation,South Africa and Turkey) between 2000 and 2016.

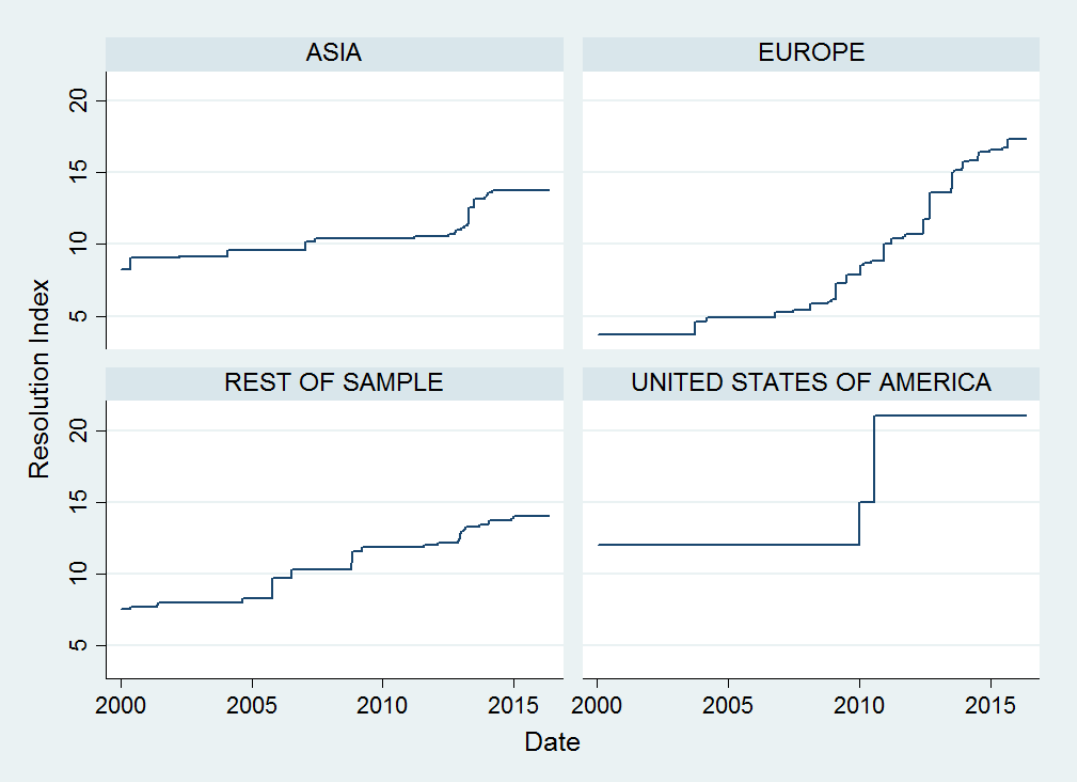


Figure 4: Resolution Index: Average for 22 countries. This figure depicts the dynamics of the unweighted average of the Resolution Indices of 22 FSB countries between 2000 and 2016. Refer to Figure 3 for the individual countries in the sample.

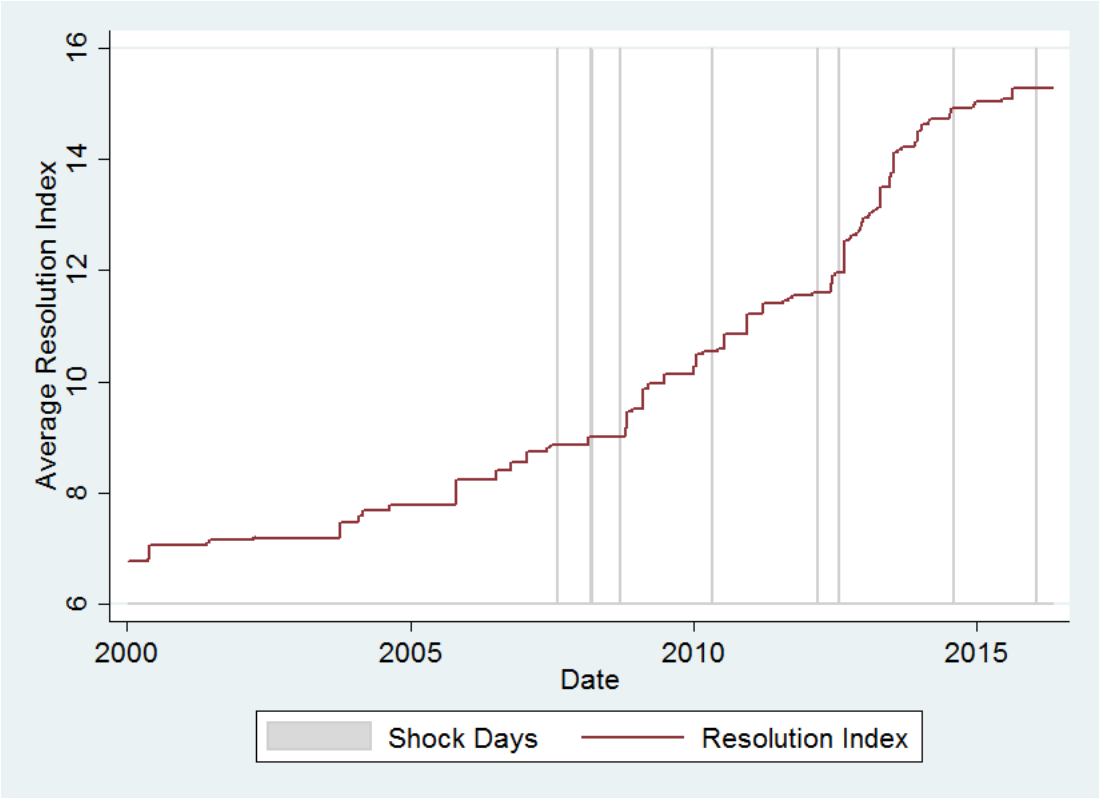


Figure 5: ΔCoVaR: Unweighted average. This figure depicts the dynamics of the unweighted average of $\Delta CoVaR$ for 760 banks in 22 FSB countries between 2000 and 2016. Refer to Figure 3 for the individual countries in the sample.

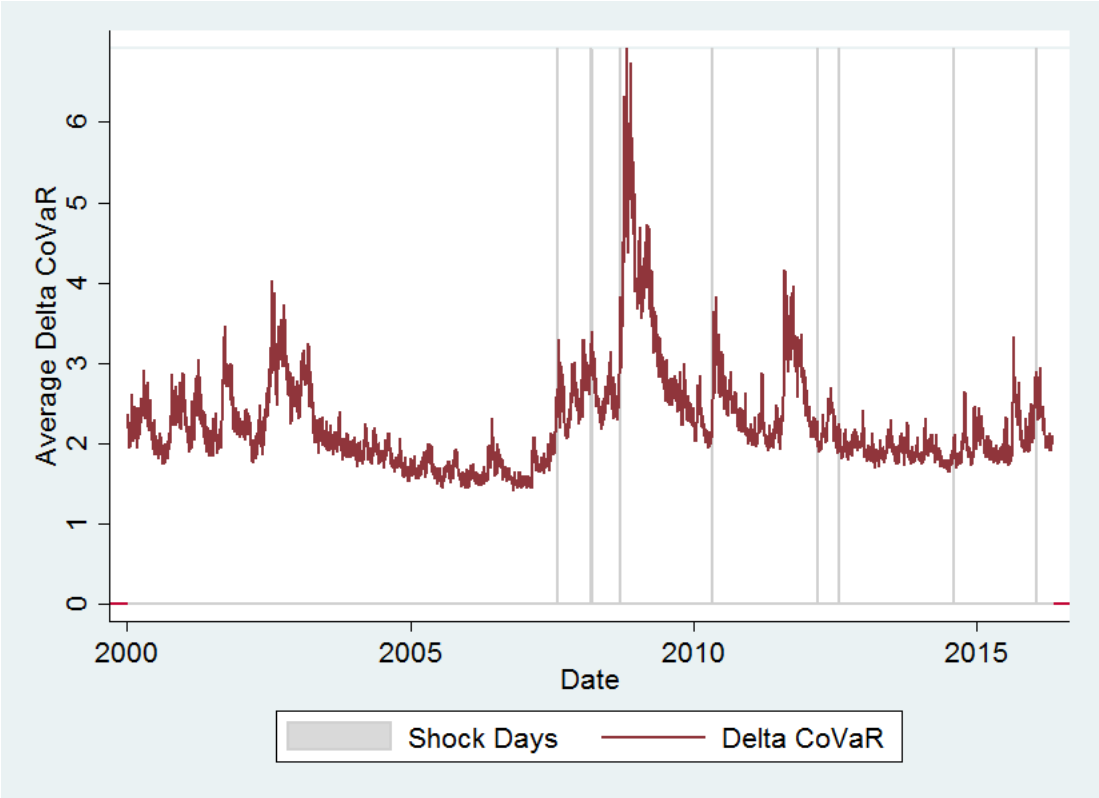


Figure 6: ΔCoVaR: Average per country group. This figure depicts the unweighted average dynamics of $\Delta CoVaR$ for 760 banks in 22 FSB countries between 2000 and 2016. Refer to Figure 3 for the individual countries in each group.

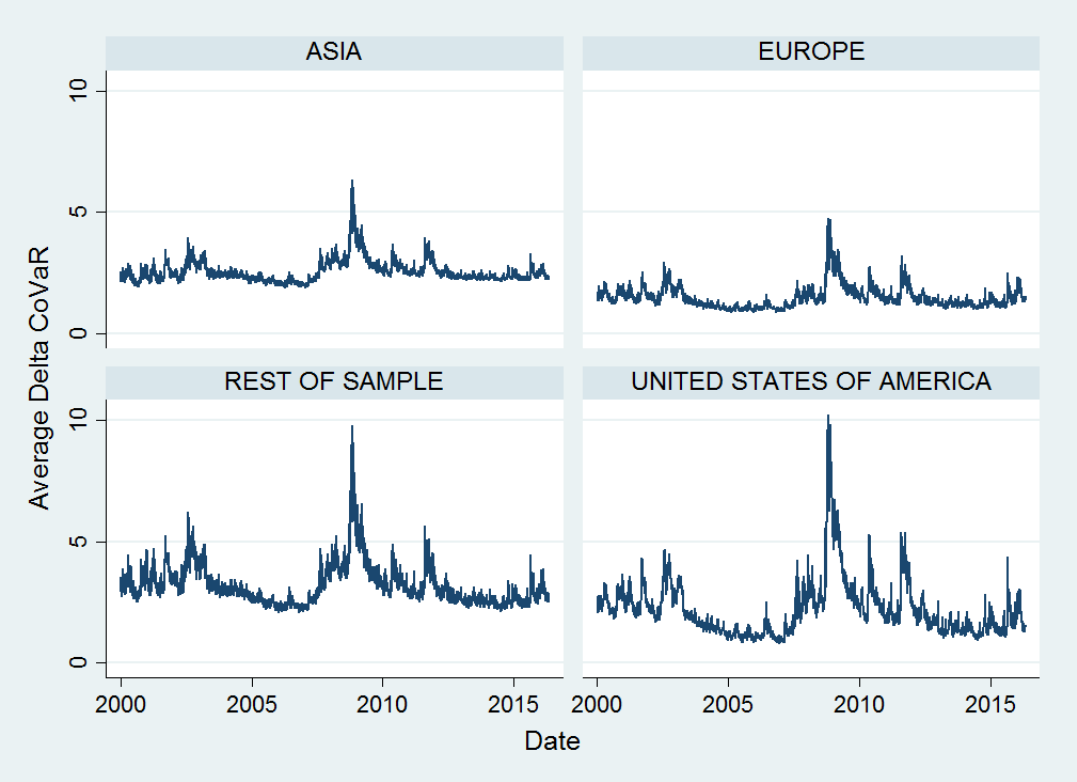


Figure 7: ΔCoVaR, Lehman: Panal A represents the average ΔCoVaR of banks in countries with Sub-median (blue) and with Above-median Resolution Regime (red). Panel B represents the difference between average ΔCoVaR of banks in countries with Sub-median (blue) and with Above-median Resolution Regime (red) from panel A.

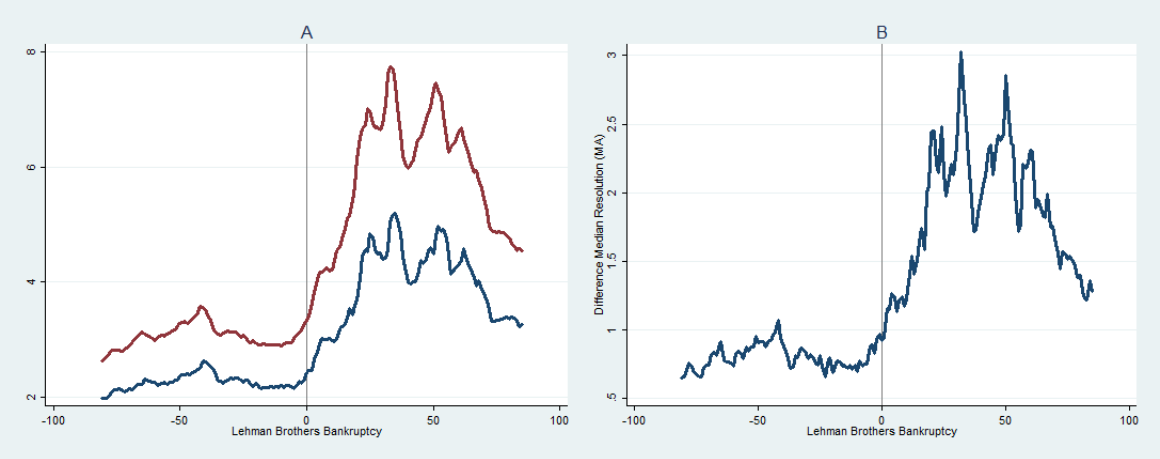
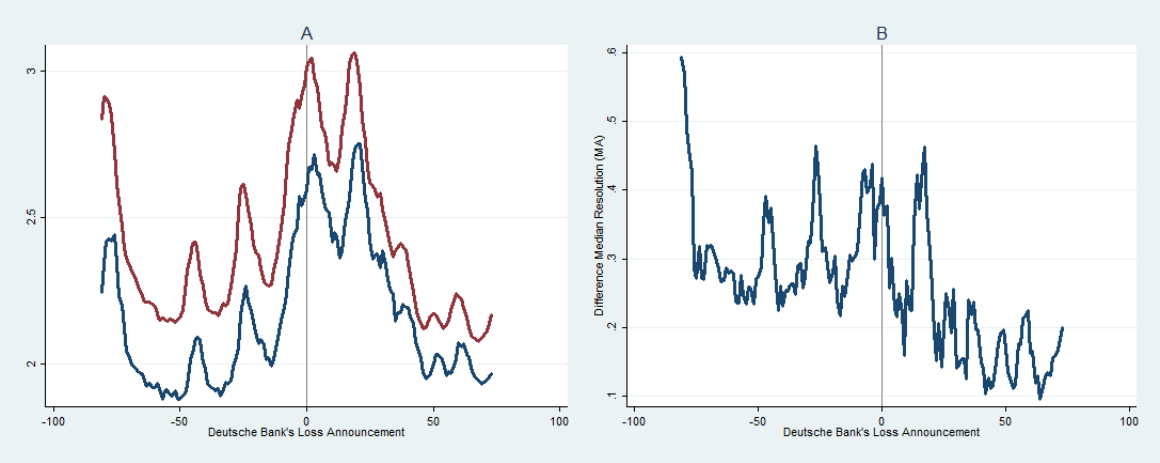


Figure 8: ΔCoVaR, Deutsche Bank's Loss Announcement: Panal A represents the average ΔCoVaR of banks in countries with Sub-median (blue) and with Above-median Resolution Regime (red). Panel B represents the difference between average ΔCoVaR of banks in countries with Sub-median (blue) and with Above-median Resolution Regime (red) from panel A.



A.2 Tables

Table 1: Key Attributes of Effective Resolution Regimes for Financial Institutions (FSB (2011))

#	Attribute	Definition
KA 1	**Scope**	Resolution regimes should apply to all potentially systemically important financial institutions, i. e., banks, financial holding and insurance companies, non-regulated entities within conglomerates, branches of foreign firms and financial market infrastructures.
KA 2	**Resolution authority**	Each country should designate an entity responsible for resolution that is operationally independent. If several agencies are responsible for resolution (e. g., for different sectors), roles and cooperation mechanisms should be clearly stated.
KA 3	**Resolution powers**	RAs should have a broad set of resolution tools available, including powers to replace the management, the transfer of assets, the establishment of a bridge bank or an asset management company or bail-in powers.
KA 4	**Set-off, netting, collateralization, segregation of client assets**	Provisions shall remain in place and entry into resolution should not trigger set-off or early termination rights.
KA 5	**Safeguards**	Creditors should never be worse off than in liquidation and the RA may need to compensate creditors if it departs from the general hierarchy of claims. The pari passu principle should apply, i. e. creditors within the same class should be treated equally and without preferences, provisions of public funds only being used after a bail-in. Actions should be subject to legal review.
KA 6	**Funding of firms in resolution**	The use of public funds for resolution should be kept to a minimum and respective mechanisms must be in place.
KA 7	**Legal framework conditions for cross-border cooperation**	Cooperation should be encouraged and facilitated. Automatic initiation of resolution activities in other countries should be avoided and creditors from different jurisdictions should be treated equally. Branches should be subjected to host country law.
KA 8	**Crisis Management Groups (CMGs)**	RAs in home and host countries of G-SIFIs should ensure preparedness for crises and resolution via CMGs that comprise representatives of institutions involved in resolution such as of the respective supervisory and resolution authority, the central bank, the finance ministry and the deposit insurance scheme.
KA 9	**Institution-specific cross-border cooperation agreements**	Agreements should be made for all G-SIFIs, regarding inter alia the establishment of CMGs as well as responsibilities for the different actors involved and information sharing.
KA 10	**Resolvability assessments**	RAs should assess the feasibility of resolution strategies for G-SIFIs on a regular basis. They may require changes to business practices or structures.
KA 11	**Recovery and resolution planning**	Recovery plans, entailing recovery options to mitigate possible shocks, are to be developed by the banks, while the competent resolution authority shall develop resolution plans for banks under its radar to familiarize with legal and operating structures.
KA 12	**Access to information and information sharing**	Legal impediments to information sharing should be dismantled. Firms should be required to introduce Information Management Systems that provide information on regular basis.

Table 2: Bank Resolution Index and Subindices

Bank Resolution Index
Subindex 1. General framework
1.1. Specific bank resolution framework
1.2. Specifically designated bank resolution authority
1.3. Another authority has powers to restructure/resolve banks
Subindex 2. The resolution authority has the power to...
2.1. Remove and replace management
2.2. Appoint an administrator
2.3. Operate and resolve the firm
2.4. Ensure continuity of essential services and functions
2.5. Override rights of shareholders when applying resolution powers
2.6. Temporarily stay the exercise of early termination rights
2.7. Impose a moratorium with a suspension of payments to unsecured, creditors and customers plus creditor stay
2.8. Liquidate the bank without the need of court decision
Subindex 3. Resolution tools available to the resolution authority
3.1. Transfer or sell assets and liabilities, legal rights and obligations
3.2. Establishment of a bridge institution
3.3. Establishment of an asset management vehicle
3.4. Bail-in tool
Subindex 4. The bail-in framework includes...
4.1. A minimum requirement of eligible liabilities (i. e., bail-inable debt)
4.2. Provisions to respect the hierarchy of claims while providing flexibility to depart from the general principle of equal (pari passu) treatment of creditors of the same class
4.3. Provisions constituting that public resources may only be used if private ones are not available and a bail-in was conducted
Subindex 5. The following supporting measures/features exist:
5.1. Implementation of Basel III
5.2. Resolution powers/tools can be used fast and flexibly. Proxy: court decision needed or not? (1 = No court decision needed)
5.3. Mandatory development of resolution and recovery plans
5.4. Resolution fund (publicly and privately financed)

Table 3: Regression Variables Description.

Variable	Description	Source
Size	Total individual bank assets, denominated in dollars.	Bankscope
Ln(Size)	Natural logarithm of total individual bank assets, denominated in dollars.	Bankscope
Leverage Ratio	Ratio of total individual bank assets and total individual bank equity	Bankscope
Ann. GDP Growth	Annual country GDP growth	World Bank's WDI
Inflation	Annual country inflation	World Bank's WDI
Dom. Credit to GDP	Domestic bank credit to GDP	World Bank's WDI

Table 4: Descriptive statistics

Variable	Mean	St. Dev.	Minimum	Median	Maximum	N
$\Delta CoVaR$	2.349939	1.695698	-3.787341	1.941174	23.40833	425248
Size	1.23E+11	3.65E+11	1646904	1.40E+10	3.81E+12	425248
Ln(Size)	23.14534	2.465992	14.31441	23.36315	28.9681	425248
Leverage Ratio	13.34269	10.90619	1	11.34242	61.54782	425248
Ann. GDP Growth	2.314923	3.770738	-7.820885	2.374947	15.24038	425248
Inflation	2.270556	3.083298	-3.932095	1.683726	13.10942	425248
Dom. Credit to GDP	92.86947	51.10944	12.48502	99.83522	169.1598	425248

Table 5: Resolution Index, Negative System-wide Events: Bank Controls. This table reports the results from the estimation of Equation 2 at the bank level for a number of *negative* system-wide events. The sample comprises listed banks in 22 countries. The dependent variable is the level of $\Delta CoVaR$. The independent variables are the Resolution Index, bank size and leverage, and their interactions with the event variable. The numbers in parentheses are p-values. We apply a two-way clustering of standard errors at the *bank* and *time* levels. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	7 days after the shock					
	All Banks					
	Subprime	Bear Stearns	Lehman	Greek Bailout	Bear Stearns (No BS)	Lehman (No Lehman)
	(1)	(2)	(3)	(4)	(5)	(6)
Shock	0.8976***	0.4383***	0.7706***	0.6635***	0.4388***	0.7691***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shock * Resolution	0.0424***	0.0434***	0.0338*	0.0488***	0.0435***	0.0335*
	(0.001)	(0.000)	(0.059)	(0.000)	(0.000)	(0.058)
Shock * Size	0.1816***	0.0461***	0.1658***	0.1469***	0.0463***	0.1650***
	(0.000)	(0.005)	(0.000)	(0.000)	(0.005)	(0.000)
Shock * Leverage	-0.0208***	-0.0072***	-0.0161***	-0.0157***	-0.0071***	-0.0163***
	(0.000)	(0.002)	(0.000)	(0.001)	(0.002)	(0.000)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Macro Controls * Shock	No	No	No	No	No	No
Observations	63008	62920	64944	64504	62832	64856
R-squared	0.8945	0.9234	0.9187	0.9206	0.9232	0.9190
Adjusted R-squared	0.8933	0.9225	0.9177	0.9197	0.9224	0.9180
Within R-Squared	0.2582	0.0548	0.1404	0.1816	0.0548	0.1399
Number of Banks	716	715	738	733	714	737

Table 6: Resolution Index, Negative System-wide Events: Bank and Macro Controls. This table reports the results from the estimation of Equation 2 at the bank level for a number of *negative* system-wide events. The sample comprises listed banks in 22 countries. The dependent variable is the level of $\Delta CoVaR$. The independent variables are the Resolution Index, bank size and leverage, and country annual GDP growth, inflation and financial development, and their interactions with the event variable. The numbers in parentheses are p-values. We apply a two-way clustering of standard errors at the *bank* and *time* levels. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	7 days after the shock					
	All Banks					
	Subprime	Bear Stearns	Lehman	Greek Bailout	Bear Stearns (No BS)	Lehman (No Lehman)
	(1)	(2)	(3)	(4)	(5)	(6)
Shock	0.8977***	0.4383***	0.7706***	0.6632***	0.4390***	0.7694***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shock * Resolution	0.0240**	0.0036	0.0414***	0.0549***	0.0036	0.0414***
	(0.013)	(0.569)	(0.000)	(0.000)	(0.571)	(0.000)
Shock * Size	0.1929***	0.0635***	0.1617***	0.1475***	0.0637***	0.1610***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shock * Leverage	-0.0199***	-0.0064***	-0.0096***	-0.0162***	-0.0063***	-0.0097***
	(0.000)	(0.003)	(0.001)	(0.000)	(0.003)	(0.001)
Shock * GDP Growth	-0.0653***	-0.0006	-0.1038***	-0.0250*	-0.0007	-0.1033***
	(0.001)	(0.962)	(0.003)	(0.057)	(0.950)	(0.003)
Shock * Inflation	0.0803***	0.0304**	0.1615***	0.0079	0.0304**	0.1612***
	(0.000)	(0.038)	(0.000)	(0.608)	(0.038)	(0.000)
Shock * Fin. Dev.	-0.0009	-0.0043***	0.0021	0.0010*	-0.0043***	0.0022
	(0.620)	(0.001)	(0.527)	(0.063)	(0.001)	(0.521)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls * Shock	Yes	Yes	Yes	Yes	Yes	Yes
Macro Controls * Shock	Yes	Yes	Yes	Yes	Yes	Yes
Observations	63008	62920	64944	64504	62832	64856
R-squared	0.8961	0.9241	0.9198	0.9211	0.9240	0.9201
Adjusted R-squared	0.8948	0.9232	0.9189	0.9201	0.9231	0.9191
Within R-Squared	0.2690	0.0638	0.1520	0.1861	0.0638	0.1514
Number of Banks	716	715	738	733	714	737

Table 7: Resolution Index, Positive System-wide Events: Bank and Macro Controls. This table reports the results from the estimation of Equation 2 at the bank level for a number of *positive* system-wide events. The sample comprises listed banks in 22 countries. The dependent variable is the level of $\Delta CoVaR$. The independent variables are the Resolution Index, bank size and leverage, and country annual GDP growth, inflation and financial development, and their interactions with the event variable. The numbers in parentheses are p-values. We apply a two-way clustering of standard errors at the *bank* and *time* levels. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	7 days after the shock				30 days after	
	All Banks					
	Greek Restructuring		Draghi		Draghi (30 days)	
	(1)	(2)	(3)	(4)	(5)	(6)
Shock	-0.4103***	-0.4102***	-0.0613	-0.0612	-0.2057***	-0.2056***
	(0.000)	(0.000)	(0.139)	(0.139)	(0.000)	(0.000)
Shock * Resolution	-0.0466***	-0.0440***	-0.0099**	-0.0086**	-0.0231***	-0.0217***
	(0.000)	(0.000)	(0.011)	(0.030)	(0.000)	(0.000)
Shock * Size	-0.0829***	-0.0864***	-0.0101	-0.0108	-0.0366***	-0.0381***
	(0.000)	(0.000)	(0.246)	(0.224)	(0.000)	(0.000)
Shock * Leverage	0.0092***	0.0094***	0.0010	0.0010	0.0043***	0.0040***
	(0.000)	(0.000)	(0.348)	(0.336)	(0.000)	(0.000)
Shock * GDP Growth		0.0193**		0.0100*		0.0159
		(0.028)		(0.059)		(0.101)
Shock * Inflation		-0.0088		-0.0109***		-0.0206***
		(0.113)		(0.007)		(0.002)
Shock * Fin. Dev.		-0.0003		0.0000		-0.0002
		(0.446)		(0.915)		(0.449)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Macro Controls * Shock	No	Yes	No	Yes	No	Yes
Observations	65912	65912	66880	66880	84360	84360
R-squared	0.8890	0.8890	0.9454	0.9454	0.9443	0.9444
Adjusted R-squared	0.8877	0.8877	0.9447	0.9447	0.9438	0.9439
Within R-Squared	0.0575	0.0582	0.0042	0.0045	0.0937	0.0954
Number of Banks	749	749	760	760	760	760

Table 8: Resolution Index, Idiosyncratic Events: Bank and Macro Controls. This table reports the results from the estimation of Equation 2 at the bank level for a number of bank-specific events. The sample comprises listed banks in 7 European countries. The dependent variable is the level of $\Delta CoVaR$. The independent variables are the Resolution Index, bank size and leverage, and country annual GDP growth, inflation and financial development, and their interactions with the event variable. The numbers in parentheses are p-values. We apply a two-way clustering of standard errors at the *bank* and *time* levels. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	7 days after the event					
	B. Esp. Santo		Deutsche Bank		Deutsche Bank (No DBank)	
	(1)	(2)	(3)	(4)	(5)	(6)
Event	0.2088***	0.2088***	0.4243***	0.4243***	0.4246***	0.4251***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Event * Resolution	-0.0075	0.0130	-0.0265**	-0.0191*	-0.0265**	-0.0191*
	(0.228)	(0.205)	(0.030)	(0.099)	(0.030)	(0.099)
Event * Size	0.0460***	0.0482***	0.1022***	0.1066***	0.1025***	0.1072***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Event * Leverage	-0.0047***	-0.0034**	-0.0077	-0.0057	-0.0077	-0.0056
	(0.003)	(0.031)	(0.132)	(0.300)	(0.134)	(0.308)
Event * GDP Growth		0.0041		0.0409		0.0413
		(0.729)		(0.122)		(0.120)
Event * Inflation		0.0729***		0.0484		0.0490
		(0.000)		(0.374)		(0.369)
Event * Fin. Dev.		0.0005		-0.0021		-0.0021
		(0.494)		(0.206)		(0.200)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Macro Controls * Event	No	Yes	No	Yes	No	Yes
Observations	21296	21296	15928	15928	15840	15840
R-squared	0.9557	0.9562	0.8683	0.8689	0.8689	0.8695
Adjusted R-squared	0.9552	0.9557	0.8668	0.8673	0.8674	0.8679
Within R-Squared	0.1655	0.1747	0.1266	0.1305	0.1257	0.1297
Number of Banks	242	242	181	181	180	180

Table 9: Subindices (Individual), Negative System-wide Events: Bank and Macro Controls. This table reports the results from the estimation of Equation 2 at the bank level for a number of *negative* system-wide events. The sample comprises listed banks in 22 countries. The dependent variable is the level of $\Delta CoVaR$. The independent variables are the Resolution Subindices, bank size and leverage, and country annual GDP growth, inflation and financial development, and their interactions with the event variable. Each *cell* in the table presents the outcome of a separate regression. We apply a two-way clustering of standard errors at the *bank* and *time* levels. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	7 days after the event					
Panel A: Bank Controls						
	All Banks					
	Subprime	Bear Stearns	Lehman	Greek Bailout	Bear Stearns (No BS)	Lehman (No Lehman)
	(1)	(2)	(3)	(4)	(5)	(6)
Framework	-0.1144***	0.0386	-0.0703	-0.1037**	0.0381	-0.0685
Powers	0.0709***	0.0769***	0.0504	0.0478***	0.0770***	0.0500
Tools	0.1931***	0.1551***	0.1652***	0.1762***	0.1555***	0.1640**
Bail-in Framework	-0.0359	-0.1030	-0.0493	0.3479***	-0.1036	-0.0467
Support	0.4649***	0.2679***	0.3473***	0.2163***	0.2702***	0.3447***
Panel B: Bank and Macro Controls						
	All Banks					
	Subprime	Bear Stearns	Lehman	Greek Bailout	Bear Stearns (No BS)	Lehman (No Lehman)
	(1)	(2)	(3)	(4)	(5)	(6)
Framework	-0.2098***	-0.0975***	-0.0596	-0.1465***	-0.0990***	-0.0578
Powers	0.0206	-0.0023	0.0620***	0.0515***	-0.0025	0.0621***
Tools	0.1718***	0.0652***	0.1723***	0.1908***	0.0654***	0.1718***
Bail-in Framework	0.0649	0.1120	-0.1467	0.4418***	0.1114	-0.1444
Support	0.4587***	0.1408***	0.2495***	0.2433***	0.1432***	0.2473***

Table 10: Subindices (Simultaneous), Negative System-wide Events: Bank and Macro Controls. This table reports the results from the estimation of Equation 2 at the bank level for a number of *negative* system-wide events. The sample comprises listed banks in 22 countries. The dependent variable is the level of $\Delta CoVaR$. The independent variables are the Resolution Subindices, bank size and leverage, and country annual GDP growth, inflation and financial development, and their interactions with the event variable. Each *column* in the table presents the outcome of a separate regression. We apply a two-way clustering of standard errors at the *bank* and *time* levels. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	7 days after the event					
Panel A: Bank Controls						
	All Banks					
	Subprime	Bear Stearns	Lehman	Greek Bailout	Bear Stearns (No BS)	Lehman (No Lehman)
	(1)	(2)	(3)	(4)	(5)	(6)
Framework	-0.1793**	-0.0312	-0.0645	0.0369	-0.0324	-0.0632
Powers	0.0017	0.0247	-0.0545	-0.0144	0.0248	-0.0547
Tools	0.1263***	0.0762**	0.1543***	0.0846**	0.0764**	0.1542***
Bail-in Framework	-0.1908*	-0.1584*	-0.2215	0.2792***	-0.1605*	-0.2194
Support	0.3483***	0.1611***	0.2846***	0.0376	0.1632***	0.2826***
Panel B: Bank and Macro Controls						
	All Banks					
	Subprime	Bear Stearns	Lehman	Greek Bailout	Bear Stearns (No BS)	Lehman (No Lehman)
	(1)	(2)	(3)	(4)	(5)	(6)
Framework	-0.2332***	-0.1134***	-0.0948	-0.0228	-0.1148**	-0.0935
Powers	-0.0059	-0.0118	-0.0044	0.0053	-0.0118	-0.0044
Tools	0.1706***	0.0947***	0.1574**	0.0731**	0.0949***	0.1573**
Bail-in Framework	-0.2348**	0.0194	-0.2383	0.3280***	0.0174	-0.2364
Support	0.3299***	0.0705	0.1553**	0.0390	0.0728	0.1534**

Table 11: Subindices (Individual), Positive System-wide Events: Bank and Macro Controls. This table reports the results from the estimation of Equation 2 at the bank level for a number of *positive* system-wide events. The sample comprises listed banks in 22 countries. The dependent variable is the level of $\Delta CoVaR$. The independent variables are the Resolution Subindices, bank size and leverage, and country annual GDP growth, inflation and financial development, and their interactions with the event variable. Each *cell* in the table presents the outcome of a separate regression. We apply a two-way clustering of standard errors at the *bank* and *time* levels. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	7 days after the event			
	All Banks			
	Greek Restructuring		Draghi	
	Bank Controls (1)	Bank + Macro Controls (2)	Bank Controls (3)	Bank + Macro Controls (4)
Framework	-0.1304***	-0.1474***	-0.0245***	-0.0147
Powers	-0.0941***	-0.0779***	-0.0182**	-0.0154*
Tools	-0.1267***	-0.1120***	-0.0277**	-0.0250***
Bail-in Framework	-0.1685***	-0.1632***	-0.0353**	-0.0324**
Support	-0.1766***	-0.1540***	-0.0354**	-0.0282*

Table 12: Subindices (Simultaneous), Positive System-wide Events: Bank and Macro Controls. This table reports the results from the estimation of Equation 2 at the bank level for a number of *positive* system-wide events. The sample comprises listed banks in 22 countries. The dependent variable is the level of $\Delta CoVaR$. The independent variables are the Resolution Subindices, bank size and leverage, and country annual GDP growth, inflation and financial development, and their interactions with the event variable. Each *column* in the table presents the outcome of a separate regression. We apply a two-way clustering of standard errors at the *bank* and *time* levels. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	7 days after the event			
	All Banks			
	Greek Restructuring		Draghi	
	Bank Controls (1)	Bank + Macro Controls (2)	Bank Controls (3)	Bank + Macro Controls (4)
Framework	-0.0480*	-0.0630**	-0.0038	0.0162
Powers	0.0015	-0.0075	0.0036	0.0053
Tools	-0.0298	-0.0275	-0.0123	-0.0196**
Bail-in Framework	-0.0982***	-0.1183***	-0.0187	-0.0210
Support	-0.0610**	-0.0131	-0.0137	-0.0054

Table 13: Subindices (Individual), Idiosyncratic Events: Bank and Macro Controls. This table reports the results from the estimation of Equation 2 at the bank level for a number of bank-specific events. The sample comprises listed banks in 7 European countries. The dependent variable is the level of $\Delta CoVaR$. The independent variables are the Resolution Subindices, bank size and leverage, and country annual GDP growth, inflation and financial development, and their interactions with the event variable. Each *cell* in the table presents the outcome of a separate regression. We apply a two-way clustering of standard errors at the *bank* and *time* levels. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

7 days after the event						
	B. Esp. Santo		Deutsche Bank		Deutsche Bank (No DBank)	
	Bank Controls (1)	Bank + Macro Controls (2)	Bank Controls (3)	Bank + Macro Controls (4)	Bank Controls (5)	Bank + Macro Controls (6)
Framework	-0.0031	0.1391	0.2121***	0.2121***	0.2123***	0.2125***
Powers	0.0022	0.0414*	-0.0015	0.0185	-0.0018	0.0174
Tools	-0.0512*	0.1217	-0.2375***	-0.2222***	-0.2375***	-0.2214***
Bail-in Framework	0.0571***	0.0247	0.0423	-0.0832*	0.0429	-0.0827*
Support	-0.0415***	-0.0065	-0.1005***	-0.1213**	-0.1006***	-0.1204**

Table 14: Subindices (Simultaneous), Idiosyncratic Events: Bank and Macro Controls. This table reports the results from the estimation of Equation 2 at the bank level for a number of bank-specific events. The sample comprises listed banks in 7 European countries. The dependent variable is the level of $\Delta CoVaR$. The independent variables are the Resolution Subindices, bank size and leverage, and country annual GDP growth, inflation and financial development, and their interactions with the event variable. Each *column* in the table presents the outcome of a separate regression. We apply a two-way clustering of standard errors at the *bank* and *time* levels. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively.

	7 days after the event					
	B. Esp. Santo		Deutsche Bank		Deutsche Bank (No DBank)	
	Bank Controls (1)	Bank + Macro Controls (2)	Bank Controls (3)	Bank + Macro Controls (4)	Bank Controls (5)	Bank + Macro Controls (6)
Framework	0.1239	0.0000	0.5215***	0.8002***	0.5205***	0.8021***
Powers	0.0572**	0.0800***	0.0959***	0.0831**	0.0977***	0.0854**
Tools	-0.0929**	-0.0510	-0.4001***	-0.7153**	-0.4032***	-0.7209**
Bail-in Framework	-0.0488	-0.0315	0.0553	0.0497	0.0542	0.0520
Support	-0.0803***	-0.0563**	0.0114	0.2621	0.0118	0.2604