“Asset portfolio maturity changes during the financial crisis: evidence from U.S. banks”

AUTHORS	Thomas W. Secrest http://orcid.org/0000-0002-4852-8037
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Thomas W. Secrest (USA)

ASSET PORTFOLIO MATURITY CHANGES DURING THE FINANCIAL CRISIS: EVIDENCE FROM U.S. BANKS

Abstract

This paper determines if the maturity structure of commercial banks' asset portfolios changed as a result of the financial crisis of the late 2000s and whether any changes in the portfolios may be homogeneous across bank size. A proxy for the maturity of rate-sensitive assets is constructed, and it is found that significant changes did begin to occur during the third quarter of 2008. The maturity structure of assets of relatively small banks gradually began to increase before leveling off six years later. The maturity of larger bank asset portfolios had been falling and continued to decrease for three more years, until reversing during the 3rd quarter of 2011. Large banks also have significantly shorter-term portfolios compared to their smaller counterparts, which tend to be very similar regardless of their small size. The composition of banks' asset portfolios is also examined with some notable differences among banks of different size.

Keywords bank lending, loan maturity, rate-sensitive assets, bank portfolios, reach-for-yield

JEL Classification G21, E02, E58

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Thomas W. Secrest, Ph.D., Professor of Economics and Finance, Coastal Carolina University, Conway, SC USA.

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INTRODUCTION

A typical U.S. commercial bank holds a wide variety of interest sensitive loans and securities, which may comprise between 75 and 85 percent of all assets. The structure of these assets is a crucial element of asset and liability management strategies of the institutions and their ability to withstand routine changes in interest rates and economic shocks. At times, the strategies in place are tested by systemic, exogenous or unforeseen events that lead the bank to adjust maturity preferences in order to avoid further deterioration in their condition or to enhance performance.

Events that occurred during the financial crisis, and particularly calendar year 2008, led to massive changes to the U.S. commercial banking system over several subsequent years. In particular, the Federal Reserve lowered their target of the fed funds rate to the zero-lower bound of 0-0.25 percent and kept it there until December 2015. At the same time, the Fed announced that they would begin paying interest on balances of required and excess reserves. This paper seeks to determine what, if any, adjustments banks made in aggregate lending and investment behavior in response to events during 2008.

There are two areas of study in this paper. First, the distribution of rate-sensitive assets for banks of different size groups is examined. Interest-sensitive asset holdings are divided into five categories and then into five standard size groups. The size groups are based on total

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assets of an institution. It is found that there were changes in the distribution of assets after 2008, however, there is no consistent pattern based on the size of the institution.

Second, upon combining the five categories of assets into a portfolio, a proxy for the reprice characteristics of the portfolio is developed. The proxy is used to test if the maturity of the asset portfolio changed as a result of the financial crisis. It is found that four of the five size groups did lengthen the maturity of their portfolios after 2008. Further, small banks follow similar asset distribution strategies, particularly after the financial crisis.

1. LITERATURE REVIEW

The choice of how to efficiently and effectively diversify assets is the topic of much literature. In the banking industry, the assets are financial contracts whose value relies on the cash flows to be received. In aggregate, these financial assets are typically classified as loans and leases, securities held for investment, and perhaps securities backed by mortgages. Typically, all banks tend to have the highest concentration of assets as loans, with real estate loans the largest loan category. Investment securities are the second largest general category.

The published literature has many examples of the effects of market conditions on rate-sensitive assets of banks. However, there is a void concerning how banks *choose* to allocate funds among rate-sensitive assets, or events that would cause a bank to allocate assets differently.

Allen, Madura, and Wiant (1995) focus on how the real estate market influences bank equity values. The authors argue that a "good" real estate market is one with increasing values, which translates to lower risk for the debt it secures (mortgages). They find a positive relationship between real estate values and bank returns. Although this result makes sense, there is no recommendation to allocate assets differently based on their conclusions.

Zarutske (2013) reveals that smaller banks and older banks make more unsecured commercial and personal loans than their larger counterparts. Larger banks tend to originate loans that have standardized information that is easy to obtain, suggesting that lending is skewed toward residential and commercial real estate that may be securitized. We are left to surmise that smaller banks are more customer-focused, and Berger, Miller, Petersen, Rajan, and Stein (2005) provide evidence concluding that small organizations (banks) have a comparative advantage over their larger counterparts in activities that process a lot of "soft" information. Given this type of research, one might expect small and large banks to have different asset distributions.

Rodnyansky and Darmouni (2017) find that banks increased lending during certain phases of quantitative easing when mortgage backed securities (MBS) were being purchased by the Federal Reserve. The banks that were "highly affected" by the Fed purchases suggests that large banks carried more MBS, so selling the MBS resulted in increased lending. It is unlikely that smaller banks possessed large amounts of MBS to remove from balance sheets, so their lending behavior and asset distributions remained constant through the quantitative easing programs. The implication is that smaller banks portfolios are constructed differently than the larger counterparts.

Also unique to small institutions is the relative lack of available funding sources. Paligorova and Santos (2017) find that if banks rely on insured deposits to fund loans, the maturity of originated loans increases. Conversely, banks will shorten the maturity of loans when they rely on short-term wholesale funding sources. Also, if the bank relies on wholesale funding, its loan yield curve becomes steeper. The increased premium is compensation for the rollover risk of the short-term funding source. It is implied that large banks prefer short-term loans. Given that small banks do not have equal access to wholesale funding markets, one might expect the average maturity of small bank loans to be longer than that of large banks.

Dutkowsky and VanHoose (2017) imply that rational behavior of banks may lead them to aban-

don lending in favor of holding excess reserves, depending on the policies surrounding fed funds and interest rates on excess reserves. Although the authors argue that banks can switch back and forth between strategies with little detrimental effect, if banks choose not to reinvest maturing loans and securities in like-kind assets in favor of holding reserves, this will lead to a shorter portfolio maturity. This argument is in agreement with Paligorova and Santos (2017) in that large banks, with wholesale funding sources and a preference for short-term loans, may likely forgo lending and hoard the wholesale funds as excess reserves. Doing so significantly reduces rollover risk. Conversely, small banks funded with insured deposits prefer longer-term loans. Assuming longer-term loans with higher yields are preferred to low-rate excess reserves, the likely result is a relatively longer-term loan portfolio for small banks.

In addition, Dutkowsky and VanHoose (2017) indicate at least one clear regime shift took place during the latter part of 2008, and they claim the shift(s) are a result of monetary policy actions regarding fed funds and the payment of interest on reserves. We are to be reminded that small institutions tend to be state-chartered and are not required to be members of the Federal Reserve System. To the extent that small banks are non-members, interest on reserves may not be a factor in their asset allocation decisions.

In a relatively low interest rate environment, it has been surmised that financial institutions may seek higher returns in a variety of ways. Both Chodorow-Reich (2014) and Hanson and Stein (2015) recognize that "reaching for yield," by switching from short- to long-term financial assets, is a conscious management decision perhaps due to frustration in a low-rate environment. Shifting to longer-term assets seeking higher yield also may increase risk beyond what equity holders would prefer. Moreria (2019) might not disagree, arguing that financial capital moves slowly and investors cannot directly measure the increased risk that arises when reaching for yield. Because of the slow movement of capital, Moreria (2019) states that incentives are particularly strong for intermediaries without good investment opportunities to reach for higher yields. Assuming that large banks have more, and better, investment opportunities, this means that small banks will move out the yield curve more aggressively than large banks. In addition to the risk consequences, the result is longer-maturity assets.

Choi and Kronlund (2018) studied reaching for yield in the U.S. corporate bond market by mutual funds. They determined that, on a risk-adjusted basis, the result was inferior returns. Further, this strategy has a negative effect on the liquidity of the mutual funds as they may have to liquidate longer-term less liquid securities at an inopportune time. The finding may argue against reaching for yield by extending the maturity of securities.

In sum, current research tends to support the assertion that (1) the construction of assets in a portfolio differs by bank size, and (2) maturity preferences of assets in the portfolio also differ by bank size. This paper addresses both of these observations.

1.1. Aims

The study aims to determine if the structure of bank assets has changed as a result of the financial crisis and whether the maturity of rate-sensitive assets is different in the post-crisis period.

2. DATA AND METHODOLOGY

The FDIC is the source of portfolio maturity and size data through the Statistics on Depository Institutions (hereafter, SDI) website and database. The tool provides access to aggregated financial statements for FDIC-insured banks of various pre-determined size groups. Data are quarterly observations, obtained from balance sheet accounts and are all common sized by total assets. The time period includes the years 2001 through 2018. Quarterly data are not available prior to 2001, so the 4th quarter of 2000 provides the starting position resulting in 73 quarters of data.

Bank size is determined by total assets each quarter, and categories examined over the data period are:

1) USD 100 million to < USD 300 million;

2) USD 300 million to < USD 500 million;

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3) USD 500 million to < USD 1 billion;

4) USD 1billion to < USD 10 billion; and

5) USD 10 billion to < USD 250 billion.

There are too few observations to be of use in the size category above USD 250 billion. These size categories will be referred to as "Tiers," where the USD 100 million to < USD 300 million banks are Tier 1, and USD 10 billion to < USD 250 billion banks are Tier 5.

A thorough examination of the variables available on SDI reveals that reprice characteristics of five interest-sensitive asset categories are available. The data on the five categories encompasses between 78 and 87 percent of the total assets of the institutions. The specific asset types are:

1) CMOs, REMICs and stripped MBs (excluding mortgage pass throughs);

2) mortgage pass-through securities backed by closed-end first lien 1-4 residential mortgages;

3) other debt securities;

4) closed-end loans secured by first liens on 1-4 residential loans;

5) other loans, which include: Construction and land development, loans secured by nonfarm residential properties, multifamily residential real estate, farmland, farm loans, commercial and industrial loans, and loans to individuals.

The five types of assets have repriced data available in six FDIC-designated time periods. The reprice time periods are displayed in column 2 of Table 1 and labelled 1 through 6. The representation of each reprice period is the midpoint of the five closed-end reprice periods in annual terms. Choosing the midpoint assumes that asset repricing is evenly distributed throughout each period. The 6th reprice period of 15 years or more is assigned a value of 20 years. The choice of 20 years is arbitrary and will not cause concern so long as it is systematically applied.

The FDIC reports the CMOs, REMICs and stripped MBs (excluding mortgage pass-throughs) separately in two reprice periods of (1) greater than three years, and (2) three years or less. The same procedure of assigning annual values is followed for the two reprice periods for the CMO category. The last column of Table 1 displays the annual values assigned for each reprice period.

Table 1. FDIC-determined reprice designations

M	FDIC-designated reprice period for loans and securities	Midpoint in years Y
1	Three months or less	0.125
2	Over 3 months through 12 months	0.625
3	Over 1 year through 3 years	2
4	Over 3 years through 5 years	4
5	Over 5 years through 15 years	10
6	Over 15 years	20
	CMOs, REMICs and stripped MBs (excluding mortgage pass-throughs)	
7	Three years or less	1.5
8	Over three years	9

In order to estimate a reprice/average asset maturity for each quarter and for each bank tier, the following equation is used to calculate a proxy of maturity.

$$QPMP_Q = \sum_{m=1}^{8} Y^m \cdot \left[\left(\frac{CMO_Q^m}{TA_Q} \right) + \left(\frac{MPT_Q^m}{TA_Q} \right) + \right.$$
$$\left. + \left(\frac{ODS_Q^m}{TA_Q} \right) + \left(\frac{RML_Q^m}{TA_Q} \right) + \left(\frac{OL_Q^m}{TA_Q} \right) \right], \quad (1)$$

where $QPMP_Q$ = Quarterly Portfolio Maturity Proxy = weighted average maturity of the portfolio for the quarter Q, Q = quarter, m = reprice period, Y^m = reprice period midpoint in years, TA_Q = total assets for the quarter Q, CMO = CMOs, REMICs and stripped MBs (excluding mortgage pass-throughs), MPT = Mortgage pass-throughs backed by closed-end first lien 1-4 residential mortgages, ODS = Other debt securities, RML = Closed-end loans secured by first liens on 1-4 residential loans, OL = Other loans.

The procedure sums the quarterly percentage of assets devoted to five asset categories within a reprice period then multiplying the result by the midpoint of that reprice period, *Ym*. Summing the result across the reprice periods results in the maturity proxy, $QPMP_Q$. The $QPMP_Q$ is calculated for each of the five tiers of bank size. Therefore,

each tier has 73 quarterly observations spanning the data period from the 4th quarter of 2000 to the 4th quarter of 2018. Simple t-tests were conducted on the average maturity proxy ($QPMP_Q$) for each bank size before and after October 1, 2008.

On October 6, 2008, the Federal Reserve announced that they will begin to pay interest on both required and excess reserves. Also, during the month, the target range for Fed Funds was changed to the lowest possible positive threshold of 0-25 basis points. For our purposes, the pre-crisis bank data contains 32 quarterly observations from December 31, 2000 through September 30, 2008. The remainder of the data period contains 41 observations from December 31, 2008 through December 31, 2018.

3. RESULTS

3.1. Asset Distribution

Table 2 describes the initial data. The first column of Table 2 displays the identifier this paper uses to signify a bank size category with the understanding that Tier 1 is the smallest in size and Tier 5 is the largest in size. Column 2 contains the specific size categories selected from SDI and used throughout. The third column of Table 2 contains the quarterly average number of institutions during the 18-year period. Columns 4 to 8 of Table 2 display the average quarterly amount of assets dedicated to the five asset categories.

By observation, there is a positive relationship of collateralized mortgage obligations and mortgage pass-through securities with bank size. The larger the bank, the higher the amount of assets dedicated to these two securities. There is also a noticeable negative correlation between bank size and assets dedicated to other debt securities with the smallest tier holding the largest amount of assets in that category. Assets allocated to residential mortgage loans follow the same negative relationship to bank size.

It is hypothesized that bank asset distribution did not change during the financial crisis. To determine if the hypothesis holds, one-tailed t-tests were performed on the average holdings before and after the third quarter of 2008, and Table 3 displays the results. In performing these tests, the average assets allocated to each category is assumed to come from distributions with unequal variance. Prior to 2008, it is assumed that asset allocations were relatively stable; however, after 2008, banks may vary considerably in asset allocations as they adjust to the changing conditions. With a confidence level of 0.05 and using the one-tailed test, one can note the determination of change direction.

One clear pattern occurs in the asset category of other loans. Only the Tier 4 banks did not have

Table 2. Bank size designations, average number of institutions, and distribution of bank assets

Tier	FDIC-designated commercial bank asset size categories (m = million, b = billion)	Average number of banks in a category over data period	Average percentage of assets in a portfolio by category and bank asset size 2001-2018					
			CMOs (CMO)	Mortgage pass-through (MPT)	Other debt securities (ODS)	Residential mortgage loans (RML)	Other loans (OL)	Total percentage of assets represented
Tier 1	USD 100m – 300m	2,3304	2.23%	4.85%	14.53%	14.29%	49.94%	85.85%
Tier 2	USD 300m – 500m	649	2.85	4.97	12.73	13.23	52.63	86.40
Tier 3	USD 500m – 1b	492	3.04	5.17	12.04	11.99	54.52	86.76
Tier 4	USD 1b – 10b	420	4.79	6.09	9.69	11.19	53.67	85.43
Tier 5	USD 10b – 250b	83	5.38	5.45	7.13	11.04	49.23	78.23
	Greater than USD 250b	6	Due to the small number of institutions in this category, it is excluded from further analysis					

Note: (CMO) – CMOs, REMICs and stripped MBs (excluding mortgage pass-throughs); (MPT) – Mortgage pass-throughs backed by closed-end first lien 1-4 residential mortgages; (ODS) – Other debt securities; (RML) – Closed-end loans secured by first liens on 1-4 residential loans; (OL) – Other loans. Include: Construction and land development, loans secured by nonfarm residential properties, multifamily residential real estate, farmland, farm loans, commercial and industrial loans, loans to individuals.

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Table 3. T-test of change in average holdings of rate-sensitive asset categories before and after the financial crisis

Before		CMOs (CMO)		Mortgage pass-through (MPT)		Other debt securities (ODS)		Residential mortgage loans (RML)		Other loans (OL)	
		After	Before	After	Before	After	Before	After	Before	After	
Tier 1		2.15	2.29	4.30	5.28	15.02	14.16	14.255	14.32	51.72	48.55
	p-value	+0.051		+0.000**		(0.004)**		+0.341		(0.000)**	
Tier 2		2.86	2.85	4.55	5.30	12.81	12.67	12.87	13.50	54.61	51.08
	p-value	(0.477)		+0.000**		(0.338)		+0.001**		(0.000)**	
Tier 3		3.01	3.07	5.20	5.14	12.42	11.74	11.62	12.28	55.94	53.42
	p-value	+0.337		(0.352)		(0.016)**		+0.004**		(0.000)**	
Tier 4		4.74	4.82	6.63	5.68	10.21	9.29	11.13	11.23	53.06	54.14
	p-value	+0.294		(0.000)**		(0.001)**		+0.359		+0.105	
Tier 5		5.17	5.54	5.34	5.53	6.62	7.54	11.91	10.36	49.74	48.83
	p-value	+0.030**		+0.127		+0.000**		(0.000)**		(0.017)**	

Note: Before: 01/01/2001–09/30/2008; after: 12/31/2008–12/31/2018; ** one-tail significance level of 0.05 percent.

significantly different assets dedicated to this category after 2008, all other tiers significantly lowered the percentage of assets dedicated to other loans. Similarly, Tiers 1, 3, and 4 significantly lowered their holdings in other debt securities, while Tier 5 increased holdings and Tier 2 had no change.

Assets devoted to collateralized mortgage obligations (CMO), real estate investment conduits, and stripped mortgage-backed securities did not change in bank size tiers below USD 10 billion, while Tier 5 banks significantly increased their holdings.

It appears that the smallest banks of Tiers 1 and 2 had higher amounts of mortgage pass-through securities, and Tier 2 banks also increased holdings of residential mortgage loans. Residential mortgage loans also increased for Tier 3 banks. Finally, the fourth-Tier institutions have significantly lower percentage of assets dedicated to the securities categories of mortgage pass-throughs and other debt securities.

Bank asset portfolios contain both commercial and consumer loans and the smaller institutions seem to have curtailed lending in these areas following the crisis. The result conflicts with Zarutske (2013) who claims small institutions have a comparative advantage in underwriting commercial and consumer loans. Further, smaller institutions are not investing as much in other debt securities, which are primarily U.S. Treasuries. Instead, there is some increase in mortgage pass-through securities and residential mortgage loans. Rodnyansky and Darmouni (2017) noted an increase in residential lending around quantitative easing periods. It is not inconceivable that smaller banks also increased holdings of quality mortgage pass-through securities in order to increase yield or to capture capital gains as the real estate market recovered.

3.2. Asset Portfolio Maturity

The portfolio maturity proxy was calculated for each of the 73 quarters and for each bank tier. Figure 1 provides a visual representation of the results.

When viewing Figure 1, several points seem obvious. First, the maturity of bank assets for all tier sizes converges during 2008. Second, after 2008 all bank tiers altered the maturity characteristics of their portfolios. Finally, smaller banks altered their asset compositions in such a way that the average maturity of their portfolios increased.

To determine if the maturity of bank asset portfolios changed in 2008, heteroskedastic 2-tail t-tests were conducted on the average maturity proxy ($QPMP_Q$) for each bank tier before and after October 1, 2008. The only bank tier that was not significant at the 0.05 level is Tier 5. Therefore, the largest banks did not change their portfolio maturity characteristics as a result of the financial crisis, while relatively smaller banks increased the average maturity of their asset portfolio. Table 4 contains the detail of the statistical test.

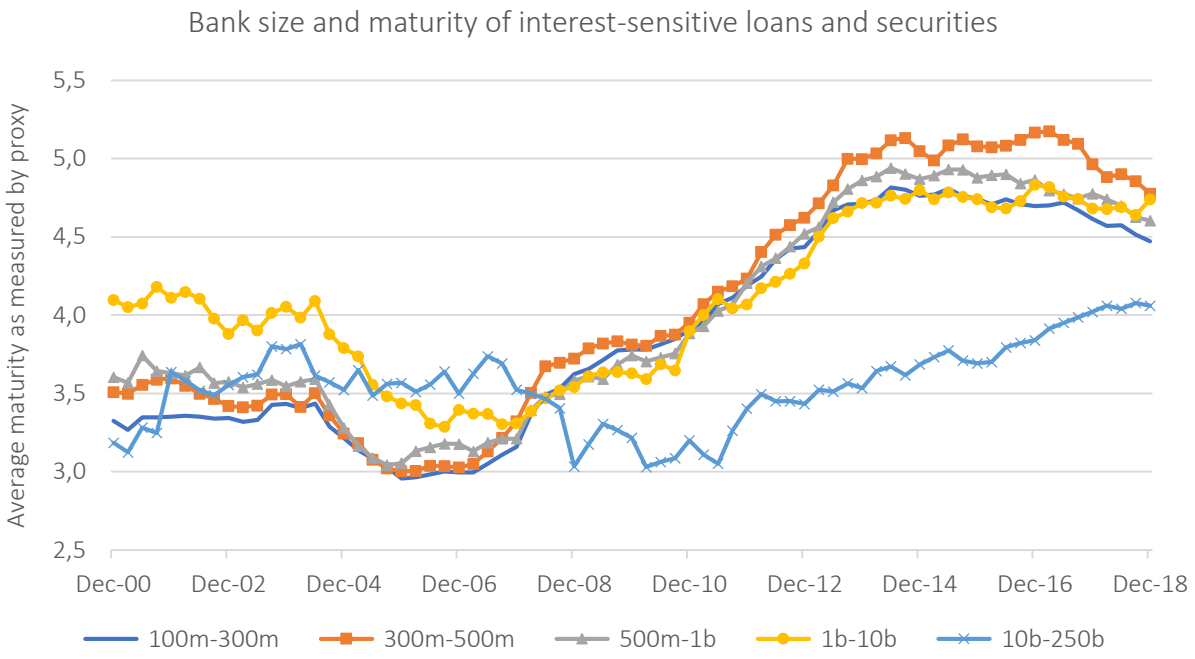

Figure 1. Portfolio maturity proxy by bank size over time

Figure 1 also shows that, prior to October 1, 2008, the maturity characteristics of all bank tier sizes were relatively similar. The 4th tier portfolios do appear to be somewhat longer in maturity than the other tiers during the pre-crisis period. However, following the third quarter 2008 the smaller bank size tiers show a very similar pattern as the portfolio maturities increase. The data do confirm that the portfolio maturity of the largest bank tier was falling prior to October 1, 2008 and continued to decline until mid-year 2011, when portfolio maturity began to increase slightly.

To confirm that small bank portfolio maturity tends to move together, 2-tail t-tests of the quarterly maturity proxy were conducted for each bank tier

Table 4. T-Test results of average portfolio maturity proxy

Tier	Bank size	Portfolio maturity proxy t-test two tailed, α= 0.05		
		PROXY value before 10-01-2008	PROXY value after 10-01-2008	P-value
Tier 1	USD 100m – 300m	3.24	4.39	0.000
Tier 2	USD 300m – 500m	3.34	4.62	0.000
Tier 3	USD 500m – 1b	3.40	4.45	0.000
Tier 4	USD 1b – 10b	3.74	4.37	0.000
Tier 5	USD 10b – 250b	3.54	3.56	0.769

Note: Before: 01/01/2001–09/30/2008; After: 12/31/2008–12/31/2018.

Table 5. P-value of quarterly portfolio maturity proxy by bank size

Tier	Bank size	USD 100m – 300m	USD 300m – 500m	USD 500m – 1b	USD 1b – 10b
Tier 1	USD 100m – 300m				
Tier 2	USD 300m – 500m	0.144			
Tier 3	USD 500m – 1b	0.347	0.547		
Tier 4	USD 1b – 10b	0.036	0.762	0.144	
Tier 5	10b – 250b	0.000	0.000	0.000	0.000

Note: Comparison period: 12/31/2000 – 12/31/2018.

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with all other tiers. The entire data period is used resulting in 73 observations as two tier sizes were compared. Table 5 displays p-values of the tests.

At the 0.05 percent level, it is concluded that the maturity of asset portfolios of banks with assets less than USD 10 billion was not significantly different from each other during the entire data period. These banks appear to follow the same asset management strategy prior to and after the financial crisis.

The maturities of the largest bank portfolios, however, are significantly different from those of their smaller counterparts. It is concluded that asset management strategies and maturity preferences of the largest institutions vary considerably from small institutions.

4. DISCUSSION

There are several reasons why banks may alter the maturity of their asset portfolios as they worked their way out of the crisis. Smaller institutions tend to rely on retail deposits that are insured by the FDIC, which may allow them to make longer-term loans or purchase longer-term securities containing more price risk (Paligorova & Santos, 2017). Lengthening the portfolio may also be the result of actions by the Federal Reserve, which lowered the Fed Funds target to the zero lower bound and kept it there for six years and began paying interest on required and excess reserves. Smaller banks are less likely to fund loans with wholesale funding sources ((Dutkowsky & VanHoose, 2017) like Fed Funds, so the low Fed Funds rate is not the attraction for those institutions that it is for large banks. Low short-term rates may also cause banks to invest in longer-term securities and loans, a practice known as reaching for yield. Small banks do not have the investment alternatives of larger banks, so reaching for yield may be the most accessible method of increasing portfolio returns. Small banks may also have relatively fewer excess reserves and the interest rate earned on reserves mirrors the Fed Funds rate, so interest income from that source is insignificant and may not alter investment strategies. Large banks using wholesale funding and active in the Fed Funds market may abandon those sources and prefer to hold excess reserves earning interest for liquidity reasons. With a stable source of funds, large banks may also reach for yield without the worry that short-term wholesale funding costs could increase. No evidence is found that this scenario is occurring in large institutions. Perhaps these banks' portfolios are so large and well diversified that marginal additions or deletions over time are of no consequence or are not detectable by the construct of this model.

It was found that fewer assets were allocated to other loan category that includes commercial and individual loans after the financial crisis in four of the five bank size tiers. Presumably, many of these loans would be variable rate as with credit cards or business lines of credit. Fewer assets devoted to those short-term reprice loans would explain the increase in the portfolio maturity proxy after 2008. An increase in the proxy would also lead to more assets directed to longer-maturity mortgage pass-through securities and residential loans, which is the case with a couple of the bank-size tiers.

CONCLUSION

This paper uses freely available U.S. bank data to determine if commercial banks allocated their assets differently after the financial crisis of the late 2000s and if any changes were affected by the size of an institution. By observation, residential loans and some debt securities are negatively related to bank size, while mortgage-backed securities and collateralized mortgage obligations have a positive relation to bank size. The only consistent change in asset allocation after the crisis was a decrease in the amount of loans unrelated to real estate by small banks. Apparently, small institutions allocated relatively less of their assets to commercial and consumer lending.

A proxy of the relative maturity of commercial bank assets is constructed and used to compare changes in the maturity of bank assets after the financial crisis. It is found that after 2008, small banks began

increasing the relative maturity of their loans and securities over an approximately 6-year period. Large bank asset portfolios did not change in maturity as a result of the financial crisis.

Future research is this area includes further study of the effect of interest payments on required and excess reserves altering banks' asset allocation decisions and the asset maturity structure. The Federal Reserve does not seem to be in a hurry to drain excess reserves from the banking system, so banks may consider the reserves a long-term, interest-bearing asset. By design or accident, the Federal Reserve has provided incentives for banks to change the maturity structure of rate-sensitive portfolios. The risk premia attached to lending or investing in certain securities may not be enough for member banks to forgo holding interest-bearing reserves. It also remains to be seen how the maturity of bank portfolios will change when the Federal Reserve attempts to draw down its balance sheet and remove excess reserves from the system.

AUTHOR CONTRIBUTIONS

Conceptualization: Thomas W. Secrest.
Data curation: Thomas W. Secrest.
Formal analysis: Thomas W. Secrest.
Investigation: Thomas W. Secrest.
Methodology: Thomas W. Secrest.
Project administration: Thomas W. Secrest.
Resources: Thomas W. Secrest.
Visualization: Thomas W. Secrest.
Writing – original draft: Thomas W. Secrest.
Writing – reviewing & editing: Thomas W. Secrest.

REFERENCES

1. Allen, M. T., Madura, J., & Wiant, K. J. (1995). Commercial Bank Exposure and Sensitivity to the Real Estate Market. *Journal of Real Estate Research, 10*(2), 129-40. Retrieved from https://pages.jh.edu/jrer/papers/pdf/past/vol10n02/v10p129.pdf
2. Beltrame, F., Previtali, D., & Sclip, A. (2018). Systematic Risk and Bank Leverage: The Role of Asset Quality. *Finance Research Letters, 27,* 113-117. http://doi.org/10.1016/j.frl.2018.02.015
3. Berger, A. N., Miller, N. H., Petersen, M. A., Rajan, R. G., & Stein, J. C. (2005). Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks. *Journal of Financial Economics, 76*(2), 237-269. Retrieved from https://www.sciencedirect.com/science/article/pii/S0304405X05000139
4. Chodorow-Reich, G. (2014). Effects of Unconventional Monetary Policy on Financial Institutions. In *Brookings Papers on Economic Activity* (pp. 155-204). Brookings Institution Press. Retrieved from https://www.jstor.org/stable/23936274?seq=1
5. Choi, J., & Kronlund, M. (2018). Reaching for Yield in Corporate Bond Mutual Funds. *Review of Financial Studies, 31*(5), 1930-65. http://doi.org/10.1093/rfs/hhx132
6. Dutkowsky, D. H., & VanHoose, D. D. (2017). Interest on Reserves, Regime Shifts, and Bank Behavior. *Journal of Economics and Business, 91,* 1-15. https://doi.org/10.1016/j.jeconbus.2017.03.003
7. Federal Deposit Insurance Corporation (FDIC). (n.d.). *Statistics on Depository Institutions*. Retrieved from https://www7.fdic.gov/sdi/main.asp
8. Hanson, S. G., & Stein, J. (2015). Monetary Policy and Long-Term Real Rates. *Journal of Financial Economics, 115*(3), 429-448. https://doi.org/10.1016/j.jfineco.2014.11.001
9. Michel, N., & Selgin, G. (2017). The Fed Must Stop Rewarding Banks for Not Lending. *American Banker, 182*(103), 1. Retrieved from https://www.cato.org/publications/commentary/fed-must-stop-rewarding-banks-not-lending
10. Moreira, A. (2019). Capital immobility and the Reach for Yield. *Journal of Economic Theory, 183,* 907-951. http://dx.doi.org/10.1016/j.jet.2019.07.010
11. Paligorova, T., & Santos, J. A. C. (2017). Banks' Exposure to Rollover Risk and the Maturity of Corporate Loans. *Review of Finance, 21*(4), 1739-1765. https://doi.org/10.1093/rof/rfw03
12. Plosser, C. (2012). Good Intentions in the Short Term with Risky Consequences for the Long-

http://dx.doi.org/10.21511/bbs.15(2).2020.03

Term. *Cato Institute 30th Annual Monetary Conference Money, Markets, and Government: The Next 30 Years*. November 15, 2012. Washington D.C. Retrieved from https://www.philadelphiafed.org/-/media/publications/speeches/plosser/2012/11-15-12_cato-institute.pdf

13. Rodnyansky, A. & Darmouni, O. M. (2017). The Effects of Quantitative Easing on Bank Lending Behavior. *Review of Financial Studies, 30*(11), 3858-3887. http://doi.org/10.1093/rfs/hhx063

14. Stein, J. (1998). An Adverse-Selection Model of Bank Asset and Liability Management with Implications for the Transmission of Monetary Policy. *RAND Journal of Economics, 29*(3), 466-486. Retrieved from https://www.jstor.org/stable/2556100

15. Trevino, R., & Yates, B. (2006). Reaching for Yield – Lessons from the Past. *Journal of Financial Planning, 19*(2), 70-77.

16. Wright, J. H. (2012). What Does Monetary Policy Do to Long-Term Interest Rates at the Zero Lower Bound? *The Economic Journal, 122*(564), F447-F466. http://dx.doi.org/10.1111/j.1468-0297.2012.02556.x

17. Zarutskie, R. (2013). Competition, Financial Innovation and Commercial Bank Loan Portfolios. *Journal of Financial Intermediation, 22*(3), 373-396. http://doi.org/10.1016/j.jfi.2013.02.001