

# What Explains Low Net Interest Income at Community Banks?

*By Charles S. Morris and Kristen Regehr*

A vibrant and strong system of community banks is critical for the health of local and regional economies across the country and, therefore, for the health of the national economy. The 2007-08 financial crisis and ensuing Great Recession led to the worst banking conditions in more than two decades, and community bank health declined commensurately. Community bank failures rose sharply and profitability plummeted, bottoming out in 2009 with the first aggregate net loss since the current reporting system began in 1959.

While performance has improved significantly over the four and a half years since the end of the recession, commentary from bankers and industry analysts suggest community banks are still struggling. While profitability has largely recovered, the quality of earnings largely has not. In particular, net interest income—the difference between interest income and interest expense as a share of average assets—rose early in the recovery but has since turned down and is near a 40-year low.

Weak net interest income is of particular concern for the long-term viability of community banks. The heart of the community bank business model is lending to local businesses and households, which makes net interest income the largest source of core operating revenue. According to many commentators, including community bankers, it has been difficult to earn an adequate spread on loans in the current

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recovery because of the low interest rates and flat yield curve resulting from the Federal Reserve's accommodative monetary policy. In addition, bankers say weak lending opportunities have contributed to reduced interest income. Thus, after more than four years of economic recovery, it is important to know whether low levels of net interest income is "normal" after accounting for factors such as low interest rates, reduced lending, and other cyclical factors, or is it cause for alarm due to other factors that are unlikely to be reversed when the economy improves.

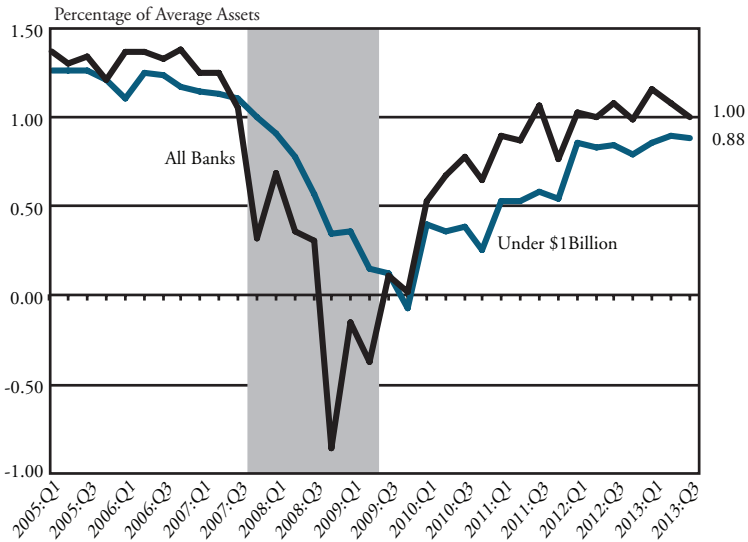
This article examines the historical behavior of net interest income for community banks, focusing on how it compares in the current recovery to four previous recoveries starting in the mid-1970s. The data show low interest rates, a flat yield curve, and a decline in lending are important reasons why net interest income still has not recovered. In fact, compared to the recoveries from the relatively severe 1973-75 and 1981-82 recessions, net interest income is somewhat stronger this far into the recovery. Thus, as monetary policy normalizes and the economy recovers, community bank net interest income should be expected to rise toward pre-recession levels.

Section I reviews the recent performance of community banks, focusing on net interest income. Section II discusses primary economic factors that drive net interest income and compares its behavior in the current recovery to the four previous recoveries. Section III conducts a statistical analysis of community bank net interest income, accounting for interest rates, bank balance sheet factors, and macroeconomic conditions, to determine whether the current recovery is different from previous recoveries.

## **I. COMMUNITY BANK PROFITABILITY IN THE RECOVERY**

Community bank profitability has rebounded sharply from the depths of the financial crisis and Great Recession, but it has stalled over the past two years below pre-crisis levels. The improvement is largely due to declining provisions for future problem loans, which can only support net earnings until problem loans are wound down. In contrast, core operating net revenue—the largest and most important component of

Chart 1

COMMUNITY BANK RETURN ON AVERAGE ASSETS:  
FINANCIAL CRISIS, RECESSION, AND RECOVERY

Notes: Net income annualized (YTD), as a percentage of average assets over the previous year. The \$1 billion size threshold is in 2012 dollars as measured by the CPI for all urban consumers. The shaded bar depicts the Great Recession quarters.

Source: Reports of Condition and Income.

which is net interest income—remains weak, which raises concerns about the longer-term sustainability of profitability.

The decline in community bank profitability and subsequent rebound from 2007 to the third quarter of 2013 is shown in Chart 1. Community banks are defined in this article as banks with total assets of \$1 billion or less in 2012 dollars.<sup>1</sup> Profitability is measured by return on average assets (ROAA), which is a bank's net income divided by its average total assets over the past year. To benchmark the performance of community banks, the chart also includes the ROAA of all U.S. banks, which reflects the differential performance of larger banks compared to community banks.

Profitability for the banking industry as a whole, and therefore for larger banks, declined more during the crisis than for community banks, but it also bounced back quicker and higher than for community banks. ROAA fell from pre-recession levels of more than 1 percent to net losses for both groups, bottoming out at -86 basis points for the industry in

the fourth quarter of 2008 and at -7 basis points for community banks a year later. In September 2013, the most recent data available, profits had risen to 1.00 percent for all banks and to 88 basis points for community banks. However, bank profits have been relatively flat for both groups since March 2012, averaging 1.04 percent for all banks and 85 basis points for community banks, about 30 basis points below their 2006 levels.

ROAA is composed of a variety of income and expense items. The most significant pre-tax items that affect community bank ROAA variability over the business cycle are net interest income and the provision for loan losses. Net interest income is the contribution to overall profits of a community bank's core business of making loans and taking deposits. Loan loss provisions are earnings deducted from bank profits to cover expected future loan losses. Loan loss provisions are a small component of ROAA in normal times, but they generally increase to much more significant levels in recessions and the early part of recoveries as loan quality declines and expected losses rise.

Not surprisingly given the severity of the financial crisis and depth of the recession, the fall in community bank ROAA in the recession was largely due to a 64-basis-point increase in loan loss provisions, followed by a 25-basis-point decrease in net interest income (Table 1, Recession column). Similarly, the recovery of community bank profits since the end of the recession is mostly due to reduced provisions. At just 17 basis points in the third quarter of 2013, loan loss provisions were actually 10 basis points lower than at the start of the recession.

The concern about the recovery in community bank profits is the absence of any post-recession growth in net interest income—indeed, it is 5 basis points lower—given it is the largest source of revenue for banks, particularly community banks. For example, in the third quarter of 2013, net interest income accounted for 62 percent of industry total revenue, but 77 percent of community bank total revenue. The Recovery column of Table 1 shows core net operating income at community banks has risen slightly since the end of the recession, but only because community banks have reduced the expense component of net noninterest income.<sup>2</sup>

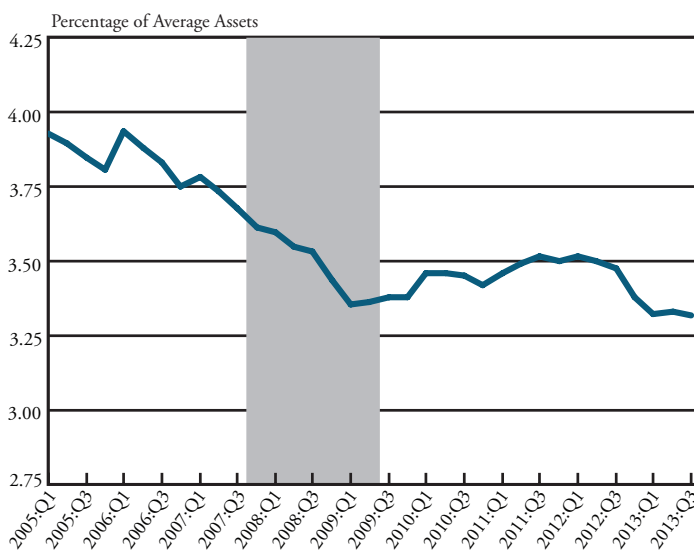
The pattern of net interest income has been lackluster in the recovery (Chart 2). Net interest income actually started falling in 2007 and

*Table 1*  
COMMUNITY BANK RETURN ON AVERAGE ASSETS

	Peak 2007:Q4	Trough 2009:Q2	2013:Q3	Change	
				Recession 2007:Q4-2009:Q2	Recovery 2009:Q2-2013:Q3
Net Interest Income	3.61	3.36	3.32	-0.25	-0.05
+ Net Noninterest Income	-2.07	-2.28	-2.11	-0.21	0.17
= Core Net Operating Income	1.54	1.09	1.21	-0.46	0.12
- Loan Loss Provisions	0.27	0.91	0.17	0.64	-0.73
+ Securities Gains (Losses) + Extraordinary Items - Taxes	-0.29	-0.03	-0.15	0.25	-0.12
= Return on Average Assets	0.99	0.15	0.88	-0.84	0.74

Notes: Data are annualized and expressed as a percentage of average assets over the previous year. Includes all banks with assets of \$1 billion or less. Size thresholds are in 2012 dollars as measured by the CPI for all urban consumers. Source: Reports of Condition and Income.

*Chart 2*  
COMMUNITY BANK NET INTEREST INCOME:  
FINANCIAL CRISIS, RECESSION, AND RECOVERY



Notes: Net interest income annualized (YTD), as a percentage of average assets over the previous year. Community banks are defined as having \$1 billion or less in assets in 2012 dollars as measured by the CPI for all urban consumers. The shaded bar depicts the Great Recession quarters.

Source: Reports of Condition and Income.

fell every quarter until just before the end of the recession. Since then, it rose somewhat from the beginning to the midpoint of the recovery, but has since given up those gains and was just under the lowest point in the crisis in the third quarter of 2013.

## II. COMMUNITY BANK NET INTEREST INCOME

Net interest income is the cash flow banks receive from loans and investments in securities minus interest payments on deposits and other forms of debt. Cash inflows and outflows depend directly on the interest rates a bank charges on loans, earns on securities, and pays on deposits and other debt instruments, and on the composition of its assets and liabilities. A bank's decisions on its prices and balance sheet structure, in turn, are affected by a variety of market and business conditions outside of its control. Some factors, such as the regulatory environment and competitive conditions in a bank's market, are relatively stable or change slowly over time. Others can change relatively often and quickly, such as the state of national and local economies and market interest rates.<sup>3</sup> Over the past 35 years, many of these factors have varied significantly, particularly around turning points in the business cycle.

### *Factors that affect net interest income variability*

*Market interest rates.* Changes in market interest rates—both the absolute and relative levels—have perhaps the most important effect on net interest income in the short term. The effect of changes in interest rates on net interest income varies with the maturity structure of a bank's assets and liabilities and the extent to which its loans and deposits have rates that reset when market rates change prior to maturity. Banks are said to be “liability sensitive” if an equal increase in all market rates—a parallel increase in the yield curve—causes net interest income to decline and “asset sensitive” if the increase causes net interest income to increase (Table 2). The effect of changes in the slope of the yield curve on net interest income may also depend on whether a bank is asset sensitive or liability sensitive.<sup>4</sup>

Traditionally, banks have been viewed as liability sensitive. For expositional purposes, suppose banks hold assets and liabilities with only two maturities—short term and long term—with corresponding interest rates. The stylized view of a bank is that it uses short-term deposits,

Table 2

## EFFECT OF CHANGES IN THE SLOPE OR LEVEL OF THE YIELD CURVE ON NET INTEREST INCOME

	Parallel Increase in Yield Curve	Increase in Slope of Yield Curve due to:	
		Increase in Long-Term Rates	Decrease in Short-Term Rates
Asset Sensitive	↑	↑	↓
Liability Sensitive	↓	↑	↑

which include nonmaturity deposits (that is, available upon demand) and short-term time deposits, to make long-term, fixed-rate loans. Such a bank is liability sensitive because an equal increase in the short-term and long-term market rates increases the rates paid on all deposits but only the rates on new loans. Thus, a stylized bank is liability sensitive because an increase in market rates causes cash outflow on liabilities to increase more than cash inflow on assets.<sup>5</sup>

While a stylized bank provides a simplified portrayal of a typical liability sensitive bank, it is not representative of all banks. Many, and sometimes most, of a bank's loans have either short maturities or longer maturities with variable rates that reset at short intervals. These longer-term variable rate loans have the same effect on net interest income as short-term loans. In recent years, improvements in technology and information systems have allowed banks to develop many variable rate products and risk management techniques that provide a greater range of options for managing assets and liabilities. On the liability side of the balance sheet, while a bank can at any time change the rates on nonmaturity deposits, such as demand deposits, savings accounts, and money market deposit accounts, the rates tend to be "sticky" and do not change immediately or by the same amount as changes in short-term market rates. Banks also offer longer-term time deposits with fixed interest rates to limit the changes in their funding costs when interest rates change.

As a result, many banks are *asset sensitive* so that a change in market rates leads to a change in interest income on loans and securities that is larger than the change in interest expense on deposits and other liabilities. In fact, current concerns about low short-term rates as the source of low net interest income make sense only for asset-sensitive banks because only then will an increase in short-term market rates lead to an increase in net interest income.<sup>6</sup>

More generally, suppose a bank has short-term assets (including longer-term, variable-rate assets that reprice within the period), long-term assets, short-term deposits (nonmaturity and time), and long-term deposits. An upward parallel shift in the yield curve will increase interest income on all short-term assets and new (longer- or shorter-term) assets and increase interest expense on nonmaturity and short-term deposits and new liabilities.

For banks that are asset-sensitive, a parallel increase in the yield curve increases net interest income because the increase in interest income from current assets repricing to a higher rate is by definition greater than the increase in interest expense on current liabilities that are repricing. This could be due to a larger share of short-term and variable-rate assets than the share of deposits, where both shares are relative to total assets.<sup>7</sup> Even if the share of short-term and variable-rate assets is smaller than the share of deposits, a bank could be asset sensitive in the short term because nonmaturity deposit rates tend to be sticky and therefore would not rise immediately as much as loan rates. Additionally, for banks that are in less competitive markets, deposit rates may be even stickier when rates rise, while loan rates may more easily be increased.<sup>8</sup> For new assets, the spread over the new liabilities funding them will be at least as large as it was before the increase in interest rates.<sup>9</sup>

While the effect of parallel shifts in the yield curve on net interest income has opposite effects on asset-sensitive and liability-sensitive banks, the effect of changes in the slope of the yield curve are not necessarily different for the two types of banks. Specifically, the effect of a change in the yield curve slope on net interest income also depends on whether it is due to a change in short-term or long-term rates. If the long-term rate increases, net interest income will increase for both asset-sensitive and liability-sensitive banks. This is because the only effect is on new and maturing long-term loans and investments, both of which will earn higher returns and can be funded with short-term liabilities at unchanged rates (Table 2).

In contrast, when the slope of the yield curve increases due to a decrease in the short-term rate, the effect on net interest income differs for asset-sensitive and liability-sensitive banks. For an asset-sensitive bank, a



fall in short-term rates will cause net interest income to fall because the interest income from short-term assets will drop more than the interest expense on short-term deposits. However, for a liability-sensitive bank, a decrease in short-term rates will increase net interest income because the income expense on short-term deposits will fall more than the interest income on short-term assets.

*Composition of assets and liabilities.* Net interest income is affected not only by the maturity and repricing structure of assets and liabilities, but also by their composition. The interest rate on bank loans generally is higher than on marketable securities because loans tend to be riskier. In addition, loans are a more costly investment because of the information requirements to make the loan and high monitoring costs once the loan is made. Moreover, some types of loans, such as commercial land development loans, are riskier and more costly to make and monitor than other types of loans. As a result, net interest income should increase with balance sheet measures such as the ratio of loans to total assets and share of loans to real estate developers.

On the liability side of the balance sheet, nonmaturity deposits tend to have the lowest interest expenses of all of a bank's liabilities. One reason is transaction deposits, which are a large share of nonmaturity deposits, provide transactions services that banks do not explicitly price. Instead, the deposit rates that banks pay are lower than comparable deposits that do not provide transactions services. In addition, a provision of the Banking Act of 1933 prohibited banks from paying interest on demand deposits, which has primarily affected business checking accounts since the mid-1980s, when banks were allowed to pay interest on other transaction deposits. While that provision was repealed as of July 2011 by the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act, few if any banks pay interest on business checking accounts. In addition, as previously noted, nonmaturity deposit rates tend to be sticky when short-term interest rates change, especially in markets where banks face little local competition. The low cost of nonmaturity deposits has a particularly large effect on net interest income because they represent such a large share of bank liabilities. For example, in the third quarter of 2013, nonmaturity deposits accounted for 64 percent of community bank liabilities.

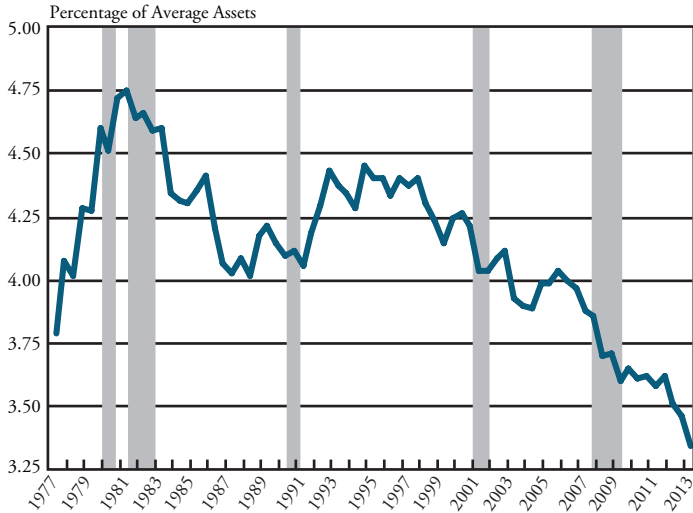
*Historical review of community bank net interest income*

Community bank net interest income has varied significantly over the past 35 years, as have the primary factors that determine net interest income. The variability in net interest income is particularly apparent around turning points in the business cycle. A preliminary comparison of net interest income in the current recovery to previous recoveries suggests the pattern over the past few years is not that different.

Net interest income is obtained from the Reports of Condition and Income (call reports) that banks regularly file with bank regulators. The data are for all U.S. community banks, defined as banks with assets of \$1 billion or less in 2012 dollars, from the first half of 1977 to the first half of 2013 (see Data Description in the Appendix). Call reports are currently filed quarterly, but prior to 1983, the income portion that includes interest income and expense was only filed semiannually.<sup>10</sup> Because the analysis in this article focuses on comparing net interest income in the current recovery to previous recoveries, it is important to include the recovery from the 1973-75 recession, which along with the 1981-82 and 2007-08 recessions were the three longest recessions since the Great Depression.<sup>11</sup> As a result, the data are analyzed on a semiannual basis, instead of the usual quarterly basis. The loss of information from using semiannual instead of quarterly data should not be significant because (1) the analysis will be conducted on a panel of all banks with real assets of \$1 billion or less over the 37 years from 1977 to the first half of 2013, and (2) much of the variability in net interest income occurs over periods longer than quarter to quarter.

The annual average net interest income for community banks varied significantly over the sample period (Chart 3). Net interest income varied from a high of 4.75 percent in the first half of 1981 to a low of 3.34 in the first half of 2013.<sup>12</sup> It rose sharply in the recovery from the 1973-75 recession into the 1981-82 recession, where it peaked and subsequently trended down until the late 1980s. The next major turning point came after the 1990-91 recession, with net interest income rising to a relatively high interim peak of 4.46 percent in the second half of 1994. Since then, net interest income has trended down, although it leveled off briefly in the mid-2000s, before plunging into and through the 2008-09 recession.

Chart 3

COMMUNITY BANK NET INTEREST INCOME:  
HISTORICAL PERSPECTIVE

Notes: Sample net interest income (semiannual) annualized as a percentage of average assets over the previous year. Community banks are defined as having \$1 billion or less in assets in 2012 dollars as measured by the CPI for all urban consumers. Shaded bars depict recession quarters. See the Appendix for a description of the data.  
Source: Reports of Condition and Income.

Not surprisingly, given the variability of net interest income, the factors that affect net interest income also varied significantly over this period (Table 3). The range of short-term interest rates, measured by the one-year U.S. Treasury bill rate, was almost 15 percentage points over the sample period, largely reflecting the sharp increase in inflation in the late 1970s and early 1980s. Even more striking, the variation in community bank ratios of loans to total assets and nonmaturity deposits to total liabilities as measured by their standard deviations was larger than that of the one-year Treasury rate.

While net interest income at community banks is at historically low levels, the pattern in the current recovery does not stand out as particularly different relative to previous recoveries (Chart 4). Net interest income is shown as an index with the recession trough equal to 1 to allow comparison across the recoveries.<sup>13</sup> The drop in net interest income in the current recovery is clearly different than after the recessions of 1973-75 and 1990-91 in which net interest income rose after

Table 3

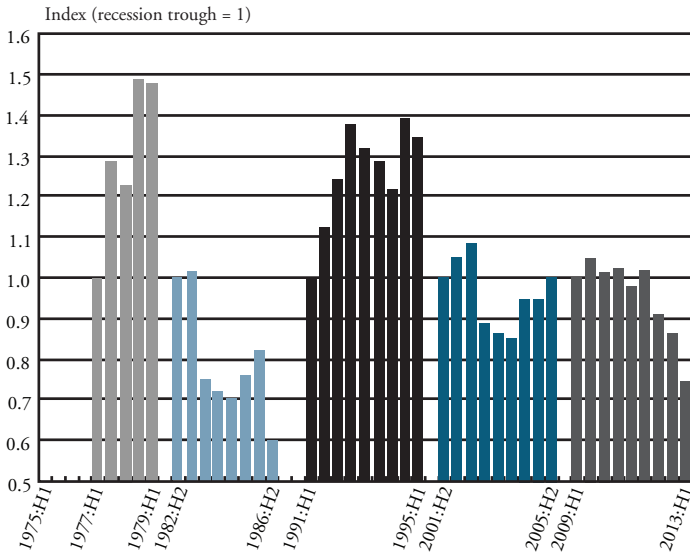
VARIABILITY OF FACTORS AFFECTING NET INTEREST INCOME: 1976:H1 TO 2013:H1

	Max.	Min.	Range	Std. Dev.
Net Interest Income	4.75	3.34	1.41	0.32
One-Year U.S. Treasury Rate	14.93	0.12	14.81	3.64
Spread (10-Year - One-Year U.S. Treasury Rate)	3.23	-1.43	4.66	1.15
Loan-Asset Ratio	66	50	16	4.7
Nonmaturity Deposits-Total Liabilities Ratio	61	40	21	4.4

Notes: See the Appendix for a description of the data.  
Source: Reports of Condition and Income.

Chart 4

COMMUNITY BANK NET INTEREST INCOME AFTER RECESSIONS



Notes: Sample net interest income (semiannual) annualized as a percentage of average assets over the previous year. Community banks are defined as having \$1 billion or less in assets in 2012 dollars as measured by the CPI for all urban consumers. See the Appendix for a description of the data. For each set of bars, with the exception of the 1975-79 period, the first bar is the half-year that included the business cycle trough and is indexed to equal 1. For the 1975-79 period, the business cycle trough was 1975:H1, but the data are indexed to 1977:H1 because that is the first available data point.  
Source: Reports of Condition and Income.

the recession troughs. However, the decline is clearly smaller than after the 1981-82 recession and it was about the same as after the 2001 recession until the second half of 2012.

### III. WHAT EXPLAINS LOW NET INTEREST INCOME?

While the simple comparison to previous recoveries suggests the current low level of net interest income may not be unusual, it does not account for differences in economic conditions, bank balance sheets, and other factors that affect net interest income. For example, because short-term interest rates were much higher after the 1973-75 and 1981-82 recessions than today, net interest income should be lower today if community banks are asset sensitive on average and all else were the same. As a result, determining why net interest income has not recovered more than four years after the end of the Great Recession requires a more thorough analysis that accounts for differences in economic and banking conditions. The results indicate the decline in community bank net interest income in the current recovery is largely consistent with the historical influence of the factors that affect it such as market interest rates and lending activity.

#### *Base model*

The base model regresses community bank semiannual net interest income on variables representing various economic and banking conditions. These variables include: market interest rates, individual bank-specific balance sheet items, the interaction of interest rates with bank-specific balance sheet items, macroeconomic conditions, and several dummy variables (see Variable Definitions in the Appendix). Ideally, the regressions would include a measure of the maturity structure of bank assets and liabilities, such as those used by English and others and Landier and others, but data on asset maturities are not available before 1997.<sup>14</sup>

The interest rate variables are the contemporaneous one-year U.S. Treasury rate, which measures short-term rates, and the difference between the 10-year and one-year U.S. Treasury rates, which measures the slope of the yield curve. The coefficient on the one-year rate represents the response of net interest income to a parallel shift in the yield curve (because the spread is held constant), and the coefficient on the spread

represents the response to a change in the 10-year U.S. Treasury rate (because the one-year rate is held constant). The difference between the one-year rate and the spread coefficients represents the response to a change in the one-year rate.<sup>15</sup> As a result, the coefficient on the one-year rate and the difference in the coefficients on the one-year rate and spread should be positive if community banks, on average, are asset sensitive and negative if they are liability sensitive. The coefficient on the spread should be positive because an increase in long-term rates should increase net interest income for both asset-sensitive and liability-sensitive banks.

The balance sheet variables are the ratios of loans to total assets and nonmaturity deposits to total liabilities (excluding equity).<sup>16</sup> The coefficients on both of these ratios should be positive because loans tend to have a higher return than other assets and nonmaturity deposits tend to have lower rates than other deposits. In addition, these variables are interacted with the one-year Treasury rate and the spread to capture the possibility that the response of net interest income to changes in interest rates may also depend on the balance sheet variables. For example, the effect of an increase in short-term rates may be larger for banks with higher ratios of nonmaturity deposits to liabilities.

Using the base model, the estimated contemporaneous effects of the interest rate variables and selected bank-specific balance sheet and dummy variables on community bank net interest income have the expected signs (for those that have expected signs), and they are all statistically significant at the 1 percent level (Table 4, see Appendix for full regression results).<sup>17</sup> The estimated contemporaneous effects show the combined direct and interaction effects of a 1-percentage-point change in an explanatory variable on net interest income, holding all other variables constant. The contemporaneous effects of 1-percentage-point increases in the one-year Treasury rate and the spread are estimated to increase net interest income 5 basis points and 3.7 basis points, respectively. The difference of 1.3 basis points between the contemporaneous effects of the one-year rate and spread is statistically significant at the 1 percent level. The contemporaneous effects of the balance sheet variables also have the expected signs, as does the recession dummy variable.<sup>18</sup>

Most of the variables in the base model also are economically significant as measured by the total cumulative effects of a change in an

Table 4

COMMUNITY BANK NET INTEREST INCOME  
REGRESSION: CONTEMPORANEOUS EFFECTS

Selective Explanatory Variables	Financial Crisis Break Model			
	Base Model	Pre-Crisis 1977:H1-2007:H1	Post-Crisis 2007:H2-2013:H1	Recovery Model
One-Year U.S. Treasury Rate <sup>a</sup>	0.050***	0.047***	0.031**	0.048***
Spread (10-year - One-Year U.S. Treasury Rate) <sup>a</sup>	0.037***	0.038***	0.018***	0.030***
Loans/Assets	0.011***	0.011***	0.012***	0.011***
Nonmaturity Deposits/Liabilities	0.011***	0.012***	0.004***	0.011***
Recession	-0.138***	-0.137***	-0.150***	-0.116***
Post-1973-75 Recession				-0.182***
Post-1981-82 Recession				-0.098***
Post-1990-91 Recession				0.137***
Post-2001 Recession				0.020***
Post-2007-09 Recession				-0.070***

\*\* Significant at 5 percent level

\*\*\* Significant at 1 percent level

Standard errors are clustered at the bank level and robust to heteroscedasticity.

<sup>a</sup>The null hypothesis that the difference between the estimated contemporaneous effects of the one-year Treasury rate and spread variables on net interest income is equal to zero is rejected at the 1 percent level for all models except for the Financial Crisis Break Model's post-crisis period.

Notes: This table shows the estimated contemporaneous effect of a 1-percentage-point increase in selective explanatory variables on net interest income holding all other variables constant from the community bank net interest income regressions. Full regression results are shown in the Appendix. The explanatory variables include two lags of net interest income, interest rate variables, bank-specific balance sheet variables, the interaction of the interest rate variables with the bank-specific balance sheet variables, macroeconomic condition variables, and several dummy variables (see Variable Definitions in the Appendix). The contemporaneous effects are calculated by evaluating the interaction terms at their sample means. For example, in calculating the contemporaneous effect of a change in the one-year U.S. Treasury rate on net interest income, the interaction with the bank-specific balance sheet variables are evaluated at their sample means. For the Financial Crisis Break Model, the sample means are calculated over the pre- and post-crisis periods, respectively. The contemporaneous effects were also calculated using median values instead of means, but the results are not materially different because the medians and means are about the same. Because the sample means in the two periods are different, the change in the contemporaneous effects from pre- to post-crisis is due to changes in the estimated regression coefficients and sample means and, therefore, cannot be tested for statistical significance.

explanatory variable (Table 5). The estimated contemporaneous coefficients in Table 4 show the initial effect of an increase in an explanatory variable. However, because the model includes lagged net interest income, the initial effect of a one-time increase in an explanatory variable will continue to affect net interest income in subsequent periods at rates that will slowly die off over time. Thus, the total cumulative effect over time of a 1-percentage-point increase in the explanatory variables depends on the persistence in net interest income as reflected in the coefficients on its lagged values.<sup>19</sup>

The base model results suggest that, on average over the sample period, community banks are asset sensitive, which is consistent with bankers' concerns about low interest rates. The estimated cumulative effect on net interest income of a 1-percentage-point increase in the one-year rate, which represents a parallel increase in the yield curve, is 14 basis points. The estimated effect of a 1-percentage-point increase in the one-year rate holding the 10-year rate constant, measured by the difference between the one-year rate and spread coefficients, is 3 basis points. Also, the positive effect of an increase in the 10-year rate holding the one-year rate constant (the spread coefficient), which is estimated to be 11 basis points, is consistent with expectations.

The balance sheet and recession variables also are economically significant, which supports the importance of lending and the deposit mix for community bank net interest income. A 10-percentage-point increase in the loan-asset and nonmaturity deposit-liability ratios are each estimated to result in a cumulative 30-basis-point increase in net interest income. The average cumulative effect of a recession, which typically will spill over into the recovery, is to lower net interest income by 40 basis points.

#### *How different is community bank net interest income in the current recovery from previous recoveries?*

The estimated coefficients in the base model—combined with declining interest rates, a flattening of the yield curve, and declining lending opportunities since the crisis—are consistent with the drop in community bank net interest income. However, it is not clear whether the decrease that has actually occurred is unusual relative to previous recoveries.



Table 5

COMMUNITY BANK NET INTEREST INCOME  
REGRESSION: CUMULATIVE EFFECTS

Selective Explanatory Variables	Base Model	Financial Crisis Break Model		Recovery Model
		Pre-Crisis 1977:H1- 2007:H1	Post-Crisis 2007:H2- 2013:H1	
One-Year U.S. Treasury Rate	0.14	0.13	0.09	0.13
Spread (10-Year - One-Year U.S. Treasury Rate)	0.11	0.11	0.05	0.08
Loans/Assets	0.03	0.03	0.03	0.03
Nonmaturity Deposits/Liabilities	0.03	0.03	0.01	0.03
Recession	-0.40	-0.38	-0.42	-0.32
Post-1973-75 Recession				-0.51
Post-1981-82 Recession				-0.27
Post-1990-91 Recession				0.38
Post-2001 Recession				0.05
Post-2007-09 Recession				-0.19

Notes: This table shows the estimated cumulative effect of a 1-percentage-point increase in selective explanatory variables on net interest income holding all other variables constant. The cumulative effects are the contemporaneous effects in Table 4 divided by  $1-\alpha-\beta$ , where  $\alpha$  and  $\beta$  are the estimated coefficients on the first and second lags of net interest income, respectively (see full regression results in the Appendix).

The financial crisis break (FCB) model columns in Table 4 provide some evidence that the base model changed somewhat after the first half of 2007. The FCB model allows all of the coefficients of the base model to change after the start of the financial crisis in the second half of 2007 (see Appendix for full regression results). The middle two columns show the signs of the estimated post-crisis contemporaneous effects of the variables on net interest income are the same as in the pre-crisis period, but some of the magnitudes tend to be smaller. In addition, all but one of the estimated contemporaneous effects are highly statistically significant in both periods. The difference between the effects of the one-year Treasury rate and spread variables is highly significant in the pre-crisis period but not in the post-crisis period.

However, changes in the contemporaneous effects from the pre-crisis to post-crisis period overstate the extent to which the *underlying base model* has changed. The changes in the contemporaneous effects reflect two factors—changes in the estimated coefficients of the underlying model, and changes in the mean values of the interaction variables. For example, the effect of the one-year Treasury rate on net

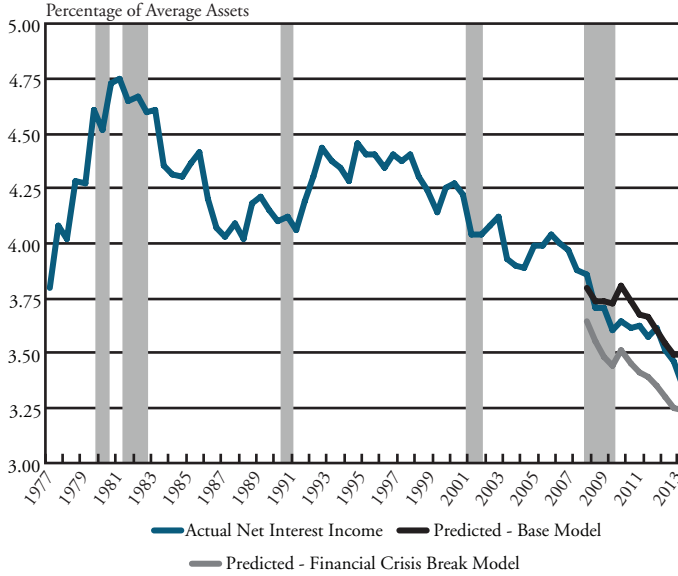
interest income in each period depends on (1) the estimated coefficients on the one-year Treasury rate, and (2) the estimated coefficients on the one-year Treasury rate multiplied by the balance sheet variables, evaluated at the means of the balance sheet variables in each period.<sup>20</sup> The changes in the estimated coefficients are jointly statistically different from zero, suggesting the model has changed (see Appendix, Regression Results).<sup>21</sup> However, the mean values of the interest rate and balance sheet variables in Table 4 also changed substantially between the two periods, as did the real total assets of banks, which is included in the regression to control for bank size. Overall, changes in both the estimated coefficients and mean values of the interaction variables contributed to smaller contemporaneous effects.

A comparison of pre-crisis and post-crisis cumulative effects of the key variables on community bank net interest income suggests the variables have remained economically significant since the crisis, although the magnitude has dropped somewhat for some variables (Table 5). The only changes greater than 1 or 2 basis points are the effects of interest rates. Overall, the results support the view that community banks have remained asset sensitive since the crisis—the cumulative effect of a parallel change in the yield curve and the difference between the one-year rate and spread variables remain positive. However, the results suggest that the effects of lower rates and a flatter yield curve, holding all else constant, if anything, are smaller since the crisis than before. Specifically, the effect of a 1-percentage-point decrease in the one-year rate on net interest income is estimated to have declined from 13 basis points to 9 basis points, while the effect of a 1-percentage-point flattening of the yield curve is estimated to have declined from 11 basis points to 5 basis points.

While the FCB model suggests there has been a post-crisis change in how the explanatory variables affect community bank net interest income, it is not clear how the combined effect of these changes affected the overall behavior of net interest income. To examine the overall differences between the base and FCB models, each model was used to construct out-of-sample predictions of community bank net interest income from the second half of 2007 to the first half of 2013 (Chart 5).<sup>22</sup> The blue line shows actual net interest income. The predicted net

Chart 5

COMMUNITY BANK NET INTEREST INCOME:  
ACTUAL AND PREDICTED VALUES



Notes: Sample net interest income (semiannual) annualized as a percentage of average assets over the previous year. Community banks are defined as having \$1 billion or less in assets in 2012 dollars as measured by the CPI for all urban consumers. Shaded bars depict recession quarters. See the Appendix for a description of the data. Source: Reports of Condition and Income.

interest income from the base and financial crisis models are shown by the black line and gray line, respectively.

While the FCB model suggests the relationship between the explanatory variables and net interest income since the crisis is statistically different from before the crisis, it does not clearly outperform the base model. The FCB model underpredicts community bank net interest income over the post-crisis period with a relatively constant gap and, overall, predicts a 64-basis-point decline from the first half of 2007 relative to an actual decline of 54 basis points. In other words, even though community bank net interest income is already near a 40-year low, the FCB model predicts it should be 10 basis points lower. The base model predictions are more reasonable but generally overpredict net interest income and, therefore, underpredict the overall decline by 15 basis points. Using the root-mean-squared error (RMSE) of the predictions as a measure of

overall performance, the base model RMSE is 9 basis points, which is 50 percent lower than the FCB model's RMSE of 19 basis points. Thus, the base model appears to forecast somewhat better than the FCB model, suggesting the behavior of net interest income in the current recovery may not be that unusual given historical experience.

A final test of whether the lack of a recovery in community bank net interest income is unusual is to add to the base model a separate recovery dummy variable for each of the previous recoveries (Tables 4 and 5, Recovery Model). For each recovery, the dummy variable is equal to 1 for four years after the end of the preceding recession, which is the length of the recovery through the first half of 2013, and zero otherwise.

The contemporaneous effects of the recovery variables indicate community bank net interest income generally differs from nonrecovery periods, and that the difference in the current recovery is the median among the five recoveries (Table 4, bottom panel).<sup>23</sup> The dummy variables measure the average differences in the recoveries from the nonrecovery periods conditional on all of the other variables in the model. In other words, the model estimates community bank net interest income in the current recovery is, on average, 7 basis points lower than in nonrecovery periods given all of the other factors in the model that affect net interest income. Compared to the other estimated contemporaneous effects of the recoveries, the results suggest the conditional mean net interest income in the current recovery is higher than after the 1973-75 and 1981-82 recessions, but lower than after the 1990-91 and 2001 recessions.

Given the persistence of net interest income, the cumulative effect of the economy moving from recession to recovery on net interest income is shown in Table 5. The last column of the top panel shows the cumulative effects of the explanatory variables are similar to the base model and pre-crisis period of the FCB model. The results provide a more stark perspective that community bank net interest income in the current recovery, while undoubtedly low, is somewhat "normal" for a recovery given the low interest rate environment and bank balance sheet adjustments to the economic environment.

#### IV. CONCLUSION

The success of community banks ultimately depends on their ability to earn an adequate return on lending. Thus, given the importance of community banks to local economies, the lack of recovery in community net interest income is a legitimate concern.

This article shows the lack of recovery in community bank net interest income four years after a recession is not unusual given economic and banking conditions. The regression results from the base model indicate factors such as low interest rates, a flat yield curve, and weak lending activity are important reasons for current low levels of net interest income. While there is some evidence that interest rates have had a somewhat smaller effect on net interest income since the crisis, their overall effect remains significant. Indeed, when compared with recoveries from other recessions over the past 40 years—two of which were the longest recessions between the Great Depression and the Great Recession—the current levels of net interest income actually are in the middle of the pack given banking and economic conditions.

The analysis here suggests an optimistic outlook for community bank net interest income is appropriate. Community banks have faced hard times over the years, particularly after the recessions of 1973-75 and 1981-82, but they have always found ways to grow their business and thrive. While net interest income is unlikely to return to the high levels of the early 1990s, history suggests it should rebound significantly as the economy improves and the Federal Reserve normalizes monetary policy.

## APPENDIX

### I. DATA DESCRIPTION

The data are semiannual observations from 1977 to the first half of 2013 for an unbalanced panel of banks with total assets of \$1 billion or less in 2012 dollars and are merger adjusted. The number of banks ranges from 11,551 in the second half of 1985 to 4,564 in the first half of 2013. Banks were excluded if there were fewer than 20 observations over the sample period or they did not have deposits or loans for 25 percent or more of their observations. De novo banks were excluded for their first three years of operation. The sample was trimmed at the 99.5 and 0.5 percentiles of the loan-to-deposit ratio. All bank-specific ratios and growth rates are expressed in annualized percent. The data include 614,452 bank semiannual observations and the average number of semiannual observations per bank is 47.

### II. VARIABLE DEFINITIONS

#### Dependent variable

**Net Interest Income:** Net interest income divided by average total assets over the previous four quarters, where average total assets for quarter  $t$  is the average of total assets at the end of quarters  $t$  and  $t-1$ .

#### Interest rate variables

**One-Year U.S. Treasury Bill rate:** Average one-year U.S. Treasury bill rate over the semiannual period.

**Spread:** The difference between the average 10-year U.S. Treasury bond and average one-year U.S. Treasury bill rates over the semiannual period.

#### Bank-specific balance sheet variables

**Loan-Asset ratio:** Total loans divided by total assets.

**Nonmaturity deposit ratio:** Nontransactions savings accounts plus transactions accounts divided by total liabilities.

**Real Total Assets:** The log of a bank's total assets divided by the CPI for all urban consumers.

Macroeconomic condition variables

**Real GDP growth:** First difference of the log of semiannual average real GDP from year earlier.

**Inflation:** First difference of the log of the semiannual average of the monthly PCE deflator from year earlier.

Dummy Variables

**Recession:** Equal to 1 if more than half of the semiannual period is in recession (1980:H1, 1981:H2 to 1982:H2, 1990:H2 to 1991:H1, 2001:H1 to 2001:H2, 2008:H1 to 2009:H1) and zero otherwise.

**Regulation Q:** Equal to 1 until 1980, declines by one-sixth each year until 1986 for the phase-out of the deposit rate ceilings, and zero thereafter.

**Urban:** Equals 1 for a bank in a Metropolitan Statistical Area and zero otherwise.

**Financial Crisis Break:** Equal to 1 from 2007:H2 to 2013:H1 and zero otherwise.

**Post-1973-75 Recession:** Equal to 1 from 1977:H1 to 1979:H1 and zero otherwise.

**Post-1981-82 Recession:** Equal to 1 from 1983:H1 to 1986:H2 and zero otherwise.

**Post-1990-91 Recession:** Equal to 1 from 1991:H2 to 1995:H1 and zero otherwise.

**Post-2001 Recession:** Equal to 1 from 2002:H1 to 2005:H2 and zero otherwise.

**Post-2007-09 Recession:** Equal to 1 from 2009:H2 to 2013:H1 and zero otherwise.

### III. REGRESSION RESULTS FOR COMMUNITY BANK NET INTEREST INCOME

	Base Model	Financial Crisis Break Model <sup>a</sup>	Recovery Model <sup>b</sup>
Net Interest Income			
First Lag	0.3165***	0.3105***	0.3088***
Second Lag	0.3338***	0.3314***	0.3305***
One-year U.S. Treasury rate	0.1186***	0.1575***	0.1401***
Spread (10-year - One-Year U.S. Treasury Rate)	0.0457***	0.0503***	0.0747***
Loans/Assets	0.0154***	0.0162***	0.0158***
Nonmaturity Deposits/Liabilities	0.0048***	0.0055***	0.0056***
Real Total Assets	-0.0801***	-0.0397***	-0.0656***
Real GDP	-0.0246***	-0.0319***	-0.0110***
Inflation	0.0211***	0.0176***	0.0025**
Recession Dummy Variable	-0.1385***	-0.1368***	-0.1164***
Urban Dummy Variable	-0.0431	-0.0240	-0.0355
Regulation Q Dummy Variable	-0.1851***	-0.1501***	0.0274***
Interactions with One-Year U.S. Treasury Rate (UST1):			
UST1*Loans/Assets	-0.0005***	-0.0006***	-0.0006***
UST1*Nonmaturity Deposits/Liabilities	0.0012***	0.0012***	0.0012***
UST1*Real Total Assets	-0.0087***	-0.0118***	-0.0102***
Interactions With Spread (S10):			
S10*Loans/Assets	-0.0012***	-0.0012***	-0.0011***
S10*Nonmaturity Deposits/Liabilities	-0.0013***	-0.0015***	-0.0017***
S10*Real Total Assets	0.0109***	0.0114***	0.0091***
Constant	0.9667	0.5240	0.7967
<b>Interactions with Financial Crisis Break Dummy Variable</b>			
Net Interest Income			
First Lag		0.0199**	
Second Lag		-0.0154**	
One-Year U.S. Treasury rate		-0.0486	
Spread (10-year - One-Year U.S. Treasury Rate)		0.0527	
Loans/Assets		0.0020**	
Nonmaturity Deposits/Liabilities		-0.0093***	
Real Total Assets		0.0035	



Real GDP		0.0134***
Inflation		0.0093*
Recession Dummy Variable		-0.0127
Urban Dummy Variable		-0.0520***
Regulation Q Dummy Variable <sup>c</sup>		N.A.
Interactions with One-Year U.S. Treasury Rate (UST1):		
UST1*Loans/Assets		-0.0018***
UST1*Nonmaturity Deposits/Liabilities		0.0023***
UST1*Real Total Assets		0.0026
Interactions with Spread (S10):		
S10*Loans/Assets		-0.0007**
S10*Nonmaturity Deposits/Liabilities		0.0039***
S10*Real Total Assets		-0.0191***
Financial Crisis Break Dummy Variable		0.1793
<b>Post-Recession (Four years) Dummy Variables</b>		
Post-1973-75 Recession		-0.1824***
Post-1981-82 Recession		-0.0982***
Post-1990-91 Recession		0.1386***
Post-2001 Recession		0.0197***
Post-2007-09 Recession		-0.0703***
Within R <sup>2</sup>	0.47	0.47
		0.47

\* Significant at 10 percent level

\*\* Significant at 5 percent level

\*\*\* Significant at 1 percent level

Standard errors are clustered at the bank level and robust to heteroscedasticity.

<sup>a</sup>The null hypothesis that the estimated coefficients on the interactions of the financial crisis break dummy variable with all of the base model variables are jointly equal to zero is rejected at the 1 percent level.

<sup>b</sup>The null hypothesis that the estimated coefficients on the post-recession dummy variables are jointly equal to zero is rejected at the 1 percent level.

<sup>c</sup>The Regulation Q dummy variable is not included because it is equal to zero for the entire post-crisis period.

Notes: This table presents the estimated coefficients of regressions of net interest income on interest rate variables, bank-specific balance sheet variables, the interaction of the interest rate variables with the bank-specific balance sheet variables, macroeconomic condition variables, and several dummy variables (see Variable Definitions). All three specifications include two lags of net interest income to address autocorrelation in the error terms and a constant term. The regressions are estimated as fixed-effects models at the individual bank level. As discussed by Wooldridge, the bias of the ordinary least squares estimator due to the lagged dependent variables and bank fixed effects is likely to be negligible because of the large number of times-series observations. The data are an unbalanced panel and trimmed for outliers and include 614,452 semiannual observations (see Data Description). The Financial Crisis Break model allows for a structural change in the model beginning at the start of the financial crisis in the second half of 2007. All variables in the base model are interacted with the financial crisis break dummy variable. The middle column of the top section of the table shows the estimated coefficients for the period from 1977 through the first half of 2007, and the middle section shows the changes in the coefficients from the second half of 2007 to the first half of 2013. The coefficients in the middle section are jointly statistically different from zero, indicating that there has been a statistically significant change in the model since 2007. The Recovery Model examines bank performance in the first four years following each recession relative to the overall sample period, with the exception of the recovery from the 1973-75 recession. For this recovery, data are available for the last two and a half years, from 1977H1 to 1979H1.

## ENDNOTES

<sup>1</sup>Using a size threshold to define a community bank is an accepted practice for data analysis even though many other factors differentiate a community bank. Community banks tend to be smaller, but also have a business model that focuses on local lending based on “soft” information, such as long-term relationships with and personal information about borrowers that come from being part of the same community. The \$1 billion threshold is common, although thresholds up to \$10 billion are sometimes used. Thus, while there may be some community banks larger than \$1 billion or even \$10 billion, and small banks that are not community banks, they tend to be the exception. For a discussion on the definition of community banks and an alternative data-based approach, see Federal Deposit Insurance Corporation (2012).

<sup>2</sup>Net noninterest income is always negative because it includes all of a bank’s noninterest expenses but only its noninterest income, which generally is small compared to the interest income that comes from the core activities of making loans and investing in securities.

<sup>3</sup>Hanweck and Ryu provide a comprehensive review of theoretical models in which the bank’s objective is to maximize net interest income.

<sup>4</sup>As will be shown later in the article, the relationship between a change in the slope of the yield curve and the asset/liability sensitivity of a bank depends on the extent to which the slope changes due to changes in long-term or short-term interest rates.

<sup>5</sup>When long-term market interest rates change, typically the change in net interest income is partially offset by changes in the market value of securities held by a bank (the Securities Gains (Losses) income component in Table 1). For example, when long-term rates rise, net interest income will increase, but it generally will be partially (or even completely) offset by securities losses. Thus, the effect of the change in long-term rates on ROAA will generally be smaller than the effect on net interest income.

<sup>6</sup>The current concern that net interest income is low due to a flat yield curve, as opposed to low short-term rates, is not as closely tied to whether a bank is asset sensitive or liability sensitive. The general concern with a flat yield curve is that banks cannot earn a profitable spread by borrowing short and lending long. As will be shown later in the article, an increase in the slope of the yield curve from an increase in long-term rates will generally increase net interest income for both asset-sensitive and liability-sensitive banks. With short-term rates currently near the zero lower bound and expected to remain there for some time, both asset-sensitive and liability-sensitive banks will benefit from an increase in the slope of the yield curve because the only way for that to happen is through an increase in long-term rates.

<sup>7</sup>In a sense, solvent banks are somewhat predisposed to being asset sensitive. A solvent bank is a net creditor because its assets are greater than its liabilities. Equity can be thought of as a liability with infinite maturity and no contractual rate that must be paid to shareholders. As a result, when interest rates rise, there is a tendency for net interest income to increase as long as assets are greater than liabilities.

<sup>8</sup>For banks that have market pricing power, their additional control over their lending and deposit rates will allow them to be relatively more asset sensitive when market interest rates rise and liability sensitive when rates fall. Mora; Hannan and Berger; Neumark and Sharpe; Driscoll and Judson; and Yankov present evidence that deposit rates are stickier upward. Mora also shows that loan rates are stickier downward.

<sup>9</sup>The new assets generally can be funded at the same spread with liabilities of the same maturity, or at a higher spread with liabilities of a lower maturity as long as the yield curve is upward sloping.

<sup>10</sup>Quarterly income statements were filed by some banks prior to 1983; however, 1983 was the first year that all banks began quarterly filings.

<sup>11</sup>The 1973-75 and 1981-82 recessions lasted 16 months, and the 2007-08 recession lasted 18 months.

<sup>12</sup>The high level of net interest income in the first half of 1981 does not mean community banks were prospering. Inflation was declining but still averaging more than 10 percent and real GDP fell 4 percent. Spong and others show the high earnings of banks were illusory because real after-tax earnings were falling due to the high level of inflation.

<sup>13</sup>For each set of bars, with the exception of the 1975-79 period, the first bar is the half-year that included the business cycle trough and indexed to equal 1. For the 1975-79 period, the business cycle trough was 1975:H1, but the data are indexed to 1977:H1 because that is the first available data point.

<sup>14</sup>English and others and Landier and others include a maturity gap measure in models similar to the one estimated in this article and find the gap has a statistically significant effect on net interest income.

<sup>15</sup>If the coefficients and interest rate variables are  $\alpha^*(\text{one-year rate}) + \beta^*(10\text{-year} - \text{one-year rate})$ , the terms can be rearranged as  $(\alpha - \beta)^*(\text{one-year rate}) + \beta^*(10\text{-year rate})$ .

<sup>16</sup>The model was also estimated by including separate loan and deposit categories as shares of assets and liabilities, respectively, but the results were not materially different.

<sup>17</sup>The regressions are estimated as unbalanced fixed-effects models at the individual bank level and include two lags of net interest income to address autocorrelation in the error terms. See the Appendix for a list of the variables, their definitions, and full regression results. The bias of the ordinary least squares estimator due to the lagged dependent variables and bank fixed effects is likely to be negligible because of the large number of times-series observations (Wooldridge). Because the regressions include interaction terms, the contemporaneous effects

are calculated by evaluating those terms at their sample means. The contemporaneous effects were also calculated using median values instead of means, but the results are not materially different because the medians and means are about the same. The data are semiannual observations on an unbalanced panel of banks, ranging from 11,551 in the second half of 1985 to 4,564 in the first half of 2013 over 36½ years (see Appendix, Data Description).

<sup>18</sup>These effects are generally consistent with, although smaller than, those found by English and others. The differences could be due to the base model not having a maturity gap. The differences might also be because English and others did not restrict their data to community banks, and they estimated their model using data from the second quarter of 1997 to the second quarter of 2007, during which there were fewer cyclical fluctuations and net interest income had a consistent downward trend.

<sup>19</sup>The lagged coefficients on net interest income are 0.32 and 0.33, which implies that 77 percent of the cumulative effect of an increase in an explanatory variable occurs in two years and 90 percent in three and a half years. The cumulative response of net interest income to a 1-percentage-point increase in an explanatory variable is the contemporaneous effect in Table 4 divided by  $1-\alpha-\beta$ , where  $\alpha$  and  $\beta$  are the estimated coefficients on the first and second lags of net interest income, respectively (see full regression results in the Appendix).

<sup>20</sup>The sample means for the interaction terms are calculated over the pre-crisis and post-crisis periods, respectively. The contemporaneous effects were also calculated using median values instead of means, but the results are not materially different because the medians and means are about the same. Because the sample means in the two periods are different, the change in the contemporaneous effects from pre-crisis to post-crisis cannot be tested for statistical significance.

<sup>21</sup>Although the changes in the estimated coefficients are jointly statistically significant, many are not individually significant, including coefficients on some key variables of interest such as the one-year Treasury rate and spread. In addition, some post-crisis coefficients have questionable signs. For example, the estimated coefficient on the ratio of nonmaturity deposits to liabilities is highly significant, but it is counterintuitively negative. While it is difficult to determine why the sign is negative, it could reflect the surge in nonmaturity deposits from 48 percent of liabilities in the first half of 2007 to 61 percent in the first half of 2013 due to the general flight to safety after the crisis, the FDIC's full insurance coverage of all business transactions deposits through the end of 2012, and the low rate of interest on time deposits over most of the period.

<sup>22</sup>The out-of-sample predictions use the actual values of the explanatory variables and the predicted values of lagged net interest income.

<sup>23</sup>Because the recovery variables are not interacted with other variables, the estimated contemporaneous effects are the same as the estimated coefficients on the recovery variables.

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