Analysis of Government Stimulus during COVID-19 and the Bank Distress of 2023

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Abstract

Due to the hardships that small businesses were facing from the onset of COVID-19 in March 2020, the government created the Payment Protection Program (PPP). This program used banks as the initial lenders for small business loans to facilitate loans from the government to small businesses. In this article, I study how participation in the PPP lending program contributes to the Bank Distress of 2023 by using a bank-level quarterly panel data set from 2019-2023. Estimation of difference-in-difference specifications reveals banks that opted into the PPP program experienced an increase in held-to-maturity securities relative to non PPP banks. The mechanism for these differences in asset holdings is most likely due to growth in depositors associated with PPP loans. As PPP banks gained more depositors, they invested many of these funds in treasury securities, which were either marked-to-market or available for sale securities. Marked-to-market securities lost a substantial amount of value from the monetary tightening which began in March 2022. Many banks were inclined to shift these marked-to-market securities into held-to-maturity securities. Subsequently, in March 2023, due to a high amount of uninsured leverage and a loss in marked-to-market securities, Silicon Valley Bank crashed with a few other banks soon following. Ultimately, this paper links this Bank Distress of 2023 back to the government stimulus from the Payment Protection Program.
Acknowledgements

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1 Introduction

In response to the COVID-19 Crisis the US Government passed the CARES Act in March 2020, providing tons of stimulus to various sectors of the economy. The Government Stimulus of 2020 included the Payment Protection Program, which provided $954 billion in loans to small businesses using banks as the primary facilitators. In other words, small businesses would go to PPP Banks and these banks would make the initial investment by giving these businesses a loan from their funds. Eventually, the bank would be reimbursed by the Small Business Administration (SBA). In April 2020, the Federal Reserve created the Payment Protection Program Liquidity Facility (PPPLF) so banks could receive liquidity to make these initial investments for PPP loans. These programs increased the lending of many banks and also their total assets. Two years after the CARES act, the US economy experienced high inflation and a low unemployment rate. In response, the Federal Reserve began rate hikes, and indirectly put lots of stress on these banks. Over time, interests rate went from 0.08% to 4.57% (Jiang et al. 2023). These rate hikes negatively impacted long term assets, and thus significantly impacted banks, as banks typically invest their deposits in long term assets with short term liabilities (Jiang et al. 2023). During COVID-19, many banks invested in treasury securities which are normally safe asset investments. However, the interest rate hikes led to marked-to-market treasury securities losing a significant amount of value. A year later, the losses from these marked-to-market securities took over the Silicon Valley Bank (SVB), and led to a bank run on SVB causing this bank to crash. This bank run led to a panic across the financial sector,
as well as a strong policy response from the Federal Reserve. The main theory behind SVB crashing is the bank’s high rate of uninsured depositors coupled with the bank’s significant decrease in asset value (Jiang et al. 2023). However, there is a greater question as to what led to this decrease in asset values? More importantly, were other banks also affected? If so, how did the PPP play a role in this systematic bank distress? This paper delves deeper into the root cause of the Bank Distress of 2023 by exploring its connection to the CARES Act of 2020.

In this paper I investigate the COVID-19 Payment Protection Program and its contribution to the Bank Distress of 2023 by examining the differences in treasury securities for banks that opted into the PPP program versus those who did not opt into the program. Any bank could opt into the program, however, larger and more profitable banks were more likely to do so (Marsh and Sharma 2022). Still community banks participated, and about 87% reported giving a PPP loan. Even weakly capitalized community banks participated in the PPP program, but gave PPP loans relative to their size (Marsh and Sharma 2022). Thus, banks with different characteristics participated in this program. Given that many banks participated in the program, the impact of the PPP may be widespread.

I use bank level quarterly panel data from 2019-2023, excluding banks with over $10 billion in total assets, and those that do not appear in the data set consistently. I explore the change in balance sheet composition from Pre COVID-19 to Post COVID 19, by analyzing held-to-maturity securities over total assets as well as deposits over total assets. I hypothesize that PPP banks have a similar value of held-to-maturity securities and deposits in Pre COVID-19, and then experience
a difference in held-to-maturity securities relative to non PPP banks Post COVID-19. If this difference in held-to-maturity securities in Post COVID-19 is true, then this difference may stem from the PPP program. Thus, my next question is what is the mechanism for this difference in PPP and non PPP banks for held-to-maturity securities post COVID-19. I hypothesize that PPP loans amounts may contribute to an increase in deposits, which ultimately leads to a difference in held-to-maturity securities.

To investigate these hypotheses, I estimate a difference-in-difference panel data regression model to investigate the variation between PPP and non PPP Banks. This difference in difference method helps to detect selection issues, as there is a concern that banks opting into the program may have different characteristics than non PPP banks. I also run a restricted model for a sample of only PPP banks to see the relationship between PPP loan amounts and deposits. Lastly, I run separate regressions restricting the sample by bank size to ensure large banks are not driving the results.

I find that PPP Banks held-to-maturity securities ratio increases relative to non PPP banks after the start of the PPP program by 0.2 percentage points. This 0.2 percentage point increase is significant, as it is roughly 15% of the Pre COVID 19 mean of the total held-to-maturity ratio for PPP banks, shown in Table 2. PPP banks experience an increase in deposit growth associated with an increase in their PPP loan amounts by 0.01 percentage points. Thus, these findings suggest that customers are going to banks participating in the PPP loans and increasing their deposits, which in turn increase these banks funds. Thus, these banks are investing some of these funds
in treasury securities and later shifting their marked-to-market securities to their
held-to-maturity securities, more so than non-PPP banks. I also find that the smaller
to medium sized banks are driving this growth in the held-to-maturity security ratio.

These balance sheet differences between PPP banks and non-PPP banks are
important, as they speak to monetary policy decisions. The mechanism that underlies
the results has to do with bankers’ balance sheet allocation decisions. PPP banks
experienced a larger growth in deposits relative to non-PPP banks, which likely re-
resulted from increases in customer demand for their PPP loan facilitation. With more
deposits, banks face a difficult decision of how to allocate these funds. Many banks
decided to purchase treasury securities. However, in 2022, the Federal Reserve in-
creased interest rates and offered more attractive securities. This policy action made
the market for securities purchased in 2021 much less attractive. If banks held 2021
securities on their balance sheet under “marked-to-market” they lost a lot of value.
As a result, banks were inclined to move these assets to “held-to-maturity,” which
is what the results show. While held-to-maturity assets keep their expected value,
they provide a long-run solution and leave banks with fewer securities to sell in a
liquidity stress scenario. Therefore, the evidence shows that PPP loans contributed
to the bank instability of 2023.

This paper is the first to connect the Payment Protection Program to the
Bank Distress of 2023. Prior literature has looked at the impact of the Payment
Protection Program on lending during COVID-19, ultimately finding that the Pay-
ment Protection Program does not crowd out private lending (Marsh and Sharma
2022). Literature from Anbil, Carlson, and Styczynski (2021) looks at the usage
of the PPPLF, and its effect on bank lending and the extent of PPP participation. There is also literature covering the Bank Distress of 2023, and how the decrease in asset values as well as uninsured depositors plays a substantial role in the SVB bank crash (Jiang et al. 2023). This paper contributes to this literature by combining the Payment Protection Program findings with the Bank Distress of 2023, in focusing on the change in long term asset values for PPP versus non PPP Banks.

This paper starts in Section 2 covering institutional background on the PPP program, the Bank Distress of 2023, the models used, and the reasoning behind exploring held-to-maturity securities for bank performance. This paper will contribute to previous literature by looking at the PPP in regards to balance sheet composition and impact on Bank Distress of 2023. Section 3 discusses the creation and use of the combined panel data set of COVID-19 PPP loans with the FFIEC Bank Call Reports. In section 4, this paper discusses the usage of panel regression methods to uncover the impact of the PPP on banks balance sheet composition. Section 5 will discuss these findings, and show robustness checks, by looking at banks balance sheet composition for various bank sizes. Lastly, section 6 will finish with the conclusion.
2 Institutional Background

Prior to the introduction of the Payment Protection Program, non-financial businesses drew a substantial amount of Commercial and Industrial (C&I) loans from lending institutions in the three COVID-19 Crisis weeks in March (Li, Strahan, and Zhang 2020). During the onset of COVID-19, banks had a $480 billion increase in loan draws. Most of the C&I loan draws were from larger banks. Small and mid-sized banks also experienced increases but it was much smaller (Glancy David and Ionescu 2020). To support these draws, smaller banks depleted their liquid assets whereas larger banks only reduced their capital ratios. Banks also had over $800 billion in deposits to support this spike in loan draws, and many of these banks with deposit increases were larger banks (Glancy David and Ionescu 2020). Furthermore, the Federal Reserve began practicing quantitative easing, as well as reinstating lending programs for banks (Li, Strahan, and Zhang 2020). Despite this support from private depositors and the Federal Reserve, many banks still exceeded deposit inflows putting a strain on their lending in the long term. Therefore, there was a great need for banks to have another source of lending to support these non-financial businesses.

After the COVID-19 crisis weeks, small businesses were experiencing many hardships, as many were closing and laying off workers. Many of them did not have the long term financial support to keep their stores open with these long term COVID-19 lock downs (Bartik et al. 2020). These businesses needed some form of financial aid to help them maintain their businesses during a period of extremely slow economic activity.
To support these small businesses, the government created the COVID-19 Payment Protection Program in the CARES Act of 2020. Congress gave a total of $954 billion to the Payment Protection Program. This funding was administered through the US Small Business Administration (SBA). The SBA used private sector lenders to process loan applications and disperse funding.

Many small business, including non-profits, self employed persons, and independent contractors used these PPP to support their businesses in COVID-19. The qualifications were relatively broad with the exception that traded companies could not access these loans. These qualified businesses applied for these low-interest private loans to pay for payroll and other pre-approved costs. These loans equaled approximately 2.5 times the applicant’s average monthly payroll costs and had an interest rate of 1%. Further, there were no fees for these loans, and no collateral or personal guarantees required. With these light restrictions on loan qualifications, these businesses may have also qualified for loan forgiveness. An NPR analysis of SBA data found that 92% of PPP loans issued were granted full or partial forgiveness.

The US Government and other parties wanted to make these loans attractive to the lenders, as these lenders were responsible for disbursing the funding. These loans were legislatively required to have a zero percent risk weight, meaning lenders did not have to post capital against these loans under the risk-based capital rules. Further, the SBA was responsible for any default or forgiveness, so lenders did not incur any credit risk. The lenders were also given payment for originating PPP loans. Further, these lenders would be reimbursed by the SBA if the loan was forgiven for the business. Lastly, not only banks could participate, as small business lending
companies, Credit Unions, Farm Credit Associations, and fin techs were also allowed to join this program.

Since lenders were responsible for providing the initial investment of funds to these businesses, banks with larger C&I loan portfolio concentrations, larger share of liquid assets (capacity to fund PPP loans), and with prior relationships to customers were more likely to join the PPP. Furthermore, banks facing more business risk or greater risk of failure due to loan losses were more likely to join the program (Marsh and Sharma 2022).

To ensure many banks could join the program, the Federal Reserve established the Paycheck Protection Program Liquidity Facility (PPPLF). The PPPLF was created to provide liquidity for banks making PPP loans. The facility extended loans at a .35% rate and collateralize it by a PPP loan. Further, the principal and maturity of the PPPLF loans matched the remaining balance and maturity of the underlying PPP collateral. By borrowing through the PPPLF, lenders could neutralize the effect of PPP lending on their balance sheet. The PPPLF provided a good source of liquidity for lenders, and specifically banks, to reduce the impact of lending large sum of funds to small businesses without increasing the liabilities of the lenders.

Banks using the PPPLF made more PPP loans, approximately twice as many relative to their asset base, compared to banks not using PPPLF. Furthermore, the PPPLF was extremely significant for small community banks, since banks that used the PPPLF made much larger loans relative to their size (Anbil, Carlson, and Styczynski 2021). Roughly 95% of PPPLF borrowers were community banks (Anbil, Carlson, and Styczynski 2021). Thus, the PPPLF provided lots of support for small
community banks. Generally, the PPPLF also supported capital constrained banks, and those with many C&I loans, as they pledged larger shares of loans to the facility compared to their counterparts (Marsh and Sharma 2022).

Overall, Marsh and Sharma (2022) finds that PPP loans positively impacted bank lending in the long run, as they offset a collapse in bank credit supply and assisted banks in producing income at a time when capital is high risk. Since lending opportunities outside of the PPP are limited over the course of the pandemic, banks that do not participate in the PPP are likely constrained in their ability to generate interest revenue from their liquid assets. Furthermore, Berger et al. (2021) finds the PPP only provided short-term relief to businesses, meaning it would not interfere with later corrective marketing functioning. It still had a positive effect on small business and farm lending during the crisis period of COVID-19 (Lopez 2021). Therefore, the PPP was effective in providing short term relief for small businesses. However, there is still a question as to the long-run impact of PPP banks on not only bank lending, but bank performance.

In 2023, the Silicon Valley bank collapsed bringing up the question as to the impact of the PPP on bank performance. Jiang et al. (2023) find the Silicon Valley Bank had a relatively significant decrease in assets in 2023. These authors investigate the actual decrease in bank’s held-to-maturity loan portfolios by decreasing bank assets based on the decrease in the market level of the long-duration of assets. They find that for all banks, market value of assets decreased by over $22 trillion lower than their suggested book value of assets accounting for loan portfolios held-to-maturity (Jiang et al. 2023). Silicon Valley Bank was on the lower end of the percentile,
showing this decline in asset value contributed to the bank’s collapse. SVB was also in the first percentile of the distribution for uninsured leverage, suggesting that over 78% of its assets were funded by uninsured deposits. This high uninsured depositor percentage significantly contributed to their bank run (Jiang et al. 2023). Thus, a main cause of the SVB crash was due to the high percentage of uninsured depositors and a decrease in asset value.

Furthermore this crash was not isolated within SVB. Metrick and Schmelzing (2023) find based on the response of the US Government and the Federal Reserve, this crash was based on a systematic issue. Immediately after the crash, the Federal Reserve created a broad based emergency lending program, the Bank Term Funding Program. It gave banks the opportunity to borrow more than the current value of their assets (Metrick and Schmelzing 2023). Furthermore, the Federal Reserve guaranteed deposits over the maximum amount ($250,000) per depositor. Since over 90% of SVB’s deposit liabilities were in customer’s accounts over the maximum limit, this response protected many uninsured depositors. These responses aligned with prior responses in which a bank crash was apart of a larger systematic issue. This systematic nature of the crash indicates that Silicon Valley Bank is not the only bank to be in a financially risky position at the time of the crash.

Given the systematic nature of the SVB crash, it is of great value to explore the causes of this bank crash to better understand how the government’s policy decisions may have played a role in the Bank Distress of 2023. To address this question, I focus on examining bank performance over time by examining total held-to-maturity securities over total assets. Held-to-maturity securities are those securities which
banks hold to maturity, rather than available-for-sale securities which are sold before maturity. Banks may adjust these securities by moving them into held-to-maturity from available-for-sale, rather than putting them as a loss. Thus, the balance sheets may provide an unrealistic number of the loss from available-for-sale securities. Jiang et al. (2023) adjust all banks held-to-maturity assets including real estate securities to their market values and find by March 2023 bank assets declined on average by 10%. Furthermore, these authors only marked down real estate loans, making this mark down a conservative estimate. Given this more realistic picture of the decline in held-to-maturity assets, it is of value to explore PPP versus non PPP banks held-to-maturity security growth. In doing so, we can better understand how bank performance may be impacted today based on bank’s decisions to invest in treasury securities during COVID 19.

I use a model to examine held-to-maturity securities based on Anbil and Vossmeyer (2018) linear panel data model with two interaction variables. It stimulates difference in difference to compare pre-treatment and post-treatment of banks that borrowed from one of the lending facilities in their paper (Anbil and Vossmeyer 2018). This model differs from previous papers within the PPP literature. Marsh and Sharma (2022) use a cross sectional joint model to analyze a bank’s decision to participate in PPP loans, the extent of their participation, and the balance sheet impact from this program. I use a panel model to exploit variation over time.

I find that the held-to-maturity securities increase for PPP banks relative to non PPP banks after opting into the Payment Protection Program. This finding suggests that PPP banks’ long term assets may have been significantly impacted by
the monetary tightening, making these banks particularly vulnerable. These findings contribute to previous literature on the Payment Protection Program, in showing the consequences of banks participating in the PPP program in the long run. Previous papers showed the type of banks that participated in the PPP and PPPLF. Furthermore, Marsh and Sharma (2022) analyze how PPP impacted bank lending in the long run. However, these papers do not assess the impact of the Payment Protection Program on bank performance using held-to-maturity securities as the variable of interest. Furthermore, this paper extends on the literature of bank crises in 2023. It looks at a potential contributor to banks instability in 2023 by analyzing the Payment Protection Program. Ultimately, this paper extends previous literature on the PPP and Bank Distress of 2023, by linking these two topics in showing the impact of PPP on Bank Distress of 2023.
3 Data

3.1 Overview

This data set is bank-level balanced panel quarterly data from 2019-2023. It includes their balance sheets, income statements, as well as PPP loan information for each quarter.

It is formed from two data sets. One of these data sets is the Federal Financial Institution’s Examination Council (FFIEC) Commercial Bank Call Reports including the balance sheet, income statement and past due from 2019Q1-2023Q2. The other data set is the Small Business Administration PPP COVID-19 Loans data from 2020Q2-2021Q2. The merged data set is focused on small and medium sized banks, excluding those with over $10 billion in total assets. Furthermore, it excludes banks that are not consistently in the data set for every quarter from 2019 to 2023. Banks may not be consistently in the data set due to them having been acquired, closed, or for some other reason.

Before merging these two sources, I restructure the PPP loan data set in terms of the bank name and quarter of the year, rather than each loan transaction. Thus, the data shows the number and amount of dollars of PPP COVID-19 loans per quarter for each bank. The FFIEC Bank Call Report includes all assets of foreign offices and domestic offices. I only focus on domestic offices related variables. When merging the data, not all PPP lending facilities are banks. Approximately, 200 are Federal Credit Unions, 150 are Credit Unions and 20 are Agricultural Credit Associations.
Thus, not all the lending institutions merge into the FFIEC bank call report since only banks are included in the data.

In this merged data set, there are 4,305 banks observed for 18 quarters from 2019Q1 to 2023Q2. Table 1 describes the banks that gave PPP loans and those that did not in 2020Q2. This table provides a breakdown of the large community and small community banks frequency of PPP loans in this quarter. Large community banks make up the majority of the PPP loans, whereas only a few small community banks give loans in this quarter.

Table 1. PPP Bank Participants

<table>
<thead>
<tr>
<th>PPP Bank</th>
<th>Non PPP Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Community Bank</td>
<td>3,104</td>
</tr>
<tr>
<td>Small Community Bank</td>
<td>319</td>
</tr>
</tbody>
</table>

Small community banks total assets of $60 million or less, Large community banks total assets greater than $60 million or less and less than $10 billion, data is from FFIEC Bank Call Reports and SBA PPP Loan data

Furthermore, 3,811 banks are large community banks with over $60,000,000 and under $10,000,000,000 in total assets. 434 are small community banks with total assets under $60,000,000.

Figure 3.1 shows the amount of banks that made PPP or second draw PPP loans (PPS) loans each quarter. As shown in this figure, a significant number of banks made loans in 2020Q2, and 2021Q2. A majority of banks participated in the program, as there are only 4,305 banks in total.
3.2 Descriptive Statistics

Table 2 presents the summary statistics for PPP versus non PPP Banks in three different time periods between 2019 and 2023. These time periods are based on three COVID eras. Pre COVID-19 era is defined as 2019Q1-2020Q1, COVID era is 2020Q2-2022Q2, and Post COVID era is 2022Q3-2023Q2. Post COVID era begins in 2022Q3 due to the beginning of monetary tightening. The Federal Reserve began monetary tightening in March (midway in 2020Q2), so Post COVID era is determined to be the quarter directly after this tightening. Furthermore, these summary statistics represent the mean of these variables.

These results are particularly revealing, as they show the differences between non PPP and PPP Banks in regards to held-to-maturity security growth. Looking at Table 2, there is a notable jump in PPP banks held-to-maturity securities increasing...
1 percentage point from Pre COVID 19 to Post COVID 19. Whereas, non PPP banks only increased by 1/2 a percentage point in this time.

Table 2. Summary Statistics

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>PPP Bank</td>
<td>Non PPP</td>
<td>PPP Bank</td>
</tr>
<tr>
<td>Total Assets</td>
<td>573123</td>
<td>281389</td>
<td>754481</td>
</tr>
<tr>
<td>Total Deposits</td>
<td>473182</td>
<td>222430</td>
<td>643522</td>
</tr>
<tr>
<td>Total Deposits/Assets</td>
<td>0.85</td>
<td>0.83</td>
<td>0.88</td>
</tr>
<tr>
<td>HTM Securities/Assets</td>
<td>0.013</td>
<td>0.024</td>
<td>0.014</td>
</tr>
</tbody>
</table>

Non PPP represent Non PPP Banks, ratios are winsorized at the fifth percentile, Total Assets and Deposits are in thousands, data is from FFIEC Bank Call Reports and SBA PPP Loan data.

Next, I examine each of these summary statistics in more depth, and start with the mean of total deposit growth shown in Figure 2. It first increased during COVID 19 for both groups and then fell for PPP Banks and increased for non PPP Banks. This difference between PPP and non PPP Banks suggests that the PPP may have played a role an increasing deposits during COVID 19. In Figure 2 total deposits steps up from 2020Q1 to 2020Q2, which is the time when the PPP program began. Looking at the growth of deposits in Figure 2, PPP banks grew very significantly until 2022Q2. The Federal Reserve began increasing interest rates in 2022Q2. Thus, this hike in interest rates may have also impacted the deposit growth of banks, especially PPP banks.

Furthermore, the ratio between total deposits and assets in Table 2 aligns with this Figure 2. As COVID 19 began, the deposit ratio increased for both types of banks (more so for PPP banks), and then decreased for PPP banks, and remained the same for non PPP banks post COVID 19. Therefore, this table and figure show
there is a difference in deposit growth at PPP and non PPP banks, with PPP banks experiencing a higher rate of deposit growth during the COVID 19 era.

**Figure 2. Growth of Mean of Held to Total Deposits 2019-2023**

![Graph of Growth of Mean of Held to Total Deposits 2019-2023](image)

*Data from FFIEC Bank Call Reports and SBA PPP Loan data*

I also look at the difference in total asset size from these three periods. Total assets significantly increase for PPP banks from pre COVID-19 to post COVID-19 shown in Table 2. Whereas, for non PPP banks there is a much smaller increase in total assets. Figure 3 provides a graphical view of this increase relative to growth. The PPP banks grew slightly more than non PPP banks. PPP and non PPP banks grew at a similar rate except for 2020Q2 and 2022Q3 - 2023Q2. The 2020Q2 divergence for PPP and non PPP may be due to the start of COVID-19 related loan draws. PPP banks are more likely to be larger banks, and larger banks experience more C&I loan draws from the initial spike at the pandemic (Li, Strahan, and Zhang 2020). The lower growth for PPP banks from 2022Q3 to 2023Q2 may be attributed
to impacts of higher interest rates on asset growth (Jiang et al. 2023). Overall, there is a substantial difference in total asset growth between non PPP and PPP banks.

Figure 3. Growth of Mean of Total Assets 2019-2023

Data from FFIEC Bank Call Reports and SBA PPP Loan data

Next, I examine a specific asset: total held-to-maturity securities. These securities are one type of treasury securities. Marked-to-market treasury securities significantly lost value after the Federal Reserve began rate hikes. Thus, many banks shifted these securities to held-to-maturity securities. Looking at Figure 4, there is a notable difference between PPP and non PPP banks. The PPP banks began increasing these securities in 2021Q2 at the time when the PPP program stopped. These banks continue to do so until 2022Q4. These banks differ in their balance sheet composition, since PPP banks significantly increase their investments in treasury securities. Figure 5 shows the difference in growth between these banks. In 2022Q1, the quarter before rate hikes, held-to-maturity security growth peaks for both types
of banks with a much higher magnitude for PPP banks. After, growth sharply declines for both types of banks. However, despite PPP having a much higher rate of growth starting in 2021Q1-2022Q1, both types of banks nearly align in 2023Q2. Thus, held-to-maturity security growth significantly shifted for PPP banks.

Figure 4. Mean of Held-to-Maturity Securities 2019-2023

Y-Axis in terms of thousands, data from FFIEC Bank Call Reports and SBA PPP Loan data

After, I analyze the variable: Held-to-Maturity Securities/Total Assets \( t-1 \) 2019-2023. From 2021Q4-2022Q4, held-to-maturity securities was increasing at a much faster rate for PPP banks compared to non PPP banks shown by Figure 6. Thus, even when controlling for total asset size, PPP banks differ in growth from non PPP banks. To get a better view of this difference in growth, I graph this increase in Figure 7. From 2021Q4 to 2022Q1, there is a spike in PPP bank growth. Furthermore, this spike is substantially greater compared to the growth in non PPP
banks in this same time frame. Thus, there is clearly a difference in balance sheet composition for these types of banks.

Figure 6. Held-to-Maturity Securities/Total Assets $t-1$ 2019-2023

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure6.png}
\caption{Held-to-Maturity Securities/Total Assets $t-1$ 2019-2023}
\end{figure}

Y-Axis in terms of thousands, data from FFIEC Bank Call Reports and SBA PPP Loan data.
These last few figures show a clear difference in PPP and non PPP bank balance sheet composition in regards to treasury securities. Thus, there is already evidence to show that PPP banks invested more in held-to-maturity securities compared to non PPP banks. However, to account for bank heterogeneity and time varying effects, I estimate panel models to ensure these differences are not just due to time or specific bank composition. This examination of the differences in performance between PPP and non PPP banks through regression analysis is necessary to fully understand the impact of the PPP program.
4 Methodology

To model these data, I use a difference in difference framework to account for the differences for PPP treatment effects. I estimate a panel regression model using Ordinary Least Squares (OLS). The \( t \) represents each quarter from 2019Q1 to 2023Q2, and the \( i \) represents each bank. The model is (1).

\[
Y_{it} = \{PPP Bank_{it} \times Pre_{Post-1}\} \beta_1 + \{PPP Bank_{it} \times Post_{it}\} \beta_2 + \alpha_i + \mu_t + \epsilon_{it} \tag{1}
\]

The \( Y_{it} \) variable is the dependent variable for each bank \( i \) at each time period \( t \). The \( PPP Bank_{it} \) variable represents the indicator variable (PPP Bank or non PPP Bank) shown in Table 2. It represents if a bank participated in the PPP program at any point in the sample period or not. This indicator variable is multiplied by the treatment time period. I use two time periods. The first time period is one period before COVID-19 started, 2019Q4 (\( Pre_{Post-1} \)). Then, the second time is during and after COVID-19: 2020Q1 to 2023Q2 (\( Post_{it} \)). I consider 2020Q1 as part of COVID-19 time period, as it was relatively unstable as rumors of COVID 19 began at this time. Thus, the PPP indicator variable is multiplied by the pre COVID-19 and the "Post" COVID-19 variable. For the first interaction variable, \( Pre_{Post-1} \) with \( \beta_1 \), if it is a PPP bank during that time period (2019 Q4), the variable is 1. For the second interaction variable, \( Post_{it} \), with \( \beta_2 \), if it is a PPP bank during that time period (during or Post COVID-19), the variable is 1.

The \( \beta_1 \) represent the change in \( Y_{it} \) prior to COVID 19. The \( \beta_2 \) represent the change in \( Y_{it} \) during and after COVID 19. If \( \beta_1 \) is not statistically significant, that
means there is no difference between PPP and non PPP banks prior to the PPP program in relation with the dependent variable. If $\beta_2$ is statistically significant, that means there is a difference between PPP and non PPP banks during and after the PPP program in relation with the dependent variable. Then, $\alpha$ represents bank fixed effects, so essentially time invariant bank characteristics. Thus, characteristics of the banks that do not change over time is controlled for in this model. Furthermore, aggregate time varying effects will also be controlled for with $\mu$. This variable controls for things like seasonal changes and monetary policy changes. The $\epsilon_{it}$ represents cluster robust standard errors to capture within bank auto correlation.

\[ Y_{it} = \frac{totaldeposits_{it}}{totalassets_{it-1}} \]  

(2)

\[ Y_{it} = \frac{totalheldtomaturitysecurities_{it}}{totalassets_{it-1}} \]  

(3)

The dependent variable is two different variables to measure bank performance. It is either (2) or (3). These equations are over a lagged total assets to avoid a simultaneity issue. Lagging for the denominator allows the model to show the change in the numerator rather than the entire equation. I winsorized the dependent variable at the 5th percentile to account for outliers.

I use held-to-maturity securities as one of the dependent variables, due to its indication of bank stability in this time period. These are treasury securities which banks hold until maturity. Jiang et al. (2023) adjust all banks held-to-maturity assets including real estate securities to their market values and find by March 2023 bank
assets declined on average by 10%. After the Federal reserve raised interest rates, some banks moved the marked-to-market securities into held-to-maturity securities to avoid losses. Thus, this variable is a proxy for bank stability, because banks increase their held-to-maturity securities which leads to them decreasing treasury securities for liquidity stress scenarios. Ultimately, this variable will uncover if PPP banks differ from non PPP banks in their variation of held-to-maturity securities Post COVID 19.

The other dependent variable is a deposit ratio, as it is a good indicator of bank performance. PPP loans increased deposits in banks as shown by the PPP literature. Thus, this variable will show if PPP banks differ from non PPP banks in regards to their deposit growth which would be linked to the impact of PPP loans on deposit growth.
5 Results

To start, I estimate the baseline model using the held-to-maturity securities ratio as the dependent variable. My findings in Table 3 suggest that held-to-maturity securities increase for PPP banks relative to non PPP banks. First, the pre-treatment variable, in which non PPP banks and PPP banks should not have much difference, is not statistically significant. This result aligns with my intuition that non PPP and PPP banks do not have statistically significant differences in held-to-maturity ratios before the PPP begins. However, after the PPP begins, holding all else fixed, PPP banks are associated with a 0.2 percentage point increase in held-to-maturity/ total assets\(_{t-1}\) relative to non PPP banks. This finding holds true with and without time effects.

First off, this 0.2 percentage point increase is actually quite substantial. Looking at Figure 6 there is a steeper increase in held-to-maturity securities for PPP banks compared to non PPP banks. This increase from 2021Q4 to 2022Q4 is roughly 1 percentage point. Furthermore, Figure 7 shows the growth of this dependent variable. In 2022Q1, there is a substantial difference between PPP and non PPP banks. This difference is 0.1 percentage point. The axes of these graphs show the significance of these seemingly small increase in held-to-maturity/ total assets\(_{t-1}\). A 0.2 percentage point increase is very close to these increases shown in these two figures. Further, this finding is also roughly 15% of the Pre COVID 19 era mean of total held-to-maturity/ total assets\(_{t-1}\) for PPP banks, shown in Table 2.
This finding expands on previous literature showing the longer run impacts of the PPP. Marsh and Sharma (2022) show that non PPP banks are likely constrained with their lending opportunities compared to PPP banks. Thus, from a lending perspective PPP seems like a great addition for banks as it improved their interest revenue and helped them produce income. However, these banks invested in more treasury securities compared to non PPP banks. This investment decision impacted their balance sheet composition once the Federal Reserve began rate hikes. Thus, the PPP impact on bank’s investment decisions is important to understand the holistic impact of the PPP on banks in the long run.

Table 3. Results from the Baseline Model: Held-to-Maturity Securities/Assets$_{t-1}$

<table>
<thead>
<tr>
<th></th>
<th>Time Effects</th>
<th>No Time Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre PPP</td>
<td>0.00005</td>
<td>-0.00006</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.00009)</td>
</tr>
<tr>
<td>Post PPP</td>
<td>0.002*</td>
<td>0.0043***</td>
</tr>
<tr>
<td></td>
<td>(0.00008)</td>
<td>(0.0004)</td>
</tr>
<tr>
<td>Observations</td>
<td>73185</td>
<td>73185</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.051</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Author’s OLS panel regression analysis uses data from FFIEC Bank Call Reports and SBA PPP Loan data

Next, I look for the mechanism that leads to this increase in held-to-maturity securities for PPP banks. If banks are giving out PPP loans, then they should have an increase in customers. In other words, since they are participating in the program, customers may choose to go to these banks so they can receive PPP loans. With that, banks receive more cash through these loans and invest in risk-averse assets. Many banks invest in treasury securities. However, once interest rates rise in 2022,
the marked-to-market treasury securities lose substantial value, so these banks shift their marked-to-market securities to held-to-maturity securities. Then, these PPP banks may experience an increase in held-to-maturity securities relative to non PPP banks, as they experience more deposit growth from the PPP.

Thus, I turn to deposits to see if this mechanism holds true. However, as I look to the next dependent variable, deposit/total assets\(_{t-1}\) there is a sample selection problem. In the appendix, Table 6 shows that the pre treatment variable is statistically significant. This statistical significance means that the non PPP and PPP banks were already significantly different before the PPP banks opted into the program. Therefore, I decide to restrict the sample to only PPP banks and use the model from 4.

\[
Y_{it} = \beta PPPlanamount_{it}/totalassets_{t-1} + \alpha_i + \mu_t + \epsilon_{it} \tag{4}
\]

When I restrict the sample, I see this mechanism theory holds true when using the deposit/total assets\(_{t-1}\) dependent variable shown by Table 4. For PPP banks, holding all else fixed, PPP loan amounts are associated with an increase in deposit/total assets\(_{t-1}\) of 0.01 percentage points with time effects. Thus, this finding suggests that the mechanism of this increase in held-to-maturity securities for PPP banks is associated with an increase in deposit growth due to more PPP loan amounts. Potentially, there may be more people going to these banks as these banks participate in the PPP program. Thus, customers can access PPP loans through these banks. Furthermore, this finding aligns with Lopez (2021), as they find an increase in bank
participation with the PPP program as an explanatory variable for growth in small business lending. Thus, people are going to these banks and receiving more loans for their businesses.

Table 4. Results from the Restricted Model: Total Deposits/Total Assets_{t-1}

<table>
<thead>
<tr>
<th></th>
<th>Time Effects</th>
<th>No Time Effects</th>
</tr>
</thead>
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<tr>
<td>PPP loan amount/total assets_{t-1}</td>
<td>0.0001*** (0.00003)</td>
<td>0.0003*** (0.00006)</td>
</tr>
<tr>
<td>Observations</td>
<td>54,723</td>
<td>54,723</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.1839</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Author’s OLS time series regression analysis uses data from FFIEC Bank Call Reports and SBA PPP Loan data

These findings on an increase in held-to-maturity securities associated with an increase in deposit growth for PPP banks expands on findings from Jiang et al. (2023). These authors find by March 2023 bank assets declined on average by 10%. This finding on PPP banks increasing their held-to-maturity securities more so than non PPP banks, may suggest PPP banks are currently facing a greater decline in treasury securities. After monetary tightening, marked-to-market treasury securities, which seemed to be risk averse, lost a significant amount of value. Banks covered these losses by shifting these securities into held-to-maturity securities. This decline impacts their bank stability, as these banks are shifting more liquid securities into a less liquid position. Thus, there is reason to believe that certain aspects of the PPP program may lead banks to have a more unstable balance sheet composition.
5.1 Robustness

After the main model, I restrict the baseline model into quintiles based on total asset size to ensure results are not being drawn by the largest borrowers. I create quintiles based on each bank’s initial total asset size (2019Q1). 1 is the smallest and 5 is the largest.

The results in Table 5 suggest that the medium to smaller sized banks largely drive the increase in held-to-maturity securities. Sizes 2 and 3 are not statistically significant in the pre-trend variable, indicating the banks are comparable. Then, the post trend variables are positive and statistically significant for these two quintiles supporting the baseline finding.

Table 5. Robustness Check: Held-to-Maturity Securities/Assets

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre PPP</td>
<td>0.0004</td>
<td>0.0000</td>
<td>-0.0003</td>
<td>-0.0006</td>
<td>-0.0005</td>
</tr>
<tr>
<td></td>
<td>(0.0005)</td>
<td>(0.0004)</td>
<td>(0.0005)</td>
<td>(0.0004)</td>
<td>(0.0006)</td>
</tr>
<tr>
<td>Post PPP</td>
<td>0.0016</td>
<td>0.0020</td>
<td>0.0019</td>
<td>0.0020</td>
<td>0.0025</td>
</tr>
<tr>
<td></td>
<td>(0.0043)***</td>
<td>0.0044**</td>
<td>0.0061***</td>
<td>0.0008</td>
<td>0.0022</td>
</tr>
</tbody>
</table>

Observations 14,637 14,637 14,637 14,637 14,637
R² 0.028 0.032 0.052 0.060 0.102

Author’s OLS time series regression analysis uses data from FFIEC Bank Call Reports and SBA PPP Loan data

These findings align with previous research. Lopez finds that small and medium banks were stronger in small business lending compared to larger banks. Furthermore, his findings suggest that the PPPLF was an important driver for small bank participation during this period. However, Lopez split the banks between small, medium and large, rather than into quintiles Lopez (2021). My findings support Lopez, as they also show that small and medium banks drive the increase in held-to-maturity
securities. This suggests that these banks had more lending, and thus may have put more of their additional funds from deposits into held-to-maturity securities.
6 Conclusion

In this paper, I explore a potential contributor to Bank Distress in 2023 by analyzing the Payment Protection Program and its impact on bank’s balance sheet compositions. Using a quarterly balanced bank level panel data set, I primarily analyze held-to-maturity securities for PPP and non PPP banks banks with $10 billion in assets or less. To do this analysis, I use a difference in difference regression model to capture pre COVID 19 trends and then post COVID 19 differences for PPP banks and non PPP banks. In this analysis, I find that PPP banks have an increase in held-to-maturity securities after opting into the PPP relative to non PPP Banks. My theory for this mechanism of increase is due to more customers interested in PPP coming to these PPP banks. This theory is supported by the restricted model only for PPP banks, showing an increase in deposit growth associated with PPP loan amounts.

This finding of PPP banks increasing held-to-maturity securities relative to non PPP banks combined with the increase in deposit growth through PPP loans is significant. It suggests that customers went to these banks more frequently due to the bank’s participation in the PPP, thus increasing these bank’s deposits. In doing so, these banks invested more in safe assets, specifically treasury securities. As interest rates rose, marked-to-market securities lost value causing these banks to face some instability. As supported by the finding above, many banks shifted these securities into held-to-maturity securities. Thus, this finding is useful in understanding one of the longer term consequences of the PPP program.
Policymakers, as well as banks, should utilize these findings for future economic policy making. Making banks the primary investors and main facilitators of roughly $1 trillion in loans puts stress on these banks. These entities gained many customers by giving out these loans, as shown by the increase in deposit growth from PPP loan amounts for PPP banks. These loans were later forgiven by the US Government, meaning these banks were reimbursed. Furthermore, if banks did not have the liquidity, they could go to the PPP Liquidity facility and receive more funding. Thus, these banks were at the forefront of a high amount of loans, deposits, and liquidity. Smaller banks ($10 billion or less in total assets) do not have the same resources as larger banks. Thus, this large increase in deposit growth may have impacted their ability to manage their balance sheets. As shown by the increase in held-to-maturity securities for PPP banks relative to non PPP banks in the period after opting into the PPP shows that these smaller banks put more of these deposits into long term assets. When the Federal Reserve began monetary tightening, the value of these securities decreased. Consequently, this tightening coupled with a higher growth in treasury securities may have contributed to current bank riskiness.

Despite these findings suggesting the Payment Protection Program contributed to a poorer bank balance sheet composition, it may never be fully realized. The Federal Reserve created programs to support the banking sector after the SVB crash in March 2023. The creation of the broad based lending program, and the insurance of deposits for SVB, show that the Federal Reserve swiftly responded to control the banking sector (Metrick and Schmelzing 2023). Thus, further bank instability may have been alleviated by these programs. Nevertheless, the Federal Reserve and US
Government should take into account the financial stress of using banks as facilitators for almost a $1 trillion loan program in future policies.
Bibliography


7 Appendix

Figure 8. Deposits/Total Assets $t-1$ 2019-2023

Figure 9. Growth of Deposits/Total Assets $t-1$ 2019-2023
Table 6. Results from the Baseline Model: Total Deposits/Assets

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>Pre PPP</td>
<td>-0.0082***</td>
<td>-0.0129***</td>
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<tr>
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<td>(0.00149)</td>
<td>(.0008)</td>
</tr>
<tr>
<td>Post PPP</td>
<td>-0.0036**</td>
<td>0.0076***</td>
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<tr>
<td></td>
<td>(0.0011)</td>
<td>(0.0006)</td>
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<tr>
<td>Observations</td>
<td>73185</td>
<td>73185</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.156</td>
<td>0.012</td>
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Table 7. Robustness Check 1

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<thead>
<tr>
<th>Variables</th>
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<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre PPP</td>
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<tr>
<td></td>
<td>(0.0032)</td>
<td>(0.0033)</td>
<td>(0.0036)</td>
<td>(-0.0038)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Post PPP</td>
<td>-0.0040*</td>
<td>-0.0019</td>
<td>-0.019***</td>
<td>0.00274</td>
<td>0.006*</td>
</tr>
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<td>(0.0024)</td>
<td>(0.0027)</td>
<td>(0.0035)</td>
<td>(0.0036)</td>
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<tr>
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<td>14,637</td>
<td>14,637</td>
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<td>0.15</td>
<td>0.17</td>
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<td>0.20</td>
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