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RESEARCH ARTICLE

Assessing disproportionality: indexes of policy responses to the 2007–2008 banking crisis

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Abstract Contemporary theories of the policy process typically assume that policy responses tend to go through long periods of stasis alternated with occasional bursts of intense activity. The concept of policy punctuations has been put forward to denote large-scale changes in public policies that take place in crisis moments. However, research on the dynamics of policy overreaction and underreaction is still in its infancy. It has mostly focused on either small-n cross-sectional analysis of government spending or case studies of single events. A comparative assessment of the extent of disproportionate responses in a crisis is still lacking. To fill this gap, in this paper we develop a framework to conceptualize, operationalize, and ultimately assess disproportionate policy responses systematically from a cross-sectional perspective. We create a series of indexes to measure policy over- and underreactions among the EU member states that experienced the 2007–2008 banking crisis. We found that a large majority of EU countries overreacted through public liability guarantee and budget commitment. On the other hand, regulatory responses are characterized by a greater variation.

Keywords Policy change · Policy underreaction · Policy overreaction · Banking crisis · European states

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Introduction

How can one assess whether a country's policy response to the 2007–2008 banking crisis was disproportionate? This question calls also for a clear and broader conceptualization and measurement of (dis)proportionate policy response: Can we assess disproportionality? If so, how? This paper argues that a nuanced assessment requires a comparative measurement that also accounts for differences in the units of analysis. Accordingly, we propose a set of indicators for understanding in a systematic way the relationship between the severity of crisis and policy reaction among the EU member states that experienced banking crises.

The literature on disproportionate policy response relies on two main anchor concepts: policy overreaction and policy underreaction (Maor 2017). Although both concepts express violations from proportionality (Maor 2017), we are not aware of any attempt to empirically measure cross-sectionally the mismatch between the severity of a crisis and the intensity of policy response. By examining a specific policy area, namely financial containment of banking crisis and banking regulation, we aim to extend the analytical framework of disproportionate policy response and propose indexes that enable us to assess the extent of policy under- and overreaction.

To do so, this study has two objectives. Our first aim is to put forward the argument that the concept of (dis)proportionality of policy responses can be measured, but it requires to be related to the extent of severity of a crisis a given government faces and to be operationalized it in a relational way. The second objective is to provide an empirical application of the proposed indicators. After identifying which European countries have recently experienced banking crisis, we rely on existing data on systemic banking crises and surveys of bank regulations. This allows us to compare the extent of a given government's disproportionate response (changes in the regulation and surveillance of the banking system, and the fiscal consequences of governments' bailouts) with the other European countries that experienced the 2007–2008 banking crisis.

Several cross-country analyses have assessed various types of policy change as a reaction to the 2007–2008 banking crisis. However, scholars have tended to focus on variations in microprudential (Zimmermann 2013; Fenger and Quaglia 2016), macroprudential regulation (Baker 2013),[1] or fiscal policy (Grossman and Woll 2014), without providing a comprehensive overview of the extent of disproportionality associated with the different measures governments utilize to respond to the crisis. Furthermore, different explanatory frameworks have taken different types of policy response as the dependent variable. For instance, Moschella and Tsingou (2013) relied on a theoretical framework to capture the interaction between institutional path dependence, on the one hand, and change agents and veto players, on the other hand, to explain the variation in the dynamics of change in financial regulation. Young and Park (2013) used a simpler variable, that is, the dominance of the financial sector in the economic and political landscape, to explain the variation in regulatory response, with the latter measured through an aggregate index. Focusing on bank bailouts, Grossman and Woll (2014) combined economic–financial explanations with the institutional context of business–government relations.

We contribute to this comparative policy analysis literature by making conceptual and methodological suggestions for the study of policy responses. The theory of disproportionate policy response provides a useful framework for comparing the extent of variation

[1] There is agreement in the literature that one can observe a shift from more importance being attached to microprudential regulation to more importance being attached to macroprudential regulation (Baker).

of both (micro- and macroprudential) regulatory and fiscal changes. We analyze the extent of governments' policy response as the distance from a supposedly proportional level of public intervention. We conceive underreaction and overreaction as a result of an adjusted ratio to the (domestic) severity of the banking crisis. Accordingly, the extent of any disproportionality is determined as the distance of a given country's set of policy responses to the average response of a sample of countries, in our case the member states of the European Union, while accounting for domestic-level variation in the severity of the crisis. Our case selection strategy allows us to focus on policy responses of governments within the same international regulatory environment, so as to endogenize the interplay between the impact of the banking crisis and compliance with international banking agreements.

The remainder of this paper is structured as follows. The next section discusses the literature on the proportionality of policy responses, while third section links this literature to the banking crisis. "Methodological steps for constructing an index of disproportionate policy response to banking crisis" section describes the methodology for the construction of indexes that can measure the proportionality of a policy response, specifically in the context of the banking crisis. "An application of the indexes" section provides descriptive findings on the application of the proposed indicators. In the "Conclusion" section concludes we propose future research avenues for comparative scholars of public policy.

Disproportionate policy responses

Governments, even more than human beings, do not generally respond proportionally to the signals they receive from their environment. Instead, they typically alternate between periods of underestimation of existing problems and periods when they overrespond to external stimuli (Jones and Baumgartner 2005). Following Jones and Baumgartner, this disproportionality depends on two main factors. First, decision costs associated with institutional constraints and with the presence of veto players limit the internal organizational capacity for quick consequential action. Second, because 'limited attention is a key facet of human cognitive capacity, and is reflected in organizations' (Jones 2017, p. 66), it is cognitively impossible for policy makers and government to allocate an optimal level of attention to all problems all the time. Therefore, most policy issues tend to remain outside the center of attention of governments—typically configuring a situation of limited policy change or underreaction—but they may become suddenly salient at some point, e.g., following an external shock or crisis—potentially triggering a large policy change or overreaction.

By challenging incrementalism, the disproportionality of policy responses is the observed pattern that contemporary theories of the policy process, in particular of the punctuated equilibrium theory (Baumgartner et al. 2014), attempt to identify and explain (Jones 2017). Accordingly, policy making is characterized by long periods of stasis and incremental change alternating with occasional bursts of intense activity that produce large-scale departures. Through distributional methodology and time-series analysis of policy changes, this type of punctuated equilibrium (characterized by a great predominance of cases in the central peak of the distribution of the extent of policy changes and by 'weak shoulders' and 'very wide tails') was empirically observed first in the budgetary policies of the US federal government and then in many other public policies and political systems, mainly by scholars associated with the policy agenda project.

Whereas this general pattern of disproportional responses seems corroborated by empirical evidence especially in the study of budgets (Jones et al. 2009), the causes of specific episodes of under- or overreaction—the policy change events falling within the 'very wide tails' of the distribution—remain to be determined. The analysis of such specific episodes has required conceptual, theoretical, and methodological (yet to be completed) advancements.

At the conceptual level, Maor (2014a, p. 426) defined policy underreaction as 'systematically slow and/or insufficient response by policymakers to increased risk or opportunity, or no response at all.' This concept can be associated with the similar concept of policy underinvestiment that 'occurs when policymakers underinvest in a single policy instrument below its instrumental value in achieving a policy goal' (Maor 2017, p. 7). A negative policy bubble occurs if policy underinvestment is sustained over a long period time (Maor 2016). Analogously, policy overreactions 'are policies that impose objective and/or perceived social costs without producing offsetting objective and/or perceived benefits' (Maor 2012, p. 235). Again, this concept can be associated with the concept of overinvestment that 'occurs when government overinvests in a single policy instrument beyond its instrumental value in achieving a policy goal' (Jones et al. 2014, p. 149). Policy bubbles occur if policy overinvestment is sustained over a long period time (Maor 2014b).

Notwithstanding their definitional similarities, there are two important elements for distinguishing the concepts of policy under–overreaction and policy under–overinvestment. First, policy under–overinvestment related to a single policy instrument as evidenced by the case studies of crime detection and punishment, charter schools and private education vouchers, and private contracting, whereas policy under–overreaction is generally associated with episodic 'big' decisions taken by government (Maor 2012, 2014a). Second, whereas economic efficiency underlies under–overinvestment in a policy tool, policy under–overreaction is based on public interest that includes other social goals beyond economic efficiency such as social justice and environmental sustainability (Maor 2017, p. 7).

The distinction between the two concepts is also present at the theoretical level. Although both strands rely on 'behavioral rationality,' policy under–overinvestments are based on positive feedback processes (in which a policy change leads to demands for even more changes usually associated with an externally generated problem, shift of attention, and high level of media coverage) and contagion through mimicking and cognitive cue-taking and shortcuts (Jones et al. 2014). On the other hand, the literature of policy under–overreaction relies on behavioral theories not exclusively related to the (organizational and individual) ability to process information in efficient way[2] in order to 'respond in proportion to the strength of information indicating the severity of problems in the in the policymaking environment' (Jones et al. 2014, p. 147). Maor (2014a) argued that underreaction could be specified in terms of both whether or not policy makers had detected and accurately estimated risks unfolding over time in a way that match their severity and whether their action had been constrained by organizational (i.e., norms and routines) and/or external (i.e., veto players) sources of path dependence. Similarly, overreaction may come in different modes, which mostly depends on whether policy makers accurately estimate information about positive or negative events (Maor 2012). Overreaction might arise from policy makers' overconfidence in their abilities and in the accuracy of their

[2] Because of complexity of the issue, the lack of institutional capacity (Epp and Baumgartner 2017), as well as inefficiency in allocating attention and institutional resistance, policy change is considered inefficient in matching the intensity of a policy action and the intensity of a policy problem (Jones et al. 2014).

information. In the literature of psychology of judgment, overconfidence is due to decision makers' inability to assess their own competence and to the psychological benefit arising from this condition.

At the methodological level, the two literature strands are also different. Sustained policy under–overinvestments have been assessed by plotting the longitudinal correspondence between the intensity of policy instrument (for instance, the total number of American incarcerated), the intensity of a policy problem (for instance, rate of crime), and media attention (for instance, the number of New York Times front pages on crime) (Jones et al. 2014). Such correspondence is a demonstration of proportionality. This approach was used in assessing the policy of housing shortage in Hong Honk (Or 2015), while the lack of statistical correlation between changes in industry-specific labor and economic measures and US states' tax incentives for motion picture industry attested the existence of a policy bubble (Thom 2016).

The literature of policy under–overreaction revolves around conceptual typologies underlying different behavioral mechanisms and processes (Maor 2012, 2014a, b) and general conditions, expectations and hypotheses of disproportionality (Maor et al. 2017; Peters et al. 2017). These conceptual and theoretical advances inspired a number of qualitative empirical studies (Behn et al. 2015; Meyer 2016; Howlett and Kemmerling 2017; Gillard and Lock 2017). For instance, Meyer (2016) studied underreaction in foreign policy with respect to transboundary security threats. A key finding was the need for more reflexivity on lessons learned from prior experiences, regarding both policy success and policy failure. Careful contextualization is required to establish the degree of similarity with the cases under investigation and to derive applicable lessons. Behn et al. (2015) examined the emergence of international law protecting investment rights. This phenomenon was characterized as a policy bubble triggered by an overestimation of the benefits of protection of foreign direct investment.

We can identify two major gaps in the literature. The first is in the operationalization of disproportionate policy responses. While existing studies—as those mentioned above—put forward rich and nuanced ways to measure policy (dis)proportionality, there is a need for a more systematic measurement strategy that is more parsimonious, intersubjective, and is suitable for large-n comparative research. Indeed, existing studies are based on single cases or on small-n studies and frequently use the secondary literature as the main source of empirical evidence. The second gap concerns the political determinants of the accuracy of risk estimation by policy makers. In the literature, the microfoundations of disproportionate policy responses are essentially rooted in psychological and behavioral determinants, such as cognitive biases and emotions. While we recognize the added value of these perspectives, we argue that the role of political factors has been underestimated. In the specific case of banking crisis, we expect that inaccurate risk estimation—and thereby the extent and type of policy under- or overreaction—can be shaped by government coalitions and ideology, by the extent of financialization, and by the relevance of financial interest group within the relationship with governments and banks and can even be a conscious political strategy. For instance, Zimmermann (2013) explained that the variety of deposit insurance is strongly related to characteristics of domestic financial markets as well as the dominant role of concentrated financial interest groups. Accordingly, the international harmonization of regulatory governance would be unlikely. Fenger and Quaglia (2016) identified 'market-making' and 'market-shaping' coalitions in order to compare regulatory changes and deposit insurance schemes in the EU, the Netherlands, and the UK. Their empirical findings show limited reform of the status quo, since 'central banks and supervisory authorities were members of one of the coalitions, rather than being objective

providers of analytical knowledge about the governance of the financial sectors' (Fenger and Quaglia 2016, p. 514). By revolving around the information asymmetry that occurs between elected decision maker and financial oversight institutions, Gandrud and O'Keeffe (2017) explained the dynamic of the Irish government's financial overcommitment to banking crisis.

In this paper, we tackle the first issue—the absence of a simple measure of policy disproportionate responses to banking crisis. This will also enable future researchers to address the second issue—the political determinants of disproportionate policy responses.

Banking crises and policy responses

Because banks are highly interdependent institutions that are exposed to systemic risks, banking crises are very complex phenomena, usually associated with (more generalized) financial crises. These crises are characterized by a situation where many financial institutions experience solvency and liquidity problems, a large number of defaults occurs, the banking system's capital becomes exhausted, the value of assets drops, capital flows to enterprises and households are slowed, and capital outflows rise dramatically (Laeven and Valencia 2013). These failures and the consequent reduction in the extent and efficiency of credit allocation can result in large economic losses for a country or region usually manifested in depressed aggregate demand and domestic growth (Laeven 2011). Furthermore, banking crises have distributional consequences, as they affect debtors and savers facing insolvency problems, as well as taxpayers when bailouts, containment policy, and other policy measures imply wealth transfers from the public sector to banks and other financial institutions.

For these reasons, banking crises represent a key and complex public policy problem and typically trigger a policy response, often in the form of a large-scale policy intervention. Public regulation of the banking sector essentially aims to minimize both the risk and the negative consequences of banking crises, to maintain the stability of the system, and to influence the credit allocation process (Busch 2009). Busch (2009, chapter 2) stated that policy makers use several methods to attain these goals, including partial or full nationalization of banks; direct interventions in the credit allocation mechanisms; capital movement controls; rules limiting banks' activities; the separation of commercial and investment banks; restrictions on competition; and deposit insurance schemes. Several of these policy measures are associated with public liability guarantees and public budget commitment.

Historically, public intervention has been mostly confined to reactive measures and quite limited with respect to other sectors that were either state-owned (such as utilities) or more strictly regulated (such as for pharmaceuticals) (Braithwaite and Drahos 2000). Banks operate in a long-standing globalized market, in which regulation is traditionally light touch and weakly internationalized, and intergovernmental initiatives have been rather limited, especially since the deregulation of banking markets from the 1980s (O'Connor 2005). Internationally coordinated regulation is increasing but remained much more limited than in other policy areas, at least until the 2008 financial crisis (Underhill and Zhang 2008). This may explain a general tendency toward underreaction until the emergence of international financial crisis that leads governments to introduce regulatory reform, which can be highly controversial.

Some authors call into question too much intervention, while others criticize the opposite, that is, insufficient regulation of the banking sector. Both positions, however, agree that a non-optimal and a non-proportional level of regulation to the severity of crisis can be disruptive. Indeed, some argue that regulatory restrictions may distort the development and effectiveness of the banking sector, e.g., those regarding the ability of banks to own nonfinancial firms and engage in securities markets (Barth et al. 2008). It has also been observed that a state guarantee on deposits may lead to moral hazard and banks taking on excessive risks, creating in turn systemic vulnerabilities (Ranciere and Tornell 2011). On the other hand, other scholars tend to put emphasis on a set of regulatory tools as crucial factors to prevent or halt a banking crisis (Griffith-Jones et al. 2010). Prudential regulation and capital requirements determining the capital/asset ratio ensure that banks do not exceed their leverage and become insolvent. Another key regulation concerns transparency obligations and the disclosure of accurate information to facilitate market actors' scrutiny and regulatory oversight. Finally, the power of national regulatory authorities to supervise banks can be related to their capacity to detect wrongdoings and systemic risks. Studies have shown that capital market liberalization produces instability, especially when it happens quickly and without the appropriate accompanying regulatory framework (Stiglitz 2000).

How can one get a sense of the effectiveness of policy responses to banking crises? Economic models have been used to identify the optimal level of regulatory and fiscal oversight of the banking and finance sector. For instance, Ennis and Keister (2010) modeled depositors' decisions and policy choices in order to find the optimal equilibrium in cases where the government gives either a full or a limited commitment to freeze deposits. Similarly, Cooper and Ross (2002) investigated the optimal equilibrium between risk sharing and moral hazard associated with deposit insurance.

An alternative way to assess government responses to banking crisis is to rely on an equilibrium that takes into account the relationship between the crisis severity and the magnitude of police change in terms of public budget commitment and regulatory reform. This equilibrium is at the core of the concept of proportionality as developed by the policy analysis literature. With regard to the public budget commitment, government aims to restore confidence to the financial system without exposing to significant fiscal costs. Accordingly, Gandrud and O'Keeffe (2017, p. 392) assumed that a decision maker has a 'moderate' preference for a level of public liability guarantees that will not have 'no direct costs to the taxpayer.' Accordingly, an elected decision maker would aim for a (proportional) level of public budget commitment (for guaranteeing the value of banking system assets) that equals the recovery value of those assets (Gandrud and O'Keeffe 2017, p. 392).

(Dis)proportionality is also a concept developed for banking regulation. It has been associated with 'excessive regulation [that] make the burden (costs at the margin) of regulatory compliance exceed the benefits' (Goodhart et al. 1998, p. 61).[3] However, measuring regulatory costs and especially regulatory benefits of a regulatory reform is very complex, if not almost impossible (Goodhart et al. 1998, p. 66). This leaves us with the relationship between severity of crisis and the extent of policy response that we will explore in the next section.

[3] Proportionality is also a principle by the European Banking Authority (2015, p. 14) that refers to the disproportionate allocation of regulatory costs to small banks: 'The principle of proportionality means that small and non-complex institutions can comply with the principles by implementing less complex, but still appropriate, […] policies, while large and complex institutions have to implement more sophisticated […] policies.'

Methodological steps for constructing an index of disproportionate policy response to banking crisis

There is an emerging but still scarce literature on how to conceptualize and construct indicators of policy dynamics and changes conceived as a dependent variable for comparative policy analysis. Change denotes an empirical observation of difference in the form, quality, or state of a policy. This broad definition encompasses concepts of policy innovation and reform and different orders of change. Taxonomies have been proposed for defining changes in policy components, as well as in the tempo or speed of change (Howlett and Cashore 2009). In addition, measures of density and intensity associated with policy instruments have been put forward (Schaffrin et al. 2015). The former equals the sum of the number of policy instruments in a specific domain; the latter is about their specific content (Knill et al. 2012) and is associated with the importance or significance of the particular policy intervention.[4]

Since the discussion on 'indexes' of policy change is, however, centered on components and instruments, datasets are created specifically for each specific policy area. Several measures have been designed to capture the extent of change of bank regulation across countries. Young and Park (2013) relied on legal consultants' surveys of banking regulatory change in order to devise a simple additive scoring system which accounts for regulatory reform, in consumer protection, regulatory powers or supervisory consolidation, bank capital requirements, bank liquidity requirements, banking corporate governance, and the early implementation of post-crisis international standards. The scores were ultimately associated with a qualitative taxonomy of banking regulatory reform 'ranging from the complete absence of regulatory reform to radical, path-breaking reform' (Young and Park 2013, p. 565)

Based on the work of Barth et al. (2013), the World Bank collects systematically data in order to measure the extent of bank regulation and financial supervisory policies. This data collection relies on surveys. Bank regulatory officials had been asked hundreds of questions on different dimensions of banking governance, such as permissible bank activities, capital requirements, the powers of official supervisory agencies, information disclosure requirements, external governance mechanisms, deposit insurance, barriers to entry, and loan provisioning. By providing systematic measures of bank regulation and supervision, the World Bank's Bank Regulation Dataset is very helpful for any research on the design and implementation of regulatory governance of banking systems.[5] Systematic collection of data has been also pursued by Laeven and Valencia (2013) in order to account for systemic banking crises. Their dataset aims to specify the occurrence of 'systemic banking crises' during 1970–2011. The dataset also provides measures of macroeconomic policy responses to the systemic banking crisis.

The combination of these two datasets, as well as Grossman and Woll's (2014) dataset on financial responses of EU member states, provides extremely useful data for the assessment of the extent of policy reactions to systemic banking crisis. This assessment can be conducted in a comparative perspective. The remainder of this section describes the methodological steps for constructing indexes of policy responses to systemic bank crisis.

[4] There is also a literature on the methodological issues, such as weighting and double counting of sub-indexes and concerning the construction of aggregated measures of policy (OECD and European Union Joint Research Centre 2008).

[5] The first wave of surveys was completed in 1999; the second wave contained information relating to year 2002; the third wave to 2006; the fourth survey to 2011.

Identifying systemic banking crises within the European Union

The first methodological step is to identify when a banking crisis occurred in a given country. Economists working at the International Monetary Fund were able to identify such occurrences (even though, as mentioned above, such identification is not uncontroversial). Laeven and Valencia (2013) distinguished between ('localized') banking crisis and systemic banking crisis. Furthermore, they specified when a systemic banking crisis led to a sovereign banking debt crisis. A banking crisis occurred in several countries during the 2008–2009 financial market turmoil. Among the European Union member states, Austria, Belgium, Denmark, Germany, Greece, Ireland, Latvia, Luxembourg, the Netherlands, Spain, and the UK experienced a systemic banking crisis, whereas France, Hungary, Italy, Portugal, Slovenia, and Sweden experienced only a banking crisis. Our focus on EU member states is justified by the fact that we want to identify cases where unilateral decisions were made in a highly coordinated policy domain such as the banking sector in the European single market, while endogenizing the role of international banking regimes.[6]

Qualifying and associating proportionate policy response to measures of severity of banking crisis

We rely on the following concept of proportionate policy response: 'Whereas proportionality is easily understood as a standard that requires perfect balance between policy costs and benefits as well as between policy ends and means, disproportionate policy response violates this standard' (Maor 2017, p. 3). This definition allows us to conceptually bring together both under- and overreaction. Overreaction occurs when policy costs exceed policy benefits and underreaction when policy means are insufficient to achieve policy ends.

As it is impossible to quantify policy costs and benefits as well as the relation between means and ends, proportionality is operationalized here as a balanced relationship between severity of crisis and the extent of policy change. We rely on this relationship in order to assess the extent to which government is capable of acquiring and using accurate information (Gandrud and O'Keeffe 2017) to calibrate policy responses proportionally to the specific crisis event.

Designing indexes of macroeconomic policy response

In this paper, the policy response to the 2007–2008 financial crisis is separately analyzed as the macroeconomic response and the regulatory response. In this regard, it is important to note that we present different indicators of the crisis ($c1$, $c2$, etc.), and, respectively, of policy responses ($r1$, $r2$, etc.), to construct our indexes of disproportionality. These indicators ($i1$, $i2$, etc.) are to be understood as alternative measures to be selected with reference to specific research goals. They can also be operationalized as components of a high-level aggregate measure, even if we restrain to do so in this article.

Grossman and Woll (2014, p. 579) stated that 'there seems to be no clear relationship between the cumulated losses in the banking and real estate sector and the amounts governments committed to save their banks by July 2009, although governments tend to

[6] The other countries that experienced a banking crisis during the 2007–2009 period were: Iceland (systemic crisis), Kazakhstan (systemic crisis), Mongolia (systemic crisis), Nigeria (systemic crisis), Russia (systemic crisis), Switzerland, Ukraine (systemic crisis), and the USA (systemic crisis).

intervene when their sector is hit.' The differences between cumulative losses in the banking sector versus committed bailout expenditures clearly attest to an intense policy response in Ireland and Denmark. Another measure is the difference between the actual fiscal expenditures and the net cost of bailout, since the money budgeted for bailing out banks was not always used (Grossman and Woll 2014, p. 581). Six of the 18 EU member states considered in Grossman and Woll's analysis did not experience a systemic banking crisis (as defined by Laeven and Valencia) during 2007–2008: France, Hungary, Italy, Portugal, Slovenia, and Sweden. A systemic banking crisis did occur in other 11 EU member states: Austria, Belgium, Denmark, Germany, Greece, Ireland, Latvia, Luxembourg, the Netherlands, Spain, and the UK. And there was a great variation in the policy response to the banking crisis among the latter group of countries. With the exception of Finland, which was not considered in Laeven and Valencia's dataset on the banking crisis, the two datasets are consistent in defining which EU member states experienced a banking crisis during the 2007–2008 period.

This consistency allows us to utilize for our analysis the following macroeconomic variables for measuring the severity of the banking crisis and the extent of a government's response.

We rely on Laeven and Valencia (2013) and Grossman and Woll (2014) for the following measures of the extent of severity of the banking crisis (c):

$c1$: Peak of nonperforming loans as a % of total loans (Laeven and Valencia 2013)
$c2$: Cumulative losses in the banking sector as % of GDP (Grossman and Woll 2014)
$c3$: Net cost of bailouts as % of GDP (Grossman and Woll 2014).

and the following measures of the extent of policy response to the banking crisis (r):

$r1$: Peak support in % of deposits (Laeven and Valencia 2013)
$r2$: Committed bailout expenditures as % of GDP (Grossman and Woll 2014)
$r3$: Actual expenditures as % of GDP (Grossman and Woll 2014).

These two types of measures can be aggregated for every alternative indicator of c and r in an index following this general form (Eq. 1):

$$i = \frac{r - c}{(\text{mean of } r) - (\text{mean of } c)} \tag{1}$$

where r indicates the intensity of the reaction and c indicates the severity of the crisis. Similarly to Gandrud and O'Keeffe (2017), we assume that a (banking) policy decision maker aims to minimize the taxpayers losses while trying to achieve the intended policy ends, and accordingly, $r-c = 0$ and $i = 0$ would indicate proportionality; $i > 0$ would indicate overreaction; and $i < 0$ would indicate underreaction.

This equation follows the method of 'distance to a reference country' which in this case is the average country of the sample. 'Distance to a reference measures the relative position of a given indicator [the numerator] vis-à-vis a reference point [the denominator]' (OECD and JRC 2008, p. 28). The reference point could be a target, a benchmark country, or as in this case the average values within the sample of countries. This method allows us to emphasize values of extreme under- or overreaction from the difference between the average of policy responses and the average of the severity of the crisis (OECD and JRC 2008, pp. 28–30). This methodological choice is justified by the high uncertainty faced by decision makers in responding to banking crisis. Accordingly, in order to relax our assumption of the extent of the quality of information concerning the severity of the crisis, our indicator does not simply measure the mismatch of a given country between r and c,

but it is a proportion of this mismatch to the reference point, the denominator of Eq. 1. Accordingly, we put forward the claim that in condition of high uncertainty, typical of severe crisis, this denominator facilitates the conceptualization and operationalization of what is the standard of policy proportionality.

From Eq. 1, we can attribute the above measures of response and severity of crisis in order to derive to the possible measures of (dis)proportionate policy response at the macroeconomic level.

In Eq. 2, $i1$ measures the extent of mismatch between the peak support of deposits and the peak of nonperforming loans. This index indicates the extent of overreaction in supporting banking customers' deposits. The link between the peak support of deposits and the peak of nonperforming loans with respect to banking crisis can be understood by referring to the Japanese government's banking policy reaction to the 1990s banking crisis. 'After Japanese banks started to suffer from the nonperforming loans crisis in the 1990s, the Deposit Insurance Act was revised in 1996 to temporarily lift the deposit insurance coverage limit of Yen 10 million (about USD 95,000) per person per bank, so as to insure all deposit without limit' (Schich 2009, p. 95). More generally, as the recent Irish financial crisis shows, governments have responded by increasing the deposit guarantee scheme limit (Gandrud and O'Keeffe 2017). Furthermore, Zimmermann (2013) argues that, given, deposit insurance has become 'a core element of social protection' against the excess of financialization and financial globalization. It is important to note that deposit insurance gives rise to moral hazard. Accordingly, excessive deposit insurance leads to an increase in nonperforming loans, because of the 'less monitoring by depositors, which allows banks to hold riskier portfolios' (Cooper and Ross 2002, p. 57). And this may generally result in nonperforming loans.

$$i1 = \frac{r1 - c1}{(\text{mean of } r1) - (\text{mean of } c1)} \tag{2}$$

In Eq. 3, $i2$ measures the mismatch between the extent of the government's budgetary commitment in banking bailout and the aggregate loss of a given country's banking system. This relationship has been the core of the investigation of several studies (Grossman and Woll 2014; Schneider 2014; Gandrud and O'Keeffe 2017). Budgetary commitment is a gross measure of the level of containment policy decided by a government in the wake of a crisis in order to restore confidence in financial systems.[7] Although commitment is not a measure of actual spending of the public budget, the choices of this containment level are not 'trivial' (Gandrud and O'Keeffe 2017, p. 394). Because it cannot be adjusted without undermining market confidence, a higher level of budgetary commitment may pose large and long-lasting effects on public finance (Gandrud and O'Keeffe 2017), also by enhancing banks' moral hazard and undermining their incentive to be prudent during the same crisis (Weber and Schmitz 2011). Accordingly, that this index assesses the extent of a given government's informative capacity in assessing the severity of a financial crisis and responding proportionally to it.

$$i2 = \frac{r2 - c2}{(\text{mean of } r2) - (\text{mean of } c2)} \tag{3}$$

[7] Containment to financial crisis usually includes guarantee and asset guarantees, liquidity assistance, and recapitalization that ensure the liquidity of banks (Gandrud and O'Keeffe 2017, p. 392).

In Eq. 4, $i3$ measures the mismatch between the government's actual financial expenditure on bailing out banks in July 2009 and the net cost of bailouts as estimated at the end of 2010 (Grossman and Woll 2014).[8] Both measures are expressed as a percentage of the GDP. This difference assesses the informative capacity of governments to design 'a costless containment' (Gandrud and O'Keeffe 2017) to banking crisis by predicting the bank assets' recovery values and by imposing lending requirements to banks benefitting from rescue packages that minimize the losses for the taxpayers, i.e., one of the objectives of the 2008 EU bank packages (Posch et al. 2009).

$$i3 = \frac{r3 - c3}{(\text{mean of } r3) - (\text{mean of } c3)} \tag{4}$$

Finally, in Eq. 5, $i4$ measures the mismatch between the committed financial expenditure and the actual expenditure. Again, we believe this ratio shed a light on the informative capacity of a given government to response to a banking crisis.

$$i4 = \frac{r2 - r3}{(\text{mean of } r2) - (\text{mean of } r3)} \tag{5}$$

Designing indexes of banking regulation response

Government responses to the banking crisis concerned also regulation and supervision of banks. Relying on the World Bank surveys, it is possible to have an assessment of the types and the extent of responses at the level of regulatory policy instruments.

The World Bank surveys on banking regulation and supervision cover hundreds of items. As a consequence, scholars have taken chosen to focus on those aspects of the extent of banking regulation and supervision that are the most pertinent in a given context (Hoque et al. 2015). This will be also our approach.

The following are the specific policy measures that we use to assess the extent of regulatory policy reaction to the banking crisis (Barth et al. 2013):

$r4$: Capital requirements
$r5$: Liquidity and risk diversification
$r6$: Supervision system.

More specifically: $r4$ corresponds to 'capital requirements: capital regulatory index,' an aggregate measure of the stringency of capital requirements (index identified by the following Roman number: IV.III in Barth et al. 2013); $r5$ corresponds to 'liquidity and risk diversification' (diversification index, question 7.1 and question 7.2 in Barth et al. 2013); and $r6$ corresponds to 'supervision system and supervisory agency' (aggregate measures of supervision power and prompt corrective power from Barth et al. 2013). Other indicators

[8] Such a difference 'depends in great part on the value of the assets governments held, which varied according to a lot of different factors, both internal to the banks' investment decisions, the evolution of financial markets and the design of the bailout (i.e., reimbursement conditions and costs of bailout participation). It is nonetheless instructive to see that bailouts cannot always be equated to throwing public money into the throats of greedy private institutions. The ways in which bailouts are designed and the costs they impose on the financial industry thus need to be taken into account for a comprehensive discussion' (Grossman and Woll 2014, p. 582).

exist,[9] but those mentioned above are the most appropriate for operationalizing policy responses in the context of the present article, as they correspond to policy measures that: were actually decided by government; can be measured before and after the crisis; and can be easily distinguished from factors that caused the crisis, or that are part of the crisis.

Measures of c, again the severity of the banking crises, are the same as in the previous section. For simplicity, in the remainder of this paper we use as a measure of the severity of the crisis only the peak of nonperforming loans as a % of total loans ($c1$). However, as mentioned before, many other instances of c can be considered.

Therefore, the (non-)proportionality of regulatory policy response to the crisis can be assessed with the following formula (Eq. 6):

$$i(p) = \frac{\alpha r - c}{(\text{mean of } \alpha r) - (\text{mean of } c)} \tag{6}$$

where αr is the percentage change in r, the regulatory change from before to after the crisis, that is, between 2006 and 2011 (Eq. 7):

$$\alpha r = \frac{(r \text{ after the crisis}) - (r \text{ before the crisis})}{(r \text{ before the crisis})} \times 100 \tag{7}$$

As for above, r indicates the intensity of the reaction and c indicates the severity of the crisis. $i = 0$ would indicate a 'normal reaction'; $i > 0$ would indicate overreaction; and $i < 0$ would indicate underreaction. As such, the scales of the indexes are not entirely comparable, as they depend on the specific values of indicators (this point will be dealt at the end of this section).

$i5$ measures the extent of (non-)proportionality as regards the adjustment of capital requirements with respect to the peak of nonperforming loans (Eq. 8):

$$i5 = \frac{\alpha r4 - c1}{(\text{mean of } \alpha r4) - (\text{mean of } c1)} \tag{8}$$

$i6$ measures the extent of (non-)proportionality as regards the variation of liquidity and risk diversification requirements with respect to the peak of nonperforming loans (Eq. 9):

$$i6 = \frac{\alpha r5 - c1}{(\text{mean of } \alpha r5) - (\text{mean of } c1)} \tag{9}$$

Finally, $i7$ measures the extent of (non-)proportionality as regards changes to the supervision system with respect to the peak of nonperforming loans (Eq. 10):

$$i7 = \frac{\alpha r6 - c1}{(\text{mean of } \alpha r6) - (\text{mean of } c1)} \tag{10}$$

To ensure comparability across indexes, z-scores can be computed, as follows, so as to provide standardized values (Eq. 11):

[9] Such as 'regulation of activities: overall restrictions' (II.IV); 'regulation of bank governance: whether changes in the bank governance were a consequence of the financial crisis' (question 6.8 in the 4th survey); 'saving protection scheme: changes to your deposit protection system as a result of the global financial crisis' (question 8.19 in the 4th survey); 'banking resolution framework: introduced significant changes to the banking resolution framework in your country as a result of the global financial crisis' (question 11.12 in the 4th survey) (Barth et al. 2013).

$$i(\text{standardized}) = \frac{i - (\text{mean of } i)}{(\text{standard deviation of } i)} \quad (11)$$

An application of the indexes

We turn now to practical applications of the suggested indexes in the 17 EU member states that experienced a banking crisis in 2007–2008 according to Laeven and Valencia (2013). After a brief presentation of the main results of the indexes and their descriptive statistics, the aim of this section is to illustrate the added value of our indexes in comparison with other comparative studies of regulatory reform of the banking sector (e.g., Lo 2009; Grossman and Woll 2014).

Results and summary statistics

Looking at the data stemming from Eqs. 2, 3, 4, and 5, we can have a nuanced assessment of the extent of the macroeconomic policy response of each country in the sample. To recall, those four indexes assess the mismatch between the extent of policy reaction *r*, measured by several measures of macroeconomic reactions (peak support in % of deposits, committed bailout expenditures as % of GDP, and actual expenditures as % of GDP) and the severity of the banking crisis, *c*, measured by the peak of nonperforming loans, the cumulative losses in the banking sector, and the net cost of bailout. The data presented in Table 1 refer to the period when the banking crisis occurred, so that we examine the prompt response of a given country. Because of data availability, the samples of EU countries vary between 15 and 17.

Table 1 Indexes of disproportionate macroeconomic responses

Country	*i*1	*i*2	*i*3	*i*4
AUT	1.316	0.597	0.353	0.802
BEL	2.186	1.762	1.155	2.173
DEN	2.012	4.949	0.009	8.617
FRA	0.6445	0.321	0.246	0.416
GER	0.945	0.427	0.362	0.509
GRE	4.051	0.1075	0.207	0.226
HUN	− 1.209	0.132	0.116	0.146
IRL	0.919	4.342	8.924	0.080
ITA		− 0.002		
LTV	− 1.414	0.626	0.284	0.965
LUX	1.773	0.315	0.450	0.306
NDL	0.751	0.916	1.069	0.885
PRT	1.3795	0.234	0.086	0.306
SLO	1.152	0.571		
SPA	0.285	0.173	0.220	0.236
SWE	1.4235	0.855	0.388	1.3745
UK	0.647	0.678	1.112	0.492

Empty cells indicate missing data

Table 2 Descriptive statistics of indexes of disproportionate macroeconomic responses

Variable	Mean	SD	Min.	Max.	*N*
*i*1	1.054	1.272	− 1.414	4.051	16
*i*2	1	1.437	− 0.002	4.949	17
*i*3	0.999	2.224	0.009	8.923	15
*i*4	1.169	2.133	0.08	8.617	15

Table 3 Indexes of disproportionate banking regulatory (and surveillance) responses

Country	*i*5	*i*6	*i*7
AUT		− 0.331479708	0.193305375
BEL	1.838629231	− 0.336386538	− 0.708559299
DEN		− 1.236088802	0.186010484
FRA		− 0.352333734	− 0.712657046
GER	− 0.054841101	1.40571323	− 0.411014804
GRE	− 0.721483366	1.212944922	1.941062194
HUN	− 1.093671334	1.236778095	− 0.664564802
IRL	1.717448874	− 0.507950332	1.0485638
LTV	0.235846756	− 0.561049238	− 0.31598609
LUX	− 0.201962153	− 0.304667389	2.001402651
NDL	0.187118802	− 0.337963733	
PRT	− 0.964390282	− 1.286734294	− 0.72760707
SLO		− 1.370150398	− 0.658981058
SPA		1.368912007	− 1.170974335
UK	− 0.942695428	1.400455912	

Empty cells indicate missing data

Table 4 Descriptive statistics of indexes of regulatory responses

Variable	Mean	SD	Min.	Max.	*N*
*i*5	0	1.054	− 1.094	1.839	10
*i*6	0	1.035	− 1.37	1.406	15
*i*7	0	1.041	− 1.171	2.001	13

The following Table 2 summarizes the descriptive statistics for macroeconomic policy response in the EU countries. The means of the four indexes are close to 1, indicating a general tendency of the EU countries facing the 2007–2008 banking crisis to overreact. There is a relatively large variation of these overreactions, especially in the response captured by the indexes *i*3 and *i*4 that tend to have minimum values close to 0 but high values (8.9 and 8.6, respectively) associated with the maximum values.

Turning to the regulatory response indexes, Table 3 presents the data of regulatory changes resulting from the banking crises. Again for data availability, the samples of EU countries vary between 10 and 15.

The descriptive statistics (cf. Table 4) show that, as the minimum and maximum values illustrate, there is a balanced representation of countries that under and overreacted through regulatory responses to the 2007–2008 banking crisis.

Discussing the macroeconomic policy responses indexes

An analysis of the four macroeconomic indexes (Table 1) indicates that only Hungary and Latvia underreacted as measured by *i*1, which takes into account the relationship between the peak nonperforming loans and the peak of support of deposits. Similarly, there are only few values that are close to zero, indicating a response that is in line with the average responses of the sample of countries. Italy attested a value close to zero in the ratio between committed bailout expenditures and the cumulated losses of the banking sector (*i*2), and Denmark and Portugal were able to calibrate an appropriate response to the net cost of bailout through the actual budgetary expenditures (*i*3). Finally, Ireland actually spent almost all the committed bailout expenditure as measured by index *i*4. And this is an interesting finding, since Ireland is a country that has greatly overreacted to the banking crisis, committing bailout expenditure regardless of the extent of cumulative losses of the banking sector (*i*2) and the extent of actual expenditure regardless of the net cost of bailouts (*i*3). Another interesting case is Denmark, which tended to overreact in supporting banking deposits (*i*1) and committing bailout expenditures (*i*2 and *i*4). Other countries that had the tendency to overreact to the banking crisis were Greece (but only on the *i*2 index) and Belgium, which that tended to overreaction across all four indexes. Overall, the macroeconomic indexes attest to widespread policy overreaction, which led to stress or even crisis in public finances. Is it the same with the regulatory response?

Discussing the indexes of banking regulation responses

In the regulatory indexes, *c* is again the peak of nonperforming loans as a % of total loans (*c*1), while the instances of *r* refer to the aggregate measure of capital requirements (*r*4), to the liquidity and risk diversification (*r*5), and to the supervision power of banking authorities (*r*6), respectively, expressed as percentage changes. The reference years are 2006 (before the crisis) and 2011 (after the crisis). It is worth noting that there are some missing data of regulatory responses, especially for the first index measuring the response through capital requirement (*i*5 is only calculated for 10 EU member states, cf. Table 3). There are no data of Italy's peak of nonperforming loans (*c*1), and there are no data for Sweden in all three regulatory responses. What is more, indicators starting with a 0 on an ordinal scale have been rescaled by one unit to avoid undefined expression (by dividing by 0).

A cursory look at the data shows some interesting patterns as regards the *intensity* of reactions. Unlike the macroeconomic responses, where few countries had shown underreaction, the regulatory responses show a greater variation in the tendency for governments to move toward either lenient or stringent measures. Quite surprisingly, this had occurred within a sample of countries that are extremely well coordinated within the European Union and the single financial market and many of them are part of the Eurozone.

Cross-country comparison indicates a distinction between governments that underreacted, such as Portugal and Slovenia, and those that tended to overact, such as Greece and Ireland. The latter are also overreacted on the macroeconomic response. Other countries with overreaction on the macroeconomics, such as Belgium and Denmark, have no clear and coherent tendency in their regulatory responses. Belgium had more stringent capital requirements, but also less stringent control over liquidity and risk diversification and banking surveillance, whereas Denmark has increased banking surveillance. Overall, with the exception of Belgium, the countries that greatly overreacted in their macroeconomic

policy response had more stringent surveillance mechanisms. It is also important to note that Denmark and Ireland had a more relaxed approach to measures that are directly linked to risk in the banking sector. For both countries, there was a tendency to underreact in an aspect of regulatory reform where many other countries went in the opposite direction. This is also evidenced by specific survey items that indicated the exceptionality of Denmark and Ireland in their regulatory control over banks. As of the end of 2010, Denmark was the only country in the sample that had no bank ownership level thresholds that would trigger evaluation and approval requirements by the banking supervisory authority. In a similar vein, as of the end of 2010, Ireland was the only country in the sample that did not require the sources of funds to be used as capital to be verified by the regulatory/supervisory authorities.

We can also observe a variation in the *type* of reactions. Changes in the three types of instruments analyzed here are about equally frequent, although measures of deregulation related to liquidity and risk diversification tend to be underregulated with a frequency of negative values that is double that the overreaction responses. However, they come in different combinations: *i*6 and *i*7 are quite frequently combined, while *i*5 is usually activated alone or even follows an opposite dynamic from the other two.

The comparison between the magnitudes of reactions is also interesting (Fig. 1). Most countries tend to react extremely, but in a specific way. Other ones display more stability, such as Austria, France, Latvia, and the Netherlands. One could argue that institutional conditions, such as veto players, may help in explaining this difference.

Systematizing the indexes of policy responses

After illustrating the empirical findings associated with the proposed indexes of disproportionate responses to the banking crisis, we attempt to systematize this set of indexes according to a number of key conceptual dimensions and taxonomies of responses. Table 5 summarizes different dimensions of disproportionate policy reaction.

We classify policy responses according to three dimensions: risk, institutions and the overall extent of regulatory and macroeconomic response. The first dimension revolves

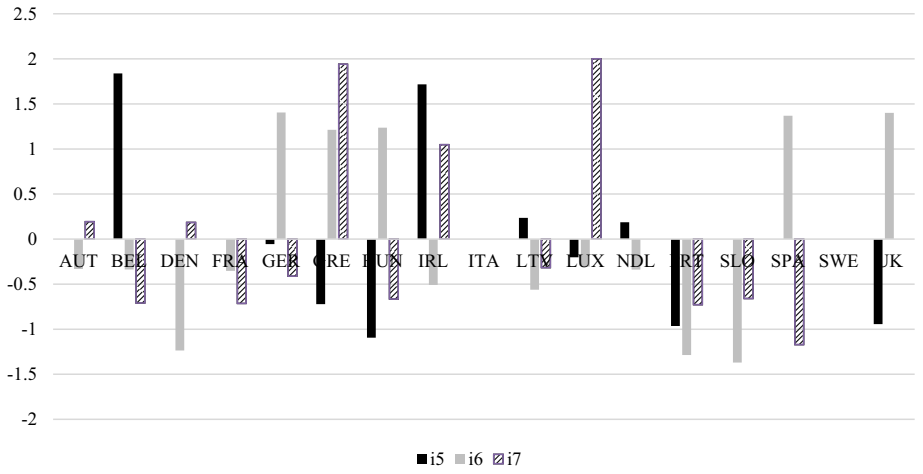

Fig. 1 The magnitude of disproportionality in regulatory (and surveillance) responses

Table 5 Synthesis of three dimensions of policy responses

Dimensions of (dis)proportionate policy response	Indexes	Overreaction	Normal action	Underreaction
Systemic risk	*i*5 and *i*6	Measures of stringent regulation in both capital requirement and liquidity and risk diversification	Compensation of stringent and lenient regulatory changes in both capital requirements and liquidity and risk diversification	Measures of lenient regulation in both capital requirements and liquidity and risk diversification
		No country	*All the countries with the exclusion of Luxembourg and Portugal*	*Luxembourg and Portugal*
Level of institutionalization for banking surveillance	*i*7	Enhancement of the surveillance through institutional innovations	Strengthening the previous surveillance institutions and mechanisms	No change or institutional deregulation
		Ireland and Luxembourg		*Spain*
Extent of change (macroeconomics and banking regulation components)	*i*1–*i*7	Large regulatory reform enacting stringent control over banking sector associated with large macroeconomic interventions	A calibrated mix of policy under- and overreaction to the banking crisis	Deregulation plus macroeconomic responses through fiscal measures
		No country	*Typical examples: Germany and the Netherlands*	*Portugal and Slovenia*

around the extent of banking regulation change that is directly related to systemic banking risk. Here the emphasis is on the policy components that aim to reduce systemic banking risk: capital requirements (*i*5) and liquidity and risk diversification (*i*6). With few partial exceptions (Portugal and Luxembourg, which adopted less stringent regulation on both components), Table 3 shows that usually governments have the preference to compensate their overreaction in one policy component with underreaction in the other policy component. No country has pursued a stringent approach on both measures for reducing the systemic banking risk.

The second dimension of policy response is related to the level of institutionalization of the banking surveillance system. Designing and utilizing new regulatory institutions may imply a certain level of policy overreaction. Relying on index *i*7, we can identify two countries that had an extreme response: Spain reduced its institutional surveillance, while Ireland and Luxembourg enormously strengthened their institutional surveillance. We are aware that this dimension of policy change would require a careful qualitative analysis of the institutional innovations adopted in the sample of countries. Accordingly, additional qualitative research is needed to assess and verify the extent of institutional innovation in Ireland and Luxembourg, as well as the policy mix in Spain, composed of a stringent

requirement for liquidity and risk diversification and lenient banking surveillance (Tables 3, 5).

The final dimension of policy response attempts to qualitatively capture the overall reaction of a government to the banking crisis. Although this classification of the level of regulatory action can be considered a crude assessment of reform, it allows us to identify those few countries that tried to deal with the banking crisis exclusively through macroeconomic policy responses (Portugal and Slovenia). It also allows us to identify the few cases of a carefully calibrated mix of macroeconomic and banking regulation changes, for example Germany and the Netherlands. We were not able to find any examples of the ideal type of extreme reaction: no countries pursued a policy response that could be characterized as macroeconomic overreaction and banking regulation overreaction.

Overall, this classification of typologies of disproportionate policy response allows us to have a nuanced discussion of changes and responses in policy domains that are populated by a mix of strategies and tools for controlling markets and reducing their associated risks, in this case of the banking sector. These classifications can guide the identification of case studies that deserve an in-depth analysis, such as Germany, Luxembourg, the Netherlands, Portugal, Slovenia, and Spain.

Conclusion

The goals of our piece of research are twofold. To begin with, we wanted to make a methodological contribution to the literature on disproportionate policy responses by developing a procedure to operationalize policy under- and overreactions that is suitable for comparative research. We did so by proposing a measure of (dis)proportionality that relates to both the average response of a sample of countries and to domestic-level variation in the severity of the crisis.

Moreover, we illustrated this procedure and its implications with an empirical study of policy responses to the 2007–2008 banking crisis. The proposed indexes capture the extent of the macroeconomic (fiscal) response and the regulatory and surveillance response. This approach has allowed us to identify some general patterns that would have not been possible to detect through a qualitative and small-n analysis:

1. The vast majority of the EU member states in our samples of macroeconomic fiscal responses to the 2007–2008 banking crisis overreacted in policy terms, through the government guarantee of banking deposits and bailout;
2. The regulatory and surveillance component of government response (captured by our sample of 15 EU member states) was more varied. Most countries combined a mix of stringent and lenient measures.
3. Stringent regulatory measures of liquidity and risk diversification requirements were a common but not a general pattern.
4. Only Portugal and Slovenia faced the banking crisis through a combination of macroeconomic measures and deregulation. No countries implemented both extreme macroeconomic policy and very stringent banking regulation and surveillance.
5. Among the countries that chose to overreact through macroeconomic measures, there was no common pattern of regulatory reform.

The proposed procedure is not specific to banking regulation and can be extended to other policy areas that are characterized by well-defined policy reactions in the form of policy outputs (e.g., decisions and regulations) to crisis events whose severity can be quantified

and displays a certain variation across entities. For instance, promising areas of research would be food safety or the regulation of therapeutic products. More generally, further comparative policy analyses should look at three specific dimensions that this paper has overlooked. First, the extent of international coordination of policy responses needs to be carefully qualified. Second, in-depth qualitative analyses of the mix of policy responses should test the effectiveness of the proposed indexes by focusing on the most extreme cases of policy over- and underreaction. Third, it would be interesting to examine variations in patterns of disproportionality not only cross-country but also cross-sector.

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