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Do Banks Issue Equity When They Are Poorly Capitalized?

Valeriya Dinger and Francesco Vallascas*

Abstract

Debt overhang and moral hazard predict that poorly capitalized banks have a lower likelihood to issue equity, while the presence of regulatory and market pressures posits an opposite theoretical prediction. By using an international sample of bank seasoned equity offerings (SEOs), we show that the likelihood of issuing SEOs is higher in poorly capitalized banks and that such banks prefer SEOs to alternative capitalization strategies. A series of tests exploring the variation of capital regulation and market discipline show that market mechanisms rather than capital regulation are the primary driver of the decision to issue by poorly capitalized banks.

I. Introduction

Bank capital is essential to ensure bank survival and safeguard financial stability (Berger and Bouwman (2013), Diamond and Rajan (2000)). Among the different options that poorly capitalized banks can pursue to restore their capital adequacy, raising equity in the stock market via seasoned equity offerings (SEOs) appears an effective and timely solution. This is because, differently from recapitalization strategies based on the accumulation of retained earnings, SEOs allow poorly capitalized banks a fast and substantial rebalancing of the capital structure toward the desired target.

The existing literature, however, is inconclusive with regard to whether poorly capitalized banks are likely to rely on equity issuance. In particular, two contrasting views have been proposed. A first view suggests that numerous

*Dinger (corresponding author), vdinger@uni-osnabrueck.de, Department of Economics, University of Osnabrueck; Vallascas, fv@lubs.leeds.ac.uk, Business School, University of Leeds. We thank Allen Berger (the referee) and Paul Malatesta (the editor) for the numerous constructive comments that have contributed to substantially improving the paper. We also thank Tim Eisert, Giuliano Iannotta, Kevin Keasey, Andrea Resti, Erik Theissen, participants at the Bundesbank-ESMT-DIW Conference "Achieving Sustainable Financial Stability," and seminar participants at the University of Bonn, the University of Mannheim, the University Cattolica of Milan, the Norges Bank, and the Central Bank of Finland for their useful comments on early versions of this paper. This project was completed when Dinger was senior research fellow at the University of Leeds.

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disincentives discourage banks from issuing equity (Acharya, Cooley, Richardson, and Walter (2011), Coates and Scharfstein (2009), Khan and Vyas (2015), Krishnan, Ergungor, Laux, Singh, and Zebedee (2010), and Squam Lake Working Group on Financial Regulation (2009)). The debt overhang framework proposed by Myers (1977) explains part of these disincentives. More precisely, banks, as other companies, are unwilling to issue equity because creditors and claimants senior to common shareholders would capture a portion of the benefits of new equity while the claim of the existing shareholders would be diluted (Acharya et al. (2011), Admati, DeMarzo, Hellwig, and Pfleiderer (2012), and Coates and Scharfstein (2009)). Furthermore, for banks, the disincentives to issue are potentially exacerbated by their typically high leverage (Admati et al. (2012)) as well as by the presence of risk-shifting opportunities for shareholders due to the expectation to receive government support when banks are unable to repay their debts (Gornall and Strebulaev (2013)).

In contrast, a second view suggests that capital requirements and market forces create incentives for poorly capitalized banks to issue equity (see, for instance, Admati et al. (2012), Berger, DeYoung, Flannery, Lee, and Oztekin (2008), Dahl and Shrieves (1990), and Erkens, Hung, and Matos (2012)). The regulatory pressure to comply with capital requirements should induce banks to issue equity when the low degree of capital strength signals a low regulatory capital adequacy. Also, the presence of market discipline might force poorly capitalized banks to raise equity, independent of their degree of capital strength according to regulatory standards, when they are closer to the default point. Furthermore, since the poor degree of capitalization exposes banks to extraordinary regulatory and market pressures that might impose a rapid adjustment of the capital structure (Berger et al. (2008)), SEOs are likely to become the preferred recapitalization strategy.

In this paper, we evaluate the relative importance of these two contrasting views in explaining the decision of poorly capitalized banks to raise equity in the stock market by presenting the first study on the determinants and timing of SEOs in the banking industry. We build our analysis on a large international sample of banks operating in the G20 countries and selected for an extensive time period ranging from the beginning of 1993 to the first half of 2011. We opt for an international sample of banks for three key reasons.[1] First, the international dimension of the sample offers the opportunity to assess the importance of pressures stemming from capital requirements on equity issuance via the numerous events of capital regulation changes at the national level observed in our sample. Second, the international dimension of the sample allows evaluation of the role of market discipline on equity issuance by using cross-country differences in systemic conditions as a source of variation in market discipline. This is the case since the eruption of a systemic shock, and the consequent increase in the likelihood of a state intervention to stabilize the banking system, does not simply increase risk-shifting opportunities for shareholders, but also undermines market discipline because of a lower sensitivity of bank creditors to fundamentals (Acharya, Anginer, and Warburton (2016), Balasubramnian and Cyree (2011), Hasan, Jackowicz, Kowalewski, and

[1]Our sample includes a large share of U.S. banks. However, the results are not driven by the peculiarities of these banks: The main findings are qualitatively confirmed when we focus only on non-U.S. banks.

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Kozlowski (2013), Hett and Schmidt (2013), Levy-Yeyati, Peria, and Schmukler (2004), and Martinez-Peria and Schmukler (2001)). As a result, if market discipline might work as an incentive for poorly capitalized banks to issue equity, this should be the case during normal systemic conditions but less so during periods of systemic distress. Third, the cross-country feature of our sample provides the opportunity to assess the role played by market discipline in the likelihood of an SEO by focusing on a sufficiently large subsample of poorly capitalized banks for which market pressure can be ineffective since they might qualify for too-big-to-fail status.

We start our analysis by showing that SEOs are more likely to occur in poorly capitalized banks. Therefore, debt overhang and the moral hazard related to risk-shifting opportunities do not seem to play a dominant role in guiding SEOs by poorly capitalized banks. We then explore whether the result that these banks are more likely to issue is mainly driven by capital regulation. Initially, we disentangle the role of capital regulation from the influence of other incentives to issue equity by investigating the different behaviors of regulatory constrained banks (defined as banks with an extremely low regulatory capital buffer) and regulatory unconstrained banks. We show that poorly capitalized banks are more likely to issue equity especially when they are not regulatory constrained and are then unlikely to be under the pressure of regulators. Next, we examine the role of regulation by employing the changes in capital regulation as quasi-natural experiments under a difference-in-difference setting. Our conjecture is that if capital requirements are a key driver of equity issuance by banks, we should witness SEOs more frequently in periods of increases in minimum capital requirements and especially in poorly capitalized banks. We find that regulatory changes do not increase the likelihood of SEOs by poorly capitalized banks. This result suggests that regulatory pressure seems to play a limited role in the decision of poorly capitalized banks to raise equity and supports the importance of market pressure on this decision.

In the following steps of our analysis, we provide more direct evidence of the importance of market discipline on our findings by showing that poorly capitalized banks do not raise equity in the quarters immediately following the eruption of a severe systemic shock. By contrast, they are more likely to raise equity than other banks in normal systemic conditions, that is, only when they are expected to be subject to more stringent market discipline than other banks (Acharya et al. (2016), Balasubramnian and Cyree (2011), Hasan et al. (2013), Levy-Yeyati et al. (2004), Martinez-Peria and Schmukler (2001), and Hett and Schmidt (2013)).We further underline the importance of market discipline by showing that the reluctance of banks to issue following a systemic shock is strongest for the largest banks in our sample. This is in support for the role of market forces, since the largest banks are the banks for which, due to the expectations of government bailouts, market discipline loosens most while the costs of issuing equity rise least in a crisis.

Finally, we show that poorly capitalized banks are also in search of a rapid rebalancing strategy. In essence, by analyzing other options that banks can chose to rebalance their capital structure, we find that poorly capitalized banks do not use more frequently than other banks recapitalization strategies that might require a longer period to be effective such as increases in capital via the accumulation

of retained earnings. Furthermore, the issuance of an SEO is also preferable to a deleveraging strategy implemented via a decrease in a bank's assets.

Overall, we find that market mechanisms rather than capital regulation are the primary and key driver of the decision to issue equity by poorly capitalized banks. This finding is consistent with the view that capital regulation is often not binding (Allen, Carletti, and Marquez (2011), Diamond and Rajan (2000), Flannery (1994), Myers and Rajan (1998)) and motivates regulatory interventions that aim at increasing the default risk sensitivity of bank-funding costs. For instance, this can be achieved via minimum mandatory requirements for uninsured debts such as subordinated debts (Evanoff, Jagtiani, and Nakata (2011), Flannery and Sorescu (1996), Sironi (2003)). Furthermore, the behavior of the largest poorly capitalized banks during periods of systemic distress suggests that the introduction of a countercyclical capital buffer and forms of contingent capital that have to be converted in equity during more unstable systemic conditions has to be especially directed toward too-big-to-fail banks (Flannery (2009)).

The analysis presented here provides the first empirical evidence on the drivers of SEOs in the banking industry and, in particular, on the role of bank capital strength. While a wide corporate finance literature has investigated explanations of SEOs in nonfinancial firms (see, for instance, Dittmar and Thakor (2007), De Angelo, De Angelo, and Stulz (2010), Erel, Julio, Kim, and Weisbach (2012), and Kim and Weisbach (2008)), extending the findings of these studies to banks might be problematic because of their peculiar capital structure and the presence of capital regulation. The empirical evidence on bank equity issuance is instead limited to a handful of U.S.-based studies focusing on the market reaction following SEOs (Cornett and Tehranian (1994), Cornett, Mehran, and Tehranian (1998), and Krishnan et al. (2010)) or on SEOs in the context of the recent global turmoil (Khan and Vyas (2015), Elyasiani, Mester, and Pagano (2014)).

Specifically, earlier event studies on U.S. banks indicate that the market does not penalize poorly capitalized banks when they issue equity (Cornett et al. (1998)), with the implication that for these banks, it would be less costly to raise capital in the stock market. More recent analyses, however, conclude that the market reaction to SEO announcements does not vary with bank capital strength (Krishnan et al. (2010)). Contrasting results on the link between bank equity ratios and the likelihood of SEOs are also offered by two recent studies of the U.S. banking system (Khan and Vyas (2015), Elyasiani et al. (2014)). In general, the extant literature omits thorough analysis of the forces behind banks' decisions to issue equity through the distinction between normal and crisis periods. This bears potential risks to the consistency of the findings, since, as we show here, the trade-off between the incentives and disincentives to issue might change substantially during crisis times.

The rest of the paper is structured as follows. Section II describes the sample, the econometric model, and the variables. Section III presents the empirical results of how bank capital strength influences the likelihood to issue equity. Section IV extends the analysis to the interplay between capital strength and systemic conditions and its effect on equity issuance by large and small banks. Section V compares SEOs to other alternatives to restore bank capital strength. Section VI offers conclusions.

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II. Sample Selection, Econometric Model, and Variable Definition

A. The Sample of Banks and SEOs

The estimation of the likelihood that a bank issues common equity requires the identification of i) the population of banks that can opt for an SEO in a given time period; ii) the number of banks that have issued an SEO in the same period.

The population of banks has been identified using the list of publicly traded and delisted banking firms drawn from Datastream International for the period from Jan. 1, 1993 to June 30, 2011. From this list, including more than 4,000 institutions, we maintain in the sample only banks that trade common equity, operate in G20 countries, and have accounting information available in Worldscope. The application of these three criteria yields a population of 2,177 unique banks chartered in 19 countries. Next, we remove U.S. banks listed in over-the-counter markets given their specificity in terms of capital raised. This reduces the number of banks in our sample to 1,522.

We then identify which banks have issued common equity during the period under investigation from the list of announced bank SEOs from Jan. 1993 to June 2011 extracted from Thomson One Banker. This produces an initial list of 3,530 SEOs. We merge the initial list of issuing banks within our population of banks. We use the International Securities Identification Number (ISIN) code to match the two data sets; if the ISIN is not available, we use the Stock Exchange Daily Official List (SEDOL) code. We apply several additional selection criteria to the resulting sample of issuing banks. First, we remove pure secondary offers, as they are based on the exchange of existing shares without any impact on the level of bank equity. Second, we remove equity offers that have been withdrawn after their announcement and, hence, do not produce any effect on bank capital structure.

As summarized in Panel A of Table 1, the application of these criteria leads to a final sample of 912 SEOs in our population of banks with a high concentration of issuances in the latest part of the sample period. The time-series evolution of the number of SEOs highlights that banks do not frequently rely on SEOs; this is especially true before 2008, as suggested by Khan and Vyas (2015). More precisely, in the period ranging from 1993 to 2007, we observe an annual average of 33 SEOs with a total number equal to 558 (about 61% of the total sample). The rarity of the issues is demonstrated by the ratio between the total number of SEOs and the total number of bank-year observations: Over the full sample period, this ratio is equal to 5.18%.

Panel B of Table 1 reports the distribution of the SEOs sample by country and shows that the largest share of SEOs (around 47%) is concentrated in the United States. However, in the following sections, we show that our results are similar when we exclude the U.S. banks from our sample. Finally, the average proceeds of the issue are equivalent to $490 billion, which is large relative to the book value of bank equity. For instance, for the median issuing bank, the ratio between the proceeds and the book value of equity is equal to 1.2. Hence, though not particularly frequent, when SEOs occur, they produce a relevant change in the amount of capital held by the issuing bank.

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TABLE 1
Distribution of Banks and SEOs

Panel A of Table 1 reports the number of banks and SEO events covered by our sample per year as well as the relative frequency of SEO events in each of the sample years. Panel B shows the distribution of SEO events as well as the average size of SEOs by country.

Panel A. Distribution of Banks and SEOs by Year

	Number of Banks	Number of SEOs	SEOs/Banks
1993	751	33	4.39
1994	841	39	4.64
1995	907	27	2.98
1996	1,045	25	2.39
1997	1,130	28	2.48
1998	1,124	41	3.65
1999	1,105	34	2.99
2000	1,073	17	1.58
2001	1,040	43	4.13
2002	1,011	34	3.36
2003	1,003	34	3.39
2004	975	43	4.41
2005	979	59	6.03
2006	955	58	6.07
2007	926	43	4.64
2008	900	72	8.00
2009	878	132	15.03
2010	845	131	15.50
2011 Q2	121	19	15.70
Total	17,509	912	5.20

Panel B. Distribution of SEOs by Country

	Number of SEOs	% of SEOs	Average Proceed (BLN US$)
Argentina	3	0.33	64.1
Australia	42	4.61	233.7
Brazil	28	3.07	1,093.2
Canada	14	1.54	224.8
China	48	5.26	1,530.4
France	18	1.97	1,294.2
Germany	35	3.84	764.8
India	38	4.17	205.5
Indonesia	58	6.36	213.4
Italy	52	5.70	425.0
Japan	70	7.68	399.8
Mexico	0	0.00	223.8
Russia	10	1.10	254.1
Saudi Arabia	2	0.22	1,113.9
South Africa	2	0.22	272.7
Republic of Korea	26	2.85	214.0
Turkey	8	0.88	172.7
United Kingdom	29	3.18	1,053.5
United States	429	47.04	260.6
Total	912	100.00	490.0

B. Econometric Model

We model the determinants of the probability that a bank issues an SEO using a panel random effect logit specification, where the dependent variable is a dummy equal to 1 when a bank has issued common equity in a given time period. While earlier research on nonfinancial firms mainly uses pooled regressions, and controls for the panel structure of the data set by clustering the standard errors at the firm level (see, e.g., De Angelo et al. (2010)), we prefer to incorporate in the analysis a panel specification, as it controls for unobserved bank heterogeneity. Although the clustering of the standard errors controls for heterogeneity in the estimation of the these errors, it does not remove the potential downward bias

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of the estimated coefficients that the omission of the firm-specific effect could generate Greene (2002).

Furthermore, we model the firm-specific effect as a random component for two reasons. First, the estimation of a logit fixed effect specification would produce a large reduction in the sample size, as the model requires some variation in the dependent variable at the bank level. As a result, banks that have not issued equity over the analyzed sample period would have to be removed from the analysis. In our sample, this would imply the exclusion of 1,021 banks from the analysis with a consequent strong sample selection bias. Second, the use of fixed effects does not allow control for time (quasi-) invariant variables, such as the characteristics of the regulatory environment characterizing the banking system that are part of our set of covariates.

More formally, we estimate via a maximum likelihood estimator the following panel random-effects logit model:

$$\begin{aligned}(1)\qquad \text{logit}\left\{\text{prob}\left(\text{SEO}_{i,j,t}=1|X_{i,j,t-4},Z_{j,t},\vartheta_i\right)\right\} \quad &= \\ \alpha+\beta\text{CAP}_{\text{STRENGTH}i,j,t-4}+\gamma X_{i,j,t-4}+\varphi Z_{j,t} \\ +\text{TIME}+\text{COUNTRY}+\vartheta_i+\varepsilon_{i,j,t},\end{aligned}$$

where SEO denotes a binary variable equal to 1 if the bank has issued common equity within a given time period; $\text{CAP}_{\text{STRENGTH}i,j,t-4}$ is one of our measures of capital adequacy; $X_{i,j,t-4}$ and $Z_{i,j,t}$ are, respectively, the vector of bank characteristics and the vector of the banking system and country control variables described in the next section; TIME is a vector of time dummies, COUNTRY is a vector of country dummies; and $\vartheta_i \sim N(0,\sigma)$ are the random intercepts that are assumed to be independent and identically distributed across banks and independent from the remaining covariates. The subscripts i, j, and t denote the bank, the country, and the time period, respectively. Notably, as in Erel et al. (2012), the bank-level explanatory variables are measured at the four-quarter lag to reduce endogeneity concerns in the regression model.

We estimate the models using a calendar quarter as the time unit of observation. This choice allows us to closely match the timing of the SEO to the time of outburst of systemic distress and thus control for the fact that, as discussed earlier, the disincentives/incentives by poorly capitalized banks to raise equity, and the related strength of regulatory and market pressures, vary with the degree of systemic stability. We address these concerns by estimating a quarterly indicator of systemic distress that we employ as a control variable. This quarterly indicator is constructed using the index of money-market pressure (IMP) suggested by von Hagen and Ho (2007). The index measures distress in the money market by both the changes in the money-market rate and the changes in bank reserves. We provide details on how we compute the systemic distress index and generate the binary systemic crisis variable in the Appendix. The advantage of this approach over other alternatives suggested in the literature (see, among others, Kaminski and Reinhart (1999), Laeven and Valencia (2013)) is that it is based on publicly available information for a cross section of countries (the data are drawn from the International Monetary Fund (IMF) International Financial Statistics) and, more importantly, allows the identification of the crisis event

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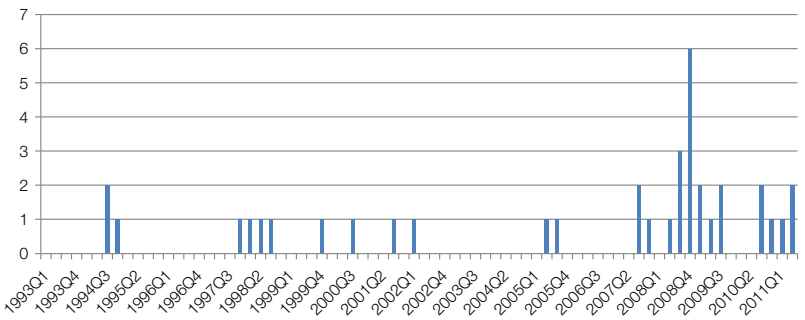
with a quarterly frequency that leads to a more precise matching with the timing of SEOs. In additional tests, which we report in the Internet Appendix (available at www.jfqa.org) and run annually, we show that using Laeven and Valencia's (2013) data for the definition of a crisis event generates qualitatively similar results.

Figure 1 shows the number of countries that have suffered from a systemic crisis in a given quarter. Overall, we identify 34 country-quarter-crisis events. The large number of cases is concentrated, as predictable, in the peak of the recent global turmoil observed during the years 2008 and 2009. Nevertheless, a substantial number of crisis quarters are also observed prior to the 2007–2009 financial turmoil period (e.g., Argentina in Q1 2001, Mexico in Q4 1994, and Russia in Q3 1998). We control for the timing of issuing equity around periods of systemic distress with a dummy variable that identifies the two quarters following the eruption of systemic crises (SYSTEMIC_SHOCK_2). In tests shown in the Internet Appendix, we also employ a dummy variable equal to 1 for the four quarters following the eruption of systemic crises.[2] Finally, as the behavior of poorly capitalized banks might differ between normal and distress systemic conditions, in Section IV, we extend equation (1) with interaction terms between the systemic distress dummy and our measures of bank capital strength described in the following section.

FIGURE 1

Number of Countries Affected by a Severe Systemic Shock in a Given Quarter

Figure 1 shows the number of countries that have been affected by a systemic shock, as defined by von Hagen and Ho (2007), in a given quarter during the sample period ranging from the first quarter of 1993 to the second quarter of 2011. We report details on the methodology proposed by von Hagen and Ho in the Appendix.



C. Measures of Bank Capital Strength and Control Variables

As shown in Panel A of Table 2, we employ in our tests two measures that signal a weak bank capital adequacy. The first (POORLY_CAPITALIZED) is a dummy equal to 1 if the bank equity to asset ratio falls in the first quartile of the sample distribution. The second variable is a dummy equal to 1 if the bank equity to asset ratio falls in the first quartile of the sample distribution in a given

[2]The time necessary to complete an SEO is about 6 weeks (Khan and Vyas (2015)). All these variables, therefore, reflect a sufficiently long time period to implement an equity offer.

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year (POORLY_CAPITALIZED_Y). This latter variable, therefore, allows control for the possibility that the regulatory and market perception of what constitutes a weakly capitalized bank has changed over time. Notably, the two variables identify banks with a low degree of capital strength: the average equity ratio in the group of poorly capitalized banks, as identified by the first (second) variable, is equal to 3.44% (3.45%), while in the group of remaining banks, it is 11.63% (11.62%).

We control for several firm- and country-specific determinants of the probability to issue an SEO that we identify by taking into account the results from previous studies on nonfinancial firms (De Angelo et al. (2010), Erel et al. (2012)) and the specificities of banks. Generally, given the potential role of SEOs as a tool for rapid recapitalization, these variables are expected to influence the probability to issue equity by affecting the desired capital level or the speed of adjustment to this level. Variable definition and summary statistics of the full set of control variables are reported in Panels B and C of Table 2.

First, we control for bank risk measured by the volatility of stock returns in a given quarter (RISK). This variable can exercise two opposite effects on the likelihood of an SEO. Risky banks are more likely to be under regulatory scrutiny and subject to a stronger market discipline that should increase their likelihood to issue equity as means of fast recapitalization. In a similar vein, Berger et al. (2008) suggest that riskier banks are likely to target higher capital ratios. Nevertheless, more risky banks could also show a lower likelihood to issue an SEO, as they have more incentives to shift risk to debtholders and are characterized by higher costs of raising equity. Two additional determinants capture the market-timing and life cycle effects on the decision to issue equity. The first variable is the relative price-to-book ratio (RELPTB), constructed as the price-to-book ratio at the bank level divided by the yearly average ratio observed for all the remaining domestic banks in our sample. According to the market-timing perspective, firms tend to invest when their shares are overvalued. Thus, higher values of RELPTB will increase the probability of an SEO. A similar positive sign is expected if we interpret this variable as capturing the value of bank rents in the domestic market. In this latter case, banks with higher RELPTB are expected to opt for higher capital targets (Berger et al. (2008)) with a consequent increase in the likelihood to issue. The second variable is the natural logarithm of the number of years (YEARLISTED) a bank is listed in the stock market. Younger firms are deemed to rely on equity issues to support growing investment opportunities, while more mature firms prefer to opt for internally generated financial resources (De Angelo et al. (2010)).

Next, we control for the degree of profitability measured by the ratio between net income and total assets (ROA). We expect that more profitable banks, having the opportunity to rely on higher retained earnings, can adjust their equity ratios without incurring the potential negative signaling effect that the market generally links to equity issuance (Dahl and Shrieves (1990)). Another expected determinant of SEO decisions is bank size, which we measure as the natural logarithm transformation of bank total assets in millions of U.S. dollars (SIZE). Usually, large banks are expected to benefit from scale economies in raising capital and from an easier access to capital markets (Dahl and Shrieves (1990)). Nevertheless, large banks are also characterized by lower capital targets (Berger et al. (2008)).

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TABLE 2

Variable Definition and Summary Statistics

Table 2 reports the variable definitions as well as the number of observations, mean and median values, standard deviations, and the 1st and 99th percentiles for each of the variables employed in the analysis.

		N	Mean	Median	Std. Dev.	1st Pctile	99th Pctile
Panel A. Measures of Bank Capital Strength							
POORLY_CAPITALIZED	Dummy equal to 1 if a bank is in the first quartile of equity to assets distribution	53,707	0.257	0.000	0.437	0.000	1.000
POORLY_CAPITALIZED_Y	Dummy equal to 1 if a bank is in the first quartile of equity to assets distribution in a given year	53,707	0.256	0.000	0.436	0.000	1.000
Panel B. Bank-Specific Controls							
RISK	Standard deviation of daily returns computed at quarterly intervals	53,707	0.057	0.043	0.051	0.009	0.259
RELPTB	Price-to-book ratio divided by the average price-to-book ratio computed yearly at the country level	53,707	1.020	0.930	0.571	0.241	2.826
YEARLISTED	Number of years a bank is listed in the stock market	53,707	11.472	10.000	8.234	1.000	35.000
SIZE	Natural logarithm of total assets in millions of U.S. dollars	53,707	7.933	7.541	2.110	4.240	13.502
ROA	Net income over total assets	53,659	0.007	0.008	0.026	−0.051	0.047
DEPOSITS	Ratio between total deposits and total liabilities	50,436	0.790	0.844	0.203	0.102	1.127
MERGERS	Dummy equal to 1 if a bank has undertaken a merger in a given quarter	53,707	0.012	0.000	0.109	0.000	1.000
CPP	Dummy equal to 1 from the first quarter after capital injection via the capital purchase program	53,707	0.034	0.000	0.182	0.000	1.000
RESCUE	Dummy equal to 1 from the first quarter after a non-U.S. bank has received capital support	53,707	0.003	0.000	0.055	0.000	1.000
Panel C. Country-Specific Controls							
REG_INDEPENDENCE	Index assessing the degree of independence of the supervisory agency. The index ranges from 0 to 3 with higher value denoting a more independent supervisory agency. The indicator is constructed based on the following three questions: i) Can the head of the supervisory agency be removed by a) the decision of the head of government (e.g., president, prime minister), finance minister, or other cabinet level authority, b) a simple majority of a legislative body (parliament or congress), or c) a supermajority (e.g., 60%, 75%) of a legislative body; ii) Are the supervisors legally liable for their actions (i.e., if a supervisor takes actions against a bank, the supervisor cannot be sued)? (No = 1); iii) Does the head of the supervisory agency (and other directors) have a fixed term, and for how long? (=1 if the term ≥ 4). From Barth, Caprio, and Levine (2004) with updated values from the World Bank Web site (http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20345037~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html).	53,707	2.355	3.000	1.052	0.000	3.000

(continued on next page)

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TABLE 2 (continued)
Variable Definition and Summary Statistics

		N	Mean	Median	Std. Dev.	1st Pctile	99th Pctile
Panel C. Country-Specific Controls (continued)							
REG_STRENGTH	Index that ranges from 0 to 10 and is based on the following questions: i) Does the supervisory agency have the right to meet with external auditors to discuss reports without the approval of the bank? ii) Are the auditors required to communicate misconduct by managers/directors to the supervisory agency? iii) Can legal action against external auditors be taken by supervisors for negligence? iv) Can supervisors force banks to change the internal organizational structure? v) Are off-balance sheet items disclosed to supervisors? vi) Can the supervisory agency order directors/management to constitute provisions to cover actual/potential losses? vii) Can the supervisory agency suspends directors' decisions to distribute: a) Dividends? b) Bonuses? c) Management fees? viii) Can the supervisory agency supersede bank shareholder rights and declare a bank insolvent? ix) Does banking law allow the supervisory agency to suspend some or all ownership rights of a problem bank? x) Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency do the following: a) Suspend shareholder rights? b) Remove and replace management? c) Remove and replace directors? From Barth et al. (2004) with updated values from the World Bank Web site.	53,707	8.434	9.000	1.189	5.000	10.000
PUBLIC_DEBT	Ratio between public sector debt and country GDP (in %)	53,707	74.078	64.900	36.166	10.700	210.200
SHARE_TRADED	Total shares traded on the stock market over GDP from World Bank financial structure databases (2012 edition).	52,657	152.484	133.859	109.977	6.131	401.233
MARKET_POWER	Accounting value of a bank's net interest revenue as a share of its interest-bearing (total earning) assets from World Bank financial structure databases (2012 edition).	52,657	2.244	2.697	1.128	0.020	5.718
SYSTEMIC_SHOCK_2	A dummy equal to 1 for the first two quarters after the eruption of a systemic shock as identified in von Hagen and Ho (2007)	53,707	0.041	0.000	0.201	0.000	1.000

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It is not surprising, therefore, that recent studies achieve conflicting results on the role of bank size: Khan and Vyas (2015) show that large banks are more likely to issue equity, while Elyasiani et al. (2014) conclude that the likelihood of an SEO decreases with asset size.

The influence of bank funding structure is controlled for with the ratio between total deposits and total liabilities (DEPOSITS). This variable can exercise two opposite effects on the likelihood to issue equity via an SEO. A larger share of deposits might reduce monitoring of bank risk-taking given the presence of deposit insurance (Demirgüç-Kunt and Huizinga (2004)). Thus, more deposits should reduce capital targets and, consequently, the probability of issuing equity (Berger et al. (2008)). However, deposits are also a cheap source of funds for banks, and thus, a larger presence of this type of liabilities should limit bank concerns over the increasing cost of capital due to an equity issue. We then introduce into the model a dummy equal to 1 if a bank undertakes an M&A in a given quarter (MERGERS). We expect a positive impact of this variable on the likelihood of an SEO given the urgent need to raise funds to support the bank investment strategy (Berger et al. (2008)).

Two additional variables control for the impact of government recapitalization programs during the most recent part of our sample period. Khan and Vyas (2015) show that U.S. banks that received capital in the context of the capital purchase program initiated in Oct. 2008 have a higher likelihood to issue equity in the following quarters. We, therefore, add in a dummy (CPP) equal to 1 from the first quarter a U.S. bank entered the CPP program. In a similar vein, we create another dummy (RESCUE) equal to 1 for non-U.S. banks that benefited from public recapitalizations.[3] Overall, banks that are recipients of public rescue funding should desire to adjust more rapidly their capital structure in response to exposure to extraordinary regulatory pressures.

The set of banking system and country characteristics includes two regulatory variables from Barth et al. (2004), with updated values from the World Bank Web site (http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20345037~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html). The first is an index that ranges from 0 to 3 measuring the degree of independence of the supervisory agency (REG_INDEPENDENCE); the second is an index with values from 0 to 10 that captures the strictness of domestic regulation (REG_STRENGTH). We expect a positive coefficient for the first variable, since more independent regulatory agencies are likely to be less prone to forbearance and more effective in forcing banks to quickly comply with regulation. Similarly, banks should have more pressure to opt for higher capital targets and to issue equity to undertake a rapid recapitalization under a stricter regulatory regime.

An additional country control is the ratio between public sector debt and gross domestic product (GDP) (PUBLIC_DEBT). This ratio should indicate the

[3] We collect data on government-funded recapitalizations from Grail Research (2009) that we complement with information from ProPublica (http://projects.propublica.org/bailout/list) for U.S. banks, Mediobanca (2012) for European banks, the Web site of the Japanese Deposit Insurance Fund for Japanese Banks (http://www.dic.go.jp/english/e_katsudo/index.html), and policy reports by Central Banks for the remaining countries in our sample.

financial capability of a country to rescue financial institutions when needed. Under a moral hazard framework, therefore, we should expect that banks operating in countries with higher PUBLIC_DEBT opt for higher capital targets with a consequent increase in the likelihood to issue equity. Nevertheless, it also could be the case that in countries with a higher fiscal capacity, regulators might exercise more pressure on banks to raise equity given the higher moral hazard incentives. We control for the degree of market power (MARKET_POWER) in the domestic banking market through the accounting value of a bank's net interest revenue as a share of its interest-bearing (total earning) assets as available from the World Bank financial structure database (2012 edition). Higher values should indicate less competitive pressures on banks and more market rents. Thus, in a less competitive market, we should observe a lower likelihood to issue equity because of the increased potential to retain earnings (Dahl and Shrieves (1990)). On the other hand, since banks operating in such markets have particularly high charter value, they could opt for higher capital targets and be more likely to recapitalize in order to avoid the hazard of losing their charter. Finally, we measure stock market development as the ratio between total shares traded on the stock market over GDP (SHARE_TRADED) from the World Bank financial structure database (2012 edition). We expect a higher probability to issue equity by banks that are listed in more developed stock markets due to easier access conditions and lower costs of issuing.

III. Are Poorly Capitalized Banks Less Likely To Issue Equity?

A. Baseline Specification

The results on the nexus between bank capital strength and the likelihood to issue equity via an SEO are reported in Table 3. Initially, we estimate a parsimonious specification with POORLY_CAPITALIZED as a measure of capital strength and with a limited number of controls. Then, in column 2, we extend the number of explanatory variables to control for the influence of public recapitalizations during the latest part of our sample period. In column 3, we include our measure of systemic conditions around the timing of the issuance. The next two columns show the results after removing U.S. banks from the sample and up to the period before July 2007 to control for the high concentration of the SEO sample in the most recent years. In the following specifications, we add country dummies or employ POORLY_CAPITALIZED_Y as an alternative measure of bank capital strength.

All the models show that the probability to issue equity via an SEO is higher when banks are poorly capitalized. For instance, using the results in column 1 of Table 3, we estimate that being in the lowest quartile of the sample distribution in terms of capital strength increases the annual probability to issue (holding all other variables at their mean values) from 5.08% to 7.16%. In essence, the incentives to issue equity produced by pressures related to capital requirements and market discipline appear more important than the disincentives from debt overhang and moral hazard.

To further corroborate the validity of this conclusion, we conduct additional tests (reported in the Internet Appendix) with three further measures of capital

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TABLE 3

Probability of Issuing Equity and Bank Capital Strength

Table 3 shows the regression results on the determinants of the likelihood to issue equity by banks. The models are estimated via a panel random logit estimator that controls for unobserved bank heterogeneity. The dependent variable is a dummy equal to 1 if a bank has issued equity in a given quarter and 0 otherwise, while the explanatory variables include bank and country characteristics. POORLY_CAPITALIZED is a dummy equal to 1 if a bank is in the first quartile of the equity/assets distribution, POORLY_CAPITALIZED_Y is a dummy equal to 1 if a bank is in the first quartile of the yearly equity/assets distribution, RISK is the volatility of the daily returns computed over the last quarter before the issue, RELPTB is the price-to-book ratio divided by the average price-to-book ratio computed yearly at the country level, ROA is the ratio between net income and total assets, YEARLISTED is the natural logarithm of the number of years a bank has been listed in the stock market, SIZE is the natural logarithm of total assets measured in thousands of U.S. dollars, DEPOSITS is computed as total customer deposits over total liabilities, MERGERS is a dummy equal to 1 if a bank has been involved in a merger during the quarter, CPP is a dummy equal to 1 from the first quarter after a U.S. bank has received capital support via the capital purchase program, and RESCUE is a dummy equal to 1 from the first quarter a non-U.S. bank has received capital support. Country controls include an index of regulatory independence (REG_INDEPENDENCE), an index measuring the regulatory strength (REG_STRENGTH), the ratio between public sector debt and country GDP (PUBLIC_DEBT), the total shares traded divided by country GDP (SHARE_TRADED), the total accounting value of a bank's net interest revenue as a share of its interest-bearing (total earning) assets (MARKET_POWER), and a dummy equal to 1 for the first two quarters following a systemic shock (SYSTEMIC_SHOCK_2). Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

		+Rescue Dummies	+Systemic Shock	Ex U.S.	Before 07/2007	+Country Dummies	Alternative POORLY_CAPITALIZED	
	1	2	3	4	5	6	7	8
POORLY_CAPITALIZED	0.505***	0.544***	0.535***	0.425***	0.608***	0.597***		
	(0.111)	(0.110)	(0.110)	(0.148)	(0.144)	(0.116)		
POORLY_CAPITALIZED_Y							0.525***	0.606***
							(0.109)	(0.116)
RISK	2.361***	1.525**	1.833***	0.735	1.626	1.587**	1.869***	1.572**
	(0.599)	(0.629)	(0.625)	(1.070)	(1.079)	(0.638)	(0.622)	(0.638)
RELPTB	0.143***	0.188***	0.192***	0.119*	0.210***	0.196***	0.192***	0.196***
	(0.047)	(0.044)	(0.045)	(0.067)	(0.071)	(0.045)	(0.045)	(0.045)
ROA	−7.875***	−6.599***	−6.403***	−3.805	−6.825**	−6.789***	−6.300***	−6.792***
	(1.518)	(1.676)	(1.701)	(2.624)	(3.025)	(1.788)	(1.692)	(1.783)
YEARLISTED	−0.009	−0.012**	−0.012**	−0.000	−0.027***	−0.012**	−0.012**	−0.012**
	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)	(0.006)	(0.006)	(0.006)
SIZE	0.354***	0.332***	0.330***	0.270***	0.292***	0.361***	0.325***	0.361***
	(0.032)	(0.031)	(0.031)	(0.047)	(0.042)	(0.033)	(0.031)	(0.033)
DEPOSITS	0.528*	0.461	0.443	0.415	0.113	1.152***	0.454	1.174***
	(0.294)	(0.290)	(0.289)	(0.360)	(0.361)	(0.347)	(0.289)	(0.347)
MERGERS	0.365	0.423	0.435	0.640*	0.844***	0.418	0.427	0.412
	(0.272)	(0.272)	(0.272)	(0.361)	(0.287)	(0.272)	(0.272)	(0.272)
CPP		1.434***	1.352***			1.280***	1.378***	1.286***
		(0.156)	(0.156)			(0.158)	(0.156)	(0.158)
RESCUE		0.627*	0.557	0.952***		0.564*	0.525	0.559
		(0.336)	(0.340)	(0.359)		(0.341)	(0.339)	(0.341)
REG_INDEPENDENCE	0.131*	0.130*	0.172**	0.288***	0.122	−0.501**	0.182**	−0.486*
	(0.074)	(0.071)	(0.072)	(0.084)	(0.090)	(0.252)	(0.071)	(0.252)
REG_STRENGTH	−0.013	0.004	0.010	0.104**	0.070	0.238***	0.018	0.238***
	(0.048)	(0.046)	(0.046)	(0.048)	(0.057)	(0.090)	(0.046)	(0.090)
PUBLIC_DEBT	−0.004**	−0.006***	−0.005***	−0.007***	−0.007***	−0.002	−0.006***	−0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
SHARE_TRADED	0.002***	0.001	0.000	−0.000	−0.001	0.000	−0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
MARKET_POWER	0.219***	0.173***	0.174***	0.055	−0.003	0.110**	0.132***	0.101**
	(0.055)	(0.054)	(0.053)	(0.047)	(0.047)	(0.050)	(0.044)	(0.050)
SYSTEMIC_SHOCK_2			0.837***	0.498**	0.964***	0.903***	0.841***	0.898***
			(0.165)	(0.240)	(0.311)	(0.169)	(0.164)	(0.169)
Constant	−8.642***	−8.047***	−8.120***	−7.321***	−7.643***	−8.907***	−7.955***	−8.924***
	(0.568)	(0.552)	(0.554)	(0.653)	(0.683)	(1.124)	(0.539)	(1.121)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	Yes	No	Yes
Pseudo-R^2	0.332	0.339	0.342	0.425	0.360	0.347	0.342	0.347
Obs.	49,872	49,872	49,872	17,147	39,419	49,872	49,872	49,872

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strength. The first two measures control for the influence of cross-country differences on our findings. They take the value of 1 if a bank is in the lowest quartile of the equity ratio distribution, respectively, in a given country and in a given country and year. The third measure is the conventional equity over asset ratio. These additional analyses confirm in unison that banks with lower capital ratios are more likely to issue equity.

Bank capital strength, however, is not the only significant determinant of the likelihood to raise equity via an SEO. For instance, the positive sign of RELPTB indicates that banks are likely to time their issues when their shares are overvalued (see also De Angelo et al. (2010), Krishnan et al. (2010)). Furthermore, larger banks are more likely to rely on an SEO, as in Dahl and Shrieves (1990), confirming that these banks can achieve economies of scale when they raise capital from the stock market. In addition, in seven out of eight specifications, an increase in ROA reduces the likelihood of an SEO; that is, consistent with a classic pecking order theory that banks prefer to retain internal resources rather than issue equity. Further, the majority of the specifications show that more risky banks issue significantly more, suggesting that banks might be concerned over their default risk and, consequently, tend to strengthen their capital structure when they are riskier. These conclusions are unchanged when we control for the effect of recapitalization via public funds in the latest part of the sample period. We confirm the results in Khan and Vyas (2015) of a higher probability of issuing for U.S. banks joining the CPP program, but we also find a similar result for non-U.S. banks that received public support (especially when the analysis excludes the United States from the sample). Finally, banks are more likely to issue equity in countries with a higher fiscal capacity, in countries with higher market rents, and after the eruption of a systemic shock.

Overall, this section shows that for poorly capitalized banks, regulatory and market pressures to raise equity seem to prevail on the disincentives to issue related to debt overhang and moral hazard produced by the presence of implicit and explicit government guarantees. More generally, our results on the impact of numerous variables on the likelihood of an SEO suggest that the disincentives to issue equity are dominated even in the case when these disincentives are expected to be particularly high, namely, when banks are larger, when they operate in countries with more capability to adopt rescue policies, or after the eruption of a systemic shock.[4]

B. Is This a Story of Regulatory Pressure Due to Risk-Based Capital Requirements?

One of the obvious explanations for our results is capital regulation. In essence, banks with lower capital ratios are also more likely to exhibit lower regulatory capital ratios. As a result, poorly capitalized banks might decide to proceed with an SEO simply because they need to avoid a violation of the minimum capital requirements. In this section, we conduct two tests to assess whether poorly

[4]Our results hold when we re-estimate the models using a pooled binomial logit model with bank-clustered standard errors, as in previous studies, and when we employ annual data to assess whether the fact that only some of the variables are observed at quarterly intervals affects our findings.

capitalized banks issue simply because of capital regulation. We present the results of these tests in Table 4.

Initially, we extend our baseline specification with the inclusion of a dummy equal to 1 if the difference between a bank's total regulatory capital ratio (including TIER1 and TIER2 capital) and the domestic minimum capital requirement is in the first quartile of the sample distribution (REG_CONSTRAINED). Similarly, we compute REG_CONSTRAINED_Y as a dummy equal to 1 if this difference is in the first quartile of the sample distribution in a given year. As in Flannery and Rangan (2008), we interpret the above dummy variables as measures of insufficient capital buffers and proxies of the pressure on banks to comply with capital requirements. We conjecture that if the influence of the equity ratio on the likelihood of an SEO is entirely driven by regulatory pressures stemming from capital requirements, these additional controls would enter the model with a positive and significant coefficient and, simultaneously, our measures of capital strength not directly related to regulation should lose their explanatory power.[5]

The second test focuses on the role of the variable POORLY_CAPITALIZED (POORLY_CAPITALIZED_Y) in the groups of regulatory constrained and regulatory unconstrained banks. Our conjecture is that if banks with low equity ratios do not issue when they have high capital buffers, their decision is simply driven by the pressure to comply with capital requirements.

The results of these tests consistently indicate that the importance of bank capital strength in driving equity issuance is not fully explained by the presence of capital requirements. This is in line with the view that capital regulation is of only secondary importance (Gropp and Heider (2010)) and not binding (Allen et al. (2011), Diamond and Rajan (2000), Flannery (1994), and Myers and Rajan (1998)) when banks have to design their capital structure. More precisely, in spite of adding one of our measures of regulatory constraints (that positively influence the likelihood to issue equity in the stock market) as a control, we still observe that banks with a lower capital ratio remain more likely to issue. Capital adequacy, therefore, matters even when regulatory pressure is controlled for. Furthermore, in the last four columns of Table 4, we find that poorly capitalized banks issue especially when they are not subject to any pressure to comply with capital requirements. By contrast, POORLY_CAPITALIZED (POORLY_CAPITALIZED_Y) is not significant in the group of banks characterized by a low capital buffer; that is, regulatory constrained banks issue independently from the value of their equity ratio.

Overall, our tests exclude the possibility that the need to comply with capital requirements is the only and primary driver of the decision of poorly capitalized banks to rely on an SEO and suggest that additional factors are also significant determinants of a bank's decision to issue equity. In this sense, market discipline appears a potential, important driver of our findings. More precisely, since

[5]It is worth noting that the relatively low correlation between POORLY_CAPITALIZED (POORLY_CAPITALIZED_Y) and REG_CONSTRAINED (REG_CONSTRAINED_Y), equal to 0.43 (0.45), allows us to include both variables in the same model without generating problems of multicollinearity. Furthermore, although we can construct the regulatory constrained variables only for a much smaller number of banks (equal to about 70% of the original sample), the total number of observations employed to conduct the test remains extremely large.

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TABLE 4

Probability of Issuing Equity and Capital Requirements

Table 4 shows the regression results on the determinants of the likelihood to issue equity by banks in relation to their regulatory capital position. The models are estimated via a panel random logit estimator that controls for unobserved bank heterogeneity. The dependent variable is a dummy equal to 1 if a bank has issued equity in a given quarter and 0 otherwise, while the explanatory variables include bank and country characteristics. POORLY_CAPITALIZED is a dummy equal to 1 if a bank is in the first quartile of the equity/assets distribution, POORLY_CAPITALIZED_Y is a dummy equal to 1 if a bank is in the first quartile of the yearly equity/assets distribution, REG_CHANGE is a dummy equal to 1 from the quarter when a country has experimented with a regulatory change in capital regulation, REG_CONSTRAINED is a dummy equal to 1 for banks in the first quartile of the sample distribution in terms of regulatory capital buffer, REG_CONSTRAINED_Y is a dummy equal to 1 for banks in the first quartile of the sample distribution in a given year in terms of regulatory capital buffer, RELPTB is the price-to-book ratio divided by the average price-to-book ratio computed yearly at the country level, RISK is the volatility of the daily returns computed over the last quarter before the issue, ROA is the ratio between net income and total assets, YEARLISTED is the natural logarithm of the number of years a bank has been listed in the stock market, SIZE is the natural logarithm of total assets measured in thousands of U.S. dollars, DEPOSITS is computed as total customer deposits over total liabilities, and MERGERS is a dummy equal to 1 if a bank has been involved in a merger during the quarter. Country controls include an index of regulatory independence (REG_INDEPENDENCE), an index measuring the regulatory strength (REG_STRENGTH), the ratio between public sector debt and country GDP (PUBLIC_DEBT), the total shares traded divided by country GDP (SHARE_TRADED), the total accounting value of a bank's net interest revenue as a share of its interest-bearing (total earning) assets (MARKET_POWER), and a dummy equal to 1 for the first two quarters following a systemic shock (SYSTEMIC_SHOCK_2). Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

			REG_CONSTRAINED			
			Yes	No	Yes	No
	1	2	3	4	5	6
POORLY_CAPITALIZED	0.333**		0.216	0.407**		
	(0.136)		(0.191)	(0.182)		
POORLY_CAPITALIZED_Y		0.338**			0.303	0.468***
		(0.137)			(0.186)	(0.177)
REG_CONSTRAINED	0.281***					
	(0.108)					
REG_CONSTRAINED_Y		0.401***				
		(0.106)				
RISK	1.149	1.136	0.054	1.616*	0.065	1.590*
	(0.717)	(0.717)	(1.426)	(0.835)	(1.421)	0.837)
RELPTB	0.204***	0.208***	0.141	0.234***	0.144	0.229***
	(0.048)	(0.049)	(0.096)	(0.062)	(0.095)	(0.062)
ROA	−8.203***	−7.788***	−10.840**	−6.806**	−10.323**	−6.603*
	(2.775)	(2.797)	(4.914)	(3.429)	(4.947)	(3.420)
YEARLISTED	−0.006	−0.006	−0.023**	−0.004	−0.023**	−0.004
	(0.006)	(0.006)	(0.012)	(0.007)	(0.011)	(0.007)
SIZE	0.310***	0.311***	0.217***	0.328***	0.209***	0.340***
	(0.037)	(0.037)	(0.061)	(0.042)	(0.060)	(0.042)
DEPOSITS	0.868**	0.858**	0.202	0.961*	0.310	0.856*
	(0.424)	(0.427)	(0.684)	(0.509)	(0.684)	(0.507)
MERGERS	0.205	0.199	0.428	0.067	0.421	0.049
	(0.332)	(0.333)	(0.527)	(0.427)	(0.528)	(0.427)
CPP	1.004***	0.996***	0.723**	1.029***	0.713**	1.058***
	(0.156)	(0.156)	(0.343)	(0.180)	(0.341)	(0.181)
RESCUE	0.705**	0.739**	1.079**	0.319	1.061**	0.438
	(0.343)	(0.343)	(0.460)	(0.506)	(0.458)	(0.507)
REG_INDEPENDENCE	0.912***	0.887***	1.116***	0.908***	−0.767**	1.131
	(0.188)	(0.187)	(0.346)	(0.230)	(0.316)	(1.054)
REG STRENGTH	1.193	1.199	−0.683**	1.050	0.184	−0.153
	(1.045)	(1.044)	(0.327)	(1.053)	(0.131)	(0.139)
PUBLIC_DEBT	0.079	0.049	0.132	0.103	0.006	0.008
	(0.110)	(0.111)	(0.142)	(0.201)	(0.007)	(0.005)
SHARE_TRADED	0.007*	0.006	0.005	0.011**	−0.000	0.002
	(0.004)	(0.004)	(0.007)	(0.005)	(0.002)	(0.001)
MARKET_POWER	0.002*	0.002**	−0.000	0.002	0.176	0.174
	(0.001)	(0.001)	(0.002)	(0.001)	(0.150)	(0.114)

(continued on next page)

TABLE 4 (continued)
Probability of Issuing Equity and Capital Requirements

			REG_CONSTRAINED			
			Yes	No	Yes	No
	1	2	3	4	5	6
SYSTEMIC_SHOCK_2	0.229**	0.224**	0.128	0.318**	1.123***	0.884***
	(0.103)	(0.102)	(0.165)	(0.138)	(0.346)	(0.229)
Constant	−13.041***	−12.826***	−4.527***	−13.765***	−5.057***	−11.131***
	(3.343)	(3.346)	(1.586)	(3.743)	(1.479)	(3.453)
Pseudo-R^2	0.488	0.489	0.216	0.258	0217	0.258
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	32,786	32,786	8,614	24,172	8,614	24,172

regulatory capital requirements are based on imperfect risk assessment, investors can view bank capital adequacy as insufficient even though the regulatory capital is well above the required minimum level. In other words, a decision to issue equity by poorly capitalized banks would be motivated by a higher likelihood to incur bankruptcy costs given, for instance, the increasing risk premium required by uninsured debtholders. Poorly capitalized banks will be more likely then to rely on SEOs independent from the presence of sufficiently large regulatory capital, as implied by the findings reported in this section.

C. Are Poorly Capitalized Banks More Likely To Issue Equity When Capital Regulation Changes?

The findings discussed above say little about how poorly capitalized banks react when they have to comply with changes in capital regulation that introduce more stringent capital requirements, as is the case of the recent adoption of the Basel III Accord. This is an important omission: The implementation of more stringent capital requirements at the country level is a fairly exogenous shock in regulation that allows the offer of a cleaner test on whether SEOs are motivated by regulatory reasons.

In this section, therefore, we explore the role of regulation using a difference-in-difference identification approach based on the numerous events of regulatory changes that have generated more stringent capital requirements at the national level. We employ these changes as quasi-natural experiments to study how individual banks react to fairly exogenous changes in the required capital level. We argue that the changes in regulation are exogenous with respect to a bank's SEO decision, since they reflect either the international synchronization of capital regulation or a shift in a regulator's perception of what constitutes a sufficient degree of capitalization for all banks rather than the undercapitalization of some specific individual banks.

In our initial tests, we study how the probability of banks to issue equity differs between affected and nonaffected banks with regard to two types of changes in regulation occurring in our sample: i) the adoption for the first time of risk-based capital requirements; ii) the increase in the minimum regulatory capital ratio. We employ these events to construct a dummy variable (REG_CHANGE) equal to 1 for the periods following a more stringent capital regulation of type i) or ii) and 0 otherwise. We then add this variable and its interactions to our

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measures of capital strength to our baseline specification. A detailed description of the evolution of capital regulation at the country level is presented in Table IA1 in the Internet Appendix. Initially, we do not include in the list of regulatory changes the adoption of the Basel II Accord, which occurred in some of the sampled countries in the latest part of the sample period. This is because Basel II was not expected to generate, on average, any need of additional capital for banks (Vallascas and Hagendorff (2013)), while we want to specifically focus on regulatory changes that are expected to produce a more stringent capital regime that would motivate the need to raise equity by banks.

Overall, in our sample, we observe 17 changes in regulation. A total of 13 of these changes did not happen during a systemic crisis or the following four quarters, suggesting that the changes in regulation are not a reaction to bank undercapitalization. We interpret this as further evidence of the exogeneity of regulatory changes. More precisely, five of the sampled countries (Argentina, Brazil, China, Russia, and Turkey) introduced risk-based capital requirements for the first time during our sample period. However, since no banks were listed in Argentina and Russia prior to the introduction of risk-based capital requirements, in our tests, we can capture the effects of this regulatory change only in Brazil, China, and Turkey. Five other countries (Canada, India, Indonesia, Republic of Korea, and South Africa), which had adopted risk-based capital requirements already at the start of our sample period, have subsequently produced six increases in the minimum required level of regulatory capital. Notably, the five countries that introduced capital requirements after 1993 also generated six additional changes in the minimum regulatory capital ratio. Out of these changes, four happened in Brazil, China, and Turkey and are obscured by the way we construct REG_CHANGE. The remaining two changes occurred in Argentina and Russia at points of time when listed banks existed prior to the regulatory changes. These two changes are recorded in our REG_CHANGE variable, which captures a total of 10 regulatory changes.

We report the results of the described tests in columns 1 and 2 of Table 5, where baseline specifications include the dummy REG_CHANGE and interaction terms of this dummy with one of our measures of weak capitalization. As suggested by Norton, Wang, and Ai (2004), in nonlinear models, it is not possible to infer the role and the degree of significance of an interaction term simply through the estimated coefficient and the related standard error. To circumvent this problem, we follow Berger and Bouwman (2013) and report in Panel B the coefficients and standard errors of the marginal effects of REG_CHANGE on the likelihood to issue equity by banks with different capital levels.

The marginal effects reported in Panel B of Table 5 confirm that changes in regulation do not lead banks with a lower degree of capital strength to raise more equity in the stock market, suggesting that capital regulation is unlikely to drive their equity issuance. By contrast, we find that a change in capital regulation increases the likelihood to issue equity by banks that do not belong to the weakly capitalized group. This latter result confirms that our measures of capital strength do not have much to do with regulatory capital requirements; that is, they are not simply imperfect proxies of the regulatory capital ratio of banks. This is also highlighted by the results reported in column 3 based on REG_CONSTRAINED as a

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TABLE 5

Probability of Issuing Equity and Changes in Capital Regulation

Table 5 shows the regression results on the determinants of the likelihood to issue equity by banks in response to regulatory changes. The models are estimated via a panel random logit estimator that controls for unobserved bank heterogeneity. The dependent variable is a dummy equal to 1 if a bank has issued equity in a given quarter and 0 otherwise, while the explanatory variables include bank and country characteristics. POORLY_CAPITALIZED is a dummy equal to 1 if a bank is in the first quartile of the equity/assets distribution, POORLY_CAPITALIZED_Y is a dummy equal to 1 if a bank is in the first quartile of the yearly equity/assets distribution, REG_CONSTRAINED is a dummy equal to 1 for banks in the first quartile of the sample distribution in terms of regulatory capital buffer, REG_CHANGE is a dummy equal to 1 from the quarter when a country has experimented with a regulatory change in capital regulation, PRE_REG_CHANGE is a dummy equal to 1 for from eight quarters before up to the implementation of the regulatory change, RELPTB is price-to-book ratio divided by the average price-to-book ratio computed yearly at the country level, RISK is the volatility of the daily returns computed over the last quarter before the issue, ROA is the ratio between net income and total assets, YEARLISTED is the natural logarithm of the number of years a bank has been listed in stock market, SIZE is the natural logarithm of total assets measured in thousands of U.S. dollars, DEPOSITS is computed as total customer deposits over total liabilities, and MERGERS is a dummy equal to 1 if a bank has been involved in a merger during the quarter. Country controls include an index of regulatory independence (REG_INDEPENDENCE), an index measuring the regulatory strength (REG_STRENGTH), the ratio between public sector debt and country GDP (PUBLIC_DEBT), the total shares traded divided by country GDP (SHARE_TRADED), and the total accounting value of a bank's net interest revenue as a share of its interest-bearing (total earning) assets (MARKET_POWER), a dummy equal to 1 for the first 2 quarters following a systemic shock (SYSTEMIC_SHOCK_2). Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3	4	5
Panel A. Regression Analysis					
POORLY_CAPITALIZED	0.796***			0.526***	
	(0.134)			(0.118)	
POORLY_CAPITALIZED_Y		0.746***			0.530***
		(0.134)			(0.117)
REG_CONSTRAINED			0.448***		
			(0.121)		
REG_CHANGE	0.645***	0.586***	0.335*		
	(0.169)	(0.169)	(0.181)		
REG_CHANGE × POORLY_CAPITALIZED	−0.705***				
	(0.203)				
REG_CHANGE × POORLY_CAPITALIZED_Y		−0.587***			
		(0.203)			
REG_CHANGE × REG_CONSTRAINED			−0.265		
			(0.208)		
PRE_REG_CHANGE				0.661	0.783*
				(0.486)	(0.474)
PRE_REG_CHANGE × POORLY_CAPITALIZED				0.174	
				(0.639)	
PRE_REG_CHANGE × POORLY_CAPITALIZED_Y					−0.121
					(0.620)
RISK	0.923	0.914	1.195*	0.948	0.935
	(0.656)	(0.655)	(0.715)	(0.654)	(0.653)
RELPTB	0.189***	0.189***	0.211***	0.186***	0.186***
	(0.045)	(0.045)	(0.048)	(0.045)	(0.045)
ROA	−6.095***	−6.154***	−9.194***	−6.137***	−6.138***
	(1.780)	(1.768)	(2.693)	(1.877)	(1.870)
YEARLISTED	−0.011*	−0.011*	−0.007	−0.010	−0.010
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
SIZE	0.344***	0.344***	0.306***	0.345***	0.345***
	(0.032)	(0.032)	(0.036)	(0.033)	(0.033)
DEPOSITS	1.169***	1.188***	0.788*	1.187***	1.204***
	(0.338)	(0.338)	(0.422)	(0.340)	(0.340)
MERGERS	0.416	0.403	0.205	0.420	0.412
	(0.273)	(0.273)	(0.332)	(0.272)	(0.272)
CPP	1.088***	1.108***	0.984***	1.148***	1.153***
	(0.153)	(0.153)	(0.155)	(0.154)	(0.154)
RESCUE	0.659*	0.621*	0.587*	0.660**	0.656*
	(0.350)	(0.350)	(0.356)	(0.337)	(0.337)

(continued on next page)

TABLE 5 (continued)
Probability of Issuing Equity and Changes in Capital Regulation

	1	2	3	4	5
Panel A. Regression Analysis (continued)					
REG_INDEPENDENCE	0.642***	0.634***	0.671***	0.584***	0.593***
	(0.180)	(0.181)	(0.239)	(0.182)	(0.183)
REG STRENGTH	0.164*	0.166*	0.055	0.221**	0.219**
	(0.091)	(0.091)	(0.114)	(0.090)	(0.090)
PUBLIC_DEBT	0.002	0.002	0.006	0.004	0.004
	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
SHARE_TRADED	0.004***	0.004***	0.002*	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MARKET_POWER	−0.018	−0.016	0.217**	0.054	0.055
	(0.046)	(0.045)	(0.106)	(0.047)	(0.045)
SYSTEMIC_SHOCK_2	0.747***	0.747***	0.908***	0.774***	0.768***
	(0.169)	(0.169)	(0.187)	(0.172)	(0.172)
Constant	−15.321***	−15.234***	−13.422***	−14.919***	−14.908***
	(3.246)	(3.244)	(3.354)	(3.249)	(3.246)
Pseudo-R^2	0.427	0.428	0.130	0.430	0.430
Year dummies	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes
Obs.	49,872	49,872	32,786	49,872	49,872
Panel B. Marginal Effects of Regulatory Changes by Strength of Capital Adequacy					
A) POORLY_CAPITALIZED = 1	−0.001	−0.000	0.002	0.023	0.017
	(0.004)	(0.004)	(0.005)	(0.018)	(0.015)
B) POORLY_CAPITALIZED = 0	0.009***	0.008***	0.005	0.010	0.013
	(0.003)	(0.003)	(0.003)	(0.010)	(0.011)
A = B (differences in margins *p*-value)	0.00***	0.01**	0.20	0.79	0.85

measure of capital strength. In such case, as highlighted in Panel B, we find that the influence of the changes in regulation on equity issuance does not vary with the value of the regulatory capital buffer; namely, after a regulatory change, banks do not issue more independently from the value of their capital buffer. In the Internet Appendix, we show that additional tests that include Basel II as part of the regulatory changes confirm our main results.

Finally, in the last two columns of Table 5, we evaluate the possibility that poorly capitalized banks anticipate the regulatory change and adjust their capital adequacy earlier than other banks in response to a shift in regulation.[6] To this end, we construct a dummy equal to 1 for the first eight quarters before the change in regulation occurs that we interact with our two measures of poor capitalization. Again, we do not find that periods of preregulatory changes encourage especially poorly capitalized banks to raise equity. We obtain similar results for the probability to issue prior to a capital regulation change when we repeat the test by using REG_CONSTRAINED as a measure of capital strength.

To sum up, poorly capitalized banks do not respond to changes in capital requirements by raising equity, and they do not issue more in the proximity of regulatory changes. Furthermore, the change in regulation seems to open (through the raised expectations that many banks will issue an SEO) a window of opportunities for better capitalized banks that have been considering increasing their

[6]This test is based on 15 changes in capital regulation, as we also include modifications in the minimum capital ratio that occurred after a country implemented capital requirements during the sample period that were previously obscured by the earlier adoption of capital regulation.

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capital levels prior to the announcement of the regulatory change but feared the negative market reaction that is typically associated with the announcement of an equity issuance. Jointly, these results again underline the limited role of capital regulation as a driver of the SEO decision by poorly capitalized banks.

IV. The Role of Bank Capital Strength on Equity Issuance under Normal and Distress Systemic Conditions

A. Does a Systemic Distress Reduce the Likelihood of Issuing Equity by Low Capitalized Banks?

In this section, we focus on the role of market discipline on equity issuance by examining how the likelihood to conduct an SEO by poorly capitalized banks varies between periods of financial system stability and those of systemic distress. It is a widely held view that negative systemic conditions act as an amplifier of poorly capitalized banks' disincentives to issue equity given the larger losses in value that the issuance could generate for shareholders. These losses are not simply motivated by the higher costs of issuing in the presence of more unstable systemic conditions, but also by the increasing likelihood to benefit from a government support that allows banks to transfer risks to taxpayers (Admati et al. (2012)).

One additional consequence of the increasing value of implicit and explicit government guarantees, however, is a decline in the effectiveness of market discipline due to a lower risk sensitivity of uninsured bank creditors (Acharya et al. (2016), Balasubramnian and Cyree (2011), and Hett and Schmidt (2013)). More generally, the presence of negative systemic conditions, by reducing the sensitivity of investors to bank fundamentals, reduces differences in the strength of market discipline applied to different banks (Hasan et al. (2013), Levy-Yeyati et al. (2004), and Martinez-Peria and Schmukler (2001)). From the highlighted theoretical arguments, it follows that if market discipline is the main driving force that reduces the disincentives by poorly capitalized banks to raise equity in the stock market, these banks should be more inclined to issue when they are deemed to be subject to more stringent market discipline than other banks, namely, under normal systemic conditions.

We analyze the influence of bank capital strength on SEOs during periods of systemic distress in the first two columns of Panel A of Table 6, where we extend the regression models reported in columns 6 and 8 of Table 3 with the inclusion of interaction terms between our systemic shock variable and the two measures of bank capital strength. Panel A of Table 6 shows that while the measures of bank capital strength maintain the sign and significant level as in the baseline specification, the interaction terms between these measures and the systemic shock dummy enter the regression models with a negative and highly significant coefficient. More importantly, the marginal effects reported in Panel B indicate that the influence of bank capital strength on the likelihood to issue equity is present only in normal times. Under negative systemic conditions, being a poorly capitalized bank does not increase the likelihood to issue. Notably, in the Internet Appendix,

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TABLE 6

Probability of Issuing Equity and Systemic Conditions

Table 6 shows the regression results on the determinants of the likelihood to issue equity by banks contingent on systemic conditions. The models are estimated via a panel random logit estimator that controls for unobserved bank heterogeneity. The dependent variable is a dummy equal to 1 if a bank has issued equity in a given quarter and 0 otherwise, while the explanatory variables include bank and country characteristics. POORLY_CAPITALIZED is a dummy equal to 1 if a bank is in the first quartile of the equity/assets distribution, POORLY_CAPITALIZED_Y is a dummy equal to 1 if a bank is in the first quartile of the yearly equity/assets distribution, RISK is the volatility of the daily returns computed over the last quarter before the issue, RELPTB is price-to-book ratio divided by the average price-to-book ratio computed yearly at the country level, ROA is the ratio between net income and total assets, YEARLISTED is the natural logarithm of the number of years a bank has been listed in the stock market, SIZE is the natural logarithm of total assets measured in thousands of U.S. dollars, DEPOSITS is computed as total customer deposits over total liabilities, MERGERS is a dummy equal to 1 if a bank has been involved in a merger during the quarter, CPP is a dummy equal to 1 from the first quarter after a U.S. bank has received capital support via the capital purchase program, RESCUE is a dummy equal to 1 from the first quarter a non-U.S. bank has received capital support. Country controls include an index of regulatory independence (REG_INDEPENDENCE), an index measuring the regulatory strength (REG_STRENGTH), the ratio between public sector debt and country GDP (PUBLIC_DEBT), the total shares traded divided by country GDP (SHARE_TRADED), and the total accounting value of a bank's net interest revenue as a share of its interest-bearing (total earning) assets (MARKET_POWER), a dummy equal to 1 for the first two quarters following a systemic shock (SYSTEMIC_SHOCK_2). Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Full Sample		Large Banks		Other Banks	
	1	2	3	4	5	6
Panel A. Regression Analysis						
POORLY_CAPITALIZED	0.621***		0.622***		0.595***	
	(0.117)		(0.210)		(0.149)	
POORLY_CAPITALIZED_Y		0.602***		0.683***		0.550***
		(0.116)		(0.209)		(0.148)
SYSTEMIC_SHOCK_2 × POORLY_CAPITALIZED	−0.764**		−1.916***		−0.580	
	(0.325)		(0.653)		(0.380)	
SYSTEMIC_SHOCK_2 × POORLY_CAPITALIZED_Y		−0.568*		−1.654***		−0.366
		(0.314)		(0.615)		(0.373)
RISK	1.002	0.978	1.923	1.859	1.862**	1.856**
	(0.655)	(0.655)	(1.253)	(1.253)	(0.752)	(0.751)
RELPTB	0.187***	0.186***	0.127*	0.125*	0.283***	0.282***
	(0.045)	(0.045)	(0.067)	(0.066)	(0.066)	(0.066)
ROA	−6.346***	−6.372***	−5.955**	−6.015**	−5.501**	−5.635**
	(1.847)	(1.838)	(2.329)	(2.345)	(2.762)	(2.742)
YEARLISTED	−0.010*	−0.010*	0.004	0.004	−0.031***	−0.031***
	(0.006)	(0.006)	(0.009)	(0.009)	(0.008)	(0.008)
SIZE	0.355***	0.356***	0.241***	0.240***	0.351***	0.352***
	(0.032)	(0.032)	(0.060)	(0.060)	(0.047)	(0.047)
DEPOSITS	1.144***	1.162***	1.417**	1.456**	0.720*	0.722*
	(0.339)	(0.339)	(0.653)	(0.655)	(0.406)	(0.406)
MERGERS	0.404	0.401	0.247	0.238	0.490	0.484
	(0.273)	(0.272)	(0.486)	(0.486)	(0.332)	(0.332)
CPP	1.154***	1.161***	1.126***	1.127***	0.920***	0.925***
	(0.155)	(0.155)	(0.285)	(0.284)	(0.182)	(0.182)
RESCUE	0.810**	0.784**	0.785**	0.757**	0.376	0.380
	(0.335)	(0.336)	(0.378)	(0.377)	(1.061)	(1.061)
REG_INDEPENDENCE	1.314	1.310	−2.102***	−2.078***	0.270	0.262
	(1.039)	(1.038)	(0.425)	(0.426)	(0.314)	(0.314)
REG_STRENGTH	0.139*	0.141*	0.221*	0.229*	0.168	0.163
	(0.077)	(0.077)	(0.134)	(0.133)	(0.114)	(0.114)
PUBLIC_DEBT	0.002	0.002	−0.006	−0.005	0.011***	−0.011***
	(0.003)	(0.003)	(0.005)	(0.005)	(0.003)	(0.003)
SHARE_TRADED	0.003***	0.003***	0.003**	0.003**	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
MARKET_POWER	0.015	0.008	0.137	0.120	0.011	0.004
	(0.041)	(0.041)	(0.123)	(0.125)	(0.052)	(0.051)

(continued on next page)

TABLE 6 (continued)
Probability of Issuing Equity and Systemic Conditions

	Full Sample		Large Banks		Other Banks	
	1	2	3	4	5	6
Panel A. Regression Analysis (continued)						
SYSTEMIC_SHOCK_2	0.989***	0.931***	1.278***	1.232***	1.248***	1.186***
	(0.200)	(0.201)	(0.370)	(0.379)	(0.241)	(0.241)
Constant	−14.170***	−14.158***	−3.200*	−3.335*	−9.739***	−9.639***
	(3.230)	(3.228)	(1.874)	(1.874)	(1.422)	(1.418)
Pseudo-R^2	0.429	0.429	0.516	0.516	0.281	0.281
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	49,868	49,868	6,242	6,242	43,630	43,630
Panel B. Marginal Effects of Low Capitalized on the Likelihood to Issue Equity under Different Systemic Conditions						
A) Systemic distress	−0.003	0.001	−0.061**	−0.048*	0.001	0.005
	(0.008)	(0.008)	(0.029)	(0.029)	0.009	(0.010)
B) Normal systemic conditions	0.009***	0.008***	0.022***	0.024***	0.006***	0.006***
	(0.002)	(0.002)	(0.008)	(0.008)	(0.002)	(0.002)
A = B (differences in margins *p*-value)	0.02**	0.07*	0.00***	0.08*	0.11	0.48

we show that this conclusion is confirmed also when we employ the alternative measures of capital strength described in Section III.[7]

In summary, a weaker capital adequacy increases the likelihood to issue an SEO only under normal systemic conditions, while it plays no role on equity issuance around systemic shocks. As these periods have been generally associated with a less effective market discipline (Acharya et al. (2016), Balasubramnian and Cyree (2011), Hett and Schmidt (2013), and Levy-Yeyati et al. (2004)), putting together the results discussed in this section with the evidence drawn from the previous sections, we conclude that market forces strongly influence the decisions of weakly capitalized banks to raise equity. When the eruption of systemic shocks reduces the effectiveness of market pressure, poorly capitalized banks do not behave differently from other banks.

B. Capital Strength and Equity Issuance: Large Banks versus Other Banks

We have interpreted the results discussed above as indicating that under a systemic crisis, the pressure on poorly capitalized banks to issue equity is reduced because of an ineffective market discipline motivated by the attempt of investors and banks to speculate on the increasing value of government guarantees. However, there is also another potential interpretation. This alternative interpretation suggests that poorly capitalized banks are subject to pressures to issue equity,

[7] In unreported tests, we also adjust the timing of the SEOs to take into account the period necessary to arrange the issuance and to achieve a more precise matching between the bank decision to raise equity and the systemic conditions. Specifically, we anticipate the timing of the issuance of 6 weeks compared with the original data, as this is considered the average time necessary to organize an issuance (Khan and Vyas (2015)). The above change in the timing of the SEO does not produce any change in our results. Further, we also repeat the analysis separately for two subperiods, 1993–June 2007 and July 2007–2011, to evaluate whether this finding depends on the high concentration of crisis episodes and SEOs in the latest part of our sample period. The results remain broadly in line with the findings obtained for the full sample period.

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but they find it too costly under negative systemic conditions even if they are willing to do so.

To discriminate between the two alternative interpretations, and to highlight if moral hazard via the attempt to speculate on the expectation to receive government support has any role in our findings, we conduct additional tests that are based on subsamples of banks. Specifically, we intend to assess whether our results differ between banks that are likely to be perceived by investors as too big to fail and the remaining banks in our sample, namely, groups of banks that are subject to different expectations to receive government support and, at the same time, also differ in terms of cost of issuance.

Our conjecture is that if our results are motivated simply by an increasing cost of issuance in crisis periods, we should observe a stronger reluctance to raise equity in response to systemic shocks when poorly capitalized banks are small in size. This is because smaller banks are typically characterized by a lower likelihood to receive government support, while they suffer from higher costs of raising equity given that a certain portion of these costs is fixed and independent from size. If the expectation of a government intervention is instead somehow important to motivate our findings, we should observe that poorly capitalized banks would be less willing to issue than other banks during a systemic shock and also when they are large and, consequently, have lower cost of issuance but benefit of a too-big-to-fail status.

To conduct these tests, we first define large banks following Beltratti and Stulz (2012) as banks with a value of total assets larger than $50 billion.[8] We report the results of these additional tests in columns 3–6 of Table 6. Overall, we find support for the view that the expectation to benefit from a government bailout is likely to play a role in discouraging poorly capitalized banks to raise equity in the market. Essentially, the lower probability to issue equity by poorly capitalized banks in crisis periods is not driven by the behavior of small banks but is also confirmed in the group of large banks. This is clearly highlighted in Panel B of Table 6, where the reported marginal effects show that while we observe that also too-big-to-fail banks remain more likely to issue equity in normal times if undercapitalized, this conclusion is not confirmed during crisis periods. By contrast, in the presence of conditions of systemic distress, the marginal effects of our measures of capital strength are significantly negative in the subsample of large banks. Thus, in the presence of an increasing value of government guarantees, which typically materializes during systemic crises, large banks are less likely to raise equity when they show a weaker capital adequacy. In additional tests (reported in the Internet Appendix), we examine the robustness of the results to choosing a different cutoff for the definition of large banks: We generate the same qualitative results if we define large banks as those with total assets exceeding $100 billion.

Further, we conduct additional tests by using size measures that rely on the cross-country dimension of our sample and are based on the ratio between bank liabilities and country GDP. The motivation for using such measures is based on the evidence provided by Correa, Lee, Sapriza, and Suarez (2014), showing that a

[8]This size limit is also in line with the U.S. regulatory definition of systemically important banks, as stated in the Dodd–Frank Act of July 2010.

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higher ratio between bank liabilities and country GDP increases the likelihood that a bank receives government support. More specifically, in the Internet Appendix, we report the results based on two alternative systemic size measures: First, we define a bank as large in relative terms when the value of its total liabilities exceeds 10% of the domestic GDP; then we alternatively identify banks as relatively large if their total liabilities over the GDP of the respective country are in the last quartile of the sample distribution. These tests again confirm that our findings are not driven by small banks, as we still find a positive and significant marginal effect of poor capitalization in normal times also in the group of too-big-to-fail banks. Nevertheless, during crisis periods, we now observe that the marginal effects are not negative and statistically significant at customary levels, unless we remove the country dummies from our specifications. Essentially, the difference in the behavior of large and small banks in crisis periods appears more pronounced when size is defined in absolute terms. This is probably related to the fact that this latter classification better removes the confounding effect generated by differences in the cost of issuance than the classification based on a relative size measure.

All in all, this section supports the primary conclusion of our analysis: Market discipline exercises a key influence on the decision of banks to issue equity when they are poorly capitalized. During crisis periods, market discipline is to some extent weakened by the rising value of implicit and explicit government guarantees, as testified by the fact that poorly capitalized banks with a large volume of total assets are less likely to raise equity in the quarters following a crisis, while they remain more likely to issue in normal times.

V. Poorly Capitalized Banks, Equity Issuance, and Alternative Recapitalization Strategies

The SEOs are not the only tool that poorly capitalized banks can use to adjust their capital structure to respond to regulatory and market pressures. For instance, banks might respond to these pressures by accumulating retained earnings. Compared to SEOs, however, this alternative is subject to a lower degree of discretion that can be exercised by bank managers, as it is constrained by the level of profitability achieved in a given year and requires a longer time of implementation. Hence, if the poor degree of capitalization signals that a bank is extremely distant from the desired capital structure, and has to react in a timely manner to external pressure by achieving a high speed of adjustment (Berger et al. (2008)), an increase in capital via retained earnings should be less likely to occur than an equity issuance via SEOs.

In this section, we offer evidence in line with this conjecture by extending our analysis to the impact of our measures of poor capital adequacy on the likelihood to observe an increase in capital via retained earnings. Given that the change in capital via retained earnings can be observed only at an annual frequency, we start by replicating our baseline specification on the likelihood of issuing SEOs with

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annual data that we then employ as our benchmark model.[9] Next, we estimate a similar model where the dependent variable is a dummy equal to 1 if a bank has increased capital without issuing new shares in a given year; that is, we model the probability that a bank increases equity by means of retained earnings.

While the results reported in the first two columns of Table 7 confirm the positive nexus between our measures of poor capitalization and the likelihood of an SEO, we do not find any significant effect of these measures in columns 3 and 4, where the focus is on the probability of an increase in capital via retained earnings. In the next four columns, we also evaluate whether poorly capitalized banks at least attempt to respond to their weak capital adequacy by increasing their retained earnings, especially if they modify the component of retained earnings that is under full managerial control, namely, the dividends paid to shareholders. Therefore, we initially re-estimate the logit models with a dummy equal to 1 when a bank has increased retained earnings in a given year, and then with a dummy equal to 1 if it has reduced dividends in the same year. These additional tests do not provide evidence of a higher probability to modify the retained earnings policy and to reduce dividends when banks are poorly capitalized. Notably, in unreported tests, we do not find any effect of our measures of poor capitalization when we estimate a linear model in which the dependent variable is the annual change in retained earnings (dividends) scaled by the volume of total assets at the end of the previous year.

Overall, these tests confirm our expectation that poorly capitalized banks are not more likely than other banks to increase capital via retained earnings as a response to pressure to restore their capital strength and as an alternative to a timely recapitalization based on raising equity via SEOs.

To further corroborate the conclusion that poorly capitalized banks are in search of a timely recapitalization strategy, we next examine whether these banks are also likely to implement another rebalancing strategy of the capital structure that allows more flexibility and a more rapid response than a capital increase via retained earnings. Essentially, we conjecture that if the speed of adjustment of the capital structure influences the recapitalization strategy chosen by poorly capitalized banks, the real alternative to SEOs is likely to be the implementation of a deleveraging via a reduction in assets. Accordingly, in the last two columns of Table 7, we show the regression results of our baseline logit specification, where the dependent variable is a dummy equal to 1 in the case of a reduction in bank assets that we use as a proxy of a bank deleveraging strategy.

These additional tests confirm that poorly capitalized banks are in search of a quick rebalancing of their capital structure: They are more likely than other banks to experiment with a deleveraging strategy. Nevertheless, the coefficient of the dummy POORLY_CAPITALIZED is significantly larger (at the 5% level) in the SEO specification (columns 1 and 2 of Table 7) than in the deleveraging specifi-

[9]The annual estimation requires a mapping of the quarterly SYSTEMIC_SHOCK_2 variable to a variable with annual frequency. To this end, we proceed as follows: If the quarterly variable identifies a systemic distress in any of the first 2 quarters of a year, we assign the annual SYSTEMIC_SHOCK variable a value of 1, and 0 otherwise. If the quarterly variable identifies a systemic distress in the third and fourth quarters of the year, we assign the annual SYSTEMIC_SHOCK variable a value of 1 in the following year.

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TABLE 7
Probability of Issuing Equity versus Other Recapitalization Strategies

Table 7 shows the regression results on the determinants of the likelihood to issue equity and to adopt other recapitalization strategies by banks. The models are estimated via a panel random logit estimator that controls for unobserved bank heterogeneity. The dependent variable is a dummy equal to 1 if a bank has issued equity in a given year and 0 otherwise, while the explanatory variables include bank and country characteristics. POORLY_CAPITALIZED is a dummy equal to 1 if a bank is in the first quartile of the equity/assets distribution, POORLY_CAPITALIZED_Y is a dummy equal to 1 if a bank is in the first quartile of the yearly equity/assets distribution, RISK is the volatility of the daily returns computed over the last quarter of the preceding year, RELPTB is price-to-book ratio divided by the average price-to-book ratio computed yearly at the country level, ROA is the ratio between net income and total assets, YEARLISTED is the natural logarithm of the number of years a bank has been listed in the stock market, SIZE is the natural logarithm of total assets measured in thousands of U.S. dollars, DEPOSITS is computed as total customer deposits over total liabilities, MERGERS is a dummy equal to 1 if a bank has been involved in a merger during the year, CPP is a dummy equal to 1 from the first year after a U.S. bank has received capital support via the capital purchase program, RESCUE is a dummy equal to 1 from the first year a non-U.S. bank has received capital support. Country controls include an index of regulatory independence (REG_INDEPENDENCE), an index measuring the regulatory strength (REG_STRENGTH), the ratio between public sector debt and country GDP (PUBLIC_DEBT), the total shares traded divided by country GDP (SHARE_TRADED), and the total accounting value of a bank's net interest revenue as a share of its interest-bearing (total earning) assets (MARKET_POWER), a dummy equal to 1 for the period following a systemic shock (SYSTEMIC_SHOCK). Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	SEOs		Increase in Equity without SEOs		Increase in Retained Earnings		Decrease in Dividends		Decrease in Assets	
	1	2	3	4	5	6	7	8	9	10
POORLY_CAPITALIZED	0.658***		0.134		−0.033		0.039		0.360***	
	(0.131)		(0.091)		(0.069)		(0.086)		(0.092)	
POORLY_CAPITALIZED_Y		0.648***		0.077		−0.067		0.081		0.447***
		(0.130)		(0.090)		(0.068)		(0.085)		(0.092)
RISK	1.612**	1.622**	−1.679***	−1.663***	0.769	0.779	−1.401***	−1.442***	2.236***	2.210***
	(0.749)	(0.748)	(0.546)	(0.545)	(0.482)	(0.482)	(0.527)	(0.525)	(0.574)	(0.575)
RELPTB	0.218***	0.218***	0.109**	0.110**	0.233***	0.234***	−0.298***	−0.290***	−0.464***	−0.468***
	(0.053)	(0.053)	(0.046)	(0.047)	(0.040)	(0.040)	(0.051)	(0.051)	(0.063)	(0.063)
ROA	−6.652***	−6.679***	3.871**	3.777**	−29.412***	−29.674***	−4.368***	−4.308***	−19.181***	−18.886***
	(2.160)	(2.150)	(1.584)	(1.577)	(2.601)	(2.605)	(1.476)	(1.467)	(2.412)	(2.396)
YEARLISTED	−0.018***	−0.019***	0.002	0.002	0.000	0.000	0.024***	0.024***	0.016***	0.017***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)
SIZE	0.379***	0.379***	−0.176***	−0.175***	0.031*	0.031*	−0.010	−0.003	−0.028	−0.030
	(0.038)	(0.038)	(0.033)	(0.033)	(0.016)	(0.016)	(0.024)	(0.024)	(0.025)	(0.025)
DEPOSITS	1.120***	1.142***	1.005***	0.998***	0.739***	0.737***	−1.098***	−1.072***	−1.863***	−1.855***
	(0.379)	(0.379)	(0.230)	(0.230)	(0.148)	(0.148)	(0.197)	(0.197)	(0.209)	(0.210)
MERGERS	0.254	0.253	−0.173	−0.174	0.206	0.206	−0.160	−0.069	0.232	0.232
	(0.368)	(0.368)	(0.227)	(0.227)	(0.192)	(0.192)	(0.242)	(0.237)	(0.239)	(0.239)

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TABLE 7 (continued)

Probability of Issuing Equity versus Other Recapitalization Strategies

	SEOs		Increase in Equity without SEOs		Increase in Retained Earnings		Decrease in Dividends		Decrease in Assets	
	1	2	3	4	5	6	7	8	9	10
CPP	1.227***	1.231***	−0.894***	−0.895***	−1.097***	−1.099***	1.626***	1.614***	1.230***	1.242***
	(0.171)	(0.170)	(0.136)	(0.136)	(0.113)	(0.113)	(0.123)	(0.123)	(0.153)	(0.153)
RESCUE	0.616	0.608	−0.966**	−0.967**	−0.063	−0.058	1.463***	1.397***	0.221	0.214
	(0.405)	(0.405)	(0.440)	(0.440)	(0.296)	(0.296)	(0.338)	(0.336)	(0.369)	(0.369)
REG_INDEPENDENCE	2.097*	2.108*	1.207**	1.216**	1.072***	1.073***	−3.046***	−2.995***	0.166	0.162
	(1.077)	(1.076)	(0.572)	(0.572)	(0.303)	(0.303)	(0.360)	(0.360)	(0.461)	(0.463)
REG_STRENGTH	0.169*	0.171*	0.219***	0.219***	−0.043	−0.043	0.180***	0.191***	−0.508***	−0.511***
	(0.102)	(0.102)	(0.069)	(0.069)	(0.053)	(0.053)	(0.060)	(0.059)	(0.069)	(0.069)
PUBLIC_DEBT	−0.006**	−0.006**	0.005***	0.005***	−0.014***	−0.014***	0.006***	0.006***	−0.017***	−0.017***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
SHARE_TRADED	0.003***	0.003***	−0.005***	−0.005***	−0.003***	−0.003***	0.008***	0.008***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
MARKET_POWER	−0.046	−0.048	−0.114***	−0.115***	0.039	0.039	0.093***	0.091***	0.005	−0.002
	(0.050)	(0.050)	(0.034)	(0.034)	(0.028)	(0.028)	(0.034)	(0.034)	(0.039)	(0.038)
SYSTEMIC_SHOCK	0.625***	0.620***	−1.176***	−1.178***	−0.727***	−0.729***	0.107	0.117	−0.049	−0.051
	(0.209)	(0.208)	(0.138)	(0.138)	(0.118)	(0.118)	(0.125)	(0.124)	(0.138)	(0.138)
Constant	−15.249***	−15.277***	−5.036***	−5.054***	−2.245**	−2.250**	5.462***	5.164***	5.191***	5.250***
	(3.386)	(3.383)	(1.862)	(1.862)	(1.037)	(1.037)	(1.226)	(1.225)	(1.519)	(1.525)
Pseudo-R^2	0.392	0.395	0.440	0.440	0.502	0.502	0.532	0.532	0.599	0.599
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	12,785	12,785	12,785	12,785	12,785	12,785	12,785	12,785	11,902	12,785

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cation (columns 9 and 10). Hence, a weak capital adequacy exercises a stronger effect on the likelihood of an SEO than on the likelihood of a deleveraging strategy.

TABLE 8

Probability of Issuing Equity versus Decrease in Assets: Multinomial Logit Model

Table 8 shows the regression results on the determinants of the likelihood to issue equity and to decrease assets under a multinomial logit setting. The models are estimated via a random multinomial logit estimator with clustered standard errors that controls for unobserved bank heterogeneity. The dependent variable is a limited variable that takes the value of 1 if a bank has issued equity in a given year, the value of 2 if the bank's total assets are reduced but no equity issues have taken place in the year, and 0 otherwise. The explanatory variables include bank and country characteristics. POORLY_CAPITALIZED is a dummy equal to 1 if a bank is in the first quartile of the equity/assets distribution, POORLY_CAPITALIZED_Y is a dummy equal to 1 if a bank is in the first quartile of the yearly equity/assets distribution, RISK is the volatility of the daily returns computed over the last quarter before the issue, RELPTB is price-to-book ratio divided by the average price-to-book ratio computed yearly at the country level, ROA is the ratio between net income and total assets, YEARLISTED is the natural logarithm of the number of years a bank has been listed in the stock market, SIZE is the natural logarithm of total assets measured in thousands of U.S. dollars, DEPOSITS is computed as total customer deposits over total liabilities, MERGERS is a dummy equal to 1 if a bank has been involved in a merger during the quarter, CPP is a dummy equal to 1 from the first quarter after a U.S. bank has received capital support via the capital purchase program, RESCUE is a dummy equal to 1 from the first quarter a non-U.S. bank has received capital support. Country controls include an index of regulatory independence (REG_INDEPENDENCE), an index measuring the regulatory strength (REG_STRENGTH), the ratio between public sector debt and country GDP (PUBLIC_DEBT), the total shares traded divided country GDP (SHARE_TRADED), and the total accounting value of a bank's net interest revenue as a share of its interest-bearing (total earning) assets (MARKET_POWER), a dummy equal to 1 for the first two quarters following a systemic shock (SYSTEMIC_SHOCK_2). Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	SEO	Decrease in Assets	SEO	Decrease in Assets
	1	2	3	4
Panel A. Regression Analysis				
POORLY_CAPITALIZED	0.609***	0.304***		
	(0.145)	(0.091)		
POORLY_CAPITALIZED_Y			0.627***	0.350***
			(0.146)	(0.090)
RISK	2.745***	2.471***	2.738***	2.449***
	(0.743)	(0.597)	(0.742)	(0.597)
RELPTB	0.155***	−0.362***	0.155***	−0.363***
	(0.044)	(0.103)	(0.044)	(0.103)
ROA	−14.153***	−14.780***	−14.088***	−14.623***
	(4.403)	(5.103)	(4.380)	(5.061)
YEARLISTED	−0.012*	0.008*	−0.012*	0.009*
	(0.007)	(0.005)	(0.007)	(0.005)
SIZE	0.338***	−0.055**	0.338***	−0.057**
	(0.033)	(0.028)	(0.033)	(0.028)
DEPOSITS	0.619*	−1.681***	0.637*	−1.676***
	(0.371)	(0.243)	(0.370)	(0.243)
MERGERS	0.279	0.266	0.280	0.266
	(0.356)	(0.239)	(0.356)	(0.239)
CPP	1.320***	0.561***	1.326***	0.565***
	(0.170)	(0.136)	(0.170)	(0.136)
RESCUE	0.519	−0.653*	0.515	−0.659*
	(0.317)	(0.376)	(0.317)	(0.375)
REG_INDEPENDENCE	2.262**	1.151***	2.275**	1.148***
	(0.987)	(0.314)	(0.987)	(0.314)
REG_STRENGTH	0.043	−0.528***	0.042	−0.528***
	(0.106)	(0.088)	(0.104)	(0.088)
PUBLIC_DEBT	−0.013***	−0.025***	−0.014***	−0.025***
	(0.003)	(0.002)	(0.003)	(0.002)
SHARE_TRADED	0.003***	0.001	0.003***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
MARKET_POWER	−0.038	0.006	−0.041	0.001
	(0.052)	(0.072)	(0.052)	(0.071)

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TABLE 8 (continued)
Probability of Issuing Equity versus Decrease in Assets: Multinomial Logit Model

	SEO	Decrease in Assets	SEO	Decrease in Assets
	1	2	3	4
Panel A. Regression Analysis (continued)				
SYSTEMIC_SHOCK	0.498***	−0.075	0.494***	−0.077
	(0.184)	(0.133)	(0.183)	(0.132)
Constant	−13.043***	2.853**	−13.050***	2.892**
	(3.143)	(1.287)	(3.137)	(1.288)
Pseudo-R^2	0.136	0.136	0.136	0.136
Year dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Obs.	12,785	12,785	12,785	12,785
Panel B. Test for Difference between the Coefficients of POORLY_CAPITALIZED (POORLY_CAPITALIZED_Y) in the SEO and Decrease in Assets Regressions				
Column 1 (SEO) – Column 2 (Decrease in Assets)	0.305*			
p-value in parentheses	(0.05)			
Column 3 (SEO) – Column 4 (Decrease in Assets)			0.277*	
p-value in parentheses			(0.08)	

This conclusion is also confirmed by the results reported in Table 8 that refer to a multinomial logit model, where the dependent variable is equal to 0 when neither an SEO or a decline in assets has been observed, 1 for the issuance of an SEO, and 2 for a reduction in assets in the absence of an SEO. Under this setting, the difference between the coefficients of POORLY_CAPITALIZED (POORLY_CAPITALIZED_Y) in columns 1 (3) and 2 (4) expresses the likelihood that a poorly capitalized bank will issue an SEO rather than reducing assets. As reported in Panel B, the difference between the coefficients is positive and significant at customary levels; namely, poorly capitalized banks are more likely to issue an SEO than to implement a deleveraging strategy. This result might indicate that poorly capitalized banks perceive the costs associated with a deleveraging solution as significantly larger than the costs produced by an equity issuance.

All in all, this section shows that a weak degree of capital adequacy not only exposes banks to pressure to rebalance their capital structure, but also forces them to opt for a timely rebalancing strategy with the issuance of an SEO appearing as the most likely response.

VI. Conclusions

Poorly capitalized banks are more likely to issue equity than are other banks. The issuance does not appear primarily motivated by the presence of capital regulation but by the influence of market forces. This conclusion is supported by the fact that poorly capitalized banks are more likely to issue equity than other banks, especially when they are far from the minimum regulatory capital ratio, namely, when they are less likely to be subject to pressure to comply with minimum capital requirements. Furthermore, by means of a difference-in-difference approach, we show that poorly capitalized banks do not react to changes in capital regulation by raising equity in the stock market, and do not issue more than other banks even in the proximity of the implementation of these regulatory changes.

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Overall, we interpret the highlighted results as indicating a primary role for market discipline in guiding equity issuance by poorly capitalized banks. Our interpretation is further supported by additional tests that analyze the behavior of poorly capitalized banks in normal and distress systemic conditions. In the presence of a systemic shock, when investors are less sensitive to bank fundamentals given their expectation to be protected by government guarantees (Acharya et al. (2016)), poorly capitalized banks do not behave differently from other banks. However, they remain more likely to issue equity during normal systemic conditions when market discipline is supposed to be more effective. This result is not confined to small banks. By contrast, when poorly capitalized banks are also large in absolute terms, with a consequent largest chance to receive government support, they tend to be more likely to raise equity in normal times and less likely to do so after a systemic shock.

Finally, the analysis of other strategies that can be employed to adjust bank capital structure shows that poorly capitalized banks are not only exposed to pressure to rebalance their capital structure, but they also opt for a rebalancing strategy that reduces the time of adjustment. This conclusion is confirmed by the fact that for poorly capitalized banks, the alternative to SEOs is deleveraging, which allows for a faster adjustment, rather than an increase in capital via retained earnings, which can only slowly rebalance their capital structure. Nevertheless, the issuance of an SEO remains the most likely response by banks with a poor degree of capitalization.

The findings discussed here suggest that minimum mandatory requirements on default risk sensitive forms of debt, such as subordinated debts or types of contingent capital, can generate incentives for equity issuance by banks. This might occur via an increase in bankruptcy costs for shareholders in the form of significantly higher funding costs motivated by a market-discipline channel. Furthermore, our results motivate the introduction of a countercyclical capital buffer and forms of contingent capital specifically designed, and more stringent, for large banks.

Appendix. Identification of Periods of Systemic Distress

The index of money-market pressure (IMP) proposed by von Hagen and Ho (2007) identifies systemic crises via the identification of distress conditions in the money market. More precisely, the distress is related to the changes in both the money-market rate and the bank reserves. More formally, the index is constructed as follows:

$$\text{IMP}_{j,t} = \frac{\Delta r_{j,t}}{\sigma_{\Delta r_j}} + \frac{\Delta \gamma_{j,t}}{\sigma_{\Delta \gamma_j}}, \tag{A-1}$$

where $r_{j,t}$ is the real short-term money-market rate in country j in the quarterly period t and $\gamma_{j,t}$ is the ratio of total credit from the monetary authority (as a measure of the central bank's liquidity support) to total deposits in country j in the same quarter t. Δ is the difference operator, and $\sigma_{\Delta \gamma_j}$ and $\sigma_{\Delta r_j}$ are the standard deviations of the two components. $\sigma_{\Delta \gamma_j}$ and $\sigma_{\Delta r_j}$ serve as scaling factors and are computed based on rolling windows of the 8 preceding quarters.

Von Hagen and Ho (2007) argue that the index can be used to detect banking crises, since a banking crisis eventually results in a severe shortage of aggregate private liquidity

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because of either the sudden withdrawal of retail and wholesale deposits or the deterioration of asset quality. The shortage of aggregate private liquidity will generate an increase of the price of this liquidity as measured by the increase in the short-term money-market rate. In this case, the index will detect a banking crisis by the sharp rise in its first component. The central bank can decide to counteract the shortage of private liquidity and flood the banking sector with additional public liquidity that comes in the form of credit to financial institutions. In this case, the index will signal a banking crisis because of the rise in the central bank's credit (the second component of the index) even in the case of no detectable rise in the price of private liquidity. Following this argument, extremely high values of the IMP can be used as a signal of periods of severe liquidity shortages and banking system distress.

As in von Hagen and Ho (2007), we establish that a systemic shock leading to a banking crisis occurs when the value of the index is very high, namely, if it exceeds the 97.5th percentile of the sample distribution of the index for the respective country. In addition, the increase in the index value from the previous period has to be at least 5%. If these two conditions are simultaneously met, the crisis variable takes the value of 1 in a given quarter; otherwise, it takes the value of 0. As pointed out by von Hagen and Ho, the index offers indications on the beginning date of a severe crisis while it does not permit a precise identification of its conclusion. Nevertheless, this is a general problem of any method adopted to identify banking crises. It is worth noting that the systemic distress indicator can be computed also at monthly intervals. Nevertheless, the remaining variables that we employ in this paper are available at best at quarterly frequency. Furthermore, the use of a monthly frequency as in Erel et al. (2012) would generate only a small portion of nonzero observations of the binary-dependent variable, since the number of SEOs relative to the number of bank observations is relatively low. Hence, the monthly frequency would cause problems in the estimation of the model through maximum likelihood, because the SEO decision would appear as an extremely "rare event" in the sample (see King and Zeng (2001) for a detailed discussion of this problem).

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