U.S. Banking Panics and the Credit Channel: Evidence from 1870-1904

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Abstract

The empirical study of the effect of banking panics on the economy has traditionally been difficult due to the lack of adequate data on output during the major part of the 19^{th} and early 20^{th} centuries. This paper proposes an alternative approach by looking at the business activity of the banking sector. Using a newly digitized dataset on National Banks resources and liabilities, I argue that distortions to the normal activity of the banking sector are a good proxy for the impact of panics on the economy. Additionally, I propose a novel Instrumental Variables approach for identifying the effects of banking panics through the exogenous drops in deposits induced by bank runs. The results show a temporary but large effect of panics on lending activity of approximately 10 p.p. (on impact) and an average duration of one year.

"I warn you, Sir! The discourtesy of this bank is beyond all limits. One word more and I – I withdraw my overdraft!"

Punch Magazine Vol. 152, June 27, 1917

I Introduction

This paper aims to estimate the effect of banking panics on the U.S. economy by using a newly digitized dataset containing aggregate categories of National Banks resources and liabilities. Banking panics were relatively common on the early stages of development of the banking system of almost every country. In a recent study, Jalil (2013) dates twenty-eight panic episodes during the period 1830-1930, seven of them widespread across the U.S. territory, which is equivalent to an average of a panic every 3.6 years, and a major one every 14 years.

Panics persisted as a recurring feature of the U.S. banking system during the first part of the 20^{th} century until the approval of the Banking Acts of 1933 and 1935, which created the FDIC and established an insurance on deposits. Therefore, even though bank runs have historically been a salient feature of the U.S. financial system, the absence of panics on the post-World War II American economy imply that their study is severely constrained by the lack of adequate data during most of the 19^{th} century.

U.S. banking panics have been extensively studied by many authors, although their approach focused mainly on case studies of particularly important and well-known panics, like the ones occurring during the Great Depression. My paper takes a different approach and asks which are the aggregate effects of bank runs as a particular type of financial distress. Therefore, this paper is closely related to studies on the impact of financial crisis like Reinhart and Rogoff (2009). Nevertheless, those papers tend to focus on a broader definition of financial crisis, often using an international post-World War II sample, which implies that their conclusions can not be easily extrapolated to the 19^{th} century U.S. bank runs. The reference paper for the study of banking panics during this period is provided by Jalil (2013), to which I will frequently refer. Jalil makes an important contribution to the literature on panics by providing a detailed and reliable account of the time and geographical extent of the bank run episodes that took place throughout the 19^{th} and early 20^{th} centuries. Prior to Jalil's study, the existing panic series differed widely, and in many instances missed to account for minor and geographically localized episodes. A second contribution of Jalil's paper is a first attempt at estimating the effects of banking panics on output, which the author finds to be large and persistent. Nevertheless, the paper leaves some room for further research and improvement. For example, my study will bring additional support for the theory that banking panics affect output by directly looking at whether the credit channel, the most obvious transmission mechanism between the banking system and the real economy, displays any signs of distress. Additionally, the national level aggregation of the output measures used by Jalil prevents him from studying the effects of minor panics, a thing that I will be able to do with my data. And finally, as I will argue in the following sections, the large effects found on Jalil (2013) are sensitive to the inclusion of time fixed effects, which largely reduce the permanent effect of bank runs.

The paper is structured as follows: Section II presents the banking data and the panic series that I will use. Section III explains the methodology. Section IV reports and discusses the results and Section V concludes.

II Data

Banking data

This paper exploits the information contained in the Annual Report of the Comptroller of the Currency, readily accessible through the Federal Reserve's Archive (FRASER).

One of the most important sections is the "Report of Condition of the National Banks", which reproduces the balance sheet (with some level of aggregation across categories) of each of the existing National Banks, as contained on the November/December call reports[1] of the previous year. It also contains, under the section entitled "Abstract of the Reports of Condition", the State and reserve city aggregate of the same categories for each of the five call reports of the year, and which is the information that I will use in this paper. The categories that it contains are summarized in Appendix B, Table 3. Table 4 explains how I created the variables that I will use throughout the paper as a combination of them.

This data is attractive for several reasons. First, because it brings a measure of banking activity at a relatively high frequency (five times per year), compared to other existing measures of economic activity for that period. Additionally, it provides a sufficiently detailed level of disaggregation. And finally, but not least important, it virtually has no measurement error or construction uncertainty, as it tends to be the case with many of the constructed variables tracking economic activity on the 19^{th} century.

Contrary to what one might think, the information contained on the Annual Reports has not been systematically exploited. Notable exceptions are provided by case studies of well known financial crisis, like Calomiris and Mason (2003), which collected the bank level data contained on the Reports at a biannual frequency for 1929 and 1931, Calomiris and Mason (1994) which uses the same data for 1930 and 1931 restricted to the banks of Chicago, and Dupont (2007) which also looks at similar data for State and National banks in Kansas surrounding the 1893 panic. Nevertheless, this is the first paper I am aware of that uses this data at such level of disaggregation to study a long period of time. My hypothesis for the lack of usage of this data is that until very recently the digitization of such a large datasets was highly impractical[2]. Nevertheless, recent advances on optical recognition software make it finally possible to exploit the data.

The information contained on the Annual Reports is digitized for the period 1870-1904 and for the States of Illinois, Massachusetts, New York and their corresponding reserve cities: Chicago, Boston, Albany, Brooklyn and New York City. This allows me to create a panel with eight banking panic episodes, seven of them directly involving the States and/or reserve cities digitized, and two of them being classified by Jalil as major (widespread across the U.S.) panics. The choice of the time periods and geographical units has been constrained by the limited amount of time for preparing this paper, which forced me to choose the time period and geographical units experiencing the highest number of banking panics. Therefore, in future versions of this paper the time period could be potentially extended beyond 1930 and include all the U.S. States and reserves cities in order to capture a total of sixteen banking panics, many of them simultaneously affecting several regions.

I treat States and reserve cities as independent observations, all of them constituting a separate entry on the panel. In order to avoid an artificial duplication/correlation across observations, State aggregates exclude the value of the variable (ex. aggregate bank lending) corresponding to the reserves cities (i.e. Illinois aggregate bank lending will not contain total lending made by Chicago banks). There may be concerns about the consideration of States and reserves cities as equal entities, but I defend this procedure for several reasons. First, the reserve cities of Boston, Chicago and New York City have an approximately similar or higher level of banking activity (number of banks, aggregate lending, total deposits, etc.) than the States that contain them,

[1] The "call reports" were one of the obligations of the nationally chartered banks, which consisted of a detailed statement of their resources and liabilities as well as some additional financial data, and that had to be sent fives times per year at the request of the Office of the Comptroller.

[2] Calomiris and Mason (2003) allegedly report having spent eight years on the digitalization of the data used on their paper.

so the observations tend to be of a similar magnitude. Secondly, this allows me to use a higher level of disaggregation, which implies a bigger panel and henceforth a more accurate estimation. And lastly, because it will allow me to test for the existence of spillovers within State boundaries (i.e. between the reserve city and the rest of the State) and the differential impact of crisis on reserve cities (for example, through correspondent relationships that link banks of these cities to the rest of the State and the country). Therefore, from now on I will generically refer to States and reserves cities as "geographical units" or simply "units" whenever the context does not ask for an explicit differentiation.

One last caveat that I have to address is the possible generalization of those results to the entire banking sector, given that my dataset does not contain information on State chartered banks, private banks and trust companies, which throughout the period considered represent a sizable fraction of total banking activity. The best response that I can present, apart from the intuitive argument that similar financial institutions operating in the same territory should be expected to perform alike, is that the charter of National Banks subjected them to stricter rules both in terms of the activities that they could perform and the reserve limits with which they had to comply compared to other entities, largely due to its capacity to emit bank notes for public circulation. Therefore, given that bank runs are triggered by a sudden distrust of the banking sector, we may conservatively take any results found in this paper as a lower bound of the real effects of panics on the banking sector as a whole.

Panic series

Throughout the paper I will use the panic series developed by Jalil (2013), which I reproduce in Table 1 for easiness of exposition. Alternative panic classifications exist, like the ones proposed by Bordo and Wheelock (1998), Reinhart and Rogoff (2009), Thorp (1926) and Kemmerer (1910), the later having been widely used in prior research. There are several reasons for this decision. The first one is that, as shown in Jalil's paper, previous series are substantially imprecise (especially the one developed by Kemmerer), lack clear and uniform guidelines for classifying an event as a panic and in many instances fail to identify minor or geographically localized panics as such. Jalil overcomes these problems by precisely defining a panic as a "widespread run by private agents in financial markets... [in order to] convert deposits into currency" and by identifying each of these episodes trough a narrative approach. The author reads several nationally distributed financial newspapers of the period in search of reports of banking panics, which allows him to precisely date the beginning and end of each episode and also to divide the panics between minor and major ones[3].

Another reason for using Jalil's series instead of broader definition of financial crisis, which for example may include stock market and currency panics, is that banking panics seem to have been relatively unpredictable and unrelated to the developments of the economy, which will help me to claim a causal interpretation of the results presented in Section IV. In order to sustain this claim, Jalil ranks the causes of each major panic in terms of its relationship with economic developments by looking at contemporaneous newspaper reports. The result is that none of the major panics is classified as being caused primarily by economic fluctuations. In this paper I will additionally make use of the minor panics series, for which Jalil does not provide a formal ranking. Nevertheless, summaries of each crisis reported on the Appendix of his paper are consistent with the idea that minor panics were primarily unrelated to economic developments as well[4]. There still

[3] Jalil identifies a panic as a cluster of three or more banks suspending payments and/or suffering runs due to a commonly identified cause. Panics are classified as major if they satisfy two characteristics: 1) They span more than one geographical unit 2) They appear on the front page of the financial newspapers. All others are classified as minor panics.

[4] For example, Jalil writes about the May 1884 panic: *"The Marine National Bank had advanced funds to Grant and Ward for speculative activities. On May 10, due to connections with Grant and Ward, the Northwestern Car and Manufacturing Company was placed into receivership. Two days later, a run broke out on the Second National Bank following the disclosure that John Eno, the bank's president, had embezzled three million dollars."*.
And about the December 1899 panic: *"Financial instability broke out in Boston in December 1899 following a decline in the price of copper stocks. The Globe National Bank had made loans on United States Oil and United*

remains the concern that while unrelated to the developments of the economy, panics may have been related to the activity of the banking sector. The examples given on the previous footnote point out to fraud scandals, risky loans and failed investments as some of the events that triggered bank runs[5]. Even though that may be true for some of the individual banks involved, this effect is negligible when we look at the State or city aggregates. In order to further strengthen this view, Table 2 reports the results of several Granger causality tests on some of the most relevant variables that I include in the regressions. The test consists on regressing the panic series on the banking variable of interest and testing for the joint significance of the coefficients. As we can see, the null hypothesis that all the coefficients are jointly equal to zero can not even be rejected at 10% confidence level for any variable.

Finally, and as it will be explained with more detail in the next Section, the narrow definition of panics as runs on private deposits will play a crucial role in my instrumental variables approach.

III Methodology

A first approach

In order to estimate the reaction of the variables of interest to panics I will use throughout the paper the local projection method developed by Jordà (2005). The Jordà method consists on the separate estimation of successive regressions of contemporaneous (time t) and future values of the variable of interest on the panic variable and other controls at time t. Then, the coefficients on the panic variable at time t are collected in order to create an impulse response function.

Jordà local projections display several features that make them especially attractive in front of traditional SVAR's. The first is that its nonparametric approach allows us to estimate impulse response functions without having to take any stances on the autoregressive nature of the variables of interest. This is particularly important in this case because the panic series does not naturally adjust to the structure of an autoregressive process[6]. Also, the use of simple linear regressions allows for great flexibility with respect to the inclusion of controls and interactions between variables.

The main regression that I will use is as follows:

$$y^i_{t+k} = \alpha^i_k + \mu^i_{\Psi(t,\,k)} + \beta^k P^i_t + \sum_{j=1}^{10} \delta^k_j P^i_{t-j} + \sum_{j=1}^{10} \varphi^k_j y^i_{t-j} + \theta^k Brklyn^i_t + \varepsilon^i_{t+k} \tag{1}$$

where t is time, k denotes the estimation horizon, i refers to geographical units, and $\Psi(t,\,k)$ indexes the pertinence to one of the five year bins used to control for time effects. y denotes the variable of interest, like lending to the private sector. Variable P denotes the binary panic variable obtained from Jalil (2013). *Brklyn* is a dummy variable that controls for the separation of Brooklyn from the State of New York in the Annual Reports of the Comptroller from 1890 onwards. [7] The variable ε denotes the error term. Coefficient α represents a geographical unit fixed effect, and μ captures a time effect over five year bins.

The regression includes ten lags of y and P as controls. The reason for including ten lags is that I want to control for the evolution of those variables in the previous two years (the data is observed five times per year). Lagged P values are necessary for controlling the effects of panics on previous periods from that of a panic occurring at time t. The lagged observations of y allow me to control for the predictable component of y, but the most crucial reason for its inclusion is

Mining securities. The market price of these securities declined, leading to the resignation of the bank's president and a threat of deposit withdrawals."

[5] Note that failed investments and/or loans may naturally occur even on diligently administered banks.

[6] Banking panics occur on clustered episodes of time, and therefore are not adequately represented by an autoregressive process. A two-state Markov chain may be a more accurate theoretical representation.

[7] Brooklyn did not became a reserve city until 1890 and therefore the aggregate categories for its banks did not start to be separately reported from the State of New York until this year. *Brklyn* is defined as a binary variable that takes the value one for all New York State observations after 1899 and zero otherwise.

the necessity to control for the non-stationarity of the variable. Once included the controls for y, and given that its coefficients roughly add to one at all horizons considered, the geographical fixed effects can be interpreted as controlling for the differential growth rate (of y) of each region.

The time effects are estimated over bins of five years for several reasons. First, because the limited cross section of the panel (eight geographical units) would make the estimation of period-by-period time fixed effects inconsistent. Additionally, given that the sample only contains eight panic episodes, standard fixed effects may incur the risk of capturing part of the effect due to panics, biasing my estimates towards zero. Therefore, I have chosen a less stringent set of time controls in order to avoid or at least mitigate these problems while controlling by the aggregate evolution of the variables of interest.

The set of coefficients $\{\beta^k\}_{k=0}^K$ are the ones we are interested in and which contain the causal effect on y of banking panics.

Finally, I compute heteroskedasticity-consistent standard errors and report a normal 95% confidence interval for all coefficients. The main reason for using robust standard errors is the possibility of having geographical units with different volatilities, which is especially true for the relatively small reserve cities of Albany and Brooklyn, where idiosyncratic shocks experienced by their banks are more likely to affect the city aggregate.

Instrumental Variables estimation

Many of the papers looking at the effects of financial crisis struggle with the problem of finding a variable which adequately represents the severity of each of the observed crisis episodes. Romer and Romer (2015) discuss this issue and propose a narrative approach for creating a continuous distress variable. This would be, in general, the highest level of precision that one can expect to obtain. Nevertheless, in the following paragraphs I will argue that banking panics are a rare exception and that there exists a natural continuous measure of distress associated to them.

Recalling Jalil's definition of banking panics: "A financial panic occurs when fear prompts a widespread run by private agents in financial markets...[in order to] convert deposits into currency". Therefore, individual deposits, which I observe in my dataset, provide for a good and continuous measure of the distress experienced by the banking system. The most obvious argument against this approach is that deposits are not, in general, exogenous to the activity of the banking sector and the economy, and that for this reason they will be correlated with the error term and bring biased estimates. This is true in general, but what we really need is not a good measure of financial distress for every observed period, but a good measure of distress *during the panic episodes*. At this respect, in Section II I have argued with narrative and statistical evidence that bank runs are exogenous to the evolution of the banking activity. Therefore, drops in deposits occurring at the beginning of a panic episode can be considered exogenous as well, and therefore provide for the variation needed to estimate the impact of a run on deposits.

In order to exploit this insight, I will make use of the Jordà instrumental variables local projection method proposed by Jordà et al. (2014) and which is a straightforward extension of Jordà (2005) in which the parameters of interests are the coefficients on (log) individual deposits of the second stage of a linear instrumental variables regression.

Therefore, each of the separate regressions constituting the Jordà's local projections can be represented as:

First stage

$$Deposits_t^i = \psi^i + \nu^i_{\Psi(t)} + \Phi Instruments_t^i + \sum_{j=1}^{10} \Upsilon_j^k Deposits_{t-j}^i + \sum_{j=1}^{10} \Lambda_j^k y_{t-j}^i + \phi^k Brklyn_t^i + \xi_{t+k}^i \quad (2)$$

Second stage

$$y_{t+k}^i = \alpha_k^i + \mu^i_{\Psi(t,\,k)} + \beta^k \widehat{Deposits}_t^{\,i} + \sum_{j=1}^{10} \delta_j^k Deposits_{t-j}^i + \sum_{j=1}^{10} \varphi_j^k y_{t-j}^i + \theta^k Brklyn_t^i + \varepsilon_{t+k}^i \quad (3)$$

where as before y denotes the variable of interest, *Deposits* denotes the logarithm of Individual Deposits, ψ and α are geographical unit fixed effects, ν, μ are five year bins time controls, *Brklyn* is the control for the inclusion of Brooklyn as previously explained, *Instruments* is a valid vector of instruments, and $\widehat{Deposits}$ is the prediction of (log) individual deposits from the first stage regression.

In order to generate continuous and exogenous variation in $\widehat{Deposits}_t^{\,i}$, the instruments are created as follows. For every geographical unit l, experiencing a panic in year s, I create a dummy variable that takes one for the observation whose geographical unit type is l and the time of observation is s, and zero otherwise[8]. Explained differently, for each panic episode and geographical unit, I measure the exogenous variation in log deposits as the difference between $t = -1$ and $t = 0$ (panic starting at $t = 0$) in log deposits not explained by the control variables. That way, I can allow for the effect on (log) Deposits of the panic of 1899 in Boston to be different from that of the same year on the (log) Deposits of New York, and both of them to be different from the effect on (log) Deposits of the 1896 Illinois panic.

IV Results

As a preliminary, hands-off approach to the effects of banking panics, Figure 1 plots the evolution of (log) lending to the private sector by geographical unit[9] and marks the beginning of a banking panic directly affecting each of them. A visual inspection of the figures reveals that panics are correlated with simultaneous drops in lending and with a temporary slowdown of its growth rate. Nevertheless, it is also evident that the drop in lending activity varies substantially across geographical units and panic episodes, which reinforces the arguments for conducing the alternative instrumental variables approach.

Jordà Local Projections

Figure 2 contains the estimated impulse responses of Lending (to the private sector) activity to a panic. Figure 2a plots the baseline specification explained in Section III, in which the dependent variable is lending and the panic variable is a dummy that takes the value of one during a panic episode and zero otherwise. We can observe that the contemporaneous (i.e. period $t = 0$) effect is significant and big, of approximately 10%, followed by another relatively small decline down to 11% in $t = 1$ and a sustained recovery up to period $t = 6$ in which lending stabilizes at a level around 3.5 p.p. below the pre-panic level (even though the coefficients are only significantly different from zero at 10% level). Therefore, up to a first approximation the results seem to support only partly the Jalil (2013) findings. We observe a large drop on impact and a permanent

[8] Given that major panics affect all geographical units, in order to avoid collinearity issues among the instruments I only include a common panic dummy for all geographical units during major panics, that is, for these episodes I only include a dummy that takes one if the observation corresponds to the date of the panic, zero otherwise.

[9] Albany and Brooklyn are not plotted for brevity of exposition, but they display the same patterns.

stabilization below pre-panic levels after 1.2 years. Nevertheless, the medium/long terms effects found are relatively small compared to the permanent 10% drop in Output reported by Jalil.

Taking advantage of the disaggregation at State and reserve city level of the data, now I ask whether there existed substantial differences between minor and major panics. Figure 2b and Figure 2c show the impulse responses of lending to a minor and a major panic, respectively. In order to obtain those impulse responses, I replace the original panic variable in the baseline specification with a dummy that takes the value one only when there is a minor (major) panic episode, and zero otherwise. The obtained results are markedly different. I find a temporary effect of minor panics on lending, which experiences a 9% drop on impact but rapidly returns to its pre-panic level after four to six periods (0.8 to 1.2 years). On the other hand, the impulse response of a major shock is very similar to the one found in the baseline specification, with an approximate drop of an 11% on impact and a permanent stabilization around 3.5 p.p. below pre-panic levels. Therefore, we may conclude that the results found on the baseline specification are driven, on the long run, by the response of lending to major panics.

Now I will investigate whether the absence of time controls on Jalil (2013)[10] may be driving the strong and persistent effects that he finds. Figures 2d - 2f show the impulse responses discussed above without the inclusion of time controls. Excepting minor panics, which are robust to the exclusion of time controls, we now observe that the response of lending to major and to the full sample of panics does not exhibit any longer the mean-reverting tendency of previous figures, settling in the long run to an average of 10-12 p.p. below its pre-panic level. Therefore, these findings are a warning that Jalil's big and negative results may be a result of the lack of time controls.

Figures 2g - 2h show the differential effect of panics on Central Reserve cities (New York and Chicago). The interaction *Panic*$\times$*Central Reserve City* is included in regression 1, where *Central Reserve City* is a dummy that takes value one if the geographical unit is Chicago or New York City, and zero otherwise. The graphic plots the coefficient associated with this interaction. As it can be seen, the response of lending on these cities is not significantly different from the response on other geographical units.

Figure 2i shows whether lending activity within regions of the same State but not directly affected by a panic has been altered. Similarly, Figure 2j shows whether geographical units belonging to other States apart from those affected by a panic have changed their lending patterns. Therefore, these figures can be seen as a measure of State and Country spillovers, respectively. Note that as major banking panics affect all geographical units, those spillovers had to be estimated from minor panics. Figure 2i shows us that there do not exist clear within State spillovers. Nevertheless, Figure 2j shows (at 10% significance level) a temporary increase in the lending activity between 0.6 and 1.6 years after a panic in the geographical units not contained within the affected States. This result can be interpreted as a temporary shift of banking activity to the regions not affected by a run.

Without entering into such a detailed description as that done for lending, now I describe some of the most salient effects of banking panics on other variables. Figure 3 shows the effect on individual deposits. We observe that the effect is purely transitory, both in response to a major and a minor panic, the later displaying very little persistence, with deposits returning to pre-panic levels after three months. We also observe the same issues with major panics once we drop the time effects. Finally, we observe a temporary but significant increase in deposits at other States not affected by panics between 0.6 and 1.6 years after the shock, which may constitute additional evidence of a temporal shift in economic activity.

Figure 4 shows that the banking system responded to major panics increasing the share of their holdings of highly liquid assets (cash, specie and related) by around 10% during the seven months following a panic. We also observe in Figure 4e that banks located in Central Reserve cities increased an additional 16% the share of their holdings allocated to liquid assets compared to other geographical regions. These temporary increases may be interpreted as banks adopting precautionary measures in face of the increased uncertainty generated by panics, for example, due

[10] Jalil (2013) uses time series data aggregated at national level, so the inclusion of time fixed effects is unfeasible.

to an increase in the probability of additional bank runs on the following months. Figure 5 shows that the response of bonds and U.S. certificates as a fraction of total assets held by the banking sector also experienced a temporary increase of around 8% following a major panic. Again, this may be interpreted as banks adopting a more conservative attitude, as bonds and certificates are also relatively liquid and safe assets.

Figure 6c shows that aggregate equity permanently drops 3.5 p.p. below its pre-panic level following a major panic, corroborating the view that major panics have persistent effects on the banking sector. Nevertheless, there is no significant effect of panics on the number of banks (Figure 7). This may be explained by several reasons. First, because the banks that close permanently their doors enter a process of liquidation that may take months, dissipating across time their exit from the sample. And secondly, because many of the banks that temporarily suspend payments are able to reopen for normal business after the panic episode has passed.

Finally, Figure 8 shows the results of the alternative instrumental variables approach. The first stage Kleibergen-Paap statistic is 34.193, which indicates that the set of instruments used is strong[11]. We can see that it brings virtually the same results as the previous methodology. The figures display the response of the analyzed variables to a 10% run on individual deposits, which is the average loss following a panic on my sample (see Figure 2a). Note also that the linear IV regressions used restrict the differences between major and minor panics to be only of scale on the initial severity of the runs on deposits. On future versions of this paper I will allow for qualitative differences as well through a nonlinear specification for deposits.

V Summary and Conclusion

In this paper I have shown through a newly digitized dataset that the impact of bank runs is transmitted to the economy through a sharp drop of the lending activity of the banking sector, which may never fully recover to its pre-panic level in the case of major episodes. This results partially agree and support the findings of Jalil (2013), which reports large (around a 10% drop) and permanent effects of major banking panics on output. Nevertheless, my paper only finds a moderate long-run impact of panics on lending (around a 3.5% decline), which may suggest much milder permanent effects on output. Crucially, I am able to replicate those discrepancies and obtain large and permanent responses of lending to a major panic (around a 12%) in my dataset by dropping the time controls, which indicates that Jalil's results may be biased due to correlations across time of some of the included panics with cyclical downturns.

Additionally, this paper is the first to systematically study the effects of localized, minor panics. My results show that their impact on the affected regions is typically large in the initial periods, with a drop in lending activity of around 9%. Nevertheless, the effect displays low persistence and after four to six months lending returns to its previous level. Therefore, this results seem to imply that the effects of banking panics not only depend on the severity of the runs on deposits suffered, but also on the geographical extension of the episode.

Finally, I also present a new instrumental variables approach for measuring the severity of banking panics through exogenous drops in individual deposits. Even though the obtained results have not been significantly different from the basic estimation using panic indicators, it provides an insightful idea for conducting research on related topics and reminds the researcher that in some cases there may exist natural measures of financial distress at his disposal.

[11] The Kleibergen and Paap (2006) statistic is the heteroscedasticity-robust equivalent to the well known Stock and Yogo (2002) statistic test for weak instruments. The first stage value obtained implies a maximal IV relative bias of less than 5%.

A Tables and Figures

Table 1

New Series on Banking Panics, 1825-1929

Major Banking Panic	Non-Major Banking Panic
Nov 1833 - Apr 1834	
Mar - May 1837	
Oct 1839	
	Jan - April 1841 (PA, DE, MD, NC, VA, IL)
	Mar 1842 (PA)
	May - Jun 1842 (New Orleans)
	Oct 1851 (NY, NJ, MD)
	Sep 1854 - Feb 1855 (OH, IN, MI, WI, IA, MO, NY, CA)
Aug - Oct 1857	
	Nov 1860 (suspension of specie payments by banks in the South)
	Dec 1861 (generalized suspension of specie payments)
Sep 1873	
	May 1884 (NYC, PA, NJ)
	Nov 1890 (New York City)
May - Aug 1893	
	Dec 1896 (IL, MN, WI)
	Dec 1899 (Boston and New York City)
	Jun - Jul 1901 (New York: Buffalo and NYC)
	Oct 1903 (PA, MD)
	Dec 1905 (Chicago)
Oct - Nov 1907	
	Jan 1908 (New York City)
	Aug - Sep 1920 (Boston)
	Nov 1920 - Feb 1921 (North Dakota)
	Jul 1926 (FL, GA)
	Mar 1927 (FL)
	Jul - Aug 1929 (FL)

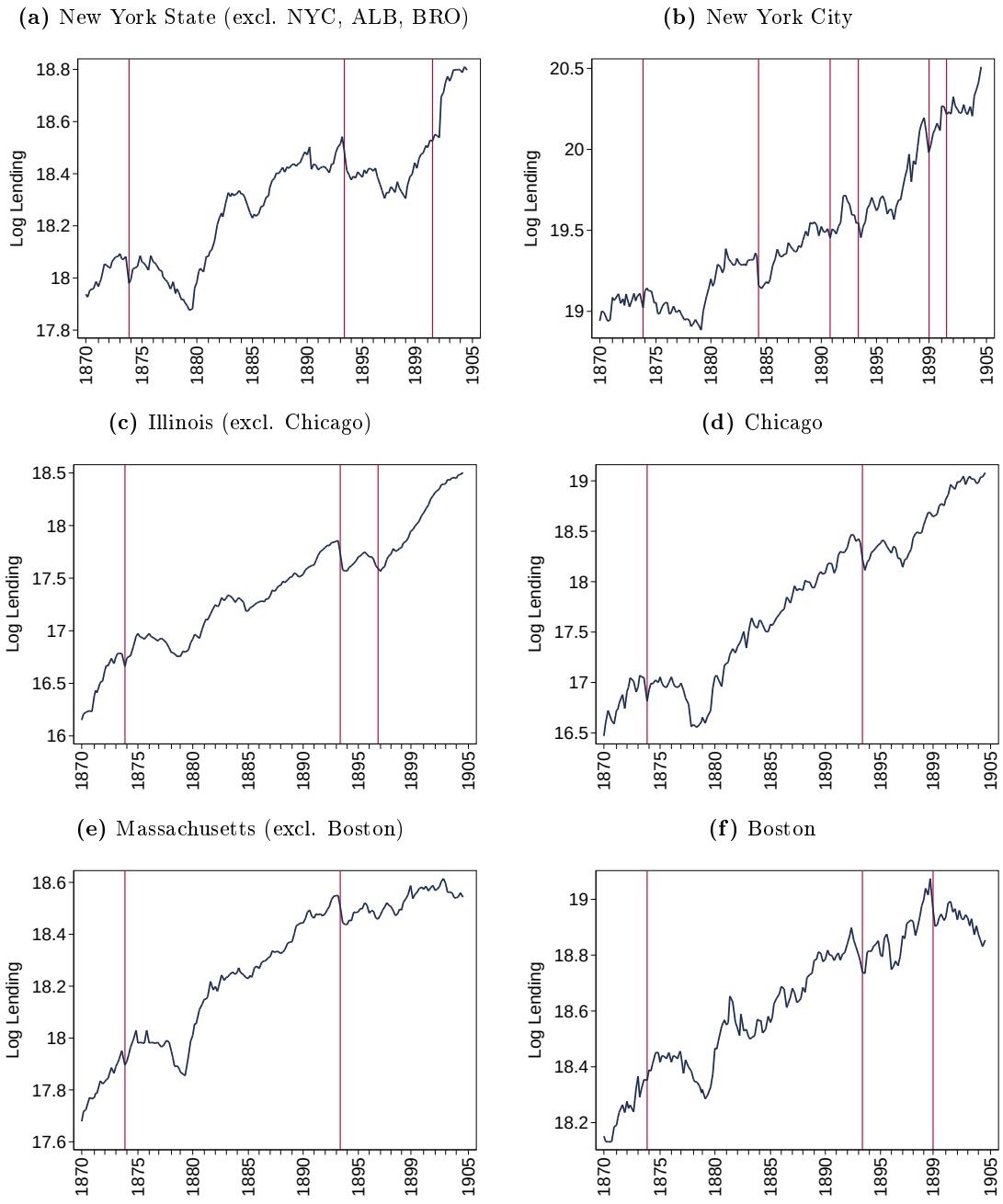
Table 2

Granger Causality Tests of the Exogeneity of the Banking Panic measure

Lag	Bank number	Private lending	Individual Deposits	Debt-to-Equity ratio
1	-0.141	-0.013	-0.014	0.013
	(0.211)	(0.092)	(0.040)	(0.021)
2	0.141	-0.091	0.012	-0.030
	(0.231)	(0.105)	(0.053)	(0.028)
3	-0.118	0.021	-0.068	-0.013
	(0.132)	(0.097)	(0.052)	(0.028)
4	-0.282	0.111	0.061	0.040
	(0.349)	(0.079)	(0.063)	(0.025)
5	0.638	-0.044	-0.061	0.030
	(0.387)	(0.101)	(0.076)	(0.029)
6	-0.239	0.080	0.068	-0.032
	(0.179)	(0.113)	(0.073)	(0.028)
7	-0.051	0.089	0.032	0.056
	(0.172)	(0.112)	(0.051)	(0.032)
8	0.018	-0.244	-0.011	-0.062
	(0.132)	(0.132)	(0.049)	(0.030)
9	-0.009	0.234	0.037	0.015
	(0.123)	(0.125)	(0.063)	(0.027)
10	0.060	-0.119	-0.043	-0.003
	(0.102)	(0.111)	(0.051)	(0.023)
F-statistic	0.840	1.280	0.830	0.970
P-value	0.587	0.235	0.600	0.470

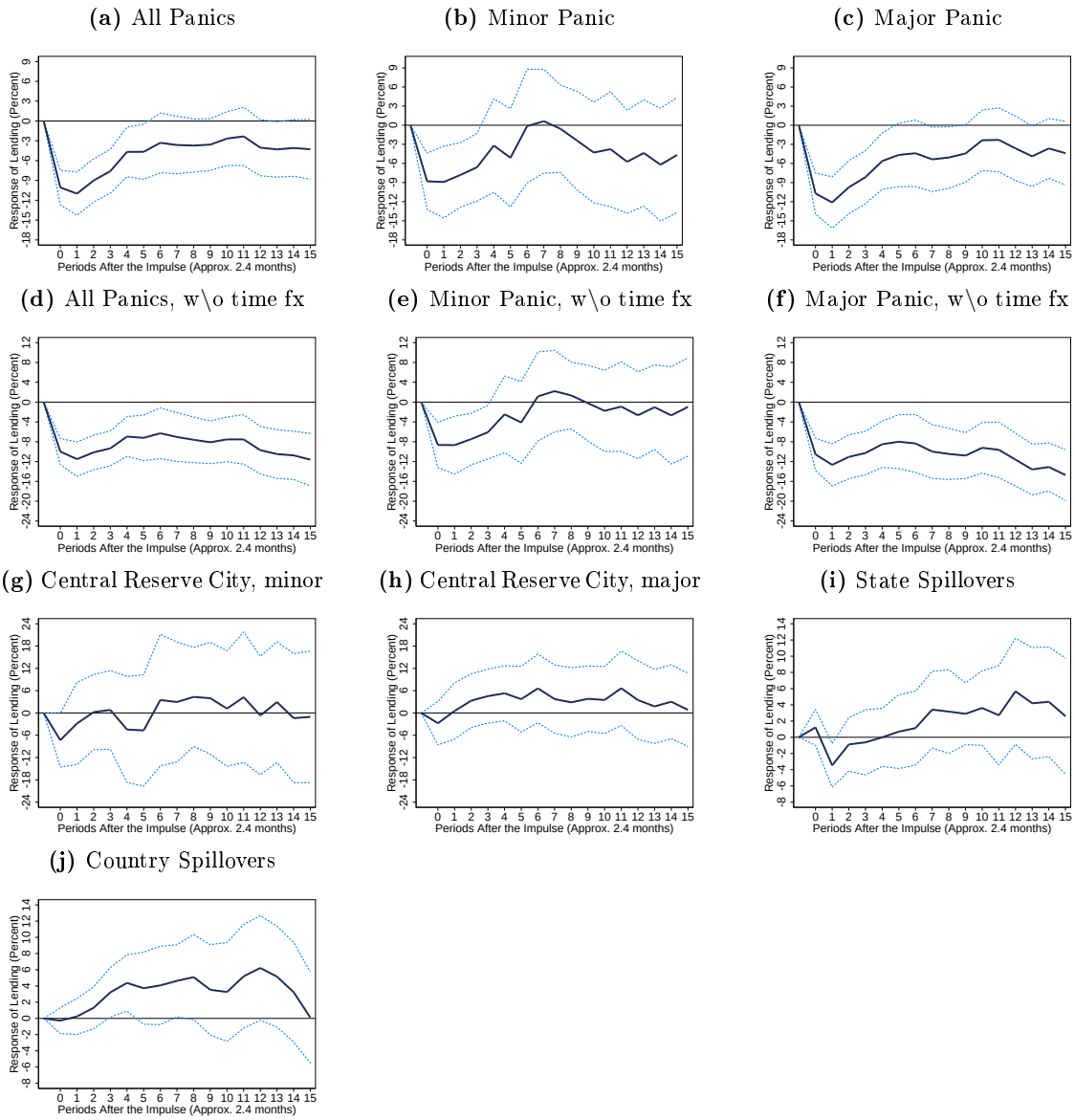
Notes: The coefficients reported are from regressions of the binary panic variable on ten own lags, ten lags of the selected banking sector variable, country and time (5yrs. bin) fixed effects. The log of the banking sector variables is used so that the coefficients reported are the impact of a hundred percentage points change in the banking sector variables. Standard errors in parentheses. The F-statistic is for the hypothesis that all coefficients of the banking sector variable are zero.

Figure 1
Private Sector Lending, by region



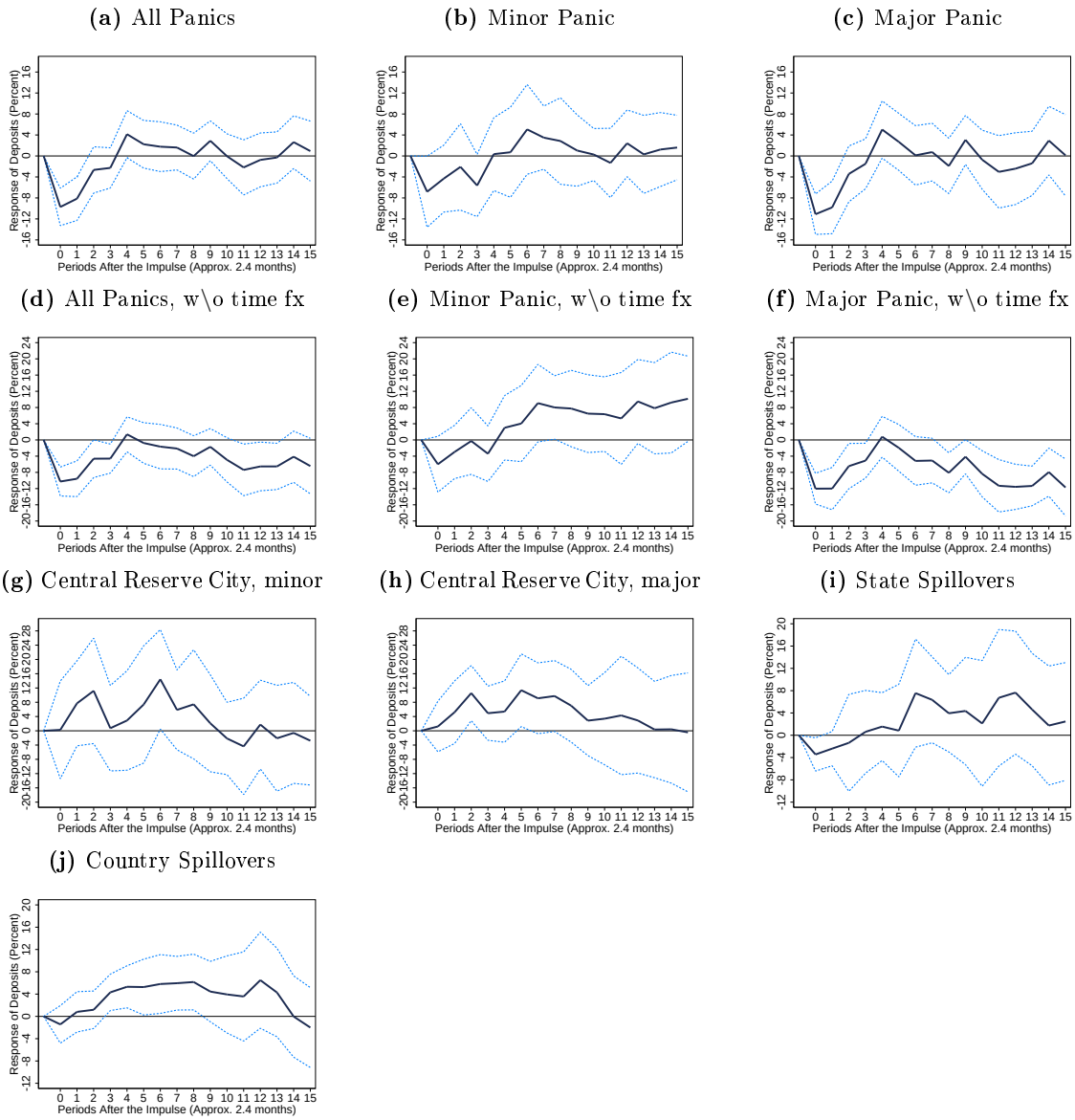
Notes: The figures display the time series of the logarithm of aggregate National Bank's lending to the private sector, by geographical unit. Vertical lines mark the start of a panic directly affecting the geographical unit, according to Jalil's classification (see Table 1).

Figure 2
Impulse Response Functions, Lending to Panic



Notes: The figures show the impulse response of lending to the private sector in response to a shock to the panic variable. Figures (2g)-(2h) show the differential impact of Banking Panics on Central Reserve cities (New York City and Chicago), by type of panic. The regressions include individual and time fixed effects, except figures (2d)-(2f) that only contain individual fixed effects (see section III for full explanation). The dashed lines show asymptotically normal 95% confidence bands.

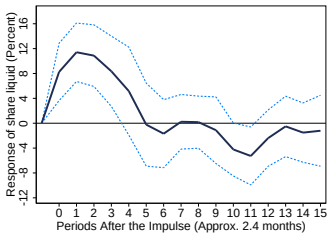
Figure 3
Impulse Response Functions, Individual Deposits to Panic



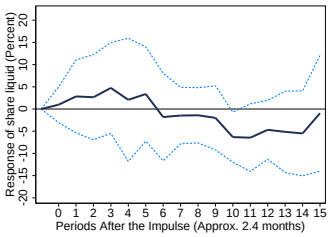
Notes: The figures show the impulse response of individual deposits in response to a shock to the panic variable. Figures (3g)-(3h) show the differential impact of Banking Panics on Central Reserve cities (New York City and Chicago), by type of panic. The regressions include individual and time fixed effects, except figures (3d)-(3f) that only contain individual fixed effects (see section III for full explanation). The dashed lines show asymptotically normal 95% confidence bands.

Figure 4
Impulse Response Functions, Liquid Assets to Panic

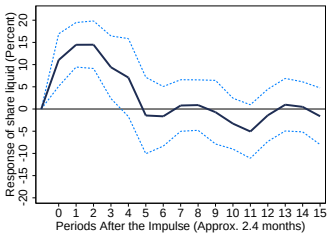
(a) All Panics



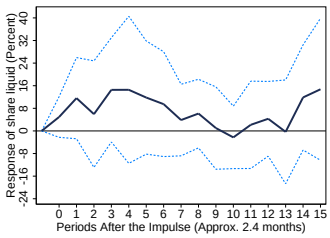
(b) Minor Panic



(c) Major Panic



(d) Central Reserve City, minor



(e) Central Reserve City, major

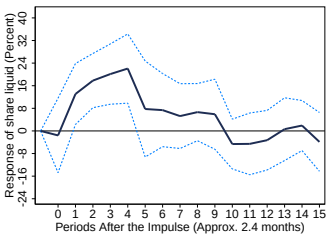
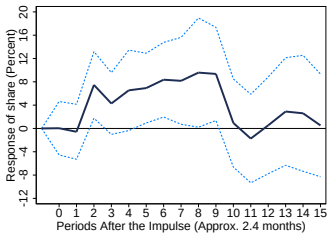
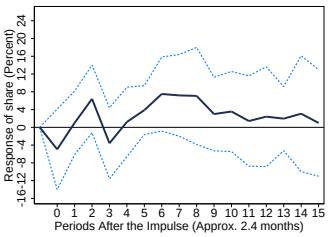


Figure 5
Impulse Response Functions, Bonds & U.S. Certificates to Panic

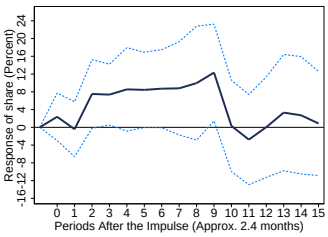
(a) All Panics



(b) Minor Panic



(c) Major Panic



Notes: The figures show the impulse response to a panic. Figures (4d)-(4e) show the differential impact of Banking Panics on Central Reserve cities (New York City and Chicago), by type of panic. The regressions include individual and time fixed effects. The dashed lines show asymptotically normal 95% confidence bands.

Figure 6
Impulse Response Functions, Equity to Panic

(a) All Panics **(b)** Minor Panic **(c)** Major Panic

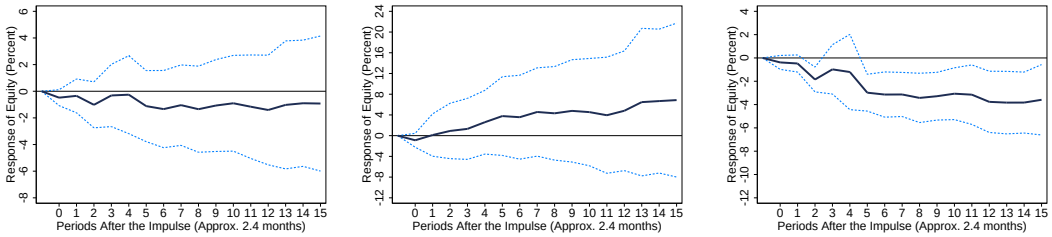
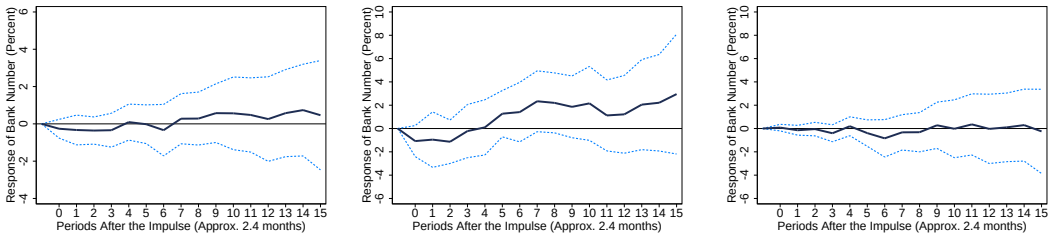


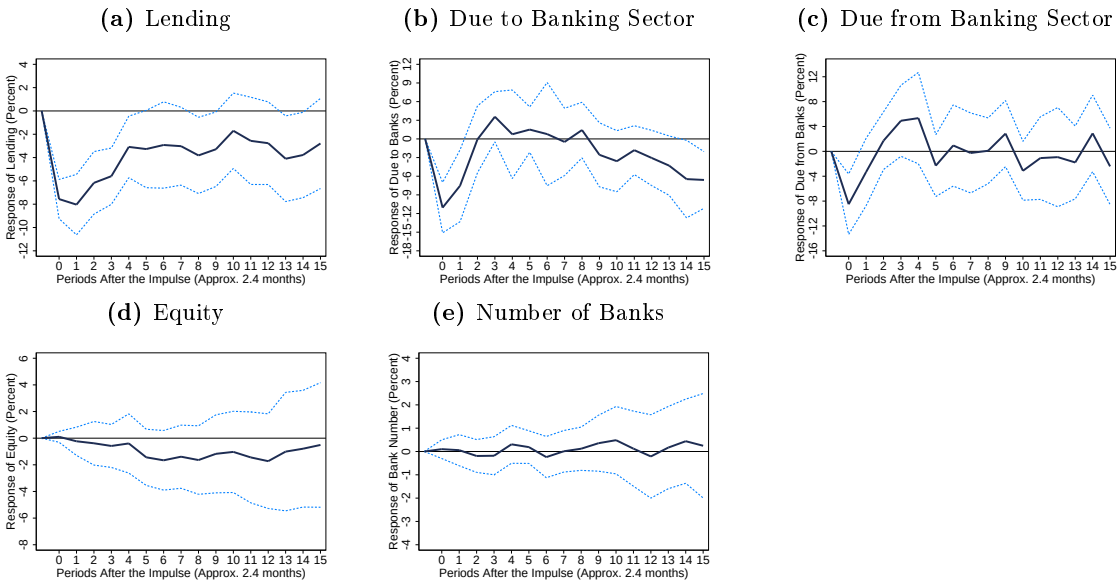
Figure 7
Impulse Response Functions, Number of Banks to Panic

(a) All Panics **(b)** Minor Panic **(c)** Major Panic



Notes: The figures show the impulse to a panic. The regressions include individual and time fixed effects. The dashed lines show asymptotically normal 95% confidence bands.

Figure 8
Impulse Response Functions, Various to Individual Deposits



Notes: The figures show the impulse response of various variables to a bank run equivalent to a 10% withdraw of the aggregate deposits (this is the average loss of deposits the first period of a panic). All regressions include individual and time fixed effects(see section III for full explanation). The dashed lines show asymptotically normal 95% confidence bands.

B Balance sheet description

The Abstract of Reports, contained on the Annual Report of the Comptroller of the Currency provides regional aggregates about the categories that I list in the following table. The categories reported tend to vary slightly across time, typically due to the subdivision of big categories into smaller ones on the latest reports. For example, the category "Loans and discounts" initially contains "Overdrafts", which eventually becomes a category on its own.

Table 3
Balance Sheet original categories, Abstract of Reports

Resources	Liabilities
Loans and discounts	Capital Stock
Overdrafts	Surplus fund
Bonds for circulation	Undivided profits
Bonds for deposits	National bank circulation
Other bonds for deposits	State bank circulation
U.S. Bonds on hand	Due to national banks
Premium on bonds	Due to State banks
Bonds, securities, etc	Due to trust companies, etc
Banking house, furniture, etc	Due to reserve agents
Real state, etc	Dividends unpaid
Current expenses	Individual deposits
Due from national banks	Certified checks
Due from State banks	U.S. deposits
Due from reserve agents	Deposits U.S. disbursing officers
Internal revenue stamps	Bonds borrowed
Cash items	Notes rediscounted
Clearing-house exchanges	Bills payable
Bills of other banks	Clearing-house certificates
Fractional currency	Other liabilities
Trade dollars	Specie
Legal-tender notes	
US certificates of deposit	
Three per cent certificates	
5% fund with Treasury	
Clearing-house certificates	
Due from US Treasury	
Total	Total

Some of the variables that I use are the result of combining several categories, they are created as follows:

Table 4
Definition of New Variables

New variable	Creation
Lending private sector	Loans and discounts+Overdrafts
Due from banking sector	Due from national banks+Due from State banks+Due from reserve agents
Due to banking sector	Due to national banks+Due to State banks+Due to trust companies, etc+ +Due to reserve agents
Equity	Capital Stock+Surplus fund+Undivided profits−Current expenses
Dividends	Dividends unpaid/Number of Banks
Debt-to-Equity ratio	(Due to national banks+Due to State banks+Due to trust companies, etc+ +Due to reserve agents+Bonds borrowed+Notes rediscounted+Bills payable+ +Clearing-house certificates+Other liabilities)/Equity
Share Liquid Assets	(Internal revenue stamps+Cash items+Bills of other banks+Fractional currency+ +Trade dollars+Specie+Legal-tender notes+Clearing-house certificates)/Total
Share Bonds & Certificates	(U.S. Bonds on hand+Premium on bonds+Bonds, securities, etc+ +Clearing-house exchanges+US certificates of deposit+ +Three per cent certificates)/Total

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