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Abstract

While the finance literature often equates government banks with political capture and capital misallocation, these banks can help mitigate financial shocks. This paper examines the role of Brazil's government banks in preventing a recession during the 2008-2010 financial crisis. Government banks in Brazil provided more credit, which offset declines in lending by private banks. Areas in Brazil with a high share of government banks experienced increases in lending, production, and employment during the crisis compared to areas with a low share of these banks. We find no evidence that lending was politically targeted or that it caused productivity to decline in the short-run.

Keywords: Credit; Financial Crises; State-Owned Banks; Local Economic Activity

JEL Classification: E44, E51, E65, G01, G21, H81, J23, R11, R5

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1 Introduction

In September 2008, the collapse of the Lehman Brothers investment bank precipitated a financial crisis and a sharp decline in international credit, with almost every country in the world experiencing some decline in bank lending in subsequent months (Aisen and Franken, 2010). Layoffs and an economic recession in the U.S. and many industrialized and developing countries ensued. In some countries, however, the effects of the financial crisis were limited and short-lived. This was true for Brazil, India, and China, all of which continued to experience high rates of economic growth. A reason cited for these countries' relative success during this period is government involvement in the banking sector (World Bank, 2012).[1]

This paper explores the argument that government banks can provide countercyclical support and mitigate economic recessions, using data on Brazil. It assesses whether government ownership of banks resulted in more lending, higher GDP, more employment and higher incomes, effectively mitigating the effects of the global financial crisis and helping Brazil avoid an economic recession.

The intuition for why government bank ownership may help mitigate a recession in the face of a supply-side shock to credit is straightforward: when governments own banks, they can instruct their banks to make loans. Lending by government banks tends to be less responsive in general to macroeconomic shocks than lending by private banks, and this is particularly the case during crises (Micco and Panizza, 2006; Bertay, Demirguc-Kunt, and Huizinga, 2012; and Cull and Martinez-Peria, 2012). In part, this is due to how government banks are funded, being less reliant on short-term debt and being able to take advantage of government funds to make loans (Ivashina and Scharfstein, 2010).[2] And in part, this can be explained by politics, with government banks coming under greater political pressure and being more susceptible to political influence to lend (Sapienza, 2004; Dinc, 2005; Carvalho, 2012). Ultimately, government banks may behave differently and extend more credit be-

[1] The World Bank's Global Financial Development Report (World Bank, 2012) cites state-owned banks in Brazil, India, China, and several other developing countries as engaging in aggressive counter-cyclical lending to shore-up domestic financial markets and bolster economic activity during the financial crisis. For Brazil, the *Economist* (May 12, 2010) cites the CFO of Bradesco, a large private Brazilian bank, as saying that government banks in the country played a critical role in promoting counter-cyclical policies. Additionally, a former governor of Brazil's Central Bank explained the consensus view in Brazil that government banks were important in propping-up the economy during the crisis.

[2] In the U.S., during the 2008-2010 financial crisis, banks cut their lending less if they had better access to deposit financing (Ivashina and Scharfstein, 2010) and if they relied more heavily on retail deposits rather than wholesale liabilities for funding (Gozzi and Goetz, 2010).

cause of softer financing constraints and explicit government guarantees against failure, making them effectively less risk averse compared to private banks.

In Brazil, government banks increased their lending, which offset the decline in private bank lending following the onset of the financial crisis. As Figure 1 shows, the sum of all lending by private-sector banks declined sharply after September 2008, while the sum of all lending by government banks increased. Whereas prior to the onset of the financial crisis, private-sector banks accounted for the majority of all lending, after September 2008, government banks became the majority lenders in Brazil.

Since government banks are not spread uniformly throughout Brazil, being concentrated in certain regions, and since lending is highly localized, areas with a high share of government banks maintained the same growth rate of employment, as shown in Figure 2, as government banks in these areas continued to lend. In contrast, for areas with a low share of government banks, the growth rate of employment slowed relative to previous trends. Our empirical strategy is to use a differences-in-differences approach, comparing what happens to lending, GDP, and employment before and after the crisis in areas with a high share of government banks versus areas with a low share of these banks.

Our results suggest that localities with a high share of government banks experienced better than expected changes in lending, GDP, formal sector employment, and incomes. These localities continued to grow during the 2008-2010 financial crisis and did so faster than otherwise comparable localities with low shares of government banks.

These findings are largely consistent with the existing banking and finance literature. Having more efficient financial markets promotes economic growth, both at the national level, as discussed in King and Levine (1993), as well as at the local level, as discussed in Guiso, Sapienza, and Zingales (2004), Burgess and Pande (2003), and Gilbert and Kochin (1989). Given this literature, it is not unexpected that relieving local financial frictions during a crisis would improve economic outcomes.

The literature also suggests that economic sectors heavily reliant on bank financing grow faster when this financing is efficiently provided (Rajan and Zingales, 1998; Cetorelli and Gambera, 2001) and suffer larger declines when it is not (Braun and Larrain, 2005; Larrain, 2006; Chava and Purnanandam, 2006; Kroszner, Laeven, and Klingebiel, 2007; and Dell'Ariccia, Detragiache, and Rajan, 2008). We examine this in our paper, and find that localities in Brazil with more bank-dependent industries indeed suffered slightly larger de-

clines following the onset of the crisis, but that government banks did not respond differently to nor disproportionally stimulate these areas by providing more lending.

While this paper examines the impact of the financial crisis in a specific country context, it has broader implications. Despite the fact that the activity and importance of government banks have declined over recent decades, these banks remain widespread around the world, accounting for approximately 10% of financial system assets in developed countries and over 20% in developing countries (Barth, Caprio, and Levine, 2004; World Bank, 2012).[3] In the Brazilian case, government banks boosted lending, production, and employment without any significant adverse consequences to productivity in the short-term. Government ownership of banks is most prevalent, however, in poor countries with inefficient governments and weak institutions (La Porta, Lopez-de-Silanes, and Shleifer, 2002). We did not find evidence that government bank lending was politically targeted in Brazil immediately following the crisis, but it is unclear whether this would also be the case in countries with weaker political institutions or even in countries with stronger institutions over a longer time horizon. In the Brazilian case, lending was neither targeted to the most bank-dependent sectors, nor was it targeted politically. Instead, it was allocated to areas where government banks had a greater presence, consistent with a directive to increase lending broadly in the face of a crisis.

This paper proceeds as follows. Section 2 provides background on Brazil's banking sector and the 2008-2010 financial crisis. Section 3 describes the data and the empirical strategy. Section 4 presents the main results. Section 5 explores variations of the main results and offers a series of robustness and specification checks. Finally, Section 6 concludes.

2 Brazil's Banking Sector and the 2008-2010 Financial Crisis

Approximately one-third of Brazil's nearly twenty thousand bank branches belong to federal government banks. These include *Banco do Brasil*, *Caixa Economica Federal*, or one of several federally-owned regional banks created in the mid-1900s to stimulate regional economic development. Prior to 1997, Brazil also had an expansive system of bank branches owned by individual state governments. Almost all of these state government banks were privatized during a consolidation of Brazil's financial sector between 1997 and 2006. Even after this consolidation, government banks continued to account for approximately 45% of total bank assets in Brazil (Barth, Caprio, and Levine, 2004).

[3] For example, government-owned banks account for over 50% of banking system assets as of 2010 in Algeria, Belarus, China, Egypt, India, and Syria, and between 20% and 50% of banking system assets in Argentina, Brazil, Indonesia, South Korea, Poland, Russia, and Turkey (World Bank, 2012).

State and federally-owned banks in Brazil functioned largely as substitutes. State banks existed in the wealthier states, whereas federally-owned banks had the greatest presence in historically underdeveloped states lacking resources to establish their own bank networks. With the privatization of state government banks beginning in 1997, bank branches that used to be state-owned in wealthier states were transferred to private ownership. Federally-owned banks, however, were never privatized. By 2008, prior to the onset of the financial crisis, this wave of state-bank privatizations and the absence of any privatization of federal banks left Brazil with bank branches either privately-owned or federally-owned, with many localities having a bank branch of a particular type (private or government) for reasons unrelated to their underlying economic characteristics.

Moreover, the location decisions of government bank branches do not appear to react to changes in localities' economic or social characteristics over time. While the initial entry of government bank branches into a locality likely corresponds to the locality's economic and social circumstances at the time of entry, government bank branches almost never exit a locality. This suggests that while a locality's economic and social characteristics evolve, it is not the case that its bank branch composition evolves with it. At the onset of the financial crisis, the mean age of the branches of the two major government banks, *Banco do Brasil* and *Caixa Economica Federal*, was 24 years and the median age was 20. Of all the bank branches ever opened by these two government banks, 86% are still in existence. There is little evidence to suggest that these government banks were strategically opening or closing branches in the years preceding the crisis.

While the locations of federal bank branches have remained fairly stable over the past half-century, Brazil has undergone a significant structural transformation. Between 1960 and 2000, Brazil has urbanized, industrialized, and experienced a shift in population from the Northeast to the Southeast of the country, as discussed in Da Mata et al. (2007) and in Feler and Henderson (2011). The determinants of locality growth in Brazil have fundamentally changed. These structural changes in the economy imply that even if a government bank branch were opened for endogenous reasons several decades before, its continued operation is at least partially orthogonal to a locality's current economic and social conditions.

We exploit the variation in bank ownership across localities to estimate how bank ownership during the 2008-2010 financial crisis affected local lending, production, and em-

ployment.[4] Figure 3 shows the extent of variation in the share of bank branches that is government-owned across localities in Brazil. Some localities have a high share of government bank branches and some have a low share despite having similar economic characteristics. Although we believe that locations of government and private bank branches do not correspond entirely to local economic conditions, we use locality fixed-effects, propensity-score matching, and an instrumental variables procedure in the estimations to mitigate potential endogeneity between a location's bank ownership and its underlying characteristics.

With the onset of the financial crisis in September 2008, localities with a high share of government bank branches experienced increases in lending whereas those with a low share did not. Conceptually, there are two main reasons why government and private-sector banks might have lent differently during the crisis.[5] Since banks lend a fraction of their liabilities (i.e., retail deposits), then in order for lending to decline, either or both liabilities must decline and/or the fraction of liabilities lent must decline.

In the results section, we show that liabilities did not decline differentially between government and private-sector banks. Instead, the fraction of liabilities lent declines for private-sector banks but increases for government banks. We attribute this differential behavior between government and private-sector banks to increased risk aversion on the part of private banks. Following Stiglitz and Greenwald (2003), banks choose a fraction of their liabilities to lend in order to maximize their valuation over several periods. This maximization must account for potential loan losses in different states of the world, with banks exhibiting risk aversion over these realizations. We have no reason to believe that private or government banks in Brazil have differential access to information about states of the world, and we control for their exposure to borrowers of different credit quality and from different economic sectors to account for differences in potential losses. This leaves risk aversion as the reason for why private-sector banks behave differently and lend a smaller

[4] An underlying assumption is that lending, especially to small firms, is highly localized. Our lending data only captures where loans originate and not the location of borrowers. However, even in developed capital markets, bank lending tends to be highly localized because of transportation costs, which give rise to spatial price discrimination (Degryse and Ongena (2005)). For Brazil, based on unofficial data provided by the Central Bank in 2004, we were able to calculate both the stock of loans held by a locality's banks and outstanding debts owed to banks by a locality's firms; these were approximately similar.

[5] Appendix A presents a simple model of bank behavior, based on Stiglitz and Greenwald (2003), to explain the differential behavior of government versus private-sector banks during financial crises. The model assumes complementarity between lending (e.g., working capital) and labor in order to explain how declines in lending translate into declines in employment and output.

fraction of their liabilities during the crisis.[6] With declines in lending, employment and output also decline as long as lending (i.e., working capital) and employment are complements in production. We now turn to the data and empirical strategy we use to test these hypotheses.

3 Data and Empirical Strategy

3.1 Sample

Brazil has 5,565 municipalities as of 2010, which can be combined into 3,659 spatially constant units. These 3,659 units reflect the 1970 municipal borders, which are roughly equivalent in size to a U.S. county. Collapsing the municipalities into 3,659 spatially constant units since 1970 serves two main purposes: first, it more closely reflects spatial areas corresponding to a common area labor market, and second, it mitigates potential issues of firms obtaining loans from outside their municipal borders.

Our analysis focuses on four federally-owned banks and 115 privately-owned ones, which are together responsible for over 18,000 bank branches in Brazil. We do not include banks owned by individual state governments in our analysis since almost all of these had been privatized by the onset of the financial crisis and since they did not enjoy the same soft-budget constraints and explicit backing as federally-owned banks.[7]

We exclude from our analysis localities that do not have any bank branches, which tend to be sparsely populated and remote. Our base sample is therefore comprised of 2,601 localities with at least one bank branch, although we experiment with alternative samples. Summary statistics for our base sample are provided in Table 1. On average, localities have over 60,000 residents in 2000 and are almost 70% urbanized. Immediately prior to the crisis, they had approximately 15,000 formally-employed workers, 1,100 formal-sector firms, contributed BRL$1.05 billion to Brazil's GDP, and had over 7 bank branches, of which, on

[6] Beltratti and Stulz (2012) and Fahlenbrach, Prilmeier, and Stulz (2012) similarly find that banks which took on greater risk prior to the financial crisis performed worse during the crisis and temporarily adjusted their holdings to reduce exposure to risk. This conforms to our findings that private banks adjusted their risk behavior more so than government banks, leading to a reduction in lending in areas where private banks were dominant.

[7] We also omit Brazil's National Development Bank (BNDES) from the sample of government banks, for two reasons: BNDES does not have bank branches nor does it engage in retail lending. The vast majority (over 85%) of its lending prior to and during the financial crisis is to large, national firms (Lazzarini, Musacchio, Bandeira-de-Mello, and Marcon, 2011; World Bank, 2012). These firms operate outside the scope of local credit markets, and it would therefore be difficult to attribute local economic fluctuations in lending and economic outcomes to BNDES. Moreover, BNDES does not account for a large fraction of overall lending in Brazil. While it is an important source of long-term lending, it accounts for only 11.6% of total direct lending in Brazil immediately prior to the financial crisis.

average, 53% were government-owned.[8] Between 2005 and 2007, the average annual locality GDP growth was nearly 5%, employment growth was over 7%, and credit growth was over 22%.

3.2 Data

This paper combines data on bank branch locations, locality-level lending, bank balance sheets, and employment censuses. The bank data were provided by the Central Bank of Brazil, and the employment censuses are from Brazil's Ministry of Labor. Data from the Central Bank indicate the locations of all bank branches – those currently in operation and those that have ceased operation – for every year since 1900 to the present. This allows us to capture a snapshot of the spatial distribution of bank branches at the beginning of the financial crisis and to see historical trends in branch openings and closures prior to the crisis.

Monthly locality-level lending is available from 1989-2012. This data, combined with bank branch locations, allow us to determine the number of bank branches in a locality, the fraction of branches that is government-owned, and the aggregate monthly lending in a locality. We create two measures to reflect the degree to which government banks operate in a locality. The primary one is simply the fraction of bank branches in a locality that is government-owned, although we also experiment with a dummy variable that is equal to 1 if the locality has above the median fraction of government bank branches.

Monthly bank-level balance sheets aggregated for all of a bank's branches for all of Brazil allow us to look at total lending of government versus private banks. Using this information, we see that private banks reduced lending and government banks did not at the onset of the crisis. Additionally, we can look at banks' liabilities to determine if the reason for the reduction in lending is due to a reduction in deposits or to a change in the fraction of deposits lent.

To measure the local economic impact of the financial crisis, we utilize the Brazilian yearly employment census, *Relaçao Anual de Informaçoes Sociais* (RAIS). The RAIS identifies all employees on the payroll of formal sector firms as well as the self-employed who pay into the social security system. The data cover approximately 2.5 million establishments and 36 million workers. It is well known that the informal sector in Brazil is non-trivial, with 30% of the overall workforce being informal and the average locality having 34% of its workers in the informal sector, based on 2000 census data. We therefore view our results

[8] In 2000, BRL$1 was approximately equivalent to USD$0.55.

as a reflection of how lending affects formal-sector employment outcomes in Brazil, although, based on a limited dataset, changes in formal and informal-sector employment are positively correlated over time.[9]

As an additional exercise, we classify localities based on their economies' dependence on external sources of financing, as done by Rajan and Zingales (1998) and Gozzi and Goetz (2010).[10] We use a measure of external financial dependence for U.S. economic sectors, match U.S. and Brazilian sectors, and then compute for each locality an employment-weighted average of external financial dependence depending on the locality's pre-crisis level of employment in different economic sectors. We also experiment with the share of small firms (those with 1 to 19 workers) in a locality as a measure of bank dependence, as discussed in Section 5.1. The intuition, based on Cetorelli and Gambera (2001), Braun and Larrain (2005), and Kroszner, Laeven, and Klingebiel (2007), is that localities whose economies' are heavily dependent on external finance or have a high share of small firms should experience greater changes in employment and GDP as a result of the financial crisis, and in these areas, government banks may play a greater role in mitigating recessions.

Finally, information on locality-level GDP and control variables including measures of urbanization, education, income, population, and exports all come from Brazil's Institute of Applied Economic Research (IPEA).

3.3 Quasi-Random Distribution of Bank Branches and Matching

Once we control for observable and fixed unobservable locality characteristics, whether localities have government bank branches should be uncorrelated with potential economic outcomes. If a time-varying locality characteristic, for which we had not controlled, were correlated with both the presence of government bank branches and greater

[9] Using the *Pesquisa Nacional por Amostra de Domicilios* (PNAD), an annual panel of 817 municipalities from 2001-2009, we estimate the elasticity between formal and informal sector employment controlling for year and municipality fixed effects. The estimate (standard error) of the elasticity is 0.024 (0.010).

[10] As in Rajan and Zingales (1998) and Gozzi and Goetz (2010), external financial dependence is defined as investment that cannot be financed through internal cash flows generated by the firm. It is capital expenditures minus cash flows from operations divided by capital expenditures. Cash flow from operations is broadly defined as the sum of cash flows from operations plus changes in inventories, receivables, and payables. We use data compiled by Gozzi and Goetz (2010) on external financial dependence for U.S. firms based on Compustat data from the 1990s. Using their measure of industry dependence on external finance, aggregated from firm-level data up to the 3-digit NAICS sector, we match to Brazilian data based on Brazil's CNAE codes. We then use the share of a locality's employment in these CNAE sectors to compute measures of external financial dependence for each locality in our sample.

economic resilience to fluctuations in lending, then the observed results might be overly attributed to the presence of government banks branches.

To minimize the potential for omitted variable bias, we employ several corrections. One is to include locality fixed effects in our estimations to control for any fixed locality characteristic that might influence both a locality's bank branch composition and economic outcomes during a financial crisis. The drawback of including locality fixed effects is that we cannot obtain estimates from time-invariant characteristics in the estimations. Another approach is to match localities based on the propensity to have more than the median share of government bank branches immediately prior to the crisis. We can then obtain a single measure—the propensity score—and match localities with similar characteristics based on this measure. Using this approach, localities have similar characteristics, but some have a high share of government bank branches while others do not.

We calculate the propensity score as a function of the following locality characteristics taken from 2000 census data: years of education, urbanization rate, illiteracy rate, average per capita income, and the natural logarithms of population, total locality income, total locality employment, a measure of total locality human capital, and several interactions of these. Details of the estimation are provided in an appendix. Within each propensity score block, we cannot reject at the 5% significance level that at least 95% of the covariates are statistically indistinguishable across localities.

We estimate whether we can predict a locality's share of government bank branches based on locality characteristics. Table 2 shows results from regressing the share of a locality's bank branches that are government-owned on the locality's urbanization rate, years of education, shares of industry, services, and agriculture in GDP, average annual GDP and employment growth, and the natural logarithms of total employment, population, GDP, and exports. From column (1), we see that localities that are more urbanized, more educated, and have higher GDP—essentially, localities that are more developed—have a lower fraction of government bank branches. In column (2), we control for the propensity score. While the propensity score is significant—higher propensity scores are correlated with higher shares of government bank branches—none of the locality characteristics is significant. Once we control for the propensity score, locality characteristics no longer have explanatory power in predicting a locality's fraction of government bank branches. In column (3) we control for 18 propensity score block dummies. Again, locality characteristics are insignificant. We take these results to imply that once we control for the propensity score,

or once we match localities based on the propensity score, the distribution of bank branches is uncorrelated with other locality characteristics that may determine economic outcomes during a financial crisis.

3.4 Empirical Strategy

3.4.1 Reduced-Form Estimates

Our goal is to assess, first, whether government banks behave differently than private-sector banks and why this may be the case, and second, whether localities with a greater share of government bank branches experience different outcomes in lending, GDP, employment, and income during the 2008-2010 financial crisis.

Using aggregate bank data for all of Brazil, we estimate the following equation:

$$y_{it} = post_t + post_t \times govbank_i + post_t \times X_i + \lambda_i + \tau_t + \varepsilon_{it}, \quad (1)$$

where y_{it} is alternately the natural logarithm of lending or deposits or the share of deposits lent by bank i in month and year t, $post_t$ is a dummy variable equal to 1 for the crisis and post-crisis period, $govbank_i$ is a dummy variable equal to 1 if the bank is one of the four federal government banks operating in Brazil, X_i are fixed bank characteristics, λ_i are bank fixed-effects, τ_t is time (in this case, months) relative to the onset of the financial crisis, and ε_{it} is the error term.[11] Controlling for $post_t \times X_i$ allows banks with different fixed characteristics to experience differential changes in the post period regardless of whether they are government or privately owned. We are interested in coefficient estimates on $post_t$ and $post_t \times govbank_i$, which respectively tell us how lending, deposits, or the share of deposits lent changes during the crisis, and how this change differs for government-owned relative to private-sector banks. Standard errors are clustered at the bank level, although we experiment with clustering at the month-year level.

We use a similar empirical strategy—differences-in-differences—to estimate the effects of government bank ownership at the locality level. When estimating effects at the locality level, our data are now annual, and instead of just a binary treatment dummy, we allow for the intensity of treatment to vary depending on the fraction of bank branches in a

[11] We experimented with a random-effects specification, estimating the following equation:

$$y_{it} = govbank_i + post_t + post_t \times govbank_i + X_i + post_t \times X_i + \tau_t + \eta_{it},$$

where we assume $\eta_{it} = \alpha_i + \varepsilon_{it} \sim N(0, \sigma_\alpha^2 + \sigma_\varepsilon^2)$. Coefficient estimates on $post_t \times govbank_i$ were not statistically different between the random and fixed-effects specifications for our main dependent variables, and so we do not report these results.

locality that is government-owned immediately prior to the crisis. When examining locality-level banking, y_{it} is alternately the natural logarithm of lending or deposits or the share of deposits lent in locality i at time t. When we are examining locality-level economic outcomes, y_{it} is alternately the natural logarithm of locality GDP, employment (both gross employment and hours), total wage bill, or number of firms. As measures of government bank involvement, $govbank_i$ is alternately the fraction of government bank branches or a dummy variable equal to 1 if the locality has above the median share of government bank branches.[12] In our base specifications, we include interactions of $post_t$ with the propensity score calculated in Section 3.3, and in the robustness checks, we include additional interactions with fixed locality characteristics; this allows localities with certain characteristics to experience differential level changes in the post period irrespective of their shares of government bank branches. When estimating using annual data, τ_t is the number of years relative to the onset of the financial crisis. Including τ_t in the estimation detrends the data and allows us to capture effects relative to an overall trend. Of interest in equation (1) are the coefficient estimates on $post_t$ and $post_t \times govbank_i$, which respectively tell us what happens to the outcome variable in the post period and how this change from the pre to post-period is different for localities with higher shares of government bank branches. For these estimations, standard errors are clustered at the locality level, although we experiment with clustering at the state-year level.

We estimate versions of equation (1) where we include interactions or split the sample to capture a locality's degree of external financial dependence as well as political alignment with the federal government. This allows us to discern whether the effects of having higher shares of government bank branches are greater for certain types of localities.

3.4.2 Instrumental Variables Estimates

We also employ an instrumental variables procedure to estimate the elasticity between locality-level lending and GDP, employment indicators, and number of establishments. We exploit the variation in government bank shares at the locality level and instrument for post-crisis changes in lending with pre-crisis shares of government bank branches.

[12] We also experimented with $govbank_i$ being a dummy equal to 1 if the locality had at least one government bank branch. The issue in doing this is that there are few large and developed localities that do not have at least one government bank branch, which makes it difficult to argue that our treatment and control localities are otherwise similar.

The intuition is that having a higher share of government bank branches should be strongly correlated with changes in lending but should not otherwise affect outcomes such as GDP, employment, and number of establishments except through the channel of lending. The validity of the instrument relies on controlling for how localities with different estimated propensities of having a high share of government bank branches would experience different changes in these outcome variables irrespective of their actual bank ownership structure. After controlling for this estimated propensity score, the share of government bank branches in a locality should be strongly correlated with pre-to-post crisis changes in lending but should be otherwise orthogonal to changes in GDP, employment, and establishments.

The structural equation of interest is:

$$\ln y_{it} = \ln credit_{it} + post_t + post_t \times X_i + \tau_t + \lambda_i + \varepsilon_{it}, \quad (2)$$

where y_{it} is alternately locality GDP, measures of employment, or number of establishments in locality i at time t, $credit_{it}$ is total credit operations, and as before, $post_t$ is a dummy variable equal to 1 for the post-crisis period, X_i are fixed-locality characteristics such as the estimated propensity score for having above the median share of government bank branches, τ_t is a time trend, λ_i are locality fixed effects, and ε_{it} is the error term. We instrument for $\ln credit_{it}$ with $post_t \times govbank_i$, where $govbank_i$ is the pre-crisis fraction of bank branches in a locality that is government-owned, although we also experiment with $govbank_i$ being a dummy equal 1 if the locality has above the median share of government bank branches. In an alternate specification, we include $X_i \times \tau_t$ and $post_t \times X_i \times \tau_t$ as exogenous controls in equation (2) to allow for the possibility that localities with different characteristics follow different pre and post-crisis trends irrespective of their banking structure, and we instrument for $\ln credit_{it}$ using $post_t \times govbank_i$ as well as $post_t \times govbank_i \times \tau_t$.

A complementary approach is to analyze the pre-to-post crisis change in average lending and economic outcomes. We calculate the difference in average $\ln credit_{it}$ and average $\ln y_{it}$ for 2005-2007 and 2008-2009 and estimate the following equation:

$$\Delta \ln y_i = \Delta \ln credit_i + X_i + \varepsilon_i, \quad (3)$$

where $\Delta \ln y_i = \ln \bar{y}_{i,2008-2009} - \ln \bar{y}_{i,2005-2007}$ and $\Delta \ln credit_i = \ln \overline{credit}_{i,2008-2009} - \ln \overline{credit}_{i,2005-2007}$. We instrument for $\Delta \ln credit_i$ with $govbank_i$, where $govbank_i$ is alternately the fraction

of bank branches government-owned or a dummy variable if the locality has above the median share of government bank branches. In the results section, we present several estimates of equations (2) and (3) using different instrumenting strategies.

4 Results

To address obvious identification concerns, we present results in several different forms. We first show results at the national level for aggregate lending (Table 3) and at the locality level for lending, output, and employment (Tables 4-6). A potential concern is that the distribution of government bank branches may be correlated with specific sectors that would be more (less) affected by the crisis. In this case, we would be over (under) attributing outcomes to the role of government banks, when in fact, they would be due to differences in localities' sectoral composition. To address this, we present results estimated at the locality-sector level, which include locality-sector fixed effects (Table 7). These results suggest that even within the same sector, there were smaller declines in employment and output during the crisis for localities with greater shares of government bank branches. To further mitigate concerns about omitted variable bias, we also present results using neighboring locality pairs (Table 8). We argue that differences in time-varying unobservable characteristics are likely smaller for geographically close localities. When we examine the differences between neighboring localities' bank ownership composition, we find that neighboring localities with a greater share of government bank branches experience smaller declines in lending, employment, and output.

In section 5, we examine other potential channels that may be driving our results. We find that our results cannot be explained by differential federal government spending or by government employment. Changes in federal government transfers are uncorrelated with the locations of government bank branches. We also find that our results for output and employment do not appear to be driven by firm migration. Rather, localities with a greater presence of government bank branches tend to experience fewer firm deaths during the crisis. Finally, our results are robust to alternative specifications, controls, and sample selection. A placebo test where we falsely assign government bank branches based on localities' observable characteristics yields no results, lending further credence that our findings are driven by the differential behavior of government bank branches during crisis periods as opposed to locality characteristics that determine the location of these bank branches.

4.1 Reduced-Form Bank-Level Results

To assess how banks in Brazil operate during the financial crisis, Table 3 shows results from estimating equation (1). For the average private-sector bank, total credit operations – which include traditional lending as well as lease financings and lines of credit – decline in the post period by approximately 15% relative to previous trends. For government banks, total credit operations actually increase by 14%, as shown in column (1). The estimation controls for bank fixed-effects and interacts the $post_t$ dummy with fixed bank characteristics to account for the possibility that banks with different characteristics would have experienced different changes in credit operations independent of the financial crisis.[13]

One concern is that banks are of vastly different sizes, and specifically, that the average government bank is much larger than the average private-sector bank. While the inclusion of $post_t \times X_i$ allows banks of different sizes to experience different post trends, the estimations treat every bank equally. In column (2), we weight the estimation by banks' total assets in the pre-crisis period, so that banks with a higher level of pre-crisis lending receive more weight.[14] When examining asset-weighted results, we still find that government banks increased their lending by almost 20% relative to similarly sized private-sector banks. As an additional exercise, we separate banks into government-owned, large private, and other private banks.[15] When doing so, we obtain similar estimates, suggesting that government banks lend more than even large private banks during the financial crisis (results not shown).[16, 17]

[13] The fixed bank-level characteristics, calculated as of August 2006, are the natural logarithms of total credit and total liabilities, a measure of portfolio quality calculated as a weighted average of credit ratings on loans, and banks' capitalization ratios, all standardized to have mean 0 and standard deviation 1.

[14] This follows from DiNardo, Fortin, and Lemieux (1996), where weighting by the likelihood of treatment (in their case, the probability of union membership) is used to derive a counterfactual distribution, and from Hirano, Imbens, and Ridder (2003), where weighting produces different estimators: an average treatment effect estimator and a treatment-on-treated effect estimator. In our case, weighting yields an average effect for larger banks or, as will be discussed later, for more populous localities where the average person resides.

[15] Large private banks include Itau/Unibanco, Bradesco, Santander, and HSBC.

[16] When we look at a previous crisis period, immediately following the Asian financial crisis in 1997-1998, we find a similar pattern of lending at the national level, but not as stark, between government and private banks. And when we conduct a placebo exercise by randomly assigning years between 2000 and 2007 as counterfactual crisis years, we find no difference in government and private bank lending relative to previous trends, as would be expected (results not shown).

[17] It is widely known that government banks earmark credit for specific types of projects. While our data does not specifically identify earmarked credit, we re-estimate the credit results omitting categories most likely to include a high share of earmarked credit, such as housing and infrastructure. Omitting these categories does not significantly alter our results.

The differential changes in credit operations between government and private-sector banks during the financial crisis could be the outcome of changes in behavior or of changes in the amount of loanable funds. Columns (3) and (4) of Table 3 show what happens to a bank's total liabilities, which includes retail deposits as well as interbank borrowing and commercial paper issues. Total liabilities for the average bank declined by nearly 8.0% in the post period, relative to previous trends. This decline is not statistically different between private and government banks. Even when we weight the estimations by banks' initial liabilities, we do not obtain significant differences for the change in liabilities between government and private banks during the post period.

The relative increase in government banks' credit operations, shown in columns (1) and (2), is not due to a relative increase in the availability of loanable funds. As columns (5) and (6) show, whereas private-sector banks may have reduced their share of liabilities lent by up to 2.5% relative to previous trends, government banks increased their share of liabilities lent. There is a significant difference of 6.6% in the fraction of liabilities lent between government and private-sector banks during the post-crisis period.

Government banks behaved differently from private-sector banks following the onset of the financial crisis. While we cannot explicitly separate whether this difference in behavior is due to differences in risk aversion, outlook, or potential loan losses, we argue that it leads government banks to increase credit operations during the crisis. We now examine how these differences in national-level bank behavior translate into locality-level outcomes.

4.2 Reduced-Form Locality-Level Results

The credit results discussed in the previous subsection are based on national aggregates. In this subsection, we first examine whether these credit results also hold when we look at locality-level credit operations. An issue here is that for localities with multiple bank branches, we cannot ascribe credit operations to a particular type of bank, i.e., government or private. Instead, we assess whether localities with a higher share of government bank branches experience different credit outcomes following the crisis. We do this by collapsing the monthly data into annual averages to make them comparable to our annual data on production, employment, and firms. We then show and discuss results on production and employment at the locality-level before proceeding to variations of these locality-level results.

4.2.1 Credit Operations and Liabilities

Table 4 shows results from estimating equation (1) using locality-level data on total annual credit operations. As shown in column (1), panel A, the average locality without any government bank branches experienced declines in lending of approximately 46% relative to previous trends following the onset of the financial crisis. Every ten percentage point increase in the share of government bank branches mitigates these declines by 6.6%. Alternatively, in panel B, we see that localities with less than half of their bank branches government-owned experienced declines of approximately 33% in lending, whereas those with a high share of government bank branches experienced increases in lending of approximately 7% (-0.330+0.399=0.069). The inclusion of $post_t \times X_i$ in the estimation allows for the possibility that localities with different initial characteristics experience different outcomes in the post-period irrespective of their shares of government bank branches. For the locality estimations, we use the propensity score calculated in Section 3.3 as the sole control variable in X_i, although we also experiment in the robustness checks with an extensive list of fixed locality characteristics as controls.

In column (2), we weight the estimations by a locality's total population in 2000. This more closely reflects the outcomes for where the average person lives; without weighting, each locality carries the same importance in the estimation regardless of whether they are minimally populated or major population centers. Based on results from the weighted regressions, we obtain that total credit operations decline by 20% following the onset of the crisis, but every ten percentage point increase in the share of government bank branches mitigates these declines by 2.6%. Alternatively, when estimating with $govbank_i$ being a dummy equal to 1 if the locality has above the median share of government bank branches, localities with a low share of government banks experience declines of approximately 10.6% in lending, whereas localities with a high share of government bank branches experience no statistically significant declines in lending relative to previous trends.[18] The impact of the crisis on total credit operations and the mitigating effects of government bank branches are smaller in magnitude in more populous areas, but the effects are nonetheless present and highly significant.[19]

[18] These results are largely consistent with those of Paravisini (2008), who finds that financial shocks to constrained banks have quick and persistent effects on the aggregate supply of credit.

[19] As a matter of interpretation, there are two potential responses by government banks that are consistent with these results. First, government banks may be responding differently than private banks to the financial crisis. Second, government banks may be reacting to the decrease in credit provided

While we do not report locality-level results for total liabilities and the fraction of liabilities lent, we obtain results that correspond to the bank-level ones discussed previously. Localities with a high share of government bank branches experience increases in total credit operations because they experience increases in the share of liabilities lent during the financial crisis.

4.2.2 Production and Employment

Localities with a high share of government bank branches likewise experience less severe declines in production and employment. Table 5 shows results for the effects of having a high share of government bank branches on locality GDP, industrial value-added, and services value-added. Declines in GDP vary from almost zero to 1.6% (in the population-weighted regressions) in localities with no government bank branches, and declines are mitigated by 0.34% to 0.51% (in the population-weighted regressions) for every ten percentage point increase in the share of government bank branches. These results are shown in columns (1) and (2). The inclusion of $post_t \times X_i$ in the estimations potentially absorbs some of the post effects and some of the effects of government bank ownership on the outcome variable during the post-crisis period, leading us to underestimate the true coefficients on both $post_t$ and $post_t \times govbank_i$. However, to the extent that localities with different characteristics may experience different post effects for reasons correlated with the presence of government bank branches, excluding $post_t \times X_i$ would cause us to overestimate the true coefficients on $post_t$ and $post_t \times govbank_i$. The results we obtain are conservative but nonetheless suggest that government bank branches mitigated contractions in local production.

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by private banks. To address these interpretations, we divide our sample into three—one has localities with only private bank branches, one has localities with only government bank branches, and one has localities with both government and private bank branches—and we compare how post-crisis lending differs from pre-crisis lending across these samples. For localities with only private bank branches, lending declines relative to previous trends during the post-crisis period. In localities with only government bank branches, lending does not decline relative to previous trends. And in localities with mixed bank branch composition, lending declines but not as much as in localities with only private bank branches (results not shown). If government bank branches were fully compensating for the decline in lending by private bank branches in these localities, their post-crisis lending would have followed the same trajectory as in localities with only government bank branches. This is not the case. While we cannot rule out that government bank branches react to the lending provided by private bank branches, we can rule out that they react fully by increasing their lending to exactly compensate for the decline in lending by private banks.

Locality GDP is calculated as the sum of locality value-added in industry, services, agriculture, and government. Industry and services together account for 75% of localities' economies (81% when population-weighted). When we disaggregate locality GDP, we see that most of the effect on production of having government bank branches is due to increases in value-added in services. None of the coefficients on industrial-value added are significant.

The mitigating effects of government bank branches on economic outcomes are only weakly reflected in pure employment numbers, as shown in Table 6. Employment declines by 3.6% (3.4% when population-weighted) in the post period relative to previous trends for areas with no government bank branches. The mitigating effects of having all or a high share of these branches in a locality are on the order of 1.8% to 3.8%, as shown in columns (1) and (2), although depending on the specification – whether the estimations are population-weighted and whether $govbank_i$ is treated as a dummy variable – these effects are not always significant. When examining only private sector employment and when examining total hours and wages, however, we obtain significant coefficient estimates on $post_t \times govbank_i$, especially in more populous localities.[20] Declines in total worker hours range from 2.9% to 4.4% in the post-period, but having all government bank branches or a high share of government bank branches mitigates these declines by 1.5% to 5.9%. Similarly, when analyzing the total wage bill of a locality, the positive effects of having a high share of government bank branches during the post-crisis period are large and significant, especially for more populous localities. [21]

Finally, as shown in Table 6, column (4), having a greater share of government bank branches increases the number of firms in a locality in the post-crisis period. These effects of government bank branches on the number of firms are highly significant and are larger for more populous localities. We examine whether this relative increase in the number of firms in areas with a greater share of government bank branches is due to comparatively fewer firm deaths or more firm births. Both firm deaths and firm births increase on average with the onset of the financial crisis: there is greater turnover of firms overall. But in areas

[20] When examining private-sector employment, the estimates (standard errors) on $post_t \times govbank_i$ range from 0.024 (0.017) to 0.040 (0.023) in the population-weighted regression, where $govbank_i$ is the fraction of bank branches government-owned. We do not obtain significant coefficient estimates when examining public-sector employment.

[21] These results are consistent with Campello, Graham, and Harvey (2010), who find that credit-constrained firms in the U.S., Europe, and Asia plan deeper cuts in capital spending, investment, and employment during the crisis.

with a greater presence of government bank branches, this turnover is lessened. In particular, the relative increase in the number of firms in areas with a greater presence of government bank branches is not due to comparatively more firm births, but rather, to fewer firm deaths (results not shown).[22]

We can separately analyze outcomes for employment, hours, wages, and firms in 17 economic sectors across our sample of 2,601 localities.[23] We re-estimate equation (1) for these variables and include locality-by-sector fixed effects. By doing so, we are comparing what happens within a specific sector to employment, hours, wages, and firms in localities with high versus low shares of government banks. Results are shown in Table 7. The coefficient estimates suggest that sectors in localities with high shares of government bank branches experience relative increases in employment, hours, wages, and number of firms compared to the same sectors in localities with low shares of government bank branches. Coefficient estimates are positive but not always significant. The results in Table 7 nonetheless provide some assurance that the reason localities with higher shares of government bank branches experience better outcomes in the post-crisis period is not simply due to differences in economic composition. Even within the same economic sectors, localities with higher shares of government bank branches perform better during the crisis.

A related exercise is to examine how neighboring localities perform in the post-crisis period given differences in the fraction of their bank branches that is government-owned. Neighboring localities have similar access to infrastructure such as ports and railways, face similar climatic and agronomic conditions, and are in the same state (we exclude neighboring localities across state lines). However, labor and some lending may flow across locality boundaries, confounding the results, even though lending is highly localized in Brazil.[24] When we estimate a version of equation (1) where our variables of interest are now $post_t$ and $post_t \times \Delta govbank_i$, and where $\Delta govbank_i$ is the difference in the fraction of

[22] When estimating equation (1) using the natural logarithms of firm births and firm deaths as the dependent variables, and when $govbank_i$ is the fraction of bank branches government-owned, the estimates (standard errors) on $post_t \times govbank_i$ are -0.145 (0.028) and -0.205 (0.041), respectively, which suggests that even though there are comparatively fewer firm births, there are far fewer firm deaths in localities with a greater presence of government bank branches during the post-crisis period.

[23] We unfortunately do not have locality-level data on value-added or lending disaggregated across these 17 sectors.

[24] Since Brazil lacks central credit registries, information on the credit worthiness of borrowers is based on borrowers' long-standing relationships with their banks. This limits the ability of borrowers to obtain loans from financial institutions with which they do not normally maintain a relationship.

government bank branches between neighboring localities, we obtain the results shown in Table 8. These estimations include fixed effects for 5,841 locality pairs covering 2,562 localities.[25] The results are largely in line with those discussed previously: in the post-crisis period, neighbors with a greater fraction of government bank branches experience larger increases in lending, production, employment, worker hours, wage bill, and number of firms.

These reduced-form results collectively suggest that the increased lending provided by government banks during the financial crisis not only props-up production and prevents a greater number of firms from failing, but also buttresses workers' labor hours and income.

4.3 Instrumental Variables Results

Using as an instrument the variation in the fraction of government bank branches across localities, we directly estimate the relationship between lending and economic outcomes such as GDP, measures of employment, and number of firms in the post-crisis period. Results are shown in Table 9. Columns (1)-(5) contain estimates from an over-identified instrumentation of equation (2), where we instrument for $\ln credit_{it}$ using both $post_t \times govbank_i$ and $post_t \times govbank_i \times \tau_t$. Columns (6)-(10) contain estimates from the cross-sectional version of equation (3), where we instrument for $\Delta \ln credit_{it}$ using only the fraction of bank branches in a locality that is government-owned prior to the crisis. The elasticities between lending and GDP, hours worked, and number of firms are all approximately 0.05.[26] Since increases in lending are on the order of 66% for localities where all bank branches are government-owned, these estimates translate into increases of approximately 3% in GDP, hours worked, and number of firms, which are similar in magnitude to the reduced-form estimates we obtained previously. Results are insignificant for total employment and wages.

We experiment with using a dummy variable for whether localities have above the median fraction of government bank branches and with using different combinations of instruments to estimate equations (2) and (3). Estimates are stable, although setting $govbank_i$ equal to a dummy variable as opposed to a continuous fraction leads to larger standard errors and causes some estimates of the elasticity between lending and hours

[25] We exclude from the estimation locality-pairs where at least one locality does not have a bank branch.

[26] In both the over-identified panel results of Table 9, columns (1)-(5), and the just-identified cross-section results of columns (6)-(10), the first stage F-statistic is above 30. For columns (1)-(5), over-identification test statistics suggest we cannot reject the null hypothesis that instruments are invalid.

worked to become insignificant (results not shown).[27] These instrumental variables estimates reinforce our previous results that increases in lending tend to increase production and prop-up firms, and have positive but less significant impacts on employment.

5 Variations on the Locality-Level Results, Quality of Loans, and Robustness

In this section, we explore variations on the locality-level results presented in Section 4, assess loan quality, and provide some robustness checks. Specifically, we are interested in whether the increased credit provided by government banks flows to where it might be most productive or whether these flows are determined by political considerations. Accordingly, we examine banks' balance sheets to assess whether government banks experience a deterioration in their loan portfolio as a result of extending credit during the crisis. We also perform some robustness checks by trimming our sample and modifying our control variables to ensure that our results are not overly sensitive to specification or data selection. Finally, we assess what happens to local productivity, as measured by the Solow residual, as a result of government bank lending. While the presence of government banks may attenuate the recessionary effects of the financial crisis, it may also prevent Schumpeterian creative destruction and the reallocation of resources to more productive firms, as suggested in Caballero, Hoshi, and Kashyap (2008) and Hsieh and Klenow (2009).

5.1 Variations based on Local Financial Dependence and Political Affiliations

We begin by estimating a variant of equation (1) that includes interactions with a measure of the fraction of firms in a locality that are dependent on banking or external finance. As discussed previously, we follow Rajan and Zingales (1998) and Gozzi and Goetz (2010), and adapt their measures of external financial dependence to Brazil. This is admittedly an imperfect measure: sectors that cannot fund themselves from retained earnings and are dependent on external financing in the U.S. are unlikely to fully approximate dependent sectors in Brazil, where financial markets are much less developed. We additionally use the fraction of a locality's firms that are small (we restrict these to firms with 1 to 19 workers) since, in Brazil, these types of firms are typically more reliant on external financing and local bank lending for start-up funding (Kumar and Francisco, 2005).[28] Results are

[27] We plot the coefficient estimates and confidence intervals of the elasticities from these different instrumentation strategies in an online appendix.

[28] To approximate the relationship in Brazil between firm size and bank dependence, and specifically, on government bank dependence, we utilize World Bank Enterprise Survey data for 2009, which includes firm-level characteristics as well as information on whether a firm's most recent loan was obtained from a government or private bank. Of the 1,802 firms in the survey, 1,176 reported having ever obtained a loan, and 379 received their most recent loan from a government bank. Among small

shown in Table 10. The coefficient estimates on $post_t \times govbank_i$ are generally positive and significant, and, as before, they suggest that areas with a higher fraction of government bank branches experience relative increases in lending, GDP, hours worked, wages, and number of firms following the financial crisis. However, the coefficient estimates on $post_t \times govbank_i \times high\ external\ dependence_i$ or on $post_t \times govbank_i \times high\ frac.\ small\ firms_i$ are generally mixed and insignificant, even when we weight the estimations by locality population.[29] If government banks targeted lending to localities whose firms were more reliant on external sources of financing, then we should obtain significantly positive estimates, but we do not. Our measures of external financial dependence are imperfect, and we experiment with several alternatives, including a continuous variables to capture the fraction of firms that are small or externally dependent rather than using a dummy variable for whether the locality is above the median in these measures. While we cannot rule out that government banks target lending during the financial crisis to where it might have the greatest impact, we have no convincing evidence that this is the case.

When we estimate a variant of equation (1) to include interactions with mayors' political affiliations around the time of the crisis, we find no conclusive evidence that credit is targeted based on political connections, despite previous research showing that lending is often allocated politically in Brazil, specifically during elections (Carvalho, 2012). We are interested in whether mayors are politically affiliated with the federal government's executive branch because it is the executive that appoints the directors of federally-owned banks. We code a locality as being politically affiliated around the time of the crisis if its mayor is from the Worker's Party, which controls the executive branch, or if its mayor is from a coalition party that has a ministerial appointment in the presidential cabinet. For localities that are comprised of multiple municipalities, we use the electorate-weighted share of mayors that belong to either the Worker's Party or a coalition party. Results are shown in Table 11.

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firms with loans (those with 1-19 workers), 41% had received their most recent loan from a government bank, whereas for medium-sized firms (those with 20-100 workers) and large firms (those with more than 100 workers), the corresponding figures are 32% and 19%, which suggests that smaller firms are comparatively more dependent on government banks for financing.

[29] The variables $high\ external\ dependence_i$ and $high\ frac.\ small\ firms_i$ are dummy variables equal to 1 if the locality has above the median locality measure of external dependence or above the median locality fraction of small firms. The median locality measure of external dependence is -0.05, where this measure is an employment-weighted average of the external dependence of all industries in a locality. Note that the external dependence measure can be negative for industries that finance themselves using retained earnings, as is also the case in Rajan and Zingales (1998). In the median locality, 95% of firms are classified as small, with fewer than 19 workers.

We report results based on whether a locality's elected mayor in either the 2004 or 2008 elections is politically-affiliated with the federal government. In general, we do not obtain any significant coefficient estimates on $post_t \times govbank_i \times affiliated_i$.[30] Regardless of whether we weight the estimations by locality population or separately consider political affiliations during different election cycles, we fail to obtain robustly significant coefficient estimates to suggest that lending is allocated based on political connections. To examine this point further, we look alternately at three subsamples: the 991 localities with one bank branch, for which we can directly attribute lending to either a government or private-sector bank; the 799 localities with only government and no private bank branches; and the 427 localities where Worker's Party or coalition candidates were engaged in close elections.[31] For these three subsamples, there is still no indication that government banks were allocating resources based on political affiliations (results not shown). Instead, we find that the coefficient estimates on $post_t \times govbank_i$ remain positive and significant, suggesting that more credit is allocated during the financial crisis to localities with a higher fraction of government banks irrespective of these localities' political affiliations with the federal government.

Even though government banks provide credit during a time when private banks are reducing their lending, they do not appear to be sacrificing their lending standards. As shown in Table 12, based on national level bank balance sheets, government banks do not significantly reduce their capitalization ratios relative to private-sector banks during the post-crisis period. The quality of their loans actually appears to improve, although insignificantly.[32] This is consistent with even high-quality borrowers being unable to obtain credit from private-sector banks and instead shifting to government banks. A caveat is that these

[30] The variable $affiliated_i$ is equal to 1 if the locality elected a mayor from either the Worker's Party or a coalition party during the 2004 or 2008 elections. For localities comprised of multiple municipalities and with mayors from different political affiliations, this variable is an electorate-weighted share of these mayors' political affiliations, where affiliated mayors receive a value of 1 and non-affiliated mayors receive a value of 0.

[31] We define close elections as those in which the margin of victory is less than five percent, although we experiment with different cutoffs without significant differences to the results.

[32] Banks provide a breakdown of the credit ratings of their loans. We apply a numerical value to these letter ratings and then use these numerical values to derive a weighted average of the overall credit quality of the loan portfolio. If the portfolio is comprised entirely of the highest-rated credits, the "Borrowers' Credit Rating" variable takes the value 1, if it is comprised entirely of the lowest-rated credits, this variable takes the value 0. Banks' capitalization ratios are calculated as total equity capital as a share of total liabilities. Loan loss provisions are calculated as capital as a share of total credit operations set aside to cover potential loan losses. Credit earnings are earnings from credit as a share of total credit operations.

credit ratings are self-reported, and so it is unclear whether government banks are becoming relatively more lax in their ratings, although we have no reason to believe this is the case. There appears to be some evidence that government banks actually reduce their loan loss provisions, especially when we weight the estimations by banks' assets in the pre-crisis period, and there is no significant difference in the post-period between the credit earnings of government relative to private-sector banks, again suggesting that government banks do not significantly relax their lending standards in an effort to provide more credit during the crisis.

5.2 Robustness to Clustering, Controls, Sample Selection, and Alternative Explanations

Our base case results are robust to alternative ways of clustering, to the inclusion of additional controls, to different sample selection, and to alternative explanations, as shown in Tables 13 and 14. When we cluster at the state-year level, as opposed to the locality level, standard errors change slightly but without adversely affecting the significance of our coefficient estimates (Table 13, Row B).[33] When we include additional or alternative controls, our estimates remain robust. In Table 14, Row C, we drop the $post_t \times pscore_i$ control; in Row D, we control for locality-specific pre-crisis trends; in Row E, we include an interaction between $post_t$ and the fraction of a locality's workers that are public sector employees to address the possibility that areas with more government sector employees receive more lending and experience better economic outcomes irrespective of their bank composition; in Row F, we match localities based on their propensity scores and control for an interaction between $post_t$ and these match fixed effects in lieu of controlling for $post_t \times pscore_i$; and in Row G, we control for the interaction between $post_t$ and several fixed locality characteristics in lieu of controlling for $post_t \times pscore_i$. For all these specifications, we continue to obtain positive and significant coefficient estimates for the effects of government bank branches on lending and firms during the post crisis period, and effects are positive for GDP and employment indicators, although we occasionally lose significance as we add more controls and lose degrees of freedom. In Row H, we trim the top and bottom 10% of our sample with respect to the propensity score to address the possibility that outliers are driving our

[33] To address issues of spatial correlation, we also cluster standard errors at the level of the own locality plus immediate neighbors. This assumes errors are correlated between localities that share borders and over time, but are otherwise independently distributed. Neither clustering at the own locality plus neighbor level nor clustering at the state-year level alters the significance of our estimates.

results; they are not. In Row I, we collapse spatial units into metro areas. These are areas defined as commuting zones and common labor markets by Brazil's statistical agency (IBGE). The majority of our localities are already unique commuting zones and labor markets, although 441 belong to a larger metro area. Finally, in Row J, we conduct a placebo exercise. We randomly assign localities to have a high or low fraction of government bank branches based on their estimated propensity scores and regardless of their actual bank branch composition. We do this in a way that maintains the number of counterfactual high government bank branch localities equal to the real number of such localities within each propensity score block, and then we estimate the effects of having a counterfactually assigned high fraction of government bank branches on outcomes during the post-crisis period. As would be expected, the effects are generally close to zero and insignificant.

It is conceivable that other government programs might stimulate local economies and also coincide with the presence of government bank branches. To test for this, we estimate equation (1) to obtain the effects of having a high fraction of government bank branches on government transfers, public sector employment, and construction employment during the post-crisis period. These results are shown in Table 14. If it were the case that the federal government differentially transferred more funds directly to localities with a greater share of government bank branches, we would obtain positive coefficient estimates on $post_t \times govbank_i$. Depending on the specification, we obtain negative estimates, statistically insignificant estimates, or small positive estimates. We also do not find evidence that the number of government workers or construction workers is differentially increasing during the crisis in areas with more government bank branches. These results suggest that other types of stimulus or infrastructure investment programs were not differentially driving economic outcomes in localities with a high fraction of government bank branches during the post-crisis period.

5.3 Productivity

As a final exercise, we estimate the effect of government-bank involvement on productivity, as measured by the Solow residual, in local economies during the financial crisis. For each locality, we estimate the following equation for 2000-2009:

$$\ln VA_{it} = \ln K_{it} + \ln L_{it} + \varepsilon_{it}, \tag{4}$$

where VA_{it} is value-added (gross municipal product) in locality i at time t, K_{it} is total credit operations, L_{it} is alternately employment or total labor hours, and ε_{it} is the error

term.[34] We obtain coefficient estimates on $\ln K_{it}$ and $\ln L_{it}$, and use these estimates to compute the residuals for each locality for 2005-2009. Note that each locality is constrained to having the same production technology throughout the period, although localities can have a different optimal mix of financial capital and labor. With the Solow residuals as the dependent variable, we estimate equation (1). Results are shown in Table 15. We find that greater government bank presence in a locality is associated with a zero to 3.8% increase in productivity, as measured by the Solow residual, during the two years following the crisis. In the long-term, however, it is unclear whether greater presence of government banks prevents structural adjustment in the economy and hampers productivity. Indeed, our previous results show that having a greater fraction of government bank branches is associated with less firm turnover and, specifically, fewer firm deaths. In the short-term, however, it does not appear that government-bank intervention leads to a relative decline in local factor productivity; in the most optimistic of estimates, local factor productivity actually increases during the post-crisis period in areas with the highest shares of government bank branches.[35]

6 Conclusion

While the onset of the 2008-2010 financial crisis results in a sharp decline in lending, production, and employment in many countries around the world, this decline is comparatively mild in Brazil. In part, the reason for only a mild economic decline in Brazil can be attributed to the country's government banks. The onset of the crisis leads private banks to change their behavior and operate more conservatively. They reduce the fraction of deposits they lend, and coupled with the decline in deposits, this results in a sharp drop in private-sector lending. Government banks actually increase their lending despite a decline in deposits. This higher lending does not appear to have been allocated politically, although there is also no evidence that it was allocated strategically to sectors or areas where it may have been more productive. Instead, it appears that government banks lend more in the areas where they operate without necessarily targeting specific localities or sectors.

[34] Since we do not have locality-level data on physical capital used by firms, we use the stock of loans held by local bank branches as an imperfect proxy for K_{it}, and refer to this as financial capital.

[35] A possible explanation for the finding of no detrimental effect on productivity, based on Benfratello, Schiantarelli, and Sembenelli (2008) and Campello, Graham, and Harvey (2010), is that firms rely on bank financing for R&D expenditures and cut both R&D and product innovation when they are credit-constrained.

In areas with a large government bank presence, the local economy is disproportionately stimulated during the crisis. Total credit operations, GDP, labor hours, income, and the number of establishments are all higher in these localities than in corresponding ones with a low share of government bank branches. Our estimates suggest that economic growth, incomes, and the number of firms would have declined in Brazil relative to previous trends if not for the involvement of government banks.[36] A counter-argument is that government bank lending may prevent Schumpeterian creative destruction in the local economy and therefore hamper productivity growth in the long-term. At least in the short-term, within two years following the onset of the crisis, there appears to be no negative effect on an area's productivity as a result of government bank involvement even though we observe lower rates of firm turnover and fewer firm deaths in areas with more government banks.

There is ample evidence that government banks and bailouts are subject to political capture and that lending can become politically motivated over time, with detrimental effects to the allocation of productive inputs and financial development (Duchin and Sosyura, 2012; Dinc, 2005; Khwaja and Mian, 2005; Carvalho, 2012; and Barth, Caprio, and Levine, 2001). Even in Brazil, this has previously been the case during the period when individual state governments owned banks (Feler, 2012). Increased government involvement in the banking sector during financial crises may affect the market shares of private banks even after the crisis is over, which could potentially reduce competition and exacerbate capital misallocation in the long run.

While federal government banks prop-up the economy in Brazil and prevent a deeper recession from occurring following the onset of the 2008-2010 financial crisis, it is unclear what the long-term implications of government bank intervention might be. At least during the crisis, government bank lending has significantly positive and fairly immediate effects on production, employment, and incomes, and helps firms remain in business.

[36] A further benefit of government involvement in the banking system, supported by Diamond and Rajan (2005) and Dahiya, Saunders, and Srinivasan (2003), is that it may prevent financial contagion. By providing liquidity during times of crises, government banks can facilitate the refinancing and repayment of borrowers' debts with private banks, thereby allowing private banks to reduce their risk exposure.

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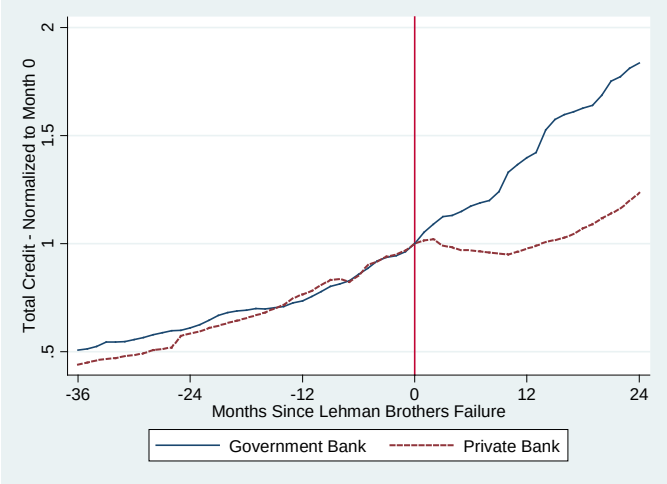
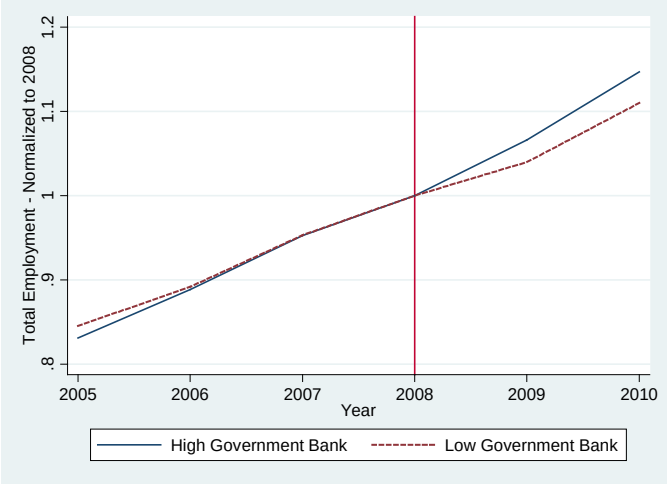
Figures

Figure 1: Total Credit Operations



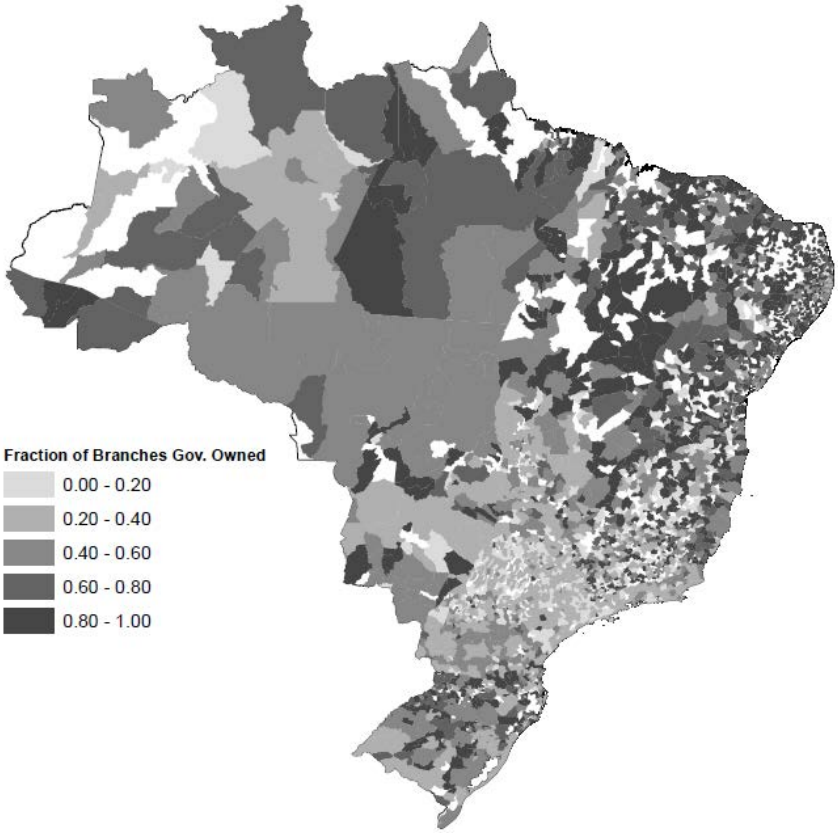
Notes: This figure shows the natural logarithm of total credit operations normalized to be 1 at the onset of the financial crisis in September 2008. Total credit is based on aggregated balance sheets of five federal government banks and 123 private-sector banks.

Figure 2: Total Employment



Notes: This figure shows the natural logarithm of locality-level employment normalized to be 1 at the onset of the financial crisis in 2008 for the 2,601 localities with bank branches. High government bank localities are defined as localities that have above the median share of government bank branches.

Figure 3: Variation in Government Ownership of Bank Branches



Notes: This figure shows the share of bank branches that is government-owned in 2007 for the 2,601 Brazilian localities that have at least one bank branch.

Tables

Table 1: Summary Statistics

	Mean	Median	Std. Dev.
Fraction Branches Government Owned	0.53	0.50	0.37
Total Bank Branches	7.6	2.0	65.6
Government Bank Branches	2.5	1.0	11.8
Private Bank Branches	5.1	1.0	54.4
Yearly Real Credit Growth	22.1%	16.6%	41.5%
GDP in 2007 (in BRL$ millions of 2000)	1,050	81	25,600
GDP in 2000 (in BRL$ millions of 2000)	447	61	3,783
Yearly Industry Value-Added Growth	4.6%	2.9%	17.9%
Yearly Services Value-Added Growth	5.9%	5.4%	6.2%
Total Employment in 2007	14,218	2,247	105,455
Yearly Employment Growth	7.1%	5.6%	14.3%
Total Hours in 2007 (in 10,000s)	2,288	357	16,613
Yearly Hours Growth	7.5%	6.0%	13.7%
Total Monthly Wages in 2007 (in BRL$10,000s)	1,866	161	18,748
Yearly Wage Growth	11.5%	8.6%	18.4%
Total Firms in 2007	1,108	256	6,049
Yearly Growth in Number of Firms	5.0%	4.3%	5.6%
Population in 2000	62,075	21,231	277,809
Fraction Population Urban	0.68	0.70	0.21
Years of Schooling in 2000	4.47	4.56	1.29
Total Exports in 2007 (in BRL$10,000s)	6,144	0	34,195

Notes: Summary statistics are based on the sample of 2,601 localities with at least one bank branch in 2007 prior to the onset of the financial crisis. Growth rates are averages for 2005-2007. Based on 2000 exchange rates, BRL$1 is approximately equivalent to USD$0.55; based on 2007 exchange rates, BRL$1 is approximately equivalent to USD$0.52.

Table 2: Determinants of a Locality's Share of Government Bank Branches

	(1)	(2)	(3)
Dep. Variable:	Fraction Branches Government Owned		
Ln(Total Employment)	0.0039	-0.0098	-0.0069
	(0.0220)	(0.0198)	(0.0200)
Frac. Urban	-0.3862***	-0.0792	-0.0415
	(0.0552)	(0.0554)	(0.0566)
Ln(Population)	0.1157***	0.0326	0.0289
	(0.0215)	(0.0204)	(0.0204)
Ln(GDP)	-0.0610***	0.0079	-0.0024
	(0.0220)	(0.0208)	(0.0209)
Years of Education	-0.0700***	-0.0023	-0.0065
	(0.0104)	(0.0104)	(0.0109)
Ln(Exports)	-0.0005	-0.0006	-0.0005
	(0.0012)	(0.0011)	(0.0011)
Industry VA/Total GDP	0.2095	0.1429	0.1577
	(0.1648)	(0.1501)	(0.1501)
Services VA/Total GDP	0.0225	0.1228	0.1148
	(0.1676)	(0.1559)	(0.1561)
Agric VA/Total GDP	0.0294	0.0222	0.0459
	(0.1574)	(0.1445)	(0.1454)
Yearly GDP Growth (2005-2007)	0.1518	0.0569	0.0537
	(0.1019)	(0.0918)	(0.0919)
Yearly Employment Growth (2005-2007)	-0.0059	0.0435	0.0455
	(0.0444)	(0.0413)	(0.0411)
Propensity Score		0.6390***	
		(0.0335)	
P-Score Block Dummies			x
Number of Localities	2,601	2,601	2,601

Notes: Robust standard errors are reported in parentheses. Results are shown from regressing the fraction of total branches in a locality that are government-owned in 2007 on locality characteristics. Column (2) includes a control for the propensity to have above the median share of government bank branches, and column (3) includes propensity score block dummies.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Total Credit Operations (Bank Balance Sheets)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.:	Ln(Tot. Credit Operations)		Ln(Tot. Liabilities)		Tot. Credit / Tot. Liabilities	
Post	-0.1481***	0.0007	-0.0777***	-0.0561	-0.0146	-0.0249
	(0.0463)	(0.1144)	(0.0249)	(0.0616)	(0.0093)	(0.0231)
PostXGovbank	0.2924**	0.1917*	0.0038	-0.0827	0.0660**	0.0656***
	(0.1315)	(0.1052)	(0.0819)	(0.0558)	(0.0272)	(0.0164)
PostXControls	x	x	x	x	x	x
Linear Time Trend	x	x	x	x	x	x
Bank Fixed Effects	x	x	x	x	x	x
Asset Weighted		x		x		x
Observations	4,403	4,403	4,403	4,403	4,403	4,403
Number of Banks	119	119	119	119	119	119

Notes: Robust standard errors, clustered at the bank level, are reported in parentheses. Bank characteristics included as controls and interacted with post are total assets, capitalization ratio, a weighted average of borrowers' credit ratings, and credit as a share of assets, all for August 2006. Columns (2), (4), and (6) report results from asset-weighted regressions to account for banks being of different size. We restrict the sample to 119 banks in continuous operation between 2006 and 2009.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Total Credit Operations (Municipality Balance Sheets)

	(1)	(2)
Dep. Variable:	Ln(Tot. Credit Operations)	
Panel A: Govbank=Frac. Branches Govt Owned		
Post	-0.4570***	-0.1993***
	(0.0578)	(0.0312)
PostXGovbank	0.6623***	0.2640***
	(0.0937)	(0.0560)
Panel B: Govbank=High Govt Bank Dummy		
Post	-0.3296***	-0.1058***
	(0.0402)	(0.0195)
PostXGovbank	0.3990***	0.0898***
	(0.0567)	(0.0235)
For both panels:		
PostXPscore	x	x
Linear Time Trend	x	x
Locality Fixed Effects	x	x
Population Weighted		x
Observations	13,005	13,005
Number of Localities	2,601	2,601

Notes: Robust standard errors, clustered at the locality level, are reported in parentheses. Results are shown from regressing the natural logarithm of inflation-adjusted total annual credit operations on post, postXgovbank, postXpscore, locality fixed effects, and a linear time trend. Column (2) shows results from a population-weighted regression to account for localities being of different size. In Panel A, govbank is the fraction of total bank branches in a locality that is government-owned, and in Panel B, govbank is a dummy equal to 1 if the locality has above the median locality share of government bank branches.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: GDP and Value-Added

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable:	Ln(GDP)		Ln(Industrial Value-Added)		Ln(Services Value-Added)	
Panel A: Govbank=Frac. Branches Govt Owned						
Post	-0.0034	-0.0161*	-0.0080	0.0149	-0.0175***	-0.0399***
	(0.0062)	(0.0089)	(0.0116)	(0.0203)	(0.0045)	(0.0072)
PostXGovbank	0.0343***	0.0509***	0.0138	0.0055	0.0217***	0.0558***
	(0.0095)	(0.0144)	(0.0185)	(0.0326)	(0.0073)	(0.0112)
Panel B: Govbank=High Govt Bank Dummy						
Post	0.0026	-0.0020	-0.0041	0.0197	-0.0131***	-0.0225***
	(0.0054)	(0.0067)	(0.0101)	(0.0138)	(0.0039)	(0.0055)
PostXGovbank	0.0218***	0.0242**	0.0062	-0.0033	0.0126**	0.0231***
	(0.0074)	(0.0095)	(0.0148)	(0.0170)	(0.0057)	(0.0069)
For both panels:						
PostXPscore	x	x	x	x	x	x
Linear Time Trend	x	x	x	x	x	x
Locality Fixed Effects	x	x	x	x	x	x
Population Weighted		x		x		x
Observations	13,005	13,005	13,005	13,005	13,005	13,005
Number of Localities	2,601	2,601	2,601	2,601	2,601	2,601

Notes: Robust standard errors, clustered at the locality level, are reported in parentheses. Results are shown from regressing the natural logarithms of locality-level GDP (columns (1) and (2)), industry value-added (columns (3) and (4)), and services value-added (columns (5) and (6)) on post, postXgovbank, postXpscore, locality fixed effects, and a linear time trend. Columns (2), (4), and (6) show results from population-weighted regressions to account for localities being of different size. In Panel A, govbank is the fraction of total bank branches in a locality that is government-owned, and in Panel B, govbank is a dummy equal to 1 if the locality has above the median locality share of government bank branches.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Total Employment, Hours, Wages, and Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Variable:	Ln(Tot. Employment)		Ln(Tot. Hours)		Ln(Tot. Wages)		Ln(Num. of Firms)	
Panel A: Govbank=Frac. Branches Govt Owned								
Post	-0.0363***	-0.0343**	-0.0440***	-0.0423***	-0.0661***	-0.0518***	-0.0137***	-0.0087
	(0.0126)	(0.0160)	(0.0123)	(0.0146)	(0.0144)	(0.0167)	(0.0043)	(0.0073)
PostXGovbank	0.0177	0.0384	0.0302	0.0592**	0.0229	0.0703***	0.0353***	0.0648***
	(0.0189)	(0.0251)	(0.0191)	(0.0233)	(0.0213)	(0.0254)	(0.0071)	(0.0125)
Panel B: Govbank=High Govt Bank Dummy								
Post	-0.0341***	-0.0313***	-0.0363***	-0.0292***	-0.0620***	-0.0361***	-0.0033	0.0099**
	(0.0104)	(0.0102)	(0.0099)	(0.0093)	(0.0118)	(0.0122)	(0.0034)	(0.0048)
PostXGovbank	0.0129	0.0318**	0.0149	0.0340***	0.0144	0.0400***	0.0148***	0.0297***
	(0.0133)	(0.0141)	(0.0129)	(0.0125)	(0.0146)	(0.0142)	(0.0047)	(0.0067)
For both panels:								
PostXPscore	x	x	x	x	x	x	x	x
Linear Time Trend	x	x	x	x	x	x	x	x
Locality Fixed Effects	x	x	x	x	x	x	x	x
Population Weighted		x		x		x		x
Observations	13,005	13,005	13,005	13,005	13,005	13,005	13,005	13,005
Number of Localities	2,601	2,601	2,601	2,601	2,601	2,601	2,601	2,601

Notes: Robust standard errors, clustered at the locality level, are reported in parentheses. Results are shown from regressing the natural logarithms of total employment (columns (1) and (2)), total worker hours (columns (3) and (4)), and total wage bill (columns (5) and (6)) on post, postXgovbank, postXpscore, locality fixed effects, and a linear time trend. Columns (2), (4), and (6) show results from population-weighted regressions to account for localities being of different size. In Panel A, govbank is the fraction of total bank branches in a locality that is government-owned, and in Panel B, govbank is a dummy equal to 1 if the locality has above the median locality share of government bank branches.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Sector-Level Estimations

	(1)	(2)	(3)	(4)
Dep. Variable:	Ln(Tot. Emp.)	Ln(Tot. Hours)	Ln(Tot. Wages)	Ln(Num. of Firms)
Panel A: Govbank=Frac. Branches Govt Owned				
Post	-0.0079	-0.0120	-0.0215	-0.0031
	(0.0062)	(0.0211)	(0.0178)	(0.0030)
PostXGovbank	0.0126	0.0245	0.0594**	0.0143***
	(0.0093)	(0.0317)	(0.0265)	(0.0046)
Panel B: Govbank=High Govt Bank Dummy				
Post	-0.0064	-0.0031	-0.0135	-0.0026
	(0.0054)	(0.0181)	(0.0153)	(0.0026)
PostXGovbank	0.0092	0.0073	0.0419**	0.0127***
	(0.0069)	(0.0223)	(0.0188)	(0.0035)
For both panels:				
PostXPscore	x	x	x	x
Linear Time Trend	x	x	x	x
SectorXLocality Fixed Effects	x	x	x	x
Observations	221,085	221,085	221,085	221,085
Number of Sectors	17	17	17	17
Number of Localities	2,601	2,601	2,601	2,601

Notes: Robust standard errors, clustered at the locality-sector level, are reported in parentheses. Results are shown from regressing the natural logarithms of total employment (column (1)), total worker hours (column (2)), total wage bill (column (3)), and total number of firms (column (4)) on post, postXgovbank, postXpscore, localityXsector fixed effects, and a linear time trend. In Panel A, govbank is the fraction of total bank branches in a locality that is government-owned, and in Panel B, govbank is a dummy equal to 1 if the locality has above the median locality share of government bank branches.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8: Neighboring Localities

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable:	Ln(Credit)	Ln(GDP)	Ln(Emp.)	Ln(Hours)	Ln(Wages)	Ln(Firms)
Post	0.0041	0.0050*	-0.0003	-0.0018	-0.0018	0.0049***
	(0.0139)	(0.0028)	(0.0041)	(0.0044)	(0.0054)	(0.0016)
PostXΔGovbank	0.6440***	0.0217***	0.0198**	0.0307***	0.0287**	0.0106**
	(0.0591)	(0.0067)	(0.0097)	(0.0112)	(0.0121)	(0.0045)
PostXΔPscore	x	x	x	x	x	x
Linear Time Trend	x	x	x	x	x	x
Locality-Pair Fixed Effects	x	x	x	x	x	x
Observations	29,205	29,205	29,205	29,205	29,205	29,205
Locality Pairs	5,841	5,841	5,841	5,841	5,841	5,841
Localities	2,562	2,562	2,562	2,562	2,562	2,562

Notes: Robust standard errors, clustered at the locality-pair level, are reported in parentheses. Results are shown from regressing the difference in the natural logarithms of total credit (column (1)), GDP (column (2)), total employment (column (3)), total worker hours (column (4)), total wage bill (column (5)), and number of firms (column (6)) between neighboring localities on post, postXΔgovbank, postXΔpscore, locality-pair fixed effects, and a linear time trend. Δgovbank is the difference in the fraction of bank branches that is government-owned, and Δpscore is the difference in the standardized propensity score between neighboring localities. Localities with neighbors that do not have a bank branch and locality-pairs that cross state boundaries are excluded from the sample.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9: Instrumental Variables Estimates of the Effects of Credit on Production, Employment, Wages, and Firms

Dep. variable:	(1) Ln(GDP)	(2) Ln(Emp.)	(3) Ln(Hours)	(4) Ln(Wages)	(5) Ln(Firms)	(6) Δ Ln(GDP)	(7) Δ Ln(Emp.)	(8) Δ Ln(Hours)	(9) Δ Ln(Wages)	(10) Δ Ln(Firms)
	Panel Fixed Effects					Cross-Sectional Pre-to-Post Crisis Differences				
Ln (Credit)	0.0508***	0.0266	0.0467*	0.0355	0.0540***					
	(0.0146)	(0.0256)	(0.0266)	(0.0289)	(0.0116)					
Δ Ln (Credit)						0.0518***	0.0268	0.0456*	0.0345	0.0533***
						(0.0147)	(0.0259)	(0.0267)	(0.0292)	(0.0115)
Locality Fixed Effects	x	x	x	x	x					
Linear Time Trend and Interactions	x	x	x	x	x					
PostXPscore	x	x	x	x	x					
Pscore						x	x	x	x	x
First Stage F-Stat	31.22	31.22	31.22	31.22	31.22	32.12	32.12	32.12	32.12	32.12
Hansen-Sargan P-val.	0.26	0.88	0.48	0.55	0.16	--	--	--	--	--
Observations	13005	13005	13005	13005	13005	2601	2601	2601	2601	2601
Number of Localities	2601	2601	2601	2601	2601	2601	2601	2601	2601	2601

Notes: Robust standard errors are reported in parentheses. For columns (1)-(5), standard errors are clustered at the locality level. Columns (1)-(5) show results from an instrumental variables estimation of ln y = ln(credit)+post+postXpscore+trend+postXtrend+postXpscoreXtrend+localityFE+ε, where we have instrumented for ln(credit) using postXfrac. branches gov.-owned and postXfrac. branches gov.-ownedXtrend. Columns (6)-(10) show results from regressing the difference between average pre and post-crisis ln y on the difference between average pre and post-crisis ln(credit) and the pscore: Δ ln y = Δ ln(credit) + pscore +ε, where we instrument for Δ ln(credit) with the fraction of bank branches that is government-owned in the locality prior to the crisis.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 10: Interactions with Credit Dependence

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dep. Variable:	Ln(Credit)	Ln(GDP)	Ln(Emp.)	Ln(Hours)	Ln(Wages)	Ln(Firms)	Ln(Credit)	Ln(GDP)	Ln(Emp.)	Ln(Hours)	Ln(Wages)	Ln(Firms)
High:	High Fraction of Small Firms						High External Dependence					
Panel A: Govbank=Frac. Branches Govt Owned												
Post	-0.4105***	0.0037	-0.0338*	-0.0380*	-0.0618***	0.0065	-0.4855***	-0.0094	-0.0463**	-0.0594***	-0.0789***	-0.0097*
	(0.0939)	(0.0095)	(0.0205)	(0.0195)	(0.0224)	(0.0061)	(0.0983)	(0.0085)	(0.0196)	(0.0187)	(0.0213)	(0.0059)
PostXGovbank	0.6529***	0.0196	0.0085	0.0155	0.0106	0.0319***	0.6844***	0.0363***	0.0295	0.0528*	0.0424	0.0407***
	(0.1406)	(0.0150)	(0.0308)	(0.0305)	(0.0340)	(0.0105)	(0.1410)	(0.0117)	(0.0288)	(0.0292)	(0.0317)	(0.0095)
PostXHigh	-0.0866	-0.0122	-0.0040	-0.0101	-0.0072	-0.0376***	0.0503	0.0106	0.0176	0.0271	0.0226	-0.0071
	(0.1314)	(0.0109)	(0.0187)	(0.0187)	(0.0216)	(0.0069)	(0.1338)	(0.0107)	(0.0174)	(0.0176)	(0.0204)	(0.0068)
PostXHighXGovbank	0.0065	0.0257	0.0166	0.0261	0.0218	0.0016	-0.0350	-0.0015	-0.0209	-0.0423	-0.0367	-0.0138
	(0.1726)	(0.0167)	(0.0290)	(0.0310)	(0.0344)	(0.0121)	(0.1742)	(0.0166)	(0.0272)	(0.0294)	(0.0329)	(0.0120)
Panel B: Govbank=High Govt Bank Dummy												
Post	-0.2500***	0.0124*	-0.0360**	-0.0350**	-0.0663***	0.0151***	-0.3520***	0.0021	-0.0411***	-0.0461***	-0.0679***	0.0013
	(0.0618)	(0.0075)	(0.0153)	(0.0144)	(0.0167)	(0.0043)	(0.0700)	(0.0072)	(0.0151)	(0.0142)	(0.0164)	(0.0044)
PostXGovbank	0.3478***	0.0034	0.0123	0.0099	0.0188	0.0157**	0.4183***	0.0152	0.0190	0.0275	0.0216	0.0195***
	(0.0773)	(0.0111)	(0.0201)	(0.0194)	(0.0217)	(0.0065)	(0.0844)	(0.0094)	(0.0187)	(0.0182)	(0.0202)	(0.0060)
PostXHigh	-0.1565	-0.0180**	0.0038	-0.0020	0.0082	-0.0375***	0.0402	0.0012	0.0124	0.0174	0.0104	-0.0088*
	(0.0988)	(0.0086)	(0.0135)	(0.0134)	(0.0157)	(0.0052)	(0.1004)	(0.0085)	(0.0127)	(0.0127)	(0.0149)	(0.0051)
PostXHighXGovbank	0.0939	0.0326***	0.0009	0.0087	-0.0079	-0.0004	-0.0344	0.0144	-0.0109	-0.0240	-0.0135	-0.0116
	(0.1031)	(0.0118)	(0.0178)	(0.0188)	(0.0212)	(0.0076)	(0.1038)	(0.0117)	(0.0164)	(0.0175)	(0.0200)	(0.0075)
For both panels:												
PostXPscore	x	x	x	x	x	x	x	x	x	x	x	x
Linear Time Trend	x	x	x	x	x	x	x	x	x	x	x	x
Locality Fixed Effects	x	x	x	x	x	x	x	x	x	x	x	x
Observations	13,005	13,005	13,005	13,005	13,005	13,005	13,005	13,005	13,005	13,005	13,005	13,005
Number of Localities	2,601	2,601	2,601	2,601	2,601	2,601	2,601	2,601	2,601	2,601	2,601	2,601

Notes: Robust standard errors, clustered at the locality level, are reported in parentheses. Results are shown from regressing the natural logarithms of total credit, GDP, total employment, total worker hours, total wage bill, and number of firms on post, postXgovbank, postXhigh, postXhighXgovbank, postXpscore, locality fixed effects, and a linear time trend. "High" is alternately a dummy equal to 1 if the locality has above the median fraction of small firms (columns (1)-(6)) or a dummy equal to 1 if the locality has above the median measure of external dependence (columns (7)-(12)). In Panel A, govbank is the fraction of total bank branches in a locality that is government-owned, and in Panel B, govbank is a dummy equal to 1 if the locality has above the median locality share of government bank branches.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 11: Political Economy and Lending

	(1)	(2)	(3)	(4)
Dep. Variable:	Total Credit Operations			
Alignment:	PT Mayor		Coalition Mayor	
Panel A: Govbank=Frac. Branches Govt Owned				
Post	-0.5081***	-0.1983***	-0.4307***	-0.1981***
	(0.0509)	(0.0287)	(0.0709)	(0.0337)
PostXGovbank	0.8281***	0.3754***	0.7493***	0.3819***
	(0.0709)	(0.0476)	(0.0909)	(0.0583)
PostXAlignment	0.0295	-0.0019	-0.1170	-0.0004
	(0.0996)	(0.0443)	(0.0857)	(0.0325)
PostXAlignmentXGovbank	0.0553	0.0536	0.1383	0.0025
	(0.1594)	(0.1095)	(0.1106)	(0.0535)
Panel B: Govbank=High Govt Bank Dummy				
Post	-0.3696***	-0.0663***	-0.3103***	-0.0678***
	(0.0415)	(0.0181)	(0.0579)	(0.0258)
PostXGovbank	0.5341***	0.1333***	0.4902***	0.1315***
	(0.0480)	(0.0246)	(0.0626)	(0.0325)
PostXAlignment	0.1149	0.0186	-0.0675	0.0081
	(0.0729)	(0.0226)	(0.0675)	(0.0281)
PostXAlignmentXGovbank	-0.0971	-0.0130	0.0499	-0.0014
	(0.0868)	(0.0420)	(0.0716)	(0.0336)
For both panels:				
PostXPscore	x	x	x	x
Linear Time Trend	x	x	x	X
Locality Fixed Effects	x	x	x	X
Population Weighted		x		x
Observations	96,237	96,237	96,237	96,237
Number of Localities	2,601	2,601	2,601	2,601

Notes: Robust standard errors, clustered at the locality level, are reported in parentheses. Results are shown from regressing the natural logarithm of total monthly credit on post, postXgovbank, postXalignment, postXalignmentXgovbank, postXpscore, locality fixed effects, and a linear time trend. "Alignment" is an electorate-weighted average of a locality's mayoral alignment with the presidential party (columns (1) and (2)) or with one of the parties in the federal government's coalition (columns (3) and (4)) in either 2004 or 2008. Columns (2) and (4) show results from population-weighted regressions to account for localities being of different size. In Panel A, govbank is the fraction of total bank branches in a locality that is government-owned, and in Panel B, govbank is a dummy equal to 1 if the locality has above the median locality share of government bank branches.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 12: Quality of Loans – National Level Bank Balance Sheets

Dep. Variable:	(1) Capitalization Ratio	(2) Borrowers' Credit Rating	(3) Ln(Loan Loss Provisions)	(4) Ln(Credit Earnings)
Panel A: Non Asset Weighted				
Post	-0.0055	-0.0219**	0.0649*	-0.0017
	(0.0075)	(0.0091)	(0.0351)	(0.0072)
PostXGovbank	-0.0115	0.0165	-0.0697	-0.0097
	(0.0190)	(0.0165)	(0.0945)	(0.0130)
Panel B: Asset Weighted				
Post	-0.0496***	-0.0123	0.0078	-0.0101
	(0.0181)	(0.0163)	(0.0282)	(0.0096)
PostXGovbank	-0.0010	0.0185	-0.0315*	0.0090
	(0.0203)	(0.0153)	(0.0162)	(0.0076)
PostXControls	x	x	x	x
Linear Time Trend	x	x	x	x
Bank Fixed Effects	x	x	x	x
Observations	4,403	4,403	4,403	3,922
Number of Banks	119	119	119	106

Notes: Robust standard errors, clustered at the bank level, are reported in parentheses. Results are shown from regressing the monthly capitalization ratio (column (1)), borrowers' average credit ratings (column (2)), and the natural logarithms of loan loss provisions (column (3)) and credit earnings (column (4)) on post, postXgovbank, postXcontrols, bank fixed effects, and a linear time trend. "Govbank" is a dummy equal to 1 if the bank is owned by the federal government; note that these estimations are all at the national bank level, as opposed to the locality level, which means that govbank can only be a binary variable and not a continuous share of government bank branches as was the case in the locality-level regressions. Controls include the natural logarithm of total assets, the capitalization ratio, a weighted average of borrowers' credit ratings, and credit as a share of assets, all for August 2006, prior to the onset of the financial crisis. Panel A reports non asset-weighted results, while Panel B reports asset-weighted results to account for banks being of different size. We restrict the sample to 119 banks in continuous operation between 2006 and 2009. The sample size is limited by data availability to 106 banks in column (4).

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 13: Alternative Clustering, Controls, Sample Selection, and Placebos

	(1)	(2)	(3)	(4)	(5)	(6)	
Dep. Variable:	Ln(Credit)	Ln(GDP)	Ln(Emp.)	Ln(Hours)	Ln(Wages)	Ln(Firms)	Localities
(A) Base Case	0.2640***	0.0509***	0.0384	0.0592**	0.0703***	0.0648***	2,601
	(0.0560)	(0.0144)	(0.0251)	(0.0233)	(0.0254)	(0.0125)	
Standard Errors							
(B) S.E. Clustered at State-Year Level	0.2640***	0.0509***	0.0384**	0.0592***	0.0703**	0.0648***	2,601
	(0.0738)	(0.0154)	(0.0172)	(0.0189)	(0.0284)	(0.0116)	
Controls and Matching							
(C) No Post X Pscore	0.1780***	0.0649***	0.0343**	0.0545***	0.1335***	0.0999***	2,601
	(0.0443)	(0.0109)	(0.0136)	(0.0139)	(0.0143)	(0.0104)	
(D) Include Locality Specific Pre-Trends	0.2278**	0.0184	-0.0053	0.0074	0.0737**	0.0582***	2,601
	(0.1046)	(0.0188)	(0.0290)	(0.0295)	(0.0349)	(0.0144)	
(E) Include Post X FracGovWorkers	0.2525***	0.0409***	0.0338	0.0437*	0.0413	0.0506***	2,601
	(0.0608)	(0.0146)	(0.0286)	(0.0258)	(0.0283)	(0.0124)	
(F) Post X PScore Block Dummies (no Post X Pscore)	0.2492***	0.0511***	0.0353	0.0544**	0.0663**	0.0594***	2,601
	(0.0539)	(0.0145)	(0.0259)	(0.0239)	(0.0261)	(0.0122)	
(G) Post X Fixed Locality Controls (no Post X PScore)	0.3227***	0.0434***	0.0270	0.0438*	0.0525**	0.0453***	2,601
	(0.0537)	(0.0146)	(0.0252)	(0.0230)	(0.0257)	(0.0101)	
Samples and Spatial Units							
(H) Trim by Propensity Score	0.3839***	0.0346**	0.0308	0.0499**	0.0588**	0.0515***	2,081
	(0.0587)	(0.0141)	(0.0204)	(0.0212)	(0.0236)	(0.0103)	
(I) Collapse to Metro Areas	0.2412***	0.0565***	0.0459	0.0647**	0.0645**	0.0696***	2,239
	(0.0827)	(0.0160)	(0.0284)	(0.0263)	(0.0286)	(0.0154)	
Placebo							
(J) Counterfactually Assign "Govbank" Based on P-score	0.0355*	0.0052	0.0008	-0.0011	0.0067	-0.0078	2,601
	(0.0190)	(0.0126)	(0.0092)	(0.0086)	(0.0111)	(0.0057)	

Notes: Robust standard errors are reported in parentheses. Each cell reports the coefficient on postXgovbank from a different regression of the natural logarithms of total credit, GDP, total employment, total worker hours, total wage bill, and number of firms on post, postXgovbank, locality fixed effects, a linear time trend, and depending on the specification, on postXpscore, postXpscore block dummies, or postXfixed locality characteristics. Govbank is the fraction of government bank branches in a locality, except in row (J), where it is a dummy variable equal to 1 that is randomly assigned based on the propensity score. All estimations are population-weighted and include locality fixed effects as well as a linear time trend. For rows (A), (B), (D), (E), (H), (I), and (J), estimations include postXpscore. For rows (C), (F), and (G), postXpscore is excluded and replaced with postXpscore block dummies in row (F) and with postXfixed locality characteristics in row (G). Rows (A)-(G) present results using the base-case sample, row (H) presents results from trimming the sample by the top and bottom ten percent of the propensity score distribution, and row (I) presents results from collapsing localities into metro areas based on Brazilian statistical definitions of commuting zones and common labor markets. In row (B), standard errors are clustered at the state-year level; in row (I), they are clustered at the metro area level; for remaining rows, they are clustered at the locality level.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 14: Alternative Explanations

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable:	Ln (Gov. Transfers)		Ln (Gov. Workers)		Ln (Const. Workers)	
Panel A: Govbank=Frac. Branches Govt Owned						
Post	0.0854***	0.1338***	-0.0607**	0.0056	0.0923*	0.1043
	(0.0038)	(0.0217)	(0.0246)	(0.0614)	(0.0521)	(0.0645)
PostXGovbank	0.0130**	-0.0762*	-0.0144	0.0071	-0.0394	-0.0640
	(0.0061)	(0.0424)	(0.0365)	(0.0536)	(0.0789)	(0.1019)
Panel B: Govbank=High Govt Bank Dummy						
Post	0.0885***	0.0989***	-0.0702***	-0.0140	0.0851*	0.0484
	(0.0032)	(0.0065)	(0.0213)	(0.0477)	(0.0442)	(0.0515)
PostXGovbank	0.0068	-0.0119	0.0033	0.0414	-0.0246	0.0368
	(0.0045)	(0.0103)	(0.0262)	(0.0281)	(0.0565)	(0.0740)
For both panels:						
PostXPscore	x	x	x	x	x	x
Linear Time Trend	x	x	x	x	x	x
Locality Fixed Effects	x	x	x	x	x	x
Population Weighted		x		x		x
Observations	13,005	13,005	13,005	13,005	13,005	13,005
Number of Localities	2,601	2,601	2,601	2,601	2,601	2,601

Notes: Robust standard errors, clustered at the locality level, are reported in parentheses. Results are shown from regressing the natural logarithms of federal government transfers to localities, the number of public sector workers in a locality, and the number of construction workers in a locality on post, postXgovbank, postXpscore, locality fixed effects, and a linear time trend. Columns (2), (4), and (6) show results from population-weighted regressions to account for localities being of different size. In Panel A, govbank is the fraction of total bank branches in a locality that is government-owned, and in Panel B, govbank is a dummy equal to 1 if the locality has above the median locality share of government bank branches.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 15: Productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Variable:	TFP		Change in TFP		TFP		Change in TFP	
	TFP Calculated Using Labor=Total Employment				TFP Calculated Using Labor=Total Worker Hours			
Panel A: Govbank=Frac. Branches Govt Owned								
Govbank			0.0142*	0.0235**			0.0149*	0.0241**
			(0.0075)	(0.0114)			(0.0076)	(0.0117)
Post	0.0148***	0.0094*			0.0138***	0.0082*		
	(0.0037)	(0.0048)			(0.0038)	(0.0050)		
PostXGovbank	0.0090*	0.0104			0.0104*	0.0123*		
	(0.0054)	(0.0063)			(0.0055)	(0.0064)		
Panel B: Govbank=High Govt Bank Dummy								
Govbank			0.0074	0.0084			0.0081	0.0098
			(0.0052)	(0.0068)			(0.0053)	(0.0068)
Post	0.0183***	0.0147***			0.0174***	0.0128***		
	(0.0031)	(0.0038)			(0.0032)	(0.0042)		
PostXGovbank	0.0024	0.0006			0.0035	0.0039		
	(0.0041)	(0.0035)			(0.0042)	(0.0040)		
For both panels:								
PostXPscore	x	x			x	x		
Linear Time Trend	x	x			x	x		
Locality Fixed Effects	x	x			x	x		
Population Weighted		x		x		x		x
Observations	26,010	26,010	2,601	2,601	26,010	26,010	2,601	2,601
Number of Localities	2,601	2,601	2,601	2,601	2,601	2,601	2,601	2,601

Notes: Robust standard errors, clustered at the locality level, are reported in parentheses. In columns (1), (2), (5), and (6), results are shown from regressing yearly Solow residuals on post, postXgovbank, postXpscore, locality fixed effects, and a linear time trend. In columns (3), (4), (7), and (8), results are shown from regressing the 2007-2009 change in the Solow residual on govbank. The Solow residual is alternately calculated using total employment (columns (1)-(4)) or total worker hours (columns (5)-(8)) as a measure of labor. Columns (2), (4), (6), and (8) show results from population-weighted regressions to account for localities being of different size. In Panel A, govbank is the fraction of total bank branches in a locality that is government-owned, and in Panel B, govbank is a dummy equal to 1 if the locality has above the median locality share of government bank branches.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix A: Conceptual Framework [NOT FOR PUBLICATION]

This appendix presents a model to explain why private banks might lend differently than government banks during financial crises, and how this differential lending might affect economic outcomes such as production, employment, and incomes. The intuition is that private banks may lend less because of funding constraints or because of a combination of greater risk aversion, loan losses, or a more pessimistic world outlook. If lending is used for capital investment and if capital complements labor in production, then declines in lending can lead to declines in GDP, employment, and income, with the magnitude of declines depending on the wage elasticity and the capital intensity of production.

A.1 Banks

There are three agents in this framework: banks, firms, and workers. Banks pay a deposit rate, r_d, on deposits, D. They lend out a fraction, γ, of deposits at interest rate r_l. There are two states of the world. A good state occurs with probability p. In this state, loans are repaid with interest. A bad state occurs with probability $(1-p)$. In this state, banks do not receive interest on their loans; they lose a fraction, δ, of what was lent; and they must recapitalize, contributing $\delta\gamma D$ from their own capital. Banks profits in the good, g, and bad, b, states can be written as:

$$\begin{aligned} \pi_g &= r_l\gamma D - r_d D, \qquad \textbf{(a)} \\ \pi_b &= 0 - r_d D - \delta\gamma D. \qquad \textbf{(b)} \end{aligned} \tag{A.1}$$

Banks have initial valuation, V. Their objective is to maximize a welfare function of their expected valuation in the next period by choosing a fraction, γ, of deposits to lend. This welfare function, capturing risk aversion and following Stiglitz and Greenwald (2003), can be expressed as:

$$W = p\frac{(V + r_l\gamma D - r_d D)^{1-\sigma}}{1-\sigma} + (1-p)\frac{(V + 0 - r_d D - \delta\gamma D)^{1-\sigma}}{1-\sigma}. \tag{A.2}$$

Maximizing this welfare function with respect to γ and simplifying yields:

$$\gamma^* = \frac{(V - r_d D)(\phi^{\frac{1}{\sigma}} - 1)}{D(r_l + \delta\phi^{\frac{1}{\sigma}})}, \tag{A.3}$$

where $\phi = \frac{pr_d}{(1-p)\delta}$ and σ is a measure of risk aversion. The expression in (A.3) provides the optimal fraction of deposits banks are willing to lend. Assuming banks are risk averse $(\sigma > 1)$ and their original valuation is always greater than the dividends paid to depositors

$(V - r_d D > 0)$, then in order for banks to lend, it must be the case that $\phi = \frac{pr_d}{(1-p)\delta} > 1$; this condition states that expected gains must be greater than expected losses.

We can now analyze what happens to the optimal fraction of deposits lent. As the probability of the good state increases, banks are willing to lend more (i.e., $\partial\gamma^* / \partial p > 0$); as risk aversion increases, banks are willing to lend less (i.e., $\partial\gamma^* / \partial\sigma < 0$); and as potential loan losses in the bad state increase, banks are willing to lend less (i.e., $\partial\gamma^* / \partial\delta < 0$).[1] Since lending is equal to a fraction of deposits, $C = \gamma D$, lending can decline if either γ or D declines. In the empirical section, we examine whether the reason for the relative decline in lending by private banks is due to relative declines in γ or D.

A.2 Firms, Employment, and Output

Lending is assumed to be transformed one-for-one into capital, $K = C = \gamma D$, which firms rent and use in production. Firms produce a globally traded good priced at 1, using capital and labor, according to a Cobb-Douglas production function. Firms maximize profit,

$$\pi = K^{\alpha} L^{1-\alpha} - r_l K - wL, \tag{A.4}$$

where K is capital, L is labor, r_l is the rental rate of capital, and w is wages. Since production is assumed to be constant returns to scale, there are an indeterminate number of firms of indeterminate size, and factor markets are competitive, with capital and labor paid their marginal products:

$$\begin{aligned} r_l &= \alpha K^{\alpha-1} L^{1-\alpha}, && \text{(a)} \\ w &= (1-\alpha) K^{\alpha} L^{-\alpha}. && \text{(b)} \end{aligned} \tag{A.5}$$

In the short-run, local labor supply is inelastic, and for simplicity, normalized to 1. With full employment, initial period wages are $w_1 = (1-\alpha)(\gamma_1 D_1)^{\alpha}$ and initial period output is $y_1 = (\gamma_1 D_1)^{\alpha}$.

We are interested in a shock to lending, either through a reduction in γ or D. In the second period, there is a decline in lending, with $\gamma_2 D_2 < \gamma_1 D_1$. Given labor is inelastically supplied, if wages can freely adjust downward, then $w_2 = (1-\alpha)(\gamma_2 D_2)^{\alpha}$ and labor

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[1] Assuming $V - r_d D > 0$ and $\phi > 1$, so that banks are willing to lend, $\frac{\partial\gamma^*}{\partial p} = \frac{(r_l + \delta)(V - r_d D)\phi^{\frac{1}{\sigma}}}{p(1-p)\sigma D(r_l + \delta\phi^{\frac{1}{\sigma}})^2} > 0$, $\frac{\partial\gamma^*}{\partial\sigma} = -\frac{\phi^{\frac{1}{\sigma}} \ln\phi (r_l + \delta)(V - r_d D)}{\sigma^2 D(r_l + \delta\phi^{\frac{1}{\sigma}})^2} < 0$, and $\frac{\partial\gamma^*}{\partial\delta} = -\frac{\phi^{\frac{1}{\sigma}}(r_l + \delta + \delta\sigma\phi^{\frac{1}{\sigma}} - \delta\sigma)(V - r_d D)}{\sigma\delta D(r_l + \delta\phi^{\frac{1}{\sigma}})^2} < 0$.

demand in the second period is 1, with full employment. If wages are downwardly rigid, however, then there will be unemployment. Letting $\eta \in [0,1]$ be a measure of wage elasticity, with $\eta = 1$ implying that wages are completely elastic, then wages in the second period can be expressed as $w_2 = (1-\alpha)[\eta(\gamma_2 D_2)^{\alpha} + (1-\eta)(\gamma_1 D_1)^{\alpha}]$. We can now write an expression for labor demand in the second period as a function of lending, the wage elasticity, and the technology parameter, α:

$$L_2 = \left(\frac{1}{\eta + (1-\eta)(\frac{\gamma_1 D_1}{\gamma_2 D_2})^{\alpha}} \right)^{\frac{1}{\alpha}}. \tag{A.6}$$

Given $0 < \eta < 1$ and $\gamma_2 D_2 < \gamma_1 D_1$, there will be unemployment, with $L_2 < 1$. Assuming $D_1 = D_2$, with the decline in lending due to a reduction in γ, we can simplify equation (A.6) and take the natural logarithm to obtain:

$$\ln L_2 = -\tfrac{1}{\alpha} \ln(\eta + (1-\eta)(\tfrac{\gamma_1}{\gamma_2})^{\alpha}). \tag{A.7}$$

Similarly, we can write the following expression for output in the second period:

$$\ln y_2 = \alpha \ln(\gamma_2 D_2) - \tfrac{1-\alpha}{\alpha} \ln(\eta + (1-\eta)(\tfrac{\gamma_1}{\gamma_2})^{\alpha}). \tag{A.8}$$

A.3 Comparative Statics

We can now perform comparative statics on equations (A.7) and (A.8) and analyze how employment and output respond to a change in γ_2 depending on the wage elasticity, η, and technology parameter, α.

As γ_2 declines, in other words, as lending declines, both employment and output decline. A higher wage elasticity (a higher value of η) mitigates the decline in both employment and output due to a decline in lending. Finally, as production becomes more capital intensive (with higher values of α), a given decline in lending results in larger declines in output and smaller declines in employment.[2]

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[2] We can differentiate equations (A.7) and (A.8) to obtain the following: $\frac{\partial \ln L_2}{\partial \gamma_2} = \frac{(1-\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha}}{\gamma_2\left(\eta + (1-\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha}\right)} > 0$, $\frac{\partial \ln y_2}{\partial \gamma_2} = \frac{\alpha\eta + (1-\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha}}{\eta + (1-\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha}} > 0$, $\frac{(\partial \ln L_2)^2}{\partial \gamma_2 \partial \eta} = \frac{-(\frac{\gamma_1}{\gamma_2})^{\alpha}}{\gamma_2\left(\eta + (1-\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha}\right)^2} < 0$, $\frac{(\partial \ln y_2)^2}{\partial \gamma_2 \partial \eta} = \frac{-(1-\alpha)(\frac{\gamma_1}{\gamma_2})^{\alpha}}{\gamma_2\left(\eta + (1-\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha}\right)^2} < 0$, $\frac{(\partial \ln L_2)^2}{\partial \gamma_2 \partial \alpha} = \frac{-\eta(1-\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha} \ln(\frac{\gamma_1}{\gamma_2})}{\gamma_2\left(\eta + (1-\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha}\right)^2} < 0$ for $\gamma_2 < \gamma_1$, and $\frac{(\partial \ln y_2)^2}{\partial \gamma_2 \partial \eta} = \frac{\eta\left(\eta + (1-\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha} + (1-\eta-\alpha+\alpha\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha} \ln(\frac{\gamma_1}{\gamma_2})\right)}{\gamma_2\left(\eta + (1-\eta)(\frac{\gamma_1}{\gamma_2})^{\alpha}\right)^2} > 0$ for $\gamma_2 < \gamma_1$ and $\alpha, \eta \in (0,1)$.

The comparative statics are fairly intuitive. With greater wage elasticity, shocks to lending are transmitted to wages rather than to employment and output. Since wages can adjust, employment and output remain high despite a decline in lending. Moreover, for industries that are more capital intensive, a decline in lending has less of an effect on employment and a greater effect on output.

This framework yields several testable implications. First, we can test whether a decline in lending is due to a decline in a bank's loanable funds or to a decline in the share of funds it is willing to lend. Second, we can test whether declines in lending lead to declines in employment and output, and whether these declines are greater depending on the capital intensity of industries and the labor market rigidities in a locality (these latter results are shown in Table A1).

Table A1: Interactions with Local Capital Intensity and Labor Market Flexibility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Variable:	GDP	Total Hours	GDP	Total Hours	GDP	Total Hours	GDP	Total Hours
Additional Control:	Industry Fraction		High Industrial		Informal Fraction		Unemployment Rate	
Panel A: Govbank=Frac. Branches Govt Owned								
Post	-0.0115**	-0.0443***	-0.0023	-0.0596***	-0.0172***	-0.0498***	-0.0144***	-0.0479***
	(0.0056)	(0.0095)	(0.0074)	(0.0152)	(0.0055)	(0.0097)	(0.0056)	(0.0097)
PostXGovbank	0.0479***	0.0261*	0.0584***	0.0657***	0.0603***	0.0411***	0.0541***	0.0361**
	(0.0084)	(0.0135)	(0.0098)	(0.0213)	(0.0081)	(0.0148)	(0.0083)	(0.0146)
PostXControl	-0.0081	0.0141*	-0.0185*	0.0283	0.0213***	0.0194*	0.0009	0.0115
	(0.0063)	(0.0085)	(0.0108)	(0.0172)	(0.0046)	(0.0103)	(0.0052)	(0.0100)
PostXControlXGovbank	-0.0167*	-0.0461***	-0.0196	-0.0746***	-0.0208***	-0.0223	-0.0117	-0.0190
	(0.0089)	(0.0128)	(0.0173)	(0.0280)	(0.0072)	(0.0174)	(0.0078)	(0.0163)
Panel B: Govbank=High Govt Bank Dummy								
Post	-0.0080*	-0.0425***	-0.0059	-0.0522***	-0.0074	-0.0400***	-0.0087*	-0.0427***
	(0.0047)	(0.0079)	(0.0069)	(0.0135)	(0.0047)	(0.0073)	(0.0047)	(0.0079)
PostXGovbank	0.0371***	0.0216**	0.0583***	0.0484***	0.0401***	0.0224***	0.0404***	0.0245***
	(0.0058)	(0.0089)	(0.0080)	(0.0157)	(0.0058)	(0.0086)	(0.0058)	(0.0091)
PostXControl	-0.0022	0.0080	-0.0041	0.0182	0.0137***	0.0163**	0.0018	0.0098
	(0.0050)	(0.0072)	(0.0086)	(0.0141)	(0.0039)	(0.0082)	(0.0043)	(0.0080)
PostXControlXGovbank	-0.0255***	-0.0324***	-0.0429***	-0.0514***	-0.0090	-0.0168	-0.0116**	-0.0143
	(0.0064)	(0.0088)	(0.0118)	(0.0183)	(0.0056)	(0.0112)	(0.0056)	(0.0101)
For both panels:								
Linear Time Trend	x	x	x	x	x	x	x	X
Locality Fixed Effects	x	x	x	x	x	x	x	x
Observations	13,005	13,005	13,005	13,005	13,005	13,005	13,005	13,005
Number of Localities	2,601	2,601	2,601	2,601	2,601	2,601	2,601	2,601

Notes: Robust standard errors, clustered at the locality level, are reported in parentheses. Results are shown from regressing the natural logarithms of locality GDP and total hours on post, postXgovbank, postXcontrol, and postXcontrolXgovbank, locality fixed effects, and a linear time trend. "Control" is alternately the fraction of employment in industry (columns (1) and (2)), a dummy equal to 1 if the locality has above the median share of industrial employment (columns (3) and (4)), the fraction of the working population that is in the informal sector (columns (5) and (6)), and the fraction of the working-age population that is not employed (columns (7) and (8)). In Panel A, govbank is the fraction of total bank branches in a locality that is government-owned, and in Panel B, govbank is a dummy equal to 1 if the locality has above the median locality share of government bank branches. In localities with more capital-intensive industries, the impact of a decline in lending should be reflected more in GDP than in labor since labor is a less important input into production. In areas with more flexible labor markets, a decline in lending should be reflected less in GDP and possibly more in employment and wages. As a measure of capital intensity, we consider the fraction of a locality's workforce initially employed in heavy industries or manufacturing. As a measure of labor market flexibility, we consider the pre-crisis share of workers in the informal sector and the pre-crisis share of the working-age population that is not employed. In more capital-intensive localities, post-crisis declines in GDP are indeed slightly larger while declines in employment are similar to those in less capital-intensive areas. While having a higher share of government bank branches buttresses GDP in these areas, their effect on GDP is smaller than in less capital-intensive localities. In localities with more flexible labor markets, the declines in GDP and employment following the onset of the crisis are smaller in magnitude. As predicted by the conceptual framework, in areas where there is more slack in the labor market, there appears to be smaller declines in both GDP and employment since firms can presumably substitute more easily between labor and capital.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix B: Propensity Score [NOT FOR PUBLICATION]

This appendix provides information on the calculation of the propensity score. The propensity to have more than the median share of government bank branches is calculated using the following locality characteristics taken from 2000 census data: years of education, urbanization rate, illiteracy rate, average per capita income, and the natural logarithms of population, total locality income, total locality employment, a measure of total locality human capital, and several interactions of these. The results of the logit estimation are shown in Table B1. Localities are stratified into 18 propensity score blocks. Within each propensity score block, we cannot reject at the 5% significance level that at least 95% of the covariates are statistically indistinguishable across localities. Figure B1 shows the overlap in the box plots of the estimated propensity scores for localities above and below the median share of government bank branches.

Figure B1: Box Plot of Estimated Propensity Scores for Localities with High and Low Shares of Government Bank Branches

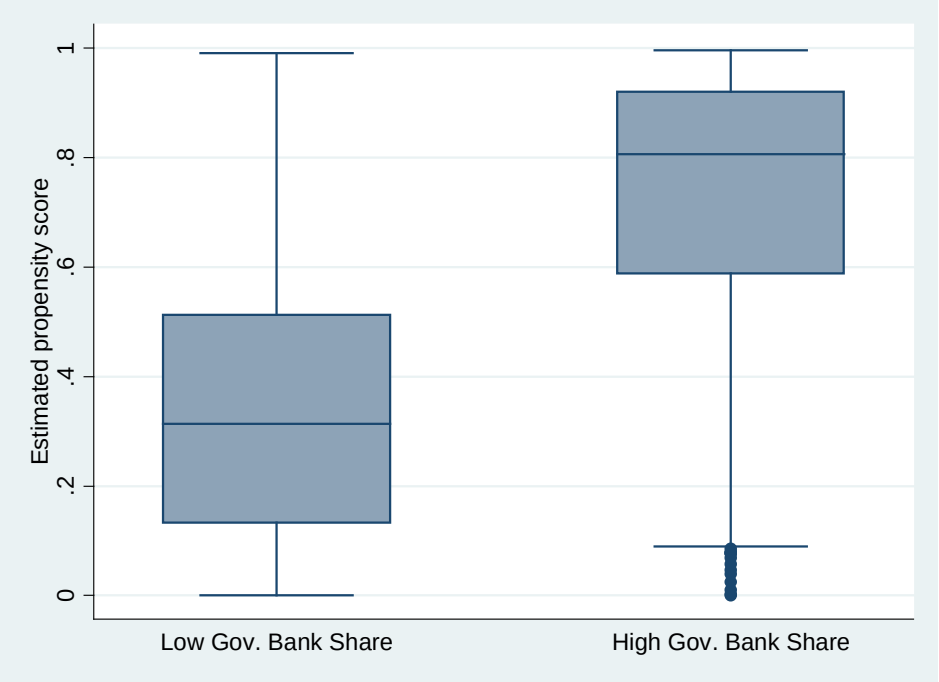


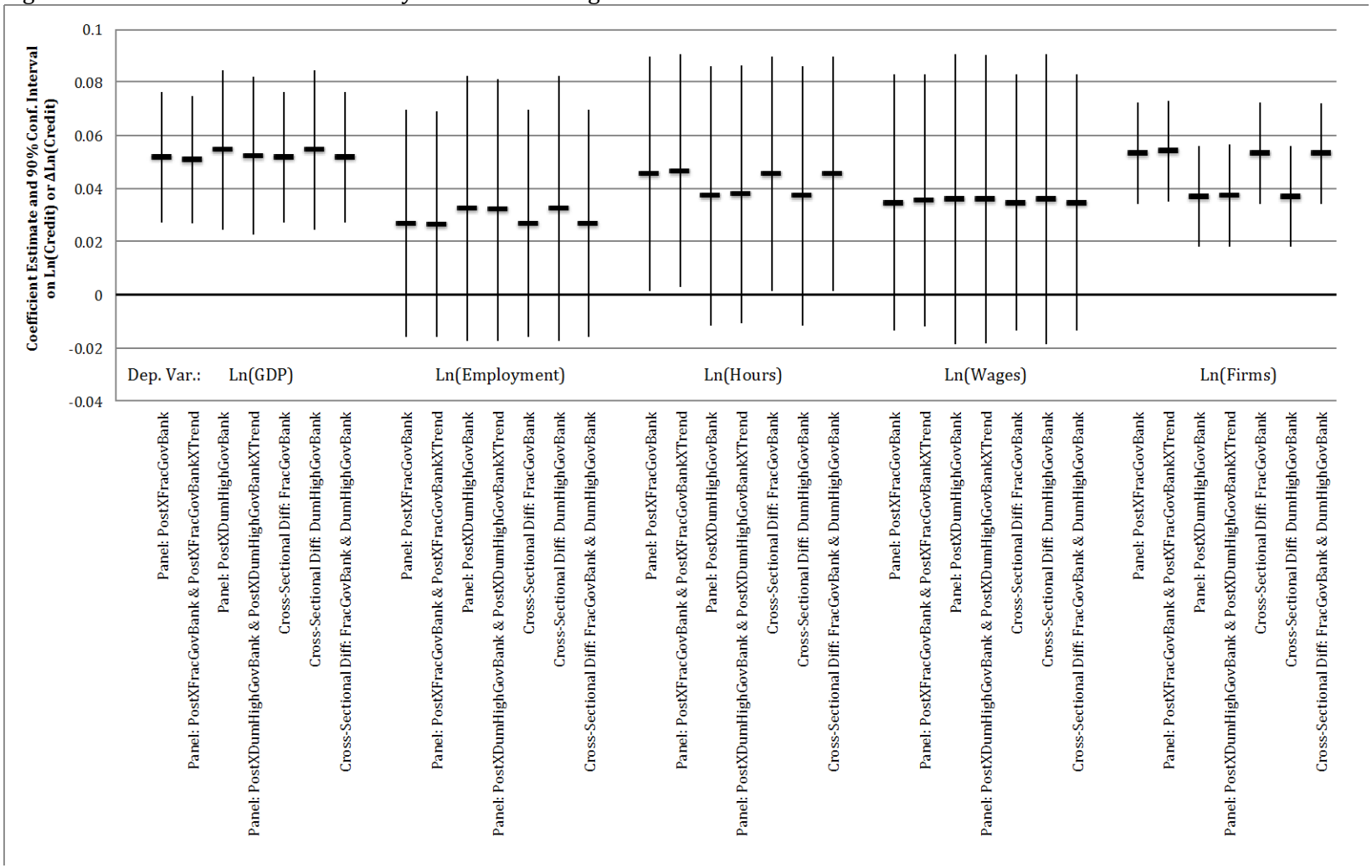
Table B1: Estimation of Propensity Scores

Years of Schooling	1.0434***
	(0.2258)
Urbanization	18.5914***
	(3.7240)
Ln(Population)	6.7971***
	(1.4356)
Ln(GDP)	6.9334***
	(1.2559)
Ln(Total Employment)	-0.2015
	(1.2783)
Ln(Human Capital)	-4.3854***
	(0.9187)
Income per Capita	0.0355***
	(0.0043)
Illiteracy Rate	0.1205***
	(0.0159)
Ln(GDP)XLn(Population)	-0.3832***
	(0.1342)
Ln(GDP)XLn(Total Employment)	-0.4279***
	(0.0819)
Ln(Total Employment)XLn(Population)	0.4883***
	(0.1321)
Ln(Population)XUrbanization	-1.3643***
	(0.3816)
Income per CapitaXUrbanization	-0.0439***
	(0.0045)
Income per CapitaXIlliteracy Rate	-0.0004***
	(0.0001)
Number of Localities	2601
Pseudo R-squared	0.33

Notes: Standard errors are reported in parentheses. Estimation is based on a logit of the propensity of a locality to have above the median share of government bank branches. All regressors are based on 2000 data.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix C: Robustness for IV Estimates [NOT FOR PUBLICATION]

Figure C1: IV Estimates of the Elasticity between Lending and Economic Outcomes



Notes: This figure shows coefficient estimates and 90% confidence intervals on $\ln(credit)$ from the IV estimation of equation (2) and on $\Delta\ln(credit)$ from the IV estimation of equation (3) using different sets of instruments. For the panel version of equation (2), instruments include postXfrac. gov. bank, both postXfrac. gov. bank and postXfrac. gov. bankXtrend, postXdummy high gov. bank, and both postXdummy high gov. bank and postXdummy high gov. bankXtrend. For the cross-section version of equation (3), instruments include frac. gov. bank, dummy high gov. bank, and both frac. gov. bank and dummy high gov. bank.