Bank Resolution, Regulatory Arbitrage, and Systemic Risk

Bank Resolution, Regulatory Arbitrage, and Systemic Risk

Michela Altieri* Deyan Radev†

Abstract

We analyze how cross-country differences in bank resolution regimes across parent banks and their foreign subsidiaries impact systemic risk. Our findings show that in developed countries, parent banks with stricter resolution regimes than their foreign subsidiaries contribute less to systemic risk. In contrast, in developing countries, systemic risk rises for parent banks with subsidiaries in jurisdictions with more lenient resolution regimes. The bail-in mechanism is particularly effective in reducing the adverse effects of resolution arbitrage on systemic risk in developed economies. This reveals a new channel through which bail-ins can benefit systemic stability: by enabling "benign" regulatory arbitrage within global banking networks. Our findings show that the country's development level and the internal capital flows within banking conglomerates shape the effectiveness of bank resolution regimes.

JEL Classification: G01, G21, G28

Keywords: Regulatory arbitrage, Systemic risk, Bank Resolution, Internal capital markets

*Department of Business and Management, Luiss Guido Carli, Rome, Italy. Email: maltieri@luiss.it.

†Faculty of Economics and Business Administration (FEBA), Sofia University, Bulgaria. Email: D.Radev@feb.uni-sofia.bg.

We are grateful for valuable recommendations provided by Jan Pieter Krahnen, Loriana Pelizzon, the participants at the seminars at Luiss Guido Carli University, and at the conferences IFABS 2023 Oxford, the AFFI 38th Finance Conference, CREDIT 2022; and at New Frontiers in Banking and Capital Markets 2022. We gratefully acknowledge financial support from Bulgarian National Science Fund's Scientific Programme "Fundamental Studies" under grant agreement KP-06-H75-9 from December 7, 2023.

1 Introduction

The 2008-2009 global financial crisis, partly driven by regulatory failures (Levine, 2012), revealed the inadequacy of relying on corporate insolvency laws, which subsequently led to widespread bailouts (Acharya, 2009). This highlighted the need for a unified resolution framework for global systemically important banks (GSIBs). In response, the Financial Stability Board proposed 12 key attributes for effective bank resolution (FSB, 2011), later embedded in global banking reforms, with a focus on systemic stability and reduced dependence on public funds (FSB, 2013; BIS, 2024).

While the reforms aimed for consistency, countries adopted these new regulations at different speeds. That variation not only increases compliance costs and reporting complexity but also creates opportunities for regulatory arbitrage among GSIBs with extensive networks of foreign subsidiaries. These GSIBs operate under multiple regulators and national resolution authorities, potentially leading to unintended negative effects on the banking system in their home markets. In this paper, we analyze whether resolution arbitrage affects systemic risk using a new measure, "Resolution Difference", that captures discrepancies between the resolution regimes faced by parent banks and their foreign subsidiaries.

Resolution arbitrage in our setting arises when global banks operate across jurisdictions with heterogeneous bank resolution frameworks and exploit these differences in ways that affect their contribution to systemic risk. Its transmission hinges on both institutional design and banks' internal organization. First, arbitrage is feasible only when resolution responsibilities are fragmented across countries - most notably under multiple-point-of-entry (MPOE)-type settings or when single-point-of-entry (SPOE) commitments lack credibility due to potential ring-fencing by host authorities (Faia and di Mauro, 2015; Bolton and Oehmke, 2019). Second, differences in the stringency of resolution tools - such as bail-in requirements or loss-absorbing capacity - create incentives for banks to reallocate assets toward subsidiaries in more lenient regimes, thereby importing implicit bailout guarantees that can stabilize the group ex post. While this may reduce system-wide collapse risk by lowering expected contagion, it can also weaken market discipline and distort incentives, particularly in countries with weaker enforcement and lower institutional quality (Acharya, 2003; Acharya et al., 2009). As a result, resolution arbitrage can either mitigate or amplify systemic risk depending on the interaction between resolution architecture, country development, and the specific resolution tools in place.

Using datasets that link global banks to their domestic and foreign subsidiaries within 22 FSB jurisdictions, we aim to determine the predominant type of regulatory arbitrage associated with resolution regulation and identify which resolution tools are more effective in reducing systemic risk. Specifically, we examine cross-country differences in the adoption of key resolution tools, including bail-in powers, resolution planning, and the availability of bridge institutions. Prior works have shown that banks engage in regulatory arbitrage for various reasons: to reduce compliance costs (see, e.g., Demirgüç-Kunt and Detragiache, 2011), to benefit from implicit government guarantees (see, e.g., Keister and Mitkov, 2023), or to mitigate the uncertainties in resolution enforcement (see, e.g., Hoque et al., 2015; Temesvary, 2018). This regulatory arbitrage can lead to heightened systemic risk (Frame et al., 2020), increased risk-taking across borders (Acharya, 2003; Acharya et al., 2009), and riskier lending abroad (Ongena et al., 2013).

Yet, Karolyi and Taboada (2015) and Karolyi et al. (2023) offer a contrasting perspective: a "benign" form of regulatory arbitrage arises when banks from stricter regimes allocate capital more efficiently abroad, benefiting both the parent and the subsidiaries through improved oversight. This contrasts with "malignant" arbitrage, where banks exploit weaker regulations to increase risk-taking, potentially undermining financial stability. Specifically, Karolyi and Taboada (2015) show that countries with weaker regulations can experience improvements in systemic stability through cross-border mergers and acquisitions.

To test whether resolution differences generate positive or negative spillovers for the systemic risk of global banks, we use the Bank Resolution Index introduced in Beck et al. (2020), which traces the implementation of bank resolution reforms across countries, to construct a measure of resolution (regulatory) arbitrage. Our main independent variable, "Resolution Difference", focuses on discrepancies between the formal bank resolution regimes in the home country and in all host countries where the group has subsidiaries. This variable captures whether the differences in resolution within banking groups affect the contribution of parent banks to systemic risk in the home country, the latter measured by $\Delta CoVaR$ (Adrian and Brunnermeier, 2016).

Our first result shows that, for parent banks based in developed countries, a larger difference in the comprehensiveness of resolution regimes between the parent and its subsidiaries is associated with lower systemic risk in the parent bank's home country: a stricter resolution regime for the parent relative to its subsidiaries reduces its contribution to home-country systemic risk by about 5.2%, a "benign" form of regulatory arbitrage. By contrast, for parents based in developing countries a stricter resolution framework at the parent level is associated with higher systemic risk: a one-step increase in the difference in resolution regulation strength between parents and subsidiaries implies a 28% increase in the bank's contribution to its home-country systemic risk, a "malignant" form of regulatory arbitrage.

We then analyze how differences between parents and subsidiaries in specific resolution tools affect banks' systemic risk. Among all the resolution tools, we find that bail-in is particularly effective in developed economies: when the parent country implements bail-in, the average contribution of financial groups to systemic risk at home falls by about 6.8%. This result survives even the most conservative robustness check with country$\times$year fixed effects.

To obtain cleaner identification and mitigate endogeneity concerns, we exploit the June 2009 announcement of the U.S. Financial Regulatory Reform Proposal – the initial draft of the Dodd-Frank Act (US Congress, 2010) – as an exogenous shock to the expected strictness of the U.S. resolution framework. This announcement shifted market expectations about future bailout practices and the credibility of no-bailout commitments, while leaving foreign resolution regimes largely unchanged at the same time. We implement a quasi-natural experiment by comparing U.S. banks with foreign subsidiaries to matched non-U.S. banks, thereby canceling out time-invariant bank characteristics and common global shocks that could otherwise confound our baseline estimates. We find that U.S. banks with subsidiaries in less-strict resolution jurisdictions experience a 28% reduction in systemic risk, consistent with cross-jurisdictional resolution asymmetries shaping risk dynamics through multinational banking structures.

Our results are robust to several refinements. We test our hypotheses using an alternative measure of systemic risk, the marginal expected shortfall (MES) by Acharya et al., 2016, and find similar results. The main findings are also robust to different sub-periods and model specifications, to excluding U.S. banks from the sample, and to controlling for the introduction of other macroprudential tools in our estimations.

An alternative interpretation of our findings is that they reflect differences in preferred cross-border resolution strategies - MPOE versus SPOE arrangements - rather than resolution arbitrage per se. Theoretical contributions emphasize that, although SPOE can be more efficient, it is time-inconsistent and may lack credibility because host authorities have incentives to ring-fence local assets when *ex post* transfers are large, or when expected transfers across countries are sufficiently asymmetric (Bolton and Oehmke, 2019; Faia and di Mauro, 2015). Policy-oriented evidence likewise stresses that, despite harmonized standards, ring-fencing remains a realistic constraint on the implementation of idealized SPOE strategies (Baudino et al., 2020), and both US and EU frameworks formally accommodate either SPOE or MPOE depending on a group's legal and operational structure (US Congress, 2010; European Parliament, 2014, 2019).

Because the actual resolution approach is rarely observed and SPOE commitments may not be credible in practice, we cannot directly map our estimates into an SPOE-MPOE channel. We therefore investigate the share of group assets booked in host countries with weaker resolution regimes than the home country on the home-country resolution index. If a resolution-arbitrage channel is operative, we should observe that groups headquartered in stricter home regimes book a larger fraction of their assets in weaker host regimes. Consistent with this prediction, we find that a one-point increase in the home resolution index is associated with an increase of about 0.48 percentage points in the share of group assets booked in weaker host regimes, significant at the 10% level. These findings are consistent with a location-based resolution-arbitrage mechanism: as the home-country regime becomes stricter, groups tilt their asset booking toward foreign subsidiaries located in relatively weaker resolution environments.

Our paper makes two main contributions to the literature. First, we work on bank resolution reforms and systemic risk by explicitly incorporating cross-border organizational structures. While Beck et al. (2020) study resolution reforms across FSB jurisdictions and document effects during crisis episodes, they abstract from parent–subsidiary links; we instead show that within-group cross-country discrepancies in resolution regimes (captured by our *Resolution Difference* measure) shape the parent bank's contribution to systemic risk. In doing so, we connect the resolution-reform perspective of Beck et al. (2020) with the regulatory-arbitrage evidence in Frame et al. (2020), and we show that the implications of arbitrage depend on institutional context: resolution asymmetries are associated with a *benign* reduction in systemic risk for parents headquartered in developed economies, but with a *malignant* increase for parents in developing economies, consistent with the distinction emphasized by Karolyi and Taboada (2015) and Karolyi et al. (2023).

Second, we contribute to the literature on regulation and regulatory arbitrage (Doidge et al., 2004; Beck et al., 2023, 2024) by isolating resolution regimes – rather than prudential regulation – as a distinct source of cross-border arbitrage incentives. Building on the mechanism in Acharya (2003) and Acharya et al. (2009) and the cross-border risk-taking evidence in Ongena et al. (2013), we provide tool-level evidence on when resolution can discipline such incentives: among the key resolution instruments, bail-in is the mechanism that most effectively limits the adverse arbitrage channel and reduces systemic risk in developed economies, aligning with theoretical arguments on the stabilizing role of credible loss absorption in resolution (Bernard et al., 2022).

We also contribute to the broader debate on post-crisis bank resolution and regulatory arbitrage. While early work argued that stronger resolution frameworks should curb systemic risk (Landier and Ueda, 2009; Rutledge et al., 2012; Huertas, 2013; Klimek et al., 2015; Chari and Kehoe, 2016), and studies on arbitrage show that cross-border scope can amplify risk-taking when oversight is weaker (Acharya, 2003; Acharya et al., 2009; Ongena et al., 2013), our evidence highlights a tool-specific and institution-dependent channel: bail-in is the instrument that most effectively lowers systemic risk, particularly in developed economies, whereas weaker institutional environments are more prone to a "malignant" arbitrage pattern (Kandrac and Schlusche, 2021; Karolyi and Taboada, 2015).

The paper is organized as follows. Section 2 presents the institutional details regarding bank resolution and discusses strategic regulatory arbitrage in that setting. Section 3 describes our empirical model while Section 4 summarizes our sample selection, data and variables. Section 5 presents our empirical results and robustness checks. Conclusions follow. All variable definitions are in the Appendix.

2 Global Bank Resolution Regimes: Institutional Design and Strategic Arbitrage

2.1 The Bank Resolution Framework

The shift to a special bank resolution framework has been the cornerstone of the overhaul of banking regulation since the global financial crisis of 2008-2009. The need for this framework arose from the inability of general corporate insolvency regimes to resolve failing banks quickly and efficiently, and without causing a deeper crisis within the banking system. General corporate insolvency involves court handling of the liquidation of a single bank and aims at satisfying the claims of creditors. This regime applies when it is already too late to restructure the bank and does not take into account the systemic repercussions of a failure of a bank, such as bank runs, domino effects and contagion within the financial system and to the real economy.

The lack of a special bank resolution legislation that avoids lengthy court proceedings and is handled by a designated resolution authority forced governments to bailout banks with public funds at the peak of the financial crisis. In some instances, such as in Ireland in 2010, the government had taken up so much debt for expensive bailouts of banks that were considered "too big to fail" that it itself had to be bailed out by syndicates of international institutions (Breen, 2012). The bailouts (and the additional austerity measures in the case of Ireland) increased the pressure on governments to find a solution to avoid the excessive use of public funds in the future.

In 2009, the Basel Committee and the G20 entrusted the Financial Stability Board to devise guidelines for a comprehensive special bank resolution framework. This assignment resulted in the publication of 12 Key Attributes (KAs) of a successful bank resolution regime in 2011 (see FSB, 2011). The KAs took into account the good practices in the United States and other countries with special bank resolution regimes and provided a holistic view on the resolution process.[1] The KAs served as a base for the development of the Bank Recovery and Resolution Directive (BRRD), which harmonized the resolution tools and proceedings in the European Union (EU).

In 2013, the FSB published a report that took stock of the state of the bank resolution framework in its member countries (see FSB, 2013). The report revealed a huge heterogeneity in the implementation of bank resolution features, with the US, Switzerland and some countries in the EU having a large lead over countries in Asia and Southern Europe. In Figure 1, we report the timeline of the implementation of the resolution framework for 15 out of 22 countries in our sample. The figure shows substantial differences in the implementation of resolution reforms in the cross-section of countries in our sample, where several subsidiaries are located in different countries with different resolution regimes.

Since FSB (2013) contains information only about the status quo at the time of publication and does not provide exact dates of rules implementation, Beck et al. (2020) use the 12 Key Attributes (FSB, 2011) and FSB (2013) as a starting point to gather information about the effect of resolution regimes in the FSB constituent jurisdictions. The authors use national and international legal documents and surveys

[1] The United States had developed a special bank resolution regime already in the early 1990s to deal with the saving and loan crisis, while the implementation of Title II of Dodd-Frank Act in the US, the Banking Act in the United Kingdom in 2009 and the Bank Restructuring Act in Germany in 2010 added modern components to the resolution framework that took into account the lessons from the financial crisis.

with national regulators to compile a bank resolution index for each FSB member state.[2] Then, they exploit the heterogeneity in the index to gauge the impact of bank resolution regimes on systemic risk during global and bank-specific crises in an event-study setup. The authors do not track how that the ownership structure of global banks affects the results. Unlike Beck et al. (2020), we use the ownership structure of global banks to investigate whether they benefit from regulatory arbitrage due to their operations being in jurisdictions with varying levels of completeness of resolution frameworks.

A less stringent regulatory regime for a bank's foreign subsidiaries can lower the systemic risk of the parent bank at home by effectively creating a safety net through implicit bailout expectations. Systemic risk refers to the possibility of a collapse across the entire banking system, which bailouts are generally aimed at reducing. For banks with extensive international networks, particularly in weaker regulatory environments, there is an expectation of government intervention to protect these subsidiaries in times of distress (see, e.g., Schoenmaker and Siegmann, 2014; King, 2019). This expectation of bailouts abroad helps stabilize the parent bank's entire group, as the potential financial support in foreign jurisdictions can mitigate risks that could otherwise spread to the parent (see, e.g., Haufler, 2021). Although this setup may weaken market discipline and prudent incentives relative to domestic-only banks without such safety nets, exposure to lenient regimes nonetheless stabilizes the group and reduces systemic risk in the parent's home market.

[2] See Figure 3 for the dynamics of the Bank Resolution Index in selected developed and developing countries.

2.2 Resolution Arbitrage, Institutional Asymmetries, and the Stability of Global Banks

We aim at identifying the effectiveness of resolution regimes on systemic risk of global banks in the presence of variations in intervention regimes and tools across different countries. Based on our previous discussion, we anticipate that global banks might exploit the differences in resolution frameworks based on the locations of their subsidiaries operating in either more or less stringent regimes. In fact, bank resolution regimes have many different features that may reduce or increase systemic risk, depending on the circumstances (Beck et al., 2020). Regarding the actual occurrence of resolution arbitrage, no literature exists. In the broader field of bank regulation, Beck et al. (2025) show that regulatory arbitrage due to improved supervisory cooperation leads to readjustments in the allocation of assets within a banking group. Namely, they find that global banks direct funds to host jurisdictions that are unaffected by the increase in regulatory coordination among some of the countries where the bank is present.

A key premise of our mechanism is that cross-border resolution is not implemented under a fully centralized SPOE regime with perfectly credible commitments. When resolution responsibilities remain fragmented across jurisdictions or when SPOE plans are undermined by host authorities' incentives and ability to ring-fence local assets, global banking groups can face heterogeneous effective resolution regimes across their subsidiary network, creating scope for resolution arbitrage.

Under an SPOE framework, losses are absorbed at the holding-company level through bail-in, and capital and liquidity can be downstreamed to critical subsidiaries to preserve key functions. Under MPOE, by contrast, resolution can be applied to multiple entities within the group, with loss-absorbing capacity (e.g., MREL/TLAC resources) held locally at resolution entities, strengthening host-country control and making subsidiary-level regimes economically salient.

Theoretical and policy work emphasizes that home–host frictions make SPOE time-inconsistent and ring-fencing a realistic outcome. Faia and di Mauro (2015) show that non-cooperative authorities have strong incentives to ring-fence local assets, raising ex post costs and inducing ex ante adjustments in foreign exposures. Bolton and Oehmke (2019) argue that SPOE can be more efficient but may fail when *ex post* transfers are large or expected transfers are highly asymmetric. Baudino et al. (2020) similarly stress that, despite harmonized standards, national authorities remain incentivized to protect domestic stakeholders, constraining SPOE implementation. Recent episodes of banks' crisis are consistent with this view: resolution outcomes often reflect discretion, public backstops, and host-country actions rather than a frictionless execution of planned group-wide SPOE.[3]

Consistent with this institutional setting, both U.S. legislation and the EU BRRD framework accommodate SPOE and MPOE strategies, with the choice depending on group structure and geographic footprint (US Congress, 2010; European Parliament, 2014, 2019). Overall, this evidence supports the plausibility of resolution arbitrage: as home-country resolution strictness changes, multinational groups can adjust the

[3]For instance, the 2023 Credit Suisse case involved extensive public support and a merger rather than the activation of the planned resolution strategy (Credit Suisse, 2023; FINMA, 2023). In the United States, the systemic risk exception was used to protect uninsured depositors in the Silicon Valley Bank (SVB) and Signature Bank failures (FDIC, 2023); and the UK authorities resolved SVB's UK subsidiary under the domestic special resolution regime (Bank of England, 2023). These cases underscore that host-country regimes and ring-fencing incentives remain empirically relevant.

location of activities and loss-absorbing capacity across subsidiaries operating under heterogeneous host-country regimes. In this setting, the extent to which such opportunities translate into observable within-group reallocation may plausibly depend on the institutional environment in which subsidiaries operate.

Due to the diverse levels of regulatory and economic development across the countries in our sample, we are also able to investigate whether a country's development level influences the impact of differences in resolution within financial conglomerates. As shown by Demirguc-Kunt and Huizinga (2000), we expect that the effect of the new resolution framework on bank risk depends on the economic and financial development of a country. Banks in less developed countries, where contract enforcement tends to be inefficient, may exploit more easily the differences between parent and subsidiaries enforcement rules across countries than in developed countries, where banks are more efficient (Demirguc-Kunt and Levine, 1999).

For banks operating across borders, this creates an opportunity to mitigate such risks by strategically placing or shifting assets to subsidiaries in jurisdictions where regulatory pressures are lighter, thereby balancing market discipline in stricter regimes and potential bailout support in less stringent ones. Specifically, we expect a more pronounced *malignant* form of resolution arbitrage among global banks whose parent companies are located in less financially developed markets, where enforcement of rules and protection of creditor rights are comparatively weaker (La Porta et al., 1999).

Because the effect of resolution arbitrage on systemic risk varies across countries, we also investigate what type of characteristics drive the effect of regulatory arbitrage on systemic risk. Specifically, we expect that differences in different tools between parent and subsidiaries affect the parent systemic risk in a heterogeneous way. For instance, a divergence in terms of bail-in framework might have a different effect compared to the case when parent and subsidiaries differ in terms of other resolution support measures (see, e.g., Haufler, 2021). Based on these previous insights, we predict that the effectiveness of the resolution framework in mitigating the systemic risk of global banks is shaped by the level of country development and the types of resolution features employed.

Empirically, we test these predictions by estimating the effect of *Resolution Difference* on $\Delta CoVaR$ separately for parent banks headquartered in developed and developing countries (and, equivalently, through interaction terms), and by decomposing *Resolution Difference* into tool-specific gaps – such as bail-in versus other resolution support measures – to assess which tools drive the cross-country heterogeneity in systemic-risk outcomes.

3 Empirical Framework

In this section, we detail the key components of our empirical analysis. We begin by describing how we construct our main measure of resolution arbitrage, the "Powers difference" index. Next, we define our measure of systemic risk, the $\Delta CoVaR$. Finally, we outline the empirical model used to estimate the impact of resolution differences on systemic risk.

3.1 Measuring Bank Resolution and Regulatory Arbitrage

In our paper, we exploit the resolution differences across parent and subsidiary banks to investigate the effect of these differences on the contribution to systemic risk of banking conglomerates. We start by employing the bank resolution index developed by Beck et al. (2020). The index tracks the development of resolution regimes in 22 members of the Financial Stability Board (FSB) across several categories: i) general resolution framework; ii) powers of the resolution authority; iii) number of tools beyond bail-in available to the resolution authority; iv) whether the resolution regime allows for bail-in; v) additional support measures to resolve a bank.

The index is constructed by country and the details about its individual elements are available in Appendix A.2. Beck et al. (2020) compile the overall Bank Resolution Index by summing up the five categories per country and per date t:[4]

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

where $I_{m,c,t}$ takes the value of one if a particular resolution measure m is implemented (or already exists) in country c at time t and zero otherwise. Because the index is assigned at the country level and since we know the location of parent and subsidiaries, we are able to construct our main measure of resolution arbitrage, which we label as $Resolution\ Diff$. We construct this new measure as the difference between the parent resolution index and the asset-weighted average of the resolution indexes of all

[4]Our dataset contains the exact date of implementation of a given bank resolution feature.

its subsidiaries, as follows:

$$Resolution\ Diff_{i,c,t} = Resolution\ Index_{c,t} - \sum_{j=1}^{N} w_{j,i,t} \times Resolution\ Index_{d,t}, \quad (2)$$

where w_{it} are the weights (assets) of subsidiary j of country d of parent bank i in country c in the year t. A positive value implies that parent banks are in a stricter resolution regime with respect to their subsidiaries, and vice versa. At a later stage of the analysis, we subdivide the index into several subcategories as in Beck et al. (2020): General resolution, resolution powers, resolution tools, bail-in framework and support measures. We then calculate the respective difference measures for these subcategories in the same way as in Equation 2.

To illustrate, the variable *"Powers difference"* represents the disparity in resolution powers between the country of the headquarters and the countries of its subsidiaries. To facilitate interpretation of the coefficient, we construct an indicator variable equal to one when the respective parent tool is more stringent compared to its subsidiaries, and zero otherwise. Table A.1 presents the definitions of all resolution variables we use. For example, the powers of the authority might include replacing the bank management, or operating the bank itself. "Tools without bail-in" mostly include the transfer of assets and liabilities, and the establishment of a bridge institution. It is noteworthy that none of the parent banks in developing countries have adopted the bail-in tool. Consequently, we are precluded from examining the disparate effects of bail-ins between developed and developing countries.

3.2 Model Specification

We start our empirical analysis with a panel fixed effects estimation. Our main dependent variable is the bank's contribution to the systemic risk of a country's banking sector, measured by $\Delta CoVaR$ (at the yearly level). As we would like to capture whether the differences in resolution within banking groups affect the contribution of parent banks to systemic risk, our main dependent variable is "Resolution Difference", which is the difference between parent and subsidiary resolution regimes (based on the country location of the respective bank), value-weighted by each bank's total assets. The resolution framework changes are annual and reported in figure 4. The model reads as follows:

$$\begin{aligned}\Delta CoVaR_{i,c,t} = \alpha + \beta ResolutionDiff_{i,c,t-1} + \beta_1 ResolutionIndex_{c,t-1} + \\ + \lambda BankControls_{i,c,t-1} + \gamma MacroControls_{c,t-1} + \mu_i + \nu_t + \epsilon_{i,c,t},\end{aligned} \quad (3)$$

where $\Delta CoVaR_{i,c,t}$ is the contribution to systemic risk of bank i in year t in country c, and μ_i and ν_t are bank fixed effects and time fixed effects, respectively. The variable $ResolutionDiff_{i,c,t-1}$, as defined above, is the difference between the resolution indices in the home country c of parent bank i and the asset-weighted average resolution index in the countries of bank i's subsidiaries at time *t-1.* The variable *ResolutionIndex* is the level of the resolution index in the home country c of parent bank i at time *t-1*, plus vectors of bank and macroeconomic controls, lagged by one period. The bank and macroeconomic variables are defined in Section 4.2 and Table A.3 in the Appendix.

Following the standard approach in the literature, we cluster standard errors at the parent bank level (and at the bank-year level as a robustness test). We also include year and bank fixed effects to control for all bank- and time-invariant characteristics that may affect our results. We estimate our model over two subsamples: developed and developing countries, according to the classification of Morgan Stanley Capital International.[5] We expect a negative (positive) coefficient of the "Resolution Difference" variable if systemic risk decreases (increases) when the parent bank is subject to a stricter resolution regulation than its subsidiaries.

4 Sample Selection, Variables and Data

4.1 Sample Selection

Our sample selection starts with the pool of all listed banks and their private subsidiaries in Bureau van Dijk's Bankscope from 2000 to 2015.[6] Bankscope also contains information about the ownership structure of global banks. We are therefore able to identify if a bank has one or more subsidiaries, and in which country a subsidiary is located. Our sample comprises parent banks from 18 countries, spanning both developed and developing economies, as defined by the MSCI classification. The developed countries in our sample include Australia, Canada, France, Germany, Hong-Kong, Italy, Japan, the Netherlands, Singapore, Spain, Switzerland, the United Kingdom, and the United States. The developing countries represented are China, India, Indonesia, Korea, and South Africa. We keep all banks with complete information on

[5] See MSCI Emerging Markets Index at `https://www.msci.com/our-solutions/indexes/emerging-markets` (MSCI, 2024).

[6] We end the sample in 2015 as our bank-level balance sheet data stop in 2015. It is important to notice that after the BRRD/SRMR the EU resolution framework should be largely harmonized, mechanically reducing cross-country variation in our index. Thus, extending the index beyond 2015 would require substantial new legal coding of national implementing laws and subsequent reforms.

size, loans, deposits, return on assets (ROA), and leverage. The balance-sheet data is unconsolidated. Consequently, we can track the total assets for each subsidiary to determine its significance within the overall group. This approach helps to avoid over-weighting countries where a group's subsidiaries are relatively small.

Corporate ownership is key information for our analysis as it allows us to construct indicators regarding the differences in the bank resolution frameworks in which a parent and its subsidiaries operate. This difference is equal to zero for all standalone banks (i.e., banks without subsidiaries). We also retrieve macroeconomic data from World Bank's World Development Indicators database. The frequency of the balance sheet and macroeconomic data is annual.[7] After merging this data with yearly balance sheet information, the final sample covers 500 listed parent banks and 3,486 subsidiaries, of which only 228 are listed, over 18 (out of 22 FSB) countries, for a total of 6,310 parent bank-year observations.[8] The details of the sample selection are in section A.4 of the Appendix.

Table 1 presents the summary of countries included in the sample, along with the number of parent banks, bank-year observations, and the average bank size relative to GDP. The United States is the largest country in the sample, accounting for 387 parent banks. Among developed countries, Japan, the United Kingdom, and Canada are also prominently represented. Japan remains a unique case in our dataset due to the close ties between financial and corporate groups, commonly known as "financial

[7]The details regarding variable construction are available in the Appendix, together with their pairwise correlations (Table A.5).

[8]For our balance sheet data, we carry forward the last reported financial values. We chose this approach, instead of interpolating balance sheet data as in Barth and Schnabel (2013), to avoid introducing artificial variation into our estimation. This conservative setup, while reducing variation in the data, ensures that any significant effects observed represent the lower bound of the actual effects.

keiretsu" (Aoki and Patrick, 1995). To ensure that our results are not disproportionately influenced by the business models or institutional specificities of the largest contributors, we exclude the United States and Japan in our robustness checks. The set of developing countries - such as China, India, Indonesia, Korea, and South Africa - account for substantial cross-sectional and regulatory variation critical to our identification strategy.

4.2 Variables

Dependent Variable

Similar to Beck et al. (2020), we use ΔCoVaR (Adrian and Brunnermeier, 2016) as our main proxy for a bank's contribution to systemic risk. This measure is computed at the parent bank level and is derived from daily stock returns. Specifically, ΔCoVaR is defined as the difference between the Value at Risk (VaR) of the financial system conditional on a bank being in distress (typically at its 5th percentile return), and the VaR of the financial system conditional on the same bank being in a median state. In our framework, higher values of ΔCoVaR indicate a stronger contribution to systemic risk, meaning that distress at that bank is associated with greater potential losses to the rest of the financial system. Positive values represent systemic risk amplification.

To construct the variable $\Delta CoVaR$, we retrieve daily bank stock prices from 2000 to 2016 from Thompson Reuters Datastream. To preserve some of the variation in CoVaR, we reduce the frequency from daily to *average* yearly values, rather than annual, following a similar approach to Barth and Schnabel (2013). Unlike Barth and Schnabel (2013), in the final empirical setup, we do not interpolate balance sheet data from annual to monthly frequency to avoid the introduction of artificial variation in our models. The results at the monthly frequency are quantitatively and qualitatively similar and available upon request.

To ensure robustness, we replicate our analysis using an alternative measure of systemic risk, the Marginal Expected Shortfall (MES), which captures the expected loss of a bank's equity value conditional on the market being in distress. The results using MES are consistent with our main findings. Further details on the construction of ΔCoVaR and the MES are provided in Appendix A.1.

Control Variables

We include a set of standard bank-level and macroeconomic control variables. **Leverage**, defined as the ratio of total assets to common equity, which is generally associated with greater risk exposure; **Managerial Quality (ManQuality)**, measured as the ratio of operating profit to total income, which proxies for operational efficiency; and **Return on Average Assets (ROA)**. We also control for bank **Liquidity**, measured as the ratio of liquid assets to customer deposits,[9] and for **Size**, defined as the natural logarithm of total assets scaled by GDP. Finally, we control for the logarithm of GDP (*lnGDP*), GDP growth, and inflation, using data from the World Bank's WDI. Higher *GDP growth* is typically associated with lower systemic risk due to improved macro conditions, whereas the effect of *inflation* can be ambiguous - either as a hedge against real shocks or a source of volatility.

[9]Higher liquidity should reduce the likelihood of distress and thus lower systemic risk.

4.3 Descriptive Statistics

Table 2 reports the summary statistics for all variables in the sample. Panel A of Table 2 shows the distribution of the main dependent variable, $\Delta CoVaR$, for all parent banks in our sample, together with their balance sheet information collapsed at the bank-year level. The descriptive statistics in Table 2 show that $\Delta CoVaR$ varies substantially across banks (from -.26 to +10.1). The mean of $\Delta CoVaR$ equals 1.25, hence, 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 1.25 daily percentage points (averaged over a year).

The plots in Figure 2 show the evolution of CoVaR over time across several dimensions. The spikes in CoVaR tend to coincide with events that significantly affect the systemic risk of the banking sector. Panel A of Table 2 also shows that banks vary substantially in size, from 0.001% to 45% (like Lloyds in UK) of the GDP of their own country.

Panel B of Table 2 presents a comparative analysis of parent banks in developed and developing countries. The average number of subsidiaries per financial group does not vary between developed and developing countries, with a median of two subsidiaries per parent. Among these, 8% of banks have at least one foreign subsidiary, yet they represent approximately 60% of the total assets held by large financial groups.

Parent banks in developed countries are generally subject to more stringent resolution regimes. The average Resolution Index is higher for developed countries (2.67 vs. 2.50), with a highly statistically significant difference. Similarly, the adoption of bail-in tools is only present among developed-country banks (33% vs. 0%), with a strongly significant gap. The resolution framework score, which captures the authority's range of tools and responsibilities, is also higher in developed countries (3 vs 1.86), reinforcing the pattern of regulatory asymmetry. In developed countries, parent banks typically operate in tighter regulatory regimes compared to their subsidiaries: the Resolution Difference is positive and significant. Framework and support measure differentials also show positive and significant coefficients ($t = 6.75$ and $t = 2.86$, respectively), again confirming the existence of regulatory arbitrage opportunities.

We also report significant differences in financial ratios. Banks in developing countries exhibit significantly higher profitability (ROA), larger average size, and greater liquidity (0.45 vs. 0.17). Macro indicators further confirm distinct environments: GDP growth and inflation are substantially higher in developing countries, with t-statistics of 27.84 and 40.11, respectively. Conversely, developed countries show significantly higher leverage and lower managerial quality, as captured by the operating profit-to-income ratio.

It is important to note that none of the parent banks in the developing countries had implemented the bail-in tool, and for this reason, we cannot investigate the heterogeneous effect of the bail-in between developed and developing countries. However, some countries (India, Indonesia) had implemented some additional tools, which include the possibility of splitting failing banks into good and bad banks, or of establishing of a bridge institution.

To illustrate the evolution of the difference across parents and subsidiaries over time, Figures 3 and 4 report for both developing and developed countries, the average resolution index (Figure 3) and the average difference of the resolution index between parent and subsidiaries by year (Figure 4). Both developed and developing countries increase the sophistication of their bank resolution regimes over time. However, while the difference in resolution strength between parents and subsidiaries has turned positive for developed countries, which implies a tighter resolution regime of parent banks, the opposite applies to developing countries. This opens up possible regulatory arbitrage opportunities across the members of the same financial group that are located in different jurisdictions.

5 Empirical Results

In a first step, we aim at investigating the contribution of parent banks to systemic risk in case they have subsidiaries located in different regimes, both for parents in developed and in developing countries. We then employ a quasi-natural experiment to address the concern that some unobserved heterogeneity drives our results.

5.1 Developed versus Developing Countries

We start our analysis by looking at the effect of resolution arbitrage on bank systemic risk when parent banks are located in a developed country. We estimate Equation 3 on the sub-sample of developed countries, as classified by the MSCI index. The results under different model specifications are provided in Table 3. Columns (1)-(4) of Table 3 show that the higher the difference in resolution regimes between the parent and its subsidiaries, the lower the systemic risk in the *developed* country where the parent bank is located. In Columns (5) and (6), we categorize our main variable into dummy variables representing positive and negative resolution regime differences and show a positive effect (i.e., a reduction) on systemic risk when parents are located in a stronger resolution regime (Column (5)), and a negative effect (i.e., an increase) on systemic risk, when parents are in a weaker regime (Column (6)). In Column (7), we replicate Column (4) excluding the United States and Japan and find similar results to the overall sample.

The results show that for each unit increase in "Resolution Diff. (Par/subs)," CoVaR decreases on average by 0.047. In terms of economic significance, that means that an increase in the difference in resolution strength from the 25th to the 75th percentile between parents and subsidiaries corresponds to a 3.06% reduction in the bank's average contribution to systemic risk. The effect is driven by the cases where the difference is positive (Column 5), with a coefficient equal to -0.08. Conversely, a laxer resolution regime in the parent country leads to a 3% increase in the parent's contribution to systemic risk (Column 6). To verify that the large U.S. sample does not affect our main results, in Column 7, we replicate Column 4 with the U.S. sample limited to the largest 50 U.S. banks.[10] The results remain qualitatively similar. Overall, the signs of the control variables are as expected. A better management quality and higher liquidity reduce systemic risk. At the same time, the finding that larger bank size reduces systemic risk may signal the presence of a too-big-to-fail phenomenon in our bank sample.

We then analyze which characteristics of the resolution framework play a larger role in decreasing parent banks' systemic risk. In Table 4, we separately look at differences between parent and subsidiaries in terms of the powers assigned to resolu-

[10] All non-U.S. banks remain in the regression sample.

tion authorities, the available tools in the resolution kit that exclude the bail-in tool, whether there is a separate bail-in framework, as well as the differences in additional support measures when resolving a bank. To interpret the direction and the magnitude of the coefficient more intuitively, we define an indicator variable equal to one when the tools in the parent bank country are stricter with respect to the resolution powers in the country of the subsidiary. Therefore, a negative sign of the coefficient would imply that a stricter resolution regime for the parent bank has positive spillover effects from its subsidiaries.

The results in Columns (1) to (4) of Table 4 indicate that the presence of a stricter bail-in regime in the country of the parent bank reduces the systemic risk of parents having subsidiaries abroad by 6.8% (0.219*2*0.157), which is the highest value for a single tool in our sample. This suggests that a comprehensive adoption of bail-in may be the most effective resolution tool in reducing the systemic risk of the banking sector. The level effect of the bail-in tool is not statistically significant as bail-in is still not fully operational across many countries, which leads to a lower statistical power in the sample. However, the coefficient is economically relevant: a more stringent bail-in framework at the parent bank level reduces systemic risk by 7.8% when moving from the 25th to the 75th percentile.

The results also indicate that a positive difference in resolution powers between parents and subsidiaries reduces systemic risk contribution of the parent bank by 2%. Therefore, we confirm that resolution powers play a major role in explaining the main effect of the resolution regime differences across parents and subsidiaries. These results are in line with the findings of Beck et al. (2020) for resolution regime levels during major crisis events around the globe. Finally, having additional support measures increases the systemic risk of the country the bank is in. This result can be explained by the additional compliance costs and resolution fund fees banks in more advanced resolution environments have to face, and these costs are even higher for banks with international operations (see, e.g., Acharya, 2003).[11]

In a second step, we answer the question whether banks from developed countries have different strategies to banks in developing regions. Columns (1) and (2) show positive but statistically insignificant coefficients of the resolution difference variable. While developing countries provide substantial cross-sectional and regulatory variation, they account for only a small fraction of the sample: around 300 parent bank-year observations, compared with more than 6000 for developed economies (see Table 1). This large imbalance implies that separate regressions for developing countries alone would deliver very imprecise estimates. Therefore, to analyze the heterogeneity by development status we proceed with specifications with the full sample of banks with interaction terms.

To this end, we estimate an additional model that includes the interaction between the resolution difference index and an indicator variable equal to one if the parent bank is in a developed country (according to MSCI). The results in Columns (3) of Table 5 show that a larger difference in resolution regimes between a parent and its subsidiaries implies a higher systemic risk for the developing country where the parent bank is located (Line 2). Specifically, a one-step increase in the difference in resolution strength between parents and subsidiaries implies a 21% increase in the contribution of the bank to the systemic risk of its own country (Column 3). The

[11] We cannot include all resolution-difference indicators in a single specification because they are highly collinear. Appendix Table A.5 shows pairwise correlations typically in the 0.7–0.9 range (e.g., bail-in differences and resolution-powers differences are correlated at about 0.91).

result is economically relevant and suggests that differences in resolution regimes are less likely to have positive spillovers when the parent is located in a developing country.

In Columns (4)-(6), we compare the effect of disparities in resolution regime tools between developed and developing countries. Our findings indicate that the powers of resolution play a crucial role in reducing systemic risk within developing countries. For other subindices, such as tools excluding bail-in and additional support measures, the coefficients of the interactions are omitted as they exhibit negative or zero values. In other words, parent banks in developing countries, on average, consistently operate under a less stringent resolution framework compared to the average of their subsidiaries and therefore, according to our definition, the respective indicator takes the value of zero.

5.2 The Dodd-Frank Act and the Quest to End "Too Big to Fail"

In this section, we address concerns about potential omitted variable problems affecting our baseline results. To control for any unobservable characteristics that might drive both the differences in resolution and bank ΔCoVaR, we exploit the announcement of the U.S. *Financial Regulatory Reform Proposal* on June 17, 2009 as an exogenous shock to the expected strictness of the U.S. resolution framework. This reform is a precursor to FSB's 2011 Key Attributes and later the Bank Recovery and Resolution Directive (BRRD) in Europe. The proposal introduced the core elements that would later become Titles I and II of the Dodd-Frank Act - mandatory resolution plans, enhanced supervisory expectations, and a new resolution authority - thereby signaling a shift away from bailout-based crisis management and toward a regime aimed at ending the "too big to fail" problem. As visible on Figure 3, the extent of the reforms in the US was substantial and has only recently been matched by other countries. Therefore the magnitude of the resolution differences affecting US banks with foreign subsidiaries could not have been predicted at the time of the announcement.

We follow the established empirical literature in using policy announcements, rather than final implementation dates, as the relevant regulatory shocks. Prior work shows that financial markets incorporate regulatory information immediately when it becomes public, rather than when legal implementation occurs (see, e.g., Puri et al., 2011; Acharya et al., 2018). By contrast, the July 2010 enactment of the Dodd-Frank Act (US Congress, 2010) did not introduce new information, as the core regulatory architecture had already been disclosed in 2009 . In line with this timing, we designate 2010 as the first full treatment year. This approach is standard in event-based regulatory studies, which typically allow one period for the shock to diffuse into banks' strategic decisions, balance sheet adjustments, and internal capital markets, while avoiding confounding effects during the announcement year itself.

The announcement is particularly suitable for our design because it affected only U.S. banking groups, while no equivalent resolution reforms were introduced simultaneously in other major jurisdictions. Therefore, foreign banks were only indirectly affected through their U.S. operations. This generated a sharp divergence in expected resolution strictness not only between U.S. parent banks and foreign subsidiaries, but also among U.S. parent banks (captured by the variable Resolution Difference) – a prerequisite for evaluating cross-border resolution arbitrage. Furthermore, the main objective of the reform was to solve the too-big-to-fail problem of U.S. banks and not to target any specific global U.S. bank with a particular corporate ownership structure. While investors around the world might have expected tighter regulation in the U.S., the magnitude and scope of the prospective reforms had been unclear. This timing provides a clean and well-justified setting to identify the effects of heightened home-country resolution strictness on the systemic risk of global banking groups.

To perform this test, we compare US banks to foreign banks of similar size to investigate whether the effect of the announcement varied depending on the resolution differences across parent and subsidiaries. Our conjecture is that parents in a stricter resolution regime will benefit from having subsidiaries in less strict resolution regimes. We expect a stronger decrease in the risk of these banks after the announcement compared to foreign banks, which are not under the jurisdiction of the Federal Reserve. We then perform a matched difference-in-difference-in-difference (DDD) estimation, where we first match US banks with foreign banks according to size, and then estimate the following model over a window of two years before and after the announcement:

$$\begin{aligned}\Delta CoVaR_{i,c,t} = \alpha &+ \beta_1(ResDiff_{i,c,t-1} \times treated_i \times after_t) + \\ &+ \beta_2(ResDiff_{i,c,t-1} \times treated_i) + \beta_3(ResDiff_{i,c,t-1} \times after_t) + \\ &+ \beta_4(treated_i \times after_t) + \beta_5 ResDiff_{i,c,t-1} + \lambda BankControls_{i,c,t-1} \\ &+ \gamma MacroControls_{c,t-1} + \mu_i + \nu_t + \epsilon_{i,c,t}\end{aligned} \tag{4}$$

where our control group consists of European and Asian banks, while the treated group includes U.S. banks matched by size. The variable $after$ is a binary indicator variable equal to one for 2010 2011, and zero for 2008 and 2009. The main variable of interest is the interaction term $ResDiff_{i,c,t-1} \times treated_i \times after_t$, which captures the heterogeneous effect of the announcement across banks with different resolution regimes.

The results are reported in Table 6. The coefficient of the interaction between the resolution difference between parent and subsidiaries of US banks after the announcement is economically and statistically significant, which confirms our expectations about banks with a US parent in a stricter resolution regime and centralized resolution framework being more affected by the announcement, compared to the foreign banks not affected by the announcement. Specifically, these banks experience a decrease in ΔCoVaR by 29% compared to the years before the announcement. Since the announcement was in mid-2009, the market-based measure for systemic risk that we could have been affected already in that period. Therefore, in Column (5) we present a robustness check, where we exclude 2009 and shift the pre-reform period one year back (i.e., starting from 2007).

These results are in line with our baseline findings and confirm that banking conglomerates exposed to different (i.e., less strict) resolution frameworks contribute to their home country's systemic risk in heterogeneous ways, depending on where their subsidiaries are located.

5.3 Robustness and Extensions

We perform a broad set of robustness checks (alternative systemic risk measure, different clustering, excluding U.S., excluding crisis years, additional controls for macroprudential policies, and tests of alternative mechanisms). Across all these exercises, our main finding that stricter parent resolution regimes relative to subsidiaries have opposite effects in developed vs developing countries remains intact.

Extension: Did Asset Reallocation Actually Occur?

First, we provide new empirical evidence that is directly informative about the presence of asset relocation when stricter rules are introduced in the home jurisdiction of the parent. Since the actual resolution approach is rarely observed and SPOE commitments may not be credible in practice, we cannot directly map our estimates into an SPOE-MPOE channel. While we do not have access to actual data for asset transfers within banking groups, we can observe whether the share of the banking group in weaker host regimes increases after reforms at home. Using group-year data, we capture the share of group assets booked in host countries with weaker resolution regimes than the home country's regime. If a resolution-arbitrage channel is operative, we should observe that groups headquartered in stricter home regimes book a larger fraction of their assets in weaker regimes.

We first identify banking groups using the consolidated parent identifier. We define an indicator $weak\ host = 1$ if the subsidiary's country has a strictly lower resolution index than the parent's home country in that year ($ResolutionIndex < home\ res$), and $weak\ host = 0$ otherwise. For each group-year, we compute total group assets and total assets located in weaker host regimes. Our main group-level dependent variable is then the share of group assets booked in weaker regimes, defined as the ratio of assets of subsidiaries in in weak hosts to total group assets (expressed in percentage points). Group-level bank controls (leverage, managerial quality, ROAA, liquidity, size) are constructed as group-year averages of the corresponding entity-level variables, and we proxy home-country macro conditions by home-country log GDP, GDP growth, and inflation.

Columns (1) and (2) of Table 7 report regressions of the share of assets in weaker host regimes on the home-country resolution index. All specifications include group and year fixed effects, so identification derives from within-group changes over time in *home_res*, interacting with the group's fixed cross-border network. In Column (1), a one-point increase in the home resolution index is associated with an increase of about 0.48 percentage points in the share of group assets booked in weaker host regimes, significant at the 10% level. Column (2) adds group-level bank controls and home-country macro controls; the coefficient of *home_res* remains practically unchanged (0.504) and statistically significant, indicating that the result is not driven by differences in average leverage, profitability, liquidity, size, or by the home macro cycle.

In Table 7, we also extend our asset-allocation analysis and show that the reallocation of assets into weaker-resolution host countries is systematically related to the institutional quality of host jurisdictions. Columns (3) and (4) introduce the average host-country rule-of-law index as a proxy for the institutional environment in which foreign subsidiaries operate. The variable "Rule of Law", retrieved from the Worldwide Governance Indicators (World Bank, 2019), captures perceptions of the extent to which agents have confidence in and abide by the rules of society, in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. The indicator is reported annually by country and is a standardized score ranging approximately from -2.5 (weak rule of law) to $+2.5$ (strong rule of law). For each banking group and year, we compute the average rule-of-law index across the host countries in which the group operates.

In Column (3), both the home resolution index and the host rule-of-law average enter with positive signs. Column (4) allows the effect of home-country resolution to vary with host-country rule of law by including an interaction between the two. In this specification, the coefficients are significant and economically meaningful: both the home resolution index and the host rule-of-law average are positive, while their interaction term is negative and statistically significant at the 5% level. This implies that the reallocation response to stricter home resolution is strongest when the banking group's foreign activities are concentrated in low-rule-of-law countries and becomes progressively weaker as the average rule of law in host jurisdictions improves. Importantly, this pattern remains when we control for group-level bank characteristics and home-country macroeconomic conditions. These findings are consistent with a location-based resolution-arbitrage mechanism: as the home-country regime becomes stricter, groups tilt their asset booking toward foreign subsidiaries located in relatively weaker resolution environments.

Extension: Liquidity Spirals vs Overleveraging

We also explore the channel influencing the impact of regulatory arbitrage on systemic risk of banks with foreign subsidiaries after the announcement of the Dodd-Frank proposal. Specifically, we test whether systemic risk escalates due to liquidity spirals (Brunnermeier and Pedersen (2009) and Adrian and Brunnermeier (2016)), or due to higher leverage Beck et al. (2020). In Table 8, we report the results of Equation 4 after splitting the sample according to high leverage or liquidity (belonging to the 75th percentile). We find support of a higher liquidity increasing the beneficial effect of resolution arbitrage across banks. Thus, preventing liquidity spirals reduces systemic risk in the US and may augment the benign effect of regulatory arbitrage observed for developed countries.

Robustness: Country-by-year fixed effects in place of country-level macro controls

As the next robustness check, we report specifications with country-by-year fixed effects in place of country-level macro controls. To illustrate how demanding this specification is in our context, we focus on the subsample of banks for which the resolution gap is economically meaningful - namely, banks that own foreign subsidiaries. In this subsample we observe only 457 bank-year observations corresponding to 48 parent banks, with an average time dimension of 9.5 years per bank. For these observations, the variable *ResolutionDiff* (Par/subs) has a mean of 0.282 and an overall standard deviation of 1.272 (see the Appendix Table A.6). The between-bank standard deviation is 0.993 across 48 banks, while the within-bank standard deviation is 0.925. This confirms that the identifying variation in the resolution gap is concentrated in a relatively small set of cross-border banking groups, which however represent 60% of the banks' assets in our sample, and reflects discrete changes over time driven by a limited number of reforms, rather than frequent high-frequency movements.

Table 9 presents the results for the resolution differences index and the subindices. While the magnitudes of the effects remain consistent, we observe a drop in statistical significance for the main variable and most of the subindices. A notable exception is the effect of bail-in differences, which survives this very conservative specification. This strengthens our finding that bail-in reduces systemic risk of global banks via regulatory arbitrage through the corporate ownership structure of global banks.

When we then estimate the outcome equation with both bank fixed effects and country-by-year fixed effects in this small and highly structured sample, most of the variation in *ResolutionDiff* is effectively absorbed by the fixed effects. Intuitively, with only 457 observations, 48 bank fixed effects, and a large number of country-by-year dummies, the design becomes almost saturated: the model attempts to identify the effect of *ResolutionDiff* from a very limited amount of residual variation, concentrated in a few large cross-border groups. As a result, the coefficient on *ResolutionDiff* becomes imprecisely estimated and is no longer statistically significant, even though the sign and the order of magnitude remain similar to our baseline specification (see Table 9). We interpret this loss of statistical significance as a mechanical consequence of the very demanding fixed-effect structure and the small effective sample, rather than as evidence against the underlying mechanism.

Econometrically, the specification with bank and country-by-year fixed effects is therefore an extremely conservative robustness check in our setting. Because resolution regimes are country-level, slow-moving policies, absorbing all country-by-year variation is close to conditioning on the main source of identification in a sample where the relevant variation is already limited to a small set of cross-border banks. Our preferred specification with bank fixed effects and year fixed effects, complemented by country-level macro controls, instead allows us to exploit the cross-country and over-time variation in resolution regimes while flexibly controlling for macroeconomic conditions, and delivers stable and precisely estimated coefficients on *ResolutionDiff*.

Alternative Measure of Systemic Risk: MES

Next, we use an alternative measure of systemic risk as our main dependent variable: the Marginal Expected Shortfall (MES), introduced in Acharya et al. (2016). We rerun Equation 3 and report the results in Table 10. The main results for the overall arbitrage indicator remain qualitatively the same after this change.

Alternative Specifications: Standard Errors, Dropping U.S. Banks and Excluding Financial Crisis Period

As additional tests, we rerun the specification in Equation 3 by two-way clustering our standard errors at the bank and year level (Table 11, columns (1)-(3)), and drop the US from our sample (Table 11, columns (4)-(6)). The results remain stable across both of these robustness tests. Since our sample period covers the global financial crisis of 2008-2009, we would like to exclude the possibility that our effects are driven by the financial crisis. We therefore drop the years 2008 and 2009 and we estimate again Equation 3. The results in Table 12 present this robustness check and are consistent with the results that include the crisis period. We also perform a placebo test using leads of the Resolution Difference variable in Table 13. We find that future changes in resolution differences do not predict current systemic risk, suggesting that pre-existing trends in systemic risk are not driving our main findings.

Alternative Explanation: Diversification

Next, we test whether our results partially capture different bank or country effects. First, we test for the existence of a diversification effect. Laeven and Levine (2007) show that the diversification of activities across financial conglomerates generates a value discount, because insiders are able to extract private benefits at the expense of minority shareholders. On the other hand, there might be a coinsurance effect that can be different between developed and developing countries.

We therefore follow Laeven and Levine (2007) and construct a measure of diversity at the group level, based on the bank's specialization on loan activity, proxied by the asset-weighted average of loans - at the group level - over the total assets. A very low value of this variable implies that the bank does not specialize in lending, and vice versa. We add this variable to the set of our control variables and estimate the model for developed (Columns (1)-(2)) and developing countries (columns (3)-(4)) in Table 14. The table shows that our effect remains stable after controlling for group specialization.

Alternative Explanation: Confounding Macro-prudential Policies

Another confounding factor is the introduction throughout the sample period of various macro-prudential policies at the parent/subsidiary level that might drive our results. We therefore employ the IMF's integrated Macroprudential Policy (iMaPP) Database (see Alam et al. (2019)) to retrieve several indicators of alternative macro-prudential policies at the country level introduced in the sample period . Specifically, we control for the average loan-to-value limits at the country level, as differences between parent and subsidiaries can be driven by more aggressive policies at the loan portfolio level. Additionally, we construct a Policy Action indicator (SUM17) that proxies for all capital and liquidity policies introduced at the country level that might affect the systemic risk of parents and subsidiaries. We furthermore would like to control for financial development, inflation differential between parent and subsidiary countries and differences in regulatory quality. Table 15 shows that our main effects remain economically and statistically significant after controlling for these alternative policies.

6 Conclusion

This paper examines whether global banks engage in resolution arbitrage when global banks have affiliates in jurisdictions with varying regulatory strengths and how these differences influence their systemic risk. Previous literature identifies two types of regulatory arbitrage concerning systemic risk: a "benign" form that enhances capital allocation and reduces systemic risk, and a "malignant" form that encourages excessive risk-taking and increases systemic risk (Frame et al., 2020). Our findings support the existence of both forms, with outcomes largely dependent on the economic development level of the parent bank's home country.

In developed countries, we observe a predominantly benign form of regulatory arbitrage, where comprehensive resolution regimes in the parent bank's country, relative to those of foreign subsidiaries, help reduce systemic risk. This effect is further strengthened by the introduction of bail-in frameworks, which promote better risk management across banking networks. Conversely, in less developed countries, regulatory arbitrage often takes a malignant form, with discrepancies in resolution regimes between the parent and subsidiaries linked to heightened systemic risk. While more extensive resolution powers and tools at the parent level contribute to stabilizing systemic risk in developed countries, they can inadvertently increase risk in developing markets.

Further analysis of the Dodd-Frank Act, designed to reduce the too-big-to-fail problem in the US banking industry, shows that U.S. banks with subsidiaries in less-regulated regions experience a positive spillover, reflected in a reduced systemic risk. This suggests that for these banks, foreign subsidiaries in more lenient regulatory environments contribute to an overall reduction in risk, offering stabilizing benefits to the U.S. banking sector.

These findings have policy implications for the ongoing discussion on the effectiveness of bank resolution regimes in lowering systemic risk – a primary goal of post-2008 financial reforms. Our results suggest that bail-in frameworks, a central yet contested aspect of these reforms, effectively reduce systemic risk in cross-border contexts. However, we also find that the impact of resolution tools varies based on the development level of the parent bank's country. The existence of malignant regulatory arbitrage in certain contexts signals that policymakers and regulators must continue refining bank business models, strategies, and incentives to ensure stability across diverse economic landscapes.

References

Acharya, V., 2003. Is the International Convergence of Capital Adequacy Regulation Desirable? Journal of Finance 58, 2745–2782.

Acharya, V., 2009. A Theory of Systemic Risk and Design of Prudential Bank Regulation. Journal of Financial Stability 5, 224–255.

Acharya, V., Wachtel, P., Walter, I., 2009. International Alignment of Financial Sector Regulation. Financial Markets, Institutions & Instruments 18.

Acharya, V.V., Berger, A.N., Roman, R.A., 2018. Lending implications of u.s. bank stress tests: Costs or benefits? Journal of Financial Intermediation 34, 58–90.

Acharya, V.V., Pedersen, L.H., Philippon, T., Richardson, M., 2016. Measuring systemic risk. Review of Financial Studies 30, 2–47.

Adrian, T., Brunnermeier, M., 2016. CoVaR. American Economic Review 106(7), 1705–1741.

Alam, Z., Alter, A., Eiseman, J., Gelos, G., Kang, H., Narita, M., Nier, M., Wang, N., 2019. Digging Deeper – Evidence on the Effects of Macroprudential Policies from a New Database. IMF Working Paper 19/66. IMF Working Paper.

Aoki, M., Patrick, H., 1995. The Japanese Main Bank System: Its Relevance for Developing and Transforming Economies. Oxford University Press.

Bank of England, 2023. Statement on silicon valley bank. `https://www.bankofengland.co.uk/news/2023/march/statement-on-silicon-valley-bank`.

Barth, A., Schnabel, I., 2013. Why Banks are Not Too Big to Fail: Evidence from the CDS Market. Economic Policy 28, 335–369.

Baudino, P., Richardson, T., Walters, R., 2020. Cross-border resolution cooperation and information-sharing: an overview of home and host authority experience. FSI Insights 22. Bank for International Settlements (BIS).

Beck, T., Radev, D., Schnabel, I., 2020. Bank Resolution Regimes and Systemic Risk. CEPR Discussion Papers 14724. C.E.P.R. Discussion Papers.

Beck, T., Silva-Buston, C., Wagner, W., 2023. The economics of supranational bank supervision. Journal of Financial and Quantitative Analysis 58, 324–351.

Beck, T., Silva-Buston, C., Wagner, W., 2024. Supervisory cooperation and regulatory arbitrage. Review of Finance , rfae041.

Beck, T., Silva-Buston, C., Wagner, W., 2025. Supervisory arbitrage and real effects. Journal of Corporate Finance 95, 102861.

Bernard, B., Capponi, A., Stiglitz, J.E., 2022. Bail-ins and bailouts: Incentives, connectivity, and systemic stability. Journal of Political Economy 130, 1805–1859.

BIS, 2024. Basel III: international regulatory framework for banks. URL: https://www.bis.org/bcbs/basel3.htm.

Bolton, P., Oehmke, M., 2019. Bank Resolution and the Structure of Global Banks. The Review of Financial Studies 32, 2384–2421.

Breen, M., 2012. The international politics of ireland's eu/imf bailout. Irish Studies in International Affairs 23, 75–87.

Brunnermeier, M., Pedersen, L., 2009. Market Liquidity and Funding Liquidity. Review of Financial Studies 22, 2201–2238.

Chari, V.V., Kehoe, P.J., 2016. Bailouts, Time Inconsistency, and Optimal Regulation: A Macroeconomic View. American Economic Review 106, 2458–2493.

Credit Suisse, 2023. Credit Suisse Group AG: Revised Resolution Plan. Technical Report. Credit Suisse. URL: https://www.fdic.gov/resources/resolutions/resolution-plans/.

Demirguc-Kunt, A., Huizinga, H., 2000. Financial structure and bank profitability. Policy Research Working Paper Series 2430. The World Bank.

Demirguc-Kunt, A., Levine, R., 1999. Bank-Based and Market-Based Financial Systems: Cross-Country Comparisons. SSRN n569255 .

Demirgüç-Kunt, A., Detragiache, E., 2011. Basel core principles and bank soundness: Does compliance matter? Journal of Financial Stability 7, 179–190.

Doidge, C., Karolyi, G., Stulz, R., 2004. Why are foreign firms listed in the U.S. worth more? Journal of Financial Economics 71, 205–238.

European Parliament, 2014. Directive 2014/59/EU establishing a framework for the recovery and resolution of credit institutions and investment firms. Bank Recovery and Resolution Directive (BRRD I).

European Parliament, 2019. Directive (EU) 2019/879 amending Directive 2014/59/EU as regards the loss-absorbing and recapitalisation capacity of credit institutions and investment firms. Bank Recovery and Resolution Directive II (BRRD II).

Faia, E., di Mauro, B.W., 2015. Cross-border resolution of global banks. Globalization Institute Working Papers 236. Federal Reserve Bank of Dallas.

FDIC, 2023. Special assessment pursuant to systemic risk determination. `https://www.federalregister.gov/documents/2023/11/29/2023-25813`.

FINMA, 2023. FINMA Report: Lessons Learned from the Credit Suisse Crisis. Technical Report. Swiss Financial Market Supervisory Authority. URL: `https://www.finma.ch/en/documentation/finma-publications/`.

Frame, W.S., Mihov, A., Sanz, L., 2020. Foreign Investment, Regulatory Arbitrage, and the Risk of U.S. Banking Organizations. Journal of Financial and Quantitative Analysis 55, 955–988.

FSB, 2011. Key Attributes of Effective Resolution Regimes for Financial Institutions. Technical Report. Financial Stability Board. Basel.

FSB, 2013. Thematic Review on Resolution Regimes: Peer Review Report. Technical Report. Financial Stability Board. Basel.

Haufler, A., 2021. Regulatory and bailout decisions in a banking union. Journal of Banking & Finance 133, 106300.

Hoque, H., Andriosopoulos, D., Andriosopoulos, K., Douady, R., 2015. Bank regulation, risk and return: Evidence from the credit and sovereign debt crises. Journal of Banking & Finance 50, 455–474.

Huertas, T., 2013. The Case for Bail-Ins, in: Dombret, A., Kenadjianin, P. (Eds.), The Bank Recovery and Resolution Directive: Europe's Solution for "Too Big To Fail"?. Berlin, Boston: De Gruyter, pp. 167–188.

Kandrac, J., Schlusche, B., 2021. Quantitative easing and bank risk taking: Evidence from lending. Journal of Money, Credit and Banking 53, 635–676.

Karolyi, G.A., Sedunov, J., G. Taboada, A., 2023. Cross-border bank flows and systemic risk. Review of Finance .

Karolyi, G.A., Taboada, A.G., 2015. Regulatory Arbitrage and Cross-Border Bank Acquisitions. Journal of Finance 70, 2395–2450.

Keister, T., Mitkov, Y., 2023. Allocating losses: Bail-ins, bailouts and bank regulation. Journal of Economic Theory 210, 105672.

King, M.R., 2019. Time to buy or just buying time? lessons from october 2008 for the cross-border bailout of banks. Journal of Financial Stability 41, 55–72.

Klimek, P., Poledna, S., Farmer, J.D., Thurner, S., 2015. To bail-out or to bail-in? Answers from an agent-based model. Journal of Economic Dynamics and Control 50, 144–154.

Koenker, R., Bassett, G., 1978. Regression Quantiles. Econometrica 46(1), 33–50.

La Porta, R., de Silanes, F.L., Shleifer, A., Vishny, R., 1999. The Quality of Government. Journal of Law, Economics, and Organization 15, 222–279.

Laeven, L., Levine, R., 2007. Is there a diversification discount in financial conglomerates? Journal of Financial Economics 85, 331–367.

Landier, A., Ueda, K., 2009. The Economics of Bank Restructuring: Understanding the Options. IMF Staff Position Notes 2009.

Levine, R., 2012. The Governance of Financial Regulation: Reform Lessons from the Recent Crisis. International Review of Finance 12, 39–56.

MSCI, 2024. MSCI Emerging Markets Index. Technical Report. Morgan Stanley Capital International. URL: `https://www.msci.com/our-solutions/indexes/emerging-markets`.

Ongena, S., Popov, A., Udell, G., 2013. "When the cat's away the mice will play": Does regulation at home affect bank risk-taking abroad? Journal of Financial Economics 108, 727–750.

Puri, M., Rocholl, J., Steffen, S., 2011. Global retail lending in the aftermath of the us financial crisis: Distinguishing between supply and demand effects. Journal of Financial Economics 100, 556–578.

Rutledge, V., Moore, M., Dobler, M., Bossu, W., Jassaud, N., Zhou, J.P., 2012. From Bail-out to Bail-in: Mandatory Debt Restructuring of Systemic Financial Institutions. Staff Discussion Notes 12, 1.

Schoenmaker, D., Siegmann, A., 2014. Can european bank bailouts work? Journal of Banking & Finance 48, 334–349.

Temesvary, J., 2018. The role of regulatory arbitrage in u.s. banks' international flows: Bank-level evidence. Economic Inquiry 56, 2077–2098.

US Congress, 2010. Dodd–Frank Wall Street Reform and Consumer Protection Act. Pub. L. No. 111–203, 124 Stat. 1376.

Table 1: Sample of banks

The table reports the complete sample of banks - countries in our sample, for which we are able to compute $\Delta CoVaR$ over the period January 2000 - December 2016. The sample is retrieved from the intersection of the Bureau van Dijk Bankscope and the Thompson Reuters Datastream databases. The data are reported at the parent bank-year level.

Country	**Banks**	**Bank-Year Obs**	**Mean Size**
Developed Countries			
Australia	8	118	0.164
Canada	9	132	0.169
France	5	70	0.182
Germany	4	60	0.141
Hong Kong	2	34	0.137
Italy	9	148	0.062
Japan	20	205	0.039
Netherlands	2	25	0.264
Singapore	4	63	0.215
Spain	6	88	0.148
Switzerland	9	105	0.085
United Kingdom	10	107	0.101
United States of America	387	4850	0.002
Developing Countries			
China	4	37	0.058
India	6	84	0.019
Indonesia	2	33	0.036
Republic of Korea	7	57	0.113
South Africa	6	94	0.113

Table 2: Summary Statistics of Main Variables

The table reports the summary statistics for all the variables used in the analysis. In Panel A, we report the summary statistics for the complete sample of banks for which we are able to compute $\Delta CoVaR$ over the period January 2000 - December 2016. In Panel B, we report the characteristics of parent banks with at least one subsidiary in the Bankscope sample in the same period. In Panel C, we report the (weighted average) characteristics of the subsidiaries. The sample is retrieved from the intersection of the Bureau van Dijk Bankscope and the Thompson Reuters Datastream databases. All variables are defined in detail in Appendix A.

Panel A: All sample	mean	median	sd	min	max	Obs
ΔCoVaR	1.41	1.25	1	-0.261	10.1	6,310
	mean	p50	sd	min	max	
Fin. ratios (yearly)						
Leverage	12.9	11.2	7.3	1.06	99.9	6,310
ManQuality	.251	.294	.261	-1.41	.807	6,310
ROAA	.918	.91	1.2	-4.52	7.75	6,310
Liquidity	.182	.0664	.392	.0116	3.33	6,310
Size	15.3	14.6	2.34	10.8	21.8	6,310
Panel B: Developed vs developing	**mean**	**sd**	**mean**	**sd**	**diff.**	**t-stat**
Num. Sub.	1.706	2.380	1.658	1.703	-0.047	-0.343
Resolution Diff. (Par/Subs)	0.013	0.327	0.055	0.301	0.041**	2.150
Framework Diff. (Par/Subs)	-0.002	0.225	0.094	0.423	0.095***	6.745
Tools with Bail-in Diff.	0.014	0.289	-0.047	0.212	-0.061***	-3.588
Support Diff. (Par/Subs)	0.014	0.191	0.047	0.212	0.033***	2.861
Resolution Index	2.670	0.402	2.504	0.140	-0.166***	-7.113
Bail-in (Y/N)	0.327	0.469	0.000	0.000	-0.327***	-12.062
Resolution Framework	1.860	0.974	3.000	0.000	1.140***	20.238
Additional Support	2.108	0.865	1.171	0.544	-0.938***	-18.553
Tools sans Bail-in	2.769	0.709	1.462	1.109	-1.307***	-30.078
Fin. ratios (yearly)						
Leverage	12.892	7.282	12.310	7.569	-0.582	-1.359
ManQuality	0.244	0.263	0.391	0.163	0.148***	9.689
ROAA	0.856	1.106	2.158	2.049	1.303***	18.977
Liquidity	0.168	0.370	0.450	0.641	0.281***	12.366
Sizeb	15.255	2.317	16.763	2.226	1.508***	11.110
lnGDP	29.821	1.004	27.392	1.088	-2.429***	-41.046
GDPgrowth	2.099	1.825	5.172	2.763	3.073***	27.842
Inflation	2.145	1.136	5.266	3.313	3.121***	40.112

Table 3: Group Resolution Differences and Systemic Risk in Developed Countries

The table reports the estimates of Equation 3, where the dependent variable is $\Delta CoVaR$ for each parent bank i for each year t over the period January 2000 - December 2016, for parents in developed countries. The variable "ResolutionDiff" is computed as the difference between the parent country resolution index and the asset-weighted average of the resolution indexes of its subsidiaries. The model controls for a vector of bank characteristics and includes time (year) and bank fixed effects. In the last column, we exclude Japan and we keep only the top 50 US banks by size, for each year. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Macroeconomic variables (GDP, GDP growth, inflation) are retrieved from the World Bank' Development indicators. All standard errors are clustered at the bank level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Resolution Diff. (Par minus subs)	-0.038**	-0.048**	-0.045**	-0.047***			-0.060***
	(0.019)	(0.020)	(0.019)	(0.018)			(0.022)
ResolutionDiff Pos (Par>subs)					-0.080**		
					(0.039)		
ResolutionDiff Neg. (Par<subs)						0.131*	
						(0.076)	
Resolution Index		0.053*	0.063**	0.063**	0.053**	0.056*	0.115**
		(0.027)	(0.027)	(0.028)	(0.027)	(0.029)	(0.053)
Leverage			0.005***	0.005***	0.005***	0.005***	0.003
			(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
ManQuality			-0.170***	-0.181***	-0.181***	-0.181***	-0.267**
			(0.039)	(0.040)	(0.040)	(0.040)	(0.113)
ROAA			0.010	0.011	0.011	0.011	0.016
			(0.008)	(0.008)	(0.008)	(0.008)	(0.012)
Liquidity			-0.034*	-0.030	-0.031*	-0.033*	-0.050
			(0.019)	(0.019)	(0.019)	(0.019)	(0.033)
Size			0.001	-0.300	-0.317	-0.320	0.532
			(0.422)	(0.463)	(0.458)	(0.464)	(0.603)
lnGDP				0.032	0.032	0.021	0.222
				(0.038)	(0.040)	(0.037)	(0.134)
GDPgrowth				0.017	0.017	0.017	0.014
				(0.015)	(0.015)	(0.015)	(0.011)
Inflation				0.029***	0.028***	0.029***	0.007
				(0.009)	(0.009)	(0.010)	(0.010)
Observations	6,003	6,003	6,003	6,003	6,003	6,003	950
R-squared	0.889	0.889	0.891	0.891	0.891	0.891	0.899
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 4: Resolution tools and Systemic Risk

The table reports the estimates of Equation 3, where we replace the Resolution difference with the vector Y_{it} that includes differences in resolution tools. The latter are computed as the difference between a parent country's resolution subcategory and the asset-weighted average of the respective resolution subcategory of its subsidiaries. To illustrate, the variable Tools sans Bail-in difference (>0) is an indicator variable equal to 1 if the difference between the number of tools that exclude bail-in in the parent bank country and the asset-weighted average of the number of tools that exclude bail-in in the countries of its subsidiaries is greater than zero. The dependent variable is $\Delta CoVaR$ for each parent bank i for each year t over the period January 2000 - December 2016, for parent banks. The model controls for a vector of bank characteristics and includes time (year) and bank fixed effects. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Macroeconomic variables (GDP, GDP growth, inflation) are retrieved from the World Bank' Development indicators. All standard errors are clustered at the bank level.

	(1)	(2)	(3)	(4)
Bailin diff.(Par>subs)	-0.219***			
	(0.062)			
Bailin	-0.041			
	(0.037)			
Powers Res. Authority (Par>subs)		-0.065*		
		(0.036)		
Powers Res. Authority		0.010		
		(0.008)		
Tools sans bailin diff.(Par>subs)			-0.100**	
			(0.046)	
Tools sans bailin			-0.034	
			(0.046)	
Additional Support diff.(Par>subs)				0.015
				(0.070)
Additional Support				0.056***
				(0.012)
Leverage	0.004***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
ManQuality	-0.180***	-0.180***	-0.181***	-0.181***
	(0.040)	(0.040)	(0.040)	(0.040)
ROAA	0.011	0.011	0.011	0.012
	(0.009)	(0.008)	(0.008)	(0.008)
Liquidity	-0.025	-0.031	-0.030	-0.031
	(0.019)	(0.019)	(0.019)	(0.019)
Size	-0.211	-0.273	-0.363	-0.489
	(0.490)	(0.454)	(0.440)	(0.470)
lnGDP	-0.004	0.031	0.036	0.013
	(0.053)	(0.040)	(0.039)	(0.043))
GDPgrowth	0.017	0.016	0.017	0.019
	(0.014)	(0.015)	(0.015)	(0.014)
Inflation	0.023**	0.028***	0.030***	0.028***
	(0.010)	(0.010)	(0.009)	(0.009)
Observations	6,003	6,003	6,003	6,003
R-squared	0.891	0.891	0.891	0.891
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

Table 5: Group Resolution Differences and Systemic Risk across Countries

The table reports the estimates of Equation 3, where the dependent variable is $\Delta CoVaR$ for each parent bank i for each year t over the period January 2000 - December 2016. In columns (1-2, we only report the subsample of developing countries, while in the remaining columns we report the entire sample of parent banks in both developed and developing countries. Standard errors are in parentheses. We take the entire sample and report the estimates of interaction effects, where we interact the variable "ResolutionDiff" with an indicator variable equal to one for developed countries (MSCI classification). The variable "ResolutionDiff" is computed as the difference between the parent country resolution index and the asset-weighted average of the resolution indexes of its subsidiaries. The model controls for a vector of bank characteristics and includes time (year) and bank fixed effects, and their interaction with the main variable of interest. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Macroeconomic variables (GDP, GDP growth, inflation) are retrieved from the World Banks' Development indicators. All standard errors are clustered at the bank level.

	(1)	(2)	(3)	(4)	(5)	(6)
Resolution Diff.	0.307	0.235	0.320***			
	(0.276)	(0.347)	(0.111)			
ResolutionDiff×Developed			-0.368***			
			(0.111)			
Developed×powers (Par>subs)				0.157*		
				(0.093)		
Powers Res. Authority (Par>subs)				-0.202**		
				(0.087)		
Tools sans bailin diff.(Par>subs)					-0.012	
					(0.044)	
Additional Support diff.(Par>subs)						0.070
						(0.069)
Resolution Index	-1.224	-1.057	-1.232**			
	(1.274)	(1.628)	(0.565)			
ROAA		-0.066*	-0.040	-0.019	-0.018	-0.018
		(0.037)	(0.032)	(0.033)	(0.032)	(0.032)
ManQuality		0.150	0.206	0.059	0.025	0.026
		(0.361)	(0.324)	(0.334)	(0.327)	(0.327)
Size		0.323	0.635	0.586	0.459	0.461
		(1.522)	(1.737)	(1.744)	(1.710)	(1.710)
Liquidity		-0.047	-0.060	-0.035	-0.037	-0.037
		(0.040)	(0.043)	(0.036)	(0.037)	(0.037)
Leverage		-0.006	-0.004	-0.000	0.001	0.001
		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
lnGDP		0.196	0.071*	0.005	-0.006	-0.008
		(0.150)	(0.039)	(0.043)	(0.043)	(0.043)
GDPgrowth		0.008	0.018	0.028*	0.029*	0.029*
		(0.022)	(0.016)	(0.015)	(0.015)	(0.015)
Inflation		-0.021	-0.010	-0.008	-0.009	-0.009
		(0.017)	(0.012)	(0.012)	(0.012)	(0.012)
pvalue (developed+developing)			0.0001***	0.0004***		
Observations	305	305	6,308	6,308	6,308	6,308
R-squared	0.901	0.906	0.904	0.904	0.904	0.904
Country Var.	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE*Developed	Yes	Yes	Yes	Yes	Yes	Yes
Control Var*Developed	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 6: Too-Big-to-Fail and Regulatory Arbitrage

This table reports an event study where our treated group is composed by US parent banks compared to parent foreign banks before and after the announcement of the U.S. Financial Regulatory Reform Proposal on June 17, 2009. We take two years before and after the announcement as our timeline window. We interact the indicator variable "after" with the resolution difference, defined as the difference between the parent country resolution index and the asset-weighted average of the resolution indexes of its subsidiaries. The model controls for a vector of bank characteristics and includes time (year) and bank fixed effects. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Macroeconomic variables (GDP, GDP growth, inflation) are retrieved from the World Banks' Development indicators. All standard errors are clustered at the bank level.

	(1)	(2)	(3)	(4)	(5)
ResolutionDiff×Treated (US banks)×Post	-0.531*	-0.537**	-0.456*	-0.457**	-0.521**
	(0.271)	(0.269)	(0.242)	(0.230)	(0.248)
ResolutionDiff×Treated	0.289	0.254	0.118	0.137	0.297
	(0.265)	(0.253)	(0.233)	(0.225)	(0.226)
ResolutionDiff×Post	0.259	0.253	0.242	0.239*	0.168
	(0.174)	(0.180)	(0.168)	(0.142)	(0.160)
Treated (US banks)×Post	0.365	0.373*	0.302	0.257	0.069
	(0.225)	(0.218)	(0.202)	(0.158)	(0.178)
Resolution Diff. (Par/subs)	-0.022	-0.009	0.046	0.051	0.001
	(0.086)	(0.085)	(0.081)	(0.078)	(0.078)
Resolution Index		-0.077	-0.039	0.212	0.075
		(0.093)	(0.088)	(0.145)	(0.177)
Leverage			0.010***	0.009***	0.024***
			(0.003)	(0.003)	(0.005)
ManQuality			-0.051	-0.048	-0.328***
			(0.066)	(0.066)	(0.105)
ROAA			-0.001	-0.001	0.107***
			(0.025)	(0.025)	(0.038)
Liquidity			0.045	0.037	-0.240
			(0.154)	(0.155)	(0.185)
Size			-6.235	-1.967	-18.455***
			(5.506)	(7.807)	(6.190)
lnGDP				1.231**	-0.096
				(0.589)	(0.756)
GDPgrowth				0.007	0.024
				(0.010)	(0.019)
Inflation				-0.077	-0.008
				(0.085)	(0.104)
Observations	914	914	914	914	905
R-squared	0.965	0.966	0.968	0.969	0.946
Bank FE	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Group Resolution Differences and Asset Allocation

The table reports regressions of the share of assets booked in weaker host regimes on the *home-country resolution index*, including group and year fixed effects. Column (1) and (3) reports the coefficient without controls, while the others reports the same regression including the following control variables: leverage, management quality, ROAA, liquidity, and size. The variable "Rule of Law", retrieved from the Worldwide Governance Indicators (World Bank, 2019), captures perceptions of the extent to which agents have confidence in and abide by the rules of society, in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. The indicator is reported annually by country and is a standardized score ranging approximately from -2.5 (weak rule of law) to $+2.5$ (strong rule of law). For each banking group and year, we compute the average rule-of-law index across the host countries in which the group operates. Standard errors are clustered at the group level and reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dep. var.	% Assets weaker hosts			
	(1)	(2)	(3)	(4)
Home Resolution Index	0.483*	0.504*	0.748*	2.209**
	(0.282)	(0.283)	(0.411)	(0.932)
Rule of Law			0.261	2.974**
			(0.194)	(1.290)
Home Resolution Index ×Rule of Law				-1.112**
				(0.486)
Observations	6,308	6,308	5,812	5,812
R-squared	0.662	0.664	0.669	0.692
Controls	No	Yes	No	Yes
Interaction with Rule of Law	No	No	No	Yes
Group FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 8: Heterogeneous effect of the Dodd-Frank Act: Liquidity Spirals vs Overleveraging (Cross-Sectional Tests)

This table reports an event study where our treated group are US parent banks with subsidiaries in tighter resolution regimes before President Obama's announcement of the U.S. Financial Regulatory Reform Proposal on June 17, 2009, compared to parent US banks with only domestic subsidiaries, on samples with high/low leverage and liquidity before the announcements. Standard errors are in parentheses. We take two years before and after the announcement as our timeline window. We interact the indicator variable "after" with an indicator variable equal to 1 for parent banks with a resolution index greater than the index of their subsidiaries before the US president announcement. The model controls for a vector of bank characteristics and includes time (year) and bank fixed effects. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Macroeconomic variables (GDP, GDP growth, inflation) are retrieved from the World Banks' Development indicators. All standard errors are clustered at the bank level.

	Leverage		Liquidity	
	High	Low	High	Low
	(1)	(2)	(3)	(4)
Resolution Diff(Par/subs) ×	-0.435***	-0.473***	-0.825***	-0.590***
	(0.076)	(0.113)	(0.149)	(0.112)
Resolution Index		0.063		0.080**
		(0.039)		(0.033)
Leverage	0.076***	0.013***	0.021***	0.012***
	(0.022)	(0.003)	(0.006)	(0.003)
ManQuality	0.055	-0.218**	-0.316***	-0.135
	(0.099)	(0.105)	(0.109)	(0.087)
ROAA	-0.016	0.051	0.110***	0.010
	(0.028)	(0.037)	(0.036)	(0.033)
Liquidity	-0.019	0.654***	2.434**	0.080
	(0.153)	(0.216)	(1.099)	(0.207)
Size	-0.937	-12.059*	-565.089	-10.370*
	(17.665)	(6.447)	(379.088)	(6.205)
pvalue	0.1845		0.0015***	
Observations	487	690	456	721
R-squared	0.950	0.944	0.950	0.944
CountryVar	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

Table 9: Using Country Year Fixed Effects

The table reports the estimates of Equation 3 with alternative clustering at the country and year level. The dependent variable is $\Delta CoVaR$ for each parent bank i for each year t over the period January 2000 - December 2016, for parents in developed countries. Standard errors are in parentheses. The variable "ResolutionDiff" is computed as the difference between the parent country resolution index and the asset-weighted average of the resolution indexes of its subsidiaries. The model controls for a vector of bank characteristics and includes time-year and bank fixed effects. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Macroeconomic variables (GDP, GDP growth, inflation) are retrieved from the World Banks' Development indicators.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Resolution Diff. (Par/subs)	-0.025*	-0.021					
	(0.015)	(0.013)					
Bailin diff.(Par/subs)			-0.246***				
			(0.043)				
Powers Res. Authority (Par/subs)				-0.019			
				(0.033)			
Tools sans bailin diff.(Par/subs)					-0.033		
					(0.046)		
Tools sans bailin diff.(Par/subs)						0.043	
						(0.038)	
Additional Support diff.(Par/subs)							-0.003
							(0.077)
Leverage		0.005***	0.005***	0.005***	0.005***	0.005***	0.005***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ManQuality		-0.198***	-0.195***	-0.197***	-0.198***	-0.198***	-0.198***
		(0.034)	(0.039)	(0.039)	(0.039)	(0.040)	(0.040)
ROAA		0.017**	0.017**	0.017**	0.017**	0.017**	0.017**
		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Liquidity		-0.011	-0.011	-0.013	-0.012	-0.015	-0.013
		(0.022)	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)
Size		-0.265	-0.297	-0.258	-0.302	-0.184	-0.258
		(0.659)	(0.532)	(0.520)	(0.506)	(0.530)	(0.527)
Observations	5,993	5,993	5,993	5,993	5,993	5,993	5,993
R-squared	0.903	0.904	0.905	0.904	0.904	0.904	0.904
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 10: Resolution Differences and Systemic Risk: Marginal Expected Shortfall

The table reports the estimates of:

$$MES_{i,t} = \alpha + \beta ResolutionDifference_{it} * Developed + \Gamma X_{i,t-1} + \varepsilon_t \,,$$

in Columns (1)-(3), where the dependent variable is $MarginalExpectedShortfall$ (MES), as computed in Acharya et al. (2016) for each parent bank i for each year t over the period January 2000 - December 2016, for parents in developed and developing countries. Standard errors are in parentheses. The variable "ResolutionDiff" is the difference between the parent country resolution index and the asset-weighted average of the resolution indexes of its subsidiaries. "Developed" is an indicator variable for developed countries (MSCI). In Column (4), we drop Japanese banks. In Columns (5)-(7), we analyze the effect of different resolution tools, by excluding tools with bail-in. Bail-in is dropped due to multicollinearity. To illustrate, the variable Tools sans Bail-in difference is computed as the difference between the number of tools that exclude the bail-in in the parent bank country and the asset-weighted average of the number of tools that exclude bail-in in the countries of its subsidiaries. The model controls for a vector of bank characteristics and includes time (year) and bank fixed effects. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Standard errors are clustered at the bank level.

	(1)	(2)	(3)	(4)
Developed*ResolutionDiff	-0.642***	-0.587***	-0.381**	-0.487***
	(0.094)	(0.116)	(0.168)	(0.162)
Resolution Diff. (Par/subs)	0.517***	0.452***	0.252*	0.277*
	(0.020)	(0.070)	(0.141)	(0.143)
ROAA		-0.028	-0.050	-0.043
		(0.072)	(0.070)	(0.071)
ManQuality		0.548*	0.554*	0.541*
		(0.326)	(0.325)	(0.326)
Size		3.097	3.261	3.026
		(4.191)	(3.805)	(3.868)
Liquidity		-0.245*	-0.202	-0.203
		(0.129)	(0.130)	(0.131)
Leverage		-0.004	-0.002	-0.001
		(0.006)	(0.007)	(0.007)
GDP			0.367	0.245
			(0.263)	(0.267)
GDPgrowth			0.006	0.011
			(0.024)	(0.024)
Inflation			0.019	0.018
			(0.032)	(0.032)
Observations	9,210	9,210	9,210	8,779
R-squared	0.788	0.789	0.790	0.791
Country Var.	Yes	Yes	Yes	Yes
Bank FE*Developed	Yes	Yes	Yes	Yes
Control Var*Developed	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

Table 11: Robustness Tests

The table reports the estimates of Equation 3 with alternative clustering at the bank-year level (columns (1)-(3)), and when dropping the US banks (columns (4)-(6)). The dependent variable is $\Delta CoVaR$ for each parent bank i for each year t over the period January 2000 - December 2016, for parents in developed countries. Standard errors are in parentheses. The variable "ResolutionDiff" is computed as the difference between the parent country resolution index and the asset-weighted average of the resolution indexes of its subsidiaries. The model controls for a vector of bank characteristics and includes time-year and bank fixed effects. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Macroeconomic variables (GDP, GDP growth, inflation) are retrieved from the World Banks' Development indicators.

	Errors Cluster			**Drop U.S.**		
	(1)	(2)	(3)	(4)	(5)	(6)
Developed×ResolutionDiff	-0.285***	-0.365***	-0.368**	-0.342***	-0.413***	-0.402***
	(0.107)	(0.118)	(0.130)	(0.127)	(0.120)	(0.129)
Resolution Diff. (Par/subs)	0.237**	0.320**	0.320**	0.301**	0.373***	0.357***
	(0.106)	(0.120)	(0.137)	(0.128)	(0.121)	(0.132)
Resolution Index	-0.638	-1.150*	-1.232*	-0.921	-1.369**	-1.329**
	(0.442)	(0.590)	(0.607)	(0.559)	(0.639)	(0.649)
ROAA		-0.050	-0.040		-0.048	-0.041
		(0.032)	(0.032)		(0.032)	(0.033)
ManQuality		0.334	0.206		0.389	0.206
		(0.340)	(0.262)		(0.376)	(0.350)
Size		0.483	0.635		0.165	0.517
		(1.631)	(1.675)		(1.654)	(1.616)
Liquidity		-0.047	-0.060		-0.036	-0.052
		(0.044)	(0.046)		(0.047)	(0.045)
Leverage		-0.006	-0.004		-0.003	-0.003
		(0.006)	(0.006)		(0.007)	(0.007)
lnGDP			0.071			0.066
			(0.087)			(0.071)
GDPgrowth			0.018			0.026
			(0.020)			(0.017)
Inflation			-0.010			-0.013
			(0.016)			(0.012)
Observations	6,308	6,308	6,308	1,328	1,328	1,328
R-squared	0.903	0.904	0.904	0.915	0.916	0.917
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 12: Resolution Differences and the Financial Crisis

The table reports the estimates of Equation 3, where the dependent variable is $\Delta CoVaR$ for each parent bank i for each year t over the period January 2000 - December 2016, for parents in developed countries and developing countries, after dropping the 2007-2008 financial crisis. Standard errors are in parentheses. The variable "ResolutionDiff" is computed as the difference between the parent country resolution index and the asset-weighted average of the resolution indexes of its subsidiaries. The model controls for a vector of bank characteristics and includes time (year) and bank fixed effects. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Macroeconomic variables (GDP, GDP growth, inflation) are retrieved from the World Banks' Development indicators. All standard errors are clustered at the bank level.

	(1)	(2)	(3)
Developed×ResolutionDiff	-0.243***	-0.284***	-0.295***
	(0.080)	(0.084)	(0.084)
Resolution Diff. (Par/subs)	0.221***	0.265***	0.276***
	(0.079)	(0.083)	(0.084)
Resolution Index	-0.498	-0.946**	-0.822*
	(0.332)	(0.440)	(0.427)
ROAA		-0.039	-0.039
		(0.032)	(0.033)
ManQuality		0.451	0.429
		(0.340)	(0.314)
Size		0.608	1.076
		(2.012)	(1.972)
Liquidity		-0.021	-0.033
		(0.042)	(0.036)
Leverage		-0.007	-0.008
		(0.005)	(0.005)
lnGDP			-0.070
			(0.055)
GDPgrowth			0.015
			(0.014)
Inflation			-0.021**
			(0.010)
Observations	5,551	5,551	5,551
R-squared	0.927	0.928	0.928
Bank FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes

Table 13: Placebo Test

The table reports placebo (lead) tests where the dependent variable is $\Delta CoVaR$ for each parent bank i in year t over the period January 2000–December 2016. The key explanatory variables are future (lead) values of the bank resolution policy differential, $ResolutionDiff_{i,c,t+k}$ with $k \in 2, 3, 4$, included to assess whether future changes in the resolution framework predict current systemic risk (i.e., to rule out anticipation or spurious correlations). Specifications alternatively include only a single lead and the resolution policy index, and then a joint specification including multiple leads. The model controls for a vector of bank characteristics (leverage, management quality, ROAA, liquidity, size) and macroeconomic conditions (log GDP, GDP growth, inflation), and includes bank and year fixed effects. The sample excludes focused and subsidiary institutions and is restricted to developed countries; U.S. banks are matched using the top-50 linkage. Standard errors are reported in parentheses and are clustered at the bank level. Significance levels are denoted by ***, **, and * for the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ResolutionDiff (t+2)	-0.013	-0.014					-0.045
	(0.021)	(0.021)					(0.037)
ResolutionDiff (t+3)			0.023	0.018			0.041
			(0.023)	(0.024)			(0.033)
ResolutionDiff (t+4)							0.016
							(0.041)
Resolution Index	0.065*	0.065*	0.042	0.042	0.043	0.044	0.074*
	(0.036)	(0.035)	(0.039)	(0.037)	(0.042)	(0.036)	(0.039)
Leverage		0.005***		0.004***		0.002*	0.003*
		(0.001)		(0.002)		(0.001)	(0.002)
ManQuality		-0.169***		-0.180***		-0.180***	-0.151***
		(0.048)		(0.050)		(0.050)	(0.049)
ROAA		0.006		0.008		0.004	-0.002
		(0.011)		(0.012)		(0.013)	(0.012)
Liquidity		-0.030		-0.034		-0.006	0.003
		(0.027)		(0.037)		(0.032)	(0.039)
Size		0.046		0.172		0.581	0.521
		(0.499)		(0.462)		(0.589)	(0.576)
lnGDP		0.050		0.097**		0.092**	0.090**
		(0.040)		(0.043)		(0.043)	(0.041)
GDPgrowth		0.020		0.013		0.009	0.008
		(0.016)		(0.016)		(0.015)	(0.014)
Inflation		0.020**		0.017		0.009	0.011
		(0.010)		(0.012)		(0.014)	(0.014)
Observations	4,943	4,943	4,494	4,494	4,075	4,075	3,980
R-squared	0.884	0.886	0.889	0.891	0.895	0.897	0.898
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 14: Group Resolution and the Diversification Effect

The table reports the estimates of Equation 3 where we add the variable 'Bank Specialization' to our main specification, computed as the asset weighted average of loans - at the group level - over the total assets (Laeven and Levine (2007)), for developed and developing countries. Standard errors are in parentheses. The dependent variable is $\Delta CoVaR$ for each parent bank i for each year t over the period January 2000 - December 2016, for parents in developed countries. The variable "ResolutionDiff" is computed as the difference between the parent country resolution index and the asset-weighted average of the resolution indexes of its subsidiaries. The model controls for a vector of bank characteristics and includes time (year) and bank fixed effects. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Macroeconomic variables (GDP, GDP growth, inflation) are retrieved from the World Banks' Development indicators. All standard errors are clustered at the bank level.

	(1)	(2)	(3)	(4)
Resolution Diff. (Par/subs)	-0.028	-0.040**	-0.038*	-0.040**
	(0.018)	(0.019)	(0.020)	(0.019)
Resolution Index		0.067**	0.072**	0.074***
		(0.029)	(0.028)	(0.028)
Bank Specialization	-0.001	0.006	0.018	0.025
	(0.076)	(0.077)	(0.076)	(0.075)
Leverage			0.004***	0.004***
			(0.001)	(0.001)
ManQuality			-0.129***	-0.144***
			(0.043)	(0.045)
ROAA			-0.001	0.000
			(0.011)	(0.011)
Liquidity			-0.018	-0.025
			(0.028)	(0.029)
Size			-0.062	-0.019
			(0.453)	(0.449)
lnGDP				0.033
				(0.036)
GDPgrowth				0.021*
				(0.012)
Inflation				0.003
				(0.009)
Observations	5,494	5,494	5,494	5,494
R-squared	0.909	0.909	0.910	0.911
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

Table 15: Controlling for Macro-prudential Policies

The table reports the estimates of Equation 3, where the dependent variable is $\Delta CoVaR$ for each parent bank i for each year t over the period January 2000 - December 2016, where we add indicators for contemporaneous macroprudential policies at the country level, other than bank resolution. Standard errors are in parentheses. We retrieve the variables from the IMF's integrated Macroprudential Policy (iMaPP) Database, originally constructed by Alam et al. (2019). We control for the average LTV limit, which is a numerical indicator of regulatory limits to loan-to-value (LTV) ratios, and for its difference across parent and subsidiaries (Average LTV limit diff.). We also add the Policy Action indicator (SUM17), which takes the sum of policy action indicators of all 17 instruments of macroprudential policy. Each tightening event is coded as a +1, each loosening event is coded as a -1, and no or neutral action is coded as a 0. Details are in the Appendix. The model controls for a vector of bank characteristics and includes time (year) and bank fixed effects. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases. Macroeconomic variables (GDP, GDP growth, inflation) are retrieved from the World Banks' Development indicators. All standard errors are clustered at the bank level.

	(1)	(2)	(3)	(4)	(5)	(6)
Resolution Diff×Developed Country	-0.145***	-0.125***	-0.107***	-0.108***	-0.105***	-0.079**
	(0.029)	(0.031)	(0.031)	(0.031)	(0.031)	(0.034)
Resolution Diff. (Par/subs)	0.111***	0.088***	0.072**	0.073**	0.070**	0.045
	(0.025)	(0.029)	(0.032)	(0.032)	(0.031)	(0.033)
GDP	0.022	0.006	0.010	0.013	0.012	-0.052
	(0.033)	(0.033)	(0.032)	(0.032)	(0.032)	(0.034)
GDP growth	0.010	0.011	0.011	0.012	0.012	0.013**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)
Inflation	-0.001	-0.002	-0.002	-0.001	-0.001	0.000
	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)
GDP diff	-0.025	-0.024	-0.021	-0.021	-0.019	0.002
	(0.022)	(0.022)	(0.021)	(0.021)	(0.021)	(0.019)
Average diff LTV limit		-0.002**	-0.001	-0.001	-0.001	-0.001
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Average LTV limit			-0.002	-0.002	-0.002	-0.001
			(0.002)	(0.002)	(0.002)	(0.002)
Policy-actions Indicator (sum 17)				-0.012	-0.011	-0.005
				(0.009)	(0.010)	(0.009)
Average difference Policy-actions Indicator					-0.007	-0.006
					(0.016)	(0.017)
Stock Mkt to GDP						-0.000
						(0.000)
Inflation diff.						-0.015***
						(0.005)
RegulatoryQuality						0.167***
						(0.058)
pvalue	0.0000***	0.000***	0.000***	0.000***	0.000***	0.000***
Observations	5,487	5,487	5,487	5,487	5,487	5,487
R-squared	0.918	0.919	0.919	0.919	0.919	0.919
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Figure 1: Resolution Framework Implementation Scheme by Country

The table reports the timeline of resolution framework implementation for the countries in our sample. The information is retrieved from FSB's, ECB's and FED's documentation on the implementation of resolution regulation.

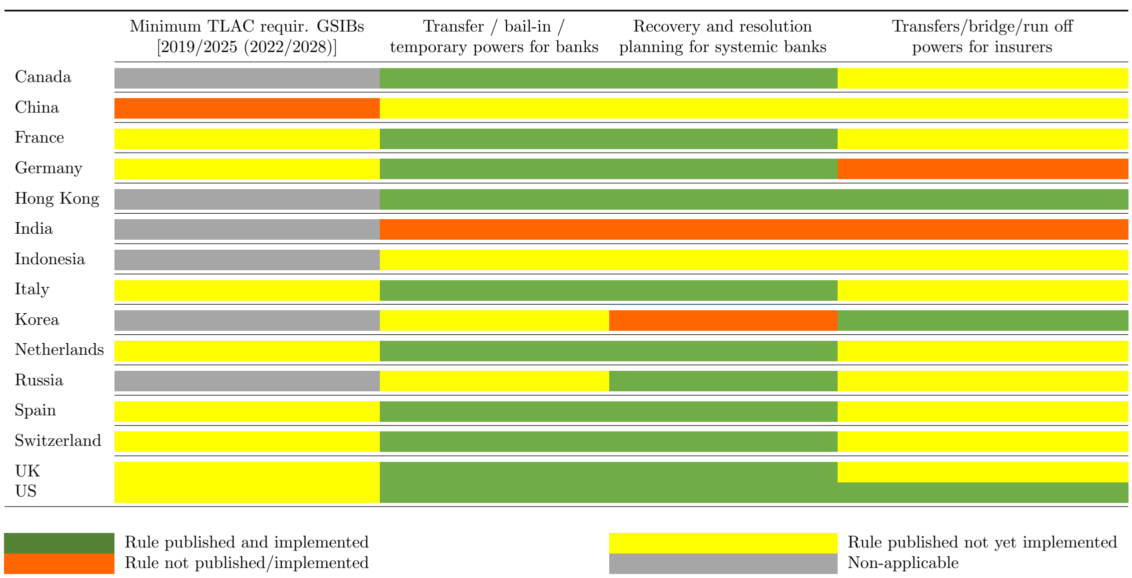


Figure 2: Systemic Risk of Parent Banks

The figure reports $\Delta CoVaR$ of parent banks between 2000 and 2016. We compare $\Delta CoVaR$of parent banks with at least one subsidiary in a different resolution regime setting (dashed), and (parent) banks that have no subsidiaries located in different resolution regimes. The details on the construction of $\Delta CoVaR$ are in the Appendix. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases.

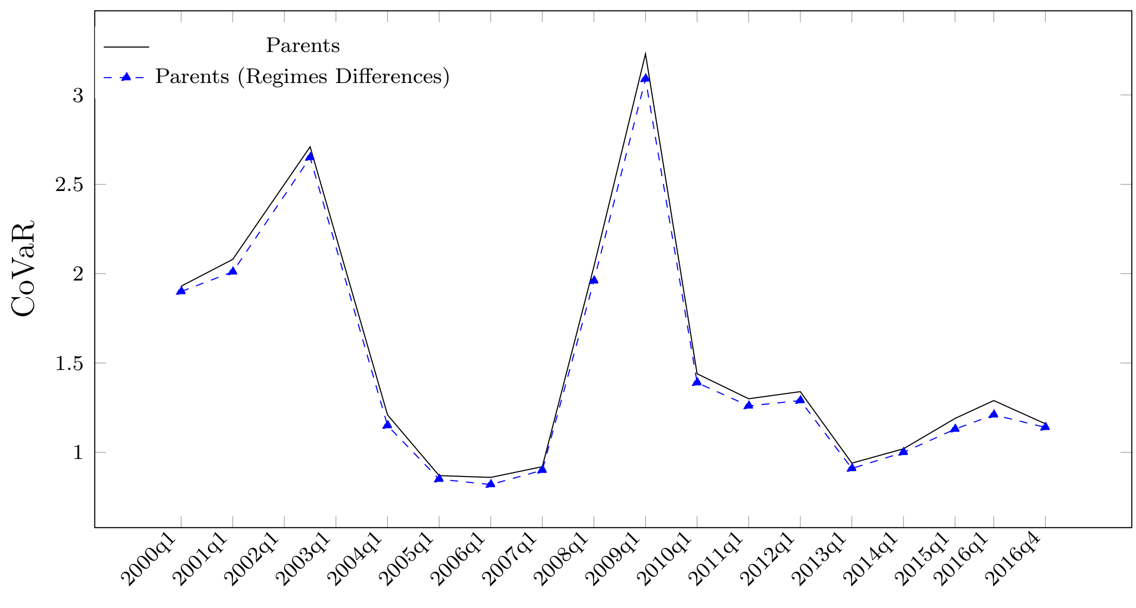


Figure 3: Countries Resolution Index

This figure reports plots the resolution index by country for developed (top panel) and developing countries (bottom panel). The details regarding the construction of the resolution index are in the Appendix. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases over the period January 2000 - December 2015.

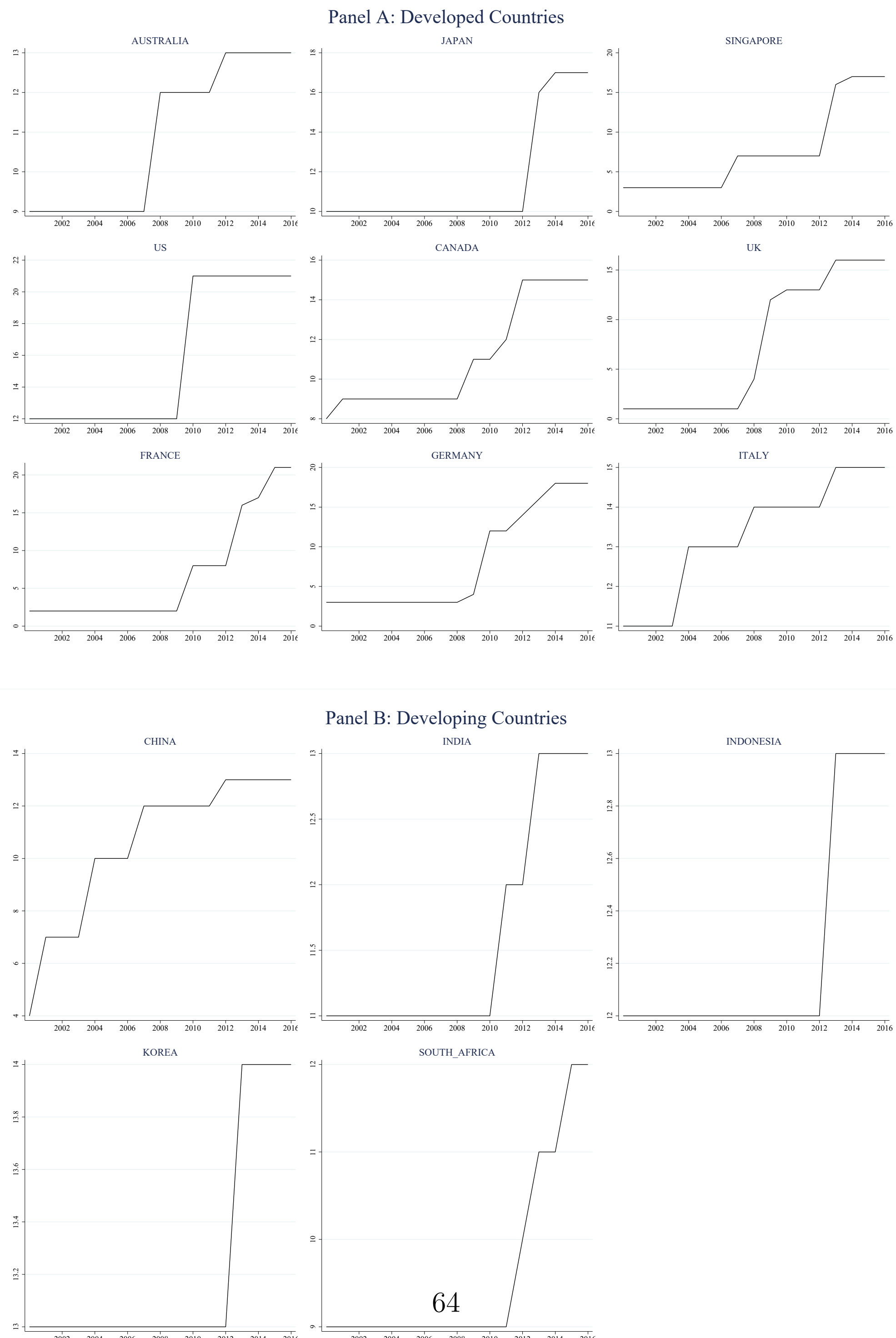
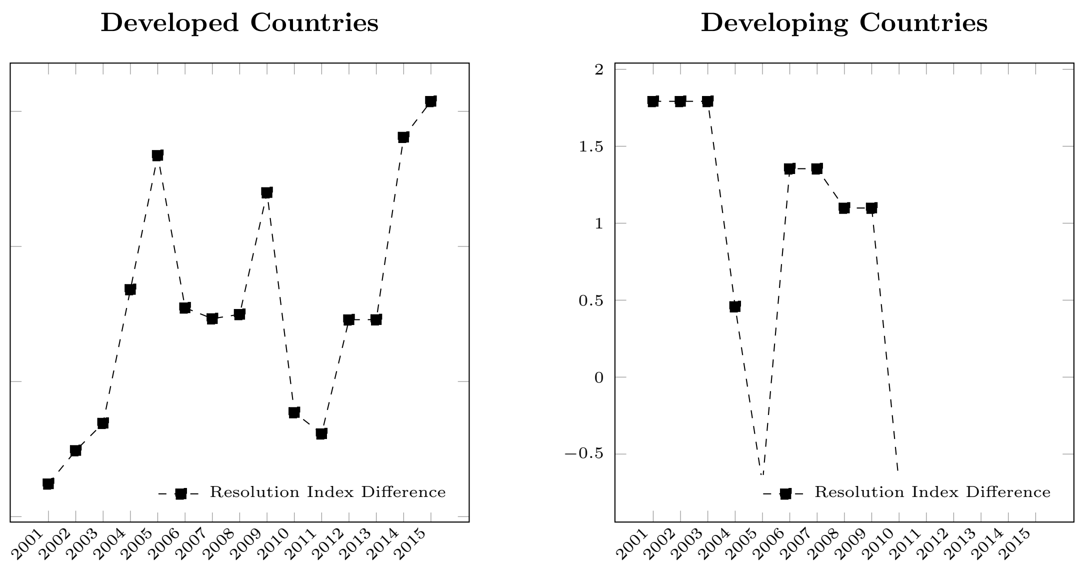


Figure 4: Resolution Regimes Differences

This figure reports plots the differences between parent and subsidiaries resolution index by year for developed (left panel) and developing countries (right panel). The details regarding the construction of the resolution index are in the Appendix. The variable "ResolutionDiff" is computed as the difference between the parent country resolution index and the asset-weighted average of the resolution indexes of its subsidiaries. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases over the period January 2000 - December 2015.



A Appendix: Variables

A.1 Dependent Variable

$\Delta CoVaR$: the variable is constructed in several steps. We first estimate the value at risk for each bank, VaR_{it}, by identifying the q-quintile for each this expression holds true:[12]

$$Pr(X^i \leq VaR_q^i | X^i) = q\%,$$

where X^i is the growth rate of the market value of bank i's assets. In a second step, we derive *CoVaR* with a quintile regression as in Koenker and Bassett (1978) built on equity prices (details provided in the Appendix). $CoVaR_q^{j|i}|X^i$ is the VaR of institution j, conditional on $X^i = VaR_q^i$ of institution$i$:

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

Hence, the *CoVaR* of the *system*,which comprises all banks operating within a country, conditional on $X^i = VaR_q^i$ of bank i, is:

$$CoVaR_q^{system|X^i=VaR^i} = Pr(X^{system} \leq CoVaR_q^{system|i} | X^i = VaR_q^i) = q\%.$$

We then construct the bank's contribution to *systemic* bank risk as follows:

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

[12] Similar to Koenker and Bassett (1978), we apply a stress level of q = 99% in our regressions.

which captures the difference between the value at risk of a country's banking system when bank i is in distress, compared to the value at risk of the system when the bank is at its median level of returns. The variable is estimated for each bank at the daily frequency and then averaged at the year level.

A.2 Resolution Variables

Bank Resolution Index and Subindices: this section presents the individual reforms and categories that comprise the bank resolution index in Beck et al. (2020).

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)

A.3 Macroprudential and country development indicators

The macroprudential variables are retrieved from the IMF's integrated Macroprudential Policy (iMaPP) Database, originally constructed by Alam et al. (2019), while country development variables are retrieved from the World Bank.

Average LTV limit: Simple average of the regulatory LTV limits in each country and year (LTVaverage). It focuses on LTV limits on real estate mortgage loans (both residential and commercial), while the dummy-type indicators and text information may cover other types of loans (e.g., auto loans). When a country does not have any LTV limits, in principle, we set the value at 100—i.e., you can borrow the full amount against the collateral value. For more details, please see Alam et al. (2019).

Policy Indicator (SUM17): Sum of indicators for each instrument of macroprudential policy. Each tightening event is coded as a +1, each loosening event is coded as a -1, and no or neutral action is coded as a zero. SUM17 takes the sum of policy action indicators of all 17 instruments. For more details, please see Table A.2 retrieved from Alam et al. (2019).

Stock Market to GDP: Ratio of the stock market and the GDP, retrieved from the World Bank.

Regulatory Quality Index: Captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.

Table A.1: **Resolution Variables.** This table presents a list of the resolution variables used in the empirical analysis. All level variables are retrieved from Beck et al. (2020), while the variables in differences are own calculations based on the level variables differences between parents and their subsidiaries.

Variable	**Definition**
Resolution index	Aggregate resolution index. Varies from 0 to 22.
Resolution Diff	Difference between the resolution index of the parent banks and the asset-weighted average resolution indexes of its subsidiaries.
Framework	General resolution framework (e.g. bespoke bank resolution regime, different than corporate resolution). Varies from 0 to 3.
Powers	Powers of resolution authority (e.g. to replace management). Varies from 0 to 8.
Tools with bail-in	Resolution tools including bail-in options (e.g. splitting in good and bad bank; bail-in tool). Varies from 0 to 4.
Tools sans bail-in	Resolution tools without the bail-in tool. Varies from 0 to 3.
Bail-in	Dummy that takes the value of 1 if the bail-in tool is implemented, 0 otherwise.
Bail-in framework	Features of the bail-in framework (e.g. a minimum requirement of eligible liabilities). Varies from 0 to 3.
Support	Additional support measures (living wills, resolution fund). Varies from 0 to 4.
Framework Diff	Difference between the resolution framework of the parent banks and the asset-weighted average framework of its subsidiaries and own calculations.
Powers Diff	Difference between the resolution powers of the parent banks and the asset-weighted average resolution powers of its subsidiaries and own calculations.
Tools Bail-in Diff	Difference between the tools with bail-in of the parent bank and of the parent banks and the asset-weighted average tools with bail-in of its subsidiaries and own calculations.
Support Diff	Difference between the support measure of the parent bank and of the parent banks and the asset-weighted average level of support measures of its subsidiaries.

Table A.2: **Composition of SUM17 Index** This table presents a list of all 17 tools that compose our composite Policy Action indicator (SUM17). SUM17 takes the sum of all 17 policy action instruments. All variables are retrieved from Alam et al. (2019).

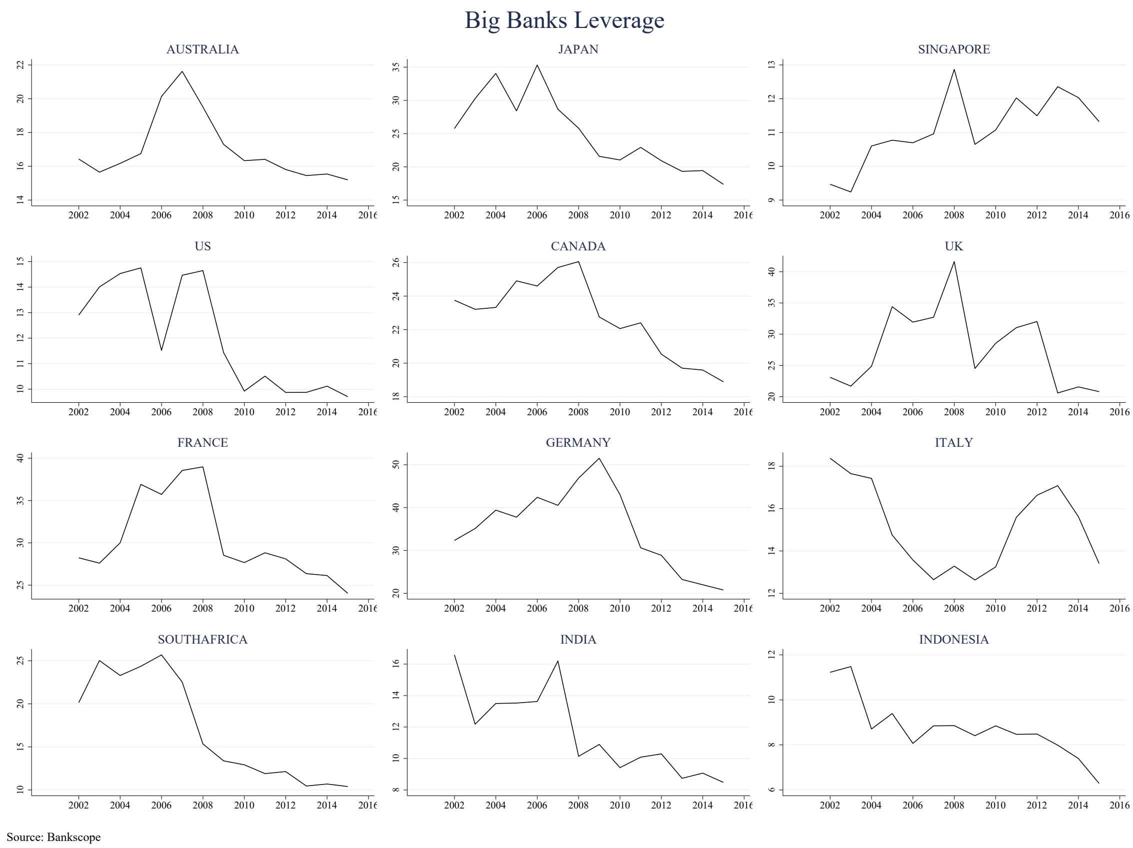
Variable	Definition
C1.CCB	A requirement for banks to maintain a countercyclical capital buffer.
C2.Conservation	Requirements for banks to maintain a capital conservation buffer.
C3.Capital	Capital requirements for banks, which include risk weights, systemic risk buffers, and minimum capital requirements.
C4.LVR	A limit on leverage of banks, calculated by dividing a measure of capital by the bank's non-risk-weighted exposures.
C5.LLP	Loan loss provision requirements for macroprudential purposes, which include dynamic and sectoral provisions.
C6.LCG	Limits on growth or the volume of aggregate credit, the household-sector credit, or the corporate-sector credit.
C7.LoanR	Loan restrictions, include loan limits and prohibitions, lender characteristics, and other factors.
C8.LFC	Limits on foreign currency (FC) lending, and rules or recommendations on FC loans.
C9.LTV	Limits to the loan-to-value ratios, applied to residential and commercial mortgages, but also applicable to other secured loans.
C10.DSTI	Limits to the debt-service-to-income ratio and the loan-to-income ratio.
C11.Tax	Taxes and levies applied to specified transactions, assets, or liabilities.
C12.Liquidity	Measures taken to mitigate systemic liquidity and funding risks, minimum requirements for liquidity coverage ratios, liquid asset ratios, net stable funding ratios, core funding ratios and external debt restrictions.
C13.LTD	Limits to the loan-to-deposit (LTD) ratio and penalties for high LTD ratios.
C14.LFX	Limits on net or gross open foreign exchange (FX) positions, limits on FX exposures and FX funding, and currency mismatch regulations.
C15.RR	Reserve requirements (domestic or foreign currency) for macroprudential purposes.
C16.SIFI	Measures taken to mitigate risks from global and domestic systemically important financial institutions (SIFIs).
C17.Other	Macroprudential measures not captured in the above categories.

Table A.3: **Independent Variables** This table presents a list of the independent variables used in the empirical analysis. Bank balance sheet variables are retrieved from Bankscope.

Variable	**Definition**
Parent Bank	A dummy equal to one if the bank has subsidiaries.
Number subsidiaries	Number of subsidiaries for each parent.
For(eign) Sub	A dummy equal to one if the Parent has a foreign subsidiary.
ROAA	Profitability (data4024) winsorized at 1%-99%.
Liquidity	Total liquid assets (data2075)/Total deposits (data2030) winsorized at 1%-99%.
Size	Data2025 converted in dollars/US GDP winsorized at 1%-99%.
Management quality	Total operating profit/Total operating income (data10220/data2190), winsorized at 1%-99%.

Figure A.1: Average Bank Leverage Across Countries

This figure reports plots the average bank leverage for some countries in our sample. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases over the period January 2000 - December 2015.



A.4 Sample Selection

Table A.4: **Sample Selection** The table reports the sample selection. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases over the period January 2000 - December 2015.

Sample of Listed Banks (bank-year)	
Balance-sheet data from 2000 to 2015	356,594
Keep Banks (drop mutual funds, clearing houses, etc)	340,637
Keep unconsolidated Bank data	302,401
With ownership information in BvD	87,365
Info on Assets, equity, and Leverage (USD)	82,377
Match with Resolution Indexes	69,197
Match by ISIN	16,801
Systemic risk	
CoVaR monthly data from 2000m1 to 2016m12	303,048
Merge with Bank year (listed)	130,804
Keep parent Banks	75,945
Drop Countries poorly covered (Brazil, Turkey, Mexico, Russia)	74,177
Collapse Covar year level	6,310

Table A.5: **Pairwise Correlations**

The table reports pairwise correlations for the main variables in our analysis. The sample is retrieved from the intersection of the Bureau-van-Dijk Bankscope and the Thompson Reuters Datastream databases over the period January 2000 - December 2015. The symbol * denotes statistical significance at the 1% level.

$\Delta CoVaR$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)		(14)	(15)	(16)	(17)	(18)	(19)
Resolutiondiff	0.0425*																			
bailindiff	-0.1062*	-0.0388*																		
frameworkdiff	0.0432*	0.4321*	0.0662*																	
sans_bailindiff	0.008	0.6869*	-0.1830*	0.1225*																
supportdiff	0.0847*	0.5365*	0.0283	0.1697*	0.1937*															
powersdiff	0.023	0.9053*	-0.0986*	0.2320*	0.6673*	0.3667*														
ResolutionIndex	-0.1794*	0.1512*	0.2695*	0.0540*	0.1164*	0.0549*	0.1669*													
bailin	-0.2000*	0.0301	0.1992*	0.0065	-0.0068	0.0095	0.018	0.7185*												
framework	0.0017	0.0628*	-0.0885*	0.1327*	0.0257	0.0446*	0.019	0.5453*	0.7443*											
sans bailin	-0.2118*	0.1181*	0.2761*	-0.0003	0.1791*	-0.0017	0.1357*	0.7026*	0.2357*	-0.0588*										
support	-0.2261*	0.0524*	0.3239*	-0.0081	0.018	0.0895*	0.0456*	0.8234*	0.7023*	0.3285*	0.6259*									
powers	-0.1998*	0.1686*	0.2478*	0.019	0.1234*	0.0537*	0.1964*	0.9672*	0.7225*	0.4925*	0.6729*	0.8231*								
Leverage	0.0732*	-0.0228	-0.2527*	-0.0498*	-0.0119	-0.0343*	-0.0228	-0.2673*	-0.1515*	-0.0404*	-0.2535*	-0.3030*	-0.2700*							
ManQuality	0.0507*	-0.0059	0.0253	0.0507*	-0.03	0.0141	-0.0202	-0.0894*	-0.0955*	-0.0174	-0.0932*	-0.1055*	-0.0992*	-0.2237*						
ROAA	0.0580*	0.0202	-0.0051	0.0041	0.0196	0.0338*	0.0185	-0.1280*	-0.0984*	0.0072	-0.2028*	-0.1342*	-0.1176*	-0.3397*	0.6538*					
Liquidity	0.0824*	0.0904*	-0.1856*	-0.0246	0.0935*	0.0849*	0.0745*	-0.1900*	-0.0410*	0.1394*	-0.3208*	-0.2158*	-0.1877*	0.0584*	-0.0244	0.2186*				
Size	0.2360*	-0.0466*	-0.2611*	-0.0051	-0.1149*	0.0605*	-0.0941*	-0.3899*	-0.1710*	0.1358*	-0.5083*	-0.4418*	-0.4430*	0.4266*	0.0596*	-0.0572*	0.2311*			
lnGDP	-0.2686*	0.0254	0.3094*	-0.0930*	0.0404*	-0.0304	0.0689*	0.5469*	0.3567*	-0.1731*	0.7167*	0.6774*	0.6060*	-0.2368*	-0.1297*	-0.1903*	-0.3519*	-0.6388*		
GDPgrowth	0.0131	-0.0048	0.1080*	0.1185*	-0.0949*	0.0313	-0.0355*	-0.0467*	-0.0123	0.0812*	-0.1545*	-0.0823*	-0.0618*	-0.0652*	0.3794*	0.2660*	0.0095	0.0603*	-0.1927*	
Inflation	0.2234*	-0.0076	0.1213*	0.0018	-0.0235	-0.025	0.005	-0.0764*	-0.2014*	-0.0737*	-0.0833*	-0.1178*	-0.0864*	-0.1033*	0.1826*	0.2021*	-0.0383*	-0.0259	-0.1325*	0.3830*

Table A.6: Decomposition of *ResolutionDiff* (Par/subs) for banks with foreign subsidiaries

This table reports the decomposition for *ResolutionDiff* (Par/subs) in the subsample of banks with foreign subsidiaries (`ForSub` = 1). The overall mean of *ResolutionDiff* in this subsample is 0.282 (with overall standard deviation 1.272). "Between banks" refers to cross-sectional variation across 48 parent banks, while "within banks" refers to the time-series variation around each bank-specific mean over an average of 9.52 years.

	Overall	Between banks	Within banks
Std. dev.	1.272	0.993	0.925
Min	-2.310	-1.803	-2.718
Max	2.485	2.209	3.139
Obs.	$N = 457$	$n = 48$	$\bar{T} = 9.52$