

## SYSTEMIC RISK, MISSING GOLD FLOWS AND THE PANIC OF 1907

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*ABSTRACT:* This paper investigates the potential systemic risks posed to the U.S. securities markets by the banking crisis during the Panic of 1907. Past studies of 1907 have focused almost exclusively on the banking crisis. Our study examines the mechanisms that minimized the spillover of the banking crisis, and allowed the U.S. capital markets to remain not only open, but also relatively liquid, during the crisis. We show that contractual arrangements in the securities markets helped to minimize spillover effects, and that global arbitrage of U.S. securities allowed the U.S. to draw significant liquidity from European markets in times of crisis.

*KEYWORDS:* systemic risk, bearer bonds, gold clauses, securities arbitrage, Panic of 1907

*JEL CLASSIFICATION:* N20, N21

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## I. INTRODUCTION

The U.S. Treasury Department is currently devising plans to establish a systemic risk regulator, whose purpose would be to oversee systemic threats to the U.S. financial system. The failure of Bear Stearns and Lehman Brothers, and the government takeovers of Fannie Mae, Freddie Mac and AIG, prompted the Treasury to propose a systemic risk regulator to monitor and minimize the spillover effects of the failure of large institutions. In the spirit of this interest in systemic risk, this paper investigates how in 1907 the structure of the U.S. financial system precluded spillover effects from the systemic suspension of bank deposit convertibility during the Panic of 1907. Indeed, the U.S. bond and stock markets remained viable and a source of economic strength during the panic. The lack of spillover and systemic failure was due to (1) contractual arrangements in the securities markets that allowed coupon and dividend payments to occur despite the suspension of such payments through the banking system, and (2) the integration of the U.S. securities markets with major European securities markets that fostered gold flows into the U.S. as U.S. asset prices became appealing to global investors. The securities market arbitrage examined in this study was an important aspect of the international gold standard that has not been examined by previous studies of this historic period.

The structure of the 1907 capital markets provided several sources of strength and support to the U.S. economy during the panic months of 1907. First, the payment system for bond and stock payments generally occurred outside of the banking system, and thus investors could continue to receive payments even when bank deposit convertibility was suspended. Second, due to the gold clauses that occurred in most bond indentures, coupon and principal payments were stipulated in gold, which helped to integrate these securities into the international markets. Third, most corporate bonds were in bearer form, allowing securities to readily move between securities markets, both domestically and internationally. Fourth, many American bond issues were jointly traded in New York and in Europe, allowing an active arbitrage to develop between these markets.

According to Sprague's 1910 report to the National Monetary Commission, two sources of liquidity were sufficient to restore convertibility of bank deposits: (1) the deposit of U.S. Treasury funds into the banking system and (2) imports of gold from abroad. While Sprague identified the size and timing of government deposits and gold flows from the merchandise trade, no attempt was made to explore the source of the remaining gold imports. One purpose of this paper is to explore whether foreign purchases of U.S. securities could account for the unexplained gold inflows.

Therefore, the paper investigates the hypothesis that bond-market arbitrage generated gold flows into New York, which helped to liquefy the U.S. economy. The study finds that during the 1907 panic a divergence in prices occurred for bonds that were dual-traded in New York and London, indicating potential arbitrage opportunities for foreign investors in the U.S. market. During this period gold flows increased into New York. We suggest that the size of the unidentified sources of gold imports in the National Monetary Commission's report is consistent with the size of potential foreign purchases of American railroad bonds.

The paper is divided into the following sections. Section II explores features of railroad bond indentures and the payment system that they created, including the inclusion of gold clauses. Section III describes the multiple-market trading of American railroad securities and the potential arbitrage between these markets. Section IV describes the banking and monetary conditions during 1907. Section V examines conditions in the New York Stock Exchange's call-loan market during 1907. Section VI examines liquidity conditions of the stock and bond markets during 1907. Section VII then presents the Panic of 1907 arbitrage. Section VIII presents our conclusions.

## **II. BOND INDENTURES, COUPON PAYMENTS AND GOLD CLAUSES**

U.S. corporate bond indentures during the late nineteenth and early twentieth century commonly specified important aspects of bond issues, including:

1. The location of bond coupon and principal payments, creating a payment system for these securities that operated largely outside of the bank clearinghouse systems;<sup>1</sup>
2. The bearer or registered form of the security, which in the first case allowed the issue to be readily transferable among exchanges, both domestic and foreign;
3. The form of payment, which was commonly specified through gold clauses, where the bond issuer stipulated the payment of coupons and principal in gold<sup>2</sup> to the bondholder;
4. In addition, many U.S. bond and stock issues were jointly traded on U.S. and European exchanges.

These contractual features served to:

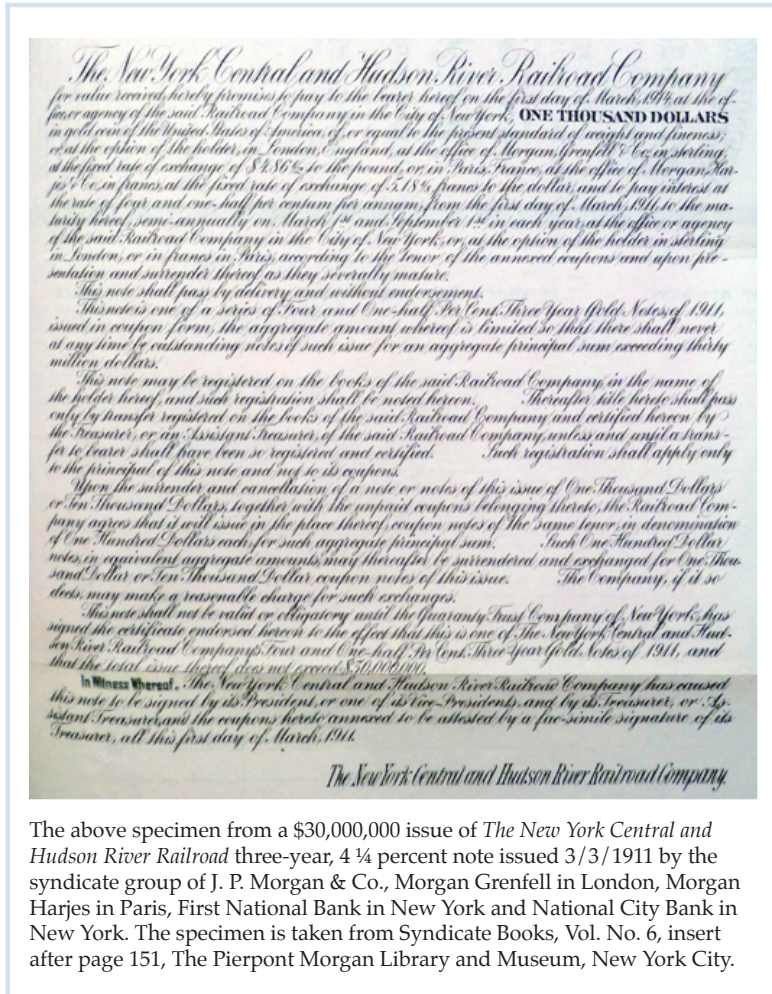
1. Increase the liquidity of American securities,
2. Integrate these securities into the international securities markets; and
3. Reduce the systemic risk exposure of the U.S. bond and stock markets to the banking crises that periodically struck the U.S. financial system, as with the Panic of 1907.

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<sup>1</sup> Note that at the time there was no centralized bond and stock depositories to handle payments and security transfers. Currently, the Depository Trust Company maintains the book entry records of bond and stock ownership and settles trades.

<sup>2</sup> The term “payable in gold” did not mean that payment was made in gold exclusively. Payment was made in U.S. or designated foreign funds equal to the value of the gold coin of the U.S. at the time the bond was issued (Holzer, 1980).

**Figure 1. The New York Central and Hudson River Railroad Company Four and One-half Percent Three Year Gold Notes of 1911**



The above specimen from a \$30,000,000 issue of *The New York Central and Hudson River Railroad* three-year, 4 ¼ percent note issued 3/3/1911 by the syndicate group of J. P. Morgan & Co., Morgan Grenfell in London, Morgan Harjes in Paris, First National Bank in New York and National City Bank in New York. The specimen is taken from *Syndicate Books*, Vol. No. 6, insert after page 151, The Pierpont Morgan Library and Museum, New York City.

We illustrate these security features in Figure 1, which gives a bond certificate specimen for *The New York Central and Hudson River Railroad Company*. The first paragraph of the specimen, reproduced again below, identifies the bond issue as in bearer form, with an

option on the part of the bondholder to register the issue with the company. The paragraph also identifies the office or agency of the company as the bond coupon and principal payment locations, with alternative payment locations in London and Paris. Payments are specified in gold, with the option for payment in pounds in London and francs in Paris at fixed exchange rates.

The New York Central and Hudson River Railroad Company for value received hereby promises to pay to the **bearer hereof** on the first day of March, 1914, **at the office or agency of the said Railroad Company** in the City of New York, ONE THOUSAND DOLLARS in gold coin of the United States of America of or equal to the present standard of weight and fineness; or at the option of the holder in London, England, at the **office of Morgan Grenfell & Co.** in sterling, at the fixed rate of exchange of \$4.86½ to the pound, or, in Paris, France **at the office of Morgan Harjes & Co.** in francs at the fixed rate of exchange of 5.18 1/8 francs to the dollar and to pay interest at the rate of four and one-half per centum per annum from the first day of March, 1911 to the maturity hereof, semi-annually on March 1st and September 1st in each year at the office or agency of the said Railroad Company in the City of New York or at the option of the holder in sterling in London or in francs in Paris according to the tenor of the annexed coupons and upon presentation and surrender thereof as they severally mature. (Bold emphasis added.)

As illustrated above, registration of the corporate bond was contractually at the option of the bondholder. Registered ownership allowed securities to be replaced if lost or stolen. In contrast, the bearer form was popular due to its ease of ownership transfer and greater liquidity, since these bonds could be purchased in the U.S. and then transported to foreign markets during periods when arbitrage opportunities developed.<sup>3</sup>

The *Commercial and Financial Chronicle* (CFC)<sup>4</sup> provides bond price and trading volume data for bearer and registered forms of the same bond issue. Analysis of this data indicates that the

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<sup>3</sup> In fact, the foreign purchase of U.S. securities became a political issue in the 1930s. For example, in a press conference on November 13, 1936, President Roosevelt commented sharply on the influx of “hot money” and stated that measures were being studied by the federal government to deal with it (*New York Times*, November 14, 1936, p. 1).

<sup>4</sup> Specifically, the table: *New York Stock Exchange – Bond Record, Friday, Weekly and Yearly* of the *Commercial and Financial Chronicle* lists bid, ask and sales prices and

registered form was quoted on average at a discount to its bearer "twin" of 1.55 percent for "A" rated securities and 1.52 percent discount for unrated securities. In addition, the bearer form tends to be much more actively traded than the registered security, perhaps accounting for some of their pricing differential.<sup>5</sup>

As illustrated by the bond certificate specimen above, the bond contract also specified the location of bond coupon payments, and thus created a payment system that occurred largely outside of bank intermediation. Poor's *Railroad Manual* (1908) lists the physical location of coupon payments for railroad bonds. For forty-nine railroad companies, (1) twenty-four coupon payment locations were *at the Office of a Lawyer, Private Bank, Trust Company or European Commercial Bank*, (2) nineteen were *at the Company's Headquarters or a European Commercial Bank* and (3) only six were *at a Commercial Bank*. Thus, bond coupon payments took place largely outside of the bank clearing system, which insulated the payment system from the systemic risk of a liquidity crisis such as the Panic of 1907, and provided a source of liquidity to the U.S. economy when bank deposits became non-convertible. As well, the settlement of trades took place by courier between brokerage houses, and thus outside a centralized clearing location.<sup>6</sup> Therefore, the coupon payment and trade settlement systems operated independently of bank clearing systems, and the New York City (NYC) Clearinghouse Association, in particular.

Most bond indentures also contained gold clauses, whereby the bond issuer stipulated the payment value of coupons and

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trade volumes for corporate and government bonds. Bearer and registered forms of the same bond are listed separately.

<sup>5</sup> We would expect that the costs and benefits of the two forms of the security might be valued differently under different market circumstances. For example, the bearer form might be valued more highly during periods of constrained liquidity, as reflected in the present analysis of the valuation of registered versus bearer bonds during 1907.

<sup>6</sup> Facciolo (2005, p. 172) describes the settlement of an NYSE securities trade as follows: "As 2 o'clock approached, the streets of the financial district presented a curious spectacle. By common consent, the delivery boys were given the right of way. Running at top speed, their hands full of securities and checks, the boys were everywhere in evidence." The development of a clearinghouse simplified the process by allowing payment and security exchange to be netted among brokers.



principal in gold.<sup>7</sup> Of 1,794 bonds outstanding in the *Poor's Manual of Railroads* (1908), 63 percent, or 1,129 bonds, had coupons payable in gold. Flandreau and Sussman (2004) conclude that denominating securities in an international currency, as with the gold standard, allowed issuing firms to benefit from both increased financial-market liquidity and increased currency liquidity.

The contractual arrangements discussed above helped to insulate the U.S. capital markets from the systemic risk posed by banking sector disruptions that occurred periodically in the National Banking era. The joint trading of American securities in New York and foreign financial centers, the bearer-form of U.S. securities and the gold clauses of corporate bonds linked the U.S. securities markets to liquid foreign markets that could serve as a source of liquidity during periods of financial stress in the U.S. These contractual features and trading arrangements were an important aspect of the historic international gold standard that has not been previously examined.

### III. MULTIPLE MARKET TRADING OF AMERICAN RAILROAD SECURITIES AND INTER-MARKET ARBITRAGE

In 1907, American railroad securities were actively traded on foreign markets including London, Amsterdam, and Frankfurt. Neal (1985, p. 221) reports that by the end of the nineteenth century, American railroad shares were traded on the major European exchanges, with share prices communicated within hours among markets by submarine cable, and that by 1914 194 North American railroad securities were traded on the Amsterdam Beurs.<sup>8</sup> As well, Michie (1986, p. 179) reports that by 1911 the London Stock

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<sup>7</sup> Thies (2005) provides a comprehensive review of the role that gold clauses played in railroad bond indentures. Gold clauses became popular in times of monetary uncertainty, as with the silver risk created by the bimetallism movement of the 1880–90s. In 1900 the Gold Standard Act settled the issue of bimetallism and established gold as the only metallic standard for redeeming paper money. Gold clauses were brought to an end with the U. S. Gold Reserve Act of 1934, which also outlawed most private gold holdings.

<sup>8</sup> Neal (1985, p. 221) also reports that forward orders and the lack of formal taxes, regulations, or controls on capital movements also helped link these markets together.



Exchange had become such a competitor in trading U.S. securities that the NYSE prohibited joint account trading between markets.

**Table 1. Bond Trading Volume in a Sample of Cross-Quoted American Railroad Bonds in 1907, as a Function of News Coverage**

Publications Quoting the Bond	Pre-Panic Weeks Jan. 4–Oct. 18		Panic Weeks Oct. 25–Dec. 28	
	NYSE Volume	% of Volume	NYSE Volume	% of Volume
CFC and 3 Int'l (12 bonds)	20,785	10.30	14,406	19.35
CFC and 2 Int'l (32 bonds)	23,333	11.56	7,456	10.02
CFC and 1 Int'l (84 bonds)	74,133	36.74	25,902	34.79
Sub-Total	118,251	58.60	47,764	64.16
Issues Quoted Only in CFC	83,546	41.40	26,679	35.84
Total	201,797	100.00	74,443	100.00

We found 128 American railroad bonds quoted in at least one of the following international news sources: *The Economist* in London, the *Frankfurter Zeitung* in Frankfurt, and the *Nieuwe Amsterdamsche Courant Algemeen Handelsblad* in Amsterdam. As well, all 128 were quoted in *The Commercial and Financial Chronicle* (CFC), published in New York. The number in parentheses indicates that 12 of the 128 bonds were quoted by all four of the news sources, 32 bonds were quoted in the CFC and in at least two of the international papers, and 84 bonds were quoted in the CFC and in at least one of the international papers. Approximately 600 bonds were quoted only in the *Commercial and Financial Chronicle*.

Fully 88 percent of the bonds (112 of the 128 issues) paid interest in gold coupons. Of those bonds without gold coupons, one issue was Canadian and two were Mexican. An investigation of the Paris newspaper, *Le Figaro*, showed only one American railroad bond.

This table shows that while internationally quoted bonds accounted for 58.597 percent of pre-Panic volume, they accounted for 64.16 percent of volume during the Panic. The contrast is more dramatic for those bonds quoted in all four news sources. Their volume comprised 10.29 percent of pre-Panic volume but fully 19.35 percent of volume during the Panic. Volume percentages were calculated in terms of number of bonds traded on the NYSE.

Table 1 lists American railroad securities that were traded in major foreign markets, abstracted from the U.S. and foreign financial press. In particular, the *Amsterdam Courant* reported on 89, *The Economist* reported on 85, and the *Frankfurter Zeitung* reported on 41 American railroad bonds trading in the Amsterdam, London and Frankfurt markets, respectively. As Table 1 shows, 12 American railroad bonds were covered by the *Commercial and Financial Chronicle* (CFC) and three of the foreign news sources, and 32 (82) American railroad bonds were covered by the CFC and 2 (1) of the foreign news sources. The table also reports the level of trading for each bond over (1) the non-panic weeks of January 4 – October 18, 1907, and (2) the panic weeks of October 25 – December 28, 1907. Trading data is taken from the CFC for the New York securities market. Also listed at the bottom of the table is the trading volume for railroad bonds listed only in the CFC, that is, not listed in the foreign news sources.

The data presented in Table 1 indicate that for those bonds covered by all four news sources, trading volumes increased from 10.30 percent in the non-panic weeks to 19.35 percent in the panic weeks of total trade volume listed in Table 1. In contrast, bonds not covered in any of the three foreign sources showed trading volume declines from 41.40 percent in the non-panic weeks to 35.84 percent in the panic weeks of the total trading volume. Total trading volume is the sum of all individual bond trades, separately for the non-panic and panic weeks.

Therefore, the table suggests that (1) the foreign-market trading interest in American railroad securities was significant during 1907 and that (2) bonds with the greatest foreign coverage showed the greatest increases in trading activities during the panic weeks.<sup>9</sup> These results suggest that foreign trading in the U.S. bond market increased during the panic weeks of 1907. In a latter section we

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<sup>9</sup> White (1940) similarly reports an increase in foreign trading of U.S. stocks during the Great Depression and comments that "beginning about 1934 various elements in the New York financial community argued that business was being seriously diverted to the London and Amsterdam stock markets from the New York Stocks Market. The diversion was laid partly to the improved liquidity and the increased number of American issues traded in the foreign stock exchanges themselves which thus made the foreign markets more attractive centers for American security trading."

investigate whether inter-market arbitrage opportunities existed during the panic weeks. Next we discuss the type of arbitrage available at the time, as outlined by H.G.S. Noble, president of the NYSE in 1914.

Noble (1915) outlines the following arbitrage mechanism between securities traded in New York and London. If a security was priced significantly lower in the New York market, then the same security would be shorted in London. The security certificates (that is, the bearer securities) from the New York purchase would be shipped to London to cover the short position there. In addition, the New York purchase could be financed in the call loan market, with ultimate payment made by gold shipment. The gold shipment covered the call loan and would thus contribute to a U.S. monetary expansion. The multiple-market trading of American securities allowed the U.S. market to draw liquidity from these more liquid foreign markets in times of U.S. crisis. As Noble (1915) notes:

In all previous American panics the foreign world markets were counted upon to come to the rescue and break the fall. Imports of gold, foreign loans, and foreign buying were safeguards which in past crises had been counted upon to prevent utter disaster.<sup>10</sup>

#### IV. MONETARY AND BANK RESERVE CONDITIONS DURING 1907

The banking and monetary conditions contributing to the panic weeks of 1907 are well documented. Sprague (1910) and Odell and Weidenmier (2004) discuss the large gold imports from Britain that occurred to fund the insurance claims resulting from the April 1906 San Francisco earthquake. The sale of bond holdings by insurance companies to fund the payment of these claims may have depressed bond prices in 1906.<sup>11</sup> As well, monetary stringency occurred

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<sup>10</sup> Noble's perspective was at the time of the 1914 closing of the NYSE, in response to an attempted liquidation of U.S. securities by European investors, which occurred in response to the closure of most other exchanges globally. H.G.S. Noble was President of the NYSE at the time.

<sup>11</sup> American railroad bond prices dipped during the Spring of 1906, but appear to have recovered by the end of 1906, as given by *Course of Prices of Railroad and*

during the summer 1907, partly due to an increase in the Bank of England's discount rate and its suspension of the acceptance of American finance bills.<sup>12</sup>

**Table 2. Gold Imports, Gold Exports, NYC Clearing House Specie, Weekly**

Date Week of	Gold Imports	Gold Exports	Net Gold Exports	NYC Clearing House Specie Level
6/1/1907	\$40,125	\$2,813,838	\$(2,773,713)	\$221,928,000
6/8/1907	45,224	5,580,588	(5,535,364)	213,574,200
6/15/1907	228,094	2,551,198	(2,323,104)	210,056,200
6/22/1907	61,163	6,172,038	(6,110,875)	208,290,500
6/29/1907	65,848	7,483,159	(7,417,311)	200,792,500
7/6/1907	12,624	1,487,400	(1,474,776)	199,710,500
7/13/1907	461,790	2,776,544	(2,314,754)	201,818,000
7/20/1907	198,861	92	198,769	204,768,300
7/27/1907	69,387	-	69,387	210,451,500
8/3/1907	102,798	513,630	(410,832)	210,339,700
8/10/1907	58,892	807,500	(748,608)	206,346,700
8/17/1907	74,510	56,000	18,510	203,988,300
8/24/1907	44,979	1,112,069	(1,067,090)	203,036,800

*Miscellaneous Bonds for the Year 1906* (*The Commercial and Financial Chronicle*, Jan 5, 1907, p. 21). In addition, the heavy use of finance bills in 1906 amounted to additional loans from Britain to the United States. In response, the Bank of England raised its bank rate from 3.5 percent to 6.0 percent, and suspended the acceptance of American finance bills (Sprague, 1910, p. 241). As well, reserve outflows were related to the credit demands of the fall agricultural cycle, while restoration of bank reserve levels resulted from payment for agricultural goods. The agricultural cycle required the extension of credit to interior agricultural interests until crops reached their end markets. See, for example, Sprague (1910) and Tallman and Moen (1990).

<sup>12</sup> In Sprague's view, "from December, 1906, the liquidation of these bills was the most potent single factor" contributing to the monetary tightness of 1907. Friedman and Schwartz (1963) likewise note that the increase in the Bank of England's discount rate and its suspension of the acceptance of American finance bills reversed the gold flows into the U.S.

Date Week of	Gold Imports	Gold Exports	Net Gold Exports	NYC Clearing House Specie Level
8/31/1907	\$305,621	\$1,005,263	\$(699,642)	\$200,889,500
9/7/1907	319,104	155,000	164,104	200,317,400
9/14/1907	155,761	50,000	105,761	198,909,900
9/21/1907	133,840	-	133,840	202,396,500
9/28/1907	76,646	2,000	74,646	198,807,900
10/5/1907	107,889	10,000	97,889	192,216,700
10/12/1907	170,347	971	169,376	198,558,800
10/19/1907	22,560	4,472	18,088	205,353,300
10/26/1907	394,269	1,697,514	(1,303,245)	196,426,000
11/2/1907	130,378	610,000	(479,622)	175,913,900
11/9/1907	7,272,752	-	7,272,752	170,712,000
<b>11/16/1907</b>	<b>21,110,672</b>	-	<b>21,110,672</b>	<b>170,347,900</b>
<b>11/23/1907</b>	<b>12,413,679</b>	-	<b>12,413,679</b>	<b>168,799,100</b>
<b>11/30/1907</b>	<b>16,546,078</b>	-	<b>16,546,078</b>	<b>170,554,600</b>
<b>12/7/1907</b>	<b>13,830,794</b>	20,000	<b>3,810,794</b>	<b>173,888,700</b>
<b>12/14/1907</b>	<b>9,470,075</b>	2,800	<b>9,467,275</b>	<b>177,165,300</b>
12/21/1907	5,712,241	9,000	5,703,241	181,503,100
12/28/1907	4,115,667	-	4,115,667	187,874,300
1/4/1908	5,311,901	14,030	5,297,871	192,120,900
1/11/1908	3,633,385	5,925	3,627,460	206,732,500

Source: *Commercial and Financial Chronicle*. Bold weeks show the surge in net gold imports.

**Table 3. Weekly NYC Bank Clearing House Reserves, Required Reserves and Surplus Reserves and Weekly Call Loan Rate Weekly Range**

Date Week of	Reservess	Required Reserves	Surplus Reserves	Call Loan Rate Weekly Range
8/3/1907	\$282,298,800	\$274,825,600	\$7,473,200	2 to 3.5%

Date Week of	Reservess	Required Reserves	Surplus Reserves	Call Loan Rate Weekly Range
8/10/1907	\$276,986,700	\$269,226,150	\$7,760,550	2 to 6%
8/17/1907	274,158,400	264,864,325	9,294,075	2.25 to 5
8/24/1907	272,072,300	262,095,900	9,976,400	1.75 to 3
8/31/1907	270,420,400	261,663,950	8,756,450	2.5 to 4
9/7/1907	268,993,600	261,621,250	7,372,350	2.25 to 4
9/14/1907	268,131,800	261,213,100	6,918,700	2 to 6.5
9/21/1907	272,661,000	264,255,900	8,405,100	2 to 5
9/28/1907	269,445,000	263,798,425	5,646,575	1 to 6
10/5/1907	261,823,900	259,175,825	2,648,075	3 to 10
10/12/1907	261,167,400	256,511,950	4,655,450	2.5 to 6
10/19/1907	267,610,500	256,427,850	11,182,650	2.5 to 10
10/26/1907	254,709,700	255,943,000	(1,233,300)	5 to 125
11/2/1907	224,107,900	262,946,725	(38,838,825)	3 to 75
11/9/1907	219,794,900	271,719,525	(51,924,625)	3 to 25
11/16/1907	218,659,000	272,325,950	(53,666,950)	5 to 15
<b>11/23/1907</b>	215,851,100	269,954,700	<b>(54,103,600)</b>	3.5 to 15
<b>11/30/1907</b>	217,831,400	270,820,825	<b>(52,989,425)</b>	3 to 12
12/7/1907	222,502,500	268,712,850	(46,210,350)	3 to 13
12/14/1907	226,615,300	266,716,475	(40,101,175)	2 to 25
12/21/1907	233,122,500	264,873,500	(31,751,000)	6 to 17
12/28/1907	242,561,000	262,731,350	(20,170,350)	12 to 15
1/4/1908	250,606,900	262,116,450	(11,509,550)	5 to 20
1/11/1908	268,996,800	262,912,750	6,084,050	2 to 9
1/18/1908	295,182,600	272,547,125	22,635,475	2.5 to 6
1/25/1908	318,856,500	281,792,000	37,064,500	1.5 to 3

This table gives the aggregate reserves, required reserves and excess reserves of the New York City Clearing House banks, along with the range in call loan rates for the week. The table illustrates that call loan rates tended to spike when excess reserves dropped below zero. Required reserves for NYC Clearing House banks were 25 percent of deposits. Source of data: *Commercial and Financial Chronicle*.

Table 2 illustrates this monetary stringency in terms of the strong gold outflows and declining specie levels reported for the NYC clearinghouse banks from the week of June 1, 1907 through the week of July 13, 1907. Banking system stress is also reflected in the reserve conditions of the NYC clearinghouse banks given in Table 3. During the week of October 26, 1907 bank excess reserves turned negative. The NYC clearinghouse banks suspended the convertibility of bank deposits on October 28, 1907, and issued clearinghouse loan certificates. Tallman and Moen (2010) and Thies (2009) discuss the issuance of clearinghouse loan certificates in 1907.

Friedman and Schwartz (1963, p.160) identify mid-December as the typical start of the return flows of agricultural payments from crop exports, with the banking system returning to a condition of ease in January (Sprague, 1910, p. 240).<sup>13</sup> However, Table 2 shows strong net gold inflows starting the week of November 9, some four weeks earlier than the typical seasonal return flows to New York described by Sprague (1910) and Friedman and Schwartz (1963).

Sprague (1910, p. 316) estimates that of the \$90,000,000 increase in the gold supply in November and December of 1907, \$70,000,000 was attributable to a surplus of merchandise exports over imports, leaving \$20,000,000 of the gold supply increase unexplained. Further, Sprague (1910, p. 284) remarks that the gold flow into New York from foreign sources was “far greater than the amount imported during any other crisis in our history and affords further evidence of the ability of this country to secure additional supplies of gold in an emergency.”

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<sup>13</sup> Sprague (1910) notes four reasons for the return flow of reserves to the banks: (1) the excess of merchandise trade exports over imports resulting in positive gold flows to money-center banks, (2) additional government deposits, (3) the start of the seasonal return of agricultural deposits from the interior banks to the New York City banks and (4) the return of money from circulation as a consequence of general business depression following suspension of convertibility.



**Table 4. Net Gold Imports at New York Harbor during 1907 and the Five Preceding Years**

Year	November	December
1902	\$279,863	-\$1,670,354
1903	6,910,527	11,078,521
1904	-19,312,207	-7,649,127
1905	86,740	95,157
1906	590,397	365,302
Total	-\$11,444,680	\$2,219,499
Average	-\$2,288,936	\$443,899
1907	\$57,550,403	\$36,545,078

The data support the statements from Friedman and Schwartz (1963) and Sprague (1910) that seasonal gold flows did not typically begin to return to the US until December. The five Novembers spanning 1902 through 1906 averaged outflows of \$2,288,936, while the five Decembers covering 1902 through 1906 averaged inflows of \$443,899. Inflows of gold at New York in November and December of 1907 dwarfed the flows from the same months in preceding five years.

Source: Andrew, A. Piatt, Statistics for the United States 1867–1909, United States National Monetary Commission report to the 61st Congress, 2nd session, Table No. 10, “Exports and Imports of Gold at New York, Monthly,” pp. 170–171.

Table 4 illustrates the conclusions of Friedman and Schwartz (1963) and Sprague (1910) concerning the timing of gold flows. The table lists the November and December net gold flows (gold inflows minus gold outflows) for 1907 and for the preceding five years. During the preceding five years, November flows had averaged  $-\$2,288,936$ , while December flows averaged  $\$443,899$ . In comparison, the 1907 net gold inflows dwarfed these earlier gold inflows by large amounts. The results indicate how extraordinary the 1907 gold flows were. In section VII below, we further explore

whether arbitrage opportunities in the U.S. securities market could be the basis for this previously unexplained gold flow.<sup>14</sup>

## V. CALL-LOAN MARKET CONDITIONS

The New York call loan market consisted of a “money post” on the floor of the NYSE with a daily auction of loans to individuals and business including call loans to brokers.<sup>15</sup> Call loan terms were standardized: money was lent overnight at the day’s market rate, and remained outstanding until 12:15 PM the next business day, when notification to either call or pay back the loan was due. If no notification occurred, the loan remained outstanding at that day’s auction rate. Required margin was ordinarily 25 percent of the loan. If collateral value dropped, the lender could request additional collateral or call the loan.<sup>16</sup>

The call loan market was central to the NYSE’s settlement process, which required trade settlement on the following trade day. In particular, security buyers could finance their purchases in the call loan market and cover the loan as their own funds became available. According to Michie (1986, p. 182),

The need to finance every transaction lasting longer than a day took a substantial proportion of the liquid funds available in New York. In 1913, for instance, the ratio of security loans to commercial bank deposits was 37.7 percent in New York compared with only 13.3 percent in London.

Table 3 illustrates one link between call loan rates and aggregate NYC bank clearinghouse deposits and reserves.<sup>17</sup> A sharp drop in surplus reserves occurred starting the week of October 26, 1907, with call loan rates spiking to 125 percent and remaining high

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<sup>14</sup> *The Economist* (November 9, 1907) supports this view: “Many people are asking whether this is not a favourable opportunity to invest money in American Roads. That it may be.”

<sup>15</sup> Griffiss (1925) reviews the functioning of this NYSE money post in detail.

<sup>16</sup> The call loan market allowed dealers to finance inventory in a similar way to today’s repo market.

<sup>17</sup> Seltzer and Horner (1922) showed that seasonal money demand increases caused call-loan rates to increase, which pressured bond and stock prices.

through the end of the year.<sup>18</sup> More specifically, on October 24 call loan rates had reached 100 percent, and a J.P. Morgan-led pool of \$25 million was quickly absorbed into the call loan market.<sup>19, 20</sup>

The call loan market provided liquidity for the U.S. reserve system that pyramided the reserves of interior banks on reserve banks in regional cities, and ultimately to the NYC central reserve banks. During times of crisis interior banks would withdraw their reserve deposits, which would then require the removal of funds from the call loan market. However, the liquidity of the call loan market was limited, since call loan funds were needed to clear security transactions. Actually, the volume of NYSE security transactions increased during the panic months of 1907, potentially increasing the demand for call loan funds. According to Michie (1986, p. 182),

The daily settlement system tended to exaggerate crises. The short time before payment was due meant that it was difficult for either bankers or brokers to take measures to avoid crisis. Any tightening of the money available on the call-loan market had an immediate and all embracing impact, since almost all borrowings were for day-to-day money. If stocks

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<sup>18</sup> Sylla (1998) points out that the call loan market created a strong connection between the U.S. banking system and the country's bond and stock markets. More specifically, Tallman and Moen (2003) hypothesize that the call loan market was at the center of the financial crisis of 1907, and that the NYC clearing banks, with their large stake in the call loan market, imposed a suspension of convertibility of deposits to preserve the liquidity of the call loan market.

<sup>19</sup> Specifically, the *New York Times* (October 26, 1907, p. 2) reports that J.P. Morgan, along with George F. Baker and James Stillman, who ran First National and National City Bank of New York, respectively, raised a total of \$25 million on October 24th and 25th in a money pool, deposited money with the stock exchange's brokers to keep the stock exchange open during the liquidity crisis. According to *The Times of London* (October 25, 1907, p. 12), "The Morgan pool loaned at 10%, Mr. Rockefeller and the National City Bank were lenders at 6%. The ruling rate of the day was about 60% and as much as 100% was paid." On October 28 the NYC clearinghouse banks suspended the convertibility of bank deposits.

<sup>20</sup> In response to the NYC clearinghouse suspension, there were also reports of the imminent closure of the NYSE. However, this was disputed by the *New York Times* (October 25, 1907, p. 2) which reported: "Ransom H. Thomas, President of the New York Stock Exchange, made emphatic denial last night of a report that at 2 o'clock yesterday afternoon, when Union Pacific dropped to par and 100% was bid for money, he informed J.P. Morgan & Co. that the exchange would have to be closed unless money was forthcoming. 'There is not a scintilla of truth in that report,' said Mr. Thomas. 'There is absolutely nothing to justify its inception in any way, shape or form.'"

could not be immediately liquidated, or if prices dropped to the extent that loans were no longer covered, the brokers would be unable to repay the banks....

The New York Stock Exchange provided a large, essential, and remunerative home for the short-term funds lodged in New York banks; the daily settlement system meant that they absorbed a much greater proportion of these funds than they need have done. But it was only by being able to call on foreign money markets, especially London, that crises were as readily surmounted as they were before 1914.

## VI. NYSE STOCK AND BOND MARKET CONDITIONS

Since 1892, the NYSE's clearinghouse performed the function of the netting of daily trades (Facciolo, 2005, pp. 172–173 and Chamberlin, 1905, 445–454). The clearinghouse allowed a broker to net out his obligations down to a single other member. Sprague (1910, p. 152) argues that without the presence of a clearinghouse, the NYSE would have likely been forced to close during the panics in 1893 and 1907, as had happened in 1873.<sup>21</sup>

Our analysis focuses on a sample of 29 NYSE-listed railroad bonds that were cross-traded in the London market. For this dual-traded bond sample, aggregate weekly trading volume shows seasonal peaks in trading activity during March of 1907, when bond trading volumes roughly doubled, and again during November and December of 1907, when bond trading volumes reached a peak of roughly triple their normal trading volume. The spring and fall peaks in bond trading volumes also correspond to seasonal peaks in call loan rates.<sup>22</sup> As well, the suspension of convertibility by NYC clearing banks was associated with a period of heightened liquidity of our sample of railroad bonds.

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<sup>21</sup> Pre-1892, individual stock exchange transactions were settled individually by certified check, which created large increases in the check clearing operations for those banks located near the exchange. As well, brokers had formal or informal arrangements with their banks to allow temporary overdrafts of their account balances during the daily trade settlement process. In times of crisis, such as 1873 panic, the clearing of payments for security trades through the banking system became difficult, if not impossible, due to the credit required to settle trades.

<sup>22</sup> The New York bond trade volumes are taken from *The Commercial and Financial Chronicle*.

**Figure 2. Weekly London and New York Bond Indices: Sample of 29 American Railroad Bonds**

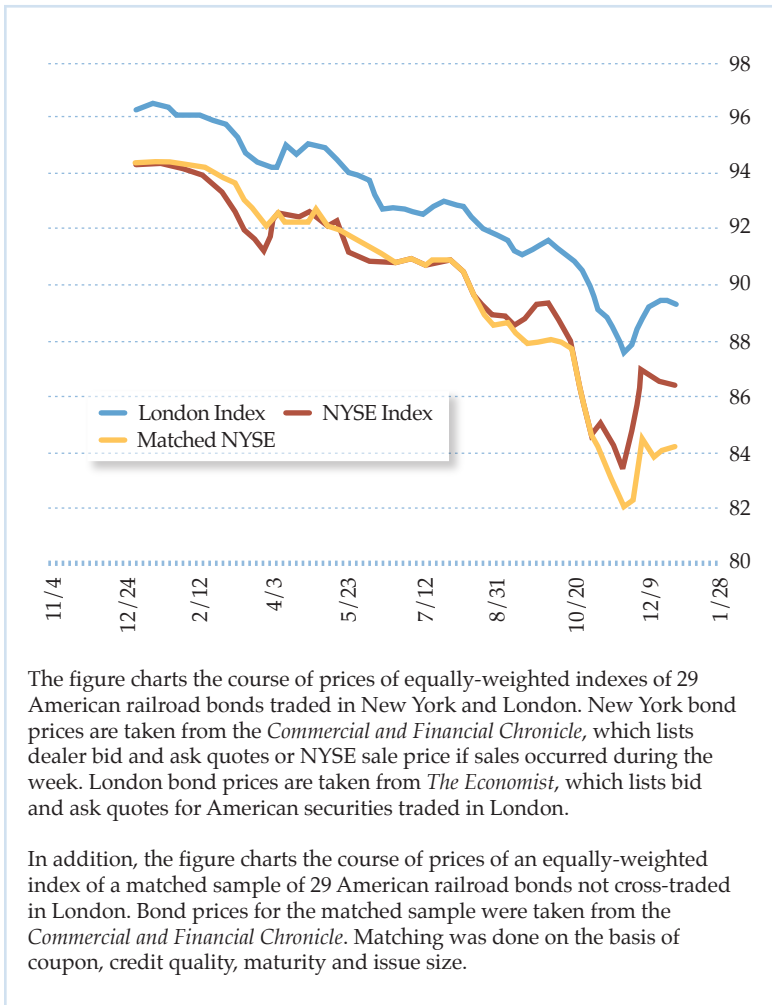


Figure 2 shows the course of bond prices during 1907 for the sample of 29 cross-traded American railroad bonds. As Figure 2 shows, these bond prices fell throughout most of 1907, perhaps in response to the tightening monetary conditions discussed above. The figure also shows the bond price index for a matched sample of

American railroad bonds that were not dually-traded in London.<sup>23</sup> For this matched sample of bonds, i.e., those without the support of London-based trading, the bond price index drops farther from peak to trough, and recovers more slowly than their dually-traded counterparts. Finally, Figure 2 also shows the London-side price index of the dual-traded sample of railroad bonds, which shows on average a 4.11 percent higher value than that of the New York prices. We explore this price differential further in the next section.

Railroad bond prices appear to bottom during the week of November 23, 1907, in contrast to the reversal in call loan rates that started the week of October 26, 1907 (as noted above and shown in Table 3. News sources at the time cite two coincident events which might explain the bond market price reversal. First, the *New York Times* (November 18, 1907, p. 1) reported that the U.S. Treasury was issuing \$50 million of Panama Canal bonds and \$100 million of 1-year U.S. Treasury notes to provide banks with collateral to issue additional bank notes.<sup>24</sup>

Second, the *New York Times* (November 23, 1907, p. 12) reported that the Bank of France would buy commercial paper in exchange for American eagle gold coin, where the commercial paper was issued by a selection of top tier investment banks with strong ties to France. The private investment banks included Kuhn Loeb, Heidelbach Ichelheimer, Lazard Freres, and Goldman Sachs, which received \$1,500,000, \$2,000,000, \$3,000,000, and \$1,500,000, respectively, totaling \$8,000,000 from Europe, of which \$5,000,000 was directly from the Bank of France.<sup>25</sup> Of significance was that the issue resulted in a direct infusion of gold into the U.S. securities

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<sup>23</sup> Bonds were matched in terms of coupon, credit quality, maturity and issue size.

<sup>24</sup> The offer was tepidly received, with Sprague (1910, p. 317) noting that the new securities "excited much opposition" (1910, p. 316). Sprague further notes that the positive effect of the bank notes was not felt until December (1910, p. 316). George Cortelyou, Secretary of the Treasury, however, insisted that the flotation was a worthwhile signal to the markets, arguing that "the most potent weapon... in bringing a crisis to an end is... the knowledge that adequate resources existed to avoid disaster."

<sup>25</sup> A well known Parisian economist of the day, Arthur Raffalovich, noted the willingness of the Bank of France to proceed with the arrangement despite the refusal of the U.S. Treasury to guarantee the commercial paper (Dewey, 1908, p. 235).

market, which bypassed the U.S. commercial banks and the U.S. Treasury. According to the *New York Times* (November 23, 1907):

The gold secured by local banking houses with Paris connections from the Bank of France was obtained upon commercial paper, and the movement was generally construed as an indication of the willingness of the French bank to do what it could to relieve the stringency.

Flandreau (1997) and Gallorotti (2005) document that the Bank of France undertook an historic role as an international lender of last resort, frequently lending gold in foreign markets as a pre-emptive strategy to prevent a more severe drain of liquidity from the banking sector. A National Monetary Commission report also documents the Bank of France's role as international lender of last resort: "With a comparatively small sum, with which it can temporarily assist a solvent and well-managed foreign concern, for the moment in difficulties, (the Bank of France) is able to take an effective part in the relief of international markets, and to avoid the disastrous effects of the contagion on our own market" (Patron, 1910).

## VII. THE PANIC OF 1907 BOND MARKET ARBITRAGE

This section investigates the potential arbitrage in American railroad bonds between the New York and London securities markets. During 1907, some 85 American railroad bonds were traded in London, with security prices given in *The Economist*. If New York security prices were at a substantial discount to the London prices, then the resulting arbitrage would generate gold inflows into the New York market, helping to produce a monetary stimulus to the U.S. economy.

Our analysis focuses on a sample of 29 American railroad bonds for which New York and London prices were available weekly throughout 1907 from *The Economist* and from *The Commercial and Financial Chronicle* for London and New York prices, respectively. An equally-weighted index was constructed for the matched sample of securities traded in each market.

To make the security prices comparable, Patterson (1917, p. 158) indicates that:



Parity, when applied to a stock, means the price which is its equivalent when quoted in a different market. For instance, the London price of a stock exceeds the New York price of the same stock by about  $2\frac{1}{2}$  or 3 per cent, after the exchange rate and the London method of quoting American stocks (\$5.00 to the pound) are taken into consideration. With a cable rate of  $4.87\frac{1}{2}$  the London parity of New York stock at 68 would be 69.75.

$$\text{N.Y. parity} = \frac{\text{London parity} \times \text{rate of exchange}}{5} \text{ or } \frac{69.74 \times 487\frac{1}{2}}{5} = 68.$$

$$\text{London parity} = \frac{\text{New York parity} \times 5}{\text{Rate of exchange}} \text{ or } \frac{68 \times 5}{487\frac{1}{2}} = 69.74.$$

Using the arbitrage outlined in Section III, we assume the following arbitrage execution costs. Shorting an American railroad bond in London at a bid price of 100, the corresponding price of the security at its bid price in New York would be about 2.75 percent less, due to the London quotation convention for American securities just cited.<sup>26</sup> The London brokerage cost would be  $1/8$  point or 0.125 percent (Michie, 1986). Simultaneously, the same security would be purchased in New York at the ask price, which during 1907 was about 1.5 percent higher than the bid price for the sample of railroad bonds.<sup>27</sup> To pay for the New York purchase, gold would be shipped from London to New York, which would require about one week to ten days to execute, and would cost about 0.15 percent (Patterson, 1911). In the interim, next day settlement at the NYSE would require a call loan. Assuming a 15 percent annual call loan rate, which was somewhat typical for November 1907, a 7-day

<sup>26</sup> Consistent with the description given by Patterson, *The Financial Review* (February 1908, p. 52) describes how the LSE changed its method of quoting American securities in 1874 by adopting a dollar to sterling exchange rate of  $97\frac{1}{3}$  cents of parity, or at \$5 per £1, rather than the official exchange of \$4.8665 per £1. "This valuation, being  $2\frac{2}{3}$  cents below par, is equal to a quotable premium of about  $2\frac{3}{4}$  per cent, and accordingly the present London quotations of American securities are about  $2\frac{3}{4}$  per cent above their actual value—a bond worth 100 here being quoted there at  $102\frac{3}{4}$ ."

<sup>27</sup> The Economist consistently reported two-sided quotes for London trading in American securities, while the Commercial and Financial Chronicle often provided only one-sided quotes and most often the bid price. The data sample of railroad bonds showed that, when both a bid and ask were present, the New York bid-ask spread was 60 percent of the London bid-ask spread. According, the analysis used the 60 percent average to generate missing bids or asks for the New York market data.

loan would cost 0.28 percent, or 15 percent divided by 52 weeks. The brokerage cost to buy in New York if done by a member firm would add another 0.40 percent (Biais and Green, 2007). We term the arbitrage resulting from these costs the “institutional cost arbitrage.” We also investigate the case where the brokerage and interest costs are set to zero; that is, the limiting case where arbitrageurs’ costs are zero.

**Figure 3. Weekly Arbitrage Profit (%) During 1907 Sample of 29 American Railroad Bonds**

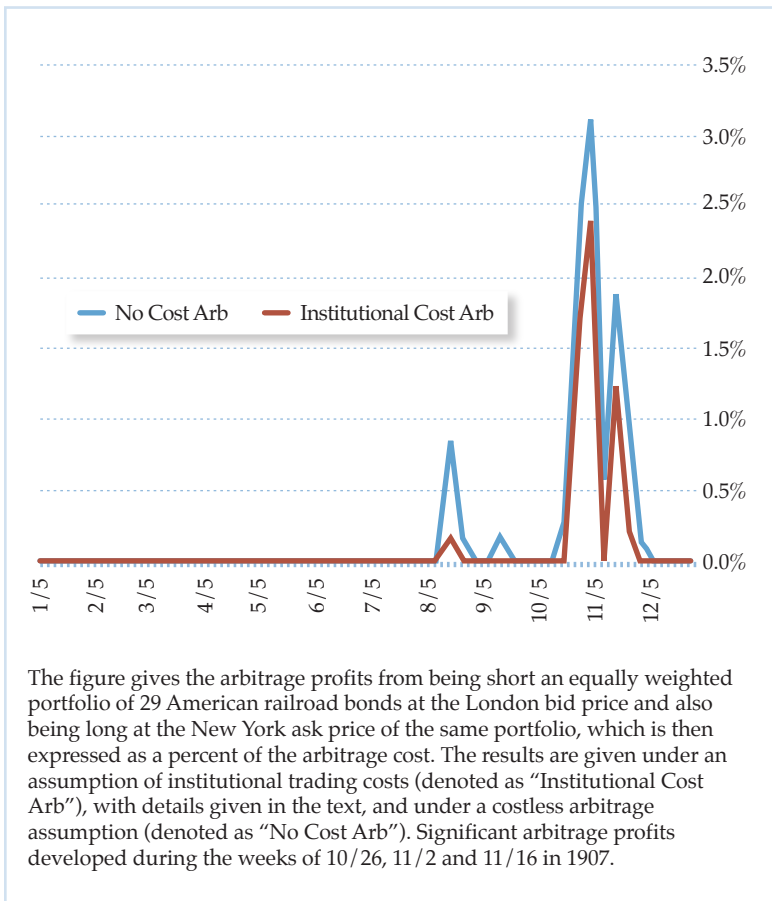


Figure 3 graphs the results of the arbitrage strategy outlined above. The results indicate that economically significant arbitrage profits of 1.70 (2.39) percent occurred during the week of October 26, arbitrage profits of 2.40 (3.10) percent occurred during the week of November 2 and arbitrage profits of 1.23 (1.91) percent occurred during the week of November 16, for the institutional cost (zero cost) arbitrage.<sup>28</sup> During the remainder of 1907 the results indicate that arbitrage profits were insignificant, i.e., that arbitrage was successful in keeping the pricing in New York and London in line.

In addition to the bond market arbitrage, a premium of gold to deposits had emerged during the panic weeks of 1907, and, in particular, during October 26, 1907 through November 16, 1907, which averaged three and one-half percent.<sup>29</sup> Silber (2007) describes how the transaction of exchanging checks for gold worked: "A person wanting cash of October 31 had to present a certified check for \$103 to acquire \$100 in currency from a money broker."<sup>30</sup> The implication would be that a British investor would exchange pounds at the Bank of England for gold and then ship the gold to the U.S., rather than using an exchange bill, because the gold premium could offset the shipping and other costs. As well,

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<sup>28</sup> The Economist (November 2, 1907) underscores the arbitrage explanation by noting that "the sympathetic connections of prices in England and the States was for some days interrupted.... That there would have to be an approximation of the prices sooner or later everyone knew, but in which direction, no one could tell," and also reports on the German market that: "The immediate cause of the heavy demand for cable transfers to New York is found in the heavy buying of American securities in Wall Street for German accounts." As well, the Wall Street Journal (December 2, 1907, p. 4) reports that a spokesman for the brokerage firm A. O. Brown stated: "There is an impression that some large blocks of railroad bonds have been taken recently by foreign bankers and this disposition to reinvest in American securities not only implies a revival of confidence but indicates that much of the recently imported gold will remain here."

<sup>29</sup> A. Piatt Andrew, National Monetary Commission, 1910, Table No. 29, pp. 136, 137.

<sup>30</sup> Isador Straus (1908) explains it similarly: "the currency famine placed bank checks at a discount, or as it is more commonly but erroneously expressed, currency at a premium."

Friedman and Schwartz (1963, p. 162) discuss the gold premium and the corresponding gold arbitrage.<sup>31, 32</sup>

Additionally, we examined the correlation between net gold imports at New York Harbor and bond market volume at the New York Stock Exchange and found a positive, significant relationship of .347. This finding seems to imply that increased gold flows were associated with increased bond market volume.

Collectively, the evidence presented above indicates that when potential arbitrage profits were at their highest, gold flows into the New York harbor were increasing sharply (see Table 2) and bond volumes were peaking. Table 2 shows that strong net gold inflows started the week of November 9, some one to two weeks following the start of heightened arbitrage profits between London and New York; a delay which would approximate the transatlantic shipment time of gold. In contrast, in the two months until November 9, gold inflows into New York harbor were relatively small. Therefore, collectively our study results indicate a strong relationship between potential arbitrage activities by foreign investors and the inflow of gold which marked the beginning of a monetary expansion.

## VIII. CONCLUSIONS

Contractual features of U.S. bonds in 1907 helped to insulate the U.S. securities markets from the spillover effects of the systemic suspension of deposit convertibility that occurred in October 1907.

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<sup>31</sup> Suppose the exchange rate of deposit dollars against sterling to be at par: £1 = \$4.86. Then through the exchange market £1 will purchase \$4.86 in deposits. Let the premium on currency over deposits be 3.5 percent. By shipping gold, and exchanging this at the Treasury, £1 would purchase \$4.86 in currency and this in turn would purchase \$5.03 in deposits ( $4.86 \times 1.035$ ). Hence, so long as the deposit-dollar exchange rate remained at \$4.86, it was profitable to ship gold (Friedman and Schwartz, 1963, p. 162). Of course, this meant that the deposit-dollar price of a pound tended to rise. It rose as high as \$4.8875, "well above the gold export point in normal times, and still gold imports continued upon an enormous scale" (Sprague, 1910, p. 283).

<sup>32</sup> In addition, the New York Times (October 26, 1907, p. 2.) reports that "actual cash was brought to many Stock Exchange houses for investment yesterday. Members of Stock Exchange houses said yesterday that they recall no time when they received so much cash in their offices to be invested." The quotation potentially reflects as well that hoarded cash was being returned to the brokerage houses.

Specifically, U.S. corporate bond indentures at the time specified important aspects of bond issues, including (1) the form of bond coupon and principal payments, which was commonly specified through gold clauses, (2) the location of these payments, which facilitated payment in specie even when bank deposit convertibility was suspended, (3) the bearer or registered form of the security, where the bearer form could be readily transferred among exchanges. In addition, many U.S. bond and stock issues were traded on European as well as the U.S. exchanges. These contractual features and trading arrangements were an important aspect of the historic international gold standard that has not been previously examined, and which added elasticity to the otherwise inelastic U.S. money supply.

As our results show, these contractual features served to (1) increase the potential liquidity of trading in American securities, (2) integrate these securities into the international securities markets, and (3) reduce the systemic risk exposure of the U.S. securities markets to the banking crises that tended to characterize the National Banking era. As well, significant arbitrage opportunities arose during the panic months of 1907, which likely resulted in increased gold flows into the U.S.

In addition, while the U.S. securities markets were integrated with international exchanges, the linkages with the U.S. banking sector were minimal enough to prevent the systematic spillover of the banking problems of 1907. The strongest link between the U.S. banking and securities markets occurred through the call loan market. The New York City clearing banks, in particular, funneled their excess reserves into the call loan market due to the liquidity it provided. While the suspension of convertibility served to protect liquid funds within the banking industry, the resulting panic depressed security prices, which served to attract investment flows from Europe, which then helped to reliquefy the U.S. economy and ease the conditions leading to the bank suspension.

Ultimately, our analysis indicates that foreign market trading in American railroad securities provided liquidity for the U.S. securities market, which served to promote a monetary expansion to ease the panic conditions of 1907. First, an analysis of the foreign press coverage of American railroad securities revealed that those American railroad bonds that were followed by the foreign press

in London, Amsterdam and Frankfurt showed the largest gains in U.S. trading volume, which further suggests the involvement of foreign investors in the New York market.

In addition, Sprague (1910, p. 316) estimates that of the \$90,000,000 increase in the gold supply in November and December of 1907, \$70,000,000 was attributable to a surplus of merchandise exports over imports, leaving \$20,000,000 of the gold supply increase unexplained. Of the remaining \$20,000,000, \$8,000,000 was related to the shipment of gold by the Bank of France to selected U.S. investment banking houses in exchange for commercial paper obligations, leaving \$12,000,000. Our results suggest that the increased trading volume in U.S. railroad securities in the New York market during November and December, 1907 may have provided a plausible source for the remaining \$12,000,000 of gold imports that were left unidentified by the National Monetary Commission in 1910.<sup>33</sup>

In this case, the foreign trading of U.S. securities in Europe provided a source of support for the U.S. securities markets. The gold flows resulting from the settlement of foreign purchases of U.S. securities added to the monetary expansion underway in the U.S. to resolve the 1907 crisis. In addition, the gold flows resulting from the security arbitrage occurred earlier in the fall of 1907 than the gold inflows expected in payment for the U.S. crop exports. Therefore, the security market arbitrage provided gold inflows that helped to elasticize the otherwise inelastic U.S. money supply. In summary, the security arbitrage served to moderate the depth and shorten the length of the Panic of 1907, by attracting gold inflows during the period before payment for exports had fully re-inflated the U.S. money supply.

## REFERENCES

Andrew, Abram Piatt. 1910. *Statistics for the United States 1867–1909*, United States National Monetary Commission.

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<sup>33</sup> Weekly dollar volume of bond trading was calculated as the sum of the weekly trade volume multiplied by \$1,000 par value times the price for each bond issue listed in the *Commercial and Financial Chronicle* for 1907. Only railroad bonds were included since these tend to be the most liquid issues.

- Biais, Bruno and Richard C. Green. 2007. "The Microstructure of the Bond Market in the 20th Century." Working paper.
- Chamberlin, David C., Sr. 1905. "The Loan Market," chapter VI in *The New York Stock Exchange, Its History, Its Contribution to the National Prosperity, and Its Relation to American Finance at the Outset of the Twentieth Century*, vol. I, ed. Edmund C. Stedman, New York: New York Stock Exchange Historical Company.
- Dewey, Stoddard. 1908. "The Year in France," *The Atlantic Monthly Magazine*, Vol. 102, p. 235. Cambridge, Mass.: Riverside Press.
- Facciolo, Francis J. 2005. "A Broker's Duty of Best Execution in the Nineteenth and Early Twentieth Centuries." *Pace Law Review* 26, no. 1: 155–182.
- Flandreau, Marc. 1997. "Central Bank Cooperation in Historical Perspective: A Skeptical View." *Economic History Review* 50: 735–763.
- Flandreau, Marc, and Nathan Sussman. 2004. "Old Sins: Exchange Rate Clauses and European Foreign Lending in the 19th Century." Discussion Paper No. 4248, Center for Economic Policy Research.
- Friedman, Marc, and Anna J. Schwartz. 1963. *A Monetary History of the United States, 1867–1960*. Princeton University Press. Princeton, N.J.
- Gallorotti, Giulio M. 2005. "Hegemons of a Lesser God: The Bank of France and Monetary Leadership under the Classical Gold Standard." *Review of International Political Economy* 12, no. 4: 624–646.
- Griffiss, Bartow. 1925. "The New York Call Money Market." Ph.D. dissertation, Johns Hopkins University.
- Holzer, Henry M. 1980. *The Gold Clause*. Lincoln, Nebraska: iUniverse.
- Michie, Ranald C. 1986. "The London and New York Stock Exchanges, 1850–1914." *The Journal of Economic History* 46, no. 1: 171–187.
- Morgan, John P. 1882–1933. *Syndicate Books*. unpublished archives, J.P. Morgan Library, New York.
- Neal, Larry. 1985. "Integration of International Capital Markets: Quantitative Evidence from the Eighteenth to Twentieth Centuries." *The Journal of Economic History* 45, no. 2: 219–226.
- Noble, Henry G. S. 1915. *The New York Stock Exchange in the Crisis of 1914*. Garden City, New York: The Country Life Press.



- Odell, Kerry, and Marc Weidenmier. 2004. "Real Shock, Monetary Aftershock: The 1906 San Francisco Earthquake and the Panic of 1907." *The Journal of Economic History* 64, no. 4: 1002–1027.
- Patron, Maurice. 1910. *The Bank of France in Its Relation to National and International Credit*. Washington, D.C.: National Monetary Commission.
- Patterson, E. L. Stuart. 1917. *Domestic and Foreign Exchange*. New York: Alexander Hamilton Institute.
- Poor, Henry V. 1908. *Manual of the Railroads of the United States, 1907*. New York: H.V. and H.W. Poor.
- Seltzer, Lawrence H. and Seward L. Horner. 1922. "The Relation of the Percentage of Bank Reserves of National Banks in New York City to the Call Money Loan Rate on the New York Stock Exchange." *Journal of Political Economy* 30: 108–118.
- Silber, William. 2007. *When Washington Shut Down Wall Street: The Great Financial Crisis of 1914 and the Origins of America's Monetary Supremacy*. Princeton N.J.: Princeton University Press.
- Sprague, Oliver M. W. 1910. *History of Crises under the National Banking System*. Washington, D.C.: National Monetary Commission.
- Straus, Isador. 1908. "Causes of the Present Business Situation." *Annals of the American Academy of Political and Social Science* 32: 50–54.
- Sylla, Richard. 1998. "U. S. Securities Markets and the Banking System, 1790–1840." *Review*, St. Louis: Federal Reserve Bank of St. Louis.
- Tallman, Ellis W. and Jon R. Moen. 1990. "Lessons from the Panic of 1907." *Economic Review* 75: 2–13.
- . 2003. "The Call Loan Market in the U.S. Financial System Prior to the Federal Reserve System." Federal Reserve Bank of Atlanta Working Paper 2003–43.
- . 2010. "Liquidity Creation Without a Lender of Last Resort: Clearinghouse Loan Certificates in the Banking Panic of 1907." Revision of Federal Reserve Bank of Atlanta Working Paper No. 2006–23.
- Thies, Clifford F. 2005. "Gold Bonds and Silver Agitation," *The Quarterly Journal of Austrian Economics* 8, no. 4: 67–86.
- . 2009. "The Economics of Depression Scrip." *Mises Daily*. June 30, 2010.
- White, Horace G. 1940. "Foreign Trading in American Stock-Exchange Securities," *The Journal of Political Economy* 48, no. 5: 655–702.