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Regional banking instability and FOMC voting☆

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ABSTRACT

This study analyzes if regionally affiliated Federal Open Market Committee (FOMC) members take their districts' regional banking sector instability into account when they vote. Considering the period 1979–2010, we find that a deterioration in a district's bank health increases the probability that this district's representative in the FOMC votes to ease interest rates. According to member-specific characteristics, the effect of regional banking sector instability on FOMC voting behavior is most pronounced for Bank presidents (as opposed to Governors) and FOMC members who have career backgrounds in the financial industry or who represent a district with a large banking sector.

1. Introduction

This paper studies the relevance of regional banking sector stability for the voting behavior of Federal Open Market Committee (FOMC) members. In the past three decades, major episodes of bank distress have been associated with significant increases in the dispersion of regional banking sector instability among Federal Reserve districts. Given the relevance of bank failures for the regional economy, FOMC members may take banking sector instability in their district into account when they vote. Moreover, the (re)election process of regional Fed Bank presidents may establish a strong connection between the stability needs of district's member banks and their respective Bank president's voting preferences in the FOMC.

To the best of our knowledge, we are the first to examine the impact of regional banking sector stability on the voting behavior of FOMC members, and to analyze the member specific characteristics that establish this channel. Matching call report data on U.S. banks and FOMC voting records taken from the FOMC minutes over the years 1979–2010, we find robust evidence that FOMC members align their voting behavior with bank stability in their district. Using fixed-effects ordered probit models, our results show that higher levels of banking sector instability (indicated by a lower z-score)[1] in the FOMC member's Federal Reserve district are associated with a higher probability of voting for lower interest rates and a lower probability of voting for higher interest rates. This result is robust to using alternative bank instability measures, and model specifications. Moreover, we use instrumental variable (IV) ordered probit models to address possible endogeneity issues. Using a banking deregulation indicator capturing the state specific lifting of interstate bank entry restrictions associated

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[1] Bank instability is measured using the z-score, which relates the sum of a bank's equity to assets ratio and return to assets ratio to the standard deviation of the bank's return to assets ratio. Z-scores of banks are aggregated to the district level using total assets as the weighting scheme. Lower z-scores indicate higher levels of bank instability.

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with the 1994 Riegle–Neal Act, and lagged z-scores as instrumental variables, we obtain robust confirmatory support for our baseline results.

In terms of economic importance, we note that despite its statistically robust effect, the standardized impact of regional banking sector stability on voting behavior of FOMC members is rather small. A one standard deviation reduction in the regional banking sector z-score is associated with a 1.7 percentage points increase in the probability of a vote for lower interest rates by the district's representative in the FOMC. The standardized effect on raising interest rates is around 2 percentage points. To assess the economic significance of the results, we note that 16.8% of all votes in our sample favored monetary easing, and 21% were in favor of tightening. The standardized impact of regional banking sector instability is around 40%, respectively 25%, as large as the impact of national inflation and the national output gap. Thus, regional banking sector stability seems to shape the monetary policy preferences of FOMC members significantly, but with a limited impact compared to the traditional stabilization goals. We further note that we estimate member specific voting models. Thereby, our results are only indicative of the monetary policy preferences on the *individual monetary policymaker* level, but we cannot draw conclusions about actual interest rate decisions of the committee as a whole. However, since the FOMC's interest rate decisions result from the majority vote of FOMC members, regional bank stability does not only influence the probability of individual interest rate votes, but indirectly has also implications for the committee's interest rate decision (although such a test is not the focus of the paper).

Interaction models reveal which channels transfer the impact of regional banking sector instability to FOMC members' voting preferences. In particular, FOMC voting behavior depends more on regional banking sector instability when the FOMC member has a career background in the financial industry or represents a Federal Reserve district with a larger banking sector. FOMC members with a finance background may want to improve their outside job market opportunities in the banking sector by aligning their interest rate preferences with the stability needs of regional banks. Alternatively, FOMC members with a finance background may have a different preference structure or better abilities to detect threats to banking sector instability and may therefore target their voting behavior to bank risk. FOMC members representing large banking sectors may acknowledge the greater importance of regional banks for the district's economy or the role of regional banks for their reelection (which is explained in more detail below).

In terms of policy relevance, our results indicate an influence of regional banks on the voting behavior of the regionally affiliated FOMC members, which may be interpreted as lobbying. The influence of regional banks on voting is likely to be established by the institutional structure of the Federal Reserve System. The Board of Directors of a district's Federal Reserve Bank elects its President. The Board consists of nine members. The three Class A Directors and the three Class B Directors are selected by the regional Fed's member banks. The three Class C Directors are determined by the Board of Governors in Washington. The Class A Directors are recruited from the regional banking sector. Class B and Class C Directors are recruited from other industries and the general public. Given their large influence on the selection of directors, the member banks of the district Fed also have influence on the election and reelection of the district Fed's President. This fact may produce an incentive for the district Fed's President to vote in line with the interests of the regional banking industry. Since the enactment of the Dodd-Frank Act in 2010, the three Class A Directors are no longer allowed to elect the district Fed's President. Although regional member banks still have a say on the election of the Fed's President by determining the three Class B Directors, their influence on the election process is reduced. A possibly intended effect of this regulatory change may have been to reduce the relevance of district member banks' interests for the monetary policy preferences of the regional Bank Presidents.

Our paper is related to two strands of the literature. Several empirical papers investigate if central banks consider financial stability as a monetary policy goal. For example, Alcidi et al. (2011) and Gnabo and Moccero (2015) use a Taylor Rule setting to investigate the Federal Reserve's response to inflation and output during times of financial and economic stress. Using a regime switching approach for the Greenspan era, Gnabo and Moccero (2015) find that during regimes with higher levels of financial risk the Fed responds more aggressively to the output gap, while the response to the inflation outlook is uniform across high and low risk regimes. Alcidi et al. (2011) show that the fit of the Taylor rule is improved if one distinguishes between high and low credit risk regimes. Some studies include financial instability measures directly into a Taylor Rule and reveal significant influences on the policy interest rate setting of the Federal Reserve (Cecchetti and Li, 2008), the Bank of England (Martin and Milas, 2013), the European Central Bank (Castro, 2011; Eichler and Hielscher, 2012), or a panel of countries (Baxa et al., 2013).

Whereas these studies address the *central bank level*, we analyze the impact of regional banking sector instability on the voting records of each individual *central banker* and use member-specific characteristics to identify channels through which banking sector instability affects monetary policy preferences.

Second, a large body of literature reveals persistent differences in the voting behavior of FOMC members, while the role of bank stability has not been investigated so far. A key finding of this literature is that Bank presidents generally show higher dissenting rates and a more hawkish monetary policy stance than Board members (e.g., Chappell et al., 1993, 1995; Chappell and McGregor, 2000; Meade and Sheets, 2005; Eichler and Lähner, 2014b). Moreover, FOMC members' career backgrounds shape their monetary policy preferences (e.g., Havrilesky and Gildea, 1991; Havrilesky and Schweitzer, 1990; Chappell et al., 1995; Eichler and Lähner, 2014a). For example, Havrilesky and Gildea (1991) and Eichler and Lähner (2014a) find that a former career in the financial sector increases the likelihood for FOMC members to prefer a tighter monetary policy stance. On the contrary, Smales and Apergis (2016) find that former career experiences do not explain much of the heterogeneity in the voting behavior of FOMC members. Instead, the member's time spent with the Federal Reserve System, or the committee itself, has a significant impact on the decision-making process. Several papers study appointment effects of FOMC members. FOMC members with a Democratic Party affiliation prefer lower interest rates whereas Republican affiliates tend to prefer higher interest rates (Havrilesky and Gildea 1992; Chappell et al., 1993, 1995; Tootell 1996; Meade and Sheets, 2005). Finally, regional economic conditions do also explain differences in monetary policy preferences of FOMC members (Belden, 1989; Gildea, 1990; Meade and Sheets, 2005; Chappell et al., 2008; Meade, 2010; Hayo and Neuenkirch, 2013; Eichler and Lähner, 2014b).

2. Baseline model

2.1. Empirical model

To test the impact of regional banking sector instability on voting behavior by FOMC members, we use an ordered probit model. The dependent variable is the monetary preference of the FOMC member, as revealed by his or her interest rate vote in each FOMC meeting, taken from the minutes of the Board of Governors. The Federal Funds Rate is determined by the Federal Open Market

Committee eight times a year.[2] There are 12 voting members: seven members of the Board of Governors and five Federal Reserve Bank presidents. The Federal Reserve Bank of New York has permanent voting rights; the voting rights of the remaining 11 districts rotate annually. Each member represents one of the 12 Federal Reserve districts in the FOMC. Thus we are left with a panel of 12 interest rate votes for each of the eight FOMC meetings per year.

The dependent variable takes a value of +1 if the member votes in favor of a higher interest rate, 0 if he/she votes to leave the interest rate unchanged, and -1 if he/she votes for a lower interest rate. The ordered and categorical nature of this dependent variable led us to use an ordered probit model to analyze the determinants of interest rate votes. To account for unobserved heterogeneity among Federal Reserve districts, we employ a fixed effects model, including White heteroskedasticity-consistent standard errors.:

$$Y_{it}^{*} = X_{it}'\beta + \varepsilon_{it} \tag{1}$$

and

$$Y_{it} = -1 \ if \ Y_{it}^{*} \leq \gamma_1, \tag{2a}$$

$$Y_{it} = 0 \ if \ \gamma_1 < Y_{it}^{*} \leq \gamma_2, \tag{2b}$$

and

$$Y_{it} = 1 \ if \ Y_{it}^{*} > \gamma_2. \tag{2c}$$

The observed voting records of FOMC member i during the FOMC meeting in t, Y_{it}, are used to model the unobserved monetary policy preferences of the member, Y_{it}^{*}, as a function of explanatory variables X_{it}, which include regional banking sector instability (as measured by the z-score), other regional variables (regional unemployment rates, regional house price gap, and size of banking sector), national variables (national inflation and output gap, Federal Funds rate), institutional characteristics (Board member dummy, Meeting dummy, FOMC Chairmanship dummies), individual characteristics (FOMC experience, career experience, political appointment dummies), and district dummies. γ_1 and γ_2 are the cut-off points to be estimated. The βs denote the regression coefficients to be estimated, and ε_{it} is the normally distributed disturbance term.

We can match the interest rate votes of FOMC members with the banking sector stability of their district due to the regional affiliation principle in the Federal Reserve system. Each FOMC member is legally affiliated with his or her Federal Reserve district, though the de facto regional affiliation of Bank presidents is typically more intense than for the Governors.

2.2. Hypotheses and data

Our main explanatory variable is the z-score, which proxies the level of banking sector stability in a FOMC member's district.

$$z-score = \frac{\mathrm{RoA} + \mathrm{EQ}}{\sigma(\mathrm{RoA})}, \tag{3}$$

The z-score is defined as the sum of a bank's returns on assets (RoA) and its equity to assets (EQ), scaled by the standard deviation of the bank's profitability ($\sigma(RoA)$) (e.g., Laeven and Levine, 2009). It thus indicates if the bank's equity is sufficient to cover its losses. In essence, a higher z-score indicates a more stable bank, whereas a lower z-score implies that the bank is closer to default. To compute the z-score, we use call report data provided by the Federal Reserve Bank of Chicago for 1979–2010 on a quarterly basis. In general, data for U.S. banks are available on three levels: bank holding company, individual bank, and, for some information, the branch level. By investigating the individual bank level, we can link the banks to their Federal Reserve Districts.[3] We calculate the z-score for these individual banks using banks' RoA, total capital ratio, and the 12-quarter rolling standard deviation of their RoA. The data set also provides information about which of the 12 Federal Reserve districts each bank belongs to, so we can calculate the per quarter, per district value of banks' z-score for 1979–2010. We subsequently aggregated the individual bank z-scores to the district level, using total assets as the weighting scheme. Definitions and sources of variables are reported in Table A1 in the Appendix. We provide descriptive statistics in Table A2.

Hypothesis 1: $\beta^{z-score} > 0$: We expect that a lower z-score (indicating a lower level of regional banking sector stability), is associated with an FOMC member's preference for easier monetary policy, i.e., a higher probability of lower interest votes, and a lower probability of higher interest rate votes.

FOMC members may align their voting behavior with the stability of their district's banking sector for at least two reasons. First, the failures of regional banks are likely to have significant negative effects on a Federal Reserve district's economy. To stabilize the district's economy, FOMC representatives thus might augment their monetary policy rule with a regional banking sector instability measure. Second, FOMC members likely consider their reelection probability. Regional Bank presidents are elected and can be reelected by the Board of Directors of their regional Federal Reserve Bank. Since the member banks of the district's Fed have large influence on the selection of Directors, they may use their electoral power to lobby for the stability of the regional banking industry, which may influence Bank president's voting behavior in the FOMC.

We include a large number of control variables proposed in the literature on FOMC voting behavior. We incorporate other regional economic factors, namely the regional house price gap and the regional unemployment rate for each district. We assume that better regional economic conditions (i.e., lower unemployment rate and larger house price gap) will be associated with a preference for monetary tightening.

We also include national macroeconomic variables, such as the national inflation rate, national output gap, and their respective forecasts (provided by the Survey of Professional Forecasters) to account for the traditional monetary policy goals.[4] We also use the previous federal funds rate to check for potential autoregressive voting patterns. For all national variables except previous federal funds rate, for which the expected sign is not clear a priori, we expect a positive coefficient. According to the Taylor Rule leaning against inflationary pressure and overheating of the national economy, the need for monetary tightening implemented through higher interest rates is justified.

Furthermore, we include a number of institutional dummy variables. We use a dummy variable indicating one for Board members and zero for voting Bank presidents and expect Bank presidents to prefer tighter monetary policy a priori. We consider a dummy in-

[2] Occasionally, FOMC members meet via conference call to implement unscheduled monetary policy decisions, as in the periods of financial turmoil after 2008.

[3] Banks from different Fed districts might merge during the sample period. But this possibility is not a problem for our identification, because even if a merger occurs, with a different bank holding company or not, each individual bank's assets and business still would be allocated to its original district. Only if a bank closed after a merger would it potentially affect (depending on the size of the institution) the z-score for the district's banking sector.

[4] Including inflation and the output gap is of particular importance to capture indirect effects of regional banking sector instability. The stability of banks should affect inflation and the output gap, which, in turn, influence FOMC members' voting behavior. Both measures are therefore included to control for such indirect effects and to insulate the direct impact of regional banking sector instability on voting.

Table 1
Ordered probit baseline results.

	I	II	III	IV
Z-score	0.015***	0.014***	0.015***	0.015***
	(0.00)	(0.01)	(0.01)	(0.01)
Regional house price gap		0.088***	0.065***	0.087***
		(0.01)	(0.01)	(0.01)
Regional unemployment rate		0.009	−0.055***	0.001
		(0.02)	(0.02)	(0.02)
National inflation		0.522***		0.498***
		(0.09)		(0.09)
National output gap		0.421***		0.426***
		(0.04)		(0.04)
National inflation forecast			0.305***	
			(0.03)	
National GDP forecast			0.113***	
			(0.02)	
Federal funds rate		−0.059***	−0.133***	−0.056***
		(0.01)	(0.02)	(0.01)
Board		−0.067	−0.075*	
		(0.04)	(0.04)	
Meeting		0.175	0.233**	0.176
		(0.11)	(0.12)	(0.11)
Volcker		−0.132	−0.039	−0.140
		(0.14)	(0.16)	(0.14)
Greenspan		−0.292**	0.126	−0.293**
		(0.15)	(0.16)	(0.15)
Bernanke		−0.965***	−0.420**	−0.982***
		(0.16)	(0.17)	(0.16)
FOMC experience				0.000
				(0.01)
Finance background				0.007**
				(0.00)
Republican Bank president				0.154**
				(0.07)
Democratic Bank president				0.077
				(0.09)
Republican Governor				0.097
				(0.07)
Banking sector				0.001
				(0.00)
Threshold 1	−0.676	−1.144	−0.380	−0.904
	(0.21)	(0.30)	(0.29)	(0.32)
Threshold 2	1.160	0.796	1.500	1.042
	(0.21)	(0.30)	(0.29)	(0.32)
Observations	3083	3083	3083	3073
Wald chi²	35.6***	359.92***	314.39***	362.00***
Pseudo R^2	0.01	0.08	0.05	0.08

Notes: This table reports the baseline ordered probit model estimations using the FOMC member's interest rate vote as the dependent variable; regional district dummies are included but not reported. The robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

dicating if the FOMC meeting was conducted face-to-face or via a conference call, and time dummies for the chairmanships of Volcker, Greenspan, and Bernanke.

We account for individual characteristics of FOMC members. We incorporate the number of years a member worked in the financial industry before becoming Governor or Bank president, a dummy variable for the member's political party affiliation (Democratic = 1, Republican = 0),[5] and an experience count variable reflecting the years of FOMC membership. For the political party variable, we follow prior literature and predict more hawkish FOMC members have Republican affiliations. However, we cannot formulate clear hypotheses about the influence of FOMC experience or finance background on voting behavior a priori.

2.3. Baseline results

The results of the baseline models are reported in Table 1. We estimate four specifications. Specification I considers only the insulated effect of the z-score on FOMC voting; the other three specifications include different combinations of regional, national, institutional, and member-specific control variables. To assess the economic significance of regional banking sector instability on FOMC voting, Table 2 provides the standardized marginal effects for the regional z-score and the traditional monetary policy goals national

Table 2
Standardized marginal effects.

	−1	0	+1
Z-score	−0.017***	−0.003**	0.020***
	(0.00)	(0.00)	(0.00)
National inflation	−0.041***	−0.007***	0.048***
	(0.02)	(0.01)	(0.02)
National output gap	−0.071***	−0.012***	0.083***
	(0.01)	(0.01)	(0.01)

Notes: This table reports the standardized marginal effects based on specification (IV) of the baseline ordered probit model reported in Table 1. The standardized marginal effects provide the marginal effect of a one standard deviation increase in the z-score on the probability of voting in favor of lower (-1), unchanged (0) or higher (+1) interest rates. Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

[5] Governors are coded as Democratic (Republican) appointees if they were appointed by a Democratic (Republican) President. Bank presidents are coded as Democratic (Republican) appointees if they were appointed *during* a Democratic (Republican) presidency.

Table 3
Coefficient estimates of instrumental variable ordered probit models (IV-Oprobit).

Specification	I		II		III		IV	
	First stage	Second stage	First stage	Second stage	First stage	Second stage	First stage	Second stage
Z-score		0.017***		0.023***		0.019***		0.024***
		(0.00)		(0.01)		(0.01)		(0.01)
Lagged z-score	0.960***		0.946***		0.951***		0.941***	
	(0.02)		(0.02)		(0.02)		(0.02)	
Twice lagged z-score	−0.049**		−0.065***		−0.065***		-0.063***	
	(0.02)		(0.02)		(0.02)		(0.02)	
Liberalization Index	0.085***		0.184***		0.180***		0.176***	
	(0.02)		(0.04)		(0.04)		(0.04)	
Regional house price gap			0.013	0.087***	0.018	0.065***	0.019	0.086***
			(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
Regional unemployment rate			0.030	0.017	0.043	−0.050***	0.051	0.009
			(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)
National inflation			0.410***	0.498***			0.402***	0.475***
			(0.13)	(0.09)			(0.13)	(0.09)
National output gap			0.126***	0.418***			0.118**	0.422***
			(0.04)	(0.04)			(0.05)	(0.04)
National inflation forecast					−0.030	0.301***		
					(0.05)	(0.03)		
National GDP forecast					0.003	0.115***		
					(0.04)	(0.02)		
Federal funds rate			−0.037**	−0.056***	−0.003	−0.130***	−0.037**	−0.052***
			(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)
Board			−0.003	−0.074*	−0.001	−0.082*		
			(0.07)	(0.04)	(0.07)	(0.04)		
Meeting			0.034	0.139	−0.012	0.199	0.048	0.138
			(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Volcker			−0.873***	−0.208	−1.178***	−0.195	−0.947***	−0.218
			(0.19)	(0.25)	(0.18)	(0.26)	(0.20)	(0.25)
Greenspan			−1.441***	−0.298	−1.697***	0.006	−1.478***	−0.301
			(0.22)	(0.25)	(0.22)	(0.27)	(0.23)	(0.26)
Bernanke			−1.396***	−1.018***	−1.686***	−0.564**	−1.383***	−1.040***
			(0.24)	(0.26)	(0.25)	(0.28)	(0.26)	(0.26)
FOMC experience							0.013	0.000
							(0.01)	(0.01)
Finance background							−0.011**	0.007***
							(0.00)	(0.00)
Republican Bank president							−0.211*	0.179**
							(0.12)	(0.08)
Democratic Bank president							0.116	0.092
							(0.12)	(0.09)
Republican Governor							−0.090	0.114
							(0.16)	(0.07)
Banking sector							−0.001	0.001
							(0.00)	(0.00)
Threshold 1		−0.613***		−0.957**		−0.425		−0.685*
		(0.14)		(0.39)		(0.38)		(0.40)
Threshold 2		1.163***		0.976**		1.447***		1.254***
		(0.14)		(0.39)		(0.38)		(0.40)
Observations		3024		3024		3024		3014
Wald chi^2		15,370***		22,669***		23,013***		23,068***
Chi^2 (F-Test of instrument relevance)	11,759***		7460***		7587***		7286***	

Note: This Table shows coefficient estimates of instrumental variable ordered probit models conducting a two-way regression approach. In the first stage, the z-score is instrumented with the first and second lags of the z-score as well as the Liberalization index. We include the same controls and fixed effects as in Table 3. The second stage includes the instrumented z-score and controls taken from Table 3 with the FOMC member's interest rate vote as the dependent variable. Regional district dummies are included but not reported, robust standard errors in parentheses, *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively

output gap and national inflation, which give the change in the probability of voting for a lower (-1), higher (+1), or unchanged (0) interest rate after a one-standard deviation change in the respective explanatory variable.

Overall, the results provide robust evidence in support of our prediction that FOMC members take the level of regional banking sector instability into account when voting on interest rates in the FOMC. The coefficient on the regional banking sector z-score is significant at the 1% level and has the expected positive sign in each specification. Lower regional banking sector z-scores—indicating a higher degree of instability—are associated with a higher probability of votes to lower the interest rate and a lower probability of votes to raise the interest rate. A one standard deviation decrease in the regional banking sector z-score (being around 5) increases the probability of votes to lower interest rates by around 1.7 percentage points (−1), while decreasing the probability of votes to raise interest rates by around 2 percentage points (+1). To assess the economic significance of these results, we note that 16.8% of all votes cast favored monetary easing, whereas 21% were in favor of monetary tightening. Regarding the relative economic importance of regional banking sector instability, compared to traditional stabilization goals, Table 2 reveals that a one standard deviation increase in the national inflation rate decreases the probability of votes to lower interest rates by 4.1 percentage points and increases the probability of votes to raise interest rates by 4.8 percentage points. A one standard deviation increase in the national

Table 4
Indication of exogeneity of instruments.

Specification	I			II			III			IV		
Lagged z-score	0.002 (0.01)			−0.009 (0.01)			−0.005 (0.01)			−0.010 * (0.01)		
Twice lagged z-score		0.005 (0.01)			0.000 (0.01)			0.000 (0.01)			−0.000 (0.01)	
Liberalization Index			−0.034 (0.02)			−0.026 (0.02)			−0.010 (0.03)			−0.033 (0.03)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3024	3024	3024	3024	3024	3024	3024	3024	3024	3014	3014	3014

Note: The dependent variables in each regression are the residuals of second stage IV-ordered probit estimations in which we use two out of three relevant instruments. The residuals of the second stage are regressed on the remaining instrument and controls taken from Specification I to IV from Table 3. For each column, the coefficient of the remaining instrument is reported. Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

output gap decreases (increases) the probability of lower (higher) interest rate votes by 7.1 (8.3) percentage points.

That is, the standardized marginal effect of the z-score on voting behavior is approximately 40% as substantial as that for national inflation and 25% as great as that for the national output gap. Although the economic significance of regional banking sector instability for FOMC voting is lower than the economic significance of inflation or the output gap, it is still considerable and offers explanatory value in terms of voting behavior in the FOMC.

The results for the control variables are mostly in line with our expectations. The most important drivers of FOMC voting are national inflation and output gap (or their respective forecast values, according to the Survey of Professional Forecasters). Regional house prices are robust drivers of FOMC voting behavior, reflecting the importance of housing prices for monetary policy making, as was particularly stressed during the recent subprime mortgage crisis. The coefficient of the Federal Funds rate was negative and significant, indicating some anticyclical voting behavior in the FOMC. The Board dummy variable also was negative and significant, in line with frequent prior findings (e.g., Belden, 1989; Havrilesky and Gildea, 1995; Meade and Sheets, 2005).

2.4. Robustness checks

A potential concern regarding our identification might be that there is an endogeneity bias stemming from the fact that actual voting behavior of the FOMC members could have feedback effects on regional banking sector instability. In this section, we address this issue by using an instrumental variable (IV) ordered probit approach to identify the effects of regional banking sector instability. For that we employ two instruments for regional banking sector instability and perform a two stage ordered probit regression. As the first instrument we use the first and second lags of the z-score to reduce concerns that today's voting behavior has any contemporaneous feedback effect on regional banking sector instability. Therefore, we only require weak exogeneity here which builds on the fact that future values of the regressors should not be correlated with the error term. On the other hand, past values of regional banking sector instability are very likely to be good predictors of next period's level of bank instability. As a second instrument, we choose the shutdown of state-regulations that kept banks from expanding into other states before 1994 and came with the Riegle-Neal Interstate Banking and Branching Efficiency Act. In particular, we choose the index provided by Rice and Strahan (2010) that indicates at the state level how restrictive banking regulation is set up in terms of out-of-state bank entry and collapse it to the Federal Reserve district year level. For ease of discussion we use the reverse version of the index for which now larger values (on a scale from 0 to 4) indicate a less restrictive regulation regarding bank entry from out-of-state.[6] Our rationale for using this kind of index as an instrument for regional banking sector instability is that we assume, according to the literature, that less restrictive banking regulations trigger more competition which affects banks' risk-taking (Keeley, 1990).

Table 3 presents the results of our IV estimations for the same baseline specifications used in Table 1. In all four panels, we find that our instruments are relevant for regional banking sector instability since the instruments' coefficients of the first-stage regressions are highly significant. The F-test on joint relevance of the instruments (reported at the bottom of Table 3) is highly significant in each specification. Furthermore, the direction of the effects seems reasonable since we find that the first lag of z-scores impacts current z-scores positively while the second lag comes out negative indicating some volatility of regional banking sector instability. Moreover, we find that more liberalized banking markets are more stable which contrasts the charter value paradigm by Keeley (1990) but provides evidence for the competition-stability view of Boyd and Nicolo (2005).

More importantly, the results of the second stage regressions reported in Table 3 reveal that the estimated coefficients on the instrumented z-score are positive and highly significant, which confirms our baseline results.

Table 4 additionally provides tests on the exogeneity of instruments. For each regression we use two (out of three) instruments to estimate the first and second stage ordered probit model according to Table 3 and then run a third regression using the values of the residuals from the second stage as a dependent variable which is then explained by the remaining third instrument and the other control variables. This procedure provides a direct test on whether each instrument is correlated with the second stage residuals. We find that the coefficients for the three instruments in Specifications I to IV of Table 4 largely come out insignificant[7] which indicates the validity of our instruments. In summary, the instrumental variable regressions indicate that our baseline results stay robust when we account for potential reverse causality issues.

We perform several other sensitivity analyses to further check the robustness of our results. First, we used alternative measures of regional banking sector instability – namely, ratios of non-performing assets to total assets, provisions to loans, and failed deposits of regional banks. The results are summarized in Table 5. Second, we applied the natural logarithm of the z-score to cope with potential problems of skewed z-scores (Laeven and Levine, 2009). Third, we used member-specific (instead of dis-

[6] In order to account for developments before 1994, the period when the regulation was not implemented, we account for possible bilateral agreements for bank entry between some states by setting the value of the index to 1.

[7] One exception is the lagged z-score in Specification IV of Table 4 with a t-value of -1.72, which is near the 10% significance level.

Table 5
Robustness checks using alternative bank stability indicators.

	I	II	III	IV
NPA to assets	−26.067***	−20.012***	−18.259***	−28.060***
	(3.57)	(5.13)	(5.17)	(5.73)
Provisions to loans	−19.684***	−10.953***	−9.723***	−13.922***
	(2.96)	(3.24)	(3.27)	(3.43)
Failed deposits of regional	−15.112***	−7.466*	−11.401**	−7.864*
banks per total assets	(4.59)	(4.32)	(4.97)	(4.24)
Controls	Yes	Yes	Yes	Yes
Observations	3083	3083	3083	3073

Notes: This table reports the results of robustness checks using non-performing loans to assets, provisions to loans to total loans, or failed deposits of regional banks to total assets as alternative regional banking sector stability indicators, respectively. Specifications I to IV, for each model, use the same control variables as used in the baseline model in Table 1. Results for the controls are not reported but available upon request. t-values based on robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

trict) fixed effects to account for heterogeneity among FOMC voting members. The results for these checks are available upon request. Overall, the sensitivity checks show that the baseline regression results remained robust, indicating the strong link between regional banking sector instability and the voting preferences of regionally affiliated FOMC voting members.

3. Interaction models

3.1. Empirical model and hypotheses

Our baseline models suggest that FOMC members align their voting behaviors with the degree of banking sector instability in their Federal Reserve district. This result holds for the whole sample, yet it seems plausible to expect different magnitudes of this effect, in terms of its economic importance and statistical significance, across various types of FOMC members. For example, a FOMC member with a career background in the financial industry is probably more focused on banking sector instability when deciding on the appropriate interest rate than a FOMC member with no finance background. Thus, member-specific or regional characteristics may determine the extent to which a FOMC member takes instability in the banking sector in his or her district into account when voting on the interest rate in FOMC meetings.

To test for such a conditionality in FOMC voting sensitivity to regional banking sector instability, we used interaction models with the following conditioning variables:

Hypothesis 2: Career background in finance (number of years the FOMC member worked in full-time positions in the financial industry before becoming Federal Reserve Bank president or Governor). We expect FOMC members with a career background in finance to respond more sensitively to regional banking sector instability. Members with a finance background may align their voting behavior with the needs of the district's banking sector to improve their outside job market opportunities after leaving the FOMC. They may also have advantages in gathering and interpreting information on bank stability making their voting behavior more responsive to bank stability. Third, their career experience in the finance branch may shape an FOMC member in a way that he/she focuses more on bank stability.

Hypothesis 3: Size of regional banking sector (value of total banking assets relative to total income in the Federal Reserve district of the voting member). We expect that members representing districts with a large banking sector respond more sensitively to instabilities in the regional banking sector. First, bank failures are more important to the district's economy when the banking sector is large. Second, in districts with large banking sectors, district banks likely have a larger influence on the (re)election of regional Bank presidents making their voting behavior more dependent on the stability needs of regional banks.

Hypothesis 4: Board dummy (1 = Governor, 0 = Bank president). We expect that the voting behavior of Bank presidents is more responsive to regional banking sector instability than for Governors. Bank presidents have frequent contacts to representatives from their region, including businessmen from the banking sector. Therefore, Bank presidents gain a potential information advantage over Board members in this respect. Also the influence of regional banks on the (re)election process of Bank presidents offers a reason to expect that Banks presidents especially account for the stability needs of regional banks when they vote.

Hypothesis 5: Committee experience (number of years the voter has been a member of the FOMC). We expect that longer FOMC membership is associated with a higher relevance of bank stability for voting behavior. Since banking crises are rather erratic and occur with considerable time lags, FOMC members with longer experience in the committee might face those crises more often than unexperienced members leading to a stronger reaction on changes in the stabilization needs of the regional banking system.

Political affiliation: Republican Bank president dummy (1 = Bank president was elected during Republican presidency, 0 = Bank president was elected during Democratic presidency); and Republican Governor dummy (1 = Governor was appointed by Republican President, 0 = Governor was appointed by Democratic President). Literature has shown that Democratic appointees tend to prefer lower interest rates than Republican appointees (e.g., Havrilesky and Gildea 1992, 1995; Chappell et al., 1993, 1995; Tootell 1996; Meade and Sheets, 2005). However, in terms of the interplay between regional banking sector instability and the political affiliation of FOMC members it is not clear a priori whether Democratic appointees or Republican appointees react stronger to the deterioration in bank stability, and we therefore cannot formulate a hypothesis.

Conditioning variables 3, 5, and 6 are binary; variables 1, 2, and 4 instead are continuous variables or, alternatively, coded as dummies to indicate if the value is above (1) or below (0) the sample median. Then, to identify these conditional effects of regional banking sector instability, we estimated the following interaction model:

$$Y_{it}^{*} = X_{it}'\beta + \varepsilon_{it} = X_{it1}\beta_1 + C_{it}\beta_2 + C_{it}X_{it1}\beta_3 + \sum_{(j=2)}^{J} X_{itj}\beta_{(j+2)} + \varepsilon_{it}, \quad (4)$$

where unobservable voting preference Y_{it}^{*}, is determined by the degree of banking sector instability in the FOMC member's district X_{it1}, interacted with one of the conditioning variables, C_{it}. The voting categories introduced in Eqs. (2a)–(2c) still apply.

Table 6
Marginal effects of Z-score interacted with member-specific characteristics.

Z-score				
interacted with	Easing (-1)		Tightening (+1)	
	0	1	0	1
Finance background	−0.002	−0.005***	0.002	0.006***
	(0.00)	(0.00)	(0.00)	(0.00)
Banking sector	0.002	−0.005***	−0.002	0.006***
	(0.00)	(0.00)	(0.00)	(0.00)
Board	−0.005***	−0.002	0.006***	0.003*
	(0.00)	(0.00)	(0.00)	(0.00)
FOMC experience	−0.000	−0.008***	0.000	0.009***
	(0.00)	(0.00)	(0.00)	(0.00)
Republican Governor	−0.010***	0.001	0.009***	−0.001
	(0.00)	(0.00)	(0.00)	(0.00)
Republican Bank president	−0.015***	−0.002	0.018***	0.002
	(0.00)	(0.00)	(0.00)	(0.00)

Notes: This table reports the marginal effects based on the interaction model estimations. Detailed estimation results of interaction models are not reported but available upon request; Interaction models include the linear effects of the z-score and the conditioning member specific variable, the respective interaction term, and the same control variables as used in the baseline specification IV of Table 1. Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

3.2. Results

Based on the results of the interaction models, we report the marginal effects of the conditioning dummy variables in Table 6 and the marginal effects of the continuous conditioning variables in Fig. 1.[8] For each conditioning dummy variable, we report four marginal effects and their respective significance. The first marginal effect represents the impact of a one-unit change in the regional banking sector z-score on the probability of voting in favor of a lower interest rate (−1), given that the conditioning dummy variable equals 0. The second effect indicates the marginal impact of the regional z-score on the probability of a lower interest rate vote (category -1), given that the conditioning dummy equals 1. With the third and fourth marginal effects, we assess the marginal impact of the regional banking sector z-score on the probability of a higher interest rate vote (category +1), given that the conditioning dummy equals 0 or 1, respectively. In Fig. 1, the marginal effects for the three continuous conditioning variables (career background in finance, committee experience, and size of the regional banking sector) are reported. For each conditioning variable, we indicate the marginal effect of the regional banking sector z-score on the probability of voting in favor of a lower interest rate (-1), followed by the marginal effect of the regional banking sector z-score on the probability of voting in favor of a higher interest rate (+1). The x-axis shows the value of the respective conditioning variable, and the y-axis represents the marginal effect of a one-unit change of the regional banking sector z-score on the probability of being in the respective voting category.

The results suggest that regional banking sector instability exerts a significant impact on the voting behavior of FOMC members with a career background in finance, but we detect no significant effect for FOMC members with no such career background. Lobbying for the regional banking industry is plausible in this setting, for several reasons. First, FOMC members with a career background in finance may enter the finance branch again (in their district) after they complete their service to the FOMC. To improve their job market opportunities, these members might vote in ways that meet the banking sector stability needs of their district. Second, FOMC members with a finance background may have informational advantages, such that they can better anticipate potential threats to banking sector stability than their peers without a finance background. Third, a career in finance could shape the monetary policy objectives of FOMC members. Traditional monetary policy objectives include stabilization of output and inflation, but stabilizing the banking sector typically is not a standard monetary policy objective. However, FOMC members with a background in finance may have a less orthodox view of monetary policy goals, such that they might be more likely to align their voting behavior with various economic variables, including regional banking sector instability.

We also find that FOMC members representing a district with a large banking sector are more likely to align their voting behavior with banking sector instability than FOMC members representing a smaller regional banking sector. The potential impact of bank distress on regional output and price fluctuations should be greater in districts with a larger banking sector. Moreover, a more powerful regional banking industry can exert more pressure on regional Bank presidents (e.g., influencing reelection), so this president's voting decision may probably be more sensitive to the interests of the large regional banking industry.

The Board dummy results indicate that the interest rate votes of Bank presidents depend much stronger on regional banking sector instability than the votes of Board members. This result resembles the greater regional bias of Bank presidents, compared with Board members, indicated in prior literature (e.g., Belden, 1989; Chappell and McGregor, 2000). Bank presidents typically appear to have closer regional affiliations to the Federal Reserve district they represent, but Board members' regional affiliation is rather de jure. We assume, that Bank presidents thus enjoy an information advantage over Board members, which can make them more likely to align their voting behavior with regional banking sector instability. Bank presidents also are elected (and can be reelected) by the Board of Directors of their regional Federal Reserve Bank, which features representatives of the district's banking industry. To get reelected, Bank presidents reasonably may take the stabilization needs of the regional banking sector into account when voting on interest rates in the FOMC. Board members instead are appointed directly by the President of the United States, so their term of office is independent of the interests of their district's banking industry.

The interaction models with FOMC experience suggest that FOMC members with longer terms of office align their voting more with regional banking sector instability. FOMC members might shift their monetary policy objectives during their term in office, putting more weight on banking sector stability at the expense

[8] For each conditioning variable, we estimate an interaction model which includes the linear effects of the z-score and the conditioning member specific variable, the respective interaction term, and the same control variables as used in the baseline specification IV of Table 1.

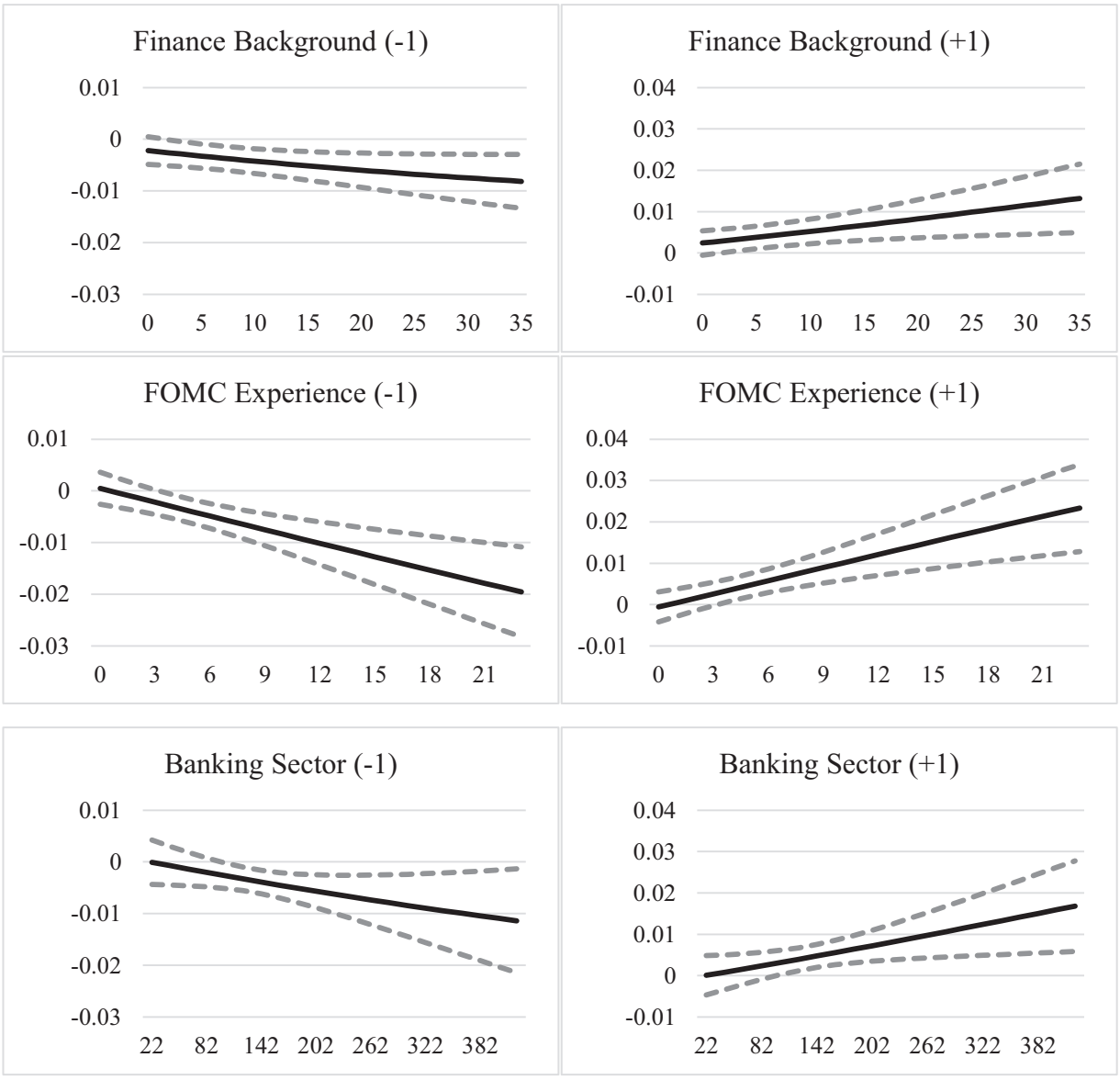

Fig. 1. Marginal effects of z-score interacted with member-specific characteristics.
Note: Solid line displays the marginal effect of the regional z-score on the probability of dissenting in favor of easier (−1) or tighter (+1) monetary policy. Dashed lines display the 95 % confidence intervals. The x-axis of each figure shows the range of the moderating variables (Finance background, FOMC Experience, Banking Sector). The y-axis of each figure shows the magnitude of the marginal effect of a one unit higher regional z-score on the probability of dissenting in favor of easier (−1) monetary policy or dissenting in favor of tighter (+1) monetary policy. The displayed marginal effects are based on interaction models which include the linear effects of the z-score and the conditioning member specific variable, the respective interaction term, and the same control variables as used in the baseline specification IV of Table 1.

of more traditional monetary policy targets, because these experienced FOMC members become more pragmatic during their terms. Second, FOMC members with longer committee experience likely have faced more frequent banking crises than committee members with less experience. This circumstance may lead the experienced members to react more sensitively to an economy marked by banking instability.

For the political affiliation dummies, our results offer greater insight by shedding light on conditional monetary preferences: Democratic appointees focus on regional banking sector stability, but Republican appointees do not.

4. Conclusions

We investigate whether FOMC members align their voting behavior in the FOMC with the degree of banking sector instability in their districts. Our robust results show that FOMC members vote for lower interest rates when confronted with higher levels of banking instability in their district.

We explore different channels for the impact of regional banking sector instability on the voting behavior of FOMC members. Bank presidents react more sensitively to bank instability in their district than Governors. Longer committee experience increases the impact of bank instability on the voting behavior. Moreover, regional banking sector instability affects voting behavior only for Democratic affiliates, while no significant effect is found for Republican affiliates.

When FOMC members have a career background in the finance industry they react strongly to bank instability, e.g., because they make better assessments of the financial industry's situation or because they are considering their future job market opportunities. The votes of FOMC members representing relatively large financial sectors also are significantly affected by the stability needs of these sectors, which likely reflects strong lobbying pressure from

the banking industry in these districts. Overall, our results suggest that the institutional structure of the Federal Reserve System (regional representation, influence of regional banks on the appointments of Bank presidents) constitutes a channel that enables regional banks to lobby for their interests in the FOMC, using the voice of the district representatives. The Dodd Frank Act reduced the influence of regional banks to elect the district's Bank President. Given our results, this institutional reform may be meant to reduce the link between regional banking sector stability and voting in the FOMC.

Appendix

Table A.1, Table A.2.

Table A.1
Variable definitions and sources.

Variable	Definition	Data Source
	Dependent Variable	
Vote	FOMC member from Federal Reserve district votes in favor of interest rate increase (+1), interest rate decrease (−1), or unchanged interest rate (0)	FOMC voting *minutes*
	Regional variables	
Z-score	Ratio of the sum of a bank's return on assets and its equity ratio by the (12-quarter rolling) standard deviation of return on assets. Individual bank z-scores are aggregated to the district level, using total assets as a weighting scheme.	Call reports: Fed Chicago and own calculations
Provisions to loans	Provisions for loans and lease losses over total assets. Individual bank provisions to loans are aggregated to the district level using total assets as a weighting scheme.	Call reports: Fed Chicago
NPAs to assets	Sum of total loans and lease financing receivables past due 30–90 or more than 90 days and other real estate owned, both in relation to total assets. Individual bank non-performing assets to assets are aggregated to the district level using total assets as a weighting scheme.	Call reports: Fed Chicago
Failed deposits of regional banks to total assets	Failed deposits of insolvent banks per total assets in the district	Failed deposits: Federal Deposit Insurance Company Call reports: Fed Chicago
Banking sector size	Sum of total assets of all banks in each district, relative to the district's total income.	Call reports: Fed Chicago
Regional house	Percentage deviation of district house price index from time trend.	House price index for U.S. states: Federal Housing Finance Agency
price gap	The state-specific house price gap is calculated as the percentage difference between the state-specific house price index and Hodrick-Prescott-based time trend; the smoothing parameter for the Hodrick-Prescott filter was set to 1600; quarterly house price indexes are interpolated to monthly data using the cubic spline method.	
	The district-specific house price gap is the weighted average of state-specific house price gaps (district boundaries taken from Chappell et al., 2008), with population shares used as the weighting scheme.	Resident population: Census Bureau
Regional unemployment rate	Difference between unemployment rate in the district and national unemployment rate.	National and state unemployment rate: Bureau of Labor Statistics
	The district unemployment rate is the weighted average of state-specific unemployment rates (district boundaries taken from Chappell et al., 2008), with population shares used as the weighting scheme.	Resident population: Census Bureau
	National Variables	
National inflation	Month-over-month percentage change in consumer price index	Consumer price index: Bureau of Labor Statistics
National output gap	Month-over-month change in Hodrick-Prescott-based GDP gap; the smoothing parameter for the Hodrick-Prescott filter was set to 1600	National output gap: Bureau of Labor Statistics
National inflation forecast	Inflation forecasts made by professional forecasters, published in the quarterly Survey of Professional Forecasters	Inflation forecast: Federal Reserve Bank of Philadelphia
National GDP forecast	National GDP forecasts made by professional forecasters, published in the quarterly Survey of Professional Forecasters	GDP forecast: Federal Reserve Bank of Philadelphia
Federal funds rate	Federal funds rate on the Wednesday prior to the FOMC meeting	Federal funds rate: Board of Governors
	Institutional Dummy Variables	
Board	Dummy variable; 1 if vote cast by Board member, 0 if vote cast by Bank president	
Meeting	Dummy variable; 1 if vote cast at face-to-face meeting, 0 if vote cast at conference call	
Volcker	Dummy variable; 1 if FOMC chairman is Volcker, 0 otherwise; reference category is the chairmanship of Arthur Miller	
Greenspan	Dummy variable; 1 if FOMC chairman is Greenspan, 0 otherwise; reference category is the chairmanship of Arthur Miller	
Bernanke	Dummy variable; 1 if FOMC chairman is Bernanke, 0 otherwise; reference category is the chairmanship of Arthur Miller	
	Individual background characteristics	

(*continued on next page*)

Table A.1 (*continued*)

Variable	Definition	Data Source
FOMC Experience	Number of years FOMC member has been a committee member	Own calculations
Finance background	Number of years FOMC member has worked in full-time positions in the financial industry before becoming Federal Reserve Bank president or Governor	Own calculations
Republican Bank president	Dummy variable; 1 if Bank president was elected during Republican presidency; 0 if Bank president was elected during Democratic presidency	Own calculations
Republican Governor	Dummy variable; 1 if Governor was appointed by Republican president; 0 if Governor was appointed by Democratic president	Own calculations

Table A.2
Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Vote	3083	0.0412	0.6134	−1	1
Z-score	3083	26.3693	4.9369	10.5408	47.6933
Provisions to loans	3083	0.0052	0.0060	−0.0397	0.0572
NPAs to assets	3083	0.0066	0.0055	0.0007	0.0364
Failed deposits of regional banks per total assets	3083	0.0007	0.0041	0	0.1074
Regional house price gap	3083	0.0019	2.7780	−9.9255	12.5274
Regional unemployment rate	3083	6.1260	1.7391	2.7110	13.5400
National inflation	3083	0.3525	0.3617	−1.8028	1.4304
National output gap	3083	−0.0307	0.7263	−2.5669	1.8174
National inflation forecast	3083	3.7689	2.2310	1.2363	9.4611
National GDP forecast	3083	2.5009	1.3882	−2.8214	4.8088
Federal funds rate	3083	6.4885	4.2200	0.11	18.84
Board	3083	0.5501	0.4976	0	1
Meeting	3083	0.9358	0.2452	0	1
Volcker	3083	0.2864	0.4522	0	1
Greenspan	3083	0.5595	0.4965	0	1
Bernanke	3083	0.1278	0.3339	0	1
FOMC experience	3073	4.8627	4.3399	0	23
FOMC experience dummy	3073	0.4299	0.4951	0	1
Finance background	3073	6.0290	8.6953	0	35
Finance background dummy	3073	0.4494	0.4975	0	1
Banking sector (in %)	3083	93.1193	57.3759	22.1231	431.6582
Banking sector dummy	3083	0.4934	0.5000	0	1
Republican Bank president	3073	0.3101	0.4626	0	1
Democratic Bank president	3073	0.1386	0.3456	0	1
Republican Governor	3073	0.3697	0.4828	0	1

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