Heterogeneous Bank Responses to Loan Guarantee Expansion: Evidence from the U.S. Small Business Administration (SBA) Loans*

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Abstract

US Small Business Administration (SBA) temporarily expanded its loan subsidy program from 2009 to 2010 in an effort to stimulate loans to small businesses. We explore the heterogeneous bank responses following this policy change. Using a novel data that merges the quarterly bank-level call report to the subsidized loan data, we first show that big banks prefer to issue many loans of small size while small banks issue few loans of bigger size. Then, we show that these big banks that make up the majority of the loan volume were particularly inelastic in increasing loan supply in response to this positive policy shock. This has strong policy implications given that a sizable amount of taxpayer's money was used to fund this temporary expansion.

Keywords: banks, loan guarantee, lending, heterogeneity, SBA
JEL Classification : G21, E51, G28, H81

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1 Introduction

In the aftermath of the banking panic of Fall 2008 and the subsequent Great Recession, lending by US banks fell precipitously (Ivashina and Scharfstein (2010)) and the magnitude of this decrease was particularly big compared to previous recessions (Dvorkin and Shell (2016)). At the time, one particular concern that policymakers expressed was the big decline in lending to small businesses (Wilkinson and Christensson (2011) and Chen, Hanson, and Stein (2017)) since deteriorating lending conditions would greatly constrain hiring and investment decisions of small businesses who often face greater working capital and wage bill constraints compared to their bigger counterparts. As part of the effort to reverse the dwindling lending to small businesses that could seriously hamper real economy, the US government decided to spend $900 million to temporarily expand Small Business Administration's (SBA) 7(a) Loan Guaranty Program.

Designed to expand access to capital for small businesses, 7(a) Loan Guaranty Program is unique in that the government does not lend directly to the firm; instead, in exchange for a guaranty fee paid by the lenders, the government guarantees 50 to 85 percent of loans made by participating lending institutions in the event of a loan default. The rationale is that a partial government guarantee would encourage lending to small businesses—especially to those with short credit history and/or small collateral—that a lender would deem to be too risky to lend to on its own. In effect, the SBA 7(a) loans are government subsidized loans designed to open up lending opportunities to small businesses by reducing default risk for the lenders; hence, policymakers included temporary expansion of this loan program as part of the 2009 stimulus package—also known as the American Recovery and Reinvestment Act of 2009—in an effort to bolster lending to small businesses.

In this paper, we focus on a positive policy shock provided by the 2009-2010 temporary expansion of the SBA 7(a) Loan Guaranty Program in which the guaranty fees were eliminated and the guaranty rate was increased to 90 percent, and explore the heterogeneous effects of this policy shock on small business lending and their implications. To do so, we

create a novel dataset in which we aggregate the SBA 7(a) loan data by lender at quarterly frequency, and then merge it to the quarterly call report. Using this data, we first document the following three stylized cross-sectional facts. First, the big banks who are at the top 5% of the size distribution dominate the SBA loan market both in terms of total volume and total number of loans issued. Second, these same big banks have always issued many SBA 7(a) loans of small size whereas small banks typically issue few loans of bigger size. Third, we provide evidence that this is not the result of an assortative matching of riskier firms with certain types of banks.

Next, we use the panel structure of the data to estimate how bank's elasticity with respect to the positive supply shock of 2009-2010 differs according to lender characteristics such as lender size and whether or not it is part of SBA's Preferred Lender Program (PLP). We first define "big banks" as lenders whose level of asset holding is at the top 5% of the distribution and "small banks" as those at the bottom 95%. We then divide lenders into four different groups: big banks that participate in the Preferred Lender Program with the SBA which enables them to make the final credit decision on their own and speed up the loan procuring process; big banks that do not; small banks that have the preferred lender status; and small banks that do not. We also divide the 7(a) loans into two types: SBA Express loans that have quick turnaround but fairly strict loan restrictions and Standard 7(a) loans that take much longer to be processed but has much less restrictions.

Using panel fixed effect regressions and difference-in-difference regressions, we find that bank size and participation in the Preferred Lender Program play an important role in determining the heterogeneous response of the lenders to the temporary elimination of guarantee fees and increase in guaranty rate. We estimate that the small PLP lenders were particularly elastic to this temporary shock, as they increased the total volume of both the Express loans and Standard 7(a) loans by 65 to 90% compared to the periods in which this expansionary policy was not in place. The magnitude of the increase by these small PLP lenders is much greater in a statistically significant way compared to any other banks with

different lender characteristics, and is the result of a statistically significant increase in both the extensive margin (number of loans) and the intensive margin (average size of loan). In contrast, we estimate that big banks were relatively more inelastic to these shocks, especially for the Standard 7(a) loans that make up more than 85% of the total volume of all types of SBA 7(a) loans. This has serious policy implications given that close to $900 million of taxpayer's money were used to fund this temporary expansion, yet big banks that dominate this government subsidized loan market were particularly inelastic to this expansion.

This paper contributes to three strands of literature. First, we contribute to a rich literature that studies bank lending to small businesses. Stein (2002) and Berger and Udell (2002) provided theoretical foundation behind why small banks have comparative advantage over large banks in relationship lending that is often associated with small business loans, while Berger, Miller, Petersen, Rajan, and Stein (2005) and Liberti and Mian (2009) find empirical evidence consistent with this description. More recently, the literature has focused on how bank lending to small businesses have been impacted by the Great Recession. Wilkinson and Christensson (2011) documents that small business loans have steadily declined during this period and Chen, Hanson, and Stein (2017) shows that the small business lending by the four largest banks fell sharply relative to others during the Great Recession and remained depressed thereafter. In particular, Deyoung, Gron, Torna, and Winton (2015), Berger, Bouwman, and Kim (2017), and Beck, Degryse, Haas, and van Horen (2018) show that banks that engage in relationship lending have comparative advantages over others in alleviating financial constraints of small businesses and that these comparative advantages increase during an economic downturn such as the Great Recession. Our paper extends this literature in three important ways. First, we show that the heterogeneous lending practices across lender size is also prevalent in a government-subsidized small business loan market. Second, whereas the literature has focused on the negative shock on the credit market and the subsequent slow recovery after the recession, we utilize a unique and explicit positive policy shock to document how the loan elasticity of small banks are statistically significantly

different compared to that of their bigger counterparts. Third, whereas the literature uses bank-level data[1] often merged with a firm-level survey data,[2] we use a unique data that merges a universe of loan-level microdata on all approved SBA loans from Fiscal Year 1991 to 2017 to the bank-level call report data.

Second, starting with the seminal papers by Kashyap and Stein (1995) and Kashyap and Stein (2000) in which they empirically show small banks are particularly more sensitive to monetary policy since big banks have easier access to external funds that they could tap into during periods of tight monetary policy, a number of empirical studies have explored the heterogeneity of bank-level lending responses to monetary policy (Ashcraft (2006), Cetorelli and Goldberg (2011), Altavilla, Canova, and Ciccarelli (2016), and Bluedorn, Bowdler, and Koch (2017)). Most of these papers are speaking to the lending view of monetary policy transmission in which contractionary monetary policy is transmitted to the real economy mainly through small illiquid banks. Although our paper has nothing to do with monetary policy transmission, we contribute to this literature by showing that an expansionary lending policy has particularly elastic effect on small banks. In effect, our paper is unique in that we use a policy shock that is designed to directly impact the loan supply to document the heterogeneous response of bank lending, rather than using monetary policy shocks that indirectly affect bank lending through the impact of interest rate on the bank's ability to create deposits and grant loans.

Third, we contribute to the literature that studies the economic impact of SBA loans. Young, Higgins, Lacombe, and Sell (2014) use county-level data to study the relationship between the volume of SBA lending per capita and income growth at the county level. Brown, Earle, and Morgulis (2016) and Brown and Earle (2017) merge the SBA loan data with the Longitudinal Business Database (LBD) to estimate the impact of SBA loans on survival and employment growth at the firm level. Our paper extends this small literature

[1]Some examples are Reports of Condition and Income (call reports) and Community Reinvestment Act data on small business loan originations by US banks.

[2]Some examples are National Survey of Small Business Finance, World Bank's Business Environment and Enterprise Performance Survey, and Small Business Economic Trends survey.

by focusing on the lenders who participate in this loan program. To do so, we had to create a novel dataset that merges SBA loan data to the detailed microdata on banks, which—to our knowledge—has never been done and is a contribution in itself.

The paper is outlined as follows. In Section 2, we explain the 7(a) loan and its guaranty expansion of 2009-2010 in detail and Section 3 describes the dataset used for our analysis. In Section 4, we establish the importance of lender characteristics on loan characteristics at the cross-section. Section 5 uses longitudinal dimension of our dataset to estimate how elastic the US lenders were in response to the temporary expansion of the 7(a) Loan Guaranty Program. The last section concludes.

2 SBA 7(a) Loan Guaranty Program

2.1 Overview

Small Business Administration (SBA) is a US federal government agency established in 1953 to "aid, counsel, assist and protect, insofar as is possible, the interests of small business concerns."[3] One of its flagship program is the 7(a) Loan Guaranty Program, which derives its name from Section 7(a) of the Small Business Act of 1953. 7(a) Loan Guaranty Program is a government subsidized loan program in which the Small Business Administration (SBA) offers government guarantees on loans made by commercial lenders to small businesses.[4] Because SBA does not directly accept SBA loan applications, the loan application process starts with local participating lenders. First, an applicant prepares an application portfolio that can demonstrate the viability of the project. The application material includes SBA loan application form, statement of personal history, personal financial statement, business finan-

[3] 15 U.S. Code § 631

[4] In order to qualify as a "small business" eligible for this loan program, the business must meet the size standard as required by the SBA. In some industries, the size standard is in terms of average number of employees—such as in mining and machinery manufacturing—whereas in others, the size standard is in terms of average annual receipts—such as in crop production and real estate. See https://www.sba.gov/document/support--table-size-standards for details.

cial statements that includes profit and loss statements and projected financial statements, business certificate/license, loan application history records, income tax returns, detailed business plan that includes clear statement of the total capital requirements of the business, collateral, etc. Then, the applicant submits his application to financial institutions that are authorized to underwrite SBA loans. Like any other business loans, repayment ability from the cash flow of the business is a primary consideration in the SBA loan decision process, but good character, management capability, collateral and owner's equity contribution are also important considerations. One additional important requirement is that the lender must apply "Credit Elsewhere Test", in which the lender must provide a detailed explanation of why the loan applicant is unable to obtain the loan on reasonable terms without a guaranty from the federal government. Once the bank approves the underwriting and ensures that all SBA requirements have been met, the package is sent to the SBA for review. If the SBA approves the bank's request for a loan guarantee, the lender disburses the funds to the applicant and the lender pays guarantee fee to the SBA.

The incentive for the lender to participate in the SBA 7(a) Loan Guaranty Program is that in the case of a loan default, the SBA pays off the guaranteed portion of the remaining loan balance. For example, suppose a risky firm borrowed $1 million from Citibank through 7(a) Loan Guaranty Program with guaranty rate of 75% from the SBA. Suppose this firm managed to pay back $200,000 to Citibank, but defaulted on the rest. SBA would reimburse 75% of the defaulted amount back to Citibank, which in this case would be $600,000. In this simple example, Citibank only lost $200,000 due to its risky lending, rather than $800,000 it would have faced without the 7(a) Loan Guaranty. In other words, partial guaranty of the loan by the SBA lowers risk to the lending institutions, which should allow—in theory—for small businesses that may not otherwise qualify for credit to get the funds they need.

Table 1 shows the two main types of 7(a) loans,[5] along with their maximum loan amount

[5]There are other types of 7(a) loans, such as Export Express, Export Working Capital, International Trade, CAPLines, etc. These loans are quite small in terms of aggregate amount, compared to the Standard 7(a) and SBA Express, as can be seen in Figure (1). Details about these loans can be seen at https://www.sba.gov/partners/lenders/7a-loan-program/types-7a-loans.

Table 1: Maximum Loan Amount and Guaranty Rate By 7(a) Loan Program

Loan Program	Maximum Loan Amount	Guaranty Rate
Standard 7(a) Loans	$5,000,000	85% for loans of $150,000 or less 75% for loans over $150,000
SBA Express Loans	$350,000	50%

and the guaranty percentage, which varies by the type of loan. Standard 7(a) loans currently have a maximum loan amount of $5 million. SBA can guarantee a maximum of 85% for loans up to $150,000 and 75% for loans greater than $150,000. Standard 7(a) loan can take few weeks to process. Firms that need quicker turnaround on their loan process can opt for SBA Express Loans. This loan only has a maximum loan amount of $350,000 of which only 50% will be guaranteed by the federal government, but the process is usually completed within a week.

Standard 7(a) loans can be further divided into Preferred Lenders Program (PLP)[6] Standard loans and non-PLP Standard loans. In the Preferred Lender Program (PLP), the SBA gives participating Preferred Lending Partners more authority by delegating the final credit decision and most servicing and liquidation authority to PLP lenders, enabling them to make loan decisions more rapidly compared to non-PLP standard 7(a) loans. To earn the PLP designation, lenders must establish a successful track record in processing and servicing SBA-guaranteed loans and display a thorough understanding of SBA lending policies and procedures.

Table 2 shows the guarantee fee that lenders must pay to the SBA, which increases with maturity and loan size and applies for both the Standard 7(a) Loans and the SBA Express Loans. For example, for a $150,000 loan, the guaranty rate would be 85% which means the fee would be 2% of the guaranteed portion $127,500, which would be $2,550. For a $5 million loan, the guaranteed portion would be $3.75 million since the guaranty rate would be 75%. The resulting guaranty fee would equal $138,125, calculated as 3.5% of the first $1 million guaranteed ($35,000) plus 3.75% of the remaining guaranteed amount

[6]Also often referred to as Preferred Lending Partner (PLP).

Table 2: Guaranty Fees for SBA 7(a) Loan Program

Maturity	Gross Loan Size	Fees
12 months or less	Up to $5 million	0.25% of the guaranteed portion
More than 12 months	Up to $150,000	2% of the guaranteed portion
	$150,001 to $700,000	3% of the guaranteed portion
	$701,000 to $5,000,000	3.5% of guaranteed portion PLUS 3.75% of the guaranteed portion over $1,000,000

($\$2,750,000 \times 3.75\% = \$103,125$).

Figure 1 and Figure 2 are cumulative graphs that respectively show how the total volume and total number of 7(a) loans have changed since October 1990 on a monthly basis for the following four types of 7(a) loans: Standard 7(a) loans issued through Preferred Lenders Program (PLP), non-PLP Standard 7(a) loans that are issued by lenders without the PLP status, SBA Express loans, and all other 7(a) loans. The red shaded rectangles correspond to the time period in which the policy shock to the loan guaranty program—in the form of temporary elimination of guaranty fee and the increase in legal maximum guaranty rate—took place, the details of which can be seen in the next subsection. As can be seen in Figure 1, the Standard 7(a) loans—combining the PLP loans and non-PLP loans—constitute the majority of the total volume of all SBA 7(a) loans. On the other hand, Figure 2 shows that the SBA Express loans constitute the majority of 7(a) loans in terms of numbers, even though it registers as a tiny number in terms of volume due to the legal limit of $350,000 as the maximum loan size. Because of their dominance in the 7(a) loan market, we focus on Standard 7(a) loans—which is the sum of PLP Standard 7(a) loans and non-PLP Standard 7(a) loans—and SBA Express loans for the rest of this paper.

2.2 Temporary Expansion of 2009-2010

As can be seen in Figures 1 and 2, lenders abruptly decreased SBA 7(a) lending in the run-up to the Great Recession. By end of 2008, the concern that the distress in the financial sector is throttling real economic activity started to realize as obtaining credit

Figure 1: Total Volume (in $1 mil) of 7(a) Loans Approved by Loan Category: 1990Q4 to 2017Q3

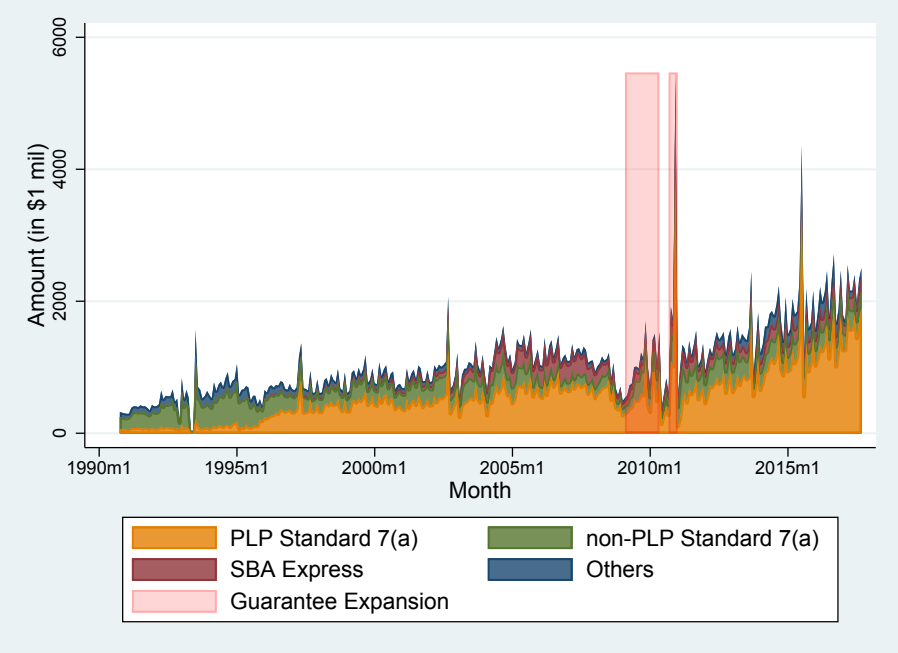
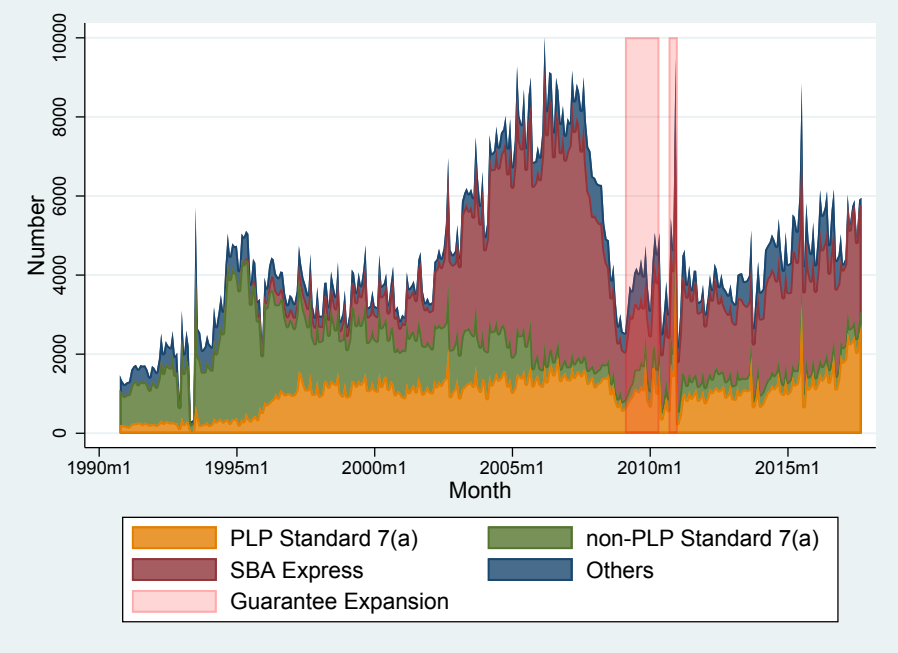


Figure 2: Total Number of 7(a) Loans Approved by Loan Category: 1990Q4 to 2017Q3



has become a great challenge for firms. In an effort to increase lending activity to small businesses, the American Recovery and Reinvestment Act of 2009 (ARRA)—widely known as the "Recovery Act" or simply "stimulus package"—was enacted on February 17, 2009 and included the provision to provide the the SBA $375 million to temporarily eliminate fees in the 7(a) and 504/CDC loan guaranty programs, and increase the 7(a) program's maximum loan guaranty percentage to 90% for all standard 7(a) loans through September 30, 2010, or until available funds were exhausted. The funding ran out on May 31, 2010 and the temporary elimination of guaranty fees and 90% guaranty percentage expired. The Small Business Jobs Act of 2010, enacted September 27, 2010, provided the SBA additional $505 million (plus an additional $5 million for related administrative expenses) to reinstate the fee subsidies and 90% maximum loan guaranty percentage, which ultimately lasted until January 3, 2011.

In sum, because of the funding situation, the US government introduced two discontinuous periods of temporary expansion of the SBA 7(a) Loan Program, in which the government sought to increase the supply of small business loans by increasing the incentive for the lenders to participate. The first period of expansion was between February 17, 2009 and May 31, 2010 for about 15 months, and it is important to note that the maximum loan size was $2 million during this period. The second period of expansion was between September 27, 2010 and January 3, 2011 for only 3 months, and this period also coincided with permanent increase of the maximum loan size from $2 million to $5 million. In both periods, the maximum guaranty rate was increased to 90% for all Standard 7(a) loans regardless of the loan size,[7] whereas guarantee fee for loans with maturity greater than 12 months were temporarily eliminated.[8] It is important to note that the guaranty rate of SBA Express loans remained at 50% throughout this expansion period, but fees were temporarily eliminated in the same fashion as the Standard 7(a) Loans. Tables 3 and 4 sum up how loan restrictions

[7]Guaranty rate increase during the first period of expansion was instituted about a month later compared to the temporary elimination of fees due to funding.

[8]Loans with maturity of less than or equal to 12 months still had to pay 0.25% of the guaranteed portion as the fee.

Table 3: Changes to Guaranty Rate and Maximum Loan Amount for Standard 7(a) Loans

Loan Approval Period		10/1/2002 ~ 3/15/2009	3/16/2009 ~ 5/31/2010	6/1/2010 ~ 9/26/2010	9/27/2010 ~ 1/3/2011	1/4/2011 ~ now
Maximum Loan Amount		**$2,000,000**			**$5,000,000**	
Maximum Guaranty Rate	Loans up to $150,000	85%	**90%**	85%	**90%**	85%
	Loans over $150,000	75%	**90%**	75%	**90%**	75%

Table 4: Changes to Guarantee Fee for Standard and Express Loans

Loan Approval Period	Guarantee Fee (as percentage of guaranteed portion)	
	$\leq$ 12 months	Loan Term > 12 months
10/1/2002 to 9/30/2004	0.25%	1% if total loan amount is $150,000 or less
		2.5% if total loan amount is more than $150,000 but not more than $700,000
		3.5% if total loan amount is more than $700,000
10/1/2004 to 2/16/2009	0.25%	2% if total loan amount is $150,000 or less
		3% if total loan amount is more than $150,000 but not more than $700,000
		3.5% if total loan amount is more than $700,000
2/17/2009 to 5/31/2010	**0.25%**	**0%**
6/1/2010 to 9/26/2010	0.25%	2% if total loan amount is $150,000 or less
		3% if total loan amount is more than $150,000 but not more than $700,000
		3.5% if total loan amount is more than $700,000
9/27/2010 to 1/3/2011	**0.25%**	**0%**
1/4/2011 to 11/27/2011	0.25%	2% if total loan amount is $150,000 or less
		3% if total loan amount is more than $150,000 but not more than $700,000
		3.5% if total loan amount is more than $700,000
11/28/2011 to Now	0.25%	No more than 2% if total loan amount is $150,000 or less
		No more than 3% if total loan amount is more than $150,000 but no more than $700,000
		No more than 3.5% if total loan amount is more than $700,000
		Additional 0.25% if total loan amount is more than $1,000,000

changed between FY 2003 and FY 2017.

3 Data

We use a publicly available database of all 1,460,880 7(a) loans approved by the Small Business Administration from the fourth quarter of 1990 through the third quarter of 2017, which in terms of fiscal year (FY) would be from FY 1991 to FY 2017. This data has information on the name and address of both the firm and the lender, along with detailed information about the 7(a) loan itself, including gross loan amount, amount guaranteed by the SBA, the date approved, interest rate, maturity, and the current loan status.[9]

[9]The list of variables included in this dataset can be seen in Table 9 of the Appendix.

Table 6: Summary Statistics of 7(a) Loan by Loan Type: Average Between FY 1991 and FY 2017

	PLP Standard 7(a)	Non-PLP Standard 7(a)	SBA Express	Total
Gross Amount Approved	753187.7	802801.8	77730.2	375840.5
	(826086.7)	(877144.0)	(91965.4)	(652525.1)
Percentage Guaranteed by SBA	0.788	0.795	0.500	0.626
	(0.0656)	(0.0681)	(0.00626)	(0.150)
Interest Rate (in Percentage)	5.664	5.727	6.731	6.275
	(0.737)	(0.731)	(1.683)	(1.453)
Maturity (in Months)	182.5	155.1	76.93	120.0
	(92.72)	(85.91)	(32.00)	(81.64)

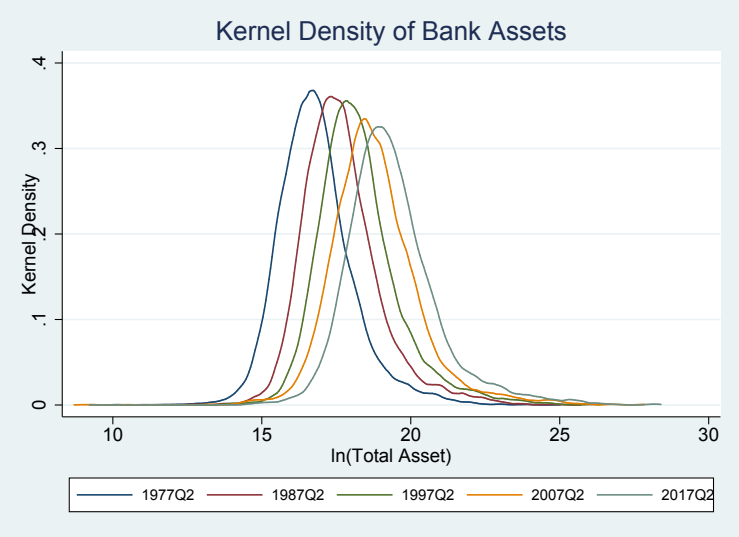
Note: Raw mean is shown with the standard errors in parentheses

Figure 1 and Figure 2 from the previous section shows the time trend of total volume and number of 7(a) loans guaranteed by the SBA in that 17 year time period. Table 6 shows the summary statistics of key loan characteristics by loan type, averaged over the period between FY 1991 and FY 2017.[10] Standard 7(a) loans are divided into those issued by PLP lenders and non-PLP lenders, and there is no statistically significant difference between these two in terms of average loan size, percentage guaranteed by SBA, and interest rate charged by the lender. The only noticeable difference is that PLP Standard 7(a) loans tend to be a bit longer in maturity compared to non-PLP Standard 7(a) loans. On the other hand, SBA Express loans differ a lot compared to the Standard 7(a) loans as its average size is 10 times smaller, the interest rate charged to the borrowing firm is much higher, and the maturity is much shorter.

Because this paper focuses on lender behavior in the government guaranteed loan market, we also use the call report data. Call reports—formerly known as Consolidated Report of Condition and Income—is a quarterly report that all regulated financial institutions in the United States are required to file with the Federal Deposit Insurance Corporation (FDIC). All banks must file a call report on the last day of each quarter and these reports contain extensive information that a bank would list on its income statement and balance sheet, such as positions in many individual assets. We use the unique identifier (variable RSSD9001)

[10]Loans that had the gross amount of 0 and had more amount guaranteed by SBA than the gross amount of the loan were dropped.

Figure 3: Evolution of Bank's Size Distribution: 1977 to 2017



to link and merge all quarterly call reports to create a panel data of call reports.[11] Figure 3 shows how the size distribution of banks (as reported in variable RCFD2170, which is the sum of all domestic and foreign asset) have changed every decade, starting in 1977. The bank size distribution has been consistently shifting to the right and the tail has been getting bigger, while the number of banks has halved over this 40 year period.

To link the 7(a) loan database to the quarterly call report, we first aggregate the 7(a) loan database to the unique lender level at quarterly frequency, where we define unique lender as one in which the bank's name and address is unique. We then merge the lender-level quarterly SBA loan data to the call report panel data using the lender name and address to match the two dataset. Our match rate is quite high, successfully matching 78% of unique lender-quarter observations in the collapsed SBA loan data to the call report. This match rate corresponds to over 80% of the total amount and 82% of the total number of 7(a) loan in the SBA dataset successfully matched up with detailed lender information from the call report. Our match rate is extremely high, considering that a sizable number of SBA lenders

[11]For call reports before 2011, we use the consolidated data that the Federal Reserve Bank of Chicago has available for download on https://www.chicagofed.org/banking/financial-institution-reports/commercial-bank-data. For call reports beginning with the first quarter of 2011, we use the FFIEC Central Data Repository's Public Data Distribution site (https://cdr.ffiec.gov/public/).

are lending companies—such as Readycap Lending, LLC and Crossroads Small Business Solutions, LLC—that would not be present in the call report data. Table 7 shows the top 30 lenders—in terms of number of loans approved—that participated in the 7(a) loan program between FY 1991 and FY 2017, and there are many non-commercial bank lenders that cracks this list. Another notable characteristic from Table 7 is that the top 20 lenders have issued over half of all the 7(a) loans issued in this period, in terms of number of loans.

4 Cross-sectional Evidence

In this section, we use the SBA 7(a) loan data linked to the bank's call report to establish cross sectional facts of how loan characteristics differ according to lender characteristics. We first characterize that lender size—measured by the total amount of asset reported in the call report—is an important factor behind the heterogeneity in the extensive margin (number of loans) and the intensive margin (average loan size) of SBA loan issuance at the cross-section. We then show that this cross-sectional heterogeneity is heavily driven by a subset of big banks that particularly dominate the SBA Express loan market.

4.1 Empirical Findings

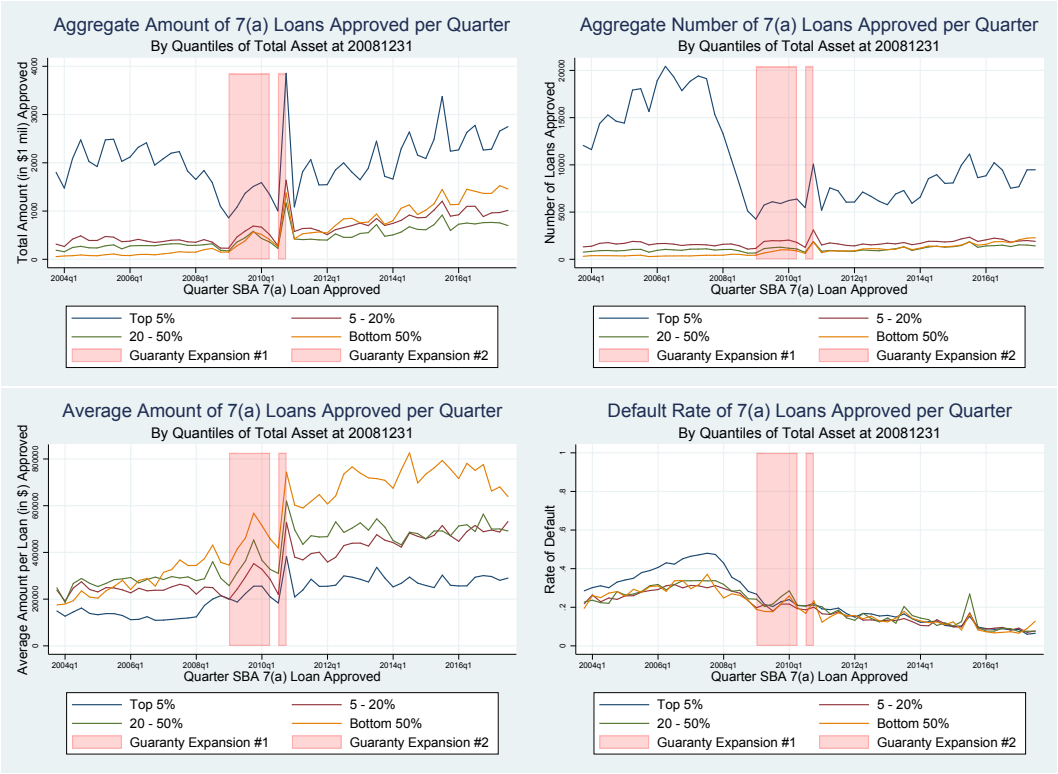
Figure 4 shows the strong effect of lender size on loan characteristics. To derive this graph, we first look at the asset distribution of banks at the fourth quarter of 2008 (the quarter immediately before the SBA loan guarantee expansion) and apportion all the banks into vigintiles (20-quantiles). We aggregate these vigintiles into four different groups: big banks that consists of the top vigintile (top 5% in terms of total asset); group that consists of the next three vigintiles (banks that are in between top 5% and 20% of the distribution); group that consists of the next six vigintiles (banks that are in between top 20% and 50% of the distribution); and banks that belong in the bottom half of the distribution. Then, we calculate how the total volume of all 7(a) loans—which consists of Standard 7(a) loans and

Table 7: Top 30 Lenders That Issued SBA 7(a) Loans from FY1991 to FY2017

Name of Bank	Frequency	Percent	Cumul. Percent
Wells Fargo Bank, National Association	113357	7.76	7.76
Bank of America, National Association	103218	7.07	14.82
JPMorgan Chase Bank, National Association	81206	5.56	20.38
U.S. Bank National Association	60849	4.17	24.55
Citizens Bank, National Association	46042	3.15	27.70
The Huntington National Bank	42677	2.92	30.62
Bank of Hope	36295	2.48	33.11
PNC Bank, National Association	36169	2.48	35.58
Zions Bank, A Division of	26714	1.83	37.41
Manufacturers and Traders Trust Company	24213	1.66	39.07
TD Bank, National Association	22578	1.55	40.61
KeyBank National Association	21609	1.48	42.09
Capital One, National Association	21258	1.46	43.55
Compass Bank	19684	1.35	44.90
Readycap Lending, LLC	18952	1.30	46.19
Branch Banking and Trust Company	15977	1.09	47.29
Crossroads Small Business Solutions, LLC	12204	0.84	48.12
Banco Popular North America	11586	0.79	48.91
Comerica Bank	11324	0.78	49.69
Banco Popular de Puerto Rico	10678	0.73	50.42
Umpqua Bank	10412	0.71	51.13
Citibank, N.A.	10049	0.69	51.82
Business Loan Center, LLC	9452	0.65	52.47
Bank of the West	8991	0.62	53.08
Regions Bank	8776	0.60	53.68
Fifth Third Bank	8595	0.59	54.27
COFSB, National Association	8167	0.56	54.83
SunTrust Bank	7779	0.53	55.36
BMO Harris Bank National Association	7465	0.51	55.88
Santander Bank, National Association	7465	0.51	56.39

Total of 1,460,880 SBA 7(a) loans were issued between FY1991 and FY2017.

Figure 4: Cross-sectional Loan Characteristics: By Asset Size



Express loans—changed over time for each of these four groups (top left panel), and similar graphs are shown for total number of 7(a) loans issued (top right panel), average loan size (bottom left panel), and default rate (bottom right panel) calculated as number of defaulted loans divided by number of disbursed loans.

The most distinctive feature of Figure 4 is that the big banks at the top 5% of the asset distribution dominate the SBA loan market both in terms of total volume (aggregate amount) and total number of loans issued. In fact, the dominance of these big banks in this government subsidized loan market was especially pervasive prior to the Great Recession, such that summing up the total volume and total number of loans issued by the bottom 95% banks still did not measure up to those of the big banks. Such dominance by the big banks has also persisted in the last decade in terms of total number of loans issued, but we observe circumstantial evidence that the bottom 95% increased the total volume of loans relatively more than their bigger counterparts after the temporary loan guaranty expansion

of 2009-2010. The reason for this relative increase in total volume by small banks is mostly coming from the increase in intensive margin—the average loan size. Bottom left panel shows that an average SBA loan size has always had a negative relationship with lender size at the cross-section. We also observe that after the loan guaranty expansion of 2009-2010, the small banks increased the average size of their loans relatively a lot more than their bigger counterparts.[12]

In sum, we observe that the bank's size is an important factor that creates heterogeneity at the extensive and the intensive margin of SBA loan issuance, as big banks prefer to issue many loans of small size and small banks issue few loans of bigger size. One possible explanation for this could be that the small businesses are assortatively matching with the banks based on default risk. Suppose small banks prefer to issue SBA loans only to small businesses with relatively low default risk and only the big banks prefer to do business with small businesses that appear to have much riskier profile. If that were the case, it would not be surprising for the big banks to optimize their overall loan portfolio risk by issuing many loans of small sizes. However, the bottom right panel of Figure 4 dispels that argument. This panel shows the default rate as measured by number of defaulted loans divided by number of disbursed loans, and we see a natural downward trend for all four categories of banks since recently issued loans have lower probability of default than loans that were issued several years ago. The important feature of this panel is that there is no major difference in default rate across these groups of lenders, especially after 2008. Hence, it is not the case that risky firms tend to flock to banks of certain size; all banks face firms with similar default risk, yet loan characteristics differ greatly by lender size.[13]

Next, we divide the banks by size and whether a bank is part of the Preferred Lender

[12]Because many papers argue that bank's leverage ratio is more important than its size in explaining various lender behaviors and patterns, we have also done exactly same type of analysis dividing the lenders according to quantiles of leverage ratio. However, we do not see any significant difference across leverage ratio quantiles. Lenders at the bottom 5% in terms of leverage ratio had similar level of total amount and total number of 7(a) loans as the lenders with top 5% leverage ratio, both before, during, and after the expansion period.

[13]Section B of Appendix develops a simple model of portfolio optimization that explains why we should expect to observe such heterogeneity with respect to lender size without resorting to assortative matching.

Table 8: Number of banks in each category in 2008Q4

	Number of SBA loans issued > 0		Number of loans issued = 0	Total
	PLP Status	No PLP Status		
Top 5%	101	27	264	392
Bottom 95%	217	458	6777	7452
Total	318	485	7041	7844

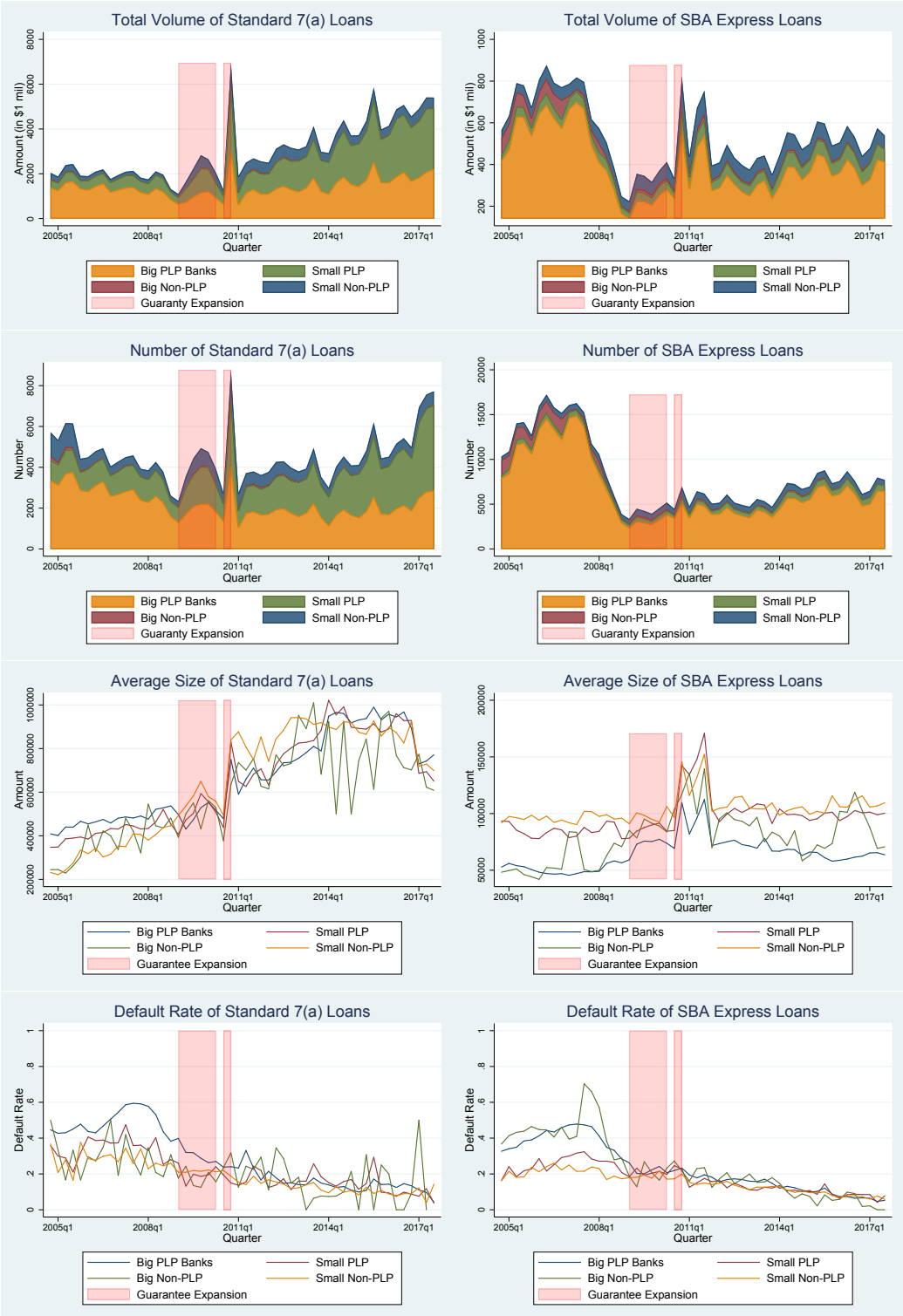
Program (PLP) with the SBA. Specifically, we create two dummy variables *PLP* and *top5p*. The variable *PLP* is a dummy variable that equals 1 if the bank has ever issued at least one PLP loan in a given year, and 0 otherwise.[14] The variable *top5p* is a dummy variable that equals 1 if bank i belonged in the top 5% of all banks in terms of total assets (RCFD2170 in call report) in 2008Q4, and 0 otherwise. Hence, we divide the banks into four different groups: big banks (top 5% of asset distribution) with PLP status, big banks without PLP status, small banks (bottom 95% of asset distribution) with PLP status, and small banks without PLP status. Table 8 shows how the 7844 banks reported in 2008Q4 call report are classified according to the variables *PLP* and *top5p*.[15] Only 803 banks (10.24%) out of 7844 issued at least one SBA 7(a) loan in that quarter. We also observe that big banks are more likely to have issued these loans and are also more likely to have the PLP status with the SBA, compared to their smaller peers. In fact, the correlation coefficient between the dummies *PLP* and *top5p* is 0.35 when using only 2008Q4 data, and 0.315 when using 2004Q4 to 2017Q3 data.

Figure 5 shows how the cross-sectional loan characteristics for each of the four groups of banks differ across the two main types of SBA loans—the Standard 7(a) loans (left column) and the Express loans (right column). The top two rows are cumulative graphs that respectively show the total volume and total number of loans of each of the four groups of

[14]It is possible for banks to obtain the preferred lender status and then lose it later, or vice versa. However, we do not have data on when each of the banks in our dataset have obtained preferred lender status and how long they have maintained that. Hence, we use the aforementioned proxy to determine whether bank i can be classified as a PLP lender during that year. This is identical to how Brown and Earle (2017) classified a bank as a PLP Bank.

[15]We choose 2008Q4 for calculating this summary statistics because this is the quarter prior to the temporary expansion of the SBA loan guaranty program. We still obtain similar pattern even if we change the baseline quarter.

Figure 5: Cross-sectional Loan Characteristics: By Size and PLP Status



lenders. The third row shows the average loan size and the last row shows the default rate. The top two rows together show that the big PLP lenders particularly dominate the SBA Express loans that have much lower maximum loan amount and guaranty rate compared to the Standard 7(a) loans, but much quicker turnaround. In fact, on average, 72% of total volume and 79% of total number of Express loans were issued by the big PLP lenders, dwarfing all other groups in this market. On the other hand, we observe that big non-PLP lenders do not actively participate in neither of the two types of loans, even when adjusting for the fact that the number of PLP banks outnumber the non-PLP banks as documented in Table 8. Such disparity between PLP banks and non-PLP banks is also present among small lenders, especially for Standard 7(a) loans. Small PLP lenders, as a group, issue as much Standard 7(a) loans as big PLP lenders. Small non-PLP lenders play very minor role in issuing Standard 7(a) loans, despite outnumbering small PLP lenders by more than two to one.

Interestingly, we do not observe substantial differences in average loan size for Standard 7(a) loans across the four groups of lenders, but the big PLP lenders consistently issue much smaller sized Express loans throughout this time period. Hence, the reason why big lenders appear to issue many SBA 7(a) loans of small size while small lenders issue few loans of bigger size in the bottom left panel of Figure 4 is twofold. First, the big lenders—especially the big PLP lenders—dominate the Express loan market, which naturally would lower the average size of the overall 7(a) loans. Second, on top of that, these big PLP lenders prefer to issue much smaller sized Express loans compared to their peers. The last row of Figure 5 again lends credence to the idea that this is not because of assortative matching between small businesses and lenders based on default risk.

5 Longitudinal Estimations

Figures 4 and 5 from Section 4 show that the temporary expansion of SBA 7(a) loan program of 2009-2010, in which guaranty fees were eliminated and guaranty rates were increased to 90%, had a sizable impact on both the extensive and the intensive margin of loan issuance, as the policy makers intended. In this section, we use the panel structure of our data to estimate the elasticity of banks with respect to this temporary shock, and how that elasticity differs according to lender characteristics such as size and prior relationship with SBA as proxied by Preferred Lender Program (PLP) status. First, we conduct panel fixed effect regressions to empirically estimate the elasticity of loan supply with respect to the temporary elimination of guarantee fees and increased guaranty rate. We estimate how responsive the overall banking sector was to this expansionary policy when measured in terms of total volume (in dollars) of loans, and then separately for the extensive margin (number of loans issued) and intensive margin (average loan size). Then, we split the sample into four different groups according to lender's size and whether the lender participates in Preferred Lender Program and repeat. Second, we do a difference-in-difference analysis to focus on how important the difference in lender size is on lender's elasticity with respect to this temporary shock, which serves as an additional robustness check to our panel fixed effect regressions.

5.1 Panel Fixed Effect Regressions

We empirically estimate the following fixed effect panel regression specification:

$$\ln Y_{it} = \alpha + \beta \cdot X_{it} + \gamma_i + \delta_t + \epsilon_{it} \tag{1}$$

in which Y_{it} is the dependent variable of interest for bank i in quarter t, with $t \in [2004Q4, 2017Q3]$ since the last time the SBA loan fee and guaranty structure changed prior to February 2009

was in October 1, 2004.[16]

X_{it} is a vector of independent variables and control variables. Our main independent variable of interest is *temp*. The variable *temp* is a dummy variable that equals 1 if the quarter $t \in \{[2009Q1, 2010Q2], 2010Q4\}$ which is exactly the time period that coincided with temporary increase of guaranty rate to 90% for Standard 7(a) loans and elimination of fees for all loans with maturity longer than 12 months, and 0 otherwise. Of note, the variable *temp* does not include 2010Q3, as that is the quarter prior to which the funding that allowed for temporary changes to fees and guaranty rates ran out and the continuation of this policy did not commence until the next quarter (2010Q4) through emergency stop-gap measure. Hence, in this section, we focus on the coefficient β estimated for the dummy *temp*, which measures the percentage increase in Y_{it} during the temporary expansion of the SBA 7(a) loan program *relative* to the other quarters in the observation.

In addition, we divide the sample of banks by preferred lender status (variable *PLP*) and bank size (variable *top5p*). The variable *PLP* is a dummy variable that equals 1 if bank i has ever issued at least one PLP loan in a given year, and 0 otherwise. The variable *top5p* is a dummy variable that equals 1 if bank i belonged in the top 5% of all banks in terms of total assets (RCFD2170 in call report) in 2008Q4, and 0 otherwise. These two variables are identical to what we used in cross-sectional analysis in Section 4. As for the control variables, the main one is the dummy variable *incmax*, which equals 1 if the quarter $t \in [2010Q4, 2017Q3]$, and 0 otherwise, to control for the fact that the maximum loan amount was permanently increased from $2 million to $5 million starting in 2010Q4. It is important to note that $t = 2010Q4$ is the only quarter in which both the independent variable *temp* and the control variable *incmax* equal 1. Other control variables include natural log of total asset of bank i in quarter t, total liabilities (RCFD2948), and leverage ratio which is calculated as

$$\text{leverage ratio} = \frac{\text{total liabilities}}{\text{total asset - total liabilities}}$$

[16] Refer to Tables 3 and 4 for details.

The term γ_i is the individual fixed effect that controls for all time-invariant characteristics unique to each bank i.[17] δ_t are quarter dummies that control for aggregate time effects, since it is clear that there have been some business-cycle dynamics that impacted this loan market prior to the 2008 recession, as can be seen in Figures 1 and 2. In all the regressions, we winsorize the dependent variable at 1% level by each quarter to control for outliers,[18] and use robust standard errors.

Table 10 shows the results from the panel fixed effect regressions in which the dependent variable Y_{it} in regression specification (1) is the total volume of loans approved by bank i in quarter $t \in [2004Q4, 2017Q3]$. Column (1) shows that an average bank increased total volume of loan issued by 53% as a response to the temporary elimination of guarantee fee and increase of guaranty rate. Columns (2) and (3) show that this increase is common across both types of 7(a) loans: the total volume of SBA Express loan (Column (2)) and Standard 7(a) loans (Column (3)) respectively increased by 53.2% and 50% as a response to this temporary policy shock.

Rest of the columns in Table 10 show how the results differ when we restrict the sample by their asset size (dummy variable *top5p*) and whether the lender participates in Preferred Lender Program (dummy variable *PLP*). Columns (4) through (6) restrict the sample to big banks (top 5% in asset distribution) who are non-PLP lenders, while Columns (7) through (9) restrict the sample to big banks who are PLP lenders. Columns (10) through (12) restrict the sample to small banks (bottom 95% in asset distribution) who are non-PLP lenders, while Columns (13) through (15) restrict the sample to small PLP lenders.

Key observation from Table 10 is that small banks—regardless of its PLP status—responded to the temporary expansion by greatly increasing the total volume of 7(a) loans issued, and this increase is quite robust across the two loan types. Not only that, the magnitude of the increase is much greater for small PLP banks that already have preestablished

[17] The inclusion of these individual fixed effect is the reason why the variables *PLP* and *top5p* are not part of our independent variables as they are totally absorbed by the γ_i term.

[18] We have done all the regressions without winsorizing and the results are essentially the same. Truncating the outliers also does not change the results.

relationship with the SBA and enjoys much quicker turnaround on their loan application compared to their non-PLP counterparts. On the other hand, how the big banks responded to this policy differs greatly based on their PLP status. Big PLP lenders did respond to the temporary expansion of the loan program by increasing the total volume of both SBA Express and Standard 7(a) Loans—albeit in a smaller magnitude compared to their smaller PLP counterparts—but the big non-PLP lenders only increased total volume of SBA Express loans relative to the non-expansionary quarters. Since the turnaround on SBA Express loans are much quicker than Standard 7(a) Loans and is unaffected by PLP status, it appears that the incentives provided by temporary elimination of fees and increase in guaranty rate was not big enough for big non-PLP lenders to overcome whatever cost they faced in issuing 7(a) loans greater than $350,000. Instead, these big non-PLP lenders dramatically increased total volume of SBA Express loans, which theoretically do not have different turnaround based on whether a bank is PLP or non-PLP lender. The fact that the magnitude of the coefficient on *temp* is the greatest in Column (5) suggests that big non-PLP lenders did want to take advantage of the positive policy shock, but only found the SBA Express loan as the feasible option.

Table 11 shows the elasticity of the extensive margin of loan issuance with respect to the temporary expansion, in which the dependent variable Y_{it} in regression specification (1) is the total number of loans approved by bank i in quarter t. In columns (1) through (3), we observe that banks on average increased number of loans issued by 28% when the Obama administration temporarily eliminated guaranty fee and increased guaranty rate to 90%, with bigger increase coming from the SBA Express loans. When we divide our sample of banks by their size and preferred lender status (PLP), we estimate that the increase in number of loans is predominantly coming from small banks, both small non-PLP lenders and small PLP lenders. Big PLP lenders did not respond in terms of number of loans, whereas big non-PLP lenders increased the number of SBA Express loans issued.

Table 12 shows the elasticity of the intensive margin with respect to the temporary

expansion, in which the dependent variable is the natural log of the average amount loans approved by bank i in quarter t. Again, we see that the banking sector overall increased average loan size as a response to these temporary policies, and this was mostly led by small banks. Big PLP banks—even though they did not increase the number of loans—greatly increased average loan size, which resulted in the increase in total volume that we observed in Table 10. Big non-PLP banks did increase average size of SBA Express loans, but not the Standard 7(a) loans.

In sum, we estimate that the temporary elimination of guarantee fees and increase in guaranty rate particularly created a big incentive for the small lenders—regardless of their PLP status—to increase the total volume of both SBA Express loans and Standard 7(a) loans compared to their previous levels. This increase in total volume was the result of a statistically significant increase in both the extensive margin (number of loans) and intensive margin (average size of loan). In contrast, the response of the big banks to this policy is quite different based on their PLP status. Big PLP lenders increased total volume of both the Express and Standard 7(a) loans, but this is because they increased the average loan size while the extensive margin was kept intact. As for big non-PLP lenders, they increased total volume of only the Express loans, with both the intensive and the extensive margin increasing with statistical significance. However, the big non-PLP lenders did not change its Standard 7(a) loan issuing behavior.[19]

5.2 Difference-in-Difference

The panel fixed effect regression from the previous subsection was conducted on a sub-sample of lenders, and hence, the coefficients only show how a typical lender belonging to that group (such as big PLP lenders or small non-PLP lenders, etc.) changed its behavior *relative* to the point in time in which the temporary elimination of guarantee fees and increase

[19] As can be seen on the coefficient for dummy variable *incmax*, the permanent increase in maximum loan amount from $2 million to $5 million did change the big non-PLP bank's issuance of Standard 7(a) loans. They responded by decreasing the number of loans while increasing average loan size. However, in terms of the total volume, we do not observe statistically significant change.

in guaranty rate was not in place. Given that the big banks issue many loans of small size and small banks issue few loans of big size,[20] the panel fixed effect regression is not able to quantify the relative difference in elasticity of each subset of lenders. Hence, as a robustness check, we estimate the following difference-in-difference regressions:

$$\%\Delta Y_i = \alpha + \beta \times Bot95_i + \boldsymbol{\gamma}' \boldsymbol{X_i} + \epsilon_i \tag{2}$$

$$\%\Delta Y_i = \alpha + \beta \times PLP_i + \boldsymbol{\gamma}' \boldsymbol{X_i} + \epsilon_i \tag{3}$$

in which the dependent variable $\%\Delta Y_i$ is the percentage point change of variable Y_i from 2008Q4 to 2010Q1. The reason we use 2008Q4 as the base is because that is the quarter immediately prior to the quarter in which the policy change first took place. We use 2010Q1 as the other reference date because the first expansion period ended on May 31, 2010, which means 2010Q2 is a bit contaminated by the fact that loans approved in June 2010 did not benefit from the temporary expansion. We also do not use 2010Q4 as the other reference date, since the policy change that took place in 2010Q4 included permanent increase in maximum loan size.

The dummy variable *Bot95* in regression equation (2) is a dummy variable that equals 1 if bank i belonged in the bottom 95% of all banks in terms of total assets (RCFD2170 in call report) in 2008Q4, and 0 otherwise. The dummy variable *PLP* is identical to the one used in panel regressions and indicates whether the lender issued any PLP loans within that year, which in this case would be 2008. Hence, the coefficient β in equation (2) represents how much variable Y_i changed for small banks relative to big banks in the units of percentage points, while β in equation (3) represents how much variable Y_i changed for PLP banks relative to non-PLP banks in the units of percentage points. X_i is a vector of control variables, such as total liabilities and leverage ratio. We weight each observation by its level of asset at 2008Q4 and winsorize at 1% level to control for outliers.

[20] This was documented in Section 4.

Table 13 shows the results in which the dependent variable Y_i in regression equation (2) is either total volume of all 7(a) loans or one of its two subsets—total volume of SBA Express loans or total volume of Standard 7(a) loans. Column (1) shows that total volume of 7(a) loans originating from small banks (in terms of volume) increased by a whopping 257.2 percentage points relative to the big banks as a response to the temporary policy change. This sizable difference stems from the fact that the total volume of Standard 7(a) loans issued differ relatively according to lender size (Column (3)). On the other hand, we observe no statistically significant relative difference in terms of SBA Express loans. This is not terribly surprising since we already established in Table 10 that all lenders—regardless of their size and PLP status—increased total volume of Express loans but big non-PLP lenders did not increase the volume of Standard 7(a) loans.

Columns (4) through (9) estimate the same difference-in-difference specifications on a sub-sample of the lenders. Columns (4) through (6) do the same diff-in-diff regression on only the PLP lenders and find that the small PLP lenders increased total volume of Standard 7(a) loans by a whopping 362 percentage points compared to big PLP lenders, whereas there is no statistically significant difference in terms of SBA Express loans. This pattern is also present among non-PLP banks, although the magnitude of the relative difference across lender size is much smaller for this group.

Table 14 shows the results from regression equation (3) in which the dependent variable is the relative change in total volume, and the independent variable is the dummy *PLP*. Unlike Table 13, we observe no statistically significant relative differences between PLP lenders and their non-PLP counterparts. The only exception is in Column (9), in which we estimate that the small PLP lenders increased total volume of Standard 7(a) loans by 313 percentage points relative to small non-PLP lenders. Combining with what we already knew from panel regression in Table 10, we are able to conclusively argue that even though all small lenders increased total volume of both the SBA Express and Standard loans by a statistically significant magnitude, the small PLP lenders were much more elastic compared

to their small non-PLP lenders with respect to Standard loans.

Tables 15 and 16 show the results in which the dependent variable Y_i in regression equations (2) and (3) is either total number of all 7(a) loans issued or one of its two subsets—total number of SBA Express loans or total number of Standard 7(a) loans. These two tables paint the picture that when it comes to the extensive margin of SBA loan issuance, the only relative difference that matters at a 5% statistically significant level is the difference in number of 7(a) loans issued by small PLP banks relative to small non-PLP banks. Similar to the total volume of loans, we are able to conclude that the small PLP lenders were much more elastic compared to any other groups in terms of Standard 7(a) loans.

Tables 17 and 18 show the results in which the dependent variable Y_i in regression equations (2) and (3) is average loan size. These two tables paint the picture that all the relative differences we observed in total volume in Tables 13 and 14 are coming from the intensive margin. That is, the difference in bank size is a very important factor that determines the relative difference in how lender changes average loan size of a Standard 7(a) loan as a response to the temporary expansion of the 7(a) loan program, and this relative differences in elasticity of average loan size is the main driver of the robust relative differences we observe in total volume of Standard 7(a) loans between big lenders and small lenders. However, such statistically significant relative differences does not exist for Express loans. In addition, it is the case that within the subset of small lenders, small PLP lenders increased average size of a Standard 7(a) loans by 90.86 percentage points relative to small non-PLP lenders.

5.3 Summary of Longitudinal Estimations

Based on our panel fixed effect and difference-in-difference regressions, we conclude that when it comes to Express loans, all four subsets of lenders—big PLP banks, big non-PLP banks, small PLP banks, and small non-PLP banks—responded to the temporary elimination

of guaranty fees[21] by increasing both the extensive (except for big PLP banks) and the intensive margin relative to non-expansionary quarters. The magnitude of this increase was not statistically different across any of these groups.

Our empirical results paint an extremely different story for Standard 7(a) loans. Big non-PLP banks were particularly inelastic with respect to the policy change, despite the temporary elimination of guaranty fees and increase in guaranty rate to 90%. Big PLP banks only increased the intensive margin (average loan size), while the extensive margin was unaffected. Only the small banks responded the way the policymakers intended, as they increased both the average loan size and the number of loans issued, with relatively greater increase coming from the small PLP banks.

6 Conclusion and Policy Implications

As documented in this paper, banks were starting to greatly reduce lending to small businesses by end of 2007 and this trend intensified as the banking sector experienced various trials and tribulations throughout 2008. One of the ways in which the government sought to reverse this trend was to temporarily increase guaranty rates and eliminate guaranty fees for government subsidized SBA 7(a) small business loans. Our analysis shows that this policy was particularly effective in increasing loan issuance by small banks, especially the ones that participate in the Preferred Lender Program (PLP) with the SBA and thus have much faster turnaround compared to banks without the PLP status. Big PLP banks also responded, but the magnitude of their elasticity was far smaller than that of small banks, whereas big non-PLP banks were content in only increasing SBA Express loans. In other words, lender characteristics such as its size and the PLP status with the SBA not only play a significant role in how these lenders participate in this government subsidized loan market at the cross-section, but also how they respond to a positive policy shock, such as the aforementioned temporary expansion of the loan program.

[21] Increase in guaranty rate to 90% did not apply to SBA Express loans.

All this heterogeneous responses by the lenders were the result of a close to $900 million worth of government funding. However, we find that the big banks that really dominate this government-subsidized small business loan market responded to this temporary expansion by mostly increasing the issuance of Express loans but not the Standard 7(a) loans. Unfortunately, these Express loans only make up less than 10% of total volume of all SBA 7(a) loans and are legally capped at $350,000, which one could argue was not enough for many firms that were going through a particularly challenging time during early 2009.

Hence, our findings naturally raise two questions. First is whether or not this policy was worth pursuing given its cost and the inelastic response of the big lenders that dominate this market. Second is whether the small businesses actually benefited from this policy as much as they should have or the banks benefited more by reducing their exposure to risk on behalf of the taxpayers. These are questions that should be answered using a structural incidence analysis in which one could estimate how much the small businesses actually benefited from this policy change, compare that to the benefit that the lenders have received, and weigh it against the taxpayer's outlay. For now, we leave that up for future research.

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A Tables

Table 9: List of variables included in SBA 7(a) Loan Database

Variable Name	Description
BorrName	Business name
BorrStreet	Business address
BorrCity	Business address
BorrState	Business address
BorrZip	Business address
ApprovalDate	Approval date
AppvSBA	Amount guaranteed by SBA
GrossApproval	Approval gross loan amount
BankName	Name of 7A lender
BankStreet	Address of 7A lender
BankCity	Address of 7A lender
BankState	Address of 7A lender
BankZip	Address of 7A lender
BankInterest	Interest rate charged by bank
SBAInterest	Interest rate charged by SBA
TermInMonths	Loan terms at time of approval (in months)
NaicsCode	NAICS code
NAICS_Description	NAICS code (spelled out)
FranchiseCd	SBA Franchise Code
FrnchsName	Franchise Name
Noemp	Number of employees
Created	Jobs created
Retained	Jobs retained
BusOrg	Business Organization Type
OrgCodeDescription	Business Organization Type (spelled out)
NewExist	New or Existing business
BusNewExistCdDesc	New or Existing business (spelled out)
MisStatus	SBA loan status
PIFDate	Date loan was paid back in full
ChgOffDt	Date loan was charged off
ChgOffGross	SBA portion of the charged-off loan

Table 10: $\ln(\text{Total Volume})_{it} = \alpha + \beta \cdot X_{it} + \gamma_i + \delta_t + \epsilon_{it}$

	All Banks			Big Non-PLP			Big PLP			Small Non-PLP			Small PLP		
	(1) All	(2) Express	(3) Standard	(4) All	(5) Express	(6) Standard	(7) All	(8) Express	(9) Standard	(10) All	(11) Express	(12) Standard	(13) All	(14) Express	(15) Standard
temp	0.532***	0.532***	0.500***	0.757+	1.236**	-0.0250	0.368*	0.508**	0.436**	0.523***	0.414***	0.480***	0.958***	0.654***	0.898***
	(9.38)	(7.53)	(7.85)	(1.91)	(3.03)	(-0.06)	(2.49)	(2.90)	(2.67)	(7.48)	(4.46)	(5.38)	(8.52)	(4.70)	(7.93)
incmax	0.292***	-0.102	0.565***	-0.424	-1.025*	0.472	0.136	0.0270	0.288	0.318***	0.187	0.695***	-0.400*	-0.604***	-0.204
	(3.92)	(-1.09)	(6.98)	(-0.92)	(-2.05)	(1.06)	(0.48)	(0.11)	(1.02)	(3.77)	(1.48)	(7.15)	(-2.37)	(-3.49)	(-1.23)
ln (asset)	0.220***	0.0609	0.174***	-0.182	-0.223	-0.0393	0.208	0.0377	0.0909	0.0608	-0.00695	0.0820+	0.319***	0.121+	0.275**
	(4.78)	(1.11)	(3.66)	(-0.65)	(-0.42)	(-0.20)	(1.05)	(0.24)	(0.47)	(1.19)	(-0.09)	(1.67)	(3.68)	(1.94)	(3.27)
Liability (in bil)	-1.207*	-1.480*	-0.652	-21.03	-22.97	3.107	-0.857*	-1.113*	-0.160	30.94	125.9*	-17.73	-53.06**	-31.77+	-55.58**
	(-2.49)	(-2.50)	(-1.44)	(-0.90)	(-0.97)	(0.13)	(-2.10)	(-2.23)	(-0.40)	(0.76)	(2.08)	(-0.58)	(-2.96)	(-1.74)	(-2.99)
Leverage Ratio	0.000273	-0.000433	-0.000290	0.0179	0.00682	0.0308	0.0536**	0.0390	0.0461*	0.00920*	0.0161	0.000636	-0.000727*	-0.000754***	-0.000827**
	(0.23)	(-1.15)	(-0.36)	(0.78)	(0.28)	(1.01)	(2.88)	(1.44)	(2.38)	(2.51)	(1.55)	(0.18)	(-2.39)	(-7.95)	(-3.02)
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	51385	25767	35999	1537	1027	926	5233	4342	4928	30304	13304	17341	14311	7094	12804
Adjusted R^2	0.040	0.023	0.066	0.038	0.065	0.058	0.093	0.086	0.085	0.027	0.013	0.081	0.072	0.032	0.078

Note: Quarters Used: 2004Q4 to 2017Q3. Variable *obama* refers to $t \in [2009Q1, 2010Q2]$ and 2010Q4. Variable *incmax* refers to $t \in [2010Q4, 2017Q3]$. All specifications are fixed effect panel regressions with robust standard errors. Dependent variables were winsorized at 1 percent level at each quarter.
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. t statistics in parentheses.

Table 11: $\ln(\text{Number of Loans})_{it} = \alpha + \beta \cdot X_{it} + \gamma_i + \delta_t + \epsilon_{it}$

	All Banks			Big Non-PLP			Big PLP			Small Non-PLP			Small PLP		
	(1) All	(2) Express	(3) Standard	(4) All	(5) Express	(6) Standard	(7) All	(8) Express	(9) Standard	(10) All	(11) Express	(12) Standard	(13) All	(14) Express	(15) Standard
temp	0.282***	0.262***	0.169***	0.929***	0.644*	0.293	0.180	0.139	0.205	0.217***	0.208***	0.105*	0.678***	0.480***	0.516***
	(7.32)	(4.90)	(4.00)	(3.88)	(2.16)	(1.28)	(1.49)	(0.84)	(1.45)	(5.68)	(3.36)	(2.54)	(7.86)	(5.00)	(6.41)
incmax	-0.0919+	-0.152+	-0.0704	-0.855*	-0.584	-0.694*	-0.171	-0.0405	-0.134	-0.0322	0.0268	-0.106*	-0.637***	-0.536***	-0.414***
	(-1.74)	(-1.85)	(-1.28)	(-2.44)	(-1.34)	(-2.30)	(-0.70)	(-0.14)	(-0.56)	(-0.68)	(0.33)	(-2.32)	(-4.80)	(-3.47)	(-3.45)
ln (asset)	0.150***	0.0403	0.0949**	0.00582	-0.346	-0.00856	0.0605	0.0272	-0.0643	0.0763*	0.0292	0.0448+	0.245***	0.152**	0.176**
	(4.21)	(0.76)	(2.75)	(0.02)	(-0.79)	(-0.06)	(0.37)	(0.15)	(-0.40)	(2.27)	(0.51)	(1.76)	(3.65)	(2.84)	(3.07)
Liability (in bil)	-1.850**	-1.702*	-0.465	-16.83	-19.45	1.873	-1.170**	-1.288*	0.0640	9.945	50.37	-10.32	-60.06***	-37.66*	-67.21***
	(-2.97)	(-2.23)	(-1.04)	(-0.94)	(-1.00)	(0.20)	(-2.66)	(-2.00)	(0.17)	(0.39)	(1.17)	(-0.42)	(-4.26)	(-2.02)	(-4.82)
Leverage Ratio	0.000814	0.000374	0.000408	0.0208	0.0226	-0.00813	0.0534**	0.0355	0.0400*	0.00287	0.00425	0.00205	0.000142	0.000118+	-0.000137
	(1.01)	(1.26)	(0.61)	(1.13)	(1.11)	(-0.30)	(2.90)	(1.25)	(2.30)	(1.34)	(0.55)	(0.88)	(0.67)	(1.80)	(-0.63)
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	51385	25767	35999	1537	1027	926	5233	4342	4928	30304	13304	17341	14311	7094	12804
Adjusted R^2	0.029	0.036	0.047	0.081	0.088	0.155	0.136	0.102	0.131	0.011	0.011	0.030	0.065	0.059	0.074

Note: Quarters Used: 2004Q4 to 2017Q3. Variable *obama* refers to $t \in [2009Q1, 2010Q2]$ and 2010Q4. Variable *incmax* refers to $t \in [2010Q4, 2017Q3]$. All specifications are fixed effect panel regressions with robust standard errors. Dependent variables were winsorized at 1 percent level at each quarter.
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. t statistics in parentheses.

Table 12: $\ln\left(\text{Average Amount of Loans}\right)_{it} = \alpha + \beta \cdot X_{it} + \gamma_i + \delta_t + \epsilon_{it}$

	All Banks			Big Non-PLP			Big PLP			Small Non-PLP			Small PLP		
	(1) All	(2) Express	(3) Standard	(4) All	(5) Express	(6) Standard	(7) All	(8) Express	(9) Standard	(10) All	(11) Express	(12) Standard	(13) All	(14) Express	(15) Standard
temp	0.256***	0.265***	0.334***	-0.131	0.602**	-0.321	0.231*	0.347***	0.226*	0.304***	0.203**	0.371***	0.291***	0.172+	0.395***
	(6.58)	(5.69)	(7.87)	(-0.53)	(2.69)	(-1.10)	(2.49)	(3.79)	(2.58)	(5.17)	(2.85)	(5.12)	(4.53)	(1.89)	(6.17)
incmax	0.378***	0.0582	0.631***	0.391	-0.443	1.164***	0.283*	0.113	0.426***	0.351***	0.160+	0.804***	0.222*	-0.0641	0.191*
	(8.18)	(1.03)	(12.87)	(1.30)	(-1.64)	(4.15)	(2.34)	(0.99)	(4.12)	(5.36)	(1.76)	(10.37)	(2.49)	(-0.57)	(2.23)
ln (asset)	0.0789***	0.0193	0.0817***	-0.141	0.138	-0.0245	0.176*	-0.00863	0.156**	-0.0157	-0.0354	0.0371	0.0861*	-0.0313	0.105**
	(3.42)	(0.70)	(3.86)	(-1.04)	(0.93)	(-0.16)	(2.17)	(-0.13)	(2.72)	(-0.45)	(-0.59)	(1.06)	(2.15)	(-0.77)	(2.91)
Liability (in bil)	0.736	0.0648	-0.0601	0.140	-2.948	0.971	0.363	0.00515	-0.101	21.32	75.10**	-6.947	6.010	6.024	11.80
	(1.45)	(0.13)	(-0.56)	(0.06)	(-0.76)	(0.05)	(0.83)	(0.01)	(-1.18)	(0.99)	(2.69)	(-0.41)	(0.53)	(0.71)	(1.24)
Leverage Ratio	-0.000552	-0.000809***	-0.000689***	-0.00655	-0.0177	0.0386+	-0.00127	0.00235	0.00530	0.00640**	0.0123	-0.00139	-0.000868***	-0.000875***	-0.000681***
	(-1.32)	(-7.26)	(-3.80)	(-0.56)	(-1.21)	(1.84)	(-0.11)	(0.21)	(0.72)	(2.62)	(1.52)	(-0.51)	(-7.08)	(-15.67)	(-7.95)
Quarter Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	51385	25767	35999	1537	1027	926	5233	4342	4928	30304	13304	17341	14311	7094	12804
Adjusted R^2	0.041	0.017	0.110	0.005	0.012	0.143	0.155	0.062	0.199	0.025	0.011	0.131	0.056	0.020	0.072

Note: Quarters Used: 2004Q4 to 2017Q3
Variable *obama* refers to $t \in [2009Q1, 2010Q2]$ and 2010Q4
Variable *incmax* refers to $t \in [2010Q4, 2017Q3]$
All specifications are fixed effect panel regressions with robust standard errors.
Dependent variables were winsorized at 1 percent level at each quarter.
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. t statistics in parentheses.

Table 13: $\%\Delta\left(\text{Total Volume}\right)_i = \alpha + \beta \times Bot95_i + \boldsymbol{\gamma}'\boldsymbol{X_i} + \epsilon_i$

	All Banks			PLP Banks			Non-PLP Banks		
	(1) All	(2) Express	(3) Standard	(4) All	(5) Express	(6) Standard	(7) All	(8) Express	(9) Standard
Bottom 95	257.2***	48.76	250.3*	300.3**	48.11	362.0**	37.45	-375.0	251.8*
	(3.41)	(0.95)	(2.55)	(2.86)	(0.83)	(3.00)	(0.26)	(-1.29)	(2.59)
Liability (in bil)	106.3	90.91	393.7*	108.0	100.9	391.4*	-4793.1**	-6635.3+	37708.4***
	(0.94)	(1.08)	(2.39)	(0.96)	(1.24)	(2.36)	(-2.76)	(-1.70)	(5.85)
Leverage Ratio	39.28+	38.37+	32.59	42.16+	41.83+	34.14	-7.426	-6.809	-1.078
	(1.85)	(1.78)	(0.91)	(1.80)	(1.70)	(0.91)	(-0.36)	(-0.34)	(-0.26)
Constant	-285.0	-339.5+	-298.9	-320.0	-390.8	-313.3	376.2	553.7	-171.4
	(-1.42)	(-1.65)	(-0.86)	(-1.41)	(-1.63)	(-0.87)	(1.61)	(1.21)	(-1.52)
Observations	801	440	487	316	198	287	485	242	200
Adjusted R^2	0.154	0.272	0.423	0.180	0.373	0.423	0.070	0.154	0.073

Note: %Δ calculated using 2008Q4 and 2010Q1 data. Observations weighted by asset level at 2008Q4. Robust standard errors used. Dependent variables were winsorized at 1 percent level.
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. t statistics in parentheses.

Table 14: $\%\Delta\left(\text{Total Volume}\right)_i = \alpha + \beta \times PLP_i + \boldsymbol{\gamma}'\boldsymbol{X_i} + \epsilon_i$

	All Banks			Big Banks			Small Banks		
	(1) All	(2) Express	(3) Standard	(4) All	(5) Express	(6) Standard	(7) All	(8) Express	(9) Standard
PLP	-133.5	-169.5	-11.25	-84.59	-217.8	21.48	29.45	-40.10	313.3**
	(-1.63)	(-1.60)	(-0.11)	(-0.83)	(-1.35)	(0.13)	(0.26)	(-0.81)	(3.13)
Liability (in bil)	98.07	100.9	380.7*	108.1	100.4	393.4*	168910.8	29643.4	-70477.4
	(0.89)	(1.25)	(2.31)	(0.96)	(1.23)	(2.33)	(1.28)	(0.53)	(-0.90)
Leverage Ratio	41.25+	40.32+	32.84	41.86+	41.78+	32.51	-23.33	10.40	41.59
	(1.96)	(1.88)	(0.91)	(1.89)	(1.86)	(0.87)	(-1.03)	(0.73)	(1.55)
Constant	-162.9	-205.3	-272.8	-232.2	-172.2	-319.2	447.2+	-22.13	-275.5
	(-0.87)	(-1.05)	(-0.70)	(-1.34)	(-0.81)	(-0.71)	(1.92)	(-0.16)	(-1.02)
Observations	801	440	487	128	106	103	673	334	384
Adjusted R^2	0.143	0.293	0.416	0.184	0.301	0.446	0.008	0.000	0.038

Note: %Δ calculated using 2008Q4 and 2010Q1 data. Observations weighted by asset level at 2008Q4. Robust standard errors used. Dependent variables were winsorized at 1 percent level.
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. t statistics in parentheses.

Table 15: $\%\Delta\left(\text{Number of Loans}\right)_i = \alpha + \beta \times Bot95_i + \boldsymbol{\gamma}'\boldsymbol{X_i} + \epsilon_i$

	All Banks			PLP Banks			Non-PLP Banks		
	(1) All	(2) Express	(3) Standard	(4) All	(5) Express	(6) Standard	(7) All	(8) Express	(9) Standard
Bottom 95	30.12	5.319	77.45	58.23	3.028	114.9+	-11.35	-95.55	67.38
	(0.76)	(0.13)	(1.19)	(1.30)	(0.07)	(1.66)	(-0.40)	(-1.36)	(1.55)
Liability (in bil)	94.90	103.1	304.6*	92.80	104.6	300.7*	-1518.1***	-1988.4*	5375.9+
	(1.28)	(1.42)	(2.05)	(1.26)	(1.48)	(2.02)	(-3.67)	(-2.06)	(1.74)
Leverage Ratio	37.31*	33.98+	40.88	40.24*	37.17+	42.73	4.449	5.987	1.456
	(2.43)	(1.82)	(1.29)	(2.42)	(1.74)	(1.30)	(1.15)	(1.17)	(0.85)
Constant	-330.2*	-329.2+	-419.6	-360.7*	-365.6+	-435.4	20.12	58.21	-83.37
	(-2.32)	(-1.87)	(-1.34)	(-2.28)	(-1.78)	(-1.35)	(0.37)	(0.51)	(-1.59)
Observations	801	440	487	316	198	287	485	242	200
Adjusted R^2	0.479	0.415	0.518	0.481	0.420	0.515	0.234	0.300	0.011

Note: %Δ calculated using 2008Q4 and 2010Q1 data. Observations weighted by asset level at 2008Q4. Robust standard errors used. Dependent variables were winsorized at 1 percent level.
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. t statistics in parentheses.

Table 16: $\%\Delta\left(\text{Number of Loans}\right)_i = \alpha + \beta \times PLP_i + \boldsymbol{\gamma}'\boldsymbol{X_i} + \epsilon_i$

	All Banks			Big Banks			Small Banks		
	(1) All	(2) Express	(3) Standard	(4) All	(5) Express	(6) Standard	(7) All	(8) Express	(9) Standard
PLP	-20.53	-56.30	40.62	-31.94	-77.40	96.28	41.94*	-20.74	108.8***
	(-0.50)	(-1.11)	(0.52)	(-0.60)	(-1.15)	(0.78)	(2.14)	(-1.11)	(3.80)
Liability (in bil)	94.38	107.0	298.9*	94.95	106.1	301.8*	15889.1	23020.8	-22197.1
	(1.30)	(1.51)	(2.02)	(1.28)	(1.47)	(1.99)	(0.90)	(1.40)	(-0.87)
Leverage Ratio	37.58*	34.59+	41.08	38.71*	35.59+	41.88	0.790	6.741	1.599
	(2.45)	(1.85)	(1.29)	(2.42)	(1.82)	(1.28)	(0.23)	(1.60)	(0.22)
Constant	-312.1*	-285.0+	-454.7	-314.2**	-273.4+	-523.4	32.59	-64.68	0.824
	(-2.42)	(-1.86)	(-1.33)	(-2.68)	(-1.90)	(-1.34)	(0.92)	(-1.49)	(0.01)
Observations	801	440	487	128	106	103	673	334	384
Adjusted R^2	0.478	0.419	0.517	0.488	0.411	0.507	0.014	0.019	0.052

Note: %Δ calculated using 2008Q4 and 2010Q1 data. Observations weighted by asset level at 2008Q4. Robust standard errors used. Dependent variables were winsorized at 1 percent level.
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. t statistics in parentheses.

Table 17: $\%\Delta\left(\text{Average Loan Size}\right)_i = \alpha + \beta \times Bot95_i + \boldsymbol{\gamma}'\boldsymbol{X_i} + \epsilon_i$

	All Banks			PLP Banks			Non-PLP Banks		
	(1) All	(2) Express	(3) Standard	(4) All	(5) Express	(6) Standard	(7) All	(8) Express	(9) Standard
Bottom 95	61.22**	-5.792	37.57	77.41*	-0.417	74.22*	-2.657	-139.5+	189.4***
	(3.03)	(-0.42)	(1.46)	(2.34)	(-0.02)	(2.09)	(-0.08)	(-1.81)	(3.69)
Liability (in bil)	-7.378	-16.85**	20.09	-8.264	-15.37*	20.83	-2173.1***	-2891.2**	39524.6***
	(-0.95)	(-2.61)	(1.16)	(-0.96)	(-2.24)	(1.17)	(-5.75)	(-2.87)	(8.03)
Leverage Ratio	-0.667	5.218*	-6.545	-2.312	4.110*	-6.716	-4.061	-4.913	-1.466
	(-0.24)	(2.52)	(-1.49)	(-0.90)	(2.10)	(-1.47)	(-0.89)	(-0.98)	(-0.62)
Constant	42.92	-33.12	85.39*	63.00*	-23.20	86.32*	128.4*	201.1+	-202.0**
	(1.39)	(-1.50)	(2.20)	(2.28)	(-1.26)	(2.16)	(2.56)	(1.76)	(-3.19)
Observations	801	440	487	316	198	287	485	242	200
Adjusted R^2	0.024	0.071	0.062	0.032	0.092	0.076	0.124	0.279	0.297

Note: %Δ calculated using 2008Q4 and 2010Q1 data. Observations weighted by asset level at 2008Q4. Robust standard errors used. Dependent variables were winsorized at 1 percent level.
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. t statistics in parentheses.

Table 18: $\%\Delta\left(\text{Average Loan Size}\right)_i = \alpha + \beta \times PLP_i + \boldsymbol{\gamma}'\boldsymbol{X_i} + \epsilon_i$

	All Banks			Big Banks			Small Banks		
	(1) All	(2) Express	(3) Standard	(4) All	(5) Express	(6) Standard	(7) All	(8) Express	(9) Standard
PLP	15.82	1.320	0.734	51.94	-2.775	-33.54	21.19	-1.782	90.86**
	(0.43)	(0.03)	(0.02)	(1.11)	(-0.05)	(-0.44)	(0.58)	(-0.09)	(2.66)
Liability (in bil)	-13.72+	-16.64**	18.05	-10.39	-16.99**	21.00	64245.5	38780.5	17915.0
	(-1.67)	(-2.75)	(1.05)	(-1.26)	(-2.77)	(1.18)	(1.54)	(1.39)	(0.54)
Leverage Ratio	-0.604	5.183**	-6.502	-0.957	5.510**	-6.848	-11.28	-6.619	4.956
	(-0.22)	(2.73)	(-1.47)	(-0.37)	(2.91)	(-1.52)	(-1.53)	(-1.17)	(0.71)
Constant	34.99	-34.36	86.94	-1.559	-33.28	121.1	149.9*	45.61	-62.63
	(0.69)	(-0.72)	(1.46)	(-0.03)	(-0.52)	(1.32)	(2.01)	(1.01)	(-0.95)
Observations	801	440	487	128	106	103	673	334	384
Adjusted R^2	0.008	0.070	0.055	0.006	0.075	0.089	0.014	0.018	0.021

Note: %Δ calculated using 2008Q4 and 2010Q1 data. Observations weighted by asset level at 2008Q4. Robust standard errors used. Dependent variables were winsorized at 1 percent level.
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. t statistics in parentheses.

B Simple Model of Portfolio Optimization

Earlier, we have shown cross-sectional evidence that big banks—especially the big PLP banks—prefer to issue many loans of small size, whereas small banks prefer to issue few loans of bigger size, and that this appears not to be based on assortative matching of risky small businesses based on their perceived level of default risk. Here, we develop a simple model of portfolio optimization that can explain the aforementioned cross-sectional fact while maintaining the assumption that all small business loans face same risk.

Suppose a bank has total asset equaling a. The bank can make loans to small businesses where each loan will get you expected return of $\mathbb{E}[r]$ with variance of the return σ_r^2. In other words, all small business loans are drawn from the identical distribution

$$r \sim \mathcal{N}\left(\mathbb{E}[r], \sigma_r^2\right)$$

where there is no covariance between any two loans.[22] The goal of the bank is to minimize the return variance of the portfolio that consists of loans to small businesses. Specifically, let n denote the number of loans issued and x as the loan amount per loan, such that nx is the total amount (volume) of loans. Then, the bank with asset level of a is solving the following portfolio optimization problem

$$\min_{n,x>0} \left\{ \frac{1}{n^2} \sum_{i=1}^{n} \sigma_r^2 \right\}$$

subject to

$$a \geq n\left(x + k\left(a\right)\right) \tag{4}$$

$$\frac{nx}{a} \geq \tau \tag{5}$$

[22] In reality, there would be covariance between any two loans due to macroeconomic factors. However, adding covariance only complicates the derivation without qualitatively changing the key results we obtain.

in which the bank is choosing n and x optimally. Equation (4) is the bank's budget constraint where $k(a)$ denotes the fixed cost of issuing a loan. This fixed cost represents all the administrative cost associated with issuing a loan (such as labor cost, checking credit score and collateral of the loan applicant, paper work, etc.) and we will assume that $\frac{\partial k(a)}{\partial a} < 0$ such that the marginal cost is lower for bigger banks. Equation (5) represents the loan to deposit ratio and we require it to be higher than some exogenous value τ set by outside investors, since low value of τ implies bank may not be earning enough return and thus is not sufficiently profitable.

The Lagrangian for this problem would be

$$\mathcal{L} = \frac{\sigma_r^2}{n} - \lambda_1 \left[a - n\left(x + k\left(a\right)\right)\right] - \lambda_2 \left[\frac{nx}{a} - \tau\right]$$

which means the first order conditions are

$$[n] \ : \ \frac{\sigma_r^2}{n^2} = \lambda_1 \left[x + k\left(a\right)\right] + \lambda_2 \cdot \frac{x}{a} \tag{6}$$

$$[x] \ : \ 0 = \lambda_1 n + \lambda_2 \frac{n}{a} \tag{7}$$

Even though the optimal n and x both must be positive, there is no need to use Kuhn-Tucker conditions. As for n, because you can tell from the objective function that the bank wants n to be biggest as possible, it must be that $n \neq 0$. Also, if $x = 0$, there is no way that Equation (5) can be satisfied as long as $\tau > 0$.

Now, suppose that equation (5) is not binding, such that $\frac{nx}{a} > \tau$. This would imply that $\lambda_2 = 0$. That would mean that the equation (7) would become $0 = \lambda_1 n$ but since $\lambda_1 > 0$ (since budget constraint is binding with equality), it implies that $n = 0$, which is a contradiction. Hence, the loan-to-deposit ratio requirement (5) must hold with equality. That means $nx = \tau a$, which can be plugged into the budget constraint (equation (4)) to

obtain

$$n^* = \frac{a\,(1-\tau)}{k\,(a)}$$

and

$$x^* = \frac{\tau k\,(a)}{1-\tau}$$

Hence, this simple model predicts that big banks with high level of a would issue more loans (bigger n^*) but average loan size x^* would be smaller compared to small banks. In other words, introduction of simple fixed cost of issuing a loan in which the big banks handle this cost relatively more efficient, allows us to obtain the theoretical implication that big banks diversify its small business loan portfolio by issuing many loans of small size.