Railroad Defaults, Land Grants, and the Panic of 1873

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Abstract

This paper investigates the relationship between railroad bond defaults and financial outcomes in the National Banking System during the Panic of 1873. Contemporary accounts and anecdotal evidence indicate the importance of a boom and bust in the railroad industry to the onset of the panic. I use comprehensive balance sheet data for national banks before and after the panic, along with detailed GIS data on the location and features of the railroad network, to show that railroad defaults had a strong negative impact on the balance sheets of those banks most vulnerable to railroad failures. I also explore the factors which contribute to railroad failures in the first place. I find that land grant railroads were significantly more likely to default on their bonds, suggesting that land grand railroads might have been overbuilt relative to demand and therefore particularly vulnerable to the downturn in the bond market.

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1 Introduction

The National Banking period (1863-1913) was characterized by immense nationwide growth in the level and distribution of banking services in the U.S., but also by financial instability and frequent banking panics. The Panic of 1873 was the first nationwide panic during this period, triggering a depression that lasted until 1879. The most salient feature of this cycle was the astounding boom and bust in the railroad industry. Early observers such as Sprague (1910) pointed to an overextension of railroads into unprofitable areas, necessitating the ensuing contraction. However, this explanation for railroad boom-bust cycles during this period was cast into serious doubt by the work of Albert Fishlow (1965). He found that, for railroads in the antebellum period, the predictions of the overbuilding hypothesis were not borne out in firm profit data. Subsequent work Atack et al. (2010) further shows that antebellum railroads followed rather than drove population growth. However, looking instead at the post-Civil War period, Mercer (1974) concludes that the case for building ahead of demand among the land grant railroads was much stronger during that time. One possible reason for this discrepancy might be that federal land grants, which basically operated as subsidies to particular railroads, induced railroad construction in areas where it otherwise would not have occurred. If this were the case, then these companies might have been more vulnerable to a tightening of the bond market. Along a similar vein, Mixon (2008) argues for the importance of fundamental economic factors in driving the bond market in 1873, showing that the prices of various financial assets seem to have tracked risk consistently throughout the buildup and the Panic. In this paper, I quantify the role of railroad bond defaults in promoting poor local economic conditions following the panic. I also provide an explanation for the railroad boom and bust itself based on fundamental economic factors and government land grant policy.

My task in this paper is twofold. First, I capture the real economic effects of railroad bond defaults through the impacts that they had on the balance sheets of national banks. To do so, I use bank-level balance sheet data for all national banks both before and after

the panic, as well as detailed GIS data on the location and features of existing railroads. I differentiate banks by geographic location, and I find that those banks that were most vulnerable to railroad defaults saw significant negative balance sheet outcomes, even a year after the panic itself. Geographic variation is an often underappreciated but common aspect of boom-bust cycles centered around construction. For example, Shiller (2015) discusses the uneven nature of the recent housing bubble, which was very severe in many major cities across most states, but markedly less acute in other regions. Abel and Deitz (2010) highlight this immense diversity across cities in the magnitude of the housing boom and bust. In the national banking period, Dupont (2009) highlights the regional concentration of the Panic of 1893, and links this to agricultural markets and the distribution of crops and farming across regions. My paper captures the importance of geographical variation in the Panic of 1873, and thus further highlights this common feature of construction bubbles.

My second task is to explain the railroad defaults themselves with their economic fundamentals and the incentives that they faced. In doing so, I find that railroads receiving a land grant were much more likely to default on their bonds during the downturn, even when accounting for factors that reflect the demand and level of competition that they faced. This finding helps to reconcile the findings of Fogel (1962) and Atack et al. (2010) concerning the lack of overbuilding in the antebellum period with Mercer's (1974) work on postbellum railroad overbuilding. It provides an explanation for the presence of overbuilding during the period of national land grants, even while earlier building might have been financially sound.

2 Background

The Panic of 1873 was set off by the failure of the merchant bank Jay Cooke & Co. on September 18, 1873. This failure, appropriately enough, was closely connected to the downturn in railroads that had already begun. Jay Cooke was heavily invested in the Northern Pacific Railroad, and with the failure to float bonds to fund the construction costs of the

railroad, his well-respected firm had to shut down. Runs began almost immediately on a number of New York banks, and the New York Clearing House soon suspended cash payments (followed by banks throughout the rest of the country). The stock market was temporarily shut down for the first time in its history.[1]

In the railroad industry, a number of other railroads were forced, in the face of a declining bond market and decreased interest in railroad bonds (particularly in Europe), to default on their debt. All told, nearly a quarter of railroad companies with outstanding bonds engaged in at least a partial default during this period[2]. Railroad construction collapsed, and this diminished level of construction characterized the subsequent depression. Table 1 shows the yearly rate of growth of completed railroad miles during the period before, during, and after the Long Depression that followed the panic. It illustrates the incredibly high rate of growth in railroads at this time in history generally, and also the peculiarity of railroad construction during the downturn.

Table 1: Rate of growth of railroad miles by period

Period	Average yearly increase in miles
1865-1872	9.11%
1873-1878	3.08%
1879-1882	8.85%

[3]

Because of the central nature of railroad construction in both the Panic and the subsequent downturn, I focus my analysis primarily on the link between railroad construction, bond defaults, and national bank outcomes. Although state banks would eventually become more numerous than national banks during the post-Civil War period, at this point they were still relatively insignificant (there were 277 state banks in operation in 1873, as opposed to 1968 national banks). Thus, the data from national banks should be sufficient to characterize the effects of this crisis.

[1]For an in-depth account of the panic, see Wicker (2006).
[2]Source: Commercial and Financial Chronicle, 1875 p.174
[3]Source: American Railroad Journal

3 Data

Data on national bank balance sheets before and after the financial panic come from the Reports of the Comptroller of the Currency. The Comptroller reports contain annual bank balance sheet data on all national banks in operation during each year. This paper uses complete national bank balance sheet data from 1872, 1873, 1874, and 1880. The data from 1873 comes from September 12, immediately preceeding the failure of Jay Cooke and Co. and the onset of the crisis. Although there were business failures prior to Jay Cooke, major stock prices generally held steady until September 16, when they began to fall precipitously (Mixon 2008). Thus, this data reflects the state of national bank balance sheets immediately prior to the crisis. Past research on other financial crises during this period has tended to focus on the causes of bank closures. However, despite the severity and nationwide character of the Panic of 1873, there were virtually no bank closures following the panic (only 9 national banks went into receivership between the onset of the panic and the end of 1873). Thus, this paper will instead focus on the effect of the panic on the balance sheets of banks which survived. This is made more difficult by the fact that such post-crisis balance sheet data is not available until over a year after the onset of the panic, on October 2, 1874. On aggregate, the financial system seems to have recovered significantly from the crisis over this time. Both total deposits and total loans in the national banking system fell significantly following the crisis; loans and discounts fell from $944,220,116 on September 12 to $856,816,555 on December 26. Similarly, individual deposits fell from $622,685,563 to $540,510,602 over that same period. However, by October 2, 1874, aggregate loans and deposits had recovered and actually exceeded their pre-crisis levels. Loans and discounts had risen to $954,394,791, while individual deposits had increased to $669,068,995.

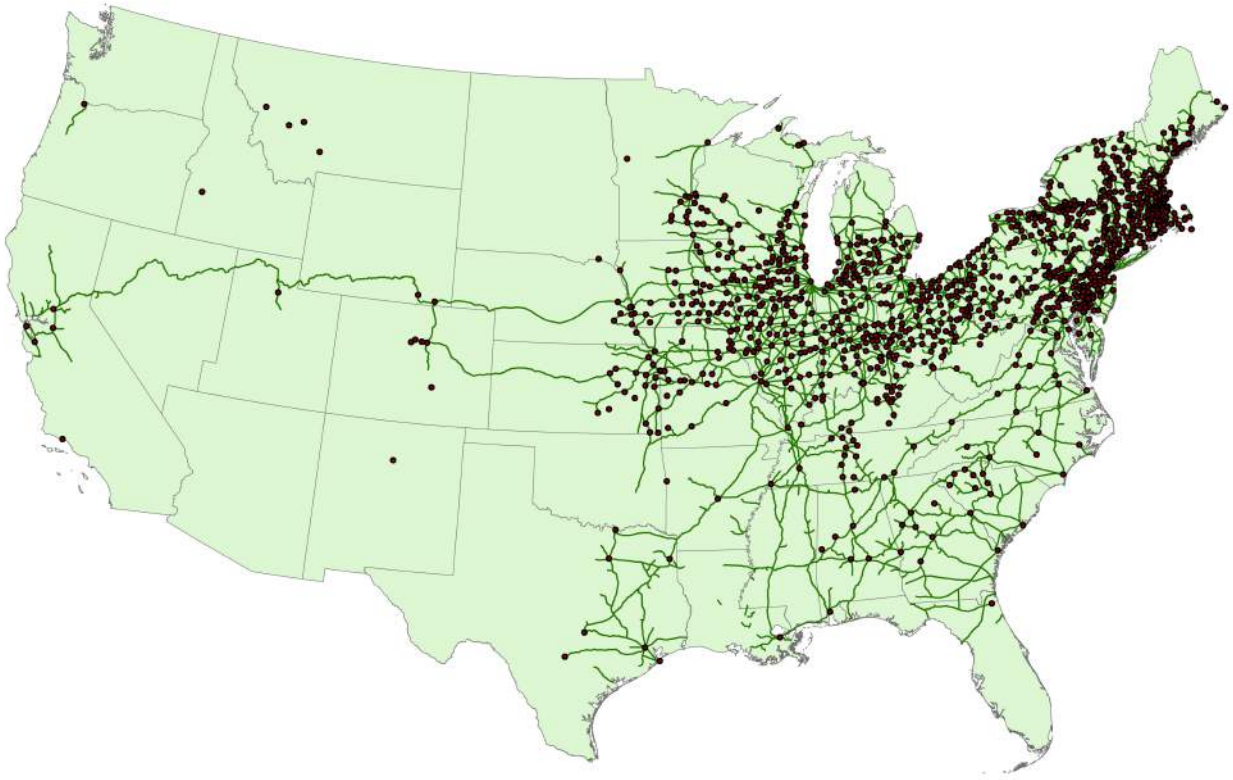
However, this rebound at the aggregate level conceals a wide divergence in the impact of the panic at the bank level. As we will see, there is considerable geographic variation in the status of banks a year after the panic. This paper provides an explanation for this bank-level variation through using their geographic variation relative to the railroad transportation

network and the particular locations of railroad defaults. The data on the contemporary railroad network comes from a transportation GIS database created by Jeremy Atack. This database contains precise information on the location of railroad lines in the year 1872, along with other transportation information on rivers and canals. Figure 1 shows the full set of transportation data available (railroads in green, rivers and canals in blue).

Figure 1: 1872 Railroad, River, and Canal Network

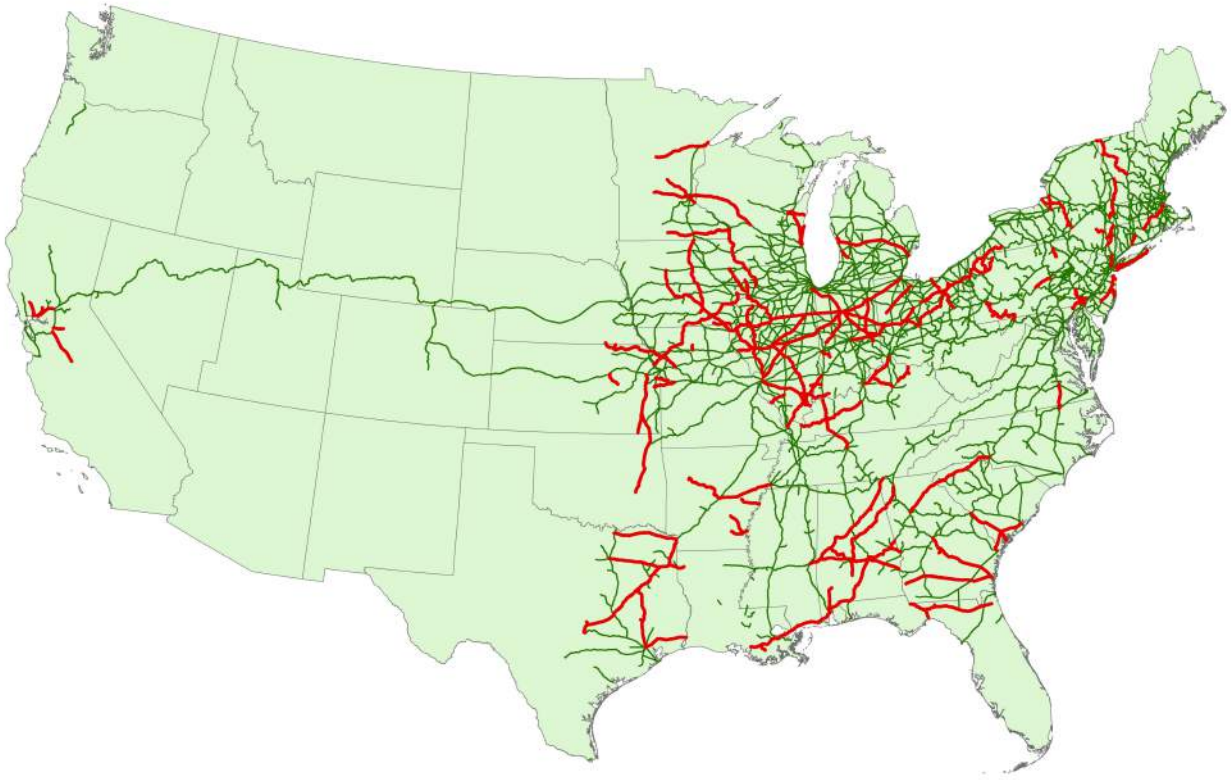
The city location for each bank is used to determine its geographic relationship to the troubles in the railroad industry. The location of all national banks operating during this period is shown in Figure 2. As we can see, the South, the Plains, and the West are heavily underbanked relative to the Northeast and the Midwest.

Figure 2: Bank City Locations and the Rail Network



I paired the GIS data on railroad locations with firm-level data on the precisely which lines were operated by which firms. This data came from the American Railroad Journal and Poor's Manual of Railroads for the relevant years. This allows me to determine the geographical distribution of railroad bond defaults, in order to analyze the effects these might have had on local banks. The following map illustrates the geographical distribution of railroad bond distress; railroads highlighted in bright red are those that defaulted on at least part of their bond debt during the time between my bank balance sheet observations.

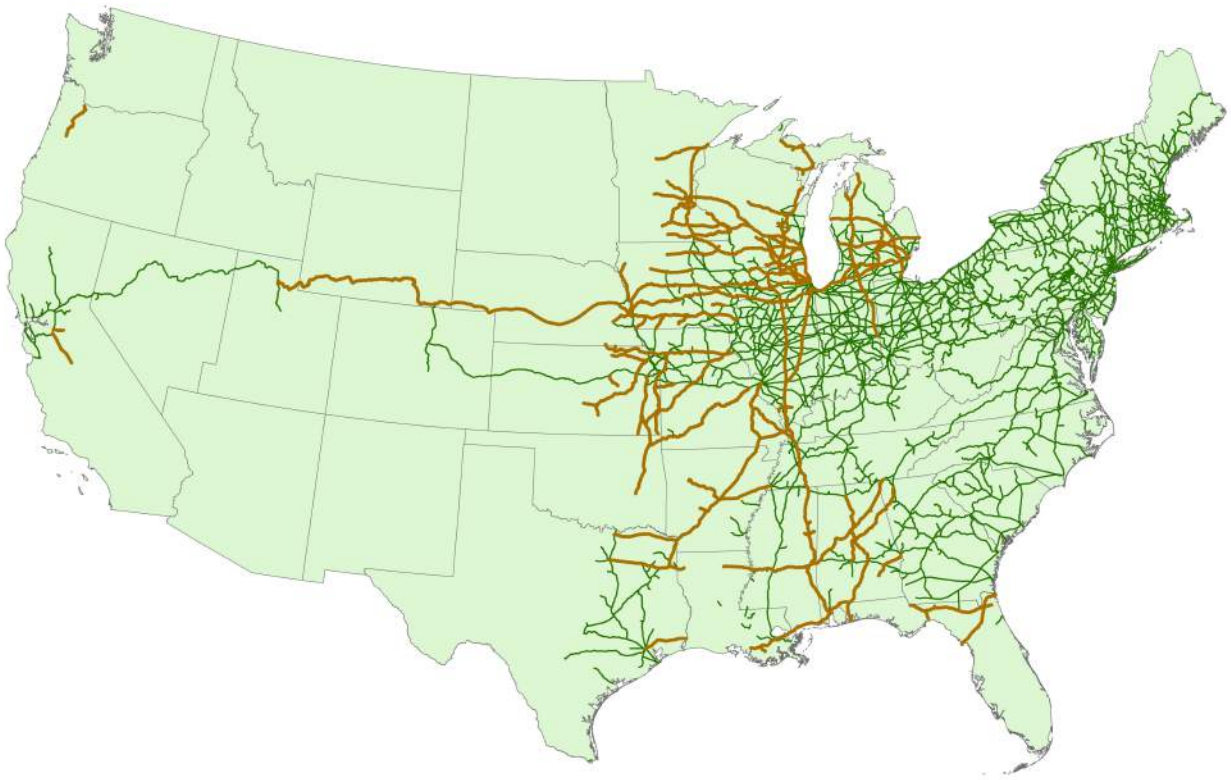
Figure 3: Railroad Bond Defaults from September 1873 to October 1874



The data on railroad bond defaults come from the Commercial and Financial Chronicle. This publication provides information for each railroad bond on the outstanding principal, the date of issuance, the corresponding number of railroad miles already constructed, and the default status of the bond. As I will discuss further below, the real economic effects of railroad bond defaults depended upon whether the railroads in question were still under construction or were completed and fully operational. In order to look at each of these types separately, I use data from the American Railroad Journal on railroad construction and the full planned length of each line to differentiate completed lines from lines still under construction in my dataset. Furthermore, from the planned routes described in Poor's Railroad Manual, I can determine which cities (and therefore which banks) were along planned construction routes. I will use this below to look particularly at the effects of the bust in railroad construction following the panic.

In the final section of the paper, I turn to the role of land grants in promoting riskier railroad building and contributing to railroad defaults. The information on land grants comes from a letter from the Secretary of the Interior to the House of Representatives documenting a comprehensive list of federal land grants given to particular railroads[4]. The report contains the recipient railroad, the date of issuance, the estimated maximum amount of land which could be claimed under the grant, the amount of land expected to be claimed, and the amount of land actually claimed as of June 1871. Railroad lines which received land grants are shown in brown in the following map.

Figure 4: Land Grant Railroads



Clearly, railroads that received land grants are concentrated in the Midwest, South, and West. This might reflect the use of land grants to incentivize building in relatively unpopulated areas which would otherwise have been unprofitable. This data will be used to

[4]Source: United States. Cong. House. Committee on Public Lands, C. Delano. 42 Cong., 2 sess. H. Rept. 43.

explore the relationship between land grants and vulnerability to default. County-level data on population, farm capital, and manufacturing capital come from the 1870 Census data as found in Haines (2004).

4 Results: The Impact of Railroad Defaults

4.1 Simple Measure of Railroad Construction and Default

The first task is to definitively establish the link between railroad bond defaults and outcomes in the financial system. Intuitively, the clearest impact would come from railroads that were under construction during the period of the panic and downturn. Although a number of railroads which were completed before the panic would subsequently default on their payments to bondholders, the economic impact of these defaults is unclear. If a railroad could not make good on its bond payments in short order, it was usually placed in the hands of receivers while litigation proceeded against the company on behalf of the bondholders. This might ultimately result in a reorganization of the company, or complete foreclosure and sale of the company's line and other assets. However, the extent of transportation disruptions during this process is unclear. Certainly, these railroads continued to operate at some capacity during this process, although the bond default might have indicated a lack of the cash necessary to carry out full operations.

However, the impact for railroads which were still under construction was much clearer. Bond defaults generally resulted from the lack of resources to continue construction, and greatly hindered the railroad's ability to raise further capital. Construction on the railroad came to almost a complete halt in most cases. For example, the Northern Pacific railroad, following the failure of Jay Cooke and Co. and defaulting on its bonds in January of 1874, shut down construction completely. Between 1871 and January of 1874, 558 miles had been constructed along the intended route; by 1878, the total had only increased by 30 additional miles. The collapse of the construction industry along a defaulted rail line should have had

an immediate impact on local economic conditions as construction jobs disappeared, service was disrupted, and planned future expansion was halted.

The following regressions capture this relationship between railroad construction and local banking outcomes. The dependent variable is the percentage change in various measures of banking outcomes, over the period from September 1873 (immediately before the panic) to October 1874. Throughout this paper I focus on loans, deposits, and excess reserves. If a bank was severely weaked by the crisis, we would expect their loans and deposits to fall, while their excess reserves would rise as they attempted to shore up their balance sheets. The measures of loans and deposits come directly from the balance sheets. Excess reserves is defined as $ExcessReserves_i = Reserves_i - .06 * Deposits_i$. This reflects the reserve requirements faced by country banks, those national banks outside of the reserve and central reserve cities. These banks were required to hold in reserve 15% of their deposits, but 3/5 of this amount could be held as deposits in reserve city banks (these deposits paid interest, so country banks typically took full advantage of this). Banks in reserve cities (e.g. Boston, Philadelphia, Chicago) and the central reserve city (banks in New York City) had to hold 25% reserves against deposits, all in their own vaults. However, for banks in reserve and central reserve cities, the deposits of lower-tier banks could be counted as reserves, and thus it is unclear from their balance sheets what their true total reserves were. Therefore, the sample in the third column of Table 2 is limited to country banks, and the measure of excess reserves is defined by the 6% reserves that country banks had to physically hold in their own vaults.

The main independent variable of interest is a dummy variable indicating whether a railroad under construction which ran through or was projected to run through the bank's city went into default during this period. This identification is very simplistic and does not utilize the full transportation network data, but it could still capture some of the impact of railroad defaults and a halt in construction. I also construct a dummy variable based on whether a solvent railroad under construction ran through or was projected to run through

the city. With this measure, I am interested in examining the spillovers from railroad defaults to the rest of the railroad construction industry. This sample only includes railroads which had outstanding bonds at the time and were therefore vulnerable to default themselves.

The regression also contains a number of bank balance sheet variables which might have influenced how well a bank fared during the downturn. Total assets are included to control for the size of the bank. Because the levels of other balance sheet variables will be highly correlated with the level of assets and each other, they are included relative to assets. The initial level of loans, deposits, and reserves are included relative to assets, as these might show a convergence effect. The amount of capitalization might also affect the outcome for a particular bank, as well as the amount of notes outstanding and the amount of bonds held to back these notes. All balance sheet control variables are taken from 1872. Dummies for the type of bank (county, reserve city, or central reserve city) are also included, as different types faced different regulatory standards. Standard errors are clustered at the city level.

Table 2: Percent Change in Loans, Deposits, and Excess Reserves from 1873 to 1874, for Railroads Under Construction

	(1) Loans	(2) Deposits	(3) Reserves	(4) Loans	(5) Deposits	(6) Reserves
Railroads in Default	-0.0643***	-0.0885***	-0.0853			
	(-4.09)	(-3.22)	(-0.68)			
Solvent Railroads				-0.0490***	-0.0462**	0.199***
				(-3.43)	(-2.36)	(2.72)
ln(Assets)	-0.0145**	0.0303***	-0.0831*	-0.0137*	0.0316***	-0.0908*
	(-2.04)	(3.03)	(-1.74)	(-1.92)	(3.15)	(-1.95)
Capital/Assets	0.398***	0.446***	-1.092**	0.398***	0.465***	-1.046**
	(7.44)	(3.05)	(-2.21)	(7.61)	(3.17)	(-2.13)
Loans/Assets	-0.119**			-0.113**		
	(-2.27)			(-2.15)		
Deposits/Assets		-0.0319			-0.0223	
		(-0.34)			(-0.24)	
Reserves/Assets			-1.272			-1.829
			(-0.97)			(-1.38)
Reserve City	0.0896***	0.0670**		0.0851***	0.0592**	
	(4.00)	(2.41)		(4.13)	(2.38)	
Central Reserve City	0.136***	0.156***		0.180***	0.199***	
	(6.80)	(5.73)		(7.98)	(6.32)	
Constant	0.114	-0.548***	1.605**	0.104	-0.574***	1.680**
	(1.18)	(-3.23)	(2.14)	(1.08)	(-3.38)	(2.29)
Observations	1847	1843	1614	1847	1843	1614
R^2	0.084	0.040	0.006	0.084	0.037	0.009

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

These results show that banks in cities where railroad construction halted because of a default saw an average fall in their loans by 6.4% and in their deposits by nearly 9% as compared to other banks. However, this specification shows no significant change in excess reserves from these banks. It is worth noting that the R^2 for the excess reserves regressions are far lower than for other banking outcome variables. With regards to construction by solvent railroads, banks in these cities saw their loans and defaults fall by 4-5%. Furthermore, we see a large and significant increase in excess reserves.

Turning to the other variables, the impact of bank size is somewhat unclear. Larger banks appear to contract their loans more, but also attract more deposits and hold fewer

excess reserves. Thus, there is not a uniform positive or negative effect of size on bank balance sheets. Capitalization behaves as we would expect; better capitalized banks fare better with loans and reserves, and do not increase their excess reserves as much. Loans show a statistically significant convergence effect, but deposits and reserves do not. Banks in reserve cities and in the central reserve cities also fared better, as more capital flowed to the major cities.

From these results, we can make the preliminary conclusion that banks in areas where railroad construction was impeded due to default saw the most severe impact, but that we also see spillovers from the overall collapse in construction. Thus, even when the specific railroads running through a town did not default, simply operating in an area dependent on railroad construction was associated with negative banking outcomes. I interpret this result as pointing to the existence of spillovers in the construction market, in addition to the impact of particular defaults.

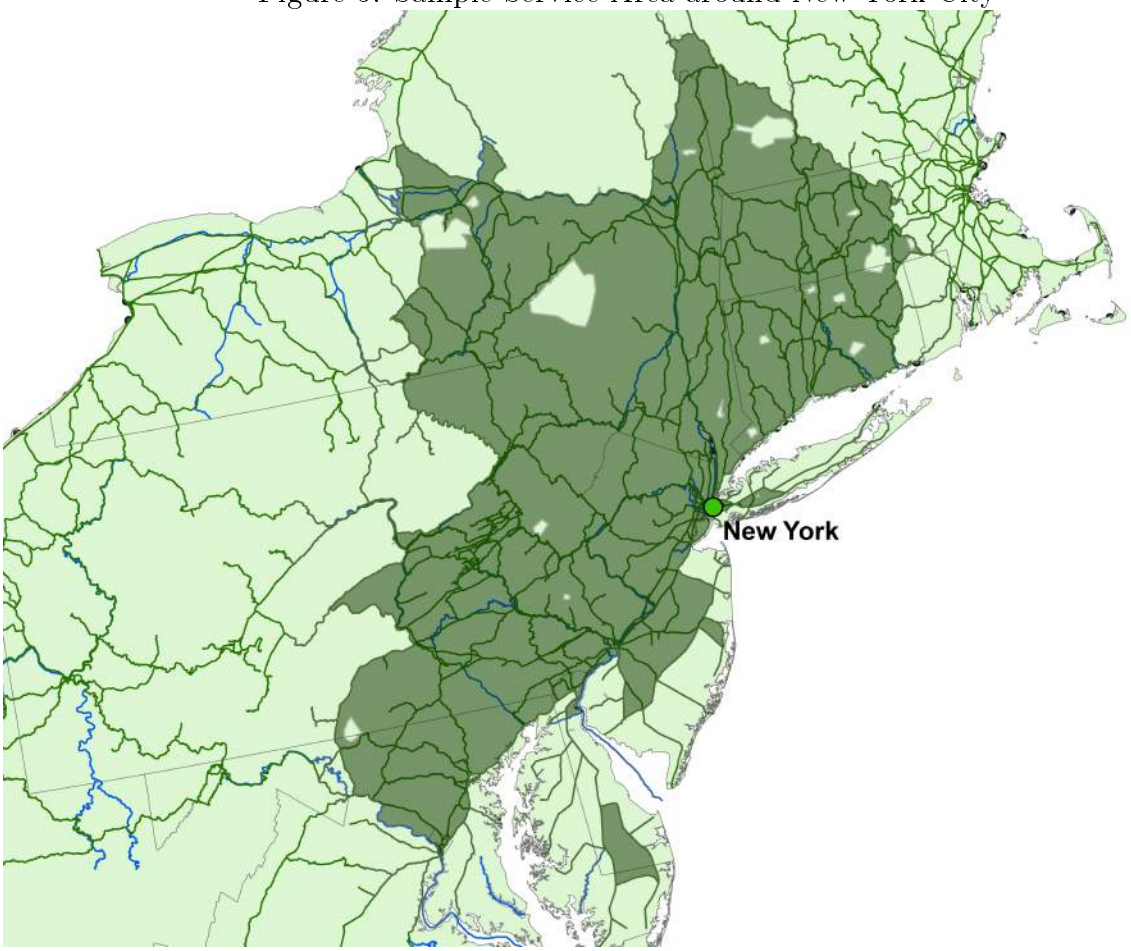
4.2 Complex Measure of Railroad Construction and Default

Despite the strong results in our initial regressions, the simple dummy specificaton leaves something to be desired; it is a very crude way of capturing the importance of railroad construction to the local banks. For some cities, the railroad under construction would have been the only or the new primary railroad servicing that market (particularly in the West and South). However, for others (particularly in the Northeast), they were already well-connected through an extensive rail network, and the construction of an additional railroad would not have been nearly as vital. In order to more closely capture the importance of railroad construction, I utilize the GIS data on transportation networks as well as ArcGIS network features to construct a better measure.

In order to capture the railroad lines that are most economically relevant to each city, I construct 'service areas' around each city. These service areas consist of the portion of the country which falls within a certain maximum transportation cost of a particular city. In

calculating transportation costs, I follow Fogel (1962) and Donaldson and Hornbeck (2013) in setting the railroad transportation costs to 0.63 cents per ton-mile and water transportation costs to .49 cents per ton-mile. Transportation by wagon (in the absence of any other transportation option) costs 23.1 cents per ton-mile. Using these rates, I can define an area around each city within a particular transportation cost range. For my initial results below, I use the (rather wide) radius of $2 per ton around each city. As an example, the resulting service area for New York City is shown in the figure below.

Figure 5: Sample Service Area around New York City



Clearly, the particular choice of radius is somewhat arbitrary. In order to check the robustness of my results, I will eventually want to vary the cost radius around each city which is used to examine the local railroads, to see if the choice of a $2 radius is driving my results.

Using this method, I define an area of particular economic relevance for each city in my sample. I use this to estimate the actual number of railroad miles under construction (solvent and/or in default), as well as the total railroad miles, 'around' each city (i.e. within the borders of the service area). I use the results to better capture the impact of railroad construction and railroad defaults on bank balance sheets.

The following tables show the initial results from these measures. The dependent variables are again the percentage changes in loans, deposits, and excess reserves from before the panic to one year after. Table 2 focuses only on railroads that were both under construction and went into default during the period of interest. The main variable of interest is the total number of projected miles (in thousands of miles) for railroads under construction and in default within each city's area. Only the portions of railroad lines or projected lines which were actually within the service area are included. To isolate the importance of these miles to the overall transportation possibilities, I control for the total number of railroad miles within each service area.

Here we find that having high number of railroad miles under construction go into default had a strong negative effect on bank balance sheets. Loans and deposits fall and excess reserves sharply rise. Furthermore, although railroad defaults negatively impacted banks, the overall number of railroad miles around the city has the opposite effect. It appears that banks with better surrounding transportation networks fared better over the course of the panic. The results for the other control variables are similar to before.

Table 3 looks at railroad construction more generally, focusing on railroads which were under construction but did not default on their bonds during this period. The variable of interest here is the total projected miles within each area for railroads that were under construction but whose bonds remained solvent.

Unlike the dummy variable results from before, we do not see loans and defaults contracting due to having railroad construction during the railroad bond downturn. However, we do see a significant increase in excess reserves for these banks. In this respect, these

Table 3: Percent Change in Loans, Deposits, and Excess Reserves from 1873 to 1874

	(1) Loans	(2) Deposits	(3) Excess Reserves
Miles of Rail Under Construction and in Default	-0.0750***	-0.107***	0.377**
	(-3.28)	(-3.01)	(2.54)
Total Miles of Rail	0.00414**	0.00813***	-0.0137
	(2.48)	(3.44)	(-1.32)
ln(Assets)	-0.0168**	0.0298***	-0.0676
	(-2.33)	(2.88)	(-1.41)
Capital/Assets	0.439***	0.510***	-1.129**
	(8.01)	(3.41)	(-2.14)
Loans/Assets	-0.119**		
	(-2.26)		
Deposits/Assets		-0.0355	
		(-0.37)	
Reserves/Assets			-2.038
			(-1.56)
Reserve City	0.0860***	0.0568**	
	(3.88)	(2.24)	
Central Reserve City	0.143***	0.160***	
	(7.24)	(5.94)	
Constant	0.107	-0.617***	1.464*
	(1.08)	(-3.56)	(1.93)
Observations	1823	1819	1590
R^2	0.082	0.040	0.010

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 4: Percent Change in Loans, Deposits, and Excess Reserves from 1873 to 1874

	(1) Loans	(2) Deposits	(3) Excess Reserves
Miles of Solvent Rail Under Construction	-0.00570	-0.00138	0.0973**
	(-1.04)	(-0.18)	(2.55)
Total Miles of Rail	0.00197	0.00321	-0.0214
	(1.02)	(1.18)	(-1.58)
ln(Assets)	-0.0175**	0.0321***	-0.0344
	(-2.27)	(2.98)	(-0.62)
Capital/Assets	0.430***	0.485***	-1.022*
	(7.99)	(3.22)	(-1.94)
Loans/Assets	-0.107**		
	(-2.04)		
Deposits/Assets		-0.0476	
		(-0.50)	
Reserves/Assets			-2.359*
			(-1.81)
Reserve City	0.0873***	0.0551**	
	(3.99)	(2.20)	
Central Reserve City	0.147***	0.166***	
	(7.40)	(6.13)	
Constant	0.120	-0.618***	1.066
	(1.17)	(-3.48)	(1.30)
Observations	1823	1819	1590
R^2	0.076	0.036	0.011

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

results do reflect what we saw in Table 1, where the strongest impact of solvent construction on banks was an increase in excess reserves. This shows that while banks in these areas were not in trouble at the time in terms of loans and deposits, they did anticipate that they were more vulnerable to railroad defaults that might occur in the future. Thus, they increased their excess reserves more than other banks in order to prepare for the possibility of future negative impacts on rail construction in their areas.

Table 4 moves away from looking at railroad construction, and instead focuses on completed railroads that went into default during this period. The variable of interest here is the total miles of railroads whose main lines were completed before they went into default.

Table 5: Percent Change in Loans, Deposits, and Excess Reserves from 1873 to 1874

	(1)	(2)	(3)
	Loans	Deposits	Excess Reserves
Miles of Completed Rail in Default	-0.123***	-0.204***	0.138
	(-5.34)	(-4.99)	(0.98)
Total Miles of Rail	0.0108***	0.0200***	-0.00726
	(4.75)	(5.20)	(-0.49)
ln(Assets)	-0.0187***	0.0272***	-0.0735
	(-2.62)	(2.62)	(-1.56)
Capital/Assets	0.437***	0.521***	-1.078**
	(8.16)	(3.58)	(-2.06)
Loans/Assets	-0.105**		
	(-2.02)		
Deposits/Assets		-0.0214	
		(-0.23)	
Reserves/Assets			-1.579
			(-1.22)
Reserve City	0.0843***	0.0535**	
	(4.14)	(2.26)	
Central Reserve City	0.149***	0.165***	
	(7.50)	(6.03)	
Constant	0.107	-0.626***	1.475*
	(1.10)	(-3.62)	(1.94)
Observations	1823	1819	1590
R^2	0.093	0.051	0.007

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Even for these railroads, we find siginficant evidence of negative banking outcomes. In fact, the coefficients on loans and deposits are more negative than before (although the change in excess reserves is not significant). As previously discussed, the mechanism through which defaults of completed lines affect economic activity is less clear than in the case of railroad construction. However, we might think that if some of these railroads (which were completed and therefore relied upon for transportation by local businesses) did experience transportation disruptions, this might have been more severe for the local economy than simply the halt in construction for a future road. However, the anecdotal evidence from contemporary accounts on whether or not railroads going through default litigation decreased their rail service is scant.

4.3 Longer-Term Impacts of Railroad Defaults

The downturn in railroad construction ended around 1878, and the Long Depression that resulted from the panic is generally dated as ending in the spring of 1879. Thus, it might be interesting to see whether railroad defaults from 1873 and 1874 had local effects which outlasted the Depression itself. Did the railroad collapse result in a permanently lower level of economic development for these areas, or were the effects erased by the end of the depression? I use bank balance sheet data from 1880 to address this question in Table 5. The specification is similar to Tables 2-4, but here I examine the change in balance sheets over the period from 1874 to 1880. These results are also run at the city level, rather than the bank level. Thus, this regression abstracts from the opening and closure of particular banks over this period, and focuses on the net change in deposits and loans in each city. It is unclear what we should expect from this specification. As more railroads continued to go into default through the years from 1874-1878, we might expect to see a negative impact from railroad construction (solvent in October 1874, but perhaps defaulting later) on later balance sheet outcomes. However, we could also see that areas which suffered in the immediate aftermath of the panic actually grew faster following the initial slump, as railroad

construction picked up again, reorganization and foreclosure litigation came to an end, and reorganized railroads returned to normal service.

Table 6: Percent Change in Loans, Deposits, and Excess Reserves from 1874 to 1880

	(1) Loans	(2) Deposits	(3) Loans	(4) Deposits	(5) Loans	(6) Deposits
Construction, Default Miles	-0.00280	0.306**				
	(-0.03)	(2.37)				
Completed, Default Miles			-0.00851	0.295**		
			(-0.08)	(2.23)		
Construction, Solvent Miles					0.0239	0.0971***
					(1.04)	(3.41)
Total Miles of Rail	0.00125	-0.00749	0.00181	-0.0172	-0.00532	-0.0185**
	(0.19)	(-0.96)	(0.19)	(-1.44)	(-0.72)	(-2.07)
ln(Initial Assets)	-0.0187	-0.0757**	-0.0189	-0.0733**	-0.0140	-0.0577*
	(-0.76)	(-2.52)	(-0.76)	(-2.44)	(-0.56)	(-1.90)
Initial Capital/Assets	-0.282	-0.537	-0.283	-0.408	-0.245	-0.571
	(-0.97)	(-0.84)	(-0.97)	(-0.65)	(-0.84)	(-0.90)
Initial Loans/Assets	-0.689**		-0.688**		-0.642**	
	(-2.56)		(-2.57)		(-2.37)	
Initial Deposits/Assets		-1.457***		-1.405***		-1.573***
		(-3.87)		(-3.76)		(-4.16)
Reserve City	0.108	0.0542	0.108	0.0597	0.0873	-0.0195
	(0.56)	(0.23)	(0.56)	(0.26)	(0.45)	(-0.08)
Central Reserve City	0.425	0.523	0.426	0.498	0.427	0.486
	(0.55)	(0.55)	(0.55)	(0.53)	(0.55)	(0.51)
Constant	0.614*	1.917***	0.614*	1.849***	0.545	1.785***
	(1.69)	(3.41)	(1.69)	(3.30)	(1.48)	(3.20)
Observations	1010	1010	1010	1010	1010	1010
R^2	0.009	0.046	0.009	0.045	0.010	0.052

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Across all types of railroad construction and default, we see no impact on the growth of loans over this period. There is no evidence that banks in these areas recovered relative to other banks. However, deposits in these cities did grow significantly faster than for other cities. It appears from these results that the negative impact of railroad defaults on bank deposits was temporary; banks which saw deposits fall from 1873 to 1874 saw these losses

erased by 1880.

5 Causes of Railroad Bond Defaults

So far, we have seen some evidence of the effects of railroad defaults on local national banks. However, a more fundamental question concerns the causes of the railroad failures themselves. Do these failures simply reflect the end of a speculative mania centered around the railroad industry, or are they linked to railroad firm fundamentals? The following table shows the results of probit regressions on the determinants of default for railroad companies. The sample includes 387 railroads with outstanding bonds listed in the Commercial and Financial Chronicle. The dependent variable Default takes a value of 1 if the railroad defaulted on at least one bond, and 0 otherwise. 22.5% of railroad companies in the sample defaulted on at least one bond. The first column includes those variables available for each bond in the Commercial and Financial Chronicle, as well as a dummy variable indicating whether or not the railroad received a land grant. All variables are in log form.

Table 7: Determinants of Railroad Bond Default Rates (Probit)

	(1) Default	(2) Default	(3) Default
Land Grant Dummy	0.494**	0.606**	
	(2.09)	(2.05)	
State Aid Dummy			-0.938**
			(-2.17)
Railroad Length (Total Miles)	-0.222	-0.586**	-0.563**
	(-1.48)	(-2.45)	(-2.39)
Outstanding Principal	0.260**	0.622***	0.690***
	(2.25)	(3.33)	(3.69)
Average Age of Bonds	-0.377**	-0.384*	-0.310
	(-2.47)	(-1.71)	(-1.39)
Average County Population		0.364	0.329
		(1.46)	(1.37)
Average County Farm Capital, per capita		0.294*	0.139
		(1.65)	(0.81)
Average County Manufacturing Capital, per capita		-0.536***	-0.517***
		(-2.82)	(-2.75)
Miles of Track Operated by Other Railroads		-0.373**	-0.464**
		(-1.98)	(-2.41)
Constant	-2.888**	-8.878***	-8.498***
	(-2.36)	(-2.93)	(-2.93)
Observations	321	225	225

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

The land grant dummy is strongly associated with a higher default probability. The other variables tend to have the sign that we would expect. For instance, we would expect that a company with a larger amount of outstanding debt (Principal) would more likely to default, while a comany with a larger number of miles actually constructed would less likely to default. Companies with more recently issued debt should also be more likely to default. The second column includes a number of other variables that were obtained through linking railroad-level data to the 1872 railroad GIS data. This linkage enables me to calculate, for example, the average county population for all counties that a particular railroad passed through in 1872. Thus, I can incorporate data on the features of the geographic area where

each railroad actually operated, to test the impact of local economic factors. The sample for this column only includes railroads which are present somewhere in the GIS dataset, so the sample size for this column is lower. The second column includes the average population across all counties in which each railroad operated, the average farm capital per capita, and the average manufacturing capital per capita. Each of these variables is weakly negatively correlated with the Land Grant dummy (R around -.3 in each case), indicating that land grant railroads were generally built in less populated areas with less economic activity. This regression also includes the average number of miles of track operated by other railroad companies within the county. This variable is intended to capture the level of competition that each railroad faced around its area of operation.

As in column 1, receiving a land grant is strongly and positively associated with the likelihood of default, even accounting for local demand factors. Turning to the new control variables, railroads that run through areas with more manufacturing capital per capita are also less likely to default, as we might expect. Strangely, population and farming capital are both positive correlated with default, but only farm capital is significant at the 10% level. Operating in a relatively competitive area, as captured in miles of other companies' track, is also negatively associated with default. This could simply mean that the other control variables are not completely capturing all of the demand factors that make a particular county more attractive to railroad companies, so that the miles of other companies are simply proxying for these omitted demand factors. It could also be the case that this increased competition serves to impose additional financial discipline on a railroad that relatively monopolistic railroads do not adopt.

The final column replaces the land grant dummy with a state aid dummy, indicating whether or not the railroad was classified as a state aid railroad in the 1873 Railroad Journal. These railroads were likely to have their bonds directly supported by state governments, and as such we see that being a state aid railroad is negatively associated with default. Thus, there seems to be a difference between state support of railroads through land grants and

direct support of a railroad's bonds. While direct support helps prevent bond defaults, land grants seem to have encouraged riskier bond issues without any compensating protection, and thus contributed to railroad bond defaults.

The following table shows the marginal effects that come out of the previous probit regressions, evaluated at the means of each variable.

Table 8: Marginal Effects from Railroad Default Probit

	(1)	(2)	(3)
Land Grant Dummy	0.147**	0.132**	
	(2.09)	(2.01)	
State Aid Dummy			-0.201**
			(-2.18)
Railroad Length (Total Miles)	-0.0662	-0.127**	-0.121**
	(-1.48)	(-2.55)	(-2.50)
Outstanding Principal	0.0775**	0.135***	0.148***
	(2.27)	(3.62)	(4.05)
Average Age of Bonds	-0.112**	-0.0833*	-0.0664
	(-2.49)	(-1.72)	(-1.40)
Average County Population		0.0790	0.0704
		(1.47)	(1.37)
Average County Farm Capital, per capita		0.0638*	0.0298
		(1.68)	(0.81)
Average County Manufacturing Capital, per capita		-0.116***	-0.111***
		(-2.94)	(-2.84)
Miles of Track Operated by Other Railroads		-0.0809**	-0.0995**
		(-1.96)	(-2.38)
Observations	321	225	225

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

As the first row indicates, receiving a land grant is associated with a nearly 15% increased chance for default. These results strongly support the view that railroad defaults during this downturn were related to the economic fundamentals of the railroads themselves, and that land grants railroads in particular were significantly more vulnerable to default. This would tend to support the view expressed in Mercer (1974) that, after the Civil War, land grant railroads were likely to be built ahead of demand. This would have left many of them in a relatively weaker financial position in the event of a constriction of the bond market. Such an event occurred in the early 1870s as Continential European investors, who had been heavily involved in the railroad bond market, grew more wary of the risks involved. The negative effects of this constriction fell hardest upon those railroads subsidized by federal land grant

policy.

6 Robustness Check: Reverse Causality

The railroad defaults that I include in the sample occur between the bank balance sheet observations in September of 1873 and October of 1874. This allows me to capture the full effect of a solvent railroad going into default on a bank's balance sheets, but only under the assumption that reverse causality is not an issue. That is, it could be the case that a fall in bank balance sheets results in subsequent default for nearby railroads. This is less likely than we might think due to the fact that railroads were funded almost exclusively through the national bond market at this point. Funding did not rely on local towns and investors (which was a more common model for funding railroads in the antebellum period). Rather, railroad bonds were bought and sold in major financial centers such as New York City and Chicago. In particular, my sample of railroads under construction and railroads in default only includes railroads whose bonds were listed in the Commercial and Financial Chronicle's railroad bond list. The fact that railroads were nationally rather than locally funded makes it significantly less likely that a change in bank balance sheets would lead to a railroad default. However, we can still devise a partial test of whether this is an issue by using bank data from 1872 and 1873. The following table essentially reverses my earlier regressions, placing the various railroad variables of interest on the left hand side, and balance sheet changes on the right hand side. Essentially, I am testing whether a negative change in bank balance sheets from 1872-1873 is related to the subsequent railroad defaults over the period from 1873-1874. Table 6 below shows the results.

There is a strong positive relationship between changes in loans and deposits and subsequent railroad defaults, and a strong negative relationship for excess reserves. This is the opposite of the relationship that we would expect if reverse causality were a problem in my specification. In fact, this shows that areas which later defaulted were the areas of highest

Table 9: Test for Reverse Causality: Miles of Rail Under Construction and in Default as Dependent Variables

	(1) RR Miles	(2) RR Miles	(3) RR Miles
Loans	0.131***		
	(4.76)		
Deposits		0.0712***	
		(4.84)	
Excess Reserves			-0.00957**
			(-2.22)
Total Miles of Rail	0.0493***	0.0491***	0.0474***
	(25.55)	(25.16)	(23.96)
ln(Assets)	-0.0154	-0.0176	-0.0178
	(-1.38)	(-1.63)	(-1.52)
Capital/Assets	0.0248	0.415***	0.150*
	(0.31)	(3.34)	(1.73)
Loans/Assets	-0.230***		
	(-3.30)		
Deposits/Assets		0.244***	
		(2.73)	
Reserves/Assets			1.890***
			(6.44)
Reserve City	0.0173	0.0191	
	(0.37)	(0.40)	
Central Reserve City	-0.0885***	-0.0703**	
	(-2.71)	(-2.20)	
Constant	0.122	-0.153	-0.0623
	(0.82)	(-0.94)	(-0.37)
Observations	1847	1842	1619
R^2	0.636	0.638	0.623

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

growth during the preceeding boom period. This is not altogether suprising in a typical credit boom. In any case, it is not consistent with the idea of low growth areas leading to railroad defaults.

7 Conclusion

The Panic of 1873 was intimately connected to the railroad boom and bust following the Civil War. As is well documented, the factors that set of the panic such as the failure of Jay Cooke and Co. can be directly linked to large failures in the railroad industry. This paper has shown that, more generally, railroad failures across the nation had lasting negative impacts on the banking system. Collapses in railroad construction led banks to signfiicantly restrict their loans, and increase their excess reserves, and caused withdrawals of bank deposits. Furthermore, when I investigate the roots of the troubles in the railroad industry, I find that land grants induced railroads into riskier behavior, increasing their probability of bond default during the downturn. This lends some credence to the idea that land grant railroads were built ahead of demand during this period, and that this contributed to their weakness in dealing with stricter conditions in the bond market. Both the boom and the bust seem to have been helped along by government land grant policy.

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