Essays in Economic & Business History
2022, 40: 156-187
Published October 29, 2022

How J. P. Morgan Picked the Winners and Losers in the Panic of 1907: An Exploration of the Individual over the Institution as Lender of Last Resort

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Abstract

The actions taken by J. P. Morgan during the Panic of 1907 reveal how a skilled leader can dominate those of formal institutions during the resolution of a financial crisis. First, we examine how Morgan coordinated emergency liquidity infusions during the Panic in the absence of a formal lender of last resort (LOLR). Morgan's Syndicate Books provide evidence that all applicants for liquidity had participated in earlier bond underwriting syndicates with Morgan. The single denial of aid was to an agent from an unprofitable syndicate, the Knickerbocker Trust. Morgan's decisions to provide or withhold aid to distressed institutions appear to track more closely with his previous syndicate experience with each applicant. Recommendations made by committees he formed to estimate applicants' solvency appear less important. Then, we show that Morgan's decisions had a distinguishable effect during the Panic on the prices of bonds underwritten by his syndicates. We find that during the Panic bond traders revised upward their valuation of bonds underwritten by Morgan compared to bonds underwritten by bankers that had not undertaken LOLR activities. We interpret these results as implying that market agents had greater expectations of valuable advice or liquidity infusions to Morgan-backed issuers than to issuers backed by other bankers. These findings provide support for Morgan's effectiveness as a mobilizer of private reserves, a private LOLR, during the Panic of 1907.

JEL Classifications : G01, G12, G23, G24, L14, N11, N21.

Keywords: JP Morgan; Panic of 1907; lender of last resort; syndicates; liquidity; call loan; clearing house; consols; Knickerbocker Trust; railroad bonds.

ISSN 0896-226X LCC 79-91616 HC12.E2

Introduction

We contribute to the literature about the Panic of 1907 by taking a new viewpoint, that of J. P. Morgan. His influence played a unique role in the resolution of that crisis. We examine the decisions Morgan made during the Panic, especially his influence on bond yields. We seek to understand how he, acting as de facto coordinator or lender of last resort (LOLR), determined which financial institutions to aid and which to ignore. We examine how his previous experience with institutions facing liquidity distress during the Panic may have influenced his decisions. We contrast the recommendations of six committees that Morgan and others appointed to study distressed institutions to the actions Morgan ultimately took with respect to those same institutions, finding several discrepancies. We compare the size of Morgan's lending facilities to other facilities that opened up during the crisis for perspective on the importance of his contributions; Morgan invested very little of his or his firm's capital in the LOLR facilities. The lesson we draw for present-day policy formation is that the individuals responsible for crisis resolution will bring to the table a unique approach that will influence the crisis resolution, in a way that might not have been expected a priori.

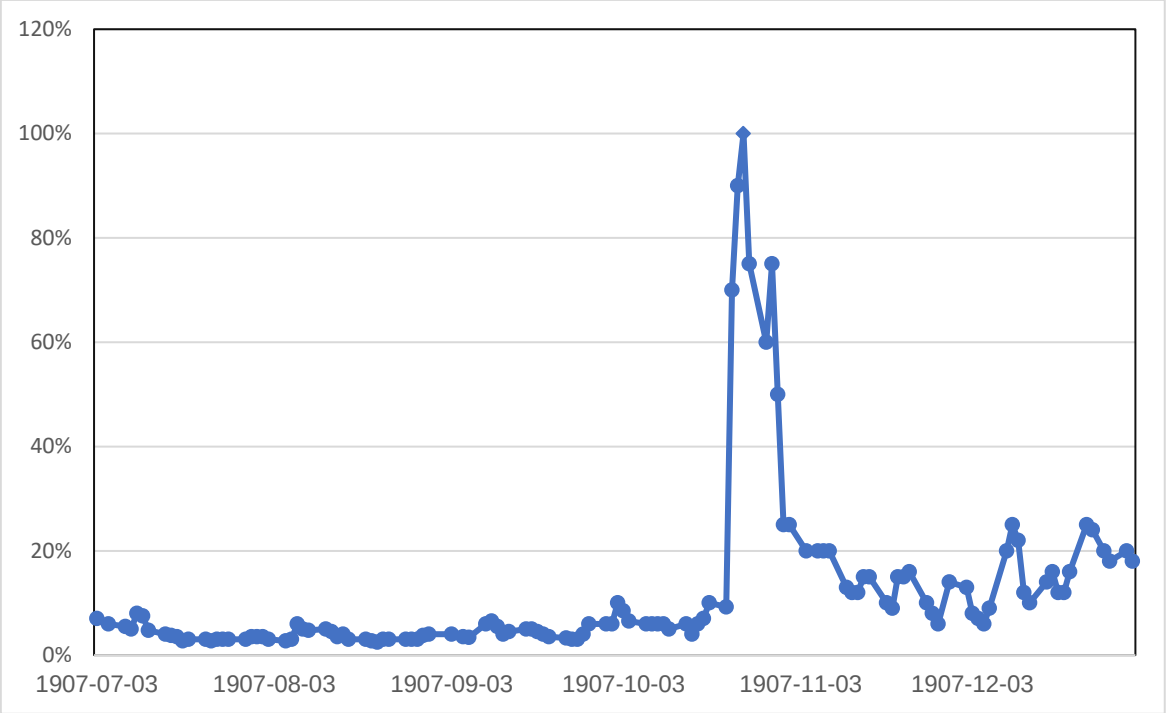
Our first section addresses two literatures: that of information asymmetry, the lens through which we analyze the effect Morgan's actions might have had on depositors at trust companies and on other market agents, and that of how leaders make decisions during crises. We also reference the LOLR literature. In the next section, we present data about distressed institutions that requested emergency liquidity provision during the Panic, Morgan's efforts to uncover their condition and his previous relationships working with them. We then analyze whether Morgan's individual LOLR activities may have been distinguishable from institutional LOLR actions taken by the US Treasury and the New York Clearing House. We conclude with discussion of our findings and the implications for how the narrative of the Panic of 1907 may be altered.

Literature Review and Historiography

We begin by reviewing how the literature on information asymmetries can frame the immediate problem Morgan faced on Sunday, October 20, 1907: incipient runs on trust companies by depositors. Information asymmetries are widely acknowledged as sources of market inefficiencies or of market failures (George Akerlof 1970). In the case of the market for bank deposits, adverse selection and moral hazard are two primary sources of information asymmetry between depositors (lenders) and banks (borrowers). When depositors cannot solve the adverse selection or moral hazard problems, often exacerbated in periods of high interest rates, they refrain from depositing funds with solvent banks in their effort to avoid depositing funds in insolvent ones. A rational response from depositors may even be to "run" a bank as a test of its solvency (Charles Calomiris and Gary Gorton 1991). If runs emerge, the surpluses to both depositors and to banks that are present in well-functioning deposit markets disappear as the market for deposits freezes.

At least three surplus recovery mechanisms to resolve adverse selection problems have been identified in the literature and Morgan used each one: signaling to lenders (depositors) (Brian Connelly, Trevis Certo, Duane Ireland, and Christopher Reutzel. 2011), screening borrowers (banks) (Maitreesh Ghatak 1999; Hayne Leland 1979), and wielding reputational capital to amplify signals (Amir Sufi 2007; Toshio Yamagishi and Masafumi Matsuda 2002). Another surplus recovery mechanism can be used to resolve moral hazard problems: monitoring borrowers' (banks') cash flows after a loan (deposit) has been made. Each of the four mechanisms reduces asymmetric information between lenders and borrowers, allowing the deposit market to function again, thus restoring market surpluses to both depositors and to banks. In this article, we study how Morgan used the four mechanisms to resolve information asymmetries.

While Morgan was active in resolving problems in the later nineteenth century, his actions become most apparent during the Panic of 1907. In October 1907, conditions existed for unresolvable adverse selection problems to emerge in the market for both bank deposits and for trust company (shadow bank) deposits. First, rates in the money markets had been elevated since March of 1907, in response to raising the bank rate the previous December by the Bank of England. Rate increases in the call loan market accelerated in early October, exacerbating the likelihood of adverse selection (see Figure 1). Next, a boom-bust pattern in copper prices, perhaps representing a secondary channel for London's tight money policy, resulted in plunging prices of copper-related securities (Rodgers and James Payne 2018). Rumors spread that certain banks and trust companies had funded highly-leveraged positions in those copper securities (Caroline Fohlin, Thomas Gehrig, and Marlene Haas 2016), adding to adverse selection problems for depositors who worried that some institutions were more exposed to plunging copper securities than others.



Source: Data compiled from the daily "Money and Exchange" column, *The New York Times*.

Figure 1
New York Stock Exchange, Daily High Call Loan Rates, July 1, 1907 through December 31, 1907[1]

During the week of October 13, the New York Clearing House resolved adverse selection problems for depositors at seven national banks associated with plunging copper

[1] Call loan rates began to elevate somewhat sharply on October 2, 1907, increasing adverse selection problems for bank and trust company depositors. The highest quote at 100 percent occurred on the afternoon of October 24, shortly before J. P. Morgan announced the formation of a syndicated bank loan, now known as the Money Pool, to lend up to $25,000,000 to floor brokers to aid in the trade settlement process. Moen and Tallman (2019) discuss the growing presence of the trust companies in the call loan market and their destabilizing effect on that market during the crisis.

securities. The banks were controlled by F. Augustus Heinze and Charles Morse, who had suspicious reputations on Wall Street at best. Their association with these banks was widely revealed when Heinze's attempt to corner the stock of United Copper collapsed, sparking depositors to run their deposits at the banks associated with him. Through quick action, however, the Clearing House stepped in and removed Heinze and Morse from these banks, replacing them with reputable managers. The Clearing House channeled liquidity to the national banks to maintain depositors' withdrawal privileges (Moen and Ellis Tallman 1992), and the runs on deposits quickly stopped. This revealed the value of the limited LOLR functions available to the Clearing House.

Even though the Clearing House was able to rescue these national banks, being a LOLR was not its primary function, that being instead to net clearings between member banks. Nor was the Clearing House led by a strong policy maker. Rather, it was guided by a group of member bank presidents, the Clearing House Committee, with the Committee chairmanship rotating among members. The minutes of the Clearing House Committee meetings usually recorded the chairman's main function as performing a tallying of outstanding loans, not that of being a singular policy maker. Lacking a strong LOLR policymaker to lead the institution in the fall of 1907, the leadership vacuum was ultimately filled by J. P. Morgan.[2]

During the following week, that of October 20, adverse selection problems spilled over to the trust companies operating outside the Clearing House Association. Distinct from the national banks, additional adverse selection problems faced depositors at trust companies. Trust companies paid higher rates on deposits, had lower reserve requirements and did not have a coordinated clearing house or screening system. Indeed, they were not members of the New York Clearing House. These differences all contributed to depositors' heightened suspicions regarding the vulnerability of the trust companies to the copper shock compared to banks (Moen and Tallman 2000). When it was subsequently revealed that Heinze and Morse were also associated with the Knickerbocker Trust Company, it should come as no surprise that as a rational test of their suspicions, depositors "ran" the New York trust in question; runs on other trust companies followed, most notably the Trust Company of America and Lincoln Trust. This led to a failure of the market for deposits and the loss of market surplus for depositors and the trust companies, most notably in trust companies whose deposits were dominated by smaller, retail depositors uptown in New York (Bradley Hansen 2014). The trusts were prime candidates for spreading distress into the real sector. Carola Frydman, Eric Hilt, and Lily Zhou (2015) show that corporations and businesses that had affiliations with the most affected trusts during the Panic later had higher borrowing costs, lower profitability, and less capital investment after the Panic had subsided. The Panic quickly threatened to spill over into the national banks and the New York Stock Exchange. With no clearing house or similar institution to provide nascent LOLR functions, Morgan, as if almost by default, quickly emerged as the central leader of the financial community to serve as LOLR to the financial system beyond the national banks where the Clearing House did not operate.[3] This included aiding the trust companies, the City of New York, and the brokerage firm of Moore & Schley after having created the money pools to support the call loan market of the stock exchange.

[2] In his capacity as a Director of National Commerce Bank, a member bank of the New York Clearing House, Morgan had helped draft a resolution supporting the Clearing House's LOLR activities during the 1890 crisis, so he was well aware of the capabilities and limitations of the Clearing House to act during crisis (O. M. W. Sprague 1910, 143).

[3] Charles Morris (2005) refers to Morgan as "the accidental central banker". In future work, we will examine the literatures that theorize how collective behavior is motivated when organizing LOLR constructs, seeking to understand why securities underwriting syndicates (led by Morgan) became de facto last resort loan mechanisms, rather than mechanisms that had been used effectively during previous National Banking Era crises, such as pooled reserves and clearing houses.

We explore how Morgan used surplus recovery mechanisms to unfreeze the stock exchange call loan market. First, evidence is provided that Morgan was indeed an informed agent with a substantial reputation whose signals, should he make them, would influence depositors' estimation about the solvency of financial institutions. We define signals as actions taken by Morgan regarding a financial institution that would inform market agents about its solvency or liquidity condition as measured by announcements in prominent newspapers. Then, we document several sources of Morgan's prodigious reputation, finding justification that his reputation could likely have strongly amplified his reported LOLR actions. Finally, we uncover evidence regarding how he decided which signals to make, that is, how he decided which requests for liquidity provision would be granted in estimation that the institution was solvent and which requests would be denied, signaling that the institution was likely insolvent. The effects of the value of being associated with Morgan can be seen indirectly. Fohlin and Zhikun Lu (2021) show that trust companies that were associated with Morgan and his associates, while suffering during the Panic, recovered quickly and more completely than trusts with no connections to Morgan.

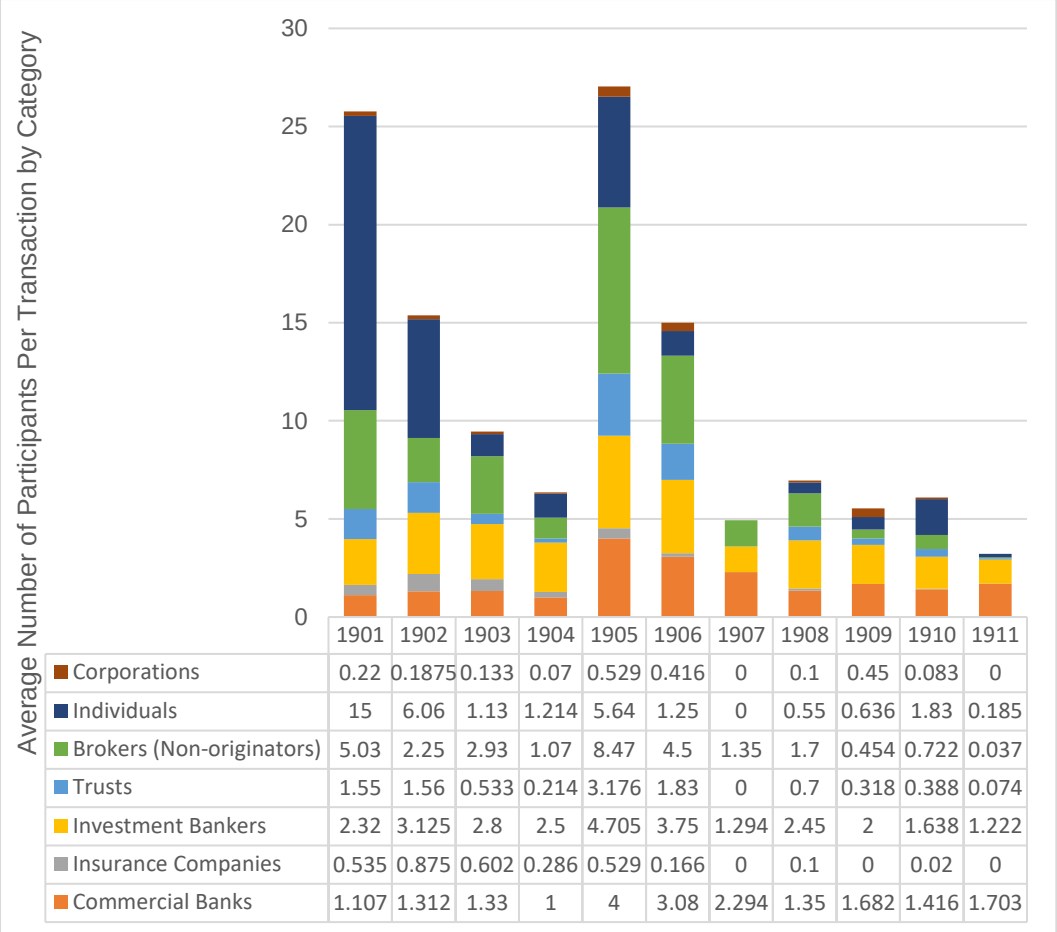
Evidence that Morgan was likely perceived as an informed agent comes from Morgan's Syndicate Books covering his firm's transactions over the 30 years before the 1907 Panic.[4] He had achieved almost systemic omniscience by including hundreds of banks, shadow banks, insurance companies, investment banks, and wealthy individuals both from the US and from abroad in his securities underwriting syndicates (see Figure 2). Besides knowing how many individuals and institutions with whom he partnered in syndicate formation, it is also useful to know that in the five years before the Panic, some of the firms with whom he partnered most frequently were the Clearing House banks and Kuhn Loeb, the investment bank headed by Jacob Schiff. His relationships with the banks, especially First National Bank and National City Bank, would prove pivotal during the Panic weeks. In-depth analysis of which institutions he dealt with most frequently and under which conditions is planned for future research.

The securities Morgan underwrote changed over time according to prevailing liquidity conditions ranging from short-term loans to long-term bonds, indicating his experience with navigating cyclical swings in liquidity (see Figure 3).[5] Although unobservable to the public, further proof of his informed agency is supported by our finding that 41 percent of the securities held in his 1913 personal estate consisted of shares of financial intermediaries that together placed 341 directors in 112 corporations with $22 billion in resources (see Table 1).[6]

[4] Susie Pak (2013) provides a careful description of the usual participants, organization and incentives embedded in Morgan's syndicates. Rodgers and Payne (2020) discuss how syndicate membership changed after the Panic of 1907, based perhaps on intensive collaboration with George Baker from the First National Bank and James Stillman from City National Bank occurring during the crisis. From 1901 through 1907, the Morgan firm averaged about 17 syndicated transactions per year, ranging from 12 to 24 per year.

[5] Figure 3 shows that only in the crisis year of 1907 were loans and notes a more frequent transaction for Morgan-led syndicates than were bonds, perhaps revealing the liquidity-constrained conditions of that year.

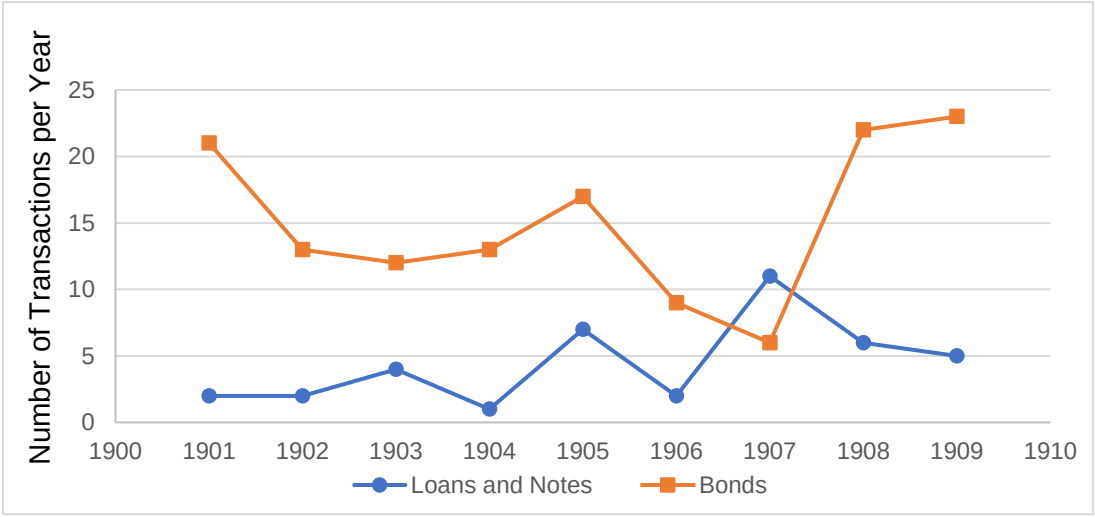
[6] US Congress (1913), Part III, Section III, p. 136.



	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
Corporations	0.22	0.1875	0.133	0.07	0.529	0.416	0	0.1	0.45	0.083	0
Individuals	15	6.06	1.13	1.214	5.64	1.25	0	0.55	0.636	1.83	0.185
Brokers (Non-originators)	5.03	2.25	2.93	1.07	8.47	4.5	1.35	1.7	0.454	0.722	0.037
Trusts	1.55	1.56	0.533	0.214	3.176	1.83	0	0.7	0.318	0.388	0.074
Investment Bankers	2.32	3.125	2.8	2.5	4.705	3.75	1.294	2.45	2	1.638	1.222
Insurance Companies	0.535	0.875	0.602	0.286	0.529	0.166	0	0.1	0	0.02	0
Commercial Banks	1.107	1.312	1.33	1	4	3.08	2.294	1.35	1.682	1.416	1.703

Source: J. P. Morgan & Co., Syndicate Books.

Figure 2
Composition of Morgan-led Underwriting Syndicates, 1901-1911



Source: J. P. Morgan & Co., Syndicate Books.

Figure 3
Frequency of Bond and Loan and Note underwritings at J. P. Morgan & Co., 1901-1909

Table 1
Securities Holdings in Estate Holdings of J. Pierpont Morgan, 1913

Issue	Shares or Face Value	Price per share	Value ($)	Percentage of total (%)
First National Bank	3500	900	3,150,000	27
National City Bank	1500	400	600,000	
National Bank of Commerce	2000	172	344,000	
Bankers Trust	1000	425	425,000	
Guaranty Trust	1000	375	375,000	
Sub-total: financials			4,894,000	41
Atchison Topeka & Santa Fe	2000	99.5	199,000	
New York Central	4000	106	424,000	
Sub-total: all stocks			5,517,000	47
New York Central	$500,000	101	555,000	
New York Central Deb 6%	$500,000	93	470,625	
Anglo French	$1,000,000	95.25	963,056	
Morgan Building Corp deb 5% (Morgan & Co. asset)	$2,500,000	100	2,500,000	21
Interboro RT 5%	$1,000,000	96	985,000	
Southern Railway deb 4%	$500,000	68	345,000	
Southern Railway 5%	$500,000	101	517,500	
Sub-total: all bonds			6,336,181	53
Totals			11,853,181	100

Source: J. P. Morgan & Co., General Ledger II, Syndicate Books.

The rise of Morgan's systemic reputation can be inferred from our estimates of his large share of the railroad bond underwriting market (see Table 2).[7] His firm's 17 percent average share of new railroad bond offerings indicates his dominant role in capital raised in the years leading up to the Panic, implying he was likely well-versed in the liquidity conditions of many prominent railroad firms and of many other bankers and investment bankers. Being appointed as the fiscal agent of the United States, and his well-known roles in the successful resolution of the US Gold crisis of 1895 and in the 1890 emergency Barings' facility organized by the Bank of England also elevated his reputation. Young (1993) finds that more access to information about the past, as Morgan had by acting in the 1890 and 1895 crises, is a strategic advantage for leaders. Finally, the dynastic aspect of his firm, stretching back to his father's start of the London branch in 1851, may have enhanced his reputation with the expectation that family members seek to preserve economic rents over future generations' life spans and not squander rents for short-term gain (Ronald Gilson 2007). Jack Morgan, Jr. was already prominent in Morgan's firm by 1907.

[7] The average market share in the pre-Panic period 1901-1907 was 17.1 percent. The average market share in the post-Panic period through 1911 was 23.5 percent.

Table 2
Estimated Market Share of Railroad Bond Offerings by Morgan-Led Syndicates, 1901-1911

Year	Railroad Bond Syndicates Led by J. P. Morgan & Co. ($)	Total Railroad Bond Offerings ($)	Share of New Railroad Bond Offerings
1901	152,772,000	758,600,000	0.20
1902	108,654,000	624,900,000	0.17
1903	106,892,000	453,800,000	0.23
1904	74,236,000	554,500,000	0.13
1905	178,770,000	803,400,000	0.22
1906	92,100,000	508,200,000	0.18
1907	32,476,000	645,500,000	0.05 [8]
1908	129,427,000	619,100,000	0.21
1909	137,943,274	762,800,000	0.18
1910	216,620,000	549,000,000	0.39
1911	93,115,000	597,500,000	0.16

Source: J. P. Morgan & Co., Syndicate Books; total railroad bond offerings: W. Braddock Hickman (1953).

By signaling which institutions merited emergency liquidity provision and which did not, Morgan could resolve depositors' adverse selection problems by either confirming that an institution was solvent or insolvent. Evidence for how Morgan decided which signals to give come from two sources: narratives provided by historians and his Syndicate Books. Four financial firms (Knickerbocker Trust, Trust Company of America, Lincoln Trust, and Moore & Schley brokerage house), one municipality (the City of New York) and one financial system utility (the New York Stock Exchange) requested emergency liquidity (see Table 3 for a timeline of Morgan's signals to market agents interspersed with announcements of LOLR activities made by the Clearing House, the US Treasury and J. D. Rockefeller).

Before responding to requests from those distressed institutions, Morgan, market agents and depositors would have had access to the August 22, 1907, Comptroller of the Currency Reports on the status of New York Clearing House Bank balance sheets. The distressed banks that experienced runs during the week of October 13 and that had been examined and saved by the New York Clearing House were covered in the Comptroller reports. Those problem banks' deposed leaders, Morse and Heinze, were related to the Knickerbocker Trust's president Charles Barney through joint participation in many investments. From our analysis of the report (see Table 4), it is not apparent ex-ante that the Morse-Heinze chain of banks were inherently more vulnerable to runs than non-Morse-Heinze banks, providing scant evidence that the Knickerbocker Trust, had it been linked to the Morse-Heinze chain, might

[8] We note the anomaly in the data of the 5 percent market share of railroad bond offerings during the Panic year. Definitive evidence is lacking, but various explanations are possible. Figure 3 shows that the firm participated in more loan and note offerings (not reflected in this table) than in other years. The firm's General Ledger indicates that the firm recorded a $21 million loss in 1907, its largest since the partnership formed in 1893. Large unrealized losses on holdings, or large remaining open syndicate holdings that had not yet been moved, could have constrained the firm's liquidity position and willingness to underwrite large new offerings during 1907. Alternatively, Morgan's railroad clients may have balked at issuing new bonds in an environment of elevated interest rates (although rates did not rise significantly until the fourth quarter of the year), waiting instead to issue bonds in future periods of lower rates.

have been a distressed institution. As far as depositors and Morgan were concerned, before the crisis, the Knickerbocker, Lincoln Trust, and Trust Company of America had no irregularities.

Table 3
Requests and Responses for Liquidity Provision during the Panic Weeks of 1907

Date	Event	Request Made By	Responder	Action
October 15	Copper Corner Fails			
October 16	Gross & Kleeberg Fails			
October 17	Runs on banks	Mercantile Bank	New York Clearing House	Aid granted
October 19	Runs on banks	Bank of North America, New Amsterdam Bank	New York Clearing House	Aid granted
October 20	Runs on Knickerbocker Trust	Charles Barney of Knickerbocker	J. P. Morgan at his Library	Refused to even meet with Barney
October 21		Knickerbocker Trust	New York Clearing House	Aid refused
October 23	Runs on Trust Companies	Trust Company of America and Lincoln Trust	J. P. Morgan	Aid organized and granted
October 24	NY Stock Exchange freezes	NY Stock Exchange	J. P. Morgan, US Treasury, J. D. Rockefeller	Aid organized and granted (three actions by three agents)
October 25		NY Stock Exchange	J. P. Morgan	Aid organized and granted
October 26			New York Clearing House	Clearing House suspends convertibility suspended and grants loan certificates
October 28	NY City cash drain	NY City	J. P. Morgan	Aid organized and granted
November 4	Moore & Schley margin calls	Moore & Schley brokerage	J. P. Morgan	Aid organized and granted
November 6	Trust Company runs	Trust companies	J. P. Morgan	Organized loan facility among trust companies

Source: Robert Bruner and Sean Carr (2007).

Table 4
Comparison of Morse-Heinze Banks to Non-Morse-Heinze Banks, August 22, 1907[9]

Account	Non-Morse-Heinze banks	Morse-Heinze banks, saved by the Clearing House after runs during the week of October 13
Composition of Assets		
Loans	0.56	0.58
US Bonds	0.05	0.03
Other bonds, investments, real estate	0.08	0.10
Due from Banks, Exchange	0.16	0.16
Lawful money	0.15	0.13
Total percent of Assets	1.00	1.00
Composition of Funded Capital		
Paid in Capital	0.09	0.11
Surplus and Profits	0.08	0.12
Sub-total: Equity	**0.17**	**0.23**
Circulation	0.04	0.02
Individual Deposits	0.43	0.43
US Deposits	0.02	0.03
Due to Banks & Other liabilities	0.34	0.29
Sub-total Liabilities	**0.83**	**0.77**
Total percent of Funded Assets	1.00	1.00

Source: Author's calculations from *Annual Report of the Comptroller of the Currency to the First Session of the 60th Congress of the United States* (1907).

[9] We explore in this table whether the Morse-Heinze banks look more susceptible to runs than non-Morse-Heinze banks, before bank runs began in the week of October 13, given that all were members of the New York Clearing House. This question is important because if they were, and Morgan had evidence that the Morse-Heinze banks, to which the Knickerbocker was linked through the person of Charles Barney, were too speculatively managed, then Morgan might have been justified in denying aid to the Knickerbocker. We find that the opacity of publicly-available bank balance sheet data could not inform Morgan or any other market agent about important details such as loan quality or loan portfolio concentration, thus making Morgan's proprietary knowledge about such matters highly valued.

We analyze balance sheets of two groups of banks to shed light on the question. Using data from the *Report of the Comptroller of the Currency* (1907, 722), we select the five banks identified by Wicker (2000, 89) as those controlled by Heinze and Morse. Then, we select seven banks of similar size that were not part of the Morse-Heinze chain and compare key risk metrics from the balance sheets.

To summarize our findings, the composition of both the Asset and Funding sides of the balance sheets of each group of banks does not provide conclusive evidence that the Morse-Heinze banks should have been more susceptible to runs than a matched group of like-sized Clearing House banks that were not part of the Morse-Heinze chain. On its face, Morgan might not have been able to conclude that these data supported the decision to deny aid to an institution related to the Morse-Heinze chain, the Knickerbocker Trust. We also analyze Clearing House bank balance sheets to which Morgan had access and find no appreciable ex-ante differences between institutions that requested aid from the Clearing House and those that did not, implying that balance sheet analysis was likely not a useful tool to understand Morgan's decisions.

Historians chronicle Morgan's formation of at least six screening committees during the weeks of October 20 and 27 to ascertain the solvency of the five institutions that requested help (Bruner and Carr 2007; Herbert Satterlee 1940), but no screening committee was apparently convened to examine the New York Stock Exchange.[10] Morgan assigned Ben Strong, Henry Davison, and George Perkins, from the First National Bank, Bankers Trust, and J. P Morgan & Co. respectively, to first evaluate the Knickerbocker Trust and then Trust Company of America and Lincoln Trust. He also encouraged the Knickerbocker to form a special committee of its directors to evaluate the firm. He formed a committee of Tom Joyce from J. P. Morgan & Co. and Dick Trimble from Moore & Schley to study the Moore & Schley brokerage. Finally, Morgan urged the finance committee of US Steel to assess Tennessee Coal & Iron's equity valuation. Historians also note that in two cases (Knickerbocker Trust and Moore & Schley), time constraints imposed by a fast-evolving crisis did not permit thorough solvency tests. Each committee reported its findings to a de facto coordinating committee of Morgan, George Baker of the First National Bank, and James Stillman of the City National Bank.[11]

In order to understand how Morgan might have used the data gathered by these ad hoc committees, we turn to the literature on decision-making during a crisis. This literature finds that agents rely upon experience rather than on data mined during the crisis when making pivotal judgment calls (David Snowden and Mary Boone 2007). For Morgan in 1907, that means that an analysis of his pre-crisis interactions with the five petitioners should be useful (excluding the sixth petitioner, the New York Stock Exchange, as a special case). Table 5 compares the data mined during the crisis by Morgan-appointed committees investigating the solvency and liquidity of distressed institutions to Morgan's personal syndicate underwriting experiences with those same institutions before the Panic.

In general, this literature finds that leaders learn to define the crisis framework with examples from their own organization's history. When information is incomplete, they assess the facts of the situation, categorize them, and then base their response on established practice (Snowden and Boone 2007). Morgan had considerable experience with syndicates, having honed the apparatus for over fifty years.[12] Therefore, it is not surprising that when discrepancies appeared between committees' findings and Morgan's personal experiences working with the applicants, he relied on his personal experience to make the decision (see Table 5 for discrepancies and decisions).

Complicated crisis contexts, unlike simple ones, may contain multiple right answers; Morgan and others could have configured any number of responses to the crisis. Because the complicated context calls for investigation of several options, many of which may be excellent, good practice as opposed to best practice is what is implemented. During a shock, none of the actors know a priori what problems would emerge or which solutions would be best (Snowden and Boone 2007).

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[10] The New York State Superintendent of Banking notes that he, too, was hard pressed to hire extra examiners to meet the needs of emergency information production, hiring 52 new examiners during the crisis. (Annual Report for 1907).

[11] See Anna Burr (1927) for a full description of James Stillman's interactions with Morgan during the Panic.

[12] The extensive securities underwriting syndicate system might be understood as a private market coordinating device to overcome the limitations of a fragmented banking system when confronting the task of raising capital to develop the American economy. See Peter Rousseau and Richard Sylla (2005) for discussions of the mutual dependency of the US banking system and the American securities markets and Calomiris (1995) for a contrast of the fragmented American financial system with the centralized European system.

Note that while Morgan worked within the syndicate structure for 50 years since he was 21 (1857 through 1907), comprehensive data on Morgan syndicates exist for only 30 years of his career (1877 through 1907).

Table 5
Morgan's Decisions to Approve or Deny Liquidity Provision to Distressed Organizations Related to Committees' Findings and to Morgan's Prior Syndicate Experience with the Organizations

Firm	Findings of Committee Formed during Crisis	Morgan's Prior Syndicate Experience	Morgan's Decision to Approve or Deny Liquidity Provision
Knickerbocker Trust	1) Morgan's committee headed by Ben Strong was unsure, had too little time 2) Knickerbocker's committee of directors found positive justification for solvency argument; stay open	Extremely negative, incurring large loss on Pacific Packing & Navigation syndicate organized by Knickerbocker Trust	Deny
1) Trust Company of America, 2) Lincoln Trust through the same agent, Oakleigh Thorne	3 & 4) Strong's committee performs cursory, four-hour review of Trust Company of America and much longer review of Lincoln	Very positive, Thorne crucial to successful New York New Haven Hartford rail segment purchase	Approve Approve
New York Stock Exchange	No committee	Extensive interaction; NYSE central to system	Approve
New York City	No committee	Very positive, two prior profitable bond underwritings	Approve
Moore & Schley	5) Morgan committee headed by Trimble and Joyce had insufficient time for thorough review of Moore & Schley 6) Finance committee of US Steel did not approve of interim financing for Moore & Schley	American Tobacco Trust profitable underwriting. Same participants were underwriters of Tennessee Coal & Iron including James Buchanan Duke and Grant Schley	Approve

Source: Bruner and Carr (2007); Federal Reserve of New York Archives (1924).

Hanna Oh, et al. (2016) find that decision-making is bounded by uncertain information, limitations in cognitive resources and a lack of time to allocate to the decision process. It is thought that humans overcome these limitations through satisficing, that is, a fast but good enough heuristic decision-making process that prioritizes some sources of information (cues) while ignoring others. They found that under high time pressure, decision makers systematically discount a subset of the cue information by dropping the least informative cues and instead consider the most diagnostic cue information, thus maintaining good enough

accuracy. Morgan overruled the Knickerbocker directors' committee that had declared the Knickerbocker was solvent. He also overruled the finance committee of US Steel which had recommended US Steel not pursue the acquisition of Tennessee Coal & Iron; he engineered the acquisition and organized an emergency syndicate to effect the acquisition to save the distressed brokerage house Moore & Schley.

The last strand of literature that informs this study is that of the LOLR: it provides a framework to understand the actions of J. P. Morgan as an individual and the actions taken by the US Treasury and the Clearing House as institutions (Calomiris, Marc Flandreau, and Luc Laeven 2016). The chief difference between Morgan's LOLR facilities and those of a formal central bank were that reorganizing private reserves did not expand systemic liquidity. Without a central bank in 1907, shipments of gold reserves from Europe and the cessation of hoarding specie by interior banks and by individuals would be how the system could fully reliquefy.[13] Morgan's actions kept short-term lending from freezing up. While his behavior approached that of a traditional LOLR, his actions were at best temporary, a necessary—but only a temporary—fix.

Morgan's Decisions and Signals to Market Agents

Morgan's Syndicate Books provide evidence that all applicants for emergency liquidity, except the New York Stock Exchange, participated in his securities underwriting syndicates. The New York Stock Exchange provided the critical platform on which all of his syndicated transactions depended. The single denial of aid was to an agent from an unprofitable syndicate, the Knickerbocker Trust. All of the approvals were made to agents from profitable syndicates or to agents who were instrumental in turning unprofitable syndicates into profitable ones. The approval to aid the New York Stock Exchange was conceivably done to maintain the platform, key to all his transactions.

Only ten syndicates were unprofitable among the almost 200 from 1901 to 1907 (see Table 6). Despite an estimated profit of $25,000,000 between 1901 and 1906 across more than 135 transactions, Morgan's losses on the ten losers totaled $896,978.[14] Five were railroads and five were industrial corporations. Twenty-four percent of the losses, or $217,184, were on a Pacific Packing & Navigation syndicate led by Charles T. Barney from the Knickerbocker Trust. Twenty-nine percent of the losses, or $261,304, were on a New York, New Haven and Hartford (NYNHH) Railroad bond underwriting, a firm experiencing stiff competition from Morse's Consolidated Steamship line that ran from Maine to New York City. Morse was a close business partner with Barney. With over half Morgan's syndicate losses coming from transactions involving Barney and Morse, it is not surprising that Morgan refused to even meet with Barney when Barney arrived at Morgan's home on Sunday, October 20, 1907.

[13] For a discussion of arbitrage opportunities for gold imports in the presence of a premium on gold, see Rodgers and Berry Wilson 2011.

[14] Profits and losses are reported in Morgan's Syndicate Books and in his firm's general ledgers. They are not calculated by this article's authors. These sources do not record another loss until 1913, beyond our time frame of analysis. A well-known and problematic syndicate formed by Morgan, the International Mercantile Marine (IMM) issuance of equity and debt, was not profitable for many of the syndicate members. Thomas Navin and Marian Sears (1954) analyze the IMM transaction in detail using documents from the Price Waterhouse archives. They note that the firm had at least $11,000,000 of its own funds tied up in the transaction between 1902 and 1906 or 1907 (Navin and Sears 1954, 35). They estimate that had the securities been sold in 1906 when the syndicate was terminated, J. P. Morgan & Co. might have broken even. Had the firm liquidated its position between 1907 and 1913, it might have incurred a $1,000,000 to $1,500,000 loss, but if the position had been liquidated later in the 1910s or 1920s, a gain might have been recorded. We could not find a gain or loss recorded in the Morgan Syndicate books on this transaction.

Table 6
Loss-Producing Syndicates of J. P. Morgan & Co. 1901-1911

Money losing syndicates	Date	Size ($)	Morgan share ($)	Loss ($)	Led by	Industry	Loss as % of funds committed
Pacific Packing & Navigation	December 3, 1901	7,000,000	500,000	217,184	Knickerbocker	salmon canning	43
Susquehanna Power	March 25, 1905	20,000,000	250,000	106,760	Harvey Fisk	electricity	43
NY, New Haven & Hartford RR	September 14, 1905	1,874,315	937,157.50	261,304	Morgan	railroad	28
Colorado & Southern RR	July 4, 1905	1,700,000	250,000	27,744	Hallgarten	railroad	11
American Woolen Co	November 12, 1906	10,000,000	1,000,000	80,635	Brown Bros	wool	8
Lakeshore & Michigan Southern	February 15, 1906	35,000,000	600,000	32,755	Not Available	railroad	5
San Francisco Street Railway	February 17, 1902		250,000	9,427	Brown Bros	street railway	4
American Smelters	January 5, 1905	25,500,000	1,000,000	33,303	Kuhn Loeb	copper	3
Louisville & Nashville	May 2, 1906	10,000,000	7,500,000	123,000	Morgan	railroad	2
Michigan Central	November 27, 1901	10,000,000	5,000,000	4,866	Morgan	railroad	0
Total loss				896,978			

Source: J. P. Morgan & Co., Syndicate Books.

August Radke (2002) and Dianne Newell (1989) recount the story of the Pacific Packing & Navigation securities origination underwritten by the Knickerbocker Trust led by Barney. The new firm was intended to amalgamate several independent Pacific coast salmon canning operations. Once a monopoly on the trade was secured, Pacific Packing could drive out marginal players and raise prices to compensate for the risk of uncertain catch sizes that had plagued the industry. Radke notes that even though the operation was well-financed with the $3,000,000 proceeds of the debenture underwriting, it was forced into receivership in March of 1903 after only two years of operation. The organizers had failed to convince Alaska Packers Association to join the amalgamation. Alaska Packers then deliberately initiated a successful "Salmon War" to drive Pacific Packing out of business. Pacific Packing's properties were sold at "ridiculously low prices" at bankruptcy auctions in late 1904 and early 1905, leaving bondholders with significant losses on their investment (Radke 2002). Morgan was among those losing investors, having pledged $500,000 of the $3,000,000 total issue. His loss amounted to $217,184, 43 percent of his investment.

It is important to note that as organizer of the syndicate, Barney had indicated in the offering circular that Alaska Packers were expected to join the amalgamation. After the syndicate members, including Morgan, had committed to funding the enterprise, Barney revealed that Alaska Packers had not been persuaded to join the endeavor after all, meaning that monopoly pricing power would not likely be achieved by Pacific Packing. We do not find evidence that the syndicate failed because of changes to macroeconomic conditions, changes in consumer preferences, or technological shocks to the industry. The evidence of letters in the Syndicate Books and the offering circular suggests that Barney led the syndicate members to believe Alaska Packers would participate in the industry consolidation when in fact, that commitment had never been secured. Perhaps the denial of aid to Barney in the Panic of 1907 is an example of what was on Morgan's mind when he said, "Because a man I do not trust could not get money from me on all the bonds in Christendom", during his testimony at the Pujo hearings in 1912.[15]

The largest of Morgan's syndicate losses between 1901 and 1906 came from the 1905 NYNHH Railroad underwriting. A primary purpose of this railroad was to carry freight that travelled south from Boston to New Haven and then on to New York City (Vincent Carosso 1987). The NYNHH also owned the Fall River steamship line, which offered passengers luxury travel accommodations along the coast from Boston to New York. Notably, Morse's steamships that dominated traffic between Boston and New York, provided troublesome competition to Morgan's railroad.

In 1905 Morse set out to expand his Maine steamship line to compete head on with the Fall River line. He commissioned the construction of two new steamships, the *Harvard* and the *Yale,* named for schools his son attended. Philip Woods (2011) notes that in February 1907 Morgan, through the NYNHH line, bought several small steamship companies to counter Morse's lines that dominated Boston-New York traffic. Adding the steamship business to the NYNHH's operations proved costly and contributed to the 1905 bond issue being unprofitable (Carosso 1987).

Morgan approved the request for aid from Oakleigh Thorne, president of Trust Company of America and linked to Lincoln Trust, when no other trust company or bank would. Thorne was involved with Morgan on the NYNHH's successful and somewhat secretive acquisition of an integral link between New York City and Hartford, improving the competitive position of the railroad, and improving the likelihood that Morgan could make back the $261,000 he had lost

[15] US Congress (1913), Part III, Section III, p. 136.

on it. Henry Staples and Thomas Mason (1947) record how substantial steps were taken at the municipal permitting process level to hide Thorne's link to Morgan.[16]

Morgan arranged liquidity for two other applicants. On October 28, Morgan agreed to organize a $30 million three-year facility to fund working capital needs of the City of New York. Led by Mayor George McClellan, the City had tried but failed to find buyers for its debt in the capital markets in the summer of 1907. But Morgan had acted as banker for at least two New York City underwritings in the decades preceding 1907 and in the midst of the 1907 crisis devised a way to underwrite the new notes using clearinghouse certificates backed by First National Bank and City National Bank. Grant B. Schley, principal of Moore & Schley, was the other applicant to whom Morgan granted aid. In another unusual transaction, Morgan saved Schley's brokerage house by swapping its declining securities holdings for stronger ones. Schley had participated in profitable underwritings with Morgan over many years and his clients included participants in successful Morgan underwritings for American Tobacco Trust, dating back to 1890.

When comparing which factor was better associated with Morgan's decision to approve or deny aid to an applicant, all decisions are positively associated with Morgan's prior underwriting experience with the applicant whereas fewer of his decisions are positively associated with the recommendations of the committees formed to assess solvency during the crisis. It appears that Morgan relied primarily on his prior experience with the applicants rather than on the recommendations from the assessment committees.

While we do not have sufficient data to construct an econometric model to estimate the likelihood of receiving an extension or denial of aid from Morgan, we do have an "out-of-sample" observation that is noteworthy. In late December of 1907, a date shortly past the height of the crisis, the Canada Southern railroad found itself unable to roll over its bonds maturing in January of 1908. The line was leased by the New York Central and Hudson Railroad system, Morgan's client since 1879 and the source of millions of dollars of underwriting profits to his firm. While New York Central was grouped in our low-yield (high quality) sample, Canada Southern 1913 notes yielded 5 percent placing them in the high-yield subset of our sample, signaling perhaps some ambiguity about the road's credit quality. Morgan agreed to underwrite a new 3-year note for the Canada Southern, taking up any principal not rolled over by holders of the maturing bonds.[17] The note was issued at 6 percent, another sign that either stringent money market conditions or constrained liquidity conditions

[16] While we analyze the business relationships that Barney, Morse and Thorne had with Morgan, Mary O'Sullivan (2016) offers a different perspective on why those three individuals were unusually exposed to liquidity calls during the Panic. Barney and the Knickerbocker Trust were heavily invested in industrials, which he used as collateral against loans to a greater extent than the more reputable national banks (O'Sullivan 2016, 211). This contributed to Benjamin Strong's being unable to say that the Knickerbocker Trust was solvent when he was asked to evaluate its financial condition on October 22. Thorne of the Trust Company of America, in association with Morse, was interested in promoting industrial securities. Their prominence in the trust's portfolio gave rise to suspicions like those raised with the Knickerbocker, although Morgan felt it was necessary to stop the runs on trust companies at Trust Company of America lest they started spilling over into the banks (O'Sullivan 2016, 212-213). The brokerage firm Moore & Schley used industrials as collateral for a large volume of loans, which required Morgan to be especially resourceful in crafting a bailout of the troubled firm. Moore & Schley had run out of higher quality railroad securities to back their loans (O'Sullivan 2016, 219-224). In general, borrowers in the call loan market increasingly had to rely more on industrial securities as collateral as it expanded, particularly for firms with poorer borrowing reputations. The rise in industrial securities as collateral echoes the increasing use of mortgage-backed securities in the overnight repo market by 2008. Therefore, we are not surprised that Morgan's underwritings made little difference in yields of higher quality railroad securities and that his LOLR efforts during the Panic would require significant financial assistance beyond that which his firm could provide.

[17] J. P. Morgan & Co., Syndicate Books.

existed for the railroad.[18] This example supports our contention that Morgan acted to grant liquidity provision in times of crisis to those clients with whom he had enjoyed profitable relationships in the past or was able to price securities in times of crisis to permit his clients to avoid default. The $14,000,000 first mortgage bonds were issued originally at 5 percent coupon in 1878 with a maturity date of January 1,1908, but were extended at 6 percent interest until January 1, 1913, with interest being paid by the Michigan Central Railroad Co. (owned by New York Central and Hudson).

Did Morgan's Men Lower Yields?

The previous section presented evidence that Morgan likely provided liquidity to agents with whom he had enjoyed successful business experiences, rather than to those deemed worthy by ad hoc solvency committees. But did market agents price Morgan's unique willingness to aid his business colleagues into their estimations of bond valuations? Can the effect of Morgan's individual LOLR activities be separated from the institutional LOLR actions taken by the US Treasury or the New York Clearing House?

To answer those questions, we undertake an econometric analysis of bond yields before and after the series of LOLR announcements became public. Unlike customary econometric modeling, our analysis does not intend to estimate a general model for extrapolation to other crises. Rather, our intent is to illustrate whether Morgan's individual LOLR actions can be disentangled from LOLR actions taken by others. Therefore, we did not find the limitations of small, low-frequency data as insurmountable problems for the analysis. Our results will be interpreted only in the context of our narrow question about Morgan's unique involvement in the resolution of one unique crisis.

Initially, we employ an established research design pioneered by Bradford DeLong (1991) and adopted with modifications by Carlos Ramirez (1995) and Daniel Giedeman (2004) that provides a framework for how to disentangle Morgan's influences on securities' valuations from other factors that affect those valuations. Afterwards, we pursue a second research design of teasing out Morgan's unique influence by using dummy and interaction variables. Both methods yield similar results: a small but statistically significant improvement in yields on low-grade railroad bonds is detectable for Morgan-underwritten bonds compared to bonds underwritten by other bankers. We interpret this to mean that market agents may have priced in Morgan's willingness and ability to aid those issuers most likely to request liquidity during the crisis, low-grade or non-rated railroads, if he had underwritten them.

Matched Sample Method

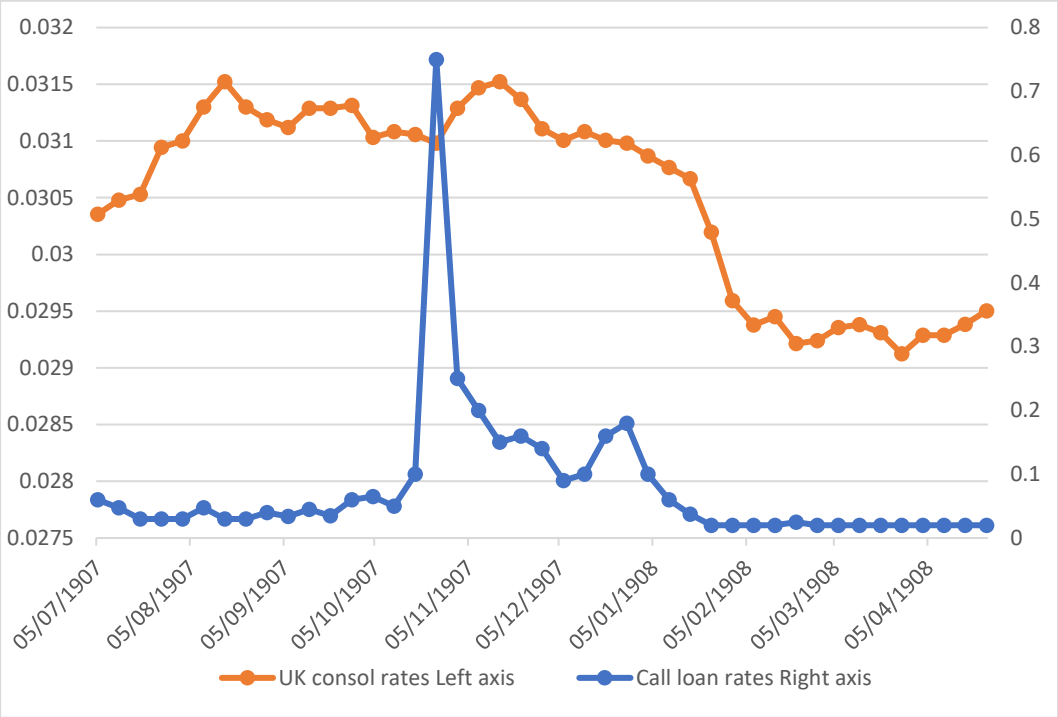
LOLR facilities organized by the Treasury or by the Clearing House would have been expected to affect all bond yields. We reason, however, that Morgan's LOLR activities, if they had been taken uniformly to benefit his business associates, would have been expected to affect Morgan-underwritten bonds more so than his activities might have affected bonds underwritten by other bankers. We therefore match two samples of Morgan and non-Morgan bonds by credit quality, issue size, and geographic operating region. We select only railroad bonds on several grounds. We reason that railroad bonds represented 61.5 percent of all corporate bonds outstanding in 1907[19] and that Morgan's outsized presence in railroad

[18] The *Commercial and Financial Chronicle* (Vol. 86, 1041) noted "The bonds are not a second mortgage or a general mortgage, but an absolute first mortgage. Yet the company finds itself obliged to offer as high as 6% in order to get the bondholders to consent to an extension of the mortgage. Up to within the last two or three years, whenever a … superior lien of this character fell due it was possible to renew the mortgage at a reduced rate of interest. There can be no doubt that five years ago, the Canada Southern Company could have renewed this loan at 4% or 4.5%".

[19] Hickman (1953), 250-252, Table A-1.

industry financing would mean that it would likely be the one in which to detect a Morgan effect, if any Morgan effect could be detected. Furthermore, approximately 69 percent of the corporate bond underwritings that J. P. Morgan & Co. managed were for railroads, indicating how important that industry was to his firm and how much specialist industry expertise resided in his firm.[20] Finally, they were widely used instruments as collateral for call loans, more deeply traded, more liquid, and less volatile than industrials (O'Sullivan 2016).[21] Weekly data are available for railroad bond yields in the *Commercial and Financial Chronicle*, and the underwriters of the bonds are identified in *Poor's Manual of Railroads*.

Then, we regress the yields of the two samples on a dummy variable covering the period starting at the end of the LOLR announcements on November 8, 1907, extending to February 7, 1908, when the financial markets had returned to more normalized conditions (see Figure 4). November 8, 1907, marks the end of thirteen LOLR announcements in the press, seven by Morgan, four by the New York Clearing House, one by the US Treasury and one by J. D. Rockefeller. We control for credit conditions to determine if the Morgan sample responded differently than the non-Morgan sample (see Table 7a for list of bonds in each sample).



Source: *Commercial and Financial Chronicle*, Vols. 85 and 86.

Figure 4
Call Loan Rates (left axis) and UK Consol rates (right axis), Weeks Ending July 5, 1907 through April 30, 1908

[20] Source: J. P. Morgan & Co., Syndicate Books.

[21] Mary O' Sullivan (2016) examines the development of US securities markets from 1866 to 1922. Her analysis of the period surrounding the Panic of 1907 is particularly relevant for our study of J. P. Morgan (pp. 211-230). She describes how railroad securities had risen to prominence in the later nineteenth century, having been established as the most reliable asset for investment and for serving as collateral on loans at the New York Stock Exchange. Industrial securities, on the other hand, were still being established as mature securities even as late as the Panic, with railroad securities being more deeply traded, more liquid, and less volatile than industrials. Their increasing use as collateral made borrowers unusually vulnerable to calls.

Table 7a

Matched Bond Samples, by High-yield or Low-yield and by Banker

Samples of Low-yielding Bonds, by Investment Banker									
Bond	Size of Issue ($)	Maturity Date	Banker	Coupon (%)	Bond	Size of Issue ($)	Maturity Date	Banker	Coupon (%)
Atchison Topeka & Santa Fe-Gen gold 4s	148,155,000	April 1, 1995	JPM	4	St. Louis San Francisco gen gold 5s	19,484,000	January 1, 1931	Blair	5
Cleveland Cincinnati Chicago & St Louis gen gold 4s	21,897,000	June 1, 1993	JPM	4	Denver & Rio Grande 1st con gold 4s	42,000,000	January 1, 1936	Kuhn Loeb	4
Erie RR 1st ext gold 4s	35,885,000	May 1, 1947	JPM	4	Louisville & Nashville Unified gold 4s	36,648,000	January 1, 1940	Belmont	4
Penn Co- Guar 1st g 4 1/2s	19,467,000	January 1, 1921	JPM	4.5	Southern Pacific RR 1st refunding 4s	79,267,000	January 1, 1955	Kuhn Loeb, Harriman	4
N Y Central & Hudson River gold 3 1/2s	85,000,000	January 1, 1997	JPM	3.5	Texas & Pacific 1st gold 5s	25,000,000	June 1, 2000	Kuhn Loeb, Gould	5
Northern Pacific- Prior lien gold 4s	104,479,000	July 1, 1997	JPM	4	Union Pacific RR & 1gr gold 4s	100,000,000	January 1, 1947	Kuhn Loeb, Harriman	4
Total Outstanding	414,883,000				Total Outstanding	302,399,000			
Average	69,147,166.67			4	Average	50,399,833.33			4.33

Table 7a (continued)

Samples of High-yielding Bonds, by Investment Banker									
Bond	Size of Issue ($)	Maturity Date	Banker	Coupon (%)	Bond	Size of Issue ($)	Maturity Date	Banker	Coupon (%)
Southern - 1st con g 5s	48,137,000	January 1, 1994	JPM	5	Col Midland 1st g 4s	8,946,000	January 1, 1947	Speyer	4
Eastern TN lien 5s	4,500,000	September 1, 1938	JPM	5	Ft W & Rio Gr 1st g 4s	30,000,000	January 1, 1998	Gould, KL	4
Chicago & Western	8,738,000	December 1, 1932	JPM	6	Chicago, Rock Island & Pacific Refunding gold 4s	54,342,000	April 1, 1934	Speyer	4
Erie RR 1st con gold 4s prior	35,000,000	January 1, 1996	JPM	4	Kansas City Southern 1st g	30,000,000	April 1, 1950	J. W. Gates	3
Gt Northern-CBQ	87,613,000	July 1, 1921	JPM	4	Seaboard Air Line g 4s	12,775,000	April 1, 1950	Blair	4
Total Outstanding	183,988,000				Total Outstanding	136,063,000			
Average	36,797,600			4.8	Average	27,212,600			3.8

Sources: Poor's Ready Reference Bond-List of Leading Steam Railroads in the US: Compiled from Official Returns to *Poor's Manual of Railroads* 1909; Carosso (1987); Naomi Cohen (1999); *Commercial and Financial Chronicle*, Vol. 85, Supplement.

Note: We observe that the average coupon rate for the non-JPM high-yield sample is not only much lower than that for the JPM high-yield sample, but lower than the average coupon rate for the JPM low-yield sample. Coupon rates reflect market conditions at the date of issue and issue characteristics, whereas the yields in our analysis reflect bond prices during the 1907 panic, which in turn reflect market agents' expectations for future cash flows and the market value of collateral at that time. For example, the Kansas City Southern and Seaboard Air Line bonds in the non-JPM high-yield sample were issued within one day of each other, April 1, 1900, at different coupon rates but with the same maturity date. However, Kansas City Southern pledged "all property", whereas Seaboard Air Line pledged a lot of collateral, but not "all property".

Table 7b
Summary Statistics: Yield Analysis, Railroad Bonds, July 1, 1907 to April 30, 1908

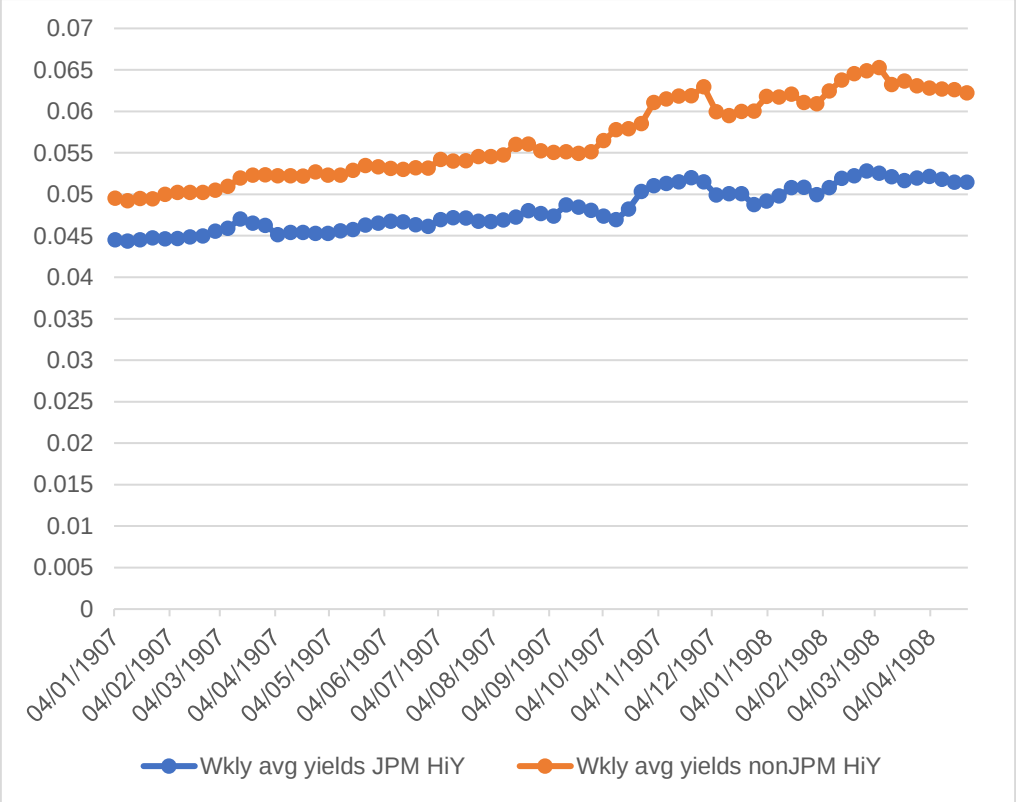
	Call Loan	UK Consol	All bankers		Low-yield		High-yield	
			Low-yield	High-yield	JPM	Non-JPM	JPM	Non-JPM
Mean	0.078984	0.030526	0.04279	0.054671	0.041027	0.044553	0.049762	0.05958
Standard Error	0.012816	8.96E-05	0.000215	0.000617	0.000122	0.000157	0.000304	0.00055
Median	0.0375	0.030982	0.043099	0.053421	0.040886	0.044367	0.050062	0.060922
Range	0.73	0.002399	0.008188	0.018577	0.00354	0.004313	0.006098	0.011261
Minimum	0.02	0.029123	0.039392	0.046714	0.039392	0.043266	0.046714	0.054029
Maximum	0.75	0.031523	0.04758	0.06529	0.042932	0.04758	0.052812	0.06529
Count	86	86	86	86	43	43	43	43

Note: The volume of the 22 bonds in our sample accounted for 20.66 percent of the total volume of railroad bonds traded on the New York bond exchange in November of 1907. November witnessed the highest monthly bond volume of the year, and it was likely the month in which many market agents reassessed the value of their holdings, coming after the series of LOLR facilities wrapped up. Therefore, we believe the sample we selected to examine likely reflects the overall market for railroad bonds reasonably well.
The number of observations for the combined samples of Morgan and non-Morgan bonds in our Interactive model is 86 because it contains two observations for each of the 43 weeks we study, one Morgan group observation and one non-Morgan group observation. The number of observations for the Matched Sample model contains 43 observations because the sample is separated into a Morgan group and a non-Morgan group of bond yields.

We control for credit conditions in our event study regression with two variables: call loan rates and UK consol rates. Call loan rates measured the marginal cost of short-term credit to financial intermediaries or speculators and the marginal cost of short-term liquidity for working capital in the real economy. The UK consol rate measured the marginal cost of long-term risk-free credit to investors in the financial markets and the marginal cost of long-term risk-free credit for capital projects in the real economy. UK consols were widely held and reflected the cost of risk-free credit in gold standard countries (see Figure 4). Call loan rates averaged 9.6 percent and UK consol rates 3.0 percent between July 5 and November 7, 1907, the time frame during which market agents were not fully informed of Morgan's LOLR activities. Between November 8, 1907 and January 24, 1908, call loan rates were higher on average at 10.9 percent and UK consol rates were 3.1 percent. Bond prices are inversely related to interest rates, meaning bond prices would have been lower on average in the weeks after November 8, 1907 than they were in the period prior to that date. Higher yields and lower prices after November 8, 1907, are consistent with the active liquidation of bonds in a period of elevated uncertainty and risk accompanying the disruption to the banking system. By February 7, 1908, yields had subsided in both the call loan market and in the UK consol market, signaling the end of crisis conditions. The October 25 spike in call rates somewhat distorts the visual presentation of the variation in such rates before and after that date. Nonetheless, one of the main points drawn from the Figure is still visible: the increase in call loan rates in December compared to the decline in the consol rate is still visible, revealing that liquidity constraints in New York remained while they dissipated in London.

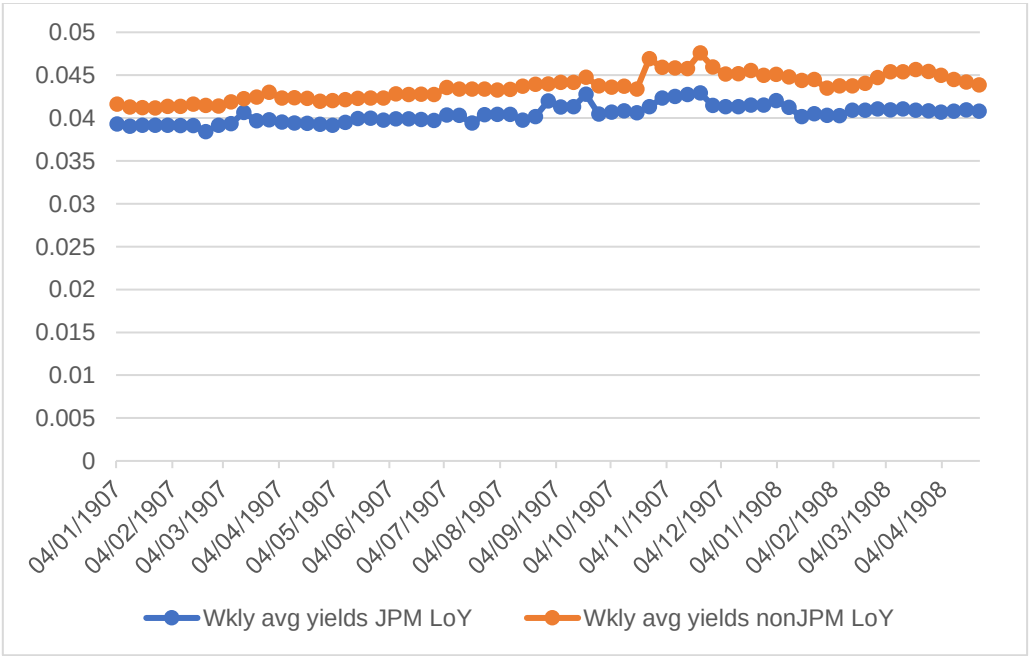
We separate railroad bonds into two groups for each of the Morgan and non-Morgan underwriting samples: high-yield bonds, and low-yield bonds, reasoning that high-yield and low-yield bond prices contain different sets of information about systemic liquidity. High-yield bond issuers might have more cyclical profit streams or poorer quality managers. Those issuers' risk of default could increase more, and yields would rise more, if access to working capital was disrupted during a crisis. High-yield issuers could tell us more about average and riskier tiers of the real economy. Lower grade issuers were closer on the risk spectrum to the mass of firms that were too small to issue at all, the ones that relied on retained earnings for capital improvement or on banks for working capital for funding. Peter Basile, Sung Won Kang, John Landon-Lane, and Hugh Rockoff (2017) find that the information provided by high-yield bonds could describe the experience of more firms than just those that were explicitly traded. By studying high-yield bonds, we explore how yields on bonds that might have been most vulnerable to disruptions to the credit markets might have responded in the crisis. We separate bonds into high- and low-yield categories by calculating the mean of each banker's sample and grouping the bonds with yields above average into the high-yield sub-sample and the bonds with yields below average into the low-yield sub-sample (see Tables 7a and 7b for summary statistics about the samples).

A visual depiction of the data from the sub-samples reveals a widening between the high-yield bonds underwritten by Morgan and the high-yield bonds underwritten by other bankers (see Figure 5). There does not appear to be a similar widening between the low-yield bonds underwritten by Morgan compared to those underwritten by other bankers (see Figure 6). The widening appears to happen around November 7, which also coincides with the end of the series of LOLR announcements.



Source: *Commercial and Financial Chronicle* for weeks in 1907 and 1908.

Figure 5
Yields on High-yield Bonds, by Banker, Weekly from July 1, 1907, through April 30, 1908



Source: *Commercial and Financial Chronicle* for weeks in 1907 and 1908.

Figure 6
Yields on Low-yield Bonds, by Banker, Weekly from July 1, 1907, through April 30, 1908

We test whether the widening, which may signal a sharper sell-off in non-Morgan bonds, was statistically significant. Our regression specification for the matched sample method is presented in equation 1.

(1) $Y_{t_q} = c + ax_{1t} + bx_{2t} + cx_{3t} + e_{t_q}$

Where Y_t = Yield on railroad bond in time t, for one of two credit quality groups (high-yield or low-yield)
c = constant
x_{1t} = Call loan rate in time t, by credit quality
x_{2t} = UK Consol rate in time t
x_{3t} = 1 if between November 8, 1907, when all LOLR announcements had been made and February 7, 1908, after crisis conditions subsided; 0 if before November 8, 1907.

We find that for both the high-yield and low-yield bond samples, the Morgan-issued bonds were less sensitive to credit conditions over the whole 43-week period compared to the non-Morgan bonds (see Table 8). For low-yield bonds, a 100-basis point increase in call loan rates was associated on average with a 17-basis point increase in the Morgan sample compared to a 52-basis point increase in non-Morgan sample. For high-yield bonds, a similar effect was estimated: a 100-basis point increase in call loan rates on average was associated with a 49-basis point increase in Morgan bond yields compared to a 62-basis point increase in non-Morgan bond yields. This result is consistent with the findings of DeLong (1991), Ramirez (1995), Giedeman (2004) and Frydman and Hilt (2017) who all find that Morgan-related firms on average were less capital constrained than non-Morgan-related firms, suggesting that the monitoring provided by Morgan-related directors was effective. Morgan or his partners sat on all but one of the boards of the issuers in our Morgan sample.[22]

Table 8
Matched Sample Method, Effects of LOLR Announcements on Railroad Bond Yields, July 1, 1907, to April 30, 1908

	High-yield Bonds		Low-yield Bonds	
	JPM	non-JPM	JPM	non-JPM
Call Loan Rate	0.00492***	0.00618***	0.001739*	0.00516***
	(0.00182)	(0.00299)	(0.001)	(0.00107)
UK Consol Rate	-1.882***	-3.475***	0.1771	-0.2627
	(0.2641)	(0.43474)	(0.1454)	(0.1559)
Date Dummy, Immediately Following LOLR Announcements November 8- February 7	0.0016***	0.003631***	0.00043*	0.00078***
	(0.000441)	(0.000726)	(0.00024)	(0.00026)
Constant	0.1063***	0.16398***	0.0353***	0.05191***
	(0.00799)	(0.01316)	(0.0044)	(0.00472)
Observations	43	43	43	43
Adj R^2	0.562	0.637	0.239	0.430

Note: *** and * denote significant at 1% and 10% levels respectively.
Source: *Commercial and Financial Chronicle*.

[22] While no J. P. Morgan partner sat on the board of the Great Northern Chicago Burlington Quincy railroad, George F. Baker, Morgan's ally from the First National Bank, did so. J. P. Morgan & Co. underwrote this road's bond in our sample with strong participation from the First National Bank.

Our regression finds that a full 1 percentage-point change in the UK consol rate would have had an extraordinarily large effect on high-yield bonds. The yield on the consol had a very tight range in the measurement period, varying only between 2.90 percent and 3.15 percent, so it is not surprising that railroad bond yields would have responded dramatically if the consol moved by an outsized 100 basis points. Moving on to discuss the sign of the consol's coefficient, one might initially be puzzled by the negative result, but a close examination of the yield movements during the measurement period may explain it. During the decline in consol yields between December and February, railroad yields were still increasing slightly, likely the source of the negative coefficient. We interpret this to mean that even though the rest of the world was moving past the crisis and the consol rate was normalizing, the high-yield US railroad bond market may still have been experiencing liquidations related to the New York crisis.

The LOLR dummy had a significant and sizeable effect for both the Morgan and non-Morgan high-yield samples. Yields on Morgan bonds rose only 16 basis points in the presence of the LOLR dummy, compared to non-Morgan bonds, which rose on average 36 basis points. This finding means that while bond prices were on average lower in the period after November 8 when uncertainty in financial markets was elevated, prices on Morgan bonds did not fall as much as prices fell on non-Morgan bonds.[23] At first, it may seem that the yield improvement on high-yield Morgan bonds, about 20 basis points, is not large enough to have economic significance. However, we did not expect to find a large effect. Bond prices could not be expected to durably recover until credit conditions would normalize later in 1908. The small, positive reaction to potential LOLR facilities that our model detected might be considered as just a first step in market stabilization.

Not surprisingly, we did not find an appreciable difference for the low-yield samples: 4 basis points for the Morgan sample to only about 8 basis points for the non-Morgan sample. We interpret this to mean that the Morgan LOLR effect was not detectable when issuers' credit quality was high and that sellers of low-yield, high-quality bonds may not have had to settle for lower liquidation prices compared to sellers of lower quality bonds in the period of heightened uncertainty.

Overall, we interpret the result of the matched sample analysis to mean that market agents may have anticipated a greater likelihood of a credit lifeline or of Morgan's unique advice if a lower quality Morgan-backed railroad ran into liquidity trouble compared to a similar non-Morgan railroad running into the same trouble. Thus, we find some support for our hypothesis that Morgan's LOLR activities may be distinguishable from other LOLR activities.

JPM Dummy Variable Method

Then for robustness, we create a different estimation method. Rather than analyzing matched samples of railroad bonds distinguished only by the underwriter, we merge the Morgan sample with the non-Morgan sample and use a dummy variable to indicate whether the bond was underwritten by Morgan or by a different banker. This method may have two advantages over the matched sample approach: it allows the number of observations to increase when all observations of weekly bond averages are contained in one sample rather than separating the observations into two samples, and it allows us to create an interactive variable to observe yield changes on bonds underwritten by Morgan after the LOLR announcements had been made. Our regression specification for the JPM dummy variable method is presented in equation 2.

[23] See Tallman and Moen (2018) for a discussion of sharply negative bond returns in the two weeks following the suspension of convertibility by the New York Clearing House.

(2) $Y_{t_q} = c + ax_{1t} + bx_{2t} + dx_{3t} + ex_{4t} + f(x_{3_t} * x_{4_t}) + e_{t_q}$

Where Y_{tq} = Yield on railroad bond in time t
c = Constant
x_{1t} = Call loan rate in time t
x_{2t} = UK Consol rate in time t
x_{3t} = 1 if between November 8 (or October 25), 1907, when all LOLR announcements had been made, and February 7, 1908, after crisis conditions subsided; 0 if before November 8 (or October 25), 1907.
x_{4t} = 1 if bond underwriter was J. P. Morgan & Co.; 0 if any other banker.
(x_{3t} * x_{4t}) = yield on JPM bonds after LOLR announcements had been made in time t, by credit quality.

This regression permits a different interpretation of the variance of the sample data. Isolating the JPM dummy variable alone allows us to estimate that high-yield bonds underwritten by Morgan yielded 93 basis points, almost 1 percent, less than high-yield bonds underwritten by other bankers, over the entire 43-week period from July 5, 1907, through April 24, 1908 (see Table 9). This may reflect the value of Morgan's monitoring and advising role, carried out when he sat on the board of the bond issuer. By contrast, the effect of the JPM

Table 9
JPM Dummy Variable Method. Effects of Lender of Last Resort Announcements on Railroad Bond Yields Prior to, Immediately Following, and After the Panic of 1907

	Immediately Following LOLR Announcements: November 8-February 7		Broader Announcement: October 25-February 7	
	High-yield	Low-yield	High-yield	Low-yield
Call Loan	0.00555***	0.00345***	0.002546***	0.0027***
	(0.0018)	(0.00076)	(0.00206)	(0.000875)
UK Consol	-2.678***	-0.04282	-2.53397***	-0.03218
	(0.26719)	(0.11008)	(0.25817)	(0.10932)
Date Dummy	0.003345***	0.000756***	0.00359***	0.000812*
	(0.000623)	(0.00026)	(0.0006)	(0.000259)
JPM Dummy	-0.00934***	-0.00343***	-0.00927***	-0.00342***
	(0.000496)	(0.000204)	(0.000488)	(0.000202)
Interaction: Date Dummy x JPM Dummy	-0.00146*	-0.0003	-0.00158*	-0.00032
	(0.00086)	(0.000358)	(0.0008)	(0.00051)
Constant	0.13982***	0.04534***	0.13538***	0.04503***
	(0.0081)	(0.0033)	(0.00782)	(0.003311)
Observations	86	86	86	86
Adj R^2	0.891	0.848	0.896	0.849

Notes: There are 86 observations for the combined samples of Morgan and non-Morgan bonds in this model because we have two observations for each of the 43 weeks we study, a Morgan yield and a non-Morgan yield.
*** and * denote significant at 1% and 10% levels respectively.
Source: *Commercial and Financial Chronicle*.

dummy on low-yield bonds is much less, only about 34 basis points, perhaps meaning Morgan's monitoring effect may have mattered more to high-yield, lower quality issuers. For robustness, we extend the crisis period by two weeks (earlier to October 25, 1907), and still find the same effect.

Furthermore, very importantly for this study, we find a statistically significant interaction between the JPM variable and the LOLR variable, implying that the yield on high-yield bonds after the LOLR announcements depended on whether J. P. Morgan & Co. had underwritten them, *separate from the effect he had over the whole 43-week period.* This is the clearest indication we have from our econometric analysis that market agents might have begun to anticipate that a struggling Morgan railroad might expect help from Morgan should the road find itself in liquidity distress. This finding may illustrate that while Morgan yields may have contained information about his board monitoring roles throughout the period, for the time after the LOLR announcements, Morgan yields might have also contained information about his willingness and ability to extend liquidity or to offer crisis management advice, too. While we cannot say for sure what amplified the Morgan effect during the Panic period, be it a heightened expectation of a bailout for a vulnerable Morgan customer or a greater reliance of high-yield bonds upon Morgan's reputation during the period of elevated uncertainty, we find that the banker variable has a unique effect during the Panic. The interaction variable was not statistically significant in the low-yield bond samples, meaning that it is not clear that Morgan had a *unique effect during the crisis* on those bonds, although he had a small effect on them over the whole 43-week period. For robustness, we extend the crisis period by two weeks to include the weeks of October 25 and November 1, and still find a similar interaction effect.

But again, we emphasize that a large effect would not be expected: a convincing reduction in yields, especially among marginal issuers, would await a broad return to normal credit conditions in 1908. We interpret the interaction variable as an indicator that market agents may have begun to observe the Morgan LOLR activities as being of particular benefit to issuers with whom he had done favorable business in the past.

Finally, we find that even though Morgan's effect as an individual LOLR may be distinguishable from other LOLR effects, the dollar value of contributions made by the New York Clearing House, the US Treasury, gold imports and J. D. Rockefeller were many levels of magnitude greater than those made by Morgan and his firm. From analysis of the Morgan Syndicate Books, it appears the facilities he organized provided about $100 million in liquidity injections to distressed organizations (see Table 10). Sprague (1910) estimates the size of clearinghouse note issuance at $458 million nationwide, a device similar to Morgan's facilities in that clearinghouse note were not additions to the money supply, but rather a tool to shift and coordinate balances among institutions in a liquidity-constrained system.[24] Sprague also itemized actual additions to the money supply and estimates it at a total of $220 million. With these figures one can argue that while Morgan's facilities were important, they were dwarfed in size by others. Even though Morgan may have coordinated about $96 million in emergency facilities, he and his firm only contributed a very small part of that. While the popular press estimated Morgan, with his firm's funds or with his own, contributed $50,000,000 of his own capital,[25] his Syndicate Books only record direct pledges of $1,000,000 to Trust Company of America on October 28 and $512,500 to the Trust Company Syndicate on November 6. The balance of the $96,000,000 facilities that Morgan personally orchestrated were funded by convincing others, especially Clearing House banks, to provide the liquidity. Perhaps the

[24] Clearinghouse loan certificates or notes did not circulate among the public in New York. In other cities small denomination notes did circulate as scrip or emergency currency among the public.

[25] New York Times (1907).

timing of Morgan's facilities was more important than their sizes because they occurred near the beginning of the crisis, thus blunting contagion early on.

Table 10
Comparison of the Sizes of Morgan's Crisis Facilities to Others ($ millions)

		Facilities to Shift Balances Among Institutions:		Increases in the Money Supply
		Clearing House notes	Morgan-organized facilities	
Clearing House notes	issued among large institutions	208		
	for use by retail depositors	250		
October 24 Money Pool			25	
October 25 Money Pool			10	
New York City loan			30	
Trust Company syndicate loan			6	
Moore & Schley			25	
Increase in gold supply				90
Increase in silver supply				5
Increase in bank notes				52
Increase in government deposits				73
Totals		458	96	220

Source: Sprague (1910), 314-316; J. P. Morgan & Co., Syndicate Books, Vol. 5.

Discussion of Findings

Morgan's signals to depositors began on October 20, 1907 when he refused to even meet with Barney regarding aid to the Knickerbocker, thereby firmly placing his seal of disapproval on that trust company, and ended on November 6 with the formation of two syndicates, one to aid to Moore & Schley and the other, a permanent syndicate to aid the Trust Company of America and Lincoln Trust. At that point, the deposit market gradually started to unfreeze when runs ended. Persistent hoarding by depositors of withdrawn specie, however, remained a sign that the deposit market had not returned to normal, evidence for which emerges by the persistence of a premium on currency, albeit a diminishing one, through early December. By late December and early January 1908, though, that practice diminished, providing evidence that the adverse selection problems were being resolved and the surplus recovery mechanisms used by Morgan and others, along with the arrival of gold from Europe, were having the desired effect.[26] Elevated yields on call loans and the UK consol subsided by February 7, 1908 (see Figure 4).

Our econometric analysis finds that Morgan's individual LOLR efforts may have been distinguishable from institutional efforts by the New York Clearing House and the US Treasury

[26] See Rodgers and Payne (2014) for a discussion of the decision by the Banque de France in late November to pay for cotton due bills from the States with American gold eagle coins from its vault, thereby providing a steady and prodigious source of incoming specie to shore up the American banking system's reserves.

in this era pre-dating the formation of a central bank. Whether his decisions were optimal, we may never know. However, if Morgan relied upon his negative experiences with Barney and Morse to inform his decision to deny aid to the Knickerbocker, such reliance might have been misplaced. A solvent Knickerbocker re-opened on March 26, 1908, after undergoing a period of receivership. One might even speculate that had Morgan agreed to aid Barney at the Knickerbocker, taking the advice of the Knickerbocker's committee to assess solvency rather than relying on his business experience, the runs on the trust companies might never have erupted and the Panic may have been completely avoided.

Morgan may have had other disappointments from relying upon past experiences as he navigated the crisis: he was unable to convince the trusts early enough to support Trust Company of America and he was unable to convince the Banque de France to lend gold to a private syndicate to reliquefy the US, the way he had been able to construct a syndicated loan of European gold for the country in 1895. However, his experience in dealing with the US Treasury served the financial system well in that Treasury Secretary Cortelyou immediately responded to Morgan's request for help. Additionally, President Roosevelt's tacit approval of Morgan's deal for US Steel to take over Tennessee Coal & Iron in order to bailout the Moore & Schley brokerage house might have forestalled a domino effect of subsequent brokerage house failures.

Finally, a point that cannot be overlooked is how a crisis's path of contagion as well as its ultimate resolution may depend on the unique individuals who emerge as leaders during the episode. If Morgan had not assumed the leadership role, his own experiences with the distressed institutions might not have been factors in the decisions on whether or not to make liquidity provisions. It is conceivable that if Jacob Schiff at Kuhn Loeb had led the crisis resolution team in 1907, Schiff might not have let the Knickerbocker Trust fail because he did not have the same experiences with the Knickerbocker that Morgan had. Indeed, the roles individuals played in the more recent 2008 sub-prime crisis were explored by the Financial Crisis Inquiry Commission. The report noted how Lehman's CEO Richard Fuld felt the Federal Reserve had a bias against Lehman Brothers preventing a bailout, which the Fed denied (Financial Crisis Inquiry Report 2011, 341). In memoirs, individual actors in the crisis resolution described how their unique backgrounds informed their decision-making as 2008 unfolded: Ben Bernanke as Chair of the Federal Reserve had studied the Great Depression extensively and perhaps brought that knowledge to the table during the resolution of that crisis (Bernanke 2015). The lesson we draw for present-day policy formation is that the individuals responsible for crisis resolution, whether they emerge to fill gaps in institutional arrangements or whether they act as agents for institutions, will bring to the table a unique approach that will influence the crisis resolution, one that might not have been expected a priori.

Acknowledgements

The authors wish to thank the attendees of the Southern Economic Association Annual Meeting, November 21, 2020 for valuable feedback especially our discussant, Dan Giedeman; at the Workshop on Monetary and Financial History at the Federal Reserve Board in Washington DC, May 7, 2019 including Eric Hilt and Charlie Calomiris; at the Money, History and Finance Workshop at Rutgers University on March 4, 2019 including Michael Bordo, John Landon-Lane, Hugh Rockoff, Gail Triner and Eugene White; and at the Central New York Economic Historians' Conference at Colgate University on April 14, 2018 for extensive discussion including Michael Haines, Chris Hanes, Matt Jaremski, David Wheelock and Susan Wolcott. Amy Smith Linton provided valuable editing guidance.

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