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Why do banks issue equity?

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ABSTRACT

US banks maintain significantly higher capital levels than required by regulatory authorities. In addition to complying with capital regulations, this paper investigates the motivations behind banks' decisions to issue equity. We find that banks use seasoned equity offerings (SEOs) to expand their assets. Our findings indicate that banks conducting SEOs experience not only an increase in their capital ratios but also in deposits and assets in the years following the SEO, compared to the other banks. The newly raised funds are primarily invested in for-sale loans and other loans. There is an overall increase in risk and a decrease in market-to-book value during the post-SEO period. Our results are not driven by changes in deposit supply before or after the bank's SEO and remain robust when tested with alternative placebo-matched samples. Taken together, our findings suggest that banks engage in risk-taking behaviors, and highlight the importance of regulating the size of banks.

1. Introduction

An undercapitalized banking system can greatly harm the economy and society as observed in the financial crisis of 2007–09. The level of bank equity capital is thus under hot debate by various stakeholders. In the absence of government capital injection, a direct and straightforward way of increasing bank capital is to issue equity in the financial market. Our evidence, however, shows that most banks that issue equity have equity well above the government required level. Thus, that is essential to investigate whether there are additional motivations for banks to conduct seasoned equity offerings (SEO) aside from simply adhering to capital regulations and how markets interpret the information through the signal of a bank's issuing equity.

This paper aims to address the question regarding which banks that issue equity through the market of seasoned equity offering (SEO), and to uncover their underlying motivations for doing so. The answers hold significant relevance for both bank regulators and external investors. Assuming that banks issue equity to strengthen their capital buffer or improve lending quality, a bank SEO is likely to mitigate its impact on systemic risk and financial crises, making it viewed favorably by regulators. This is the scenario envisaged by classical wisdom. However, if banks issue equity for other purposes such as augmenting risk-taking or leverage size, a bank SEO could have an adverse effect on systemic risk and financial crises, potentially endangering financial stability.

Since the true reason behind a bank's SEO is unobservable, we examine strategic behavior after the bank SEO, using U.S. banking industry data. Specifically, we estimate the change in a wide range of bank characteristics during the years immediately following the

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bank SEOs relative to the change during the same period among comparable banks that do not issue equity during the entire sample period of 1985 to 2013. If a consistent pattern of bank characteristics changes following the SEO is observed, we claim these changes to be the main purpose of bank SEO. We carefully rule out the alternative explanations that these changes may exist pre-SEO or only happen as a result of SEO.

Our analysis yields three main findings. *First*, SEO banks increase capital ratios relative to non-SEO banks after the SEO. For example, an SEO bank has a 1.048% points increase in equity to assets ratio in the year of SEO, while this is also true for Tier 1, Tier 2, total capital, and market capital ratios. We also observe that in the year of SEO, there is a 0.07% points increase in total assets - 49 million US dollars on average (net of the proceeds received from the SEO) - relative to the control group. The effect of assets expansion continues to increase even five years after the SEOs. By examining the assets structure in more detail, we find that the primary contributor to the rise in total assets is the increase in total deposits.

Second, it appears that SEO banks engage in more for-sale loans and other loans immediately after the SEO, but do not exhibit a higher inclination towards commercial and industrial loans, consumer loans, mortgage loans or capital expenditures. The findings do not indicate that SEO banks engage in more acquisitions following the SEO compared to non-SEO banks.

Third, we find that relative to non-SEO banks, SEO banks experience an increase in the standard deviation of ROA and loan loss provisions, and a decrease in market-to-book ratio after the SEO.

Consistent with the literature, our analysis suggests that banks voluntarily hold capital well in excess of the regulatory minimum (Ayuso, Pérez and Saurina, 2004; Estrella, 2004; Flannery and Rangan, 2008). Particularly, our findings thus point toward the theory that banks issue equity for assets expansion. An assets expansion oriented bank with the potential to increasing risk faces the risk of increased financing costs if leverage increases too quickly. By increasing equity capital in the early stage of assets expansion, banks can reduce the impact of market discipline. The increase in lending shows the SEO banks' tendency towards liquidity creation (Berger and Bouwman, 2009) and hence profitability. This tendency is consistent with the assets expansion theory. The results on the increase in overall risk and a decrease in market performance for SEO banks also confirm the findings of Fahlenbrach et al. (2017) that common stock of U.S. banks with high loan growth underperforms the common stock of banks with low loan growth.

Our results are robust to a set of empirical analyses for alternative explanations and methodologies. *First*, the increase in deposits after a bank's SEO may simply follow the trend that has already existed before the bank's SEO, or the trend may have started because the bank's SEO is interpreted by the market as a positive signal that the bank's financial safety will increase. Our empirical tests find no evidence to support these two alternative explanations. *Second*, we also find that relative to their peers, SEO banks focus less on assets expansion, if they are of later stages of lifespan, with poorer capitalization and which issued equity during the 2007–09 global financial crisis period. We find no evidence that these differences drive our main results. *Third*, our results are robust to two placebo-matched approaches to mitigate the endogeneity concern that SEO banks may be fundamentally different from non-SEO banks, and the estimated changes in the outcome variables between the two groups following the SEO may reflect the unobservable trend of the two groups. *Fourth*, our main results are robust after controlling for state-year fixed effects to control for state-level changes in the financial environment that can potentially explain the bank's need to issue equity.

Our results suggest that a bank's decision to issue equity is a strategy of assets expansion. These results imply that banks adjust deposits and debt levels instead of equity to achieve their target capital structure. This implication is in line with Gropp et al. (2018), suggesting that banks increase their capital ratios not by raising levels of equity, but by reducing their credit supply. Our results indicate that the issuance of equity by a growth-oriented bank demonstrates the effectiveness of market discipline, otherwise it is likely that the bank would not have taken this action. This evidence is consistent with the literature on the role of market discipline in banking as an effective complement to bank regulation and supervision (Soledad et al., 2001; Bliss and Flannery, 2002; Nier and Baumann, 2006; Dinger and Vallascas, 2016).

Our findings imply that bank regulators need to address banks' risk-taking incentives when they rely on external finance (equity and deposits) to grow (compared to relying on internally generated profits to grow). There is extensive literature that documents the benefits of being a larger bank in terms of extra deposit inflow during financial crisis period (Oliveira et al., 2015), higher return and lower interest costs (Bertay et al., 2013), less market discipline (Acharya et al., 2016), let alone the Too-big-to-fail policy. This benefit even applies to community banks (Hughes et al., 2016). The individual benefits, however, may accumulate to serious systemic risk at the aggregated level, as observed in the Great Depression of 2007–09.

The existing literature explaining the timing of banks' SEO is scant except a few recent papers. Baron (2018) documents a countercyclical equity issuance pattern in banking and argues it is because governments' implicit guarantee distorts bank's incentive to raise new equity when the market is good. The countercyclical SEO in banking is also observed in this paper (Fig. 2) and our findings that banks issue equity during the financial crisis period is to raise capital ratio but not assets expansion is also consistent with Baron (2018). Chu and Zhao (2018) studies the impact of bank's behavior after the SEO deregulation that allowed listed firms with public float less than $75 million to raise equity via shelf registration and find that the reduced financial constraints for the affected banks after the deregulation leads to more mortgage lending.

Our paper not only contributes to the general SEO literature (Li et al., 2022; Liu et al., 2023) but also has new implications for the bank SEO announcement effect literature. The existing literature finds that bank SEO announcement effects are in general less negative than those of industrial firms, and argue it is because of lower levels of information asymmetry in the highly regulated banking industry (Smith, 1986; Polonchek et al., 1989; Wansley and Dhillon, 1989; Li, Liu, Siganos and Zhou, 2016). This explanation is difficult to test because information asymmetry is not directly observable. It is also not unambiguous since banking research also tends to agree that banks may be more (instead of less) opaque than non-banks because of the complex financial intermediation and the nature of the underlying assets (Jones et al., 2012). Our results shed new light on explaining bank SEO announcement effects. The announcement of a bank SEO sends a signal to the market that the bank is adopting an assets expansion strategy, which leads to a negative announcement

effect because the market worries the bankers will be over-optimistic about the risk of loans extended during periods of high loan growth (Fahlenbrach, Prilmeier and Stulz, 2017). However, the market also considers that the effect of too-big-to-fail (TBTF) and the positive impact of being a larger bank reduce the negative announcement effect to a certain level, resulting in a less negative announcement effect than for industrial firms. This interpretation is also consistent with the conflicting empirical evidence on the difference between voluntary and involuntary bank SEO announcement effects (Keeley, 1989; Cornett and Tehranian, 1994; Krishnan et al., 2010), because whether a bank's SEO is voluntary or involuntary is determined by bank capital regulation and the level of bank capital, which is not the main reason why banks issue equity.

Finally, our paper contributes to the literature on bank growth/expansion. While the literature on firm growth is extensive, literature on bank growth is surprisingly rare. Our results that SEO banks do not use the raised funds (both equity and deposits) after the SEO to engage in corporate acquisitions confirms Penrose's firm growth theory (Penrose, 1959) and Lockett et al. (2011) empirical evidence that organic growth and acquisitive growth are two different strategic options for the managers of a firm.

One limitation of our paper is that it does not answer the question why some banks adopt aggressive growth strategy while others do not in the first place. Our paper shows that SEO banks are on average smaller and have lower level of bank equity than non-SEO banks, however, it is unclear whether these banks grow for profits or for empire building motivations from the executives. More robust empirical analysis is expected to answer these questions.

The remainder of the paper is organized as follows. Section 2 discusses alternative explanations of why banks issue equity. Section 3 discusses the data and summary statistics. Section 4 explains the identification strategy used and presents the analysis and results. Section 5 examines whether SEO banks actively invest in risky assets or engage in acquisitions. Section 6 examines the performance of SEO banks. Section 7 concludes.

2. Alternative explanations of why banks issue equity

Why do banks issue equity? The traditional view suggests that banks are motivated to raise equity due to market forces and capital requirements (Admati et al., 2012; Berger et al., 2008; Dahl and Shrieves, 1990; and Erkens, Hung, and Matos, 2012). When a bank's level of capitalization falls below regulatory standards, regulatory pressure should oblige them to issue equity. Additionally, market discipline can prompt undercapitalized banks to raise equity, even if they comply with regulatory capital requirements, particularly when they are close to defaulting. However, the empirical evidence suggests that banks manage to voluntarily hold capital well in excess of the regulatory minimum (Ayuso et al., 2004; Estrella, 2004; Flannery and Rangan, 2008). Table 1 shows that, for banks before their SEO during the sample period from 1994 to 2013, the average equity to assets ratio is 8.84%, well above the required leverage level of 3% set by the Basel III regulation. Fig. 1 plots the trend of *equity to assets ratio* for SEO banks and the counterfactual *equity to assets ratio* if the equity was not issued, where the counterfactual *equity to assets ratio* is derived by deducting the equity raised from the

Table 1
Summary Statistics.

	All		SEO banks (before SEO)		SEO banks (after SEO)		Non-SEO banks	
	(2141 banks)		(217 banks)				(1924 banks)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Total assets	7.13	1.90	7.01	1.27	7.42	1.36	7.13	1.98
Equity to assets ratio	9.58	3.77	8.84	2.97	9.18	2.98	9.68	3.88
Tier 1 capital ratio	11.84	4.04	11.77	4.01	11.96	3.70	11.83	4.07
Tier 2 capital ratio	3.90	4.48	2.78	3.35	2.64	2.71	4.11	4.66
Total capital ratio	15.80	5.96	14.63	5.10	14.67	3.88	16.00	6.15
Market leverage	12.66	6.15	12.49	5.81	11.42	5.25	12.76	6.22
Log Deposits	6.87	1.84	6.79	1.25	7.21	1.33	6.86	1.92
Log Current debt	2.46	4.60	2.92	3.75	2.73	4.30	2.40	4.70
Log Long-term debt	2.89	4.25	2.45	3.92	3.38	3.52	2.89	4.33
Interest paid/deposits	2.11	1.51	2.57	1.20	1.39	1.19	2.15	1.54
Consumer and Industrial loan/assets	20.26	10.13	21.85	8.96	20.59	10.94	19.94	10.20
Consumer loans/assets	12.08	7.08	10.94	5.63	12.00	7.02	12.26	7.25
Mortgage loans/assets	24.39	12.50	26.16	12.78	28.84	14.80	23.71	12.10
For-sale loans/assets	1.76	3.97	1.94	4.49	2.40	4.98	1.67	3.77
Other loans/assets	56.31	23.32	53.75	26.06	53.67	24.58	56.76	22.90
Capital expenditure/assets	0.22	0.25	0.28	0.27	0.22	0.25	0.22	0.25
Loan loss provisions/assets	0.36	0.58	0.35	0.51	0.45	0.66	0.36	0.58
ROA	0.68	0.90	0.82	0.78	0.56	0.95	0.68	0.91
SD(ROA)	0.17	0.45	0.08	0.24	0.33	0.57	0.17	0.45
Market-to-book value ratio	1.37	0.68	1.68	0.76	1.22	0.57	1.35	0.67
Deposit HHI	0.31	0.31	0.28	0.32	0.23	0.28	0.32	0.31
Log (number of branches + 1)	26.75	90.16	25.32	32.87	34.04	59.86	26.21	95.38
MA dummy	0.14	0.35	0.27	0.44	0.20	0.40	0.13	0.34

This table provides bank-level summary statistics from 1985 to 2013. The sample comprises all listed banks in the United States. The variables are for the entire sample. Variable definitions and data sources are described in the appendix.

equity to assets ratio in the post-SEO period. The figure shows significant difference between the actual and counterfactual *equity to assets ratios.* We notice that except for the Great Recession period of 2008–09, the counterfactual *equity to assets ratio* for SEO banks is well above the government required level of 3%. Additionally, SEO banks have an average Tier 1 assets ratio of 11.77% before the SEO, which increased to 11.96% after the SEO. In comparison, non-SEO banks have an average ratio of 11.83%. Taken together, these results support our argument that there are additional motivations for banks to conduct seasoned equity offerings (SEO) aside from simply adhering to capital regulations.

The existing literature has also documented evidence that bank capital structure is not bound by capital regulation. Gropp and Heider (2010) find that capital regulation is of second-order importance in determining the capital structure of large U.S. and European banks. Dinger and Vallascas (2016) find in their international bank sample analysis that regulatory pressure seems to play a limited role in the decisions of poorly capitalized banks to raise equity. Even if the banks have to increase their capital to meet special government requirements, as documented in Gropp et al. (2018) on the European Banking Authority capital exercise in 2011, they still find that banks increase their capital ratios not by raising levels of equity, but by reducing their credit supply.

Another benign reason is that banks issue equity to fund loans and investments, as suggested in life-cycle theory, or near-term cash needs, as found in DeAngelo et al. (2010) for industrial firms. If Myers and Majluf's (1984) pecking order theory applies to banks, equity issuance should be in the last order for external finance when the cost of issuing debt surpasses the cost of issuing equity. However, this explanation may not be valid because banks, unlike industrial firms, in addition to the access to the demand deposit market, also have easy access to the wholesale funding market, where they can raise financing for their prospect projects. The development of the secondary loan market has also made it easier for banks to finance their loans (Loutskina and Strahan, 2009). Different models of bank capital structure also suggest that bank equity capital is costly relative to deposits and bank debt (DeAngelo and Stulz, 2015; Allen et al., 2015). Given that banks are far from their required capital level, the cost of issuing debt/deposits will hardly be higher than the cost of issuing equity.

It is also possible that banks issue equity to achieve their optimal capital structure, as suggested by capital structure trade-off theory. If bank equity is a valid signal of quality, as indicated in Mehran and Thakor (2011), good-quality banks may use equity issuance as a signal in the separating equilibrium to differentiate themselves from low-quality banks. If achieving a certain level of equity (either target/optimal or a higher level, as a signal) is the sole reason for equity issuance, we should find that banks issue equity until the desired level is reached. However, from our data we find that banks who issue equity at the same time increase their deposits, and hence may deviate from the desired level. Table 1 shows that the natural logarithm of total deposits of SEO banks increases from 6.79 before the SEO to 7.21 after the SEO. This increase is significant and substantial given that the mean value for non-SEO banks is 6.86.

Similarly, it is also possible that banks issue equity to sell highly priced shares when stock market conditions permit (Loughran and Ritter, 1995, 1997; Baker and Wurgler, 2002; DeAngelo et al., 2010). However, this cannot explain why these SEO banks continue to increase deposits if selling overpriced equity is the main reason for the SEO. Hence, the market timing theory cannot explain why banks issue equity. In addition, Fig. 2 plots the parallel trend of the number of SEO banks and their runup from 1985 to 2015. It shows that the number of SEO banks peaks in three periods over the whole sample period, which are 1986, 1992–1994, and 2009–2013. Two of the peak periods are following the savings and loan crisis of the late 1980 s, and the Great Recession of 2007–09.[1] We find limited evidence that the number of SEO banks follows a similar trend with the stock runup, measured as the stock return over the window $(-60,-2)$ relative to the announcement date. More importantly, the graph shows that most of the time, banks issue SEO when their recent two months' stock runups are negative, which is evidence inconsistent with the market timing explanation.

In the following analysis, we provide evidence that banks issue equity for the purpose of assets expansion. An assets expansion oriented bank with the potential of increasing risk faces the risk of increased financing costs if leverage increases too quickly. By way of increasing equity capital in the early stage of assets expansion, banks can reduce the impact of market discipline.

3. Data and summary statistics

3.1. Data

We use a match between three databases: (i) bank SEO data from SDC Platinum's Global New Issues database (henceforth SDC), (ii) bank account data from Compustat, and (iii) bank demographic data from the Federal Reserve Bank of Chicago. We identify banks which have issued common equity during the period 1985 to 2013. We do not include pure secondary offers since the total equity level is not changed after the exchange of existing shares, and we also remove equity offers that have been withdrawn after their announcement.

We take steps to reduce the likelihood of poor-quality linkages by creating a "matched sample" upon which we perform all the analysis, together with the "SEO sample". First, in order to ensure a clean matching process and minimum bias from multiple equity issuances by the same bank, we exclude all banks that issued *multiple* SEOs over the sample period. This excluded "multiple SEO bank sample" is added back to the analysis in Section 4.7 to support the main results. The "matched sample" is hence chosen from the banks that never issued any form of equity over the entire sample period. Second, we consolidate multiple issuances of equity made by the same bank in the same year into the aggregate value as the total proceeds raised in that year.

[1] In the unreported figure, the ratio of the number of SEO banks as a portion of the total number of banks in the market shows a similar pattern.

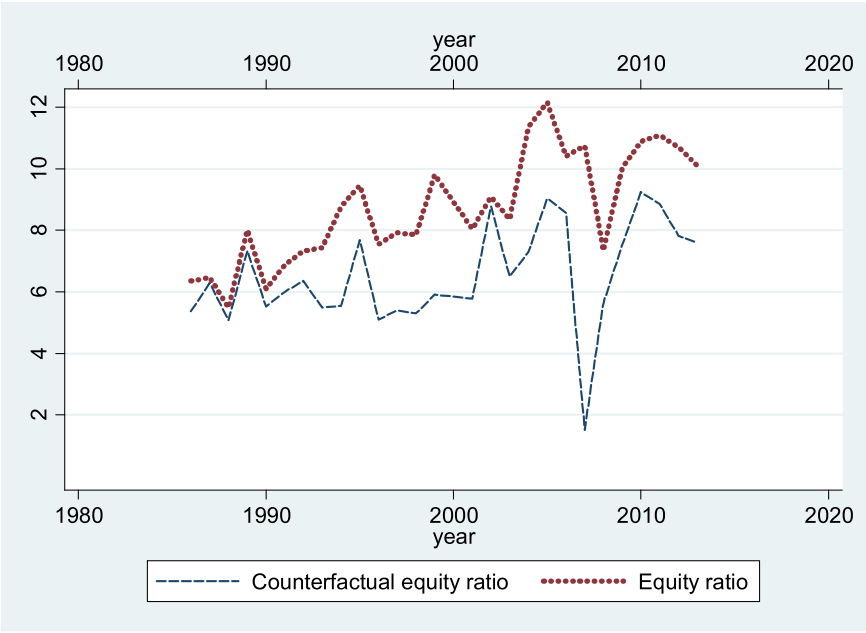

Fig. 1. The trend of SEO banks' equity ratio and the counterfactual equity ratio if no equity is issued. This figure plots the trend of *equity to assets ratio* for SEO banks and the counterfactual *equity to assets ratio*. The counterfactual *equity to assets ratio* is derived by deducting the equity raised from the *equity to assets ratio* in the post-SEO period.

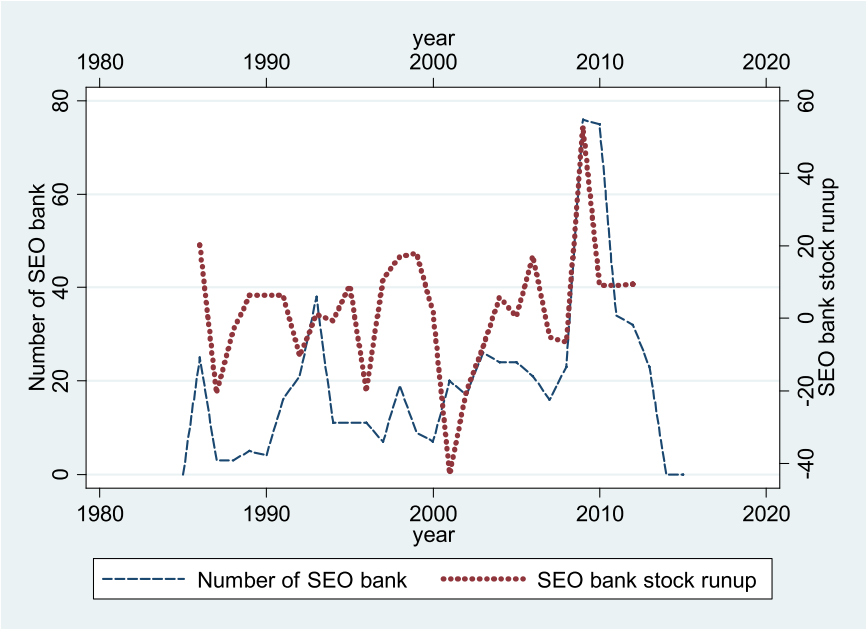

Fig. 2. Trend of number of SEO banks and their stock runup before the SEO. This figure plots the parallel trend of the number of SEO banks and their runup from 1985 to 2013 Stock runup is measured as the stock return over the window (−60,−2) relative to the SEO announcement date.

3.2. Summary statistics

Table 1 presents summary statistics for our main sample. We winsorize all the variables at the 1st and 99th percentiles, respectively, to reduce the impact of outliers in our regression analyses. The sample contains 2141 banks and 16,297 bank-year observations over the 1985 to 2015 period. There are 237 banks that issued equity during this period, while the rest did not issue common equity during the whole sample period. The average natural logarithm of bank total assets is 7.13 (corresponding to $1.3 billion). The banks are

moderately levered, with an average ratio of book equity to total assets of 9.58%, an average Tier 1 ratio of 11.84% and a market capital ratio of 12.66%.

Our empirical analysis separately considers banks which issued equity during the sample period (SEO banks) and banks which never issued common equity during the sample period (non-SEO banks), and also compares SEO banks before and after their SEOs. We therefore provide all summary statistics by subsample. We note that SEO banks increase their total assets from smaller than non-SEO banks before the SEO to larger than non-SEO banks after the SEO, and this increase seems to be driven by the increase in *Deposits* and *Long-term debt*. SEO banks (both before and after the SEO) have on average lower equity ratios than non-SEO banks, as found in all book and market capital ratios. Fig. 3 shows the trend of *Equity to assets ratio* for both SEO and non-SEO banks over the period 1986 to 2015. SEO banks have lower *Equity to assets ratio* than non-SEO banks for most of the time, except the mid-2000 s, when U.S. banks experienced a significant assets expansion period right before the 2007–09 financial crisis.

4. Empirical analysis

4.1. Identification strategy

Our identification strategy aims to identify the motivation for banks' SEO. The assets expansion theory emphasizes the role of bank SEO as an effective method of assets expansion. The most straightforward empirical strategy would exploit differences between SEO and non-SEO banks. We could define a treatment group as banks who issued equity during the sample period (only once) and a control group as banks who never issued equity during the sample period. We would then test whether our interested outcome variables of SEO banks change relative to non-SEO banks immediately after the SEO. Hence, in the first method, we estimate the following regression:

$$y_{it} = \alpha + \sum_{s=-2}^{-5} \delta_s Before_{it}^{s} + \sum_{s=0}^{5} \lambda_s After_{it}^{s} + \theta_t + \gamma_i + \epsilon_{it} \quad (1)$$

Where y is the bank level outcome variable in year t. α is the intercept of the regression. θ_t and γ_i are year and bank fixed effects[2]. $Before_{it}^{s}$ is a dummy variable equal to one if the bank issues equity and the observation is *s* years prior to the SEO, where s = 2, 3, 4, or 5 years, and $After_{it}^{s}$ is a dummy variable equal to one if the bank issues equity and the observation is *s* years after the SEO, where s = 0, 1, 2, 3, 4, or 5 years; t indexes years. As SEOs in our sample are spread over time, the specification also incorporates year dummies. This specification has been used previously by Bertrand and Mullianathan (2003), Schoar (2002), and Chemmanur et al. (2010), among others. All the data outside the five years before and after the SEO are dropped from the regressions. The coefficients of interest are δ_s and λ_s, which measure the change in outcome variables during the s years prior to and following the bank SEO in year T_i. These coefficients are measured relative to the omitted one year prior to bank SEO, a natural choice for base year. We double-cluster standard errors at the bank and year levels to allow for the correlation of error terms across banks and over time.[3]

One potential problem with Model (1) is that SEO banks may be fundamentally different from non-SEO banks, and the estimated changes in the outcome variables between the two groups following the SEO may reflect the unobservable trend of the two groups. We take one step further to address this issue.

We adopt two placebo-matched approaches to address this endogeneity problem. In the first placebo-matched approach, we match SEO banks (treatment group) with non-SEO banks (control group) using various main bank characteristics, including *logarithm of total assets*, *Equity to assets ratio* and *ROA*. We define a bank which has never issued equity during the whole sample period as a non-SEO bank. We match the banks based on the value one year before the SEO year and restrict the matching with the non-SEO banks in the same year. For each non-SEO bank, we create a placebo SEO date equal to their matched SEO bank SEO date (year t). We then compare the behaviour of SEO and non-SEO banks around year t. Hence, our estimator computes the changes in the outcome variables during the period [t-n, t + n] among SEO banks relative to non-SEO banks.

To further address the concern that the matched control group is still fundamentally different from the treated group, we adopt the second placebo-matched approach as used in Morrison et al. (2014), where we match banks who issued SEO in year t (treatment group) to banks who issued SEO in year t + n (control group). For each bank in the control group, we create a placebo SEO date equal to their actual SEO date minus n years. We then compare the behaviour of treatment and control groups around year t. Specifically, we study the n years before and after year t. During this period, banks in the treatment group experienced an SEO, but banks in the control group did not. Hence, our estimator computes the changes in the outcome variables during period [t-n, t + n] among treatment group banks relative to control group banks. The benefit of this placebo-matched approach is that all the banks used in the analysis are SEO banks at some point in time, which reduces the concern in the previous approaches that the SEO and non-SEO banks are fundamentally different.

Applying this placebo control strategy, we estimate the following model:

$$y_{it} = \alpha + \sum_{k=-s}^{s} \mu_k \bullet 1\{t - T_i = k\} + \sum_{k=-s}^{s} \delta_k SEO_i \bullet 1\{t - T_i = k\} + \theta_t + \gamma_i + \epsilon_{it} \quad (2)$$

[2] We acknowledge that bank level fixed effects have limitations to capture some within-bank variation across times as the driving force for both SEO decisions and assets growth (e.g., lending opportunities).

[3] We do not include control variables in the regression because any of the bank- or issue-specific variables may be influenced by the SEO decisions.

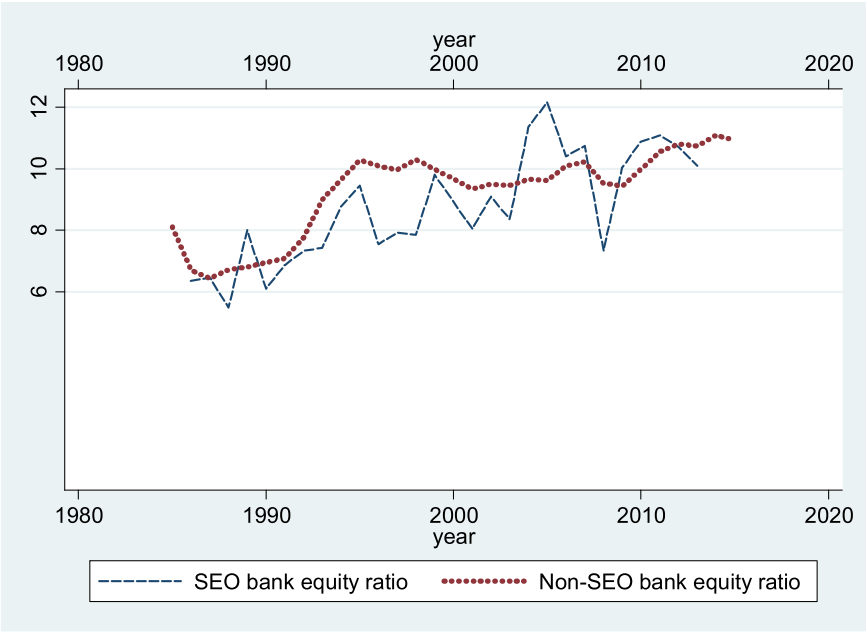

Fig. 3. The trend of bank equity ratios for SEO and non-SEO banks over the time period from 1985 to 2013.

Where y is the bank-level outcome variable in year t. α is the intercept of the regression. θ_t and γ_i are year and bank fixed effects. SEO_i is a dummy variable that equals one if bank i is a member of the treatment group (both treatment and control group issued an SEO; only the treatment group issued an SEO in the estimated window). The coefficients of interest are δ_k, which measure the change in the outcome variables among treatment group banks, relative to the control group, during the s periods before and after the SEO. Each δ_k measures the difference between treatment and control banks with respect to the change in the outcome variables in period s. These coefficients are measured relative to the omitted one year prior to bank SEO. Standard errors are double clustered at both bank and year levels. In the empirical analysis, we consider cases when n equals to 3, 4 or 5 years, and the results are robust.

One final note is that our identification strategy does not aim to investigate the impact of bank SEO on various outcome measures; rather, we explore the changes of SEO banks' outcome measure between the time periods around bank SEO relative to non-SEO banks to understand why banks issue equity.

4.2. *Do banks increase capital ratios and expand assets after SEO?*

We first examine the results on changes in bank capital ratios. Table 2 reports the results. The reported coefficients estimate the change in the differences between SEO and non-SEO banks' capital ratios during the five years preceding and following the SEO. The omitted year is the year prior to the SEO year. Compared with the year prior to the SEO, the coefficients of *Equity to assets ratio* on all the *Before* are statistically insignificant, while the coefficients on all *After* are positive and significant. These results suggest that relative to non-SEO banks, SEO banks increase their *Equity to assets ratio* after the SEO. These changes are also economically significant[4]. The increase in *Equity to assets ratio* from year − 1 to year 0 of the SEO is 1.048% points more than the changes of non-SEO banks during the same time. Similarly, the increase in Tier 1 and total capital ratios from year − 1 to year 0 of the SEO are 1.32% and 1.45% points more than the changes of non-SEO banks, respectively. The increase in Tier 2 capital ratio is not significant from year − 1 to year 0, but becomes significant from year 0 to year 1 onwards. A similar pattern is found in *market capital ratio*, where the increase from year − 1 to year 0 is 1.125% points higher than that of non-SEO banks. Fig. 4 presents estimates of specification (1) for different capital ratios. We observe that all capital ratios follow a similar trend, with a dramatic increase in the SEO year and a gradual decrease thereafter, except Tier 2 capital ratio, which follows a continually increasing trend over time.

We next examine the changes in total assets. To eliminate the effect that the total proceeds raised through SEO drives our results, we deduct it from the total assets for the post-SEO periods. We also deduct retained earnings from the total assets for the post-SEO periods

[4] For robustness tests, we include the SEO deal-fixed effects, which control for heterogeneity and any omitted variables across SEO deals because the recent research methods suggest the previously treated subjects may have an impact on the subsequently treated ones that in a difference-in-differences analysis involving multiple staggered events. Additionally, the post-event trends for treated groups can differ over time, leading to biased estimates (Callaway and Sant'Anna, 2021; Baker et al., 2022).

Table 2
Regression results on the characteristics of bank leverage and size around SEO.

	(1) Equity to assets ratio	(2) Tier 1 capital ratio	(3) Tier 2 capital ratio	(4) Total capital ratio	(5) Market leverage	(6) Log Total assets	(7) Log Deposits	(8) Log Current debt	(9) Log Long-term debt
Year 5 before SEO	0.150	0.223	-0.038	0.240	0.655	-0.105 * *	-0.107 * *	-0.536	-0.518
	(0.582)	(0.632)	(−0.192)	(0.635)	(0.951)	(−2.172)	(−2.406)	(−1.609)	(−1.209)
Year 4 before SEO	0.374	0.588	0.010	0.847 *	0.733	-0.098 * *	-0.106 * *	-0.466	-0.527 * *
	(1.407)	(1.572)	(0.036)	(1.945)	(1.337)	(−2.455)	(−2.730)	(−1.514)	(−2.065)
Year 3 before SEO	0.004	0.144	-0.055	0.155	0.311	-0.078 * *	-0.087 * **	-0.353	-0.375
	(0.021)	(0.458)	(−0.211)	(0.448)	(0.817)	(−2.511)	(−2.868)	(−1.462)	(−1.433)
Year 2 before SEO	0.453	0.594	0.130	0.958 *	0.357	-0.076 * *	-0.085 * *	-0.156	-0.117
	(1.659)	(1.495)	(0.494)	(1.874)	(0.948)	(−2.558)	(−2.709)	(−0.969)	(−0.435)
Year of SEO	1.048 * **	1.320 * **	0.129	1.451 * **	1.125 * **	0.065 * *	0.083 * **	-0.077	0.241
	(11.039)	(11.134)	(1.325)	(9.461)	(3.774)	(2.623)	(3.302)	(−0.367)	(1.433)
Year 1 after SEO	0.989 * **	1.110 * **	0.241 *	1.276 * **	0.844 * *	0.093 * **	0.103 * **	-0.412	0.232
	(5.086)	(4.292)	(1.991)	(3.827)	(2.357)	(3.552)	(4.070)	(−1.222)	(0.922)
Year 2 after SEO	0.590 * **	0.537 *	0.257	0.751 * *	0.647	0.131 * **	0.159 * **	-0.460 * *	0.144
	(3.152)	(2.008)	(1.538)	(2.118)	(1.401)	(3.683)	(4.573)	(−2.108)	(0.506)
Year 3 after SEO	0.377 *	0.359	0.449 *	0.809 *	0.560	0.141 * **	0.171 * **	-0.372	0.323
	(1.705)	(1.098)	(2.047)	(1.822)	(1.389)	(3.378)	(4.281)	(−1.223)	(1.078)
Year 4 after SEO	0.529 *	0.388	0.575 * *	1.042 * *	0.833	0.127 * **	0.160 * **	-0.829 * *	0.209
	(1.770)	(1.110)	(2.217)	(2.424)	(1.718)	(2.809)	(3.645)	(−2.308)	(0.692)
Year 5 after SEO	0.624 *	0.410	0.541 *	1.016 *	0.940	0.134 * **	0.185 * **	-0.968 * **	-0.144
	(1.719)	(0.825)	(1.905)	(1.762)	(1.660)	(3.060)	(4.402)	(−3.536)	(−0.426)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	16297	14008	13979	14146	10131	16297	16297	16297	16297
R^2	0.640	0.615	0.809	0.679	0.689	0.972	0.964	0.661	0.712

This table presents the regressions (Model 1) of bank leverage ratio and assets before and after SEO. The sample includes all bank year observations between 1985 to 2013. Equity to assets ratio is calculated as book equity divided by total assets. The Tier 1 capital ratio is determined by the Risk-Adjusted Capital Ratio - Tier 1. Similarly, the Tier 2 capital ratio is calculated as the Risk-Adjusted Capital Ratio - Tier 2, and the Total capital ratio is determined by the Risk-Adjusted Capital Ratio. The Market leverage ratio is computed by dividing the market value by total assets. All of these ratios are then multiplied by 100. Log Total assets represents the natural logarithm of the total assets, while Log Deposits is the natural logarithm of the total deposits. Log Current debt is the natural logarithm of the current debt, and Log Long-term debt is the natural logarithm of long-term debt. All the Before and After variables are dummy variables. Before equals one for s (from −5 to −2) years before the bank SEO, and zero otherwise. After equals one for s (from 0 to 5) years after the bank SEO, and zero otherwise. All the regressions are ordinary least square regressions with bank and year fixed effects. T-statistics are in parentheses and standard errors are double-clustered at the bank and year levels. * , * * and * ** indicate statistical significance at the 10%, 5% and 1% level, respectively.

to avoid the confounding effect that the bank's profit and hence retained earnings may increase after a bank's SEO. The coefficients of *Log Assets* on all *Before* are negative and significant, while the coefficients on all *After* are positive and significant. This implies that the assets of SEO banks grow more over the years around the SEO compared with their non-SEO peers.

We then examine the detailed changes in the liability structure to investigate which component of bank liability drives our results. We find that the coefficients of *Log Deposits* on all *Before* are negative and significant, while the coefficients on all *After* are positive and significant. The coefficients of *Log Current debt* on all *Before* are insignificant, while the coefficients on two, four and five years after SEO are negative and significant. We do not observe significant changes in *Log Long-term debt* in both *Before* and *After* periods. These results suggest that the increase in deposits around the SEO is the driving force for the increase in bank total assets. Fig. 5 presents the estimates of specification (1) for *Log Assets* and *Log Deposits*, where we find both assets and deposits follow a rather similar trend over time, with a sharp increase in the SEO year. We also find that SEO banks mainly rely on deposit for assets expansion rather than

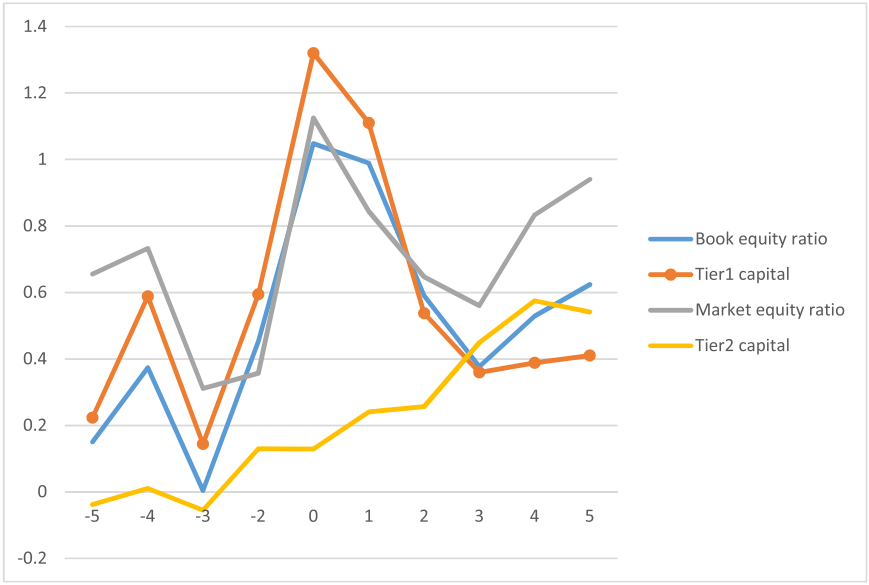

Fig. 4. Trend of SEO banks' capital ratios around SEO. This figure plots the coefficients of all *Before* and *After* dummy variables in Model (1) for various bank capital ratios, including *equity to assets ratio*, *Tier 1* and *Tier 2 capital ratios*, and *Market leverage ratio*.

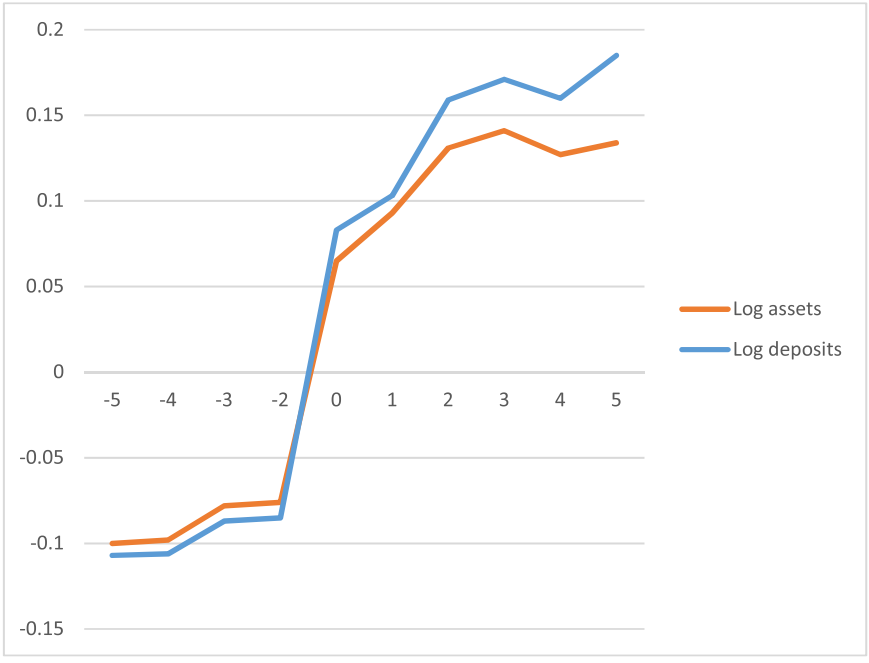

Fig. 5. Trend of SEO banks' total assets and deposits around SEO. This figure plots the coefficients of all *Before* and *After* dummy variables in Model (1) for banks' *Log total assets* and *Log total deposits*.

wholesale funding. This may be because deposits, and retail deposits in particular, are cheaper in terms of funding costs (Berlin and Mester, 1999). It may also be because these SEO banks are risk-minded, and avoid using riskier wholesale funding (Cornett et al., 2011; De Haas and Van Lelyveld, 2014) as the main source of assets expansion.

4.3. Endogeneity: are the results driven by the increase in deposits from the market demand before the SEO?

In the previous section we find that SEO banks experience an increase in capital ratios and total assets around the SEO year more than non-SEO banks, and the increase in total assets is mainly driven by the increase in total deposits. We argue that this is because

Table 3
Bank total deposits around bank SEO and the impact of the 1994 Interstate Banking and Branching Efficiency Act (IBBEA).

	Log Deposits
Year 5 before SEO	-0.475 * *
	(−2.427)
Year 4 before SEO	-0.459 * *
	(−2.261)
Year 3 before SEO	-0.120
	(−1.000)
Year 2 before SEO	-0.027
	(−0.231)
Year of SEO	0.129 *
	(2.226)
Year 1 after SEO	0.130
	(1.478)
Year 2 after SEO	0.277 * *
	(2.675)
Year 3 after SEO	0.251 * **
	(3.509)
Year 4 after SEO	0.327 * **
	(3.760)
Year 5 after SEO	0.333 * **
	(3.259)
IBBEA index	0.009
	(1.104)
IBBEA*Year 5 before SEO	0.031
	(0.620)
IBBEA*Year 4 before SEO	0.024
	(0.446)
IBBEA*Year 3 before SEO	-0.053
	(−1.301)
IBBEA*Year 2 before SEO	-0.048
	(−1.246)
IBBEA*Year of SEO	-0.003
	(−0.134)
IBBEA*Year 1 after SEO	-0.000
	(−0.002)
IBBEA*Year 2 after SEO	-0.028
	(−1.130)
IBBEA*Year 3 after SEO	-0.032
	(−1.624)
IBBEA*Year 4 after SEO	-0.052 *
	(−2.123)
IBBEA*Year 5 after SEO	-0.052 *
	(−1.816)
Time fixed effects	Yes
Bank fixed effects	Yes
Number of obs.	6813
R^2	0.979

This table presents the regressions (Model 1) of the natural logarithm of bank deposits before and after SEO and the impact of the 1994 Interstate Banking and Branching Efficiency Act (IBBEA) on these changes. The sample includes all bank year observations between 1985 to 2013. Log Deposits is the natural logarithm of the total deposits. All the Before and After variables are dummy variables. Before equals 1 for s (from −5 to −2) years before the bank SEO, and 0 otherwise. After equals 1 for s (from 0 to 5) years after the bank SEO, and 0 otherwise. All the regressions are ordinary least square regressions with bank and year fixed effects. T-statistics are in parentheses and standard errors are double-clustered at the bank and year levels. * , * * and * ** indicate statistical significance at the 10%, 5% and 1% level, respectively.

banks strategically use the SEO as a means of assets expansion, where they strategically improve the practice of customer services and provide competitive prices in deposit products to attract more deposits, while at the same time issue equity to balance out the increased leverage.

One alternative explanation, however, can also help explain why bank deposits increase after an SEO. It is possible that some strategic changes in customer services, bank culture, etc., happened before a bank's SEO, and these changes have a positive impact on a

Table 4
Bank SEO and local economic conditions.

	(1)	(2)
	SEO	SEO
Log GDP	0.031	
	(0.683)	
GDP growt%		-0.000
		(−1.273)
Log Total assets	0.224 * **	0.225 * **
	(7.419)	(7.457)
Equity to assets ratio%	0.002 * **	0.002 * *
	(2.585)	(2.487)
Non-interest income/Total operating income%	0.004	0.004
	(1.538)	(1.450)
ROA%	-0.058 * **	-0.055 * *
	(−2.643)	(−2.550)
Loan loss provisions/assets%	-0.054	-0.050
	(−1.447)	(−1.347)
Deposits/assets%	0.014 * **	0.014 * **
	(3.646)	(3.692)
Constant	-3.533 * **	-3.260 * **
	(−6.418)	(−8.354)
Number of obs.	10421	9784
R^2	0.02	0.01

This table presents the probit model regression results on the relationship between the probability of bank SEO and local economic conditions. Log GDP refers to the natural logarithm of the Gross Domestic Product (GDP). GDP growth is determined by the rate at which a country's GDP changes over a year. T-statistics are in parentheses and standard errors are clustered at the bank level. * , * * and * ** indicate statistical significance at the 10%, 5% and 1% level, respectively.

bank's prospects, thus allowing it to attract more deposits from investors. The increased deposits lead to increased bank leverage, and then induce the bank to issue more equity to balance the capital ratio. From this point of view, bank SEO is a consequence of an increase in deposits (demand-side effect) rather than a strategy decision for assets expansion.

Our identification strategy allows us to differentiate the unobserved homogenous demand-side variables that affect SEO and non-SEO banks in a given bank year in the same way, while singling out the effect of SEO relative to non-SEO. However, our identification strategy does not allow us to disentangle the heterogeneous demand-side effects proposed by this alternative explanation, especially those factors leading to an increase in deposit supply for banks before and after their SEOs.

In order to empirically disentangle our asset expansion explanation from this demand-side effect, we conduct three analyses. First, we argue that bank competition can reduce the impact of bank SEO on the increased deposits. If the relationship between deposits and the decision of SEO is driven from the demand side (deposit increase pre-SEO), we would expect to see that this relationship will be reduced immediately after the increase in bank competition, where deposits are diversified away by more banks. However, if this positive relationship is driven from the bank's strategic decision for assets expansion, we would then expect to see a delayed mitigation impact from the increase in bank competition, because the SEO temporarily increases the bank's competitiveness in the market. We consider the time periods around the introduction of the Interstate Banking and Branching Efficiency Act (IBBEA) in 1994, which relaxed geographical restrictions to bank expansion across state borders. This relaxation enhances competition by enabling banks to enter into new markets in other states, thereby allowing them to compete with banks in the local market (DeYoung, 2010; Rice and Strahan, 2010). We estimate the following model:

$$y_{it} = \alpha + \sum_{s=-2}^{-5} \delta_s Before_{it}^s + \sum_{s=0}^{5} \lambda_s After_{it}^s + \sum_{s=-2}^{-5} \beta_s Before_{it}^s * IBBEA + \sum_{s=0}^{5} \gamma_s After_{it}^s * IBBEA + \theta_t + \gamma_i + \epsilon_{it} \quad (3)$$

Model (3) is an extension of Model (1), where we add the interaction terms between the *Before* and *After* dummy variables with the IBBEA restriction index, which decreases with the extent of interstate branching deregulation restrictions in a state, or increases with an increase in bank competition (Rice and Strahan, 2010). We only consider the deposits as the outcome variable in y_{it}. The coefficients of interest are β_s and γ_s, which measure the sensitivity of the change in deposits during the periods s prior to and following the bank SEO in year T_i if the level of bank competition varies. We consider a short window around the introduction of IBBEA from 1991 to 2001 to reduce the biases by other confounding effects if a longer time window is used.

Table 3 reports the results. We find that only the coefficients of the interaction between IBBEA restriction index and four and five years after SEO dummies are significant and negative, while all other coefficients of the interaction terms are statistically insignificant. These results support our view that a bank's strategy on assets expansion through SEO changes the market's equilibrium and delays the impact of bank competition on deposits. This effect only appears in four and five years after the SEO.

Second, if it is the increase in deposit supply for banks which drives a bank's SEO decision, we would expect that stronger deposit supply would lead to more bank SEOs during the economic boom period. We assume that bank deposits grow in line with the size of the local economy, and estimate the probability of bank SEOs against local GDP and GDP growth in each bank headquarters' state,

controlling for other bank characteristics which may influence banks' SEO decisions. We bring back those banks which issued more than one SEO during the sample period to provide a more complete analysis. We obtain local GDP and GDP growth data from the Bureau of Economic Analysis (U.S. Department of Commerce). Table 4 reports the results. We find that neither *Log GDP* nor *GDP growth* has a significant impact on the likelihood of bank SEO.[5]

Third, if it is the increase in deposit supply for banks that explains our main results, we would expect an unequal deposit supply increase across bank branches located in different states before the bank's SEO. This is because demand shocks to bank deposits are more likely to be caused by local economic conditions than bank-specific characteristics. Even it is the latter, local response to the bank-specific shock may still vary across regions. On the contrary, following the assets expansion explanation, we would expect that the policy to attract more deposits would be applied across all branches of the SEO bank. One prediction of this reasoning is that the deposits of all branches would increase more proportionally, and the bank's deposit concentration across branches in different states would consequently decrease. Column (2) of Table 5 reports the results. We find that SEO banks' deposits concentration (HHI) across states decreased more around the SEO year relative to their non-SEO peers, and this evidence is consistent with our assets expansion explanation.

Overall, we find limited evidence that banks issue equity because of demand increase in deposits before the SEO.[6] [7].

4.4. Endogeneity: are the results driven by the increase in deposits from the market demand immediately after the SEO?

This section addresses the second alternative explanation of our main results of SEO banks' increases in assets/deposits after the SEO relative to non-SEO banks. It is possible that the market responds positively to a bank SEO because the increase in equity by the SEO banks sends the market a strong signal that the bank has more "skin in the game", and the demand for the bank's deposit product increases. This effect can also be instantaneous. We conduct two empirical analyses to address this concern.

First, if a strong deposit supply after the SEO does lead to an increase in deposits and assets, we would not expect to observe an increased interest expense on deposits, because the banks would have little incentive to increase deposit rates to attract more depositors if the deposit supply is already strong. However, we find the opposite result. Column (1) of Table 5 shows that, relative to non-SEO banks, SEO banks' interests to deposits ratio increases one year after the SEO. If the competitive deposit rate policy is introduced in the SEO year, it is plausible to see results reflected one year after the SEO. The finding that only the coefficient of one year after the SEO is positive and significant may suggest that the policy to attract deposits is rather temporary. It is not surprising to see many banks offering one-off cash payment to encourage customers to switch banks. We believe this result is consistent with our view that SEO banks increase the yield of deposits to attract more investors as a part of their assets expansion strategy after an SEO. This result is also inconsistent with the alternative explanation discussed in the previous section that it is the deposit supply trend before the SEO that leads to banks' SEO decisions.

Second, if the increase in deposits is a market response to the bank's SEO as a positive signal, we would not expect the bank to make significant changes to their branch structure to meet the deposit supply. On the contrary, we would expect SEO banks to open more branches or slower down the branch shuttering process as a method of to attract more deposits if it is a strategic decision on assets expansion[8]. Column (3) of Table 5 reports the results with the *logarithm of (number of branches* +1) being the dependent variable. We find that the coefficients on the two years, and the year, before the SEO are negative and significant, while the coefficients on the two years after the SEO are positive and significant. All other coefficients are insignificant. These results suggest that SEO banks tend to have fewer branches than their non-SEO peers in the pre-SEO period, but the difference is reduced and even reversed after the SEO. The economic change is also significant. By considering both the negative coefficient two years before the SEO and the positive coefficient two years after the SEO, the SEO bank will have around 17% more branches than non-SEO banks during the five-year period around the SEO year. This evidence supports our main argument that the bank's strategy is to attract more deposits through the method the SEO.

4.5. Heterogeneity among banks' strategic decisions on bank SEO

We consider the heterogeneity among banks' strategic decisions on issuing equity in this section. First, a potential concern with our analysis is that our sample of SEO banks may be biased toward early-stage banks, which, according to life-cycle theory, are more likely to issue equity for growth, and thus our results may not be generalizable to more established banks. Second, a poorly capitalized bank

[5] In robustness tests, we use a weighted average of a bank's economic exposure as a measure for local economic conditions, with the weighting determined by the volume of deposits at each bank branch at the headquarters to total deposits. Overall, we find that the weighted average of economic exposure at bank level has no significant impact on the likelihood of bank SEO, consistent with the use of local GDP and GDP growth.

[6] In an unreported analysis, we further control for state-level variation in exposure to bank's opportunities to issue SEOs to rule out the local demand effects. This would imply that state-level changes in the financial environment can potentially explain a bank's need to issue equity. We test this explanation by including a complete set of time dummies for each state in our main regression Eq. (1), i.,e, state-year fixed effects, which controls for any variation in the financial and macro-economic environment that affects all banks within a state. Our main results hold.

[7] To address the concern of deposit growth before the SEO, in our robustness tests, we divide the total sample into two groups: SEO banks with pre-SEO deposit growth and those without. Our results do not reveal any evidence that pre-SEO deposit growth significantly affects changes in balance sheet components, indicating it is not a concern for us.

[8] An article published in the Wall Street Journal on February 5, 2018 reports that banks in the U.S. are shuttering branches in fastest decline on record in decades.

Table 5
Regression results on the interest paid to depositors, deposit concentration HHI and number of bank branches around SEO.

	(1) Interest paid / deposits	(2) Deposit HHI	(3) Log (number of branches + 1)
Year 5 before SEO	0.011	-0.020	-0.033
	(0.183)	(−0.962)	(−0.625)
Year 4 before SEO	0.069	-0.007	-0.061
	(1.125)	(−0.461)	(−1.470)
Year 3 before SEO	0.016	0.003	-0.065 *
	(0.277)	(0.239)	(−1.775)
Year 2 before SEO	0.071	0.023	-0.065 *
	(1.015)	(1.386)	(−1.729)
Year of SEO	0.014	-0.020	0.007
	(0.493)	(−1.586)	(0.247)
Year 1 after SEO	0.091 * *	-0.037 * *	0.047
	(2.449)	(−2.097)	(1.215)
Year 2 after SEO	0.068	-0.049 * *	0.100 * *
	(1.376)	(−2.553)	(2.058)
Year 3 after SEO	0.111	-0.047 * *	0.067
	(1.698)	(−2.256)	(1.170)
Year 4 after SEO	0.112	-0.050 *	0.073
	(1.544)	(−1.962)	(0.806)
Year 5 after SEO	0.086	-0.064 *	0.165
	(0.897)	(−1.732)	(1.290)
Time fixed effects	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes
Number of obs.	8056	4820	4820
R^2	0.893	0.892	0.920

This table presents the regressions (Model 1) of bank interest paid over deposits, Deposit HHI and Log(number of branches +1) before and after SEO. Interest paid/deposits refers to the interest paid divided by total deposits and multiplied by 100. Deposit HHI is the Herfindahl- Hirschman Index, a measure of the market concentration of deposits, calculated as the sum of the squares of the market shares (considering deposits) of each bank (i) in a determined year (t). Log (number of branches + 1) is the natural logarithm of the number of branches plus one. The sample includes all bank year observations between 1985 to 2013. All the Before and After variables are dummy variables. Before equals 1 for s (from −5 to −2) years before the bank SEO, and 0 otherwise. After equals 1 for s (from 0 to 5) years after the bank SEO, and 0 otherwise. All the regressions are ordinary least square regressions with bank and year fixed effects. T-statistics are in parentheses and standard errors are double-clustered at the bank and year levels. * , * * and * ** indicate statistical significance at the 10%, 5% and 1% level, respectively.

may focus on capital increase rather than assets expansion. Third, a bank which issued equity during the 2007–09 global financial crisis period may target their capital structure and are less likely to pursue SEO as an assets expansion strategy.

To address these concerns, we create three dummy variables. The first is *Young*, which equals one if the SEO bank's age is below the median age of the whole sample, which is 14 years old, at the time when the equity is issued, and zero otherwise. The second is *Poorly_capitalized*, which equals one if the bank is in the first quartile of the distribution of *Equity to assets ratio* at the time when the equity is issued, and zero otherwise. The third is *Financial crisis*, which is one if the bank's SEO is during the global financial crisis period from 2007 to 2009, and zero otherwise. All three dummies are defined such that they are time-invariant across the whole sample and hence they are dropped from the regressions below. We follow Model (4) but replace *Dummy* with the three dummy variables, respectively.

$$y_{it} = \alpha + \sum_{s=-2}^{-5} \delta_s Before_{it}^s + \sum_{s=0}^{5} \lambda_s After_{it}^s + \sum_{s=-2}^{-5} \beta_s Before_{it}^s * Dummy + \sum_{s=0}^{5} \gamma_s After_{it}^s * Dummy + \theta_t + \gamma_i + \epsilon_{it} \quad (4)$$

Model (4) is also an extension of Model (1), where we add the interaction terms between the *Before* and *After* dummy variables with *Dummy*. The coefficients of interest are β_s and γ_s, which measure the sensitivity of the change in outcome variables during the periods s prior to and following the bank's SEO in year T_i for banks that are younger, more poorly capitalized and which issued equity during the financial crisis period, compared to their peers.

Table 6 reports the results. In Columns 1 to 3, we examine the differences between banks which issue equity in the early and later-stage of their existence. We do not find evidence that their Equity to assets ratio is statistically significantly different around the SEO year. However, we find that the coefficients of the interaction between *Young* and one to four years *After* SEO dummies are significant and positive in the *Log Total assets* regression, while all other coefficients of the interaction terms are statistically insignificant. These results suggest that the assets expansion pattern after the SEO is stronger for banks which issue equity when they are in the early stage of their lifespan. The main results for those more established banks still hold, although the coefficients in the *after* dummies are less statistically significant than those reported in Table 2. A similar pattern is found for *Log Deposits*.

In Columns 4 to 6, we examine the difference between banks with poor capitalization and their better capitalized counterparts. In Column 4 we find that the coefficient of the interaction between *Poorly-capitalized* and *year of SEO* dummy is significant and negative (−0.829). Combining the magnitude of the coefficient of *year of SEO* dummy of 1.14 suggests that poorly capitalized banks have significantly less of an increase in *Equity to assets ratio* than their better capitalized banks, but it is still an increase relative to non-SEO

Table 6
Bank SEO strategy: Heterogeneity.

	Young			Poorly-Caplitalized			Financial crisis		
	(1) Equity to assets ratio	(2) Log Total assets	(3) Log Deposits	(4) Equity to assets ratio	(5) Log Total assets	(6) Log Deposits	(7) Equity to assets ratio	(8) Log Total assets	(9) Log Deposits
Year 5 before SEO	-0.064	-0.104 *	-0.105 *	0.076	-0.080 *	-0.080 *	0.221	-0.113 *	-0.106 *
	(−0.228)	(−1.951)	(−2.039)	(0.306)	(−1.778)	(−1.899)	(0.667)	(−1.855)	(−1.827)
Year 4 before SEO	0.101	-0.099 *	-0.100 *	0.378	-0.084 * *	-0.091 * *	0.598 *	-0.101 *	-0.102 * *
	(0.321)	(−1.974)	(−2.040)	(1.353)	(−2.182)	(−2.590)	(1.780)	(−1.948)	(−2.069)
Year 3 before SEO	-0.140	-0.046	-0.051	0.077	-0.054 *	-0.063 * *	0.280	-0.072 * *	-0.075 * *
	(−0.546)	(−1.338)	(−1.451)	(0.337)	(−1.949)	(−2.341)	(1.191)	(−2.050)	(−2.149)
Year 2 before SEO	-0.074	-0.028	-0.026	0.512	-0.062 *	-0.071 * *	0.786 * **	-0.081 * *	-0.090 * **
	(−0.226)	(−1.298)	(−1.111)	(1.634)	(−1.980)	(−2.283)	(2.883)	(−2.469)	(−2.775)
Year of SEO	0.888 * **	0.033	0.042	1.140 * **	0.073 * **	0.089 * **	0.939 * **	0.080 * **	0.091 * **
	(6.148)	(1.294)	(1.435)	(10.804)	(4.213)	(5.267)	(5.462)	(3.724)	(4.315)
Year 1 after SEO	0.839 * **	0.071 *	0.085 *	1.044 * **	0.120 * **	0.129 * **	0.750 * **	0.110 * **	0.113 * **
	(2.920)	(1.790)	(2.004)	(5.128)	(4.421)	(4.477)	(3.155)	(3.592)	(3.663)
Year 2 after SEO	0.635 *	0.069 *	0.089 *	0.621 * **	0.154 * **	0.177 * **	0.334	0.160 * **	0.178 * **
	(2.045)	(1.742)	(1.975)	(3.070)	(4.410)	(5.369)	(1.271)	(4.095)	(4.702)
Year 3 after SEO	0.705 *	0.063	0.082	0.381	0.170 * **	0.194 * **	0.216	0.170 * **	0.185 * **
	(1.719)	(1.299)	(1.681)	(1.499)	(3.926)	(4.710)	(0.816)	(3.660)	(4.087)
Year 4 after SEO	0.592	0.038	0.058	0.533	0.157 * **	0.185 * **	0.383	0.162 * **	0.180 * **
	(1.304)	(0.727)	(1.103)	(1.664)	(3.353)	(4.046)	(1.022)	(3.075)	(3.433)
Year 5 after SEO	0.752	0.066	0.094 *	0.517	0.160 * **	0.209 * **	0.386	0.175 * **	0.206 * **
	(1.533)	(1.159)	(1.721)	(1.376)	(3.236)	(4.548)	(0.813)	(3.438)	(4.075)
Dummy*Year 5 before SEO	-0.057	-0.047	-0.040	1.768 * **	-0.063	-0.064	-0.043	0.098	0.075
	(−0.136)	(−0.708)	(−0.616)	(3.438)	(−0.278)	(−0.329)	(−0.095)	(1.559)	(1.219)
Dummy*Year 4 before SEO	0.589	-0.024	-0.040	0.683	0.030	0.046	-0.583	0.070	0.057
	(1.060)	(−0.374)	(−0.631)	(1.466)	(0.203)	(0.322)	(−1.206)	(1.285)	(1.098)
Dummy*Year 3 before SEO	0.429	-0.044	-0.050	0.478	0.007	0.014	-0.596	0.066	0.049
	(1.292)	(−0.804)	(−0.924)	(1.213)	(0.048)	(0.099)	(−1.300)	(1.661)	(1.200)
Dummy*Year 2 before SEO	0.251	-0.031	-0.040	-0.199	-0.030	-0.001	-1.133 * **	0.063 *	0.075 * *
	(1.003)	(−0.966)	(−1.362)	(−0.404)	(−0.262)	(−0.005)	(−3.497)	(1.822)	(2.250)
Dummy*Year of SEO	0.170	0.049	0.050	-0.829 * *	-0.051	-0.042	0.405	-0.034	-0.010
	(0.995)	(1.506)	(1.427)	(−2.432)	(−0.679)	(−0.551)	(1.069)	(−0.808)	(−0.296)
Dummy*Year 1 after SEO	0.083	0.092 *	0.077	-0.481	-0.157 *	-0.143 *	1.058 * **	0.000	0.027
	(0.255)	(1.919)	(1.548)	(−1.020)	(−1.859)	(−1.743)	(2.828)	(0.001)	(0.523)
Dummy*Year 2 after SEO	-0.202	0.139 * *	0.125 * *	-0.107	-0.172 *	-0.139	1.216 *	-0.099 * *	-0.062
	(−0.628)	(2.375)	(2.141)	(−0.239)	(−1.952)	(−1.630)	(1.976)	(−2.144)	(−1.441)
Dummy*Year 3 after SEO	-0.724	0.152 * *	0.137 * *	0.430	-0.193	-0.172	0.839 * *	-0.073	-0.028
	(−1.692)	(2.218)	(2.093)	(0.827)	(−1.696)	(−1.620)	(2.170)	(−1.220)	(−0.501)
Dummy*Year 4 after SEO	-0.307	0.160 * *	0.143 *	0.412	-0.173	-0.153	0.680	-0.069	-0.029
	(−0.734)	(2.063)	(1.934)	(0.892)	(−1.233)	(−1.158)	(1.505)	(−1.021)	(−0.439)
Dummy*Year 5 after SEO	-0.408	0.112	0.104	1.072 * *	-0.214	-0.208	0.837	-0.111 *	-0.050
	(−0.839)	(1.531)	(1.452)	(2.082)	(−1.375)	(−1.617)	(1.568)	(−1.762)	(−0.815)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	9126	9135	9127	16573	16712	16573	16573	16712	16573
R^2	0.585	0.964	0.961	0.642	0.974	0.968	0.642	0.974	0.968

This table presents the regressions (Model 4) of bank leverage ratio and assets before and after SEO. The sample includes all bank year observations between 1985 to 2013. Equity to assets ratio is calculated as book equity divided by total assets. The Tier 1 capital ratio is determined by the Risk-Adjusted Capital Ratio - Tier 1. Similarly, the Tier 2 capital ratio is calculated as the Risk-Adjusted Capital Ratio - Tier 2, and the Total capital ratio is determined by the Risk-Adjusted Capital Ratio. The Market leverage ratio is computed by dividing the market value by total assets. All of these ratios

are then multiplied by 100. Log Total assets represents the natural logarithm of the total assets, while Log Deposits is the natural logarithm of the total deposits. Log Current debt is the natural logarithm of the current debt, and Log Long-term debt is the natural logarithm of long-term debt. All the Before and After variables are dummy variables. Before equals 1 for s (from −5 to −2) years before the bank SEO, and 0 otherwise. After equals 1 for s (from 0 to 5) years after the bank SEO, and 0 otherwise. Young equals one if the SEO bank's age is below the median age of the whole sample, which is 14 years old, at the time when the equity is issued, and zero otherwise. Poorly_capitalized equals one if the bank is the first decile of the distribution of Total Equity ratio at the time when the equity is issued, and zero otherwise. Financial crisis equals one if the bank's SEO is during the global financial crisis period from 2007 to 2009, and zero otherwise. Dummy represents the above three dummy variables in their respective set of regressions. All the regressions are ordinary least square regressions with bank and year fixed effects. T-statistics are in parentheses and standard errors are double -clustered at the bank and year levels. * , * * and * ** indicate statistical significance at the 10%, 5% and 1% level, respectively.

banks. In Columns 5 and 6 we find that the coefficients of the interaction between *Poorly-capitalized* and *After* SEO dummies are significant and negative, indicating that poorly capitalized banks focus much less on assets expansion than their better capitalized peers. By combining the coefficients of *After* SEO dummies, we do not find the increase in total assets (deposits) is significant for poorly capitalized banks relative to non-SEO banks. These results are consistent with the expectation that poorly capitalized banks have high equity issuance costs and hence only issue equity to the target level and have fewer incentives to grow.

In Columns 7 to 9, we examine the difference between banks which issue equity during the 2007–09 global financial crisis period and banks which issue equity outside the crisis period. We find the coefficients of the interaction between *Financial crisis* and one to three years *after* SEO dummies are significant and positive, and the magnitude of the coefficients suggests that banks which issue equity during the 2007–09 global financial crisis period have on average around one percent more increase in *Equity to assets ratio* than banks which issue equity outside the crisis period. The trend of total assets and deposits show a similar pattern between these two sets of banks, although banks which issue equity during the 2007–09 global financial crisis period tend to grow slightly less (0.1%) than their peers in total assets.

Overall, in this section we find that, relative to their peers, banks of early stages of lifespan focus more on assets expansion, banks with poor capitalization have less incentive to expand their assets, and banks which issued equity during the 2007–09 global financial crisis period focus more on increasing their capital ratios. Our main results in the previous sections still hold after considering these heterogeneities among banks.

4.6. Placebo-control specifications

Our methodology so far compares SEO banks with non-SEO banks. One may argue that SEO banks may be fundamentally different from non-SEO banks, and the estimated changes in the outcome variables between the two groups following the SEO may reflect the unobservable trend of the two groups. In this section, we use two placebo-matched approaches to mitigate this potential endogeneity problem. In the first approach, we match an SEO bank with a non-SEO bank based on total assets and equity ratio, and restrict the matching in the same year. For each non-SEO bank, we create a placebo SEO date equal to their matched SEO bank SEO date (year t). In the second approach, we match banks who issued SEO in year t (treatment group) to banks that issued SEO in year t + n (control group). For each bank in the control group, we create a placebo SEO date equal to their actual SEO date minus n years. We report the results when n equals 4, while the results are robust if we change n to 3 and 5.

The results are reported in Tables 7 and 8 for the two placebo-matched sample analyses, respectively. The coefficients of interest are the interactions between the SEO bank dummy and the year dummies around the SEO. The results are comparable to those reported in Table 3 and confirm the main findings: SEO banks' assets and capital ratios increase more than non-SEO banks after the SEO year, and the increase in assets comes mainly from the increase in deposits. One noticeable difference is found in Table 8 in the *Log Long-term debt* specification, where we find significant and positive coefficients for the interaction between SEO bank dummy and one, two and three years after the SEO, while the coefficients for the interaction between SEO bank dummy and all the *Before* dummies remain statistically insignificant. These results suggest that SEO banks increase long-term debt more than non-SEO banks in the post-SEO period, confirming our assets expansion explanation. These results provide further support to the view that SEO banks' assets expansion is a strategic decision, but not a consequence of increasing demand of deposits before or after the SEO event.

4.7. Are the results biased by omitting the frequent SEO issuing banks?

Our analysis so far is based on comparing banks which issued SEO only once during the whole sample period with non-SEO banks to examine the clean effect of bank SEO. This strategy is not without concern. It is possible that banks which issued SEO only once during the 30-year period are fundamentally different from those banks which issued frequent SEOs during the same period. While those one-time issuers may use SEOs as a starting point of their assets expansion, those frequent issuers may simply issue SEOs for other purposes, for example, to sell overpriced equity. In this section, we bring back the frequent SEO issuers which issued more than one SEO during the sample period to the empirical analysis. Specifically, we investigate the relationship between equity issuance and bank assets growth with the following model:

$$Assets \quad growth_{it} = \alpha + \beta_1 SEO_{it} + \beta_2 X_{it} + \theta_t + \gamma_{ii} + \epsilon_{it} \tag{5}$$

Where *Assets growth* is the percentage change of bank's total assets from years *t*-1 to year *t*. α is the intercept of the regression. θ_t and γ_i are year and bank fixed effects. *SEO* is a dummy variable that equals one if the bank has issued equity in year t, and zero otherwise.

Table 7
Bank leverage and size around SEO (Placebo-matched sample with non-SEO banks).

	(1) Equity to assets ratio	(2) Tier 1 capital ratio	(3) Tier 2 capital ratio	(4) Total capital ratio	(5) Market leverage	(6) Log Total assets	(7) Log Deposits	(8) Log Current debt	(9) Log Long-term debt
Year 5 before SEO	0.360 * *	0.278	0.535 * **	0.691 * **	4.788 * **	-0.344 * **	-0.332 * **	-0.558 * **	-0.774 * **
	(2.553)	(1.450)	(4.020)	(2.906)	(12.905)	(−17.449)	(−17.525)	(−3.773)	(−5.910)
Year 4 before SEO	0.115	0.011	0.301 * *	0.220	3.654 * **	-0.245 * **	-0.234 * **	-0.489 * **	-0.473 * **
	(0.940)	(0.068)	(2.578)	(1.040)	(11.386)	(−15.914)	(−15.583)	(−3.343)	(−4.326)
Year 3 before SEO	0.098	0.013	0.092	0.054	2.575 * **	-0.159 * **	-0.154 * **	-0.151	-0.378 * **
	(0.956)	(0.099)	(0.999)	(0.334)	(10.244)	(−14.503)	(−14.584)	(−1.277)	(−3.709)
Year 2 before SEO	0.065	-0.091	0.087	-0.023	1.673 * **	-0.069 * **	-0.063 * **	-0.040	-0.156 *
	(0.883)	(−0.999)	(1.448)	(−0.207)	(9.884)	(−9.478)	(−8.711)	(−0.394)	(−1.850)
Year of SEO	-0.142 * *	0.067	0.093	0.156	-1.014 * **	0.080 * **	0.084 * **	-0.105	0.046
	(−2.016)	(0.686)	(1.646)	(1.459)	(−6.199)	(8.642)	(8.235)	(−0.955)	(0.631)
Year 1 after SEO	0.037	0.397 * **	0.140 *	0.585 * **	-1.055 * **	0.147 * **	0.152 * **	-0.100	0.041
	(0.374)	(2.978)	(1.940)	(3.785)	(−4.421)	(11.849)	(10.618)	(−0.789)	(0.473)
Year 2 after SEO	0.368 * **	0.654 * **	0.208 * *	0.882 * **	-0.826 * **	0.203 * **	0.204 * **	-0.046	0.093
	(3.200)	(4.489)	(2.557)	(5.274)	(−3.028)	(12.360)	(10.367)	(−0.336)	(0.930)
Year 3 after SEO	0.556 * **	0.902 * **	0.084	1.001 * **	-0.678 * *	0.255 * **	0.249 * **	-0.010	0.061
	(4.656)	(5.439)	(0.903)	(5.278)	(−2.192)	(12.764)	(10.739)	(−0.062)	(0.515)
Year 4 after SEO	0.628 * **	0.871 * **	-0.037	0.827 * **	-0.688 *	0.311 * **	0.301 * **	-0.001	0.112
	(4.171)	(4.564)	(−0.305)	(3.883)	(−1.871)	(12.168)	(9.536)	(−0.005)	(0.788)
Year 5 after SEO	0.666 * **	0.960 * **	-0.104	0.852 * **	-0.816 * *	0.383 * **	0.363 * **	0.133	0.153
	(4.431)	(4.763)	(−0.877)	(3.630)	(−2.303)	(13.816)	(11.197)	(0.653)	(0.910)
SEO bank x Year 5 before SEO	-0.198	-0.092	-0.397 *	-0.292	0.851	-0.036	-0.049	-0.082	-0.019
	(−0.842)	(−0.239)	(−1.855)	(−0.667)	(1.153)	(−0.761)	(−1.115)	(−0.226)	(−0.058)
SEO bank x Year 4 before SEO	0.237	0.490	-0.214	0.637	1.095	-0.043	-0.061	0.078	-0.212
	(0.896)	(1.156)	(−0.720)	(1.208)	(1.560)	(−1.065)	(−1.618)	(0.242)	(−0.655)
SEO bank x Year 3 before SEO	-0.033	0.058	-0.108	0.079	0.723	-0.038	-0.048	-0.163	-0.112
	(−0.168)	(0.179)	(−0.400)	(0.226)	(1.327)	(−1.159)	(−1.518)	(−0.583)	(−0.418)
SEO bank x Year 2 before SEO	0.408 *	0.580 *	0.060	0.878 *	-0.185	-0.064 * **	-0.080 * **	-0.047	0.001
	(1.795)	(1.705)	(0.245)	(1.893)	(−0.419)	(−2.746)	(−3.214)	(−0.207)	(0.004)
SEO bank x Year of SEO	1.338 * **	1.544 * **	0.022	1.588 * **	2.118 * **	0.041 * *	0.060 * **	-0.138	0.178
	(8.464)	(6.070)	(0.191)	(5.307)	(6.113)	(2.087)	(3.007)	(−0.614)	(1.139)
SEO bank x Year 1 after SEO	1.323 * **	1.286 * **	0.074	1.243 * **	1.953 * **	0.072 * **	0.079 * **	-0.413	0.190
	(7.054)	(4.166)	(0.560)	(3.195)	(3.914)	(2.625)	(2.875)	(−1.418)	(0.937)
SEO bank x Year 2 after SEO	0.750 * **	0.563	-0.035	0.450	1.424 * *	0.122 * **	0.148 * **	-0.386	0.057
	(3.550)	(1.631)	(−0.210)	(1.046)	(2.324)	(3.438)	(4.161)	(−1.284)	(0.188)
SEO bank x Year 3 after SEO	0.387 *	0.170	0.156	0.272	1.163 *	0.150 * **	0.185 * **	-0.245	0.336
	(1.697)	(0.448)	(0.732)	(0.603)	(1.762)	(3.636)	(4.538)	(−0.666)	(1.152)

(*continued on next page*)

Table 7 (*continued*)

	(1) Equity to assets ratio	(2) Tier 1 capital ratio	(3) Tier 2 capital ratio	(4) Total capital ratio	(5) Market leverage	(6) Log Total assets	(7) Log Deposits	(8) Log Current debt	(9) Log Long-term debt
SEO bank x Year 4 after SEO	0.522 *	0.316	0.299	0.639	1.830 * *	0.153 * **	0.193 * **	-0.631	0.291
	(1.944)	(0.781)	(1.090)	(1.290)	(2.339)	(3.160)	(3.923)	(−1.546)	(0.890)
SEO bank x Year 5 after SEO	0.692 * *	0.285	0.227	0.508	2.338 * **	0.169 * **	0.234 * **	-0.723 *	0.042
	(2.438)	(0.680)	(0.854)	(0.998)	(2.917)	(3.240)	(4.570)	(−1.846)	(0.107)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	8284	6925	6910	7008	5454	8297	8284	8115	8153
R^2	0.684	0.633	0.787	0.653	0.561	0.978	0.971	0.679	0.733

This table presents the regressions (Model 1) of bank leverage ratio and assets before and after SEO. The sample includes all bank year observations for SEO banks and placebo-matched sample with non-SEO banks between 1985 to 2013. Equity to assets ratio is calculated as book equity divided by total assets. The Tier 1 capital ratio is determined by the Risk-Adjusted Capital Ratio - Tier 1. Similarly, the Tier 2 capital ratio is calculated as the Risk-Adjusted Capital Ratio - Tier 2, and the Total capital ratio is determined by the Risk-Adjusted Capital Ratio. The Market leverage ratio is computed by dividing the market value by total assets. All of these ratios are then multiplied by 100. Log Total assets represents the natural logarithm of the total assets, while Log Deposits is the natural logarithm of the total deposits. Log Current debt is the natural logarithm of the current debt, and Log Long-term debt is the natural logarithm of long-term debt. All the Before and After variables are dummy variables. Before equals 1 for s (from −5 to −2) years before the bank SEO, and 0 otherwise. After equals 1 for s (from 0 to 5) years after the bank SEO, and 0 otherwise. SEO bank is a dummy variable that equals 1 if the bank issued SEO during the whole sample period. The coefficients of interest are the interaction terms between SEO bank and Before and After dummies. All the regressions are ordinary least square regressions with bank fixed effects and year fixed effects. T-statistics are in parentheses and standard errors are double-clustered at the bank and year levels. * , * * and * ** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Our research design thus far attempts to observe the changes in the bank's balance sheet after the bank's SEO to infer the reasons of the decision of SEO, and we find it is for assets expansion. One concern, however, is that there may be possibilities that banks engage in SEO for a different reason than assets expansion, and the assets are increased at the same time when the bank achieves its "true" purpose. We conducted extensive analyses in the above sections to rule out these alternative possibilities. In this section, we take one final step to further address this concern by using the instrumental variable approach.

We consider *Peer bank SEO per state*, calculated as the number of SEO banks divided by the total number of banks headquartered in the same state. We would expect a bank's decision to issue equity will be positively influenced by the peer banks' SEO decisions, while the peer banks' SEO decisions will have little impact on the bank's asset size, unless it is indirectly through the channel of the bank's own SEO.

Both the OLS and instrumental variable (IV) regression results are reported in Table 9.[9] For the IV regressions, we report the first and second stage regression results, using the two-stage-least squares estimator. The first stage results show a strong correlation between the *Peer bank SEO per state* and the likelihood of individual bank's decision to issue equity. We note that in the F-test, the p-value reported strongly rejects the hypothesis that the excluded instruments are zero, confirming the validity of the instruments. The second stage regression shows positive and statistically significant coefficients of the instrumented bank SEO dummy. We note that the coefficient in the IV regressions are significantly larger than the coefficient in the OLS analysis, indicating that omitted variables bias our estimates downwards (Rajan and Subramanian, 2008).

5. Do SEO banks actively invest in risky assets or engage in acquisitions?

The assets expansion theory says that banks borrow more deposits after an SEO to aggressively increase their size. One might wonder whether these new funds will be invested in risky or conservative assets? To answer this question, we examine the changes of the components of bank loans at loan level and capital expenditure of SEO banks relative to non-SEO banks around the SEO year, which may represent to some extent the bank's risk strategy. We thus estimate Model (1) with a different set of dependent variables. These variables include the total loan amount and various types of loans, defined by taking the *natural logarithm of loan values, commercial and industrial loans, consumer loans, mortgage loans, for-sale loans, and other loans*, as well as *the ratio of capital expenditure to total assets.*

[9] In unreported analysis, we use two additional variables. *SEO_one* is a dummy variable that equals one if the bank has issued equity in year t and this SEO is the only time when the bank issued SEO during the entire sample period from 1986 to 2015, and zero otherwise. *SEO_Frequent* is a dummy variable that equals one if the bank has issued equity in year t and this bank has issued more than once SEO during the entire sample period from 1986 to 2015, and zero otherwise. We find both dummies are positive and significant, indicating that both one time and frequent issuers increase their assets growth.

Table 8
Bank leverage and size around SEO (Placebo-matched sample with SEO banks).

	(1) Equity to assets ratio	(2) Tier 1 capital ratio	(3) Tier 2 capital ratio	(4) Total capital ratio	(5) Market leverage	(6) Log Total assets	(7) Log Deposits	(8) Log Current debt	(9) Log Long-term debt
Year 5 before SEO	-0.741 * **	-0.300	-0.113	-0.356	0.827	-0.520 * **	-0.534 * **	-0.233 *	-0.628 * **
	(−3.388)	(−0.999)	(−0.531)	(−0.887)	(1.625)	(−14.977)	(−15.176)	(−1.860)	(−5.540)
Year 4 before SEO	0.388 *	1.051 * **	-0.093	1.013 * *	1.745 * **	-0.357 * **	-0.357 * **	-0.209	-0.413 * **
	(1.884)	(3.211)	(−0.462)	(2.498)	(3.290)	(−13.340)	(−13.290)	(−1.676)	(−4.258)
Year 3 before SEO	0.486 * *	0.782 * *	-0.041	0.697 * *	1.014 * *	-0.221 * **	-0.231 * **	-0.152	-0.252 * *
	(2.686)	(2.771)	(−0.228)	(2.652)	(2.458)	(−10.678)	(−10.146)	(−1.557)	(−2.712)
Year 2 before SEO	0.193	0.227	-0.067	0.136	0.502 *	-0.096 * **	-0.095 * **	-0.141	-0.119
	(1.277)	(1.267)	(−0.478)	(0.960)	(1.804)	(−6.673)	(−6.269)	(−1.439)	(−1.352)
Year of SEO	0.196	-0.020	0.072	0.128	-0.254	0.078 * **	0.076 * **	-0.057	0.100 *
	(1.152)	(−0.106)	(0.406)	(0.450)	(−0.734)	(3.974)	(3.705)	(−0.404)	(1.935)
Year 1 after SEO	0.360 *	0.067	-0.044	0.093	-0.523	0.156 * **	0.169 * **	-0.118	-0.032
	(1.707)	(0.194)	(−0.350)	(0.271)	(−1.241)	(5.605)	(6.217)	(−1.133)	(−0.313)
Year 2 after SEO	0.043	0.073	-0.558	-0.307	-1.867 * **	0.255 * **	0.266 * **	0.226	0.132
	(0.174)	(0.174)	(−1.474)	(−0.639)	(−3.753)	(5.943)	(6.780)	(1.048)	(1.129)
Year 3 after SEO	0.052	-0.229	-0.518 * *	-0.761	-1.357 *	0.354 * **	0.365 * **	0.364	0.280 *
	(0.120)	(−0.424)	(−2.473)	(−1.304)	(−2.017)	(4.588)	(5.144)	(1.024)	(1.763)
SEO bank x Year 5 before SEO	0.978 * *	0.651	0.608	1.349 *	0.916	0.089	0.118 * *	-0.422 * *	-0.001
	(2.366)	(1.034)	(1.458)	(1.767)	(0.929)	(1.559)	(2.047)	(−2.051)	(−0.005)
SEO bank x Year 4 before SEO	0.063	-0.326	0.537	0.501	-0.077	0.011	0.014	-0.336	-0.066
	(0.168)	(−0.560)	(1.168)	(0.677)	(−0.088)	(0.227)	(0.299)	(−1.677)	(−0.386)
SEO bank x Year 3 before SEO	-0.293	-0.373	0.334	0.156	-0.041	-0.020	-0.016	-0.233	-0.076
	(−1.005)	(−0.787)	(0.797)	(0.297)	(−0.070)	(−0.543)	(−0.396)	(−1.343)	(−0.598)
SEO bank x Year 2 before SEO	0.427	0.587	0.367	1.235 * *	0.203	-0.054 *	-0.062 *	-0.054	-0.064
	(1.429)	(1.423)	(1.049)	(2.497)	(0.536)	(−1.805)	(−1.988)	(−0.456)	(−0.422)
SEO bank x Year of SEO	0.946 * **	1.330 * **	-0.057	1.190 * **	1.220 * *	0.086 * **	0.101 * **	0.092	0.124
	(5.125)	(7.987)	(−0.279)	(3.033)	(2.385)	(2.859)	(3.368)	(0.625)	(1.237)
SEO bank x Year 1 after SEO	0.893 * **	0.968 * *	0.112	0.925 *	0.911	0.144 * **	0.131 * **	0.251 *	0.433 * **
	(3.446)	(2.490)	(0.936)	(1.821)	(1.690)	(3.799)	(3.517)	(1.951)	(2.956)
SEO bank x Year 2 after SEO	0.919 * **	0.429	0.586	0.765	1.778 * *	0.171 * **	0.173 * **	-0.073	0.404 * *
	(2.947)	(0.873)	(1.350)	(1.241)	(2.544)	(2.939)	(3.287)	(−0.319)	(2.364)
SEO bank x Year 3 after SEO	0.716	0.472	0.658 *	1.061	0.804	0.171 *	0.171 *	-0.076	0.387 *
	(1.449)	(0.739)	(2.002)	(1.421)	(0.830)	(1.786)	(1.909)	(−0.196)	(1.721)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	2694	2293	2291	2296	1833	2712	2694	2669	2671
R^2	0.733	0.648	0.745	0.576	0.729	0.972	0.972	0.790	0.817

This table presents the regressions (Model 1) of bank leverage ratio and assets before and after SEO. The sample includes all bank year observations for SEO banks and the placebo-matched sample with SEO banks (see Model 2) between 1985 to 2013. Equity to assets ratio is calculated as book equity divided by total assets. The Tier 1 capital ratio is determined by the Risk-Adjusted Capital Ratio - Tier 1. Similarly, the Tier 2 capital ratio is calculated as the Risk-Adjusted Capital Ratio - Tier 2, and the Total capital ratio is determined by the Risk-Adjusted Capital Ratio. The Market leverage ratio is computed by dividing the market value by total assets. All of these ratios are then multiplied by 100. Log Total assets represents the natural logarithm of the total assets, while Log Deposits is the natural logarithm of the total deposits. Log Current debt is the natural logarithm of the current debt, and Log Long-term debt is the natural logarithm of long-term debt. All the Before and After variables are dummy variables. Before equals 1 for s (from −5 to −2) years before the bank SEO, and 0 otherwise. After equals 1 for s (from 0 to 5) years after the bank SEO, and 0 otherwise. SEO bank is a dummy variable that equals 1 if the bank issued SEO during the whole sample period. The coefficients of interest are the interaction terms between SEO bank and Before and After dummies. All the regressions are ordinary least square regressions with bank fixed effects and year fixed effects. T-statistics are in parentheses and standard errors are double-clustered at the bank and year levels. * , * * and * ** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Table 10 presents the results. Our findings show that, compared to non-SEO banks, SEO banks exhibit a notable increase in their total loan (0.135% points), particularly in the case of for-sale loans (0.350% points) and other loans (0.151% points) one year after SEO. These findings suggest that following the SEO, SEO banks tend to allocate a higher proportion of their newly raised funds to for-sale loans and other loan categories, resulting in an increased total loan. We do not find significant results for commercial and industrial loans, consumer loans, mortgage loans, or for capital expenditures.

Finally, we investigate whether banks use the raised proceeds from the SEO to engage in more acquisitions as part of assets expansion. The results are reported in Column (8) of Table 10. *Acquire* is a dummy variable, which equals one if the bank acquired another bank during the year, and zero otherwise. We do not find evidence that SEO banks engage in more acquisitions after the SEO relative to non-SEO banks.

The results in this section suggest that SEO banks invest more in lending but not in M&A activities and capital expenditures. The increase shows the SEO banks' tendency towards liquidity creation (Berger and Bouwman, 2009) and hence profitability, but with increased risks. This tendency is consistent with assets expansion theory. The finding that SEO banks do not engage in M&A is also consistent with banks' assets expansion strategy by way of SEO since they are two different growth strategies (Penrose, 1959; Lockett et al., 2011).

Table 9
Bank SEO and assets growth: full sample analysis.

	OLS	IV	
		First stage	Second stage
	(1)	(2)	(3)
	Assets growth	SEO	Assets growth
SEO	4.153 * **		12.203 * **
	(3.572)		(3.220)
Log Total assets	6.096 * **	0.019 * **	0.509 * **
	(6.233)	(4.011)	(4.305)
Equity/Total assets%	0.001 * **	-0.000 * **	0.001 * **
	(13.586)	(−3.945)	(11.165)
Non-interest income/Total operating income%	0.005	0.000	-0.002
	(1.135)	(1.602)	(−0.296)
ROA%	0.018 * **	-0.000 * **	-0.014 * **
	(4.151)	(−3.639)	(−11.213)
Loan loss provisions/Total assets%	-3.514 * **	0.001	-2.349 * **
	(−5.726)	(0.322)	(−6.310)
Deposits/Total assets%	-0.066 *	-0.000 * *	0.037 *
	(−1.812)	(−2.099)	(1.783)
Peer bank SEO per stat%		1.009 * **	
		(15.899)	
Constant	-15.709 * *	-0.093 * **	3.546
	(−2.128)	(−2.613)	(1.551)
Time fixed effects	Yes	Yes	
Bank fixed effects	Yes	Yes	
Number of obs.	15,533	15,533	15,533
First stage F test (p-value)			0
R^2	0.110	0.110	0.070

This table presents the regression analysis of the relationship between bank SEO dummies and bank assets growth using full sample, including those banks with frequent SEOs over the sample period. Assets Growth is the rate at which the bank total assets change over a year. Column 1 uses ordinary least square regressions with bank and year fixed effects. Column 2 to 3 use the Instrumental variable approach. We use the peer bank SEO per state as the instrument for bank's decision on SEO. Column 2 reports the first stage results, while column 3 report the second stage results. T-statistics are in parentheses and standard errors are double -clustered at the bank and year levels. * **Significant at the 1% level, * *significant at the 5% level, and *significant at the 10% level.

Table 10
Regression results on bank investment in loans, capital expenditures and acquisitions around SEO.

	(1) Total loan	(2) Commercial and industrial loans	(3) Consumer loans	(4) Mortgage loans	(5) For sale loans	(6) Other loans	(7) Capital expenditure	(8) Acquire = 1
Year 5 before SEO	-0.075	0.026	0.085	0.027	-0.072	-0.118	-0.027	-0.058
	(−1.432)	(0.242)	(0.889)	(0.275)	(−0.470)	(−1.252)	(−1.065)	(−1.334)
Year 4 before SEO	-0.084 *	0.044	0.056	0.105	-0.004	-0.130	-0.048	-0.044
	(−1.985)	(0.451)	(0.657)	(1.393)	(−0.027)	(−1.156)	(−1.415)	(−1.231)
Year 3 before SEO	-0.057	0.044	0.126 * **	-0.051	-0.070	-0.050	-0.030	-0.024
	(−1.584)	(0.608)	(3.236)	(−0.620)	(−0.528)	(−0.681)	(−0.885)	(−0.644)
Year 2 before SEO	-0.091 * *	0.009	0.027	0.011	-0.195 *	-0.041	0.023	-0.023
	(−2.475)	(0.213)	(0.816)	(0.337)	(−1.950)	(−1.265)	(0.704)	(−0.850)
Year of SEO	0.102 * **	-0.115	-0.086 *	-0.064	0.146	0.102	-0.004	-0.044
	(3.760)	(−1.152)	(−1.805)	(−1.559)	(1.478)	(1.698)	(−0.142)	(−1.217)
Year 1 after SEO	0.135 * **	-0.056	-0.048	-0.126 *	0.350 * *	0.151 *	0.000	-0.027
	(3.551)	(−0.729)	(−0.670)	(−1.976)	(2.104)	(1.883)	(0.002)	(−0.827)
Year 2 after SEO	0.159 * **	0.151	0.027	-0.097	0.498 * **	0.207 *	-0.011	-0.036
	(4.149)	(1.268)	(0.278)	(−1.268)	(3.217)	(1.938)	(−0.279)	(−0.884)
Year 3 after SEO	0.155 * **	0.013	-0.025	-0.098	0.375 * *	0.137	-0.016	-0.005
	(3.523)	(0.159)	(−0.192)	(−0.977)	(2.173)	(1.073)	(−0.433)	(−0.114)
Year 4 after SEO	0.156 * **	0.064	-0.008	-0.048	0.377 *	0.204	-0.015	-0.053
	(3.042)	(0.587)	(−0.059)	(−0.443)	(2.070)	(1.399)	(−0.477)	(−1.477)
Year 5 after SEO	0.172 * **	0.059	0.081	0.049	0.465 * *	0.335 * *	-0.073 *	-0.061 *
	(3.279)	(0.425)	(0.502)	(0.517)	(2.754)	(2.268)	(−1.923)	(−1.748)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	16,283	1261	2162	2223	5276	16,283	7115	16,234
R^2	0.957	0.958	0.929	0.948	0.819	0.845	0.362	0.466

This table presents the regressions (Model 1) of bank investment in loans, capital expenditures, and acquisitions before and after SEO. The sample includes all bank year observations between 1985 to 2013. Total loan amount and various types of loans, defined by taking the logarithm of loan values, commercial and industrial loans, consumer loans, mortgage loans, for-sale loans, and other loans. Capital expenditure is the ratio of capital expenditure to total assets. All the Before and After variables are dummy variables. Before equals 1 for s (from −5 to −2) years before the bank SEO, and 0 otherwise. After equals 1 for s (from 0 to 5) years after the bank SEO, and 0 otherwise. All the regressions are ordinary least square regressions with bank and year fixed effects. T-statistics are in parentheses and standard errors are double-clustered at the bank and year levels. * , * * and * ** indicate statistical significance at the 10%, 5% and 1% level, respectively

6. The performance after bank SEO

In the last section we find that SEO banks invest more in lending. While we do not have information on individual bank loans and cannot examine the credit risk, we analyse the accounting returns and loan loss provisions, the net charge-off ratio and market performance of individual banks over the sample period to seek more information of bank performance in this section.

Table 11 reports the regression results. Column (1) shows the results in return on assets (*ROA*), defined as net income/total assets, and expressed as a percentage. We do not find a significant difference in *ROA* between SEO and non-SEO banks in both pre- and post-SEO periods. However, in Column (2) we find that the *Standard deviation of ROA*, as measured by five years rolling window, increases more for SEO banks than non-SEO banks in the post-SEO period.

Column (3) shows results for *Loan loss provisions* expressed as a percentage and defined as loan loss provisions divided by total assets and multiplied by 100. The loan loss provision should be higher in the post-SEO period if the SEO bank is aware that the quick growth in assets may lead to riskier loans. We find evidence to support this view. SEO banks have significantly lower loan loss provisions two and four years before the SEO relative to non-SEO banks, but the difference diminished after the SEO. The effects are economically meaningful. The coefficient of − 0.087% for two years before the SEO can be compared with the average loan loss provisions of 0.364%. Hence, relative to the sample average, an SEO bank has increased 24% of loan loss provisions from year − 2 to year − 1 and thereafter than a non-SEO bank during the same period.

Column (4) shows the results for *net charge-off ratio* expressed as a percentage and defined as the net charge-off divided by the total assets and multiplied by 100. The increase in the standard deviation of loan loss provisions in the previous findings can shed some light

Table 11
Bank performance around SEO.

	(1) ROA	(2) SD (ROA)	(3) Loan loss provisions	(4) Net charge off	(5) Market-to-book ratio
Year 5 before SEO	-0.002	0.076	-0.100	0.074 * *	0.116
	(−0.016)	(1.355)	(−1.312)	(2.133)	(1.323)
Year 4 before SEO	0.070	0.048	-0.145 * *	0.074 * *	0.082
	(0.723)	(1.257)	(−2.064)	(2.123)	(1.347)
Year 3 before SEO	0.026	0.036	-0.098	-0.159	0.011
	(0.249)	(0.926)	(−1.510)	(−0.623)	(0.191)
Year 2 before SEO	-0.051	0.011	-0.087 * *	0.062	-0.015
	(−0.727)	(0.696)	(−2.063)	(1.538)	(−0.306)
Year of SEO	-0.073	0.043 *	-0.031	0.011	-0.066
	(−1.159)	(1.847)	(−0.617)	(0.246)	(−1.518)
Year 1 after SEO	0.093	0.055	-0.050	0.037	-0.145 * **
	(0.809)	(1.664)	(−0.615)	(0.626)	(−3.128)
Year 2 after SEO	0.009	0.079 *	-0.013	0.000	-0.095 *
	(0.087)	(1.987)	(−0.179)	(0.001)	(−1.913)
Year 3 after SEO	0.021	0.101 *	-0.119	0.125 * *	-0.104
	(0.168)	(1.955)	(−1.376)	(2.243)	(−1.689)
Year 4 after SEO	0.036	0.105	-0.108	0.141 * *	-0.086
	(0.262)	(1.636)	(−1.474)	(2.412)	(−1.411)
Year 5 after SEO	0.072	0.089	-0.102	0.145 *	-0.035
	(0.541)	(1.644)	(−1.277)	(1.953)	(−0.508)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Number of obs.	16,758	16,501	16,171	15,449	10,130
R^2	0.385	0.566	0.398	0.306	0.672

This table presents the regressions (Model 1) of bank performance before and after SEO. The sample includes all bank year observations between 1985 to 2013. ROA is the Returns on Assets. SD(ROA) refers to the standard deviation of the Returns on Assets, five years rolling window. Loan loss provisions are calculated as loan loss provisions is divided by total assets and multiplied by 100. Net charge off is determined by net charge-offs divided by total assets and multiplied by 100. Market-to-book ratio is the market value of equity over book value of equity. All the Before and After variables are dummy variables. Before equals 1 for s (from −5 to −2) years before the bank SEO, and 0 otherwise. After equals 1 for s (from 0 to 5) years after the bank SEO, and 0 otherwise. All the regressions are ordinary least square regressions with bank and year fixed effects. T-statistics are in parentheses and standard errors are double-clustered at the bank and year levels. * , * * and * ** indicate statistical significance at the 10%, 5% and 1% level, respectively.

on the consequences after assets expansion.[10] We examine changes in the ex-post loan performance, measured by the net charge-offs ratio. We find that there is a delayed increase in the net charge-offs since year three after the SEO, consistent with the view that SEO banks may pursue riskier loans.

Column (5) shows the results for market-to-book ratio expressed as a percentage and defined as the market value of equity divided by the book value of equity and multiplied by 100. We find that the differences in the *Market-to-book ratio* between SEO and non-SEO banks decreased in the post-SEO period, which may reflect the market perception of the potential increase in bank risk as a result of assets expansion. These results confirm the findings of Fahlenbrach et al. (2017) that common stock of U.S. banks with high loan growth underperforms the common stock of banks with low loan growth.

7. Conclusion

During the post-Great Recession era, banks that increase their capital levels are viewed favorably by both the government and the market. Issuing equity can signal that a bank is committed to being more accountable for its safety and the impact it has on the whole financial system. However, there is a worrisome possibility that a bank's SEO may not be driven by responsible motives and could result in greater risk-taking.

Thus, we examine the balance sheets of U.S. banks that underwent SEOs in comparison with non-SEO banks around SEO year from 1985 to 2013. We find that SEO banks increase their capital ratios relative to non-SEO banks after their SEOs. More importantly, relative to their non-SEO peers, SEO banks also experience a greater increase in total assets, mainly driven by the increase in total deposits. These results suggest that banks use equity issuance as a strategy to expand their assets. The newly raised funds from SEO and deposits are mostly invested in for-sale loans and other loans.

Additionally, our analysis reveals a higher level of risk and a lower market-to-book value ratio for SEO banks after the SEO. We find evidence that our results are not driven by the increase in deposit supply before or after the bank's SEO. Our results are also robust when using alternative placebo-matched samples. These findings cannot be explained by classical firm equity issuance theory. Instead,

[10] However, it is possible that both asset expansion and lending opportunities are at play and are complementary to each other, leading banks to chase higher risk. The bank's asset expansion may provide the funding necessary to pursue riskier lending opportunities. This can create a self-reinforcing cycle, where the bank's riskier lending leads to higher profits, which in turn allows for further asset expansion and riskier lending.

they point to risk-taking by banks and highlight the importance of bank regulation and supervision, especially concerning bank size.

CRediT authorship contribution statement

Vu Tuyet Nhung: Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Liu Hong:** Conceptualization, Formal analysis, Methodology, Resources, Writing – original draft, Writing – review & editing. **Li Hui:** Conceptualization, Methodology, Resources, Writing – original draft, Writing – review & editing. **He Liangliang:** Conceptualization, Writing – original draft, Writing – review & editing.

Data availability

The authors do not have permission to share data.

Appendix: Variable description

Variable Name	Variable Description
Log Total assets	Natural logarithm of the total assets
Equity to assets ratio	Book equity divided by total assets and multiplied by 100
Tier 1 capital ratio	Risk-Adjusted Capital Ratio - Tier 1 multiplied by 100
Tier 2 capital ratio	Risk-Adjusted Capital Ratio - Tier 2 multiplied by 100
Total capital ratio	Risk-Adjusted Capital Ratio – Combined and multiplied by 100
Market leverage	Market value divided by total assets and multiplied by 100
Log Deposits	Natural logarithm of the total deposits
Log Current debt	Natural logarithm of the current debt
Log Long-term debt	Natural logarithm of the long-term debt
Interest paid/deposits	Interest paid divided by total deposits and multiplied by 100
Consumer and Industrial loan	Natural logarithm of Consumer and industrial loans.
Consumer loans	Natural logarithm of Consumer loans
Mortgage loans	Natural logarithm of Mortgage loans
For-sale loans	Natural logarithm of For-sale loans
Other loans	Natural logarithm of Other loans
Capital expenditure	Capital expenditure divided by total assets and multiplied by 100
Loan loss provisions	Loan loss provisions divided by total assets and multiplied by 100
Non-performing loans	Non-performing loans divided by total assets and multiplied by 100
Net charge-offs	Net charge-offs divided by total assets and multiplied by 100
ROA	Returns on Assets
SD(ROA)	Standard deviation of the Returns on Assets, five years rolling window.
Market-to-book value ratio	Market value of equity over book value of equity
Deposit HHI	The Herfindahl- Hirschman Index, a measure of the market concentration of deposits, calculated as the sum of the squares of the market shares (considering deposits) of each bank (i) in a determined year (t).
Log (number of branches + 1)	Natural logarithm of the number of branches plus one
MA dummy	A dummy variable, which equals one if the bank acquired another bank during the year, and zero otherwise
Log GDP	Natural logarithm of the Gross Domestic Product (GDP)
GDP Growt%	Rate at which a country's GDP changes over a year

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