Atl Econ J (2016) 44:91–103
DOI 10.1007/s11293-016-9487-5

Implications of the Dual Banking System in the US

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Published online: 22 March 2016

Abstract This paper examines the differences in characteristics of federal and state chartered banks by using individual commercial bank's data sets from 1984 to 2006. The findings indicate significant differences between these two groups of banks in terms of their asset and liability management strategies. In line with these differences, credit channel of monetary policy is found to work differently for state and federal banks. Federal banks are found to be more responsive to monetary policy changes.

Keywords Dual banking system · credit channel · investment banking · commercial banking · monetary policy

Jel G21 · G24 · G28 · E51

Introduction

Prior to the National Bank Act of 1864, commercial banks were organized under charters granted by state legislatures. With the National Bank Act, federally chartered banks were introduced. Since then, banks in the U.S. have two charter options. The first option is to get a federal charter. A federally chartered bank is regulated by the Office of the Comptroller of the Currency (OCC) and complies with federal laws. The second option is to get a state charter. A state-chartered bank obeys state laws and is regulated by state supervisors. It may choose to be a member of the Fed or the Federal Deposit Insurance Corporation (FDIC), which would become its primary federal regulator. The "dual banking system" refers to these parallel state and federal banking systems that co-exist in the U.S.

In the beginning, there were significant regulatory differences between state and federal banks such as differences in their lending limits, their ability to branch interstate and the list of activities that they were permitted to take. Over time, these regulatory

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differences have mostly disappeared with two exceptions. First, national banks are held exempt from certain state laws to establish uniform national standards. For instance, until the 1994 Riegle-Neal Act, a national bank was able to charge its out-of-state credit card customers an interest rate on unpaid balances allowed by its home state, notwithstanding that the rate was impermissible in the state of the bank's customers. Another example is that the U.S. Supreme Court authorized insurance agent activities in small towns for national banks and this preempted Florida insurance laws that would otherwise prohibit a national bank from selling insurance in a small town. Comizio and Lee (2011) analyze implications of these types of exemptions and finds that exemptions provided a distinct charter advantage to national banks. Consequently, state banks operating on an interstate basis began to convert to federal banking charters.

The second difference between state and federal charters that has not disappeared is the way the budget of their regulators is determined. State-chartered banks pay an assessment fee for supervision "only" to their state without paying fees directly to the FDIC or the Fed. The FDIC and Fed have other income resources. In contrast, the OCC relies almost entirely on supervisory assessments for its funding needs. Blair and Kushmeider (2006) show that for banks of comparable asset size, operating with a national charter generally entails a greater supervisory cost for banks than operating with a state charter. Rosen (2003) suggests that this difference in budgeting mechanisms might influence how a bank is treated. The implication is that expensive regulators might treat their customers better.

This paper focuses on other implications of these differences between state and federal banks that have not been analyzed by the literature before. It first looks at how these remaining differences could influence the way state and federal banks were managed. For this purpose, the paper analyzes their risk and return behaviors as well as funding choices and activity mixes. Since banks play a central role in monetary transmission mechanism, differences between state and federal banks could also influence how they respond to monetary policy changes. In the second part of the empirical section, the paper focuses on the implications of these differences on the credit channel of monetary policy.

Literature Review

The empirical literature has studied some of the consequences of having multiple regulators in the banking sector. Rosen (2003) looks at whether switching among the FDIC, Fed and OCC is beneficial for U.S. banks. They find that bank returns' rise and failure rates remain unchanged for banks that switched their regulators. Rezende (2011) examines switches among three regulators and looks at whether commercial banks improve their supervisory ratings by switching regulators. The paper finds that regulators rate banks better after the switch.

Blair and Kushmeider (2006) analyze the differences in the charters' cost. They find that state banks generally pay lower exam fees, because the federal agencies alternate examinations with the states and these federal agencies do not charge for exams. Since the OCC must cover the full costs of bank examinations, the costs are higher for federal banks. George (2012) discusses the benefits of the dual banking system and argues that multiple options have led to considerable innovation and improvement in banking

services. The article suggests that the dual system has allowed local bankers and regulators to construct a banking system closely attuned to the economic needs of each state, supervised by personnel with a strong knowledge of the local economy. Agarwal et al. (2012) focuses on state chartered banks and compares the FDIC and the Fed to state regulators. They find that the FDIC and the Fed are significantly less easygoing, downgrading supervisory ratings about twice as frequently as state supervisors.

In this paper, we also examine the implications of these differences on the credit channel of monetary policy. Early studies in this literature generally focus on the size differences between banks in determining the effectiveness of the credit channel. Kashyap and Stein Jeremy (1995) and Kashyap and Stein Jeremy (2000) find that the credit channel is more effective for small banks since funding options of small banks are more limited. Ashcraft Adam (2006) and Campello (2002) both show there are differences among small banks in terms of how the credit channel works. Bank capital is another aspect that this literature studies when analyzing the credit channel. Van den Heuvel (2006) shows that less capitalized banks have less access to markets for uninsured funds. Consequently, the credit channel is more effective for these banks. Finally, a growing literature looks at the role that securitization plays on the credit channel. Altunbas et al. (2009) show that securitization provides banks with additional flexibility to face changes associated with monetary policy movements. They find that securitization reduces the effectiveness of the bank lending channel.

Empirical Section

There are two main differences in the regulation of state and federal banks. In this section we will look at how these differences influence state and federal banks. We will first analyze the influence of charters on major bank choices in a regression framework. After that, we will look at how state and federal banks finance their activities by using a different statistical tool called canonical correlation analysis. Finally, we will analyze if the credit channel of monetary policy works differently for state and federal banks.

The banking sector data used in this article are from Reports of Condition and Income of U.S. Banks downloaded from the Federal Reserve Bank of Chicago's webpage. The data are quarterly and range from the first quarter of 1984 through the last quarter of 2006. Before we run our regressions, we apply a number of screens to the data that were used by seminal articles such as Campello (2002); Ashcraft and Campello (2007) and Kashyap and Stein Jeremy (2000) and others. We drop the data point if there is a merger in that quarter.[1] We also drop the data point if the asset growth in that quarter was above 100 % and total loan growth was above +50 or below −50 %. This is to eliminate outliers. These cutoff values are standard in this literature.

[1] It is customary in this literature to drop a data point if there is merger in that quarter. Cultural and technological differences among merged firms, merger costs and changes in the acquirer's capital structure are among reasons that are known to make the data point in which merger occurred unreliable. Since this paper is solely interested in the influence of monetary policy on credit growth, we drop observations that belong to merger quarters. These dropped observations only amounts to approximately 0.7 % of our total observations.

Summary of the Data

In this section, summary statistics will be presented. As Kashyap and Stein Jeremy (2000) and others indicated, the size distribution of banks is positively skewed in the U.S. In order to control for this, small and big banks will be analyzed separately in the following sections. Small banks will be defined as those at or below the 95th percentile of the total asset distribution of banks in the sample. Big banks are defined to be those at the 99th percentile.[2]

Tables 1 and 2 provide a summary of the main characteristics of state and federal banks. Federal and state banks look very similar to each other in these tables. The only prominent difference between the two is that federal banks have a larger size on average. Small banks are also shown to be better capitalized and hold more deposits to finance their assets.

Regression Results

In this section, we will analyze two types of variables. In the first group, we will look at variables that are related to activity mix, such as share of noninterest income to total income, securities to total assets, loans to total assets, federal funds loans to total liabilities, and deposits to total liabilities. First two of these variables measure the share of bank revenues that come from nontraditional activities such as investment banking and securitization. The other three dependent variables describe loans and liabilities. In the second group of variables, we will examine return and risk behavior of federal and state banks.

The paper by Demirgüç-Kunt and Huizinga (2013) is closely related to our work because determinants of the same variables are analyzed. In this section, our analysis follows theirs. We use bank-level control variables such as log of assets, equity, asset growth and overhead expenses. Log of assets, *logta*, is used to proxy for bank size. Asset growth, *tagr*, allows us to analyze the role of bank growth. Equity, *e*, is used to measure bank leverage. Finally, the ratio of overhead expenses to total assets, *exp*, is used to represent a bank's cost structure. We use macroeconomic control variables as well. Rate of inflation, *inf*, and the growth rate of GDP, *gdp*, are used to control for overall economic conditions. Additionally, we control for regulatory and institutional differences. *Statech* and *bhc* are dummy variables taking the value of 1, respectively, when a bank has state charter or a bank is part of a bank holding company (BHC) and 0 otherwise respectively. Finally, state dummies are included to control for locational differences.

Equations (1) and (2) represent the equations that will be estimated.

$$Y_{it} = a + f(\text{logta}_{it}, \text{tagr}_{it}, e_{it}, exp_{it}, \text{statech}_{it}, bhc_{it}) + m(inf_t, gdp_t) + \text{statedummy}_i + \alpha_{it} \quad (1)$$

where Y_{it} includes the first group of variables mentioned above such as the share of non-interest income, share of securitized assets to total assets, the share of loans to total

[2] The literature focuses on the differences between small and large banks in analyzing bank choices and the credit channel. The medium-size banks are typically left out. We followed the approach in the literature and reported our results for large and small banks.

Table 1 Characteristics of small independent banks

	State	Federal
Number of Observations	158,855	58,822
Real Total Assets	$172,437,000	$418,740,000
Real Capital to Total Liabilities	0.098	0.094
Loan to Total Assets	0.567	0.561
Nonperforming Loans to Total Assets	0.018	0.020
Deposits to Total Liabilities	0.868	0.865

Source: Reports of Condition and Income, Federal Reserve Bank of Chicago. Data represent average figures for the 1984-2006 period

assets, the ratio of deposits to liabilities and federal fund purchases to total liabilities. These variables are shown as *nonint*, *secta*, *loanta*, *depliab* and *ffpurl* respectively in the tables.

$$Z_{it} = a + f(\text{logta}_{it}, \text{tagr}_{it}, e_{it}, exp_{it}, statech_{it}, bhc_{it}, nonint_{it-1}, ffpurl_{it-1}) + m(inf_t, gdp_t) + statedummy_i + \alpha_{it} \quad (2)$$

where Z_{it} includes the second group of variables such as return on assets (*ROA*) and the share of nonperforming loans to total loans, *nonper*, and equity, *e*. Nonperforming loans measures loan-portfolio risk, while equity measures how leveraged a bank is. Non-interest incomes and federal fund loans account for non-traditional activities and non-deposit liabilities. Lagged values of these two variables are used in order to deal with possible endogeniety issues.

Tables 3 and 4 present the regression results. In these tables, column titles represent the dependent variables while variables in the rows represent the independent variables. In Table 3, we estimated equation (1). The table shows that state charter dummy *statech* is significant for most of the large bank regressions. Federal banks are found to generate higher non-interest income and borrow more from federal funds market. State banks are found to make more customer loans and securitize their loans more. For small banks,

Table 2 Characteristics of large banks

	State	Federal
Number of Observations	3448	4709
Real Total Assets	$13,000,000,000	$14,400,000,000
Real Capital to Total Liabilities	0.078	0.075
Loan to Total Assets	0.619	0.651
Nonperforming Loans to Total Assets	0.017	0.022
Deposits to Total Liabilities	0.622	0.639

Source: Reports of Condition and Income, Federal Reserve Bank of Chicago. Data represent average figures for the 1984-2006 period

statech is found to be significant only in two regressions, federal funds loans and deposits regression, and these coefficients have smaller values than large banks regressions. This indicates that state banks make slightly more federal funds loans and use smaller amounts of deposit finance. Bank-specific control variables are found to be significant with expected signs. Macro control variables are found to be more influential on small bank regressions which indicates that large banks are able to insulate their activity choice decisions from macro developments.

Table 4 estimates equation (2). Regression results show that the state charter dummy is significant only in the equity equation of large banks. This indicates that large state banks are better capitalized, but there is no significant difference between large state and federal banks' return and loan portfolio risk. On the other hand, *statech* is significant in all three indicators of the small bank regressions. Small state banks are found to have higher returns and they have less risky loan portfolios and they hold slightly smaller amount of capital than federal banks.

Bank controls are found to be significant with expected signs. This time, macro control variables are found to be significant most of the time for both groups, implying that both small and large banks' risk and return decisions are sensitive to macro developments.

To summarize, regression results show that there are significant but relatively small differences between small federal and small state banks. The differences in the activity types of small banks are especially small. However, large federal banks are found to be notably different from large state banks in their activity mix. Large state banks are shown to undertake more traditional banking activities such as deposit collection and loan creation and to be better capitalized. Large federal banks are found to engage in investment bank activities more and use typically short-term liabilities to finance them.

After analyzing the differences in bank activities, we will now look at another issue that has not been examined by the literature before: policy implications of the dual banking system. The credit channel of monetary policy is about how banks adjust their

Table 3 Regression results for large and small bank activity mix

	Large Banks					Small Banks				
	nonint	*Loanta*	*Ffpurl*	*depliab*	*tosecta*	*Nonint*	*loanta*	*Ffpurl*	*depliab*	*tosecta*
statech	−0.65[a]	7.65[a]	−1.12[c]	0.97	0.11[c]	0.01	0.14	0.08[a]	−0.35[a]	−0.02
logta	0.06	0.64[a]	−0.62[a]	−7.89[c]	−0.39[a]	0.02[a]	7.15[a]	0.75[a]	−3.60[a]	−0.17[a]
tagr	−0.01[a]	0.00	0.01[a]	−0.01	0.00[a]	0.00[a]	−0.02[a]	0.00[a]	−0.01[a]	0.00[a]
e	0.07[a]	−0.59[a]	−0.33[a]	0.09	−0.01[a]	0.02[a]	0.04[a]	−0.06[a]	−0.87[a]	−0.01[a]
exp	0.32[a]	−0.35[b]	0.21[c]	0.95[a]	0.03[a]	0.63[a]	0.08[b]	0.03[a]	−0.89[a]	0.31[a]
bhc	0.02	−1.68	1.51	−5.75[a]	0.02	0.00	3.03[a]	0.04[a]	−0.25[a]	0.04
inf	−1.71[a]	−1.66[3]	0.00	6.21[a]	0.01	−0.24[a]	−0.33[a]	−0.43[a]	−0.64[a]	0.05[a]
gdp	0.06	0.80	−0.42	−2.54[a]	−0.04	−0.04[a]	0.06	0.22[a]	−0.10[a]	0.00
R[b]	0.08	0.04	0.03	0.24	0.25	0.03	0.13	0.04	0.32	0.00
N	4030	4030	4030	4030	879	558,905	558,905	558,905	558,905	125,890

[a], [b] and [c] show variables that are significant at 1, 5 and 10 % respectively. Data used in these regressions cover the 1984–2006 period. Source: Reports of Condition and Income, Federal Reserve Bank of Chicago

Table 4 Risk and return regressions of large and small banks

	Large Banks			Small Banks		
	ROA	Nonper	e	ROA	Nonper	E
statech	−0.02	−0.23	1.16[a]	0.11[a]	−0.33[a]	−0.09[b]
logta	0.04[c]	−0.52[a]	1.28[a]	0.16[a]	−0.50[a]	−0.11[a]
tagr	0.00	−0.01[a]	−0.02[a]	0.00[a]	−0.01[a]	−0.01[a]
e	0.04[a]	−0.08[a]		0.04[a]	−0.09[a]	
exp	−0.06[a]	0.03	0.50[a]	−0.04a[a]	−0.16[a]	0.32[a]
bhc	0.01	−0.10	−0.16	−0.03[a]	−0.24[a]	−0.06[a]
l.nonint	0.05[a]	0.00	0.05[a]	0.27[a]	0.01[a]	0.04[a]
l.ffpur	0.00	0.00	0.02[a]	0.00[a]	−0.02[a]	−0.04[a]
inf	−0.72[a]	0.57[a]	0.75[a]	−0.47[a]	0.49[a]	−0.70[a]
gdpq	0.29[a]	−0.803	0.54[a]	0.13[a]	−0.11[a]	0.16[a]
N	3853	3853	3853	532,068	532,068	532,068
R[b]	0.07	0.14	0.16	0.21	0.05	0.02

[a], [b] and [c] show variables that are significant at 1, 5 and 10 % respectively. Data used in these regressions cover the 1984–2006 period. Source: Reports of Condition and Income, Federal Reserve Bank of Chicago

loans when monetary policy changes. This channel is known to be more effective for banks whose funding choice is more sensitive to a policy change. In order to examine how this channel works, we will pay closer attention to funding choices of state and federal banks. We will use a method called canonical correlation coefficients to clarify how loans of state and federal banks are financed. Canonical correlations will show the degree to which one set of correlated variables (bank liabilities in our case) is useful for explaining the variance in another set of correlated variables (bank assets).

Canonical Correlation Analysis

When there are two variables, y and x, a pairwise correlation coefficient is appropriate in describing the extent to which one variable relates to the other. However, when there are multiple x and multiple y variables, pairwise correlation cannot be used because of these variables' intercorrelated nature. In order to ascertain the correlation between variables, we need a different approach. Canonical correlation seeks to find the correlation between multiple x variables, $x_1, \ldots, x_n$, and multiple y variables, $y_1, \ldots, y_n$, and it describes how well the set of x variables can predict the set of y variables. It seeks vectors a and b such that the variables a'X and b'Y maximize the correlation $p = cor(a'X, b'Y)$. Here the variables $U = a'X$ and $V = b'Y$ are called the first pair of canonical variables and a and b are called factor loadings. After finding the first canonical correlation, then one seeks vectors maximizing the same correlation subject to the constraint that they are to be uncorrelated with the first pair of canonical variables; this gives the second pair of canonical variables. This procedure may be continued up to min(m,n) times.

In case of multiple x and y variables, canonical correlations show interdependence between individual x's and y's not directly, but indirectly. In our case, for instance the

existence of a relationship between demand deposits and loans cannot be explained through pairwise correlations because of the intercorrelated nature of bank assets and liabilities, but it can be described indirectly. Figure 1 below is adopted from De Young and Yom (2009) to clarify how this works. A strong correlation between loans and demand deposits (shown by arrow D) is implied when all of the following three conditions are true: (a) There is a strong canonical correlation between assets and liabilities (shown by arrow A), (b) There is a strong canonical loading between loans and assets (shown by arrow B), and (c) There is a strong canonical loading between deposits and liabilities (shown by arrow C).

Canonical correlations, in a sense, measure the pairwise relationship in two phases. First, they measure the relationship between assets and liabilities: whether the mix of banks' liabilities reflects the mix of banks' assets. After that we can identify the underlying relationships between the individual items in the asset and liability side for instance between demand deposits and loans. This, in turn, allows us to conclude which specific assets banks tend to match with which specific liabilities in performing asset and liability managements.

We check the correlation coefficients between assets and liabilities. Following De Young and Yom (2009), we look at year-end figures to calculate these correlation coefficients for every five years in the sample. This allows sufficient time to pass between observations to react to changes. We also present results for the whole sample.

In this literature, correlation coefficients around 0.30 indicate high correlation. Table 5 shows that correlation coefficients for the first factor loadings are higher than 0.30 for year-end figures and very close to this value for the whole sample. Therefore, the paper will focus on the first factor loadings.

In Table 6, *loanta*, *liquidity*, *ddep*, *ldep*, *equity* and *ffpurta* are the ratio of loans, liquidity, demand deposits, long-term deposits, equity and federal fund purchases over total assets. In this table, correlations between individual asset accounts and their canonical variables appear on the left-hand side of each cell, while correlations between individual liability accounts and their liability canonical variables appear on the right-hand side of the cells. The results show that the signs of the relationships between loans and long-term deposits and federal funds purchases are the same for federal and state banks. However, the size of the correlation between loans and federal funds purchases is found to be stronger for federal banks. This stronger movement implies that federal banks use federal fund loans to finance their loans more than state banks do. State banks use more traditional methods to finance their loans which is evidenced by the stronger correlation between loans of state banks with long-term deposits.

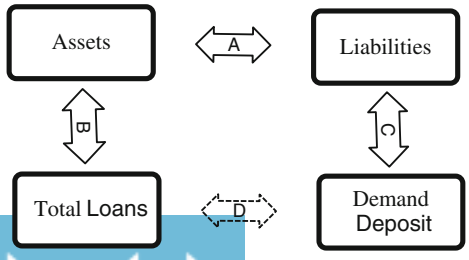

Fig. 1 The dependence between individual asset and liability accounts

Table 5 Canonical correlation coefficients

		1st Loading	2nd Loading
1990	State	0.3657[a]	0.2772[a]
	Federal	0.4304[a]	0.278[a]
1995	State	0.3678[a]	0.0845[a]
	Federal	0.3835[a]	0.1286[a]
2000	State	0.4085[a]	0.1046[a]
	Federal	0.411[a]	0.0751[a]
2005	State	0.3785[a]	0.0803[a]
	Federal	0.3583[a]	0.0371
Whole	State	0.270[c]	0.08[c]
Sample	Federal	0.296[c]	0.20[c]

[a], [b] and [c] show variables that are significant at 1, 5 and 10 % respectively. Data used in this table cover 1990–2005 period. Source: Reports of Condition and Income, Federal Reserve Bank of Chicago

To summarize, large state banks make more loans than large federal banks and they are better capitalized. Federal banks are found to deal with investment banking businesses more than state banks. Finally, federal bank loans are found to be more dependent on their borrowings from the interbank market. After analyzing how federal and state chartered banks are managed, we assess whether these differences cause state and federal banks to respond differently to policy shocks and how the credit channel of monetary policy works for them.

Lending Channel of Monetary Policy

According to the credit channel of monetary policy view, a contractionary monetary policy that drains reserves from the economy translates into a reduction in bank lending when banks are unable to replace each dollar of deposits with other funds. We analyze how this channel works for state and federal banks using a model similar to the one in Kashyap and Stein Jeremy (2000). The following derivative will be calculated in two steps for this purpose: $\frac{\partial \mathrm{lg}}{\partial mp}\frac{\partial \mathrm{lg}}{\partial \mathrm{liquidity}}$ where *lg* is the loan growth, *mp* is the monetary policy indicator and liquidity, is the share of liquid assets in total assets. In the first step, cross-sectional sensitivities of bank lending to their liquidity which is shown by equation (3), will .

$$\begin{aligned}\Delta \mathrm{Logloans}_{it} = \eta_{it} + \sum_{k=1}^{4} \alpha_{kt}\,\Delta \mathrm{Logloans}_{it-k} + \beta_t \mathrm{Nonperforming}_{i,t-1} + \kappa_t \mathrm{Capitalization}_{i,t-1} \\ + \lambda_t \Delta \mathrm{Logassets}_{it-1} + \sum \Gamma_{kt}\mathrm{State}_k + \mathrm{IMetroarea} + \pi_t \Delta \mathrm{Logliquidity}_{it-1} + \varepsilon_{it}\end{aligned} \tag{3}$$

where Δ is the first difference operator. $Logloans_{it}$ is the logarithm of total loans of bank i at time t. *Nonperforming* is ratio of nonperforming loans to total loans. The equity-to-asset ratio (*Capitalization*) and asset size are also added to explain variations

Table 6 Cross correlations between asset and liability items

1990				
State	Loanta	−0.75	Ddep	−0.53
	Liquidity	0.94	Ldep	0.28
			Equity	0.73
			Ffpurta	−0.08
Federal	Loanta	−0.28	Ddep	−0.84
	Liquidity	0.63	Ldep	0.58
			Equity	0.52
			Ffpurta	−0.12
1995				
State	Loanta	−0.97	Ddep	0.28
	liquidityk	0.65	Ldep	−0.39
			Equity	0.92
			Ffpurta	−0.07
Federal	Loanta	−0.98	Ddep	0.29
	liquidityk	0.66	Ldep	0.04
			Equity	0.76
			Ffpurta	−0.39
2000				
State	Loanta	−0.95	Ddep	0.50
	Liquidity	0.73	Ldep	−0.37
			Equity	0.85
			Ffpurta	−0.08
Federal	loanta	−0.92	Ddep	0.50
	liquidityk	0.77	Ldep	−0.20
			Equity	0.78
			Ffpurta	−0.18
2005				
State	Loanta	−0.87	Ddep	0.68
	liquidityk	0.83	Ldep	−0.41
			Equity	0.68
			Ffpurta	−0.07
Federal	Loanta	−0.88	Ddep	0.71
	liquidityk	0.79	Ldep	−0.34
			Equity	0.59
			Ffpurta	−0.17
Whole Sample				
State	loanta	−0.84	Ddep	0.26
	liquidityk	0.23	Ldep	−0.07
			Equity	0.95

Table 6 (continued)

			Ffpurta	−0.03
Federal	Loanta	−0.80	Ddep	0.31
	Liquidity	0.15	Ldep	−0.21
			Equity	0.84
			Ffpurta	−0.26

Data used in this table cover 1990–2005 period. Source: Reports of Condition and Income, Federal Reserve Bank of Chicago

in loan growth. Loan demand varies across markets. To address these issues, state dummies and another dummy that indicates if the bank is located in a Metropolitan Statistical Area (*MetroArea*) will be added. In the second step we will estimate how the sensitivity of π_t coefficients varies with monetary policy by using equation (4) below.

$$\pi_t = \eta + \sum_{k=1}^{4} \varpi_k \text{Policy}_{t-k} + \sum_{j=1} \sigma_j \text{Quarter}_r + \rho \text{Trend}_t + u_1 \tag{4}$$

where quarter represents time dummies and trend is the trend variable.

Three monetary policy indicators that have been commonly used by the literature will be used for this purpose in equation (4). These indicators are the federal funds rate, *ffr*, the difference between the federal funds rate and 10 year Treasury bill rate, *ffr10bill*, and the growth of rate of non-borrowed reserves, *nonb*. These variables will be adjusted so that increases in the monetary policy indicators would reflect contractionary monetary policies.

We next analyze the sensitivity of loan growth to liquidity. Economic theory suggests that if lending is affected by monetary policy, lending will be more dependent on balance sheet liquidity in times of monetary policy tightening and less dependent in times of monetary policy loosening. Hence, the sum of the coefficients of the monetary policy indicators in the second-step regression would be positive if the lending channel is active. Table 7 shows the estimation results. The sum of the coefficients for the four lags of the monetary policy measures are shown along with the *p*-values for the sum. The *p*-values are given in the parenthesis. Rows 1 and 4 in this table replicate previous literatures' findings. For small banks, the lending channel is found to be significant and the signs of the coefficients are positive as expected. That is to say, a contractionary policy leads to a reduction in π_t which is the sensitivity of bank lending to liquidity. For large banks, the signs are negative for all three policy indicators. So, the lending channel does not seem to be working for large banks if we do not separate them based on their charter choices. For small banks, separating banks into two groups improved the results considerably, especially for federal banks, as shown in rows 2 and 3. More strikingly, large banks, which were found to be unresponsive to monetary policy when charter differences are not considered, are found to be responsive this time. For large federal banks, the credit channel is found to be working.

These results are in line with both our previous findings and the literature. First, the literature shows that the credit channel is more effective for less capitalized banks. Our results show that capital holdings of large federal banks are smaller and the credit

Table 7 Bank lending channel

	Ffr	ffr10bill	Nonb
Small	0.001 (0.01)	0.002 (0.04)	0.005 (0.02)
State Banks	0.002 (0.01)	0.002 (0.03)	0.004 (0.02)
Federal Banks	0.317 (0.06)	0.312 (0.08)	1.801 (0.05)
Big	−3.637 (0.25)	−2.926 (0.40)	−1.033 (0.72)
State Banks	−0.104 (0.52)	−0.044 (0.91)	0.072 (0.16)
Federal Banks	0.124 (0.09)	0.251 (0.07)	0.294 (0.09)

Data used in these regressions cover the 1984–2006 period. Source: Reports of Condition and Income, Federal Reserve Bank of Chicago

channel is more effective for them as expected. Second, federal banks are found to deal more with investment bank type activities. This could make it easier for them to switch between activities. During contractionary policy periods, they can easily decrease the share of loans they make and focus more on investment banking type activities. Additionally, we found that there is a closer relationship between federal bank loan portfolios and their borrowings from the federal funds' market. Once again in contractionary monetary policy times, these funds will dry up immediately, which results in faster adjustments in their loan portfolio.

Conclusions

The literature has so far looked at the implications of the dual banking system on the cost of regulation and the innovations it created. However, the dual banking system might have significant influences on other aspects of banking such as activity mix or the risk and return choices. In this paper, we address this gap in the literature by analyzing these differences between state and federal banks. Our findings show that for small banks, charter choices made significant but relatively small differences in banks' risk and returns. On the other hand, differences in the activity mix of large state and federal banks are found to be more substantial than small banks. Large state banks are found to focus on traditional activities while large federal banks focus on investment banking activities.

While monetary policy and financial regulation are very much related and mutually reinforce each other, especially in the longer term, the literature did not analyze interactions between these two. This paper closes this gap in the literature as well and analyzes monetary policy implications of the dual banking system. The results show that state and federal banks react differently to monetary policy shocks. While state banks are found to be less responsive to monetary policy shocks, the credit channel is found to be more effective for federal banks. These results are found to be true for even large banks which were once believed to be unresponsive to the credit channel.

Considering the fact that federally chartered banks account for a considerable share of large banks in the US, this paper shows that taking charter choices of banks into account is of vital importance for monetary policy makers, especially in the recent post-crisis period. Findings indicate that ignoring charter choices in determining how

contractionary the policy needs to be could cause tighter policies than what is actually intended by policymakers. This would in turn cause an unnecessary disruption in the recovery process.

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