Journal of Financial Services Research (2023) 63:313–338
https://doi.org/10.1007/s10693-022-00382-3

US National Banks and Local Economic Fragility

Giovanni Calice[1] · **Yong Kyu Gam**[2]

Received: 21 October 2021 / Revised: 18 March 2022 / Accepted: 23 March 2022 /
Published online: 13 April 2022

Abstract
We examine the relationship between US national banks' local market shares and the economic fragility of the counties in which they operate. We find that counties with national banks that have large local market shares experience a greater fluctuation in their income growth in the subsequent year. Further, an increase in income growth is more pronounced during normal times but declines significantly in a distressed market. We further find that the national banks create greater liquidity during normal times and lower liquidity in distressed times. Overall, our results indicate that national banks may expose local economies to macro-level distress.

Keywords National banks · Branch networks · Local economy · Economic growth

JEL Classification E44 · G21 · G28

1 Introduction

In this study, we investigate how national banks' local market shares in US counties are related to macroeconomic activities during periods of stability and distress. Since the US interstate branching deregulation[1] in 1994, the number of bank branches has sharply increased across counties in the US. This increase has made local markets more connected to each other through branch networks and internal capital markets of multi-state or multi-county banks. This connectivity could result in an increase in the vulnerability of local markets to macro-level events via contagion effects through the branch networks. In this paper, we examine an environment characterized by local economies that are connected to national economies through national banks.

[1] Interstate Banking and Branching Efficiency Act (IBBEA) allowed both interstate banking and interstate branching (Rice and Strahan 2010). IBBEA was enacted in 1994.

✉ Yong Kyu Gam
kevin.gam@ucd.ie

Giovanni Calice
G.Calice@lboro.ac.uk

1 School of Business and Economics, Loughborough University, Loughborough, UK

2 School of Business, University College Dublin, Dublin, Ireland

We posit that if the national banks' share of a local market is significantly large, then it will more significantly affect the real economic activity in that market through the general macroeconomic conditions that exist in their national branch networks. To test this prediction, we first measure deposit market shares of national banks in each county as of June 30 of each year. In this study, the national banks are defined as those that have branches across more than 160 counties in the US.[2] We investigate the relationship between national banks' market shares in each county and the annual growth of the county's aggregated personal incomes during the subsequent year. Additionally, we examine how exogenous shocks to macroeconomic conditions affect the relationship between national banks' local market shares and economic activities in those counties. Our measure of market-wide distress follows Acharya and Mora (2015). It is based on the annual average daily spreads between the market yields on commercial paper (3-month CP) and the risk-free rates (3-month T-bills). We define a period as being in market distress if it is in the top 20% in terms of their annual average yield spreads. We construct a panel sample that consists of the US counties for the period from 1997 to 2016.

We find that under normal market conditions, the annual growth of county-aggregated personal income is greater in the following year for the counties in which the national banks maintain larger local market shares in the current year. By contrast, under market distress, income growth is more likely to fall in the subsequent year for these counties. These results indicate that a county's stronger connection to the national economy through national banks' branch networks is positively related to its local economic activities in normal times. However, the large local market shares of the national banks magnify the negative spillover effects of macro-level market distress on the county-level local economy.

These results may be subject to an endogeneity issue because the economic conditions of the counties dominated by national banks may trigger macro-level financial distress. In other words, if national banks hold sizable shares in the developed economies of counties that can be sources of macro-level distress, then we cannot conclude that the macro shock is exogenous to individual local markets dominated by national banks. To address this concern, we perform a robustness test by restricting our analysis to counties with small economies (bottom quartile in terms of income per capita). Our results are still robust to using this restricted sample because arguably these counties are less likely to trigger a macro-level shock.

Another important endogeneity issue is that the local market shares of national banks may be correlated with other unobservable characteristics that affect economic growth in the counties. To mitigate this concern, we conduct a further robustness test by limiting the sample to the counties that belong to the middle tercile in terms of the size of the national banks' local market shares. Our underlying assumption is that if the sample falls on either side of the median of this sub-group, it is likely to be random. We further use the nearest neighbor matching on the sizes of the economies and populations of counties. The regression results are robust to matching counties that have national banks with large local market shares with those that have national banks with small local market shares.

Our results remain robust when using different sets of real economic variables such as the median household incomes and the total employment size of counties as dependent variables. Additionally, the results are consistent even after adopting different cutoff levels (above or below 160) for the number of counties that are covered by a national bank. Furthermore, the results are robust to adding control variables that may be related to the

[2] In the Internet Appendix (Table 12), we report the list of our sample of national banks.

annual growth of the county-aggregated personal income during the subsequent year. The selected control variables are the size of the county's economy and population along with the structure of its banking market such as the market share of global systemically important banks (G-SIBs) that are defined by the Financial Stability Board[3] and the Basel Committee on Banking Supervision.[4] Our results remain robust to using the national banks' local mortgage market shares instead of the deposit market shares as the key independent variable. Finally, we conduct additional robustness checks by using state branching restrictions (following the approach of Rice and Strahan 2010) as an exogenous shock to the national banks' local market shares. Notably, our main findings remain robust to our set of different regression specifications.

In the final step of our empirical analysis, we attempt to identify the potential channels responsible for the local economic fragility of the counties dominated by national banks. To this end, we focus on how banks' liquidity creation is differentiated between national and non-national banks. To measure this creation, we follow the method of Berger and Bouwman (2009), who develop the category-based comprehensive measure for the amount of liquidity created by a bank through its assets, liabilities, and off-balance-sheet activities. We find that national banks create more liquidity than non-national banks in normal times. In contrast, national banks are more likely to reduce their liquidity creation in times of market distress. This difference is more pronounced in off-balance sheet items such as the unused credit lines of borrowers.

When we analyze the differences in the banks' balance sheets, we find that national banks more severely reduce their credit supply (total loans and unused commitments) and instead hoard more liquid assets during a time of market distress. National banks reduce their liquidity creation on their liability side under market distress by lowering interest rates on demandable deposits relatively more than those on term deposits. These changes in times of distress will ultimately shrink the pool of customers' available liquidity. Hence, we conclude that fluctuations in the liquidity creation of the national banks can be one of the primary channels for the local economic fragility of the counties dominated by national banks.

Our paper highlights two important financial stability issues that are crucial to policymakers and market participants. First, our findings show that the size of national banks' shares in local financial markets appears to make their economies more susceptible to macro-level shocks. If this relation is causal, the relevant banking authorities should incentivize alternative financing sources such as non-national local banks and non-bank local funding. Hence, it may be appropriate to effectively balance between funds from national banks and other local financing sources in the local market. Second, our results point to the geographical distribution of bank branches as one of the crucial channels through which bank-level shocks can be transferred to local real economies. Thus, in addition to a bank's size, complexity, and global activity, the geographical network of bank branches can be another key source of systemic risk.

[3] See details from FSB announcements of "Policy Measures to Address Systemically Important Financial Institutions" at www.fsb.org/wp-content/uploads/r_111104bb.pdf?page_moved=1, "Update of group of global systemically important banks (G-SIBs)" at www.fsb.org/wp-content/uploads/r_121031ac.pdf?page_moved=1, "Update of group of global systemically important banks (G-SIBs)" at www.fsb.org/wp-content/uploads/r_131111.pdf?page_moved=1, "Update of list of global systemically important banks (G-SIBs)" at www.fsb.org/wp-content/uploads/r_141106b.pdf, and "2015 update of list of global systemically important banks (G-SIBs)" at www.fsb.org/wp-content/uploads/2015-update-of-list-of-global-systemically-important-banks-G-SIBs.pdf.

[4] See details from "Global systemically important banks: assessment methodology and the additional loss absorbency requirement". Available at www.bis.org/publ/bcbs255.pdf

The remainder of the paper is organized as follows. In Sect. 2, we review the related literature. In Sect. 3, we provide the economic motivation for our study. In Sect. 4, we describe the data and the empirical methodology. In Sect. 5, we present the results. In Sect. 6, we conclude.

2 Literature review

This paper contributes to the literature that addresses the relationship between financial dependence and economic growth. There is a large body of work that shows the effect of financial integration (or development) on economic growth (King and Levine 1993a; King and Levine 1993b; Rajan and Zingales 1996; Beck et al. 2000; Levine et al. 2000; Cetorelli and Gambera 2001; Levine 2005; Ranciere et al. 2006; Kalemli-Ozcan et al. 2013). Consistent with this strand of the literature, we explore how financial integration affects economic activities. However, our primary contribution is to provide evidence on the variations across different local markets (county level) within one country (the US) rather than across different countries. In doing so, we mitigate a potential endogeneity concern that the results are driven by the heterogeneities of economic or institutional conditions across different countries.[5]

The paper also contributes to the literature on how bank branches increase financial integration. For example, Jayaratne and Strahan (1996), Clarke (2004), and Krishnamurthy (2015) investigate the effects of the relaxation of bank branching restrictions in the US on local economic activities. We contribute to the literature by examining the effects of the bank branch network in each market on the local economic activities and by differentiating between stable and distressed economic conditions. Moreover, in our setups, the main economic driver is each county's overall exposure to national banks' branch networks not solely the expansion of an individual bank's branch network to that county. Consequently, we shed light on the essential role of national banks in local financing and economic activities.[6]

In terms of policy implications, our paper is related to the vast literature on financial interconnectedness and systemic risk.[7] Indeed, we show how financial interconnectedness can exacerbate systemic risk at the local market level by uncovering the strong relationship

[5] Our study is closely related to Gilbert and Kochin (1989) and Cheng and Degryse (2010), who examine the effects of a bank failure or the financial development in local areas on economic activities of those regions. Similar to our setups, they focus on the variation of the effects across different local markets within one country (US and China).

[6] Our study is also related to the literature that investigates how banks' branch networks affect local economic activities through fund flows across different local markets via the branch networks given positive or negative liquidity shocks to local economies (Loutskina and Strahan 2015; Berrospide et al. 2016; Gilje et al. 2016; Cortés and Strahan 2017; Schüwer et al. 2018). Rather than focusing on an individual networks of bank branches across different local markets, we pay attention to each county-level aggregated financial connections with national economies, which is represented by national banks' market shares in the county. Our paper is also related to Pilloff (1999), who documents the relationship between the presence of big banks in local markets and banking market competition and bank profitability in those markets.

[7] See, for example, Acharya et al. 2017, Adrian and Brunnermeier 2008, Brownlees and Engle 2017, De Jonghe 2010, Gray and Jobst 2011, Huang et al. 2009, Lehar 2005, Glasserman and Young 2016, Allen and Gale 2000, Freixas et al. 1998, Diebold and Yilmaz 2014, Brunnermeier et al. 2012, Acemoglu et al. 2015, Shleifer and Vishny 1992, Holmström and Tirole 1998, Brunnermeier and Pedersen 2005, Lorenzoni 2008, Krishnamurthy 2010, and Allen et al. 2012.

between national banks' local market shares in each county and the local economic fragility of the county during periods of macroeconomic distress.

Lastly, our study is closely related to Chavaz (2017) who investigates how banks with diverse geographical branch networks experience severe liquidity problems during times of market distress. In a similar vein, Carlson (2004) shows that banks' reserve-to-deposit ratios were negatively associated with the number of branches of US banks before the 1930s banking crisis. We also explore how national banks with diverse branch networks across counties are vulnerable to liquidity shocks in a distressed market. Unlike other studies, however, we examine the heterogeneity of banks' liquidity creation to the real economy in normal and distressed periods between national and non-national banks rather than just that of banks' liquidity ratios. More importantly, our paper sheds light on how the reduced liquidity provided by national banks in a distressed market can spill over to local economic growth if they dominate the local banking markets. Thus, our study adds to the literature by providing insight into the implications of banks' liquidity issues on the real economy.

3 Motivation

We begin by observing that local economies are connected to each other through diverse forms of networks. A bank's branch network is one of the key channels that links different local economies through the bank's internal capital market (see, e.g., Gilje et al. 2016; Cortés and Strahan 2017). Our study focuses on the inter-county connections made through national banks' branch networks. If a certain county is dominated by national banks, the county is more strongly connected to other counties through those banks' branch networks. A bank's branch network is a route of internal capital markets within the bank through which resources can be easily allocated across different local markets. Consequently, the county with national banks that have large local market shares is better able to collect resources from other counties through those banks' internal capital markets. By contrast, if national banks have small local market shares in a county, the available resources from other counties are less likely to be transferred to that county. Simultaneously, there may be some difficulty in transferring resources from that county to other counties because of more limited transmission channels of funding (i.e., branch networks of national banks) that connect the county to other ones.

National banks' local market shares in each county could have real effects on the local economies. Jayaratne and Strahan (1996) and Krishnamurthy (2015) have shown that the relaxation of restrictions on bank branches in the US has had positive real effects on local economic activities. More broadly, a large body of the literature has found the existence of a positive relationship between financial integration and economic growth (e.g., King and Levine 1993a, b; Rajan and Zingales 1996). Similar to these studies, we hypothesize that national banks with large local market shares in a county could have lasting real effects on the local economy because of the funding externalities of the national banks' diverse branch networks across multiple markets. When the national banks' local market shares are larger in a specific county, resources can more easily move to that county through their branch networks. Thus, counties with national banks that have large local market shares can enjoy faster economic growth through the relaxed financial constraints compared to the counties with national banks that have small local market shares given the same level of investment opportunities.

In contrast, the network interconnectedness among local economies can be a source of financial or economic fragility for the counties because of potential contagion effects of negative shocks propagated via the networks. In our study, a branch network of a national bank is the key channel that transfers resources from one county to others. Thus, the counties with national banks that have large local market shares could experience an outflow of their own resources to other counties through the branch networks of those banks. This scenario assumes greater importance in an environment of greater market-wide distress.

We hypothesize that national banks with diverse internal (branch) and external (interbank) networks are more vulnerable to liquidity shocks at a time of macro-level financial distress. Given a serious liquidity problem in a national bank, many of its branches are forced to curb credit supply in local markets. Consequently, local markets dominated by national banks will face more severe financial constraints in the presence of macro-level distress via the national banks' branch networks. Hence, greater financial constraints in the county, which are amplified by the large local market shares of the national banks in the county, will ultimately exacerbate the negative effects of a macroeconomic downturn on the local economies.

4 Data, summary statistics, and empirical methodology

4.1 Data sources

We use various data sources in this study. First, we use the Summary of Deposits (SOD) from the Federal Deposit Insurance Corporation (FDIC) to detect the locations of all the branches of each bank. Therefore, we can identify which US counties are covered by a certain bank through its branch network. If the number of counties that are covered is higher than a threshold (160 counties as the baseline), the bank is defined as a national bank. In addition, by using this data source, and following Cortés (2014), we identify a local bank that is defined as a bank that collects more than 65% of its total deposits from a single county. We then can calculate the local market shares of national banks or those of local banks in each county through this data source. Furthermore, we collect other variables such as the number of banks, the number of branches, and the Herfindahl–Hirschman Index for the deposit market in each county. We use these variables as controls in our robustness tests. We gather information about each bank's mortgage origination and its market share in a county from the Federal Financial Institutions Examination Council (FFIEC) under the Home Mortgage Disclosure Act (HMDA).

Second, we rely on the Bureau of Economic Analysis (BEA) to obtain the information on county-level annual personal incomes. We use the annual growth of the county-aggregated personal incomes as the main outcome variables. From this data source, we also obtain the county-level total population that is added as a control variable in our robustness tests. We obtain other economic variables from the following sources: the data for county-aggregated wages and salaries, which is one of main components of the personal incomes, are also available from the BEA; moreover, the median household incomes, the number of establishments, and the number of employed are available from the US Census Bureau.

Third, we calculate the spreads on the 3-month yields on commercial paper against the Treasury bill rates to estimate periods of adverse market-wide shocks. The data are available from the Federal Reserve Economic Data managed by the Federal Reserve Bank of St. Louis.

Fourth, we collect the financial statements of the US banks and bank holding companies from the Call Report and FR Y-9C that are available from the database of the Federal Reserve Bank of Chicago. The Call Report and FR Y-9C provide the information on banks' financial statements and the consolidated financial data on bank holding companies, respectively. Using this data source, we classify the small banks, the big banks, and the banks affiliated with large bank holding companies. By combining such datasets with the SOD, we estimate the local market shares of each type of bank in each county. We use these variables as controls in our robustness tests. Using these data sources, we calculate each bank's financial ratios that we then use in the bank-level regression models that analyze the differential flows in liquidity between national and non-national banks during market distress. For banks' liquidity creation, we rely on Christa Bouwman's website that provides the panel dataset for banks' liquidity creation as well as the methodology to construct the data.[8]

Finally, we use RateWatch to measure each bank's branch-level interest rates for various deposit products such as money market accounts and certificates of deposits. RateWatch provides the interest rates of deposit products with varied account sizes and different maturities.

4.2 Summary statistics

Next, we present the summary statistics and univariate test results for the key dependent and independent variables in our regression models. Panel A of Table 1 shows the summary statistics for the variables used in our study. Appendix Table 11 provides the definitions of those variables. The average county-level annual income growth is around 4.0% during the sample period of 1997 to 2016. The average market share of national banks in each county is around 17.0%. The panel shows that over the sample period the national banks' local market shares in each county increased by 1.1% each year, on average. Furthermore, the average yield spreads on commercial paper against the risk-free rate are around 28 basis points. If the annual average spread is above 33 basis points (top 20%), it identifies a period of market distress. Further, the average aggregate personal income of counties is $3.7 billion. The average population in each county is around 98,000. The aggregate deposit volume in each county is $1.9 billion. The average local market shares of big BHCs, big banks, small banks, and local banks in counties are 21.5%, 24.5%, 59.0%, and 32.0%, respectively.

Panel B of Table 1 presents the results of the univariate tests for the mean values of the key variables between the counties with national banks that have large local market shares (treated group) and those with national banks that have small local market shares (control group). If the local market share of national banks in a county is above the median value of the entire sample, the county is assigned to the treated group in this univariate test. Otherwise, the county falls within the control group. Notably, if a county belongs to the treated group, the county's total income, population, and aggregate deposits will be larger than those of control group counties. Moreover, the local market shares of the BHCs with extensive subsidiary and branch footprints and those of the large banks are larger in the treated counties than in the control group. In contrast, the local market shares of both small and local banks are larger in the control counties than in the treated group.

[8] The data for banks' liquidity creation are available at https://sites.google.com/a/tamu.edu/bouwman/data.

Table 1 Summary Statistics. Panel A presents the summary statistics for the key variables in the regressions that relate growth rates of county-aggregate personal incomes to the local market shares of national banks in the counties. The variable definitions are provided in Appendix Table 11. Panel B presents the results of the univariate tests for the null hypotheses that differences in variables between the counties with national banks that have a large local market share and the counties with national banks that have a small local market share are equal to zero

Panel A				Percentile Distribution		
	N	Mean	S.D	25th	Median	75th
IncomeGrowth	60,190	3.972	4.932	1.620	3.894	6.229
MedIncomeGrowth	60,190	2.359	4.789	-0.535	2.451	5.074
WageSalaryGrowth	57,104	3.531	5.580	1.008	3.506	5.988
EstablishGrowth	48,458	0.054	3.965	-1.822	0.000	1.713
EmployGrowth	47,616	0.143	7.688	-2.822	0.348	3.020
NationalShr	60,190	17.160	22.098	0.000	7.278	29.447
Distress	60,190	0.246	0.431	0.000	0.000	0.000
Spread	60,190	0.286	0.268	0.116	0.176	0.324
Ln(Income)	60,190	13.696	1.507	12.665	13.510	14.538
Ln(Population)	60,190	10.307	1.412	9.376	10.177	11.114
Ln(Deposits)	60,190	12.671	1.614	11.672	12.584	13.548
Ln(NumBank)	60,190	1.915	0.673	1.386	1.946	2.303
Ln(NumBranch)	60,190	2.539	1.112	1.792	2.398	3.135
BigBHCShr	60,190	21.507	24.989	0.000	12.483	37.685
BigShr	60,190	24.518	28.325	0.000	13.288	44.660
SmallShr	60,190	58.825	33.646	28.930	60.909	94.507
LocalShr	60,190	31.974	30.800	3.486	23.713	53.113
GSIBShr	60,190	9.020	16.804	0.000	0.000	12.434
HHI	60,190	0.351	0.225	0.193	0.282	0.434
Panel B	High National		Low National		Mean Diff	(t-stat)
	Mean	Median	Mean	Median		
IncomeGrowth	3.994	3.949	3.950	3.819	0.043	(1.07)
MedIncomeGrowth	2.189	2.230	2.529	2.668	-0.341***	(-8.73)
WageSalaryGrowth	3.384	3.453	3.675	3.566	-0.290***	(-6.22)
EstablishGrowth	0.163	0.034	-0.071	-0.137	0.233***	(6.47)
EmployGrowth	0.164	0.611	0.119	-0.023	0.044	(0.63)
NationalShr	33.801	29.447	0.519	0.000	33.282***	(280.79)
Distress	0.224	0.000	0.268	0.000	-0.044***	(-12.54)
Spread	0.285	0.176	0.287	0.217	-0.002	(-0.86)
Ln(Income)	14.429	14.229	12.964	12.896	1.465***	(136.46)
Ln(Population)	10.967	10.801	9.646	9.620	1.320***	(129.72)
Ln(Deposits)	13.409	13.242	11.934	11.965	1.475***	(126.04)
Ln(NumBank)	2.220	2.197	1.610	1.609	0.610***	(124.70)
Ln(NumBranch)	3.024	2.890	2.054	1.946	0.970***	(118.87)
BigBHCShr	36.424	33.420	6.590	0.000	29.834***	(182.55)
BigShr	39.953	37.647	9.083	0.000	30.871***	(159.45)
SmallShr	40.487	37.953	77.163	94.507	-36.676***	(-159.49)
LocalShr	22.453	15.761	41.495	37.716	-19.042***	(-79.75)
GSIBShr	15.404	9.970	2.636	0.000	12.768***	(100.75)
HHI	0.258	0.219	0.444	0.373	-0.186***	(-111.09)

Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively

Overall, the banking market appears to be more competitive in the counties with national banks that have large local market shares. The differences between the treated and control groups for several key variables, reported in Panel B of Table 1, could lead to an endogeneity concern that the counties dominated by national banks are fundamentally different from those with national banks that have small local market shares in terms of many observable and unobservable characteristics, which may drive local economic growth. To mitigate this endogeneity concern, we use a set of robustness tests with different regression specifications and limited samples, as described in the empirical results section.

In the Internet Appendix (Table 13), we present additional summary statistics and the univariate test results for the set of variables used in our regression models that assess variations in the national banks' liquidity creation, in their balance sheets, and in their deposit interest rates during market distress.

4.3 Empirical methodology

In this study, we examine how the national banks' local market shares in a county are related to the annual growth in the county's aggregate personal income for the subsequent year. Our baseline regression model is specified as follows:

$$IncomeGrowth_{i,t+1} = \alpha_0 + \alpha_1 NationalShr_{i,t} + \alpha_2 Distress_t + \alpha_3 NationalShr_{i,t} \times Distress_t + FEs + \varepsilon_{i,t} \tag{1}$$

The subscripts i and t refer to county and year, respectively. Each observation in our panel is at the county-year level. *IncomeGrowth* is the outcome variable and represents the annual growth of county-level personal income for the following year. *NationalShr* is the key independent variable and represents the national banks' deposit market shares in the county as of June 30 of the year. The national bank is defined as a US bank that has branches across at least 160 counties in the US.[9] As a robustness exercise, we run the same regression by changing the cutoff for the number of counties to 120 and 200 counties.

In this regression framework, we use *Distress* and the interaction term between *Distress* and *NationalShr* to examine how the results are affected depending on different levels of market distress. Our measure of market distress follows Acharya and Mora (2015). It is based on the annual average of daily spreads between commercial paper yields (3-month CP) and risk-free rates (3-month T-bill rates). We define a period as being in market distress if it is in the top 20% periods in terms of their annual average yield spreads. Figure 1 plots the monthly yield spreads (Fig. 1a) between the 3-month CPs and T-bills as well as their annual averages (Fig. 1b) from 1997 to 2016. In Fig. 1b, we further plot the periods of market distress. The coefficient for *NationalShr* shows the effect under normal market conditions, and its interaction with *Distress* captures the incremental effect on county-level income growth during market distress. Moreover, we use year and county fixed effects to absorb time-invariant county-level characteristics and year-specific factors that may affect the growth rates of county-level aggregated incomes in the subsequent year. Standard errors are clustered at the county level.

[9] We remove Woodforest National Bank from the national bank list even though this bank has branches in more than 160 counties in the US because total asset size of this bank ($4.8 billion as of 2016 4Q) is quite small compared to those of other national banks (on average, $512 billion as of 2016 4Q).

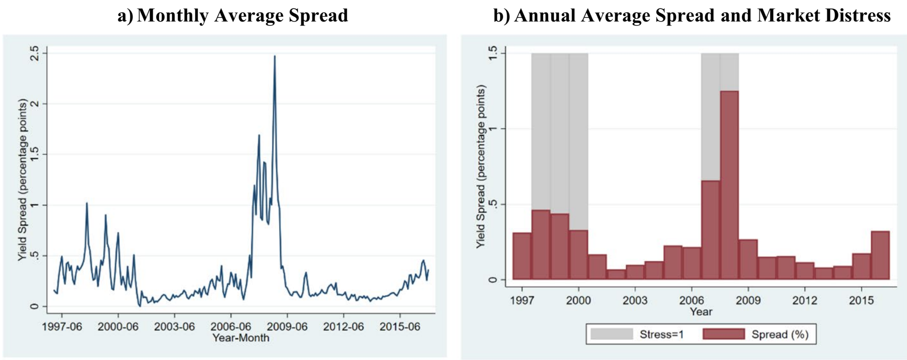

Fig. 1 Yield Spread of 3-Month CPs against T-bills. The figure plots the trend of the yield spread (percentage points) of the 3-month CP (commercial paper) rates against T-bill rates from 1997 to 2016. **a** plots the monthly average spread. **b** plots both annual average spread (bars) and the years with market distress (shaded areas), which are the years within the top 20% as measured by the annual average spread

5 Empirical results

In this section, we discuss our main findings on the effects of national banks' local market shares in a county on its local economic growth, and we identify the driving channels in the context of stable and distressed markets.

5.1 National banks' shares and local economic growth

5.1.1 Baseline results

Table 2 presents our first set of results. In this table, we use the annual growth rate of county-aggregate personal income in the following year as the dependent variable, while we use *NationalShr* and the interaction *NationalShr*×*Distress* as the main independent variables. The first column shows that the coefficient for *NationalShr* is positive and statistically significant. In contrast, the interaction term *NationalShr*×*Distress* is negative and strongly significant. The *Distress* dummy variable identifies a year of market distress that is within the top 20% that is measured by the annual average spread between the 3-month CP rate and the 3-month T-bill rate but is absorbed by the year fixed effect. From an economic perspective, the positive coefficient for *NationalShr* indicates that if the national banks hold large local market shares in a county in that year, the county is more likely to experience greater growth in its aggregate personal income in the subsequent year under normal market conditions. However, episodes of market distress lead to opposite results. As the national banks' local market shares are larger in a county, the local economy is more adversely affected by lower income growth in the following year, as indicated by the negative value of *NationalShr*×*Distress*.

The coefficients reported in this table are also economically significant. In Column 1, the estimated values of *NationalShr* and *NationalShr*×*Distress* are 0.010 and -0.023, respectively. A one percentage-point increase in *NationalShr* is associated with a 0.01% increase in the county's income growth in the following year in the non-distressed period. On the contrary, a one percentage-point increase in *NationalShr* is associated with a 0.023 percentage point decrease in the county's subsequent income growth during a distressed market.

Table 2 National Banks' Shares and Local Economic Growth. This table presents the regression results that relate the growth rates of the county-aggregate personal income to the local market shares of national banks in the counties from 1997 to 2016. We define national banks as the US banks that have branches in at least 160 counties in the US. *IncomeGrowth* is an annual percent change in county-aggregate personal income in the following year. *NationalShr* is the national banks' deposit market shares in the county as of June 30 of the year. *Distress* is a dummy variable that identifies a year of market distress that is within the top 20% as measured by the annual average spread between the 3-month CP rate and the 3-month T-bill rate. We include a set of fixed effects: *Year* (or *CountySize-by-Year*) and *County* fixed effects. *CountySize* is a decile variable from 1 to 10 for the size of the county-aggregate personal income (1 being the bottom decile). Standard errors are clustered at the county level

	IncomeGrowth	
	(1)	(2)
NationalShr	0.010***	0.010***
	(6.88)	(6.31)
NationalShr×*Distress*	-0.023***	-0.014***
	(-12.17)	(-7.39)
Observations	60,190	60,190
Adjusted R^2	0.184	0.276
Year FE	Y	N
CountySize-Year FE	N	Y
County FE	Y	Y

Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively. *t*-statistics are in parentheses

In the second column of the table, we adopt a more stringent specification to control for the effect of the county-size on its future income growth rates. We replace the *Year* fixed effect with a *CountySize-by-Year* fixed effect. *CountySize* is a decile variable that ranges from 1 to 10 for the county's aggregate personal income. By adding this fixed effect, we can compare the results within the same decile group in a given year as it allows us to absorb time-varying unobservable factors shared by similar sized counties that may affect subsequent income growth rates in the counties. Notably, even after adding this new set of fixed effects, our empirical result is still significant for both *NationalShr* and its interaction with *Distress*. In Column 2, the estimated values of *NationalShr* and *NationalShr*×*Distress* are 0.010 and -0.014, respectively. Both coefficients are statistically significant at the 1% level.

As a robustness test, we add several sets of control variables that are highly correlated with the future economic prospects of the county. Those variables are *Ln(Income)*, *Ln(Population)*, *Ln(Deposits)*, *Ln(NumBank)*, *Ln(NumBranch)*, *BigBHCShr*, *BigShr*, *SmallShr*, *LocalShr*, *GSIBShr*, and *HHI*. Appendix Table 11 provides the definitions of those variables. In this robustness test, the interactions between each of the above control variables and *Distress* are added to the regressions. The results are reported in the Internet Appendix (Table 14). Our results are robust to the addition of this set of control variables.

In Table 3, we replace the *Distress* dummy with either a continuous (*Spread*)[10] or a quintile (*StressQ*) variable for annual average spreads between the 3-month CP rate and 3-month T-bill rate to mitigate the concern that we arbitrarily selected the top 20% of

[10] When we calculate the spread, we do not winsorize the variable. In untabulated results, however, we find that the results are robust to winsorizing the daily spreads at 1 or 5% on both sides before calculating their annual average.

Table 3 National Banks' Shares and Local Economic Growth (Use a continuous or a quintile variable for market distress). This table presents the regression results that relate the growth rates of the county-aggregate personal income to the local market shares of national banks in the counties from 1997 to 2016 using a continuous or a quintile variable for market stress. In Panel A, *Spread* is the annual average spread between the 3-month CP rate and the 3-month T-bill rate. In Panel B, *StressQ* is a quintile value for the annual average spread between the 3-month CP rate and the 3-month T-bill rate (1 for the group with the lowest values and 5 for the group with the highest values). All other regression specifications are the same as the ones reported Table 2. Standard errors are clustered at the county level

Panel A	*IncomeGrowth*	
	(1)	(2)
NationalShr	0.013***	0.011***
	(7.91)	(6.12)
NationalShr × *Spread*	-0.033***	-0.017***
	(-9.69)	(-4.92)
Observations	60,190	60,190
Adjusted R^2	0.184	0.276
Year FE	Y	N
CountySize-Year FE	N	Y
County FE	Y	Y
Panel B	***IncomeGrowth***	
	(1)	(2)
NationalShr	0.015***	0.016***
	(7.42)	(7.19)
NationalShr × *StressQ*	-0.004***	-0.003***
	(-7.62)	(-6.18)
Observations	60,190	60,190
Adjusted R^2	0.183	0.276
Year FE	Y	N
CountySize-Year FE	N	Y
County FE	Y	Y

Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively. *t*-statistics are in parentheses

the yield spread as the cutoff to identify the periods of market distress. As shown in both panels of the table, our results are robust to replacing the *Distress* dummy with *Spread* (reported in Panel A) or *StressQ* (reported in Panel B).

Our results remain robust when we measure *NationalShr* by the banks' mortgage market shares in each county instead of their deposit market shares in the county. As a further robustness check, we use the number of the US counties where the banks originate mortgages instead of the number of counties where the banks have branches to define a national bank. All our results are still robust to using mortgage data provided by the HMDA instead of the bank branch and deposit data the SOD provides when measuring *NationalShr* and defining national banks. The results are reported in the Internet Appendix (Table 15).

5.1.2 Robustness: Use restricted sample

Our baseline regression results may be subject to the endogeneity concern that macro-level distress is not exogenous to local market conditions. Gabaix (2011) has found that idiosyncratic firm-level shocks can explain a large proportion of the variations in aggregate output growth. Similarly, the economic conditions of the counties with national banks that have large local market shares may be the key driving forces of macro-level distress. If national banks hold large local market shares in counties with large economies that drive macro-level financial distress, we cannot assert that the macro-level distress is exogenous to the economic conditions of the counties with national banks that have large local market

Table 4 National Banks' Shares and Local Economic Growth (Limit samples to counties with smaller economies). This table presents the regression results that relate the growth rates of the county-aggregate personal income to the local market shares of national banks in the counties from 1997 to 2016. In this table, we limit samples to counties with small economies that are in the bottom quartile in terms of county-level personal income per capita. All other regression specifications are the same as the ones reported in Table 2. Standard errors are clustered at the county level

	IncomeGrowth	
	(1)	(2)
NationalShr	0.005	0.006*
	(1.56)	(1.89)
NationalShr×*Distress*	-0.012***	-0.010**
	(-2.97)	(-2.37)
Observations	15,055	15,055
Adjusted R^2	0.285	0.311
Year FE	Y	N
CountySize-Year FE	N	Y
County FE	Y	Y

Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively. *t*-statistics are in parentheses

shares. To address this concern, we conduct a robustness test by limiting our sample to the counties with small economies that are those that belong to bottom quartile in terms of local personal income per capita. Our underlying assumption for this test is that the small economy is less likely to trigger macro-level financial distress, and thus the shock is exogenous to the county's economic conditions. We report the regression results with the restricted sample in Table 4. The sample size is almost one-fourth of our baseline regression. However, the estimation results are still consistent with our baseline results. In both columns, the interaction terms are negative (-0.012 and -0.010) and statistically significant at the 1 and 5% levels respectively.

In relation to the results in Table 4, we conduct another robustness test by replacing the local personal income per capita with the number of banks or branches in each county that is scaled by its population size as a criterion to identify the counties that are least likely to create macro-level shocks. Our prediction is that counties with smaller numbers of banks or branches relative to their population size (bottom quartile) are less likely to trigger a macro-level financial crisis. The results, reported in the Internet Appendix (Table 16), are still consistent with our baseline results.

Another important endogeneity issue is that the local market shares of national banks in a county may be correlated with other unobservable county-level characteristics that affect its local economic growth. To address this issue, we conduct an additional robustness test by limiting the sample to the counties that belong to the middle tercile in terms of the size of the local market shares of the national banks in the county. Our underlying assumption for this test is as follows: If a county falls on either side of the median size of the local market shares, it is likely to be random. We also use the nearest neighbor matching on the size of the economy and population of counties. The results are reported in Table 5. Both Panels A and B use the restricted sample of the counties that belong to the middle tercile in terms of the size of the local market shares of national banks. In Panel B, we match observations

Table 5 National Banks' Shares and Local Economic Growth. (Limit samples to middle tercile in terms of the size of national banks' local market shares). This table presents the regression results that relate the growth rates of the county-aggregate personal income to the local market shares of national banks in the counties from 1997 to 2016. In Panels A and B of this table, we limit samples to middle tercile in terms of the size of the national banks' local market shares. For this test, we remove the counties with zero local market shares of national banks. In Panel B, we match counties with national banks that have relatively large local market shares (above the median) and those with national banks that have relatively small local market shares (below the median) in the given year in terms of the sizes of their economies and populations. All other regression specifications are the same as the ones reported in Table 2. Standard errors are clustered at the county level

Panel A	*IncomeGrowth*	
	(1)	(2)
NationalShr	0.034***	0.031***
	(3.63)	(3.31)
NationalShr×*Distress*	-0.043***	-0.037**
	(-2.87)	(-2.48)
Observations	11,196	11,196
Adjusted R^2	0.295	0.335
Year FE	Y	N
CountySize-Year FE	N	Y
County FE	Y	Y
Panel B	*IncomeGrowth*	
	(1)	(2)
NationalShr	0.037***	0.031***
	(3.39)	(2.81)
NationalShr×*Distress*	-0.045**	-0.046***
	(-2.58)	(-2.71)
Observations	11,196	11,196
Adjusted R^2	0.358	0.398
Year FE	Y	N
CountySize-Year FE	N	Y
County FE	Y	Y

Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively. *t*-statistics are in parentheses

by the sizes of the county's income and population.[11] Table 5 shows that our results are still robust to matching counties with national banks that have large local market shares with those with national banks that have small local shares with similar size of incomes and populations as the restricted sample. The interaction terms have coefficients of -0.037 to -0.046 and are statistically significant at the 1 and 5% levels respectively.

Furthermore, our results are robust to removing the 2007–2009 financial crisis period from our sample. The results are reported in the Internet Appendix (Table 18). In all columns, the coefficients for *NationalShr* are positive but those for *NationalShr*×*Distress* are all negative

[11] We cannot find any statistically significant difference in the size of the county's economy (personal income) and population between the counties above the median size for national banks' local market shares and those below the median within the matched subsample. The univariate test results are reported in the Internet Appendix (Table 17).

and significant. These coefficients mean that our main findings are not driven by the unprecedented financial crisis period, when county-level income growth rates significantly declined.

5.1.3 Robustness: Use different definitions for national banks

Next, we examine the robustness of different definitions of national banks. First, we change the cutoff levels for the number of counties covered by a bank. In our baseline regressions, we define the national bank as one that has branches across at least 160 US counties. Now, we use other cutoff levels. In Panel A of Table 6, we use five different cutoff levels starting at 120 (Column 1) and going up to 200 (Column 5). However, regardless of the cutoff level, our regression results remain unaffected. In Panel B, we use different types of thresholds for the number of counties covered by each bank that range from the top 0.5% to 0.1% each year. The results are consistent with our baseline results. In the Internet Appendix (Table 19), we turn to the national BHCs. In this robustness test, we measure how many counties are covered by a single BHC rather than by a single bank. Table 19 shows that all results are robust when using national BHCs' shares as the key independent variable.

Table 6 National Banks' Shares and Local Economic Growth (Use different definitions for national banks). This table presents the regression results that relate the growth rates of the county-aggregate personal income to the local market shares of the national banks in the counties. Here, we change the cutoff for the number of counties in which a bank has branches to redefine a national bank. In Panel A, the cutoff starts at 120 counties (Column 1) and goes up to 200 counties (Column 5). In Panel B, we define the cutoff point as the top 0.5% in each year to the top 0.1% in each year among the entire sample in terms of the number of counties in which a bank has branches. All other regression specifications are the same as the ones reported in the first column of Table 2

Panel A			*IncomeGrowth*		
	120	140	160	180	200
NationalShr	0.008***	0.010***	0.010***	0.010***	0.008***
	(5.86)	(7.33)	(6.88)	(6.64)	(5.07)
NationalShr×*Distress*	-0.020***	-0.023***	-0.023***	-0.023***	-0.025***
	(-11.99)	(-12.98)	(-12.17)	(-12.12)	(-11.81)
Observations	60,190	60,190	60,190	60,190	60,190
Adjusted R^2	0.184	0.185	0.184	0.184	0.184
Year FE	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y
Panel B			*IncomeGrowth*		
	Top 0.5%	Top 0.4%	Top 0.3%	Top 0.2%	Top 0.1%
NationalShr	0.005***	0.008***	0.006***	0.008***	0.009***
	(4.11)	(5.91)	(4.71)	(5.29)	(5.76)
NationalShr×*Distress*	-0.014***	-0.015***	-0.015***	-0.019***	-0.022***
	(-10.11)	(-10.34)	(-9.95)	(-11.73)	(-11.32)
Observations	60,190	60,190	60,190	60,190	60,190
Adjusted R^2	0.184	0.184	0.184	0.184	0.184
Year FE	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y

Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively. *t*-statistics are in parentheses

5.1.4 Use different sets of real outcome variables

Next, we investigate whether our main finding can be applicable to different sets of real economic variables. Instead of the county-aggregated personal income growth rates, we use the annual growth rates of county-level median household incomes, aggregated wages and salaries, total number of establishments, and total number of the employed as new dependent variables. All other regression specifications are the same as in Column 1 of Table 2. The results are reported in Table 7. In Columns 1 to 4, the coefficients for *NationalShr* are all positive and significant. In contrast, the coefficients for *NationalShr×Distress* are all negative and significant. In other words, under normal market conditions, the large local market shares of national banks in a county are more likely to lead to higher growth in median household incomes, wages and salaries, establishments, and employments in the county in the subsequent year. However, when market distress exists, the results change sign and are statistically significant, similar to our baseline regression results. In other words, the markets dominated by national banks experience declines in economic growth for different sets of real outcome variables.

5.1.5 Using state branching restrictions as a shock to national banks' shares

Next, we present additional robustness checks by using the state branching restrictions as an exogenous shock to national banks' local market shares. We follow the approach used by Rice and Strahan (2010) to construct the variable, *BranchingRestrictions*, that measures the degree of state branching restrictions based on four important provisions (the minimum age of the target institution, de novo state branching, the acquisition of individual branches, and statewide deposit cap). *BranchingRestrictions* ranges from 0 to 4 (0 being the least restrictive and 4 being the most restrictive). Our identification assumption is that the variation in the state-level branching restrictions can affect the national banks' local market shares in each county. This effect will ultimately influence local economic growth during periods of stability as well as those of

Table 7 National Banks' Shares and Local Economic Growth (Use different sets of real outcome variables). This table presents the regression results that relate the growth rates of the county-aggregate real outcomes (median household incomes, wages and salaries, number of establishments, and number of employed) to the local market shares of the national banks in the counties. *MedIncomeGrowth* is an annual growth rate of county-level median household income in the following year. *WageSalaryGrowth* is an annual growth rate of county-aggregate wages and salaries in the following year. *EstablishGrowth* is an annual growth rate of county-aggregated number of establishments in the following year. *EmployedGrowth* is an annual growth rate of county-aggregated number of the employed in the following year. All other regression specifications are the same as the ones reported in the first column of Table 2

	MedIncomeGrowth	*WageSalaryGrowth*	*EstablishGrowth*	*EmployGrowth*
NationalShr	0.005***	0.004*	0.007***	0.018***
	(4.84)	(1.89)	(3.72)	(4.84)
NationalShr×Distress	-0.011***	-0.016***	-0.014***	-0.035***
	(-7.11)	(-6.18)	(-7.46)	(-7.91)
Observations	60,190	57,104	48,458	47,616
Adjusted R^2	0.133	0.176	0.117	0.116
Year FE	Y	Y	Y	Y
County FE	Y	Y	Y	Y

Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively. *t*-statistics are in parentheses

Table 8 National Banks' Shares and Local Economic Growth (Using interstate branching restriction as a shock to national banks' shares). This table presents the regression results that relate the growth rates of the county-aggregate personal incomes to the strictness of interstate branching restriction in each state. Following Rice and Strahan (2010), we combine four important provisions (the minimum age of the target institution, de novo state branching, acquisition of individual branches, and statewide deposit cap) to measure the strictness of the state branching restriction in each county. *BranchingRestrictions* measures the degree of the branching restrictions in each state that ranges from 0 to 4 (0 being the least restrictive and 4 being the most restrictive). In Panel A, we relate banking market structures with national banks' shares in the county to the strictness of the state-level branching restrictions. In Panel B, we relate the strictness of the state-level branching restrictions to an annual percent change in county-aggregate personal income in the following year. All other regression specifications are the same as the ones presented in Table 2. Standard errors are clustered at the state level

Panel A	*Ln(NumBank)*	*Ln(NumBranch)*	*Ln(Deposits)*	*HHI*	*NationalShr*
	(1)	(2)	(3)	(4)	(5)
BranchingRestrictions	-0.025***	-0.039***	-0.075***	0.015***	1.150*
	(-2.73)	(-3.43)	(-3.50)	(2.68)	(1.75)
Observations	26,555	26,555	26,555	26,555	26,555
Adjusted R^2	0.949	0.980	0.946	0.823	0.693
Year FE	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y

Panel B	*IncomeGrowth*	
	(1)	(2)
BranchingRestrictions	0.192	0.161
	(0.75)	(0.73)
BranchingRestrictions × *Distress*	-0.173**	-0.211***
	(-2.03)	(-2.71)
Observations	26,555	26,555
Adjusted R^2	0.170	0.256
Year FE	Y	Y
CountySize-Year FE	N	Y
County FE	Y	N

Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively. *t*-statistics are in parentheses

market distress. For this test, we limit the sample period to 1997–2005, which is within the coverage of Rice and Strahan (2010).[12]

The results are reported in Table 8. In Panel A, we first explore how the variation in the state branching restrictions influences the county-level banking market. To identify the effects, we use several options for the dependent variable: log of total number of banks, log of total number of branches, log of total deposits, deposit market competitiveness (HHI), and national banks' deposit market shares in each county. For these tests, we cluster standard errors at the state level. The regression results show that as the state branching restrictions intensified, the total number of banks and branches as well as the aggregated amounts of deposits are more likely to decline in the counties. The stricter the state branching restrictions also limits competition in the banking market. One of the most noteworthy findings in Panel A is that the higher the severity of the state branching restrictions, the larger are the *national banks'* deposit market shares in the county.

[12] In untabulated results, we find that our baseline regression results are still robust to limiting samples to the period of 1997–2005.

Hence, our evidence shows that state branching restrictions can be a key entry barrier that protects the national banks' local market shares from potential competitors from out of state.[13]

In Panel B, we obtain empirical results of the effect of state branching restrictions on local economic growth. We achieve this by replacing *NationalShr* with *BranchingRestrictions* in Eq. (1) above. Standard errors are clustered at the state level. We find that the coefficients for *BranchingRestrictions* are positive, but the coefficients for the interaction term (*BranchingRestrictions*×*Distress*) are negative and significant in both columns. These coefficients mean that if a state adopts a stricter restriction on branching, the counties in the state are more likely to face higher future income growth during normal periods. In contrast, such counties may experience reduced future income growth when there is macro-level distress. As reported in Panel A, the larger deposit shares of national banks under stricter state branching restrictions may be the main driving channel underlying the results. Furthermore, the regression results remain robust even after we use stricter fixed effect specifications (*County-Size-by-Year*, Column 2). Notably, our main finding still holds when we use the state branching restrictions as an exogenous shock to national banks' local market shares in each county.

One caveat in this robustness test is that the state branching restriction might not be truly exogenous to the pre-existing local banking markets or the economic conditions as suggested in the literature (see, for example, Kroszner and Strahan 1999). Thus, although we can argue that the state-level regulation is not directly related to the economic activities of individual counties in the state, we need to keep the potential endogeneity issues in mind in interpreting these results from the robustness test.

5.2 National banks' liquidity creation, balance sheets, and deposit interest rates

We next provide some plausible economic interpretations of our findings by identifying the possible determinants of the income growth rates of the counties that are dominated by national banks. As outlined in Sect. 4, the primary difference among counties in our sample is the deposit market shares of the national banks in those counties. As such, for comparison purposes, we need to determine the distinctive behaviors of national banks versus non-national banks in normal times as well as under market distress. As shown in the literature (e.g., Castiglionesi et al. 2019; Carlson 2004; Chavaz 2017; Choi et al. 2020), banks that rely on diverse interbank or branch networks are more vulnerable to liquidity constraints and therefore hoard liquidity during a time of market distress. The national bank defined in our study has geographically diverse branch networks and possibly also has diverse interbank relationships.[14] Accordingly, we hypothesize that the liquidity problems faced by the national banks during conditions of market distress will lead to more prudent and conservative management practices for liquidity risk that may ultimately have negative real effects on local economic growth. Thus, we first focus on a comparative analysis of banks' liquidity creation between national and non-national banks. To measure their level of liquidity creation, we

[13] In untabulated results, we find that the initial relaxation of the state branching restrictions (1997–1998) actually increases the national banks' local market shares in each county that is the opposite to the finding from the later sample period. During this early stage, many non-national banks may transform into national banks by entering other states and opening new branches in many different counties. This expansion ultimately increases the local market shares of the national banks in each county in the early years.

[14] In untabulated results, we find that the number of counties that are covered by a bank's branch network has a strong positive relationship with the number of partnerships that the bank establishes with other financial institutions. To identify the number of the interbank partnerships, we follow the method used by Choi et al. (2020).

rely on the classical approach of Berger and Bouwman (2009). Our regression equation is designed as follows:

$$LiquidityCreation_{j,t} = \alpha_0 + \alpha_1 National_{j,t} + \alpha_2 Distress_t + \alpha_3 National_{j,t} \times Distress_t + \Gamma X_{j,t} + FEs + \varepsilon_{j,t} \tag{2}$$

The subscripts j and t refer to bank and year, respectively. Each observation in our panel is at the bank-year level. *LiquidityCreation* measures how much liquidity is created by a bank in each year. The quarter-end values for *LiquidityCreation* are annualized. To measure a bank's liquidity creation, we use the category-based measure of liquidity creation that is scaled by its gross total assets as in Berger and Bouwman (2009). This is a comprehensive measure that comprises the bank's total assets, liabilities, and off-balance sheet items. We then decompose a bank's overall liquidity creation into its asset-, liability- and off-balance-sheet-sides, respectively, in subsequent tests. *National* is a dummy variable for a US bank that has branches across at least 160 counties in the US as of June 30 of the previous year. *Distress* is a dummy that denotes a state of market distress based on the top 20% periods in terms of their annual average spreads between the 3-month CP yields and the 3-month T-bill rates. In this equation, we add *Bigbhc*, *Big*, *Small*, *Local*, *Ln(total assets)*, *LeverageRatio*, *CapitalRatio*, *NPLRatio*, *Z-score, Loan/Deposit*, and *ROA* as bank-level control variables. These are calculated as of the previous year-end. Appendix Table 11 provides the definitions of variables. These regressions also contain year and bank fixed effects.

Panel A of Table 9 presents the regression results. We find that national banks create greater liquidity than non-national banks in normal times. By contrast, under market distress, national banks are less likely to provide liquidity to the economy than non-national banks do. The heterogeneity in liquidity creation between national and non-national banks is greater in an off-balance-sheet item and for items such as unused credit lines to borrowers. Therefore, these results highlight the fluctuated liquidity creation of national banks relative to non-national banks between normal and distressed times.

Next, we examine the adjustments to banks' balance sheets in periods of market distress. We use three main financial variables: *Loan/Asset*, *Credit/Asset*, and *LCR*. *Loan/Asset* is the proportion of a bank's total loans to its total assets. *Credit/Asset* is a bank's total credit supply scaled by its total asset. In our study, we define the total credit supply as the sum of a bank's total loans and its unused commitments in the off-balance-sheet. Finally, *LCR* is an estimated value for a bank's liquidity coverage ratio.[15] This variable is estimated following the methodology proposed by Hong et al. (2014) and Choi et al. (2020). Except for the financial variables listed above, all other regression specifications are the same as in Eq. (2). The results are reported in Panel B of Table 9. The results show that national banks' balance sheets significantly change in times of market distress compared to those of non-national banks. The coefficients for *National*×*Distress* are negative and statistically significant for the first two variables (*Loan/Asset* and *Credit/Asset*). In contrast, the coefficient for the interaction term with *LCR* is strongly positive. In other words, national banks downsize their credit supplies but instead hoard more liquid assets in adverse market conditions. If we compare the first and second columns, the magnitude and statistical significance of *Credit/Asset* is much greater than those for *Loan/Asset*. This difference means national banks, on

[15] The Liquidity Coverage Ratio (LCR) was introduced by the Basel Committee on Banking Supervision in 2010 as a new international standard for measuring and controlling a bank's liquidity risk. The LCR measures whether the bank holds sufficient high-quality liquid assets that enable the banks to survive liquidity evaporation for at least 30 day in financial markets. See "Basel III: The liquidity coverage ratio and liquidity risk monitoring tools" at https://www.bis.org/publ/bcbs238.pdf.

Table 9 National Banks' Liquidity Creation and Balance Sheet Structure. This table compares the liquidity creation (Panel A) and balance sheet structures (Panel B) of national banks to those of non-national banks. We define the national banks as the US banks that have branches in at least 160 counties in the US. The data consist of a panel of bank-years from 1998 to 2013. In Panel A, *LiquidityCreation* is an annual average of a bank's liquidity creation that is constructed following the method of Berger and Bouwman (2009). In Columns 2 to 4 of Panel A, *LiquidityCreation* is decomposed to asset-side, liability-side, and off-balance-sheet-side. In Panel B, *Loan/Assets* is an annual average ratio of a bank's total loans over its total assets. *Credit/Assets* is an annual average ratio of a bank's total credits relative to its total assets. We define *Total Credit* as the sum of total loans and unused commitments in this study. *LCR* is an annual average of a bank's liquidity coverage ratio estimated by its financial statement that follows the method of Hong et al. (2014) and Choi et al. (2020). *National* is a dummy variable that identifies the national bank as of the previous year-end. *Distress* is a dummy variable that identifies a year of market distress that is within the top 20% as measured by the annual average spread between the 3-month CP rate and the 3-month T-bill rate. We add a set of bank-level control variables including *BigBHC, Big, Small, Local, Ln(total assets), LeverageRatio, CapitalRatio, NPLRatio, Z-score, Loan/Deposit,* and *ROA*. Those control variables are as of the previous year-end. Appendix Table 11 provides definitions of the variables. The coefficients on those control variables are not reported for compactness. Standard errors are clustered at the bank level

Panel A	*LiquidityCreation*			
	Overall	Asset-side	Liability-side	OBS-side
National	0.077	-0.020	0.019***	0.076*
	(1.56)	(-0.90)	(2.77)	(1.77)
National × Distress	-0.155***	-0.049***	-0.014***	-0.095**
	(-3.76)	(-4.09)	(-2.66)	(-2.42)
Observations	96,121	96,121	96,121	96,121
Adjusted R^2	0.907	0.850	0.830	0.939
Bank Controls	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y

Panel B	Loans/Assets	Credits/Assets	LCR
National	-0.008	0.139	-4.301**
	(-0.45)	(1.62)	(-2.08)
National × Distress	-0.032**	-0.239***	2.169**
	(-2.09)	(-3.21)	(2.25)
Observations	96,121	96,121	80,546
Adjusted R^2	0.815	0.927	0.673
Bank Controls	Y	Y	Y
Year FE	Y	Y	Y
Bank FE	Y	Y	Y

Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively. *t*-statistics are in parentheses

aggregate, reduce their unused commitments in the off-balance-sheet more severely than their total loans in response to a market downturn.

Next, we examine the changes in banks' deposit interest rates as identified by RateWatch. For this test, we use interest rates of various deposit products at the branch level as key outcome variables. Specifically, we use interest rates for two types of deposit products: money market accounts (MMs), and certificates of deposits (CDs). MMs are demandable deposits without a specified maturity. CDs are a term deposit with a specific maturity. Deposit interest rates are differentiated not only by type but also by the size of each account. Thus, we compare the deposit interest rates among different account sizes within the same type of bank. For the CDs, the interest rates are further differentiated by maturities. Therefore, we compare CD interest rates with short-term maturity and those with long-term maturity. The data for this test are a panel of bank branches by year. Moreover, the monthly deposit interest rates of each branch are converted into an annual average. We also add year-county and branch-county fixed effects to fully control for cross-county variations that may affect a bank branch's deposit interest rates in each county.

Table 10 provides the results. Our empirical evidence clearly indicates that national banks significantly decrease the interest rates on MMs under market distress compared to non-national banks. Interestingly, these results are more significant for larger account sizes. This significance may be because MMs with larger sizes pose special threats to banks' liquidity

Table 10 National Banks' Deposit Interest Rates. This table compares deposit interest rates on various deposit products of national banks to those of non-national banks. We define national banks as the US banks that have branches in at least 160 counties in the US. The data consist of a panel of bank branch-years from 1998 to 2013. *MM* is a bank branch's annual average deposit interest rates on money market accounts (minimum account size: \$10,000, \$25,000 or \$100,000). CD is a bank branch's annual average deposit interest rates on certificate of deposit (maturity: 3-, 12-, or 24-months, minimum account size: 10,000 or 100,000). *National* is a dummy variable that identifies the national bank as of the previous year-end. *Distress* is a dummy variable that identifies a year of market distress that is within the top 20% as measured by the annual average spread between the 3-month CP rate and the 3-month T-bill rate. We add a set of bank-level control variables including *BigBHC, Big, Small, Local, Ln(total assets), LeverageRatio, CapitalRatio, NPLRatio, Z-score, Loan/Deposit* and *ROA*. Those control variables are as of the previous year-end. Appendix Table 11 provides definitions of the variables. The coefficients on those control variables are not reported for compactness. Standard errors are clustered at the bank level

Panel A		MM	
Minimum Account Size	\$10,000	\$25,000	\$100,000
National	0.111**	0.149**	0.122
	(2.23)	(2.16)	(1.10)
National × *Distress*	-0.332**	-0.497**	-0.688**
	(-2.42)	(-2.46)	(-2.52)
Observations	74,674	74,767	32,536
Adjusted R^2	0.837	0.833	0.788
Bank Controls	Y	Y	Y
Year-County FE	Y	Y	Y
Bank-County FE	Y	Y	Y

Panel B				CD		
Maturity	3-month		12-month		24-month	
Minimum Account Size	\$10,000	\$100,000	\$10,000	\$100,000	\$10,000	\$100,000
National	0.048	-0.028	0.079	-0.037	0.119	0.088
	(0.59)	(-0.31)	(0.79)	(-0.37)	(1.04)	(0.67)
National × *Distress*	-0.110	-0.431**	-0.080	-0.195*	-0.026	-0.097
	(-0.64)	(-2.38)	(-0.83)	(-1.81)	(-0.33)	(-0.87)
Observations	72,254	38,434	76,990	42,256	73,877	36,944
Adjusted R^2	0.940	0.943	0.968	0.967	0.968	0.963
Bank Controls	Y	Y	Y	Y	Y	Y
Year-County FE	Y	Y	Y	Y	Y	Y
Bank-County FE	Y	Y	Y	Y	Y	Y

Statistical significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively. *t*-statistics are in parentheses

management. Although banks normally match the duration of their assets to liabilities, the lower profitability of short-term investments and the high cost of expanding the balance sheet make banks reluctant to increase their demandable or short-term deposits. Thus, banks may need to downsize such deposit products by decreasing their interest rates. In contrast, we find no evidence of significant decreases in the interest rates on CDs except for those with short-term (3-month or 12-month) maturities and large account sizes. Similar to MMs, CDs with short-term maturities can exacerbate banks' liquidity problems under turbulent market conditions. On the other hand, CDs with longer maturities are less likely to prompt a severe bank-run in the near future even during market distress. Thus, banks may have greater incentives to rely on long-term maturity deposits by maintaining relatively higher interest rates on them. Taken together, the findings for deposit interest rates are fairly consistent with the estimated results for reduced liquidity creation on the liability side (Column 3 of Table 9 Panel A) by national banks during a time of market distress.

6 Conclusion

In this paper, we examine how the market shares of national banks in a county can affect its economic activities. Our empirical evidence shows that the greater the national banks' local market shares are in a county, the greater the county's subsequent fluctuation in its annual growth rate of aggregated personal income. In normal times, the large size of national banks' local market shares lead to a stronger growth in the aggregate personal incomes of a county in the following year. In contrast, under macro-level distress, we find that the growth rate of personal incomes in the county with national banks that have large local market shares is more likely to fall in the subsequent year. We further find that the national banks create more liquidity than the non-national banks in normal times. In contrast, under market distress, liquidity creation declines more significantly for the group of national banks. We argue that this fluctuating liquidity creation may be one of the key channels for the local economic fragility of the counties dominated by the national banks.

Overall, our results indicate a strong positive relationship between national banks' shares in a local market and the vulnerability of the local economy to macro-level distress. Our findings provide several important insights for policymaking. First, we show that a balance between funding from national banks and alternative local financing sources at the local level are critical to minimize the vulnerability of the local economy to macro-level shocks. Second, our results show that the geographical distribution of the bank branches can be one of the potential key channels of systemic risk across financial markets. These results indicate that policymakers should perhaps consider a regulatory framework specifically designed for banks with diverse branch networks beyond existing regulatory requirements for systemically important financial institutions (SIFIs). This new policy toolkit should be designed to mitigate the potential contagion mechanism of national financial distress across different local markets that is transmitted through the national banks' geographical branch dispersion.

The findings of this study leave several important questions related to the functioning of national banks for future research. How do national banks change their local market shares? Is this related to a merger and acquisition between multiple banks or just the national bank's winning the competition with the non-national banks over the local market? Another important question is why the national banks reduce their liquidity creation relative to non-national banks under market distress that is one of the major driving factors of the negative real effects in local markets. More research into these questions is needed.

Appendix A

Table 11 Variable Definition

Variable	Definition
County-Level	
IncomeGrowth	Annual growth rate of county-level personal incomes for the following year
MedIncomeGrowth	Annual growth rate of county-level median household income in following year
WageSalaryGrowth	Annual growth rate of county-aggregate wages and salaries in following year
EstablishGrowth	Annual growth rate of county-aggregated number of establishments in following year
EmployGrowth	Annual growth rate of county-aggregated number of the employed in following year
NationalShr	National banks' deposit market shares in the county. The national bank is defined as a US bank that has branches in at least 160 counties in the US
NationalBHCShr	National BHCs' deposit market shares in the county. The national BHC is defined as the BHC that has branches in at least 160 counties in the US
BranchingRestrictions	Degree of the branching restrictions in each state, ranging from 0 to 4 (0 being the least restrictive and 4 being the most restrictive). Following Rice and Strahan (2010), we combine four important provisions (the minimum age of the target institution, de novo interstate branching, acquisition of individual branches, and statewide deposit cap) to measure the degree of the state branching restrictions
Ln(Income)	Natural log of county-aggregate personal incomes
Ln(Population)	Natural log of county-level total population
Ln(Deposits)	Natural log of county-aggregate bank deposits
Ln(NumBank)	Natural log of county-aggregate numbers of banks
Ln(NumBranch)	Natural log of county-aggregate numbers of bank branches
BigBHCShr	Deposit market share of big BHCs in a county. Big BHC is the bank holding company with total consolidated assets above $50 billion
BigShr	Deposit market share of big banks in a county. Big bank is defined as the bank with total assets above $10 billion
SmallShr	Deposit market share of small banks in a county. Small bank is defined as the bank with total assets below $2 billion
LocalShr	Deposit market share of local banks in a county. Local bank is defined as the bank that collects more than 65% of their deposits from a given county
GSIBShr	Deposit market shares of G-SIBs in a county. The G-SIB is the US bank that is designated as the global systemically important bank by the Financial Stability Board and the Basel Committee on Banking Supervision
HHI	Herfindahl–Hirschman Index for a county-level deposit market
Bank Level	
LiquidityCreation	A bank's liquidity creation in each county following the measure of Berger and Bouwman (2009)
Loan/Asset	Ratio of a bank's total loans over its total assets
Credit/Asset	Ratio of a bank's total credits relative to its total assets. *Total Credit* is the sum of total loans and unused commitments
LCR	Liquidity coverage ratio estimated by its financial statement, following the method of Hong et al. (2014) and Choi et al. (2020)
National	Dummy variable for a US bank that has branches in at least 160 counties in the US (National bank)
BigBHC	Dummy variable for a bank holding company with total consolidated assets above $50 billion

Table 11 (continued)

Variable	Definition
Big	Dummy variable for a big bank, which is defined as the bank with total assets above $10 billion
Small	Dummy variable for a bank with total assets below $2 billion
Local	Dummy variable for a bank that collects more than 65% of their deposits from a given county
Ln(total assets)	Natural log of a bank's total assets
LeverageRatio	Ratio of a bank's tier 1 capital over the bank's total assets
CapitalRatio	Ratio of a bank's tier 1 capital over the bank's total risk-weighted assets
NPLRatio	Ratio of a bank's nonperforming loans over its total loans
Z-score	A bank's Z-score
Loan/Deposit	Ratio of a bank's total loans over its total deposits
ROA	Ratio of a bank's net incomes over its total assets
Bank Branch Level	
MM	Deposit interest rate for money market account
CD	Deposit interest rate for certificate of deposit account
Macro Level	
Distress	Dummy variable that identifies a year of market distress that is within the top 20% as measured by the annual average spread between the 3-month CP rate and the 3-month T-bill rate
Spread	Annual average spread between the 3-month CP rate and the 3-month T-bill rate
StressQ	Quintile variable for the annual average spread between the 3-month CP rate and the 3-month T-bill rate

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10693-022-00382-3.

Funding Open Access funding provided by the IReL Consortium

Declarations

Conflicts of Interests Conflicts of interests or competing interests due to funding: The authors declare that they have no financial or nonfinancial interests that are directly or indirectly related to the research described in this paper.

References

Acemoglu D, Ozdaglar A, Tahbaz-Salehi A (2015) Systemic risk and stability in financial networks. Am Econ Rev 105(2):564–608

Acharya VV, Mora N (2015) A crisis of banks as liquidity providers. J Financ 70(1):1–43

Acharya VV, Pedersen LH, Philippon T, Richardson M (2017) Measuring systemic risk. Rev Financ Stud 30(1):2–47

Adrian T, Brunnermeier MK (2008) Federal Reserve Bank of New York. In Liquidity, Monetary Policy, and Financial Cycles, Federal Reserve Bank of NY Current Issues in Econ. and Fin.

Allen L, Bali TG, Tang Y (2012) Does systemic risk in the financial sector predict future economic downturns? Rev Financ Stud 25(10):3000–3036

Allen F, Gale D (2000) Financial contagion. J Polit Econ 108(1):1–33

Beck T, Levine R, Loayza N (2000) Finance and the sources of growth. J Financ Econ 58(1–2):261–300

Berger AN, Bouwman CH (2009) Bank liquidity creation. Rev Financ Stud 22(9):3779–3837

Berrospide JM, Black LK, Keeton WR (2016) The cross-market spillover of economic shocks through multimarket banks. J Money, Credit, Bank 48(5):957–988

Brownlees C, Engle RF (2017) SRISK: A conditional capital shortfall measure of systemic risk. Rev Financ Stud 30(1):48–79

Brunnermeier MK, Gorton G, Krishnamurthy A (2012) Risk topography. NBER Macroecon Annu 26(1):149–176

Brunnermeier MK, Pedersen LH (2005) Predatory trading. J Financ 60(4):1825–1863

Carlson M (2004) Are branch banks better survivors? Evidence from the depression era. Econ Inq 42(1):111–126

Castiglionesi F, Feriozzi F, Lorenzoni G (2019) Financial integration and liquidity crises. Manage Sci 65(3):955–975

Cetorelli N, Gambera M (2001) Banking market structure, financial dependence and growth: International evidence from industry data. J Financ 56(2):617–648

Chavaz M (2017) Liquidity holdings, diversification, and aggregate shocks.

Cheng X, Degryse H (2010) The impact of bank and non-bank financial institutions on local economic growth in China. J Financ Serv Res 37(2):179–199

Choi S, Gam YK, Park J, Shin H (2020) Bank partnership and liquidity crisis. J Bank Financ 120:105958

Clarke MZ (2004) Geographic deregulation of banking and economic growth. J Money, Credit, Bank 36:929–942

Cortés KR (2014) Rebuilding after disaster strikes: How local lenders aid in the recovery.

Cortés KR, Strahan PE (2017) Tracing out capital flows: How financially integrated banks respond to natural disasters. J Financ Econ 125(1):182–199

De Jonghe O (2010) Back to the basics in banking? A micro-analysis of banking system stability. J Financ Intermed 19(3):387–417

Diebold FX, Yılmaz K (2014) On the network topology of variance decompositions: Measuring the connectedness of financial firms. J Econ 182(1):119–134

Freixas X, Parigi BM, Rochet JC (1998) Systemic risk, interbank relations and liquidity provision by the central bank.

Gabaix X (2011) The granular origins of aggregate fluctuations. Econometrica 79(3):733–772

Gilbert RA, Kochin LA (1989) Local economic effects of bank failures. J Financ Serv Res 3(4):333–345

Gilje EP, Loutskina E, Strahan PE (2016) Exporting liquidity: Branch banking and financial integration. J Financ 71(3):1159–1184

Glasserman P, Young HP (2016) Contagion in financial networks. J Econ Lit 54(3):779–831

Gray DF, Jobst AA (2011) Modelling systemic financial sector and sovereign risk. Sveriges Riksbank Econ Rev 2(68):106

Holmström B, Tirole J (1998) Private and public supply of liquidity. J Polit Econ 106(1):1–40

Hong H, Huang JZ, Wu D (2014) The information content of Basel III liquidity risk measures. J Financ Stab 15:91–111

Huang X, Zhou H, Zhu H (2009) A framework for assessing the systemic risk of major financial institutions. J Bank Finance 33(11):2036–2049

Jayaratne J, Strahan PE (1996) The finance-growth nexus: Evidence from bank branch deregulation. Q J Econ 111(3):639–670

Kalemli-Ozcan SEBNEM, Papaioannou E, Peydro JL (2013) Financial regulation, financial globalization, and the synchronization of economic activity. J Financ 68(3):1179–1228

King RG, Levine R (1993a) Finance and growth: Schumpeter might be right. Q J Econ 108(3):717–737

King RG, Levine R (1993b) Finance, entrepreneurship and growth. J Monet Econ 32(3):513–542

Krishnamurthy A (2010) Amplification mechanisms in liquidity crises. Am Econ J Macroecon 2(3):1–30
Krishnamurthy P (2015) Banking deregulation, local credit supply, and small-business growth. J Law Econ 58(4):935–967
Kroszner RS, Strahan PE (1999) What drives deregulation? Economics and politics of the relaxation of bank branching restrictions. Q J Econ 114(4):1437–1467
Lehar A (2005) Measuring systemic risk: A risk management approach. J Bank Financ 29(10):2577–2603
Levine R (2005) Finance and growth: theory and evidence. Handb Econ Growth 1:865–934
Levine R, Loayza N, Beck T (2000) Financial intermediation and growth: Causality and causes. J Monet Econ 46(1):31–77
Lorenzoni G (2008) Inefficient credit booms. Rev Econ Stud 75(3):809–833
Loutskina E, Strahan PE (2015) Financial integration, housing, and economic volatility. J Financ Econ 115(1):25–41
Pilloff SJ (1999) Does the presence of big banks influence competition in local markets? J Financ Serv Res 15(3):159–177
Rajan RG, Zingales L (1996) Financial dependence and growth (No. w5758). National bureau of economic research
Ranciere R, Tornell A, Westermann F (2006) Decomposing the effects of financial liberalization: Crises vs. growth. J Bank Financ 30(12):3331–3348
Rice T, Strahan PE (2010) Does credit competition affect small-firm finance? J Financ 65(3):861–889
Schüwer U, Lambert C, Noth F (2018) How do banks react to catastrophic events? Evidence from Hurricane Katrina. Rev Financ 23(1):75–116
Shleifer A, Vishny RW (1992) Liquidation values and debt capacity: A market equilibrium approach. J Financ 47(4):1343–1366