

The Volatility of Money:

The New York Call Money Market and Monetary Policy Regime Change

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Abstract:

This paper presents and analyzes a new database of daily call loan rates in New York from 1900 to 1933, covering the financial crises of 1901, 1907, 1914, 1920/1, and 1929 as well as the rapid changes in the financial markets from World War I to the Great Depression. Bai-Perron structural break tests indicate that rates dropped and became less volatile around January 15, 1908. The money market shows high volatility for most of the period 1900 through 1907 and significantly lower volatility thereafter. Interest rates spiked frequently prior to 1908 but never surpassed 20 percent thereafter. Interest rates show no structural break in level or volatility around the opening of the Federal Reserve System in November 1914, but rates fell and became nearly constant after 1933—likely due to federal securities market regulation. I augment these data with NYSE transaction volume and with the weekly volume of call loans starting in 1917.

I. Introduction

The call money (or broker loan) market intermediates renewable overnight loans between lenders and brokers to fund operations in financial markets, often speculative trading using margin purchases. Call money provided crucial liquidity in the New York stock market, due to the daily clearing required of New York Stock Exchange (NYSE) trades. In the period of this study, most loans rolled over and could continue for weeks or even months. If a lender called his loan, a trader would often need to seek out a new loan to pay off the previous loan.

In the 19th and early 20th centuries, rates on call loans fluctuated widely and usually followed a seasonal pattern due to the heavy use of correspondent bank funds, often from agricultural regions of the country. Contemporary observers and economic historians have pointed to this volatility—and the rate spikes that characterized the market— as evidence of illiquidity in the money market and as drivers or amplifiers of financial crises in the National Banking Era. Rate spikes potentially cause negative downward spirals in asset prices, as lenders require traders to meet margin calls when prices decline. If call money is scarce, then traders may have to sell assets to cover. Selling pressure drives prices down further, which may trigger additional margin calls. Volatility in short-term interest rates may cause uncertainty in financial markets and susceptibility to crises. Sprague (1910), as cited in Moen and Tallman (2015), wrote: “Among the many lessons which may be drawn from a study of the experiences of the national banks during crises, the entire absence of liquidness in call loans, so far as New York banks are concerned, is the most certain and by no means the least important.”

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Most past research has focused heavily on the impact of the Federal Reserve System on reducing interest rate volatility and seasonality, though a few studies have pointed to the passage of the Aldrich-Vreeland Act in 1908 as an important policy regime change.² After the regulatory blitz of the mid-1930s, call loans became more closely controlled and lending rates dropped to low and stable levels. Past researchers have debated the timing of this shift, and in particular, whether rates became more stable and less seasonal after the opening of the Federal Reserve System in November 1914. Angelini (1994) posited that the implementation of the Aldrich-Vreeland Act, which provided for ‘emergency currency’ to be provided in case of crisis, as the turning point. Using newly gathered daily data, I employ a Bai-Perron structural break test on both the level and variance of call money interest rates to show that rates actually stabilized even earlier—immediately following the Panic of 1907, many months before Aldrich-Vreeland and almost seven years prior to the opening of the Federal Reserve. Moreover, using daily data, I show that despite the stabilization efforts of the Fed, call money rates returned to a similar boom and bust pattern during both the post-WWI mini-bubble (1919-21) and the more dramatic bubble of the late 1920s—albeit with slightly less volatility and none of the enormous spikes of the era before the Panic of 1907. Only after the regulatory interventions of the mid-1930s, did the call loan market fully stabilize and offer consistently low rates.

In the next section, I provide historical background on the New York call money market and monetary policy regime change over the first three decades of the 20th century. In Section III, I discuss the methods for the current analysis and the relationship to the string of literature on this question and then present the newly-collected daily database of call money rates. I present the statistical results in Section IV. Section V offers some preliminary data on the volume of call money and on credit spreads and suggests avenues for future work. Section VI concludes.

II. The New York Call Money Market and Monetary Policy Regimes

Call money, overnight loans to brokers, is the grease that lubricates the wheels of financial markets. Brokers use these loans to finance stock purchases on margin and generally to facilitate the required overnight clearing of NYSE transactions. The majority of these funds traded on the New York Stock Exchange, in a market organized around a trading post, similar to a stock trading post. In the three decades before the Great Depression and ensuing strict regulation of US financial markets, the call money market passed through several significant phases; its organizational structure shifting due to World War I and then adjusting again following the war. Monetary policy regimes also changed dramatically during that period: transitioning from no central bank or LOLR (up to June 1908) to the Aldrich-Vreeland era, with emergency currency/LOLR but no central bank (June 1908-November 1914) and finally to the Fed era (November 1914 onward). How the monetary policy regime changes affected the call money market remains a topic of debate even after decades of attention in the literature.³

The call money market came into being due to the burden of clearing stock exchange transactions on a daily basis—a system that required significant liquidity to maintain. In the pre-

² Angelini (1994) and Bernstein et al (2010) use different approaches but both identify Aldrich-Vreeland as a turning point.

³ The appendix provides a timeline of monetary and financial events and regime changes.

World War I era, the market operated much like a commodity market, with a “money crowd” shouting out buy and sell orders and dealers transacting with each other pairwise.⁴ Brokers negotiated amongst themselves over quantity and price. Lenders, notably, usually could not choose borrowers. Only members could transact on the floor of exchange, so non-members had to trade through a member.

Many call loans rolled over from one day to the next, and those ongoing loans paid the ‘renewal’ rate. According to Griffiss (1923), the renewal rate was typically set at approximate average of rates on the first few million in new loans. Since brokers negotiated loans individually, they did not always follow the ruling rate, and terms varied with some arbitrariness. Once brokers agreed on loan terms, the borrower would send the collateral and margin to the lender, whereupon the lender would approve the collateral and send the borrower a certified check in amount of loan.

The particular organization of the market thereby introduced a market friction: clearing the call loan market. Banks needed to certify checks. When a bank called a borrower’s loan, but that borrower still needed the loan, he had to borrow from another lender. The first, calling bank would not return the borrower’s collateral until he paid off the first bank. Without his collateral, however, the borrower could not get a call loan from the new bank. This problem created the need for another lending market, the “day loan,” which absorbed considerable sums of bank liquidity.

The call money underwent several changes starting with the outbreak of World War I. First, the call loan market—and its rates—froze in place when the NYSE closed on July 31st, 1914. It remained in limbo for the 4 ½ months of the NYSE closure (August through mid-December of 1914). Once the market reopened, so did the call money market, and operations returned to normal. The market operated mostly as it had before the war, until the US entered the war in April 1917. As the war progressed, and as funding demands for war provisions strained capacity, NYSE leaders and monetary authorities remained vigilant about inciting a panic due to lack of funds in the call money market and simultaneously worried about attracting money away from the Liberty Loan market. To keep order, the exchange established a money committee, a sub-committee of the capital committee, which worked to keep control of the market and dampen major swings in rates. Chaired by Benjamin Strong, Governor of the NY Federal Reserve, the money committee operated from Sept. 5, 1917 to Jan. 10, 1919. The committee created a pool of funds to insure liquidity in the call loan market and prevent rate spikes. The pool, originally contributed by members of the committee, started with \$100 million and quickly added another \$100 million.

Liberty Loan issues first passed on April 24th, 1917, with a tax-deductible rate of 3.5%. Despite the relatively low interest rate, their issue attracted funds from the money market, constraining funds available for call money and restricting that market’s liquidity (Griffiss, 1923). The loan account of the exchange ran between \$400-450 million, and the committee then apportioned this amount among all NYC banks using the money market (about 65 banks). Participation was essentially compulsory. The committee also regulated the demand side, capping the amount of funds each stock exchange firm could borrow.

According to contemporary observers (Griffiss, 1923), attitudes began to change around August of 1918. Borrowers wanted to borrow more, and lenders became more interested in lending, creating an overall sense of greater speculation. The changing tone caused the money

⁴ See Griffiss (1923) for an in-depth description of the call money market in the pre-WWI era.

committee to shift from encouraging lending to restraining it. The committee instituted a requirement for (strictly confidential) daily reports from exchange members on the volume of loans. The committee increased required margins on loans from 20/25 to 30/37 ½ on mixed v. industrial collateral and encouraged shorter maturity on time loans—two to four months instead of four to six months.⁵

In September of 1918, Benjamin Strong wrote to the NYSE president, Henry Noble and essentially imposed a freeze on the level of funds allowed into the call money market: "It is obvious, however, that for the present there should be devoted to the security market no additional credit beyond the funds now used. Any tendency to expand the collateral loan account should, for the general good, under the present conditions, be checked."⁶ Strong goes on, in that letter, to request daily reports from each exchange member on its use of call money, invoking patriotic duty and the need to prevent interference with financing the war: "Lest any possible misunderstanding arise as to the object of this request, I am directed by the committee to explain that this is only one of a number of measures being undertaken by the committee with the object of exercising, by mutual understanding among the institutions and firms of this city, such reasonable and necessary control of the employment of credit as will insure no interference with the financial operations of the Government in conducting the war."⁷

After the war and the eventual disbanding of the Money Committee, the NYSE returned to a free market for call money, but they retained the money desk and employed a much more orderly process. The continual improvement in information on supply and demand for funds, along with increasing speed and availability of clearing for securities and for loans, made the market much less fragmented after the war than before. For example, before the war, banks and borrowers negotiated the daily renewal rate amongst themselves, and nobody saw the complete picture of supply and demand in the market. After the war, the money desk continued to keep track of the volume of funds and the rates contracted, thus improving information transparency. On April 26, 1920, the NYSE opened the Stock Clearing Corporation and began settlement through the "Day Branch," thereby reducing the need for unsecured day loans that brokers had needed in the previous system of collateral transfers when moving from one lender to another. The SCC next began clearing loans through the Day Branch in 1921.⁸ A lender would send a check in the name of the clearinghouse for the account of the borrower and would secure collateral through the clearinghouse. On the other side, the borrower (or his previous lender) would deposit collateral with the clearing house. This process obviated the third party certification of checks.

The system operated in this manner for the rest of the decade. The 1929 crash and ensuing financial crisis brought about a major rethinking of the country's financial structure and regulation and ushered in the modern regulatory era for financial markets with the 1933-34 regulation of corporate securities registration, issuance, trading, and market operations as well as corporate accounting and disclosure. Stringent regulation led to a virtual end to volatility in the money market.

⁵ Mixed collateral involved a substantial proportion of railroad stocks in addition to industrial shares. Since rails were safer investments, lenders required a lower margin on those securities compared to industrial shares.

⁶ Quoted in Griffiss (1923), p. 31.

⁷ Quoted in Griffiss (1923), p. 33.

⁸ See Meeker (1922).

Monetary policy regime changes intertwined with the changes in the call money market, particularly in the time between the Panic of 1907 and the start of World War I. While we think of 1914 as the beginning of central banking in the United States, the onset began many years earlier. The Panic of 1907 revealed the severe vulnerability of the financial markets to a freeze in money markets and led to a rethinking of lender of last resort facilities and precipitated the founding of the Federal Reserve System.⁹ Within months of the crisis, on January 7, 1908, Nelson Aldrich presented a bill to establish a lender of last resort facility, and it passed out of the finance committee on January 30th. After rounds of adjustments and amendments, Congress passed the Aldrich-Vreeland Act on May 30, 1908, which created the National Monetary Commission and set up the first nationwide liquidity backstop system for banks. The law—described by contemporary J. Laurence Laughlin as “a curious compound of conflicting views, compromise, haste, and politics”¹⁰—provided for a stock of extra currency available in cases of emergency, backed by deposits of municipal bonds and certain approved commercial paper. The system called for the creation of currency associations, led by at least 10 national banks in a given locale. In the law’s first six years (its original lifespan ended July 1, 1914), only 21 associations, representing 352 national banks (\$381 million in capital), appeared, and none of them had requested funds (Goodhue, 1916, p. 1039, and Secretary of the Treasury, 1914).

Whether the mere existence of the backstop precluded its need under typical cyclical conditions is difficult to assess, because demand conditions also changed as the market downturn and post-panic recession chastened speculators for some time. The incipient crisis at the onset of the war in late July of 1914 did finally precipitate the use of the renewed version of the law that accompanied the Federal Reserve Act of 1913. Treasury Secretary McAdoo and Comptroller Williams pushed banks to form currency associations and take on emergency currency, such that 24 new associations formed, representing over 2,000 national banks—1,363 of which accepted emergency currency of approximately \$300 million (Goodhue, 1916 and Secretary of the Treasury 1915). Since the stock market, and by association the call money market, closed before the emergency currency implementation, we cannot assess the impact of emergency currency usage on the call money market. Within two weeks of the markets’ reopening on December 12, 1914, banks had redeemed over 2/3 of the emergency currency outstanding. Six months later, they had redeemed all but \$200,000 of the remainder (Goodhue, 1916, p. 1039).

Meanwhile, the federal reserve banks opened for business on November 16, 1914, in the midst of the stock exchange closure and while the Aldrich-Vreeland currency provisions remained in force. This overlap complicates the identification of the impact of the founding of the full-fledged central bank, as opposed to the simpler LOLR facility embodied in Aldrich-Vreeland. After the Fed system transitioned into full operation, the early war boom had taken hold, and the call money and stock market went into full swing. For a time, no need appeared for a liquidity backstop.

Still, the founding of the Fed involved new regulations on member banks, such as limitations on the lending of country banks with correspondents in New York. Balances kept in New York banks could not count as reserves, and simultaneously, the Fed began to develop a discount market to provide substitute investments for the country banks. Nonetheless, according to contemporary

⁹ See Fohlin et al (2016) on the impact of the liquidity freeze on the NYSE during the Panic of 1907.

¹⁰ Laughlin (1908), p. 490.

accounts (Griffis, 1923, and Mitchell)—actual data remain elusive—country banks continued to lend in the New York call money market, because of the extreme ease with which bankers could add and subtract funds with just a telegraph notice. In addition, the rates on call money often exceeded those in the acceptance market, such that in many circumstances, banks preferred to keep excess reserves there.¹¹ Interestingly, Griffis highlights the impersonal nature of the New York call money market as an appealing feature, drawing country banks into lending there. In their local acceptance markets, bankers may suffer from the ill will of a borrower in the event that the banker needs to retrieve his funds. Griffis further hypothesizes that the national discount market would have expanded more rapidly, had the Federal Reserve System not divided the country into twelve districts. Notably, Griffis, writing in 1923, explains as follows:

Attempts are being made to bring the country bankers to the point of investing in the bill market by means of educating them as to what the market is and what place it holds in the economic organization of the country. Whether or not these attempts will be rewarded with any marked success remains to be seen; but it is undoubtedly a hard task to turn the country bankers away from a type of investment which they consider so liquid and safe as the call loan. It is the easier and lazier way to invest liquid funds. Some of the country banks are not even members of the Federal Reserve System and some of the bankers do not know what the acceptance market is.

Thus, nearly 10 years after the founding of the Fed, the call money still remained a focus of country bank investments of secondary reserves. At the same time, Griffis acknowledges that volatility of money market rates remained relatively low and the seasonality of rates declined after the founding of the Fed, as Bernstein et al (2010) confirm.

III. Structural Breaks in Call Money Rates: Data and Methods

Several previous authors have weighed in on the issue of regime change in the money market, and each has produced a new statistical analysis yielding different “turning points” in the money market rate. Griffis (1923) provided one of the earliest thorough investigations of the New York call money market. While his work lacks an econometric model, he gathered and tabulated significant amounts of data, and he delved into the institutional structure of the market and its changes before and after the war. Griffis considers the impact of the creation of the Federal Reserve System and emphasizes in particular the impact on out-of-town reserves, or correspondent accounts. As noted in the previous section, Griffis argues that country banks converted only gradually and reluctantly to the discount market from the call money market, which in and of itself provides a clue to the impact of this portion of the monetary policy regime change.

Miron (1986) and Mankiw et al (1987) revived the issue of monetary regime change and started something of a strand of literature on structural breaks in short-term interest rates. Miron (1986) argued that the Fed’s seasonal open market operations eliminated the seasonality of nominal interest rates and thereby decreased the frequency of panics. Mankiw et al (1987) further examine

¹¹ For data on credit spreads, see Section VI.

the regime change embodied in the founding of the Fed and the speed of adjustment to the new regime. They find that seasonality of 3-month rates declined in the 1920-33 period compared to the 1890-1910 period, and that rates followed nearly a random walk in that later period. They demonstrate further that the term structure of interest rates changed with the new monetary regime: long (6 month) rates became more responsive to short (3 month) rates after 1920. Subsequent analysis by Fisher and Wohar (1990) and Angelini (1994) called these results into question, and the latter in particular raised the issue of the 1908 Aldrich-Vreeland act and its impact on expectations. Angelini ran numerous robustness checks on the monthly data used by Mankiw et al and establishes May 1908 as a structural break in short-term interest rates.

Table 1. Literature on Structural Breaks in Money Market Interest Rates

Paper	Method	Sample	Results
Miron (1986)	regression	1890-1928 (monthly)	1914 founding of the Federal Reserve decreased seasonal
Mankiw et al (1987)	Switching regression	1890-1933 (monthly)	1914 (between December 1914 and March 1915)
Fisher and Wohar (1990)	Switching regression	Dec 6 1907 to March 1 1918 (90 day rate)	June 1912 or February 1915
Angelini (1994)	check for robustness in MMW and FW	1890-1933 (monthly)	Aldrich-Vreeland Act (May 1908).
Caporale and Mckiernan (1998)	GARCH	1890-1933 (monthly)	Founding of the Fed and Aldrich-VreelandAct.
Newbold, Leybourne, Sollis and Wohar (2001)	Logistic model test parameter transitions ($I(0) \vee I(1)$).	1890-1933	June 1917
Bernstein et al (2010)	Diff-in-diff regression		Seasonality declined after 1908
Caporale (2015)	Bai and Perron (1998, 2003) structural break	1890-1933 (monthly)	Nov. 1907 (banking panic), Sept 1917 (WW1)

Caporale and McKiernan (1998) entered the fray and, using a GARCH model, found that both Aldrich-Vreeland and the Fed turn up as turning points. Fast forward to recent years, and the latest entry on the question of monetary policy regime change (Caporale, 2015) employs Bai and Perron's (2003) structural break test. In order to compare most directly the results using the daily interest rate series with those for the monthly data, I use this same test and allow for up to three structural breaks.

Data

In evaluating the impact of monetary policy regime change, the principal variable of interest is some measure of interest rates, particularly short-term rates. In the period prior to the 1930s regulation, especially before the development of a liquid national discount market, call loans represented the

key investment vehicle for short-term funds. Thus, for this study, I analyze patterns in the rate on call loans. Most of the previous analyses have focused on 30-day or 6-month loan rates, rather than the more significant overnight call money rate, and those rates may behave somewhat differently from call money.

The more significant difference in my data lies in the high frequency. Existing data from the NBER (McCauley) is almost entirely monthly (Figure 1). From monthly frequency interest rates, it is possible to glean some idea of the pattern over time, but it is impossible to identify spikes or accurately measure volatility, particularly over the short intervals of financial panics—sometimes lasting only a day or two. Moreover, the monthly data average rates within each month, thus obfuscating brief rate spikes. Thus, I began by collecting weekly high and low call money rates from 1900 to 1921 using *The Financial Review* and similar contemporary financial periodicals. I augmented this series with data from the Fed's monetary statistics through 1941. At this higher frequency, and without smoothing, it becomes much easier to spot the peaks and troughs—as well as the shift in regimes from high volatility to low and back to higher. (Figure 2).

After determining that the weekly data would also prove insufficient to pinpoint market rate peaks precisely, and to analyze the patterns with greater statistical rigor, I began collecting daily data on the call loan market. For the period between 1900 and 1922, I used the daily money market report published in the *New York Tribune* (accessed via the Library of Congress historical newspaper website "Chronicling America"). For data from 1923 through 1933, I used the daily money market report published in the *Wall Street Journal*, via Proquest.¹² The reports vary over time in the variety of rates they report—sometimes including opening and closing quotes—however, most reports include high, low, and ruling rates for each day (Figures 3a, 3b, and 3c). I collected all reported rates but focus the analysis on the most complete series: high, low, and ruling rates.

Because the call rate spiked occasionally to extreme levels, the graphical depiction tends to dampen the visible fluctuations in rates during more normal times. When those spikes are truncated, and the range restricted to rates up to 20 percent, the episodes of smaller rate hikes come into view (Figure 4).

The daily money market report provides several rates each day, and I am able to run the test on three different rate series with nearly continuous data: high, low, and 'ruling' rates. The high rate might be considered the most important rate, because call money spikes caused severe problems in the stock market, essentially freezing liquidity, and typically coincided with liquidity crunches in the banking system. The Panic of 1907 is just one such example; certainly not unique in that era. Moreover, rates often rose considerably in December, as traders soaked up greater than average funding in adjusting their accounts prior to the end of the calendar year. The low rate of each day tells us the minimum rate at which traders could access funds on a given day, while the 'ruling' rate provides insights into the most common rate that day.

IV. Results

¹² Thanks to Emory students Aziz Aldakhel, Shirley Ren, Wenjing Yang, Lifan Zhang, Sichen Zhu, who searched methodically through each days' paper and entered the rates.

The daily series offer the most accurate means of measuring changing processes in the money market, both levels and volatility of interest rates. When assessing the impact of monetary policy regimes that changed significantly between the Panic of 1907 and the founding of the Federal Reserve System, the daily data becomes extremely useful. This high frequency data also highlights the patterns of rates during the sharp recession of 1920/1 and the boom and bust of the late 1920s. The first step in the analysis involves simple assessment of the pattern of call money rates. Most of the subsequent statistical results appear clearly in the graphs of the data. Most notably, rates dropped suddenly in January 1908 and remained low and much more stable for much of the subsequent 6-7 years before the Fed opened for business (Figure 5). The rate decline and stability preceded even the Aldrich-Vreeland Act's passage in May of 1908, suggesting that market forces dampened speculation and therefore volatility of money during 1908.

Only late in July of 1914 did call money rates creep higher, and even then, they only rose to 4-5 percent just before the closure of the exchange on July 31st, 1914. At that point, rates rose to 6 percent and then froze at 6-8 percent for the duration of the shutdown of financial markets that lasted from August 1st to December 12th, 1914. During the closure, call loans remained in limbo, but as soon as the market reopened, rates declined again for another extended stretch. Basic statistical tests demonstrate that the level and variance of call money rates are significantly lower between January 1908 and December 1915 than they are from January 1900 through December 1907. Call money rates are not significantly lower nor less volatile after the opening of the Fed in November 1914.

The results indicate several statistically significant structural breaks in call money rates, most important of which is the break in the high rate in mid-January of 1908 (Table 2), the most obvious break from visual inspection of the graph. The low and ruling rate also broke significantly in mid-January of 1908, though other breakpoints show up more prominently in both of those series. The single clearest breakpoint in the low rate appears on April 19, 1918, while that for the ruling rate came on September 1, 1917—both during critical periods of US engagement in World War I. World War I also turns up as a breakpoint for the high rate, but the turning point comes much earlier in the war, November 23, 1916, before the US entered.

Table 2. Estimated Bai-Perron Structural Breaks in Call Money Rates

The table presents results of the Bai and Perron (2003) test for multiple structural breaks in three series for call money rates—daily high, daily low, and ruling rate. See text for description of the data sources.

HIGH			LOW			RULING		
1/15/1908			4/19/1918			9/01/1917		
1/17/1908	11/23/1916		5/10/1918	11/23/1928		1/19/1908	6/02/1917	
1/17/1908	11/23/1916	8/28/1928	1/17/1908	4/19/1918	11/23/1928	1/19/1908	6/02/1917	4/08/1922

The 1920-1 recession that resulted from the Fed's rapid post-WWI monetary tightening corresponded to a short-term increase in call money rates, but the test only picks up a break in the

ruling rate on April 8, 1922. The high and low rates only show breaks as the stock market began its final run up in the latter part of 1928: August 28th for the high rate and November 23 for the low rate. Chow tests for known (assumed) breakpoints test individual suspected breakpoints, and the results confirm most of the expected turning points, such as the US entry into the war, the end of the war, and the formation of the Money Committee. Two notable exceptions: the opening of the Federal Reserve banks in November 1914 has no impact on the high interest rate series, and the passage of the Aldrich-Vreeland Act in May 1908 shows no effect on the ruling rate.

Perhaps more important for financial firms is the volatility surrounding their short term borrowing costs, so I next search for structural breaks in the volatility of the call money rate, using the intra-month variance of each of the three rate series. The graphical evidence and basic means comparisons indicate that the volatility of the high rate dropped after 1908. While the Bai-Perron test statistic is below the 5 percent critical value, the test finds the single most important structural break in volatility in January 1908. With two breaks allowed, the BP test turns up June 1904 along with October 1908, while adding a third break keeps those two breaks and adds December 1920. That month coincides with the sharp recession that followed the Fed's tightening, as it attempted to rein in inflation after the war.

Table 3. Bai-Perron (2003) Structural Breaks in Volatility of Call Money Rate, 1900-1933

High

- 1: Jan 1908
- 2: Jun 1904, Oct 1908
- 3: Jun 1904, Oct 1908, Dec 1920
- 4: Jun 1904, Oct 1908, Oct 1913, Dec 1920
- 5: Jun 1904, Oct 1908, Oct 1913, Dec 1920, Jul 1928

Low

- 1: Feb 1908
- 2: Apr 1904, Jul 1908
- 3: Apr 1904, Jul 1908, Aug 1928
- 4: Apr 1904, Jul 1908, Nov 1916, Dec 1928
- 5: Apr 1904, Jul 1908, Jul 1916, Apr 1924, Jul 1928

Ruling

- 1: Feb 1908
 - 2: Jul 1905, Feb 1910
 - 3: Jul 1905, Feb 1910, Nov 1916
 - 4: Jul 1905, Feb 1910, Nov 1916, Jul 1921
 - 5: Jul 1905, Feb 1910, Nov 1916, Jul 1921, Jul 1928
-

Even allowing for four or five breaks turns up no structural break in volatility for the high call money rate surrounding the opening of the Federal Reserve System. More important were the return to greater volatility in 1913—following a lengthy post-1907 lull—and the rising volatility due to the expansion of the market bubble in summer of 1928. In other words, the opening of the Federal

Reserve System in itself had no immediate impact on the volatility of the money market, and even its actions during the war show little direct effect. Again, the test statistics are below the critical value, since the data are now collapsed into monthly variance measures. Clearly, however, rates never passed 20 percent after the Panic of 1907 and the passage of the Aldrich-Vreeland Act, and the episodes of elevated rates became fewer and farther between.

V. Loan Volumes and Credit Spreads—Preliminary Investigations

The imposition of new policies by the Federal Reserve System naturally raises the question of lending volume. We would also like to be able to analyze interest rates as the price produced by the equilibration of supply and demand for call money. Rate spikes could result from a sudden contraction in supply or a positive shift in demand—or a combination of the two. In crisis episodes, such as the Panic of 1907, contemporary reports described both forces at play.¹³ Unfortunately, only anecdotal quotes exist on the volume of call loans during the pre-WWI period, making it impossible to test for a structural break. Griffis (1923) gathered volume data for 1919-21, and the Fed reports weekly call loan volume data for 1917 onward in its 1941 compilation of monetary statistics. I have coded the printed data and present preliminary results here (Figure 6).

Though we cannot analyze the impact of the founding of the Fed, the evidence does show two interesting phenomena: first, correspondent funds for call loans still made up half of all lending early in 1919 and grew rapidly to exceed own account funds of New York banks by 1920 (figure 6). Out of town bank funds continued to grow in the mid- to late-twenties, reaching about double the own account funds near the peak of the 1929 bull market. Clearly, the founding of the Fed and its corresponding development of a discount market failed to deter lending in the call money market. The 1929 crash led to an exodus of out-of-town funds, which continued to dwindle throughout the remainder of the period of the data. Second, the volume of call loans seems to follow roughly the same pattern, albeit with less variability, as the trading volume of the NYSE (figure 7). This pattern highlights the importance of liquidity in the overnight lending market for the smooth functioning of the stock market. In ongoing work, I am gathering and analyzing a more extended series of volumes in order to provide a statistical test of the correlation. Future work will also improve our understanding of the causal relationships among volume of loans, interest rates on loans, volume of stock market trading, and stock market liquidity.

The analysis of call money rates during monetary regime change also relates to the question posed by Mankiw et al (1987) of the impact of the Fed on the term structure of interest rates and on the credit spreads among various short rates. In order to give a first glimpse, I have coded the monthly (1890-1941) and weekly (1919-38) rates on a variety of instruments—call money, Fed discounts, 90-day stock market loans, 90 day prime bankers' acceptances, and 4-6 month prime commercial paper—from the Fed's 1941 Monetary Statistics (Figure 8, two panels). From the weekly data, we can see the volatility of credit spreads during the 1920-21 mini-depression and the 1929 financial crisis. The monthly data runs much longer but dampens volatility. Still, we can see that credit spreads varied tremendously throughout the period until the early 1930s.

¹³ Fohlin et al (2016) provide extensive contemporary reporting from the financial press.

Call money commanded a premium over Fed discounts following World War I until the 1929 crash, but not during the initial few wartime years of the Fed's operation, nor following the crash. If Griffis was correct about the failure of the Fed to elicit the development of an attractive discount market for many years, then these patterns in credit spreads make sense. Stock market speculation in the late teens pushed demand for call money and increased those rates. The Fed's sudden tightening at the end of the war and corresponding contraction in stock market speculation activity decreased the spread until the late 20s bubble began. In order to rigorously analyze the term structure relationship and credit spreads, one would need to collect additional higher-frequency data similar to the call money data presented in the previous sections. In the meantime, it would be possible to use the existing data for a provisional test. Such work is in progress.

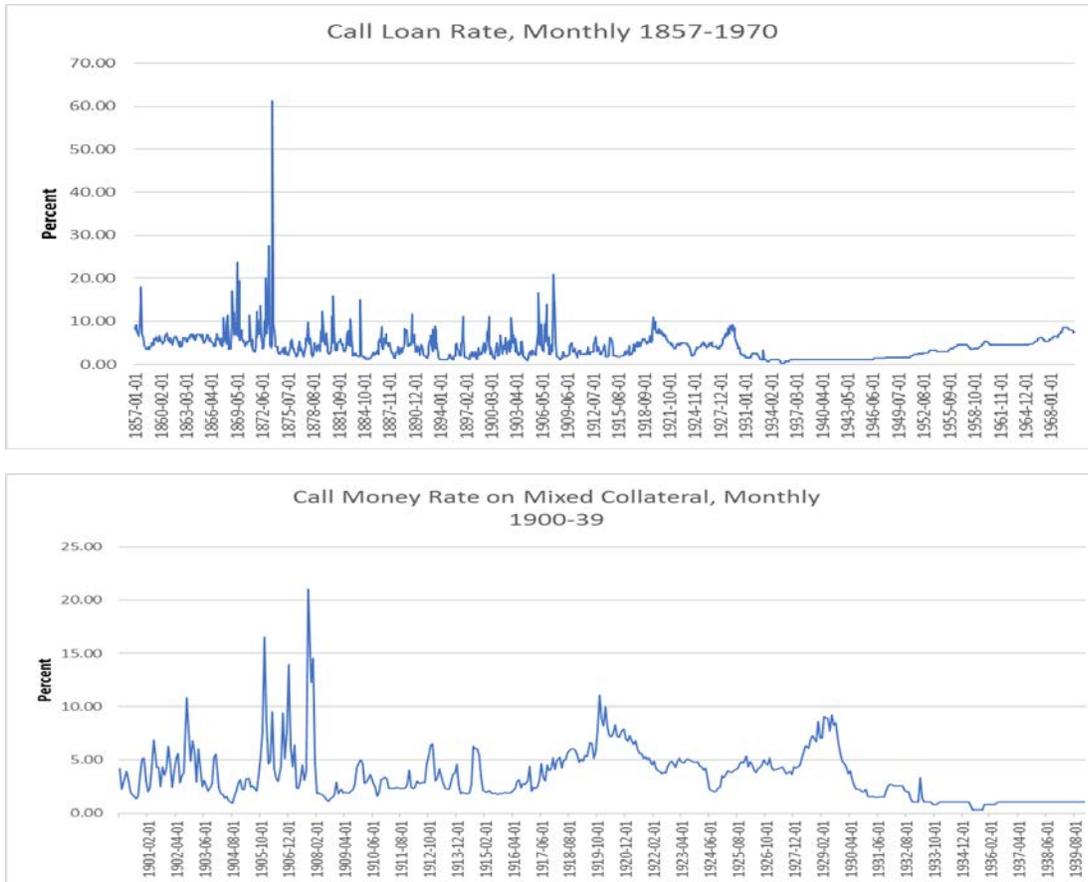
VI. Conclusion

The findings here relate to two different issues, first in the theory and historical narratives of financial crises and the role of the call money market and, second, debates over monetary policy regime changes, such as the relative impact of the Aldrich-Vreeland Act, the Federal Reserve System, and the Securities Exchange Act. The two issues naturally are connected.

The primary contribution of this paper is a new daily series of rates on call money at the New York Stock Exchange and the ability to precisely pinpoint structure shifts in the level and volatility of nominal interest rates surrounding monetary policy regime changes and surrounding key events that altered the structure of the money market. In particular, I find that call money rates dropped suddenly in the middle of January 1908, which significantly precedes not just the founding of the Federal Reserve System but also the promulgation of the Aldrich-Vreeland Act on May 30, 1908. Treasury reports from the original six-year lifespan of the Aldrich-Vreeland system indicate that no such emergency currency entered use before the start of World War I. It is notable that when the NYSE closed on July 31st, 1914, the call money rate became fixed, while few stock transactions took place. The money market almost by definition froze in place at that point, since the market was closed. The availability of Aldrich-Vreeland emergency currency provided the necessary backstop to infuse the banking system with liquidity and prevent a more serious financial crisis.

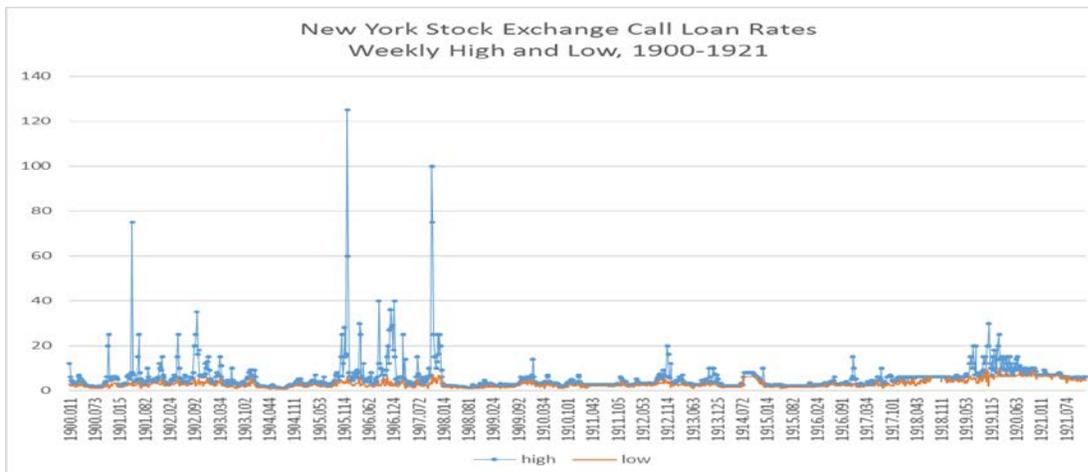
Also notable is that during the post-WWI crisis and during the stock market bubble of the late 1920s and the crash of 1929, while the call loan rate did rise and then fall significantly, the rate followed a much smoother path up and down than it had in the pre-Fed panics, and the rate never spiked. Given the greater severity of the 1929 crash, this pattern looks less severe than one would expect if the market were operating similarly to earlier times. Clearly, the improvements in the monetary and financial system following the Panic of 1907 and again during and after World War I led to a more transparent, orderly, and liquid money market with safeguards that seem to have prevented the call money market from playing its own active role in propagating or exacerbating financial panics. In light of the analysis here, the Fed foundation looks more like a continuation of the Aldrich-Vreeland liquidity backstop and less like an additional regime change of its own. The Federal Reserve System did provide alternative short-term investment opportunities, but the analysis here supports the contemporary discussions that considered the transition to the new system a gradual one.

Figure 1



Source: NBER (via FRED)

Figure 2



Source: Financial Review (various years)

Figure 3a

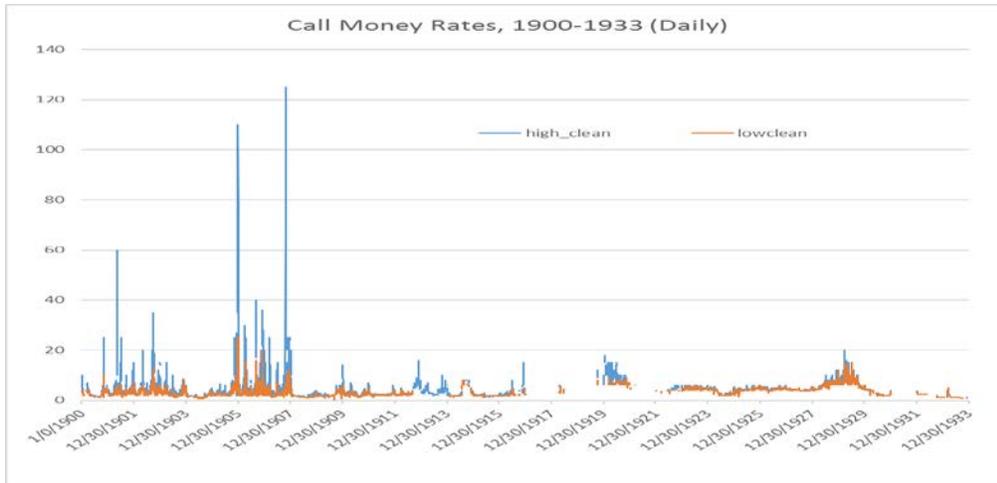


Figure 3b

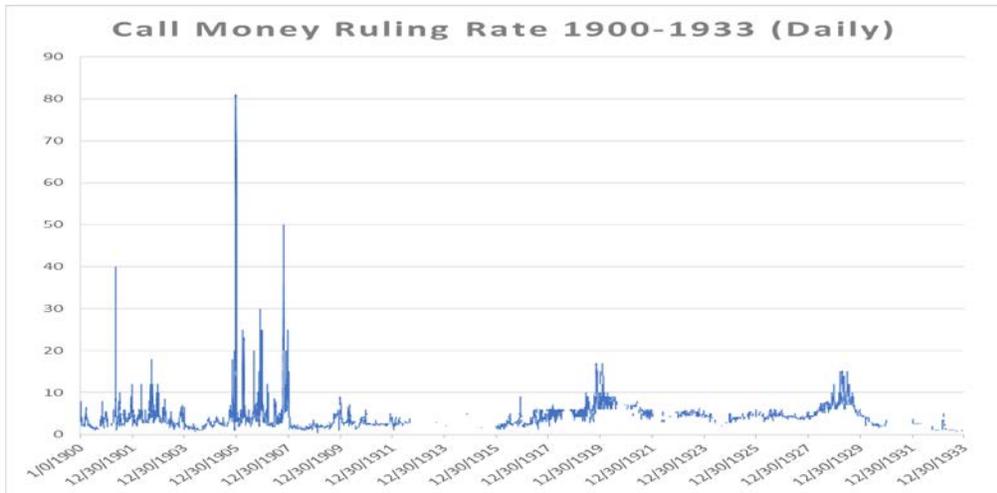
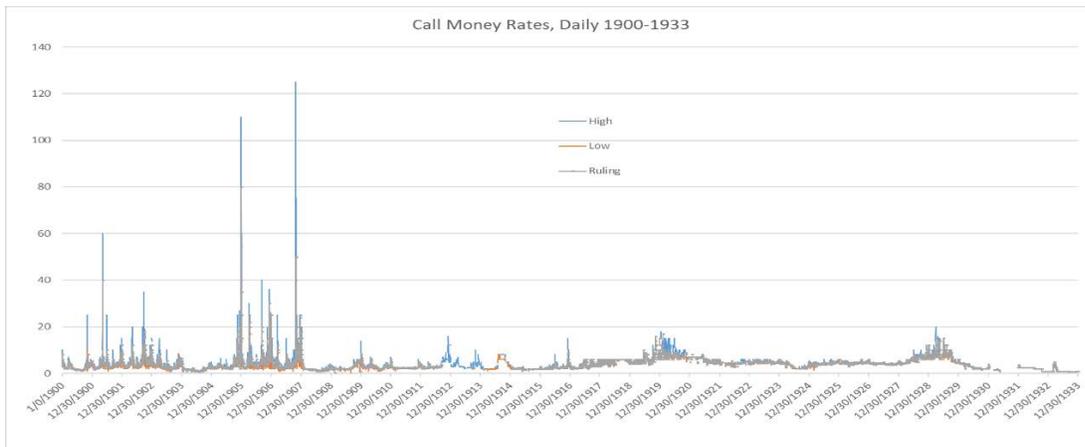
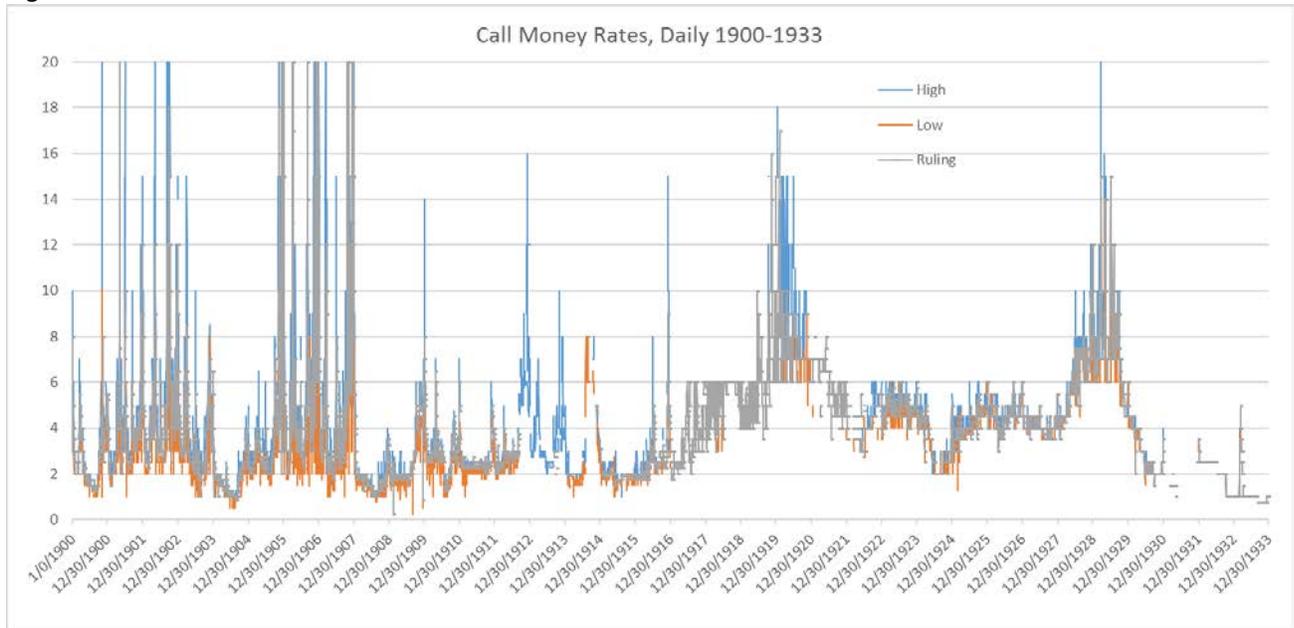


Figure 3c



Source: *The New York Tribune* (1900-22), via Library of Congress, and *The Wall Street Journal* (1923-33), via Proquest.

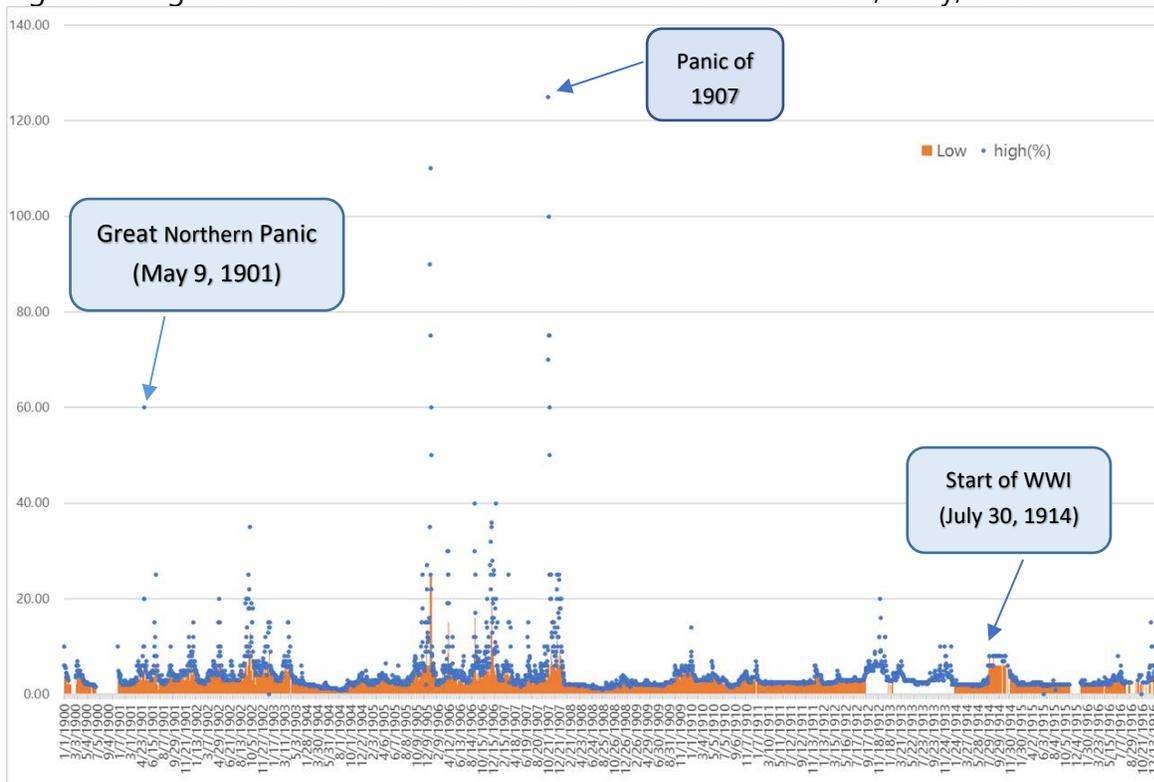
Figure 4



Source: *The New York Tribune* (1900-22), via Library of Congress, and *The Wall Street Journal* (1923-33), via Proquest.

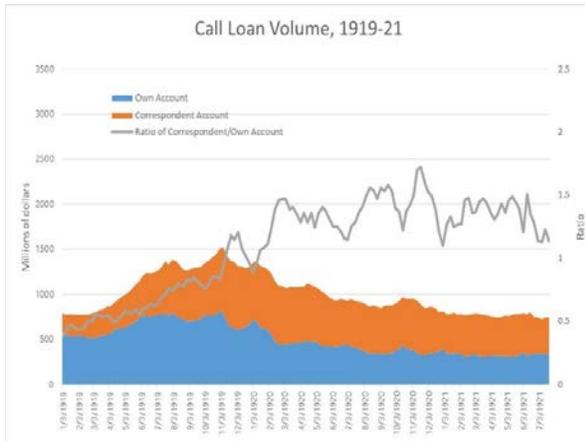
Note: This graph depicts a truncated x-axis (20 percent max) to allow better observation of the underlying patterns over time.

Figure 5. High and Low Interest Rates on Call Loans in New York, Daily, 1900-16

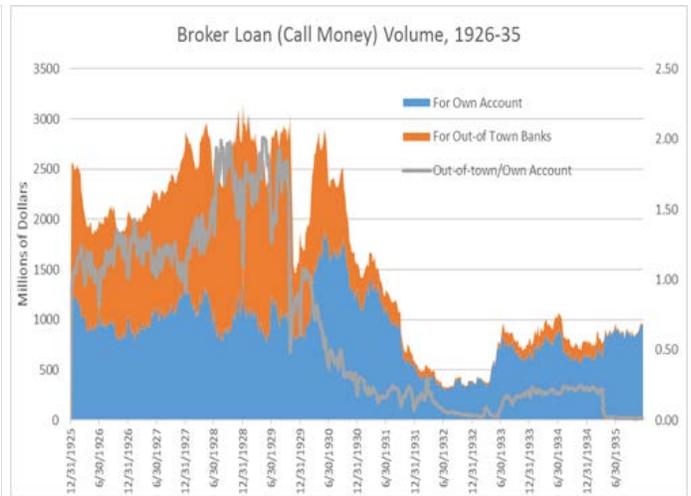
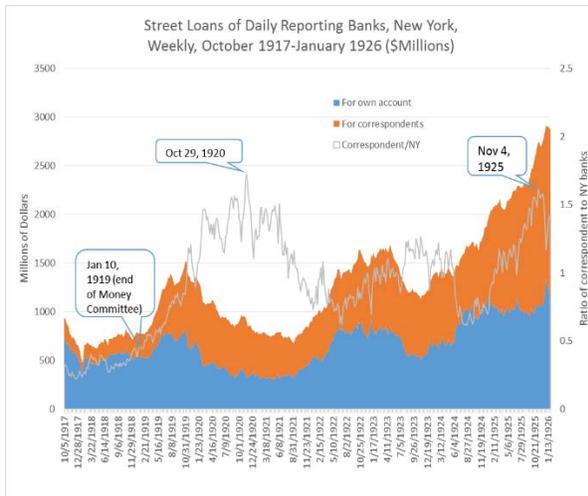


Source: collected from *New York Tribune*, daily issues 1900-1916

Figure 6.

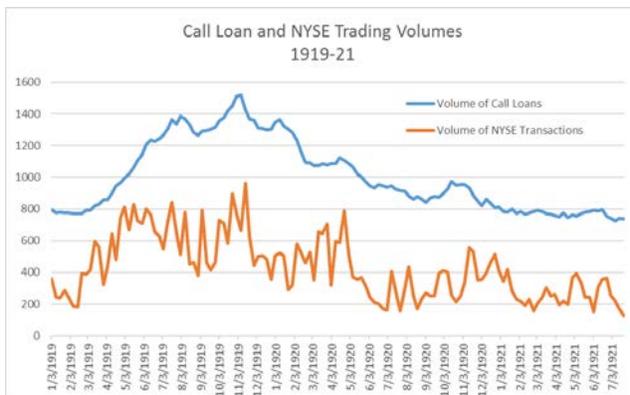


Source: Griffiss (1923)



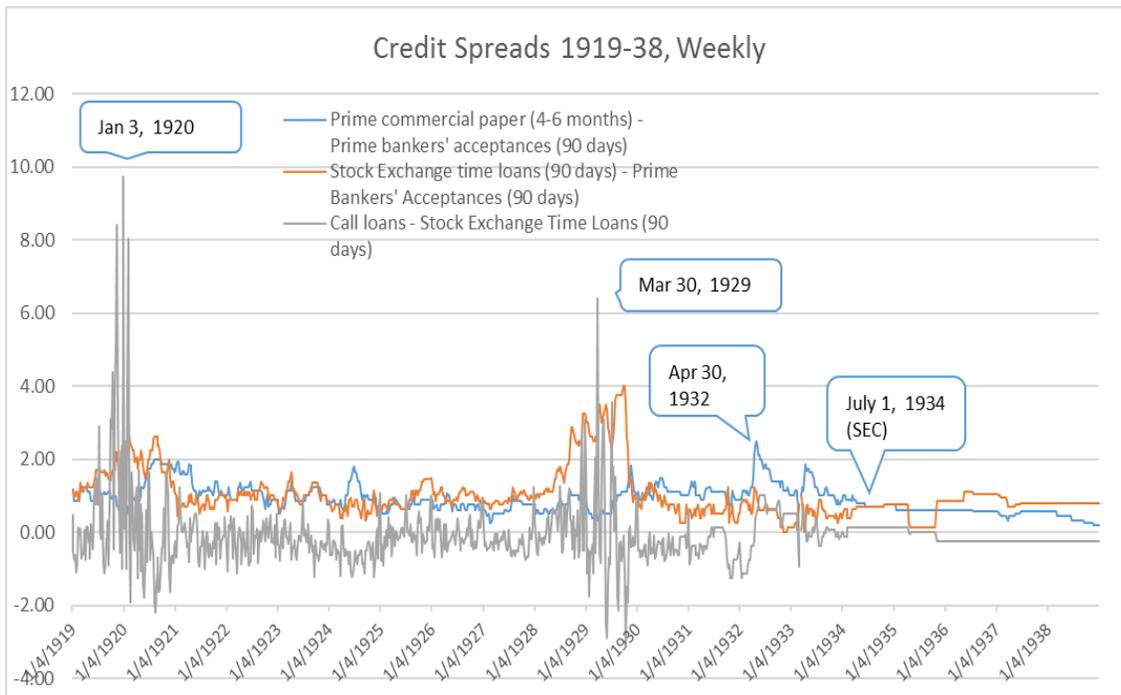
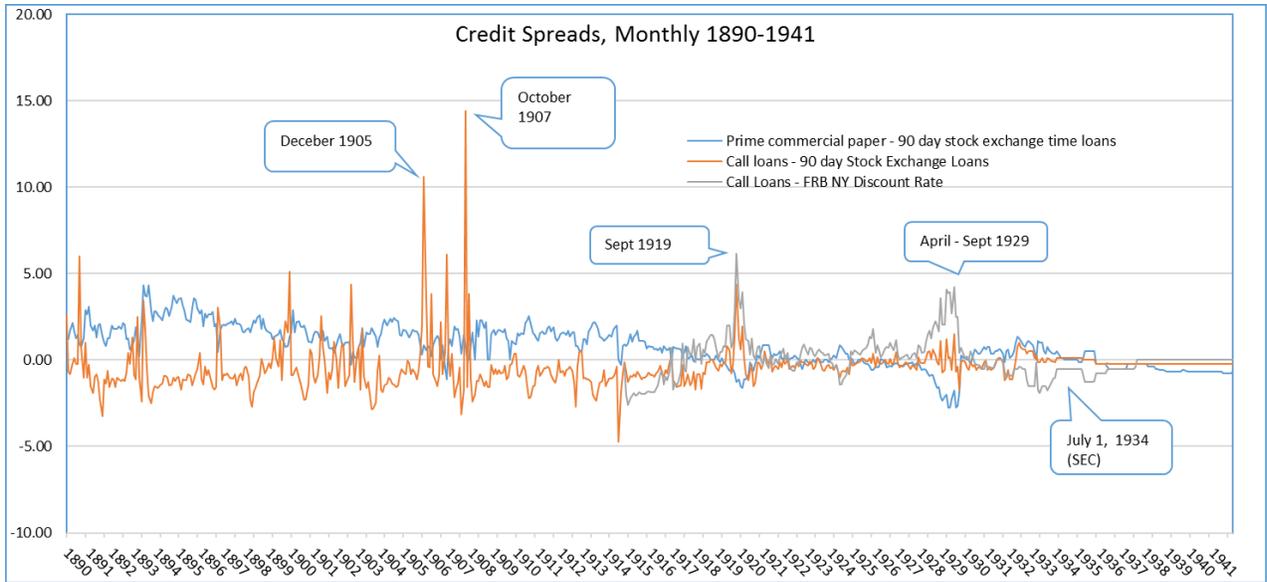
Source: Federal Reserve (1941)

Figure 7.



Source: Griffiss (1923)

Figure 8



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Appendix: Chronology of Financial and Monetary Events

	Call money market	NYSE	LOLR	Monetary policy/regulation
5/9/1901		No. Pacific panic		
10/23/1907		Panic of 1907	New York Clearing House	
1/8/1908				1 st Aldrich bill (S. 3023) introduced
1/30/1908				1 st Aldrich bill (S. 3023) reported out by Committee on Finance
5/30/1908			Aldrich-Vreeland Act passed	
12/23/1913			Federal Reserve Act passed	Federal Reserve Act passed
6/30/1914			Aldrich-Vreeland Act extended (for one year)	
7/31/1914	loans/rates frozen	Market closed	Aldrich-Vreeland currency issued	Gold flows restricted
11/16/1914			Federal Reserve banks opened	Federal Reserve banks opened
12/12/1914	loans/rates unfrozen	Market reopened (with constraints)		
4/6/1917		US entry into WWI		
4/27/1917		First Liberty Loan issued		
9/5/1917	money committee began controlling market			
Aug/Sept 1918	increased margin requirements			
11/11/1918		End of WWI		
1/10/1919	end of money committee (continued centralized structure)			

4/26/1920		Establishment of Stock Clearing Corporation and first day's settlement through the Day Branch.		
9/16/1920		Wall Street explosion. Thirty killed and over 100 injured.		
1920-21		Significant price declines		Fed rate increase/ sharp recession
3/22/1921	Stock Clearing Corporation began clearance of loans for members.			
10/28/1929		Black Monday crash (13% decline)		
10/29/1929		Black Tuesday crash (12% decline)		