

**Real Shock, Monetary Aftershocks:  
The San Francisco Earthquake and the Panic of 1907**

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*Abstract*

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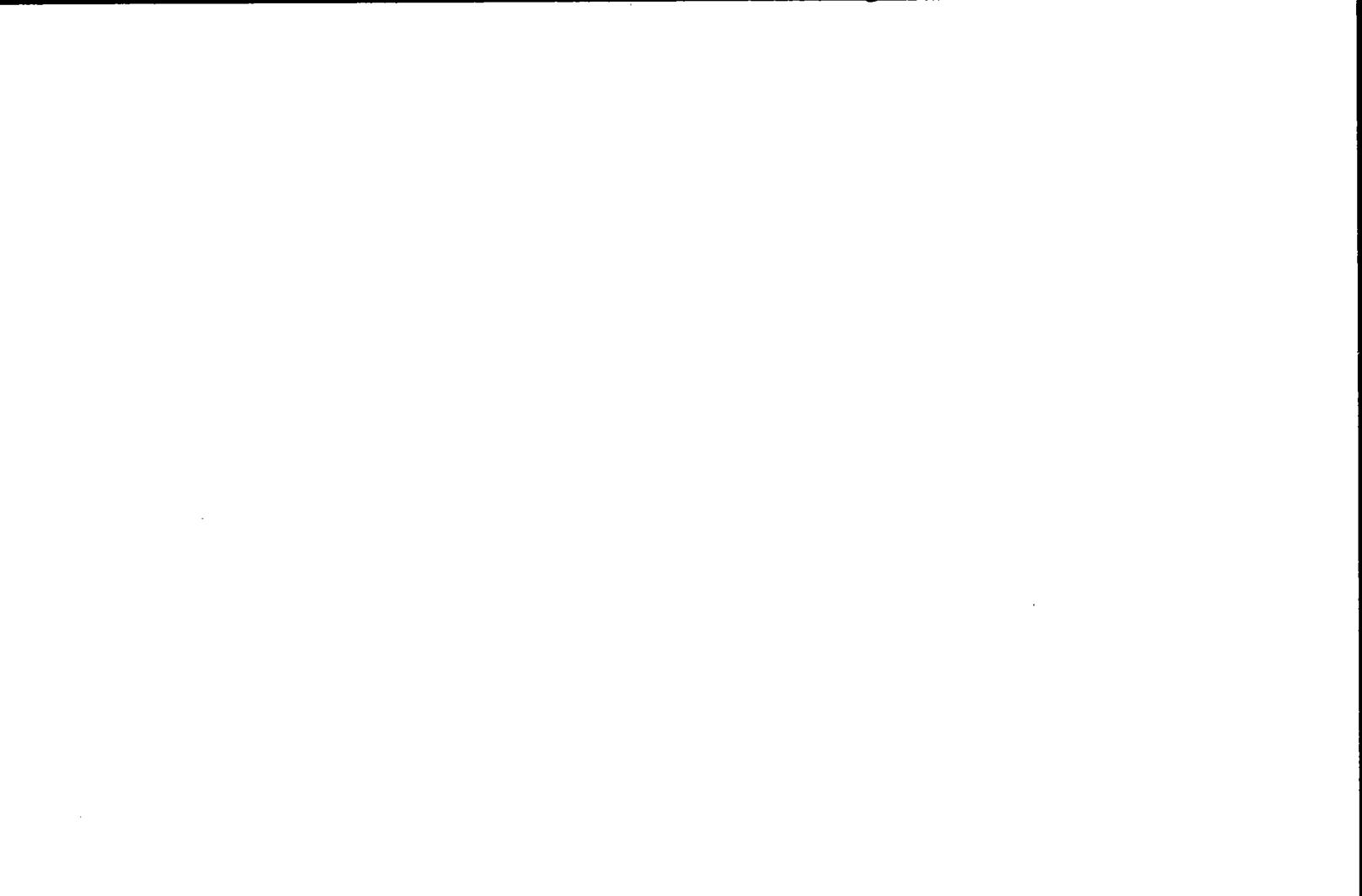
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While economics has a large theoretical literature explaining the interaction between the real and monetary sectors of an economy, empirical evidence on the relationship is less clear. Endogeneity between the two sectors makes it difficult to identify the effects of shocks in vector autoregressions and calibration exercises.<sup>1</sup> This paper takes advantage of a natural experiment created by the 1906 San Francisco earthquake and fire to examine the effects of an exogenous real shock on financial and money markets as well as the response by a central bank. While recent disasters such as Hurricane Andrew in 1992 and the terrorist attacks on the World Trade Centers incurred property damage of about 1 percent of U. S. GDP, the costs of the San Francisco catastrophe were substantially higher (*Wall Street Journal*, October 9, 2001).<sup>2</sup>

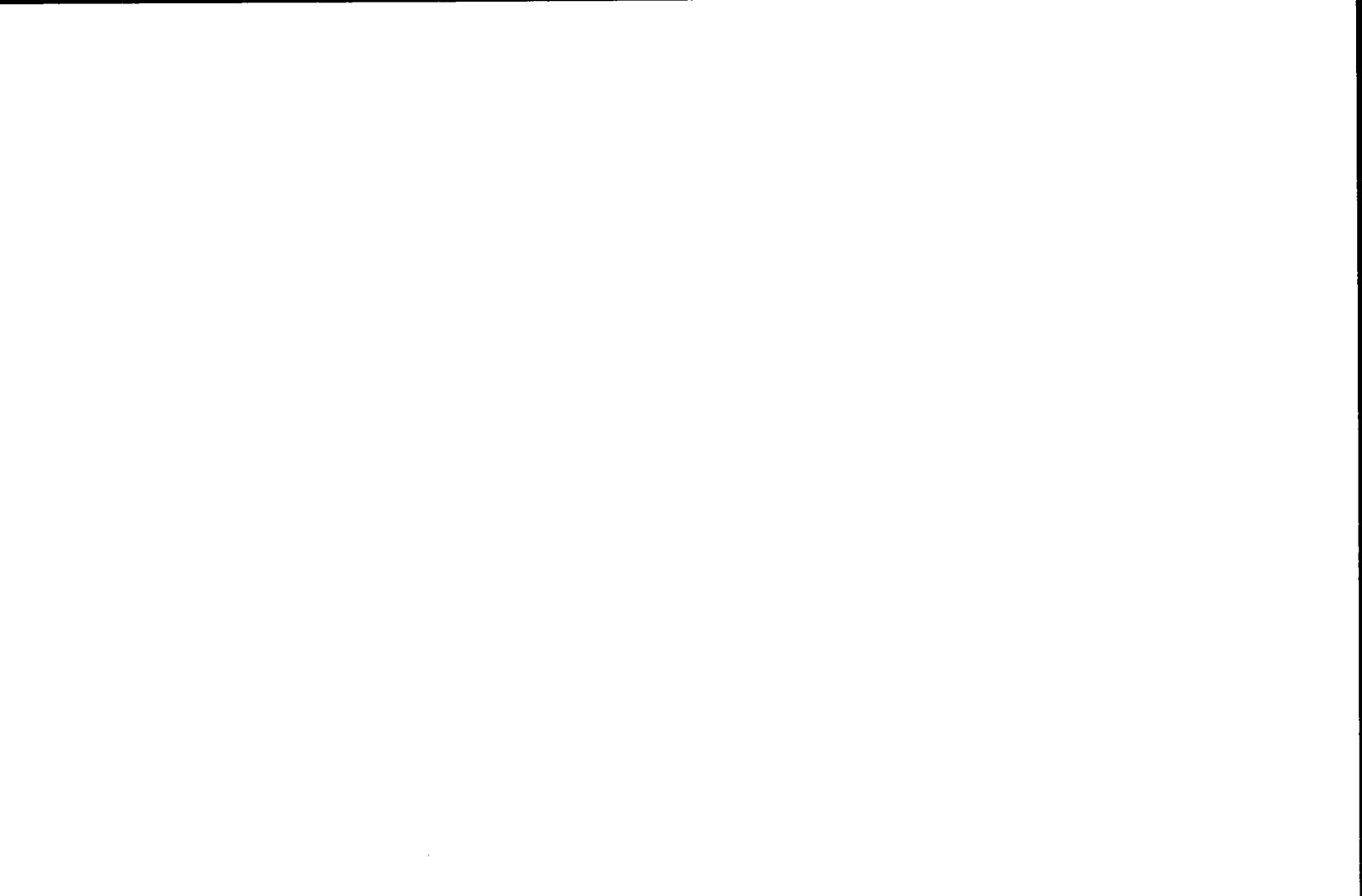
Damage from the San Francisco earthquake and fire of April 1906 was estimated to be between \$350- \$500 million, or 1.3 to 1.8 percent of U. S. GNP in 1906;<sup>3</sup> large amounts of relief flowed into the city in the weeks immediately following the disaster. Because British companies



most severe recessions in American history (Friedman and Schwartz, [1963]). Thus primed for a financial crisis, already-weakened world markets crashed in October 1907 with the collapse of the Knickerbocker Trust Company in New York. Ultimately, the Panic of 1907 led to one of the most important institutional changes in American history: the creation of the Federal Reserve System designed to provide for an elastic currency and to act as a lender-of-last resort.

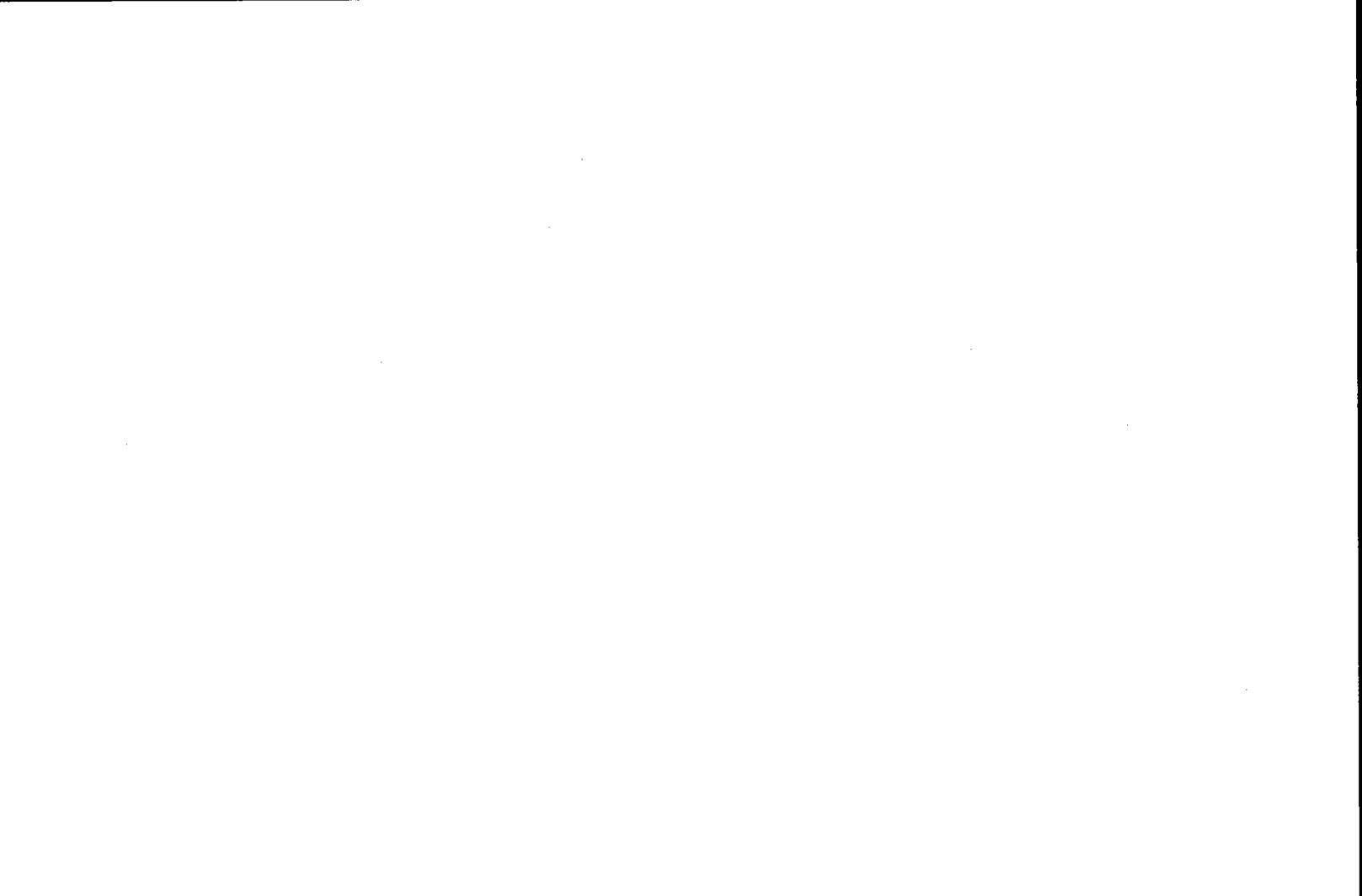
## **I. Background**

The Panic of 1907 was a watershed event for the United States. This was the last in a series of financial crises during the National Banking Era that prompted reform of the American financial system. Troubled by recurring financial panics and the economic distress that resulted, Congress established the National Monetary Commission to consider whether there was a role



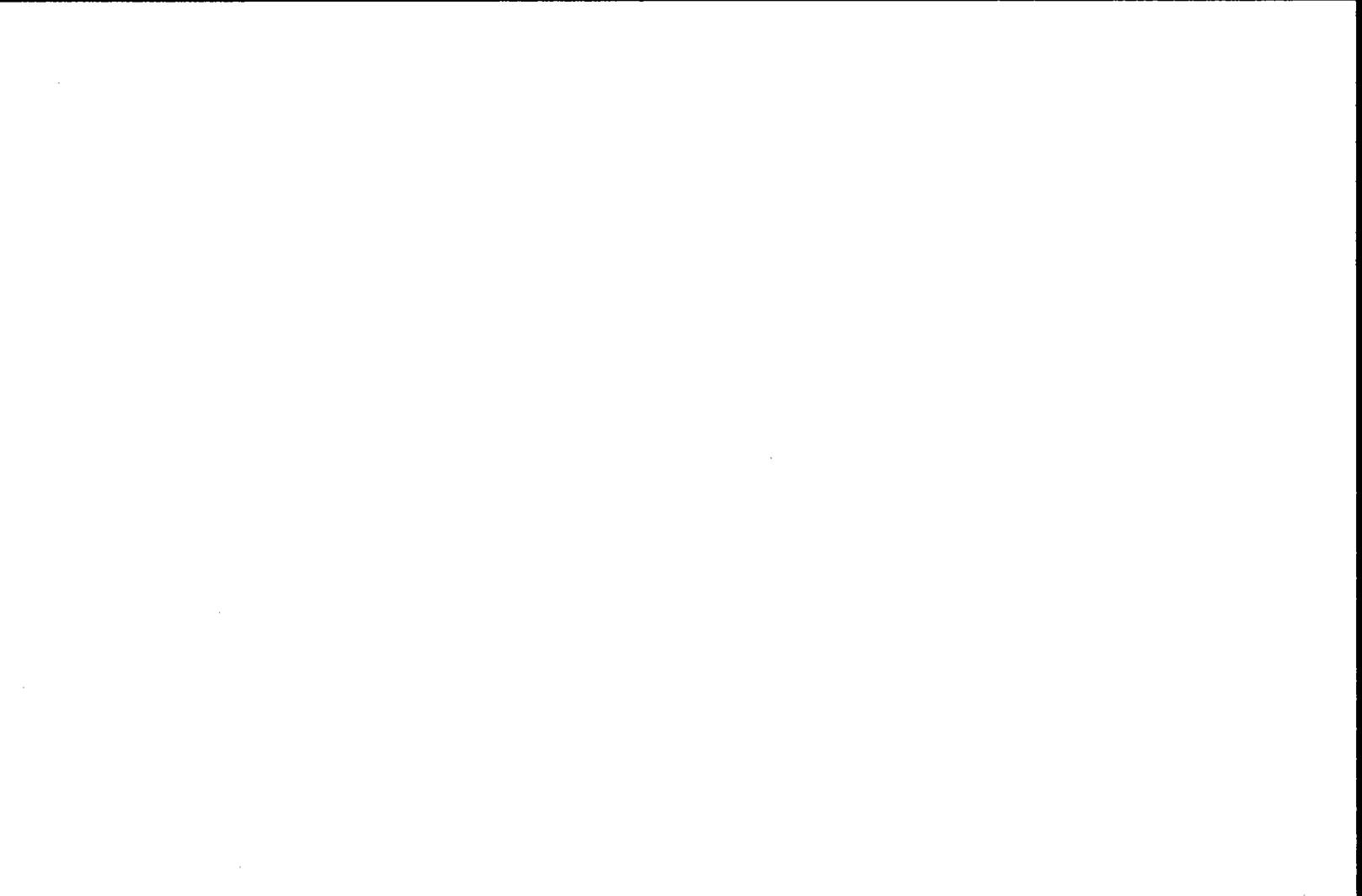
Treasury and, more importantly, of the Bank of England exacerbated the liquidity crisis, making American and world financial markets vulnerable to shocks that otherwise would have been temporary in nature. Markets finally collapsed in October 1907 with a run on New York's Knickerbocker Trust Company. We will briefly discuss some of the factors that contributed to the tightness in the London and New York money markets and their role in propagating the financial crisis. The accompanying timeline, Figure I, summarizes key events leading up to the Panic.

O.M. Sprague, writing on behalf of the National Monetary Commission, traces tight credit conditions in 1906 to New York (Sprague, [1910]). He notes that the United States experienced surges of gold imports between April and May, and again between September and October. As shown in Figure II, the United States imported over \$50 million in the spring and approximately \$80 million in the late summer and early fall. Sprague attributes the first wave of



October 19. As shown in Figure III, the Bank held the discount rate constant for the remainder of 1906 and then subsequently lowered it in early 1907. This would seem to indicate an easing of credit conditions in England. On the contrary, the Bank of England had, in effect, closed down credit facilities with American firms when it raised the discount rate in the autumn of 1906: the central bank threatened joint stock companies with a 7 percent rate on money if they did not stop discounting U. S. finance bills, credit instruments used to borrow overseas in anticipation of profit from exchange rate fluctuations. The actions practically cut off gold exports to the United States. As shown in Figure IV, England reversed its position from a net gold exporter to a net gold importer. England successfully defended the dollar/sterling exchange rate, but at what cost?

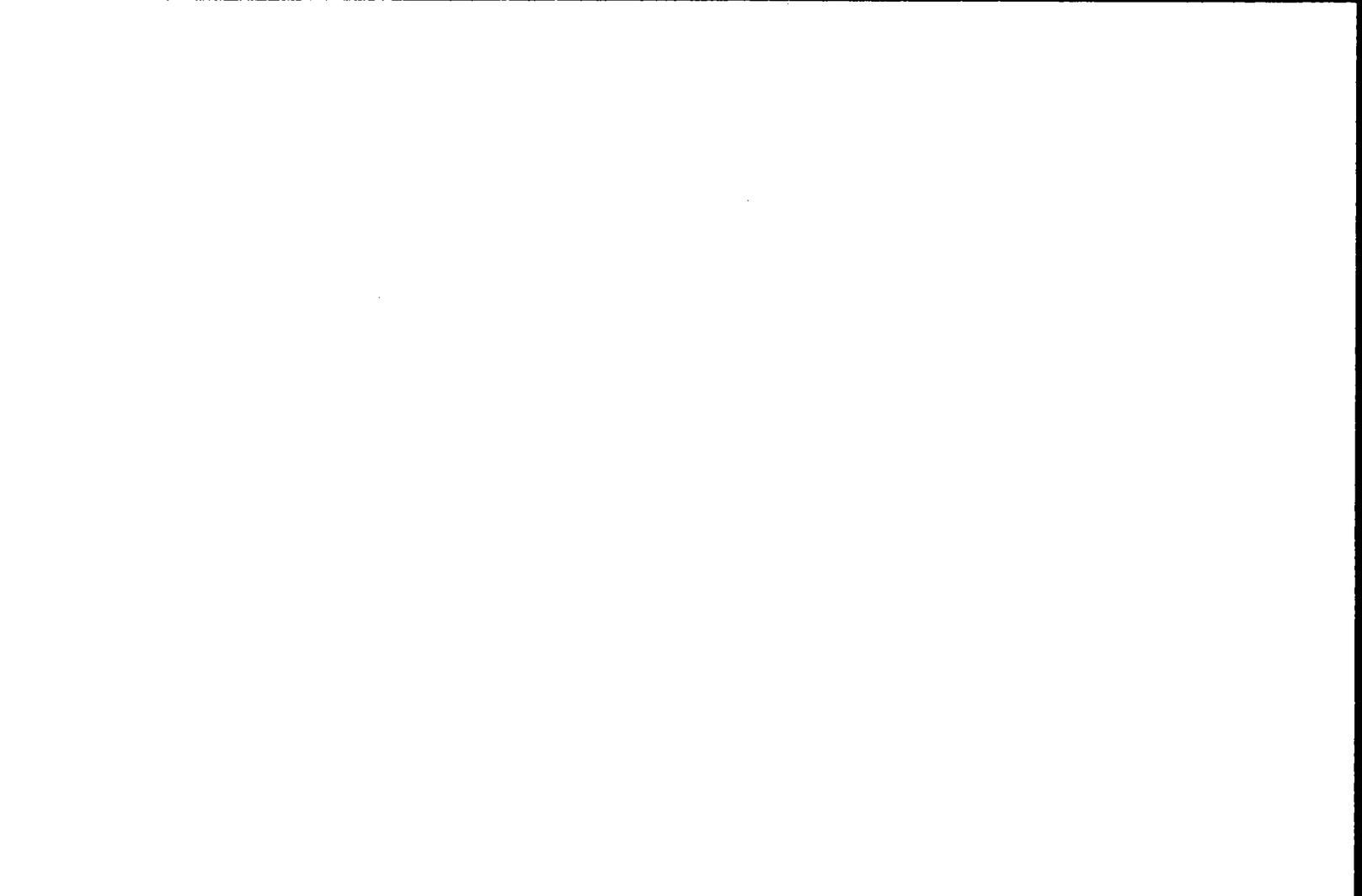
Friedman and Schwartz [1963] argue that the Bank of England's policy toward American finance bills altered the normal course of gold arbitrage and pushed the United States into recession. Typically, American banks and trust companies drew finance bills payable in pound



the export of nearly \$30 million in gold from the United States in the summer of 1907 (Moen and Tallman, [1990]; Tallman and Moen, [1998]).

The New York money market entered the fall of 1907 low on cash reserves and primed for a panic. On Tuesday, October 22, New York's second largest trust company, Knickerbocker, experienced a run following news that the firm was in financial trouble. A day later, panic-stricken depositors ran on two other large trust companies, followed by several national banks. Within a few weeks, the panic spread to other regions of the United States.

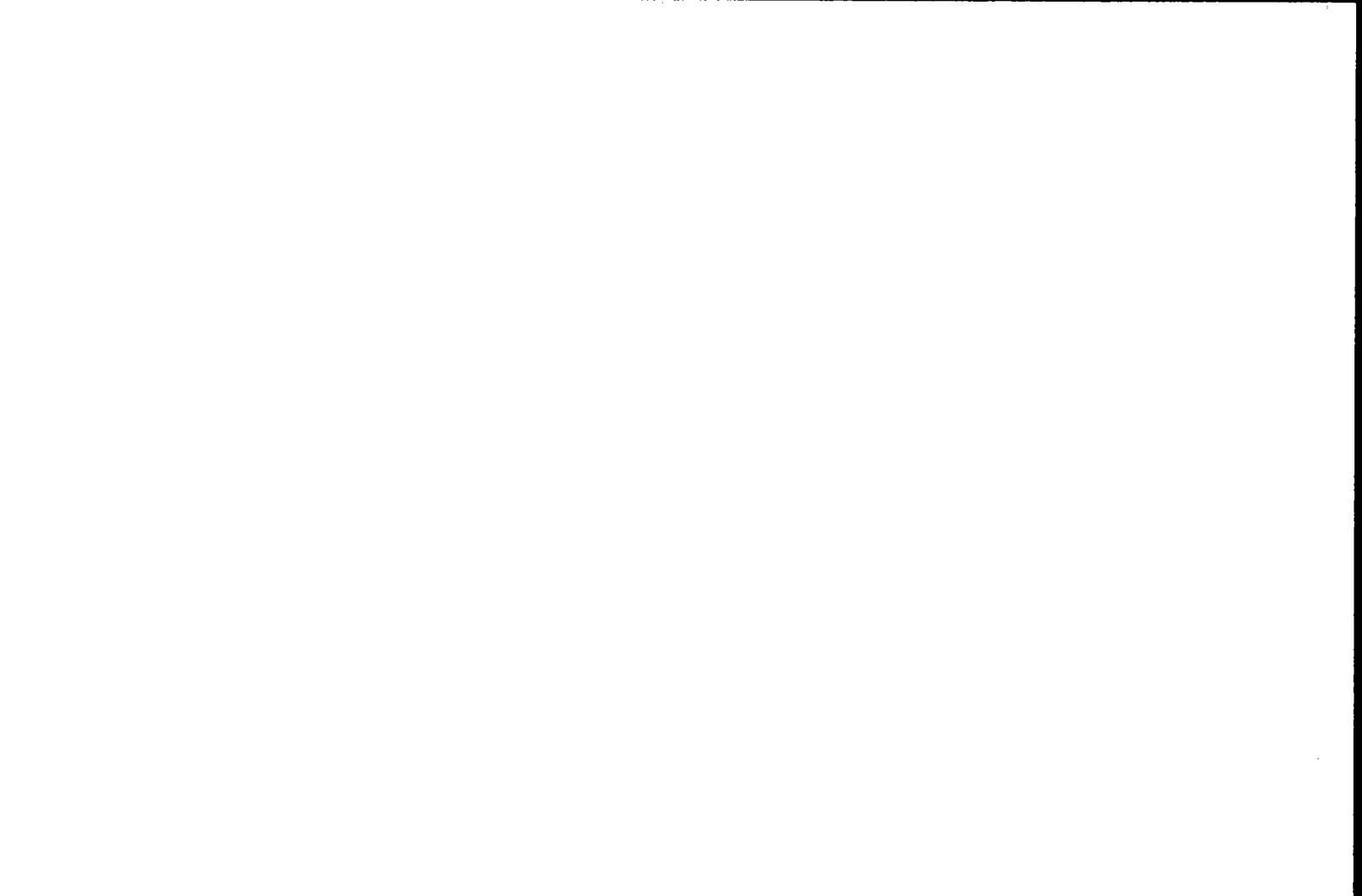
Several measures were taken to contain the crisis. The New York Clearinghouse Association issued loan certificates, a money substitute used to clear accounts between banks. Clearinghouse loan certificates artificially increased the money supply and freed up currency for depositors who demanded cash. Federal aid came in the form of public funds deposited by the U.S. Treasury at key New York City banks, and J. P. Morgan formed a money pool with bankers



of the U.S. Treasury and the Bank of England in propagating the Panic of 1907. These studies, however, have overlooked the role of the San Francisco earthquake in the financial crisis. In this paper, we utilize data from contemporary newspapers as well as internal documents from British insurance companies to examine the effects of the quake on American and world financial markets.<sup>6</sup> The payment of claims by British insurance companies to policyholders in San Francisco holds the key to understanding the shock that prompted defensive actions by the Bank of England and the chain of events that culminated in the Panic of 1907.

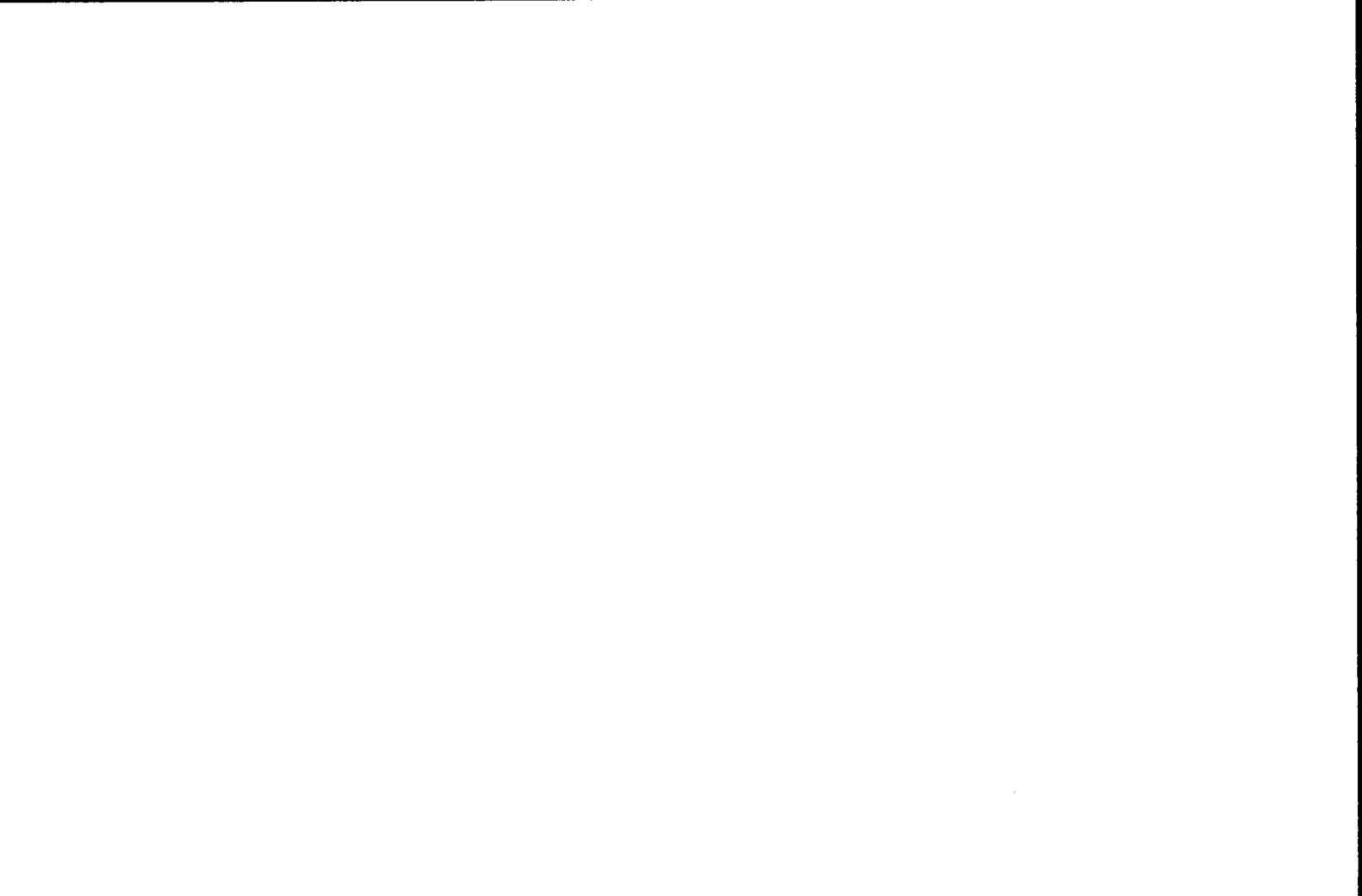
## **II. The Setting**

By the time the transcontinental railroad was completed in 1869, San Francisco had already established itself as the center for export trade from the Pacific Coast region. Endowed



[1922]). By 1890 in California, there were 127 American fire insurance firms, each underwriting an average of \$13.5 million in risks. On the other hand, there were 52 foreign firms (more than half of which were British), each of whom underwrote \$23.5 million in risks; nearly 27% of California term fire insurance policies were carried by British companies. In fact, the fire insurance company writing the most policies in California was Liverpool & London & Globe, with total risks of \$173 million. In comparison, 28% of all fire insurance policy risks in New York were underwritten by foreign firms, while in Illinois foreign companies insured less than twenty percent of the value of all risks (United States Census, [1891]).

Twenty-five years later, these patterns persisted. At the end of 1905, slightly more than half of insured risks were underwritten by American firms, with almost forty percent of business still carried by foreign firms, most of whom were based in Britain. On the other hand, California-based firms were writing only seven percent of fire insurance business in the state (Kirschner,

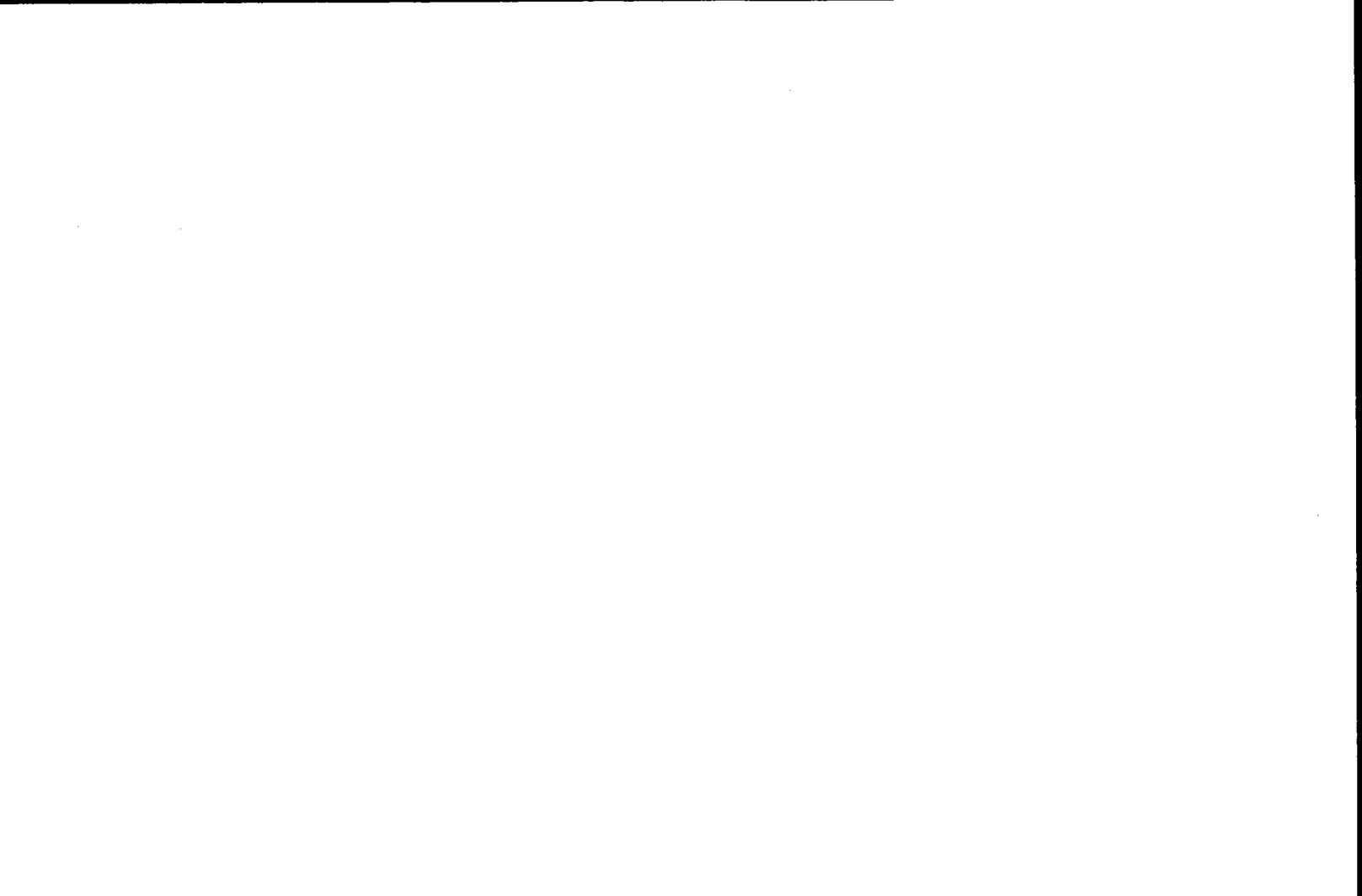


### **III. The Disaster**

On Wednesday, April 18, 1906, an earthquake of Richter magnitude 8.3 hit San Francisco. Most of the damage was not done by the tremor itself (which was especially severe in areas of landfill where liquefaction occurred) but by the fires that followed. The majority of the city's buildings had been made of wood; this material was far more plentiful and inexpensive than brick, thanks to the city's central place in the coastal lumber trade. The combination of close quarters, highly flammable building materials, and earthquake-damaged water mains hampered the efforts of firefighters. Ultimately more than four square miles -- about half of the city -- were destroyed. Although fewer than 1,500 of the city's 375,000 residents were killed, damage was estimated at between \$350 million and \$500 million (*Commercial and Financial*



<u>Company</u>	<u>Value of San Francisco Policies in Effect (\$)</u>	<u>Estimated Losses (\$)</u>
Alliance	3,526,220	1,758,686
Atlas (& subsidiaries)	6,790,000	2,757,957
Caledonian and Cal.-American	5,457,727	1,521,064
Commercial Union and Palatine	7,802,722	4,116,281
Law Union	2,205,290	1,368,460
Liverpool and London and Globe	4,850,000	3,998,000
London Assurance	7,668,471	4,016,471
London and Lancashire and Orient	9,662,291	4,229,721
North British	4,021,943	3,012,500
Northern	4,238,646	2,063,926
Norwich Union	2,716,097	750,030
Phoenix and Pelican	5,000,948	2,808,313
Royal and Queen	9,044,050	5,787,776
Royal Exchange	5,518,342	2,639,564
Scottish Union and National	2,013,185	1,300,000
Sun	3,122,091	1,651,666
Union	<u>4,238,775</u>	<u>2,345,420</u>
TOTAL	87,877,678	46,125,835



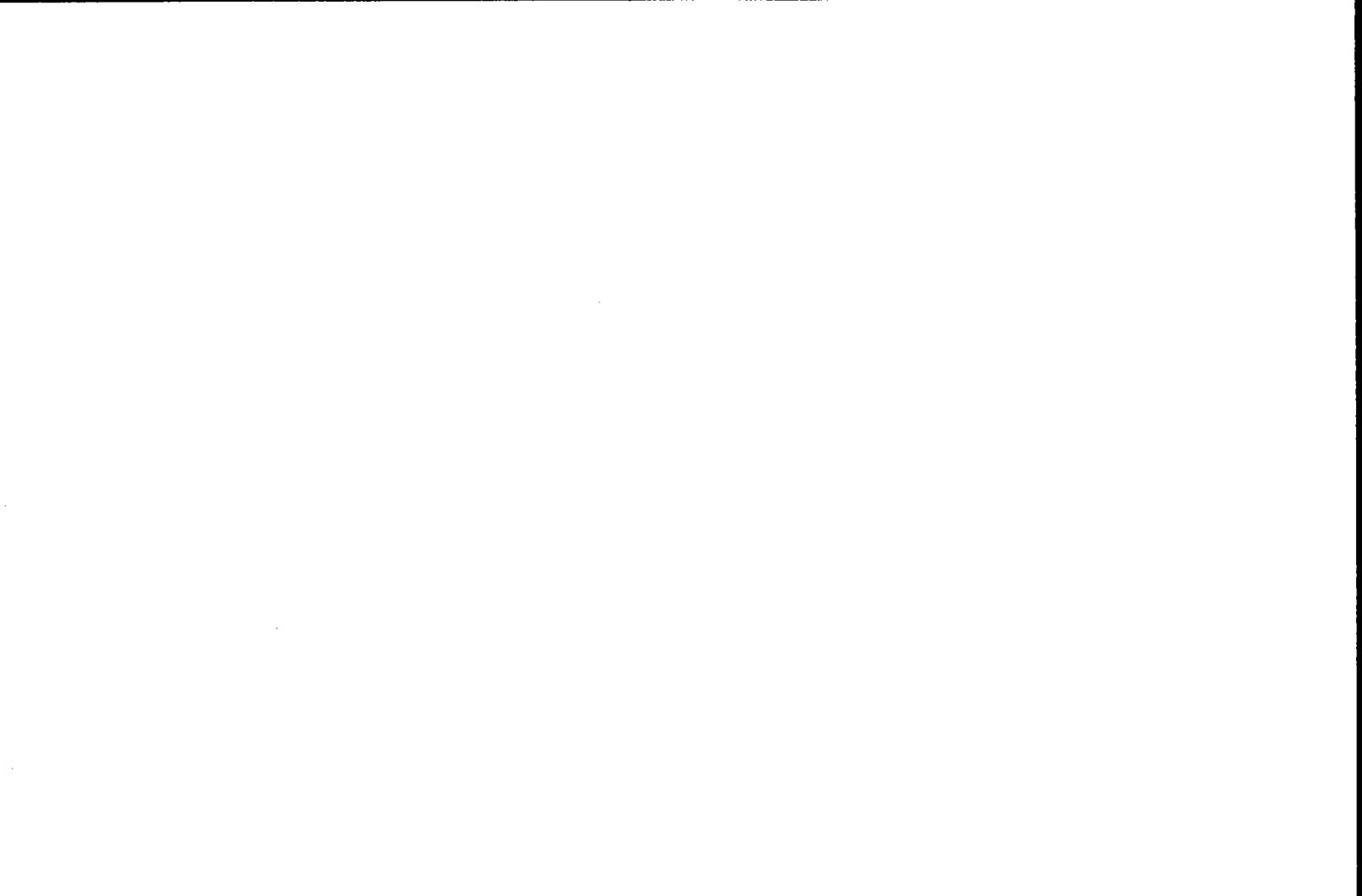
pay out such claims:

Under any circumstances, the British insurance offices will pay only losses for which they are legally liable, since to go beyond their contracts would be illegal. They cannot recognize any liability for damage by earthquake where no fire ensured nor for any damage by fire to fallen or partly fallen buildings, nor for any damages to buildings pulled down or destroyed by order of the San Francisco authorities. (*Los Angeles Times*, May 4, 1906)

Reaction to these statements was met with published outrage: In one San Francisco newspaper, the editor's sarcasm was unrestrained:

To say that [insurers] will not recognize as an obligation the destruction of a building by fire, which fire was the result of an earthquake, is to take a position hardly more reputable than that of an ordinary pickpocket. (. . .)

A HIGH WIND IS AS LIKELY TO CAUSE A GENERAL CONFLAGRATION UNDER CERTAIN CIRCUMSTANCES AS AN EARTHQUAKE. THE PROPOSITION IS YET TO BE ADVANCED THAT INSURANCE COMPANIES ARE NOT LIABLE BECAUSE THE WIND BLEW

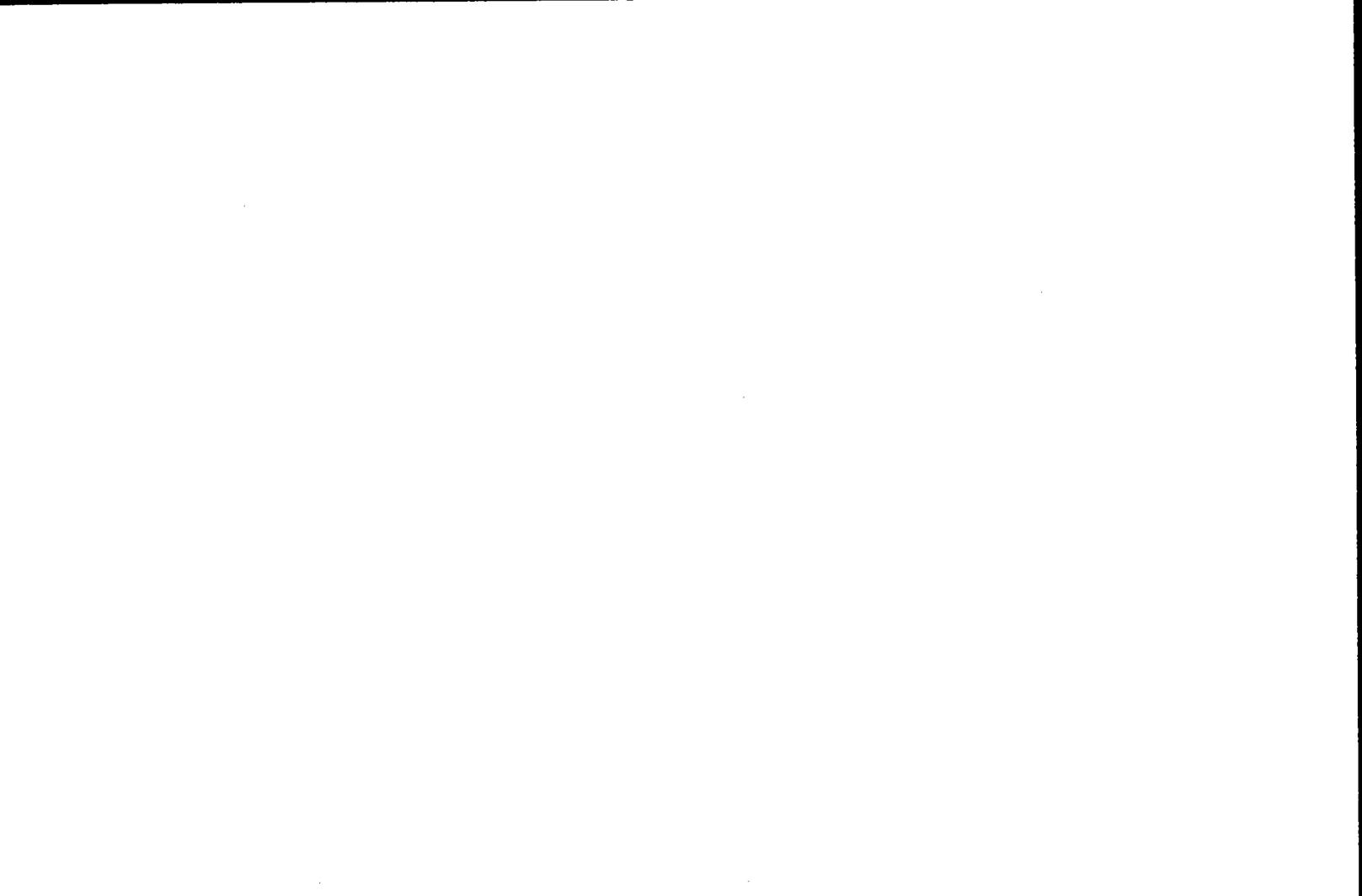


without the San Francisco disaster and the enormous liquidation of securities which it precipitated. (*New York Times*, May 3, 1906)

In essence, the earthquake had the effect of softening credit markets in the first two or three months after the disaster. As shown in Figure V, interest rates on 60-day commercial paper for both the United States and England moved very little in the weeks following the earthquake. Potential borrowers and stock speculators in the rest of the country were taking a wait-and-see attitude toward the disaster and its possible impact on economic activity. At the same time, insurance companies were liquidating stocks *in anticipation* of making payments to San Francisco.

Funds for relief and rebuilding flowed into the city quite quickly. As shown in Figure II, in late April and May of 1906, nearly \$50 million of gold poured into the United States from Germany, France, the Netherlands, and England (whose contribution amounted to \$30 million).

The *New York Times* (May 7, 1906) indicated that 80 percent of these funds were transferred to

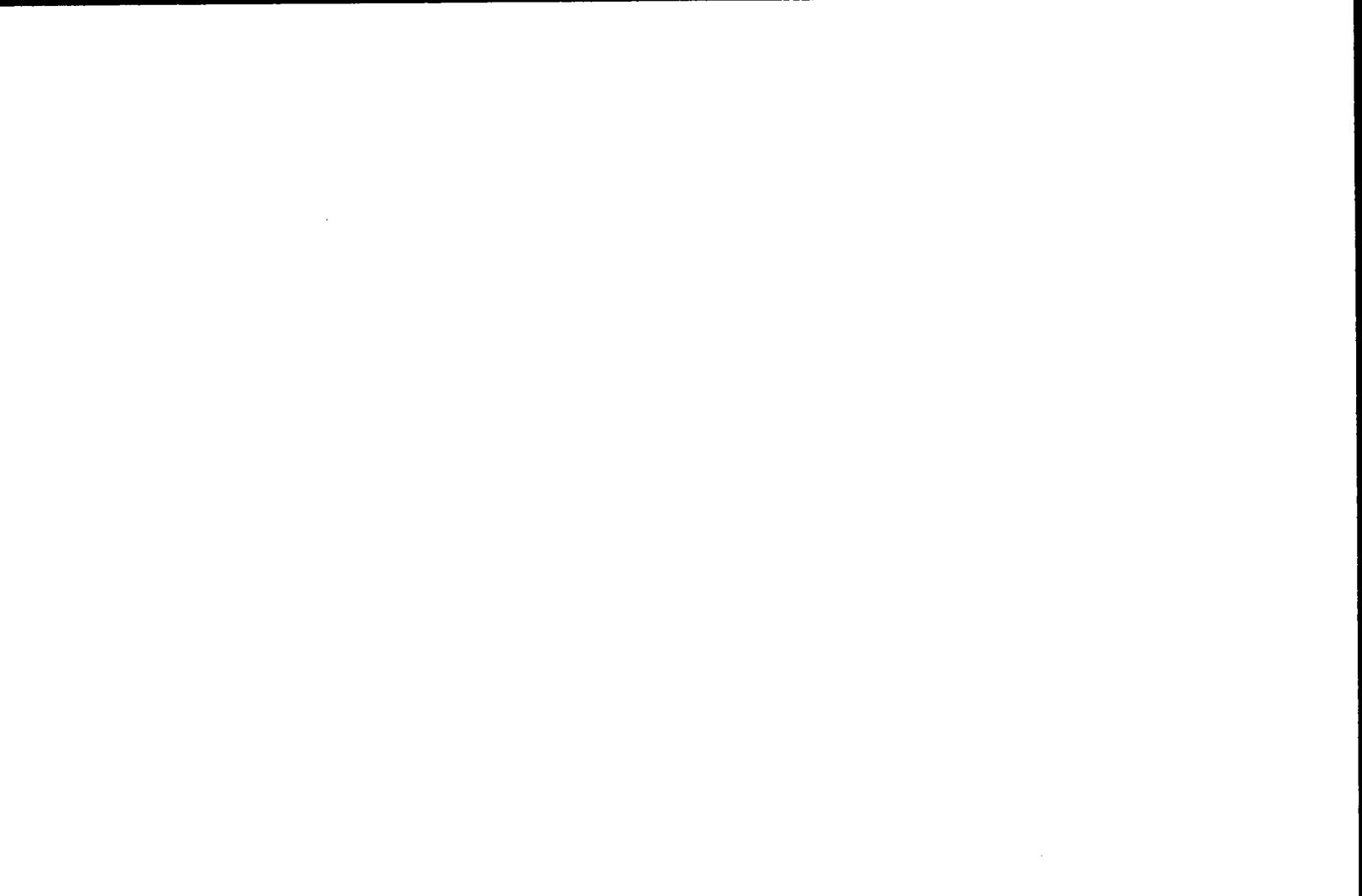


What made this all the more significant for international financial markets was the fact that most foreign insurers decided to pay claims out of "home funds" rather than reserves in the United States.<sup>9</sup> The rationale for this decision was apparently based on transactions costs and thickness of markets:

Considering that their outstanding liabilities in America have been largely curtailed by the San Francisco conflagration, it might have been thought the companies would utilise some portion of their funds there for the purpose of meeting the claims upon them. It was probably decided, however, that, in view of the magnitude of these claims, the amount that could be so obtained would be, comparatively speaking, so small that it would not be worth while going through the formalities requisite to obtain the release of the funds which are held by trustees for the company and for the American policyholders. (*Economist*, August 11, 1906)

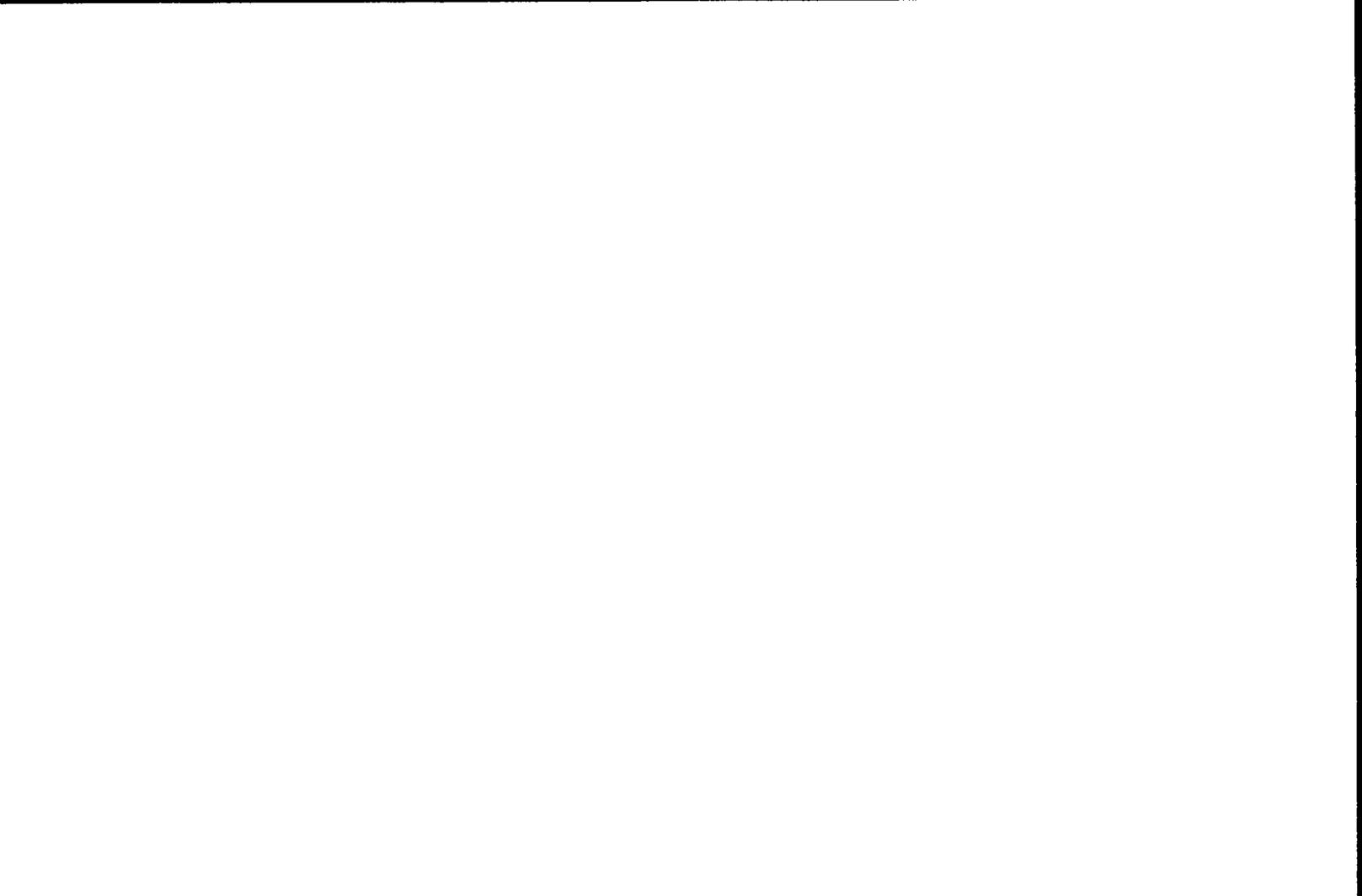
At home, the British companies were also hesitant to liquidate the securities in which they held reserves. Given the size of losses involved, such sales would undoubtedly depress stock prices.

As a consequence, a number of firms negotiated term loans with their banks and so postponed



large public outcry in San Francisco, members of the Norwich Union reconsidered their liability in the San Francisco earthquake. Legal counsel in the United States advised these British firehouses to pay claims in order to avoid possible litigation. Lawyers for the firehouses noted that British companies were likely to lose in court given that a San Francisco jury would be influenced by the “extraordinary conditions” surrounding the quake (Business Minutes of the Commercial Union Archives, May 28, 1906). Persuaded by these arguments, directors for the Norwich Union accepted liability for damage caused by the earthquake.

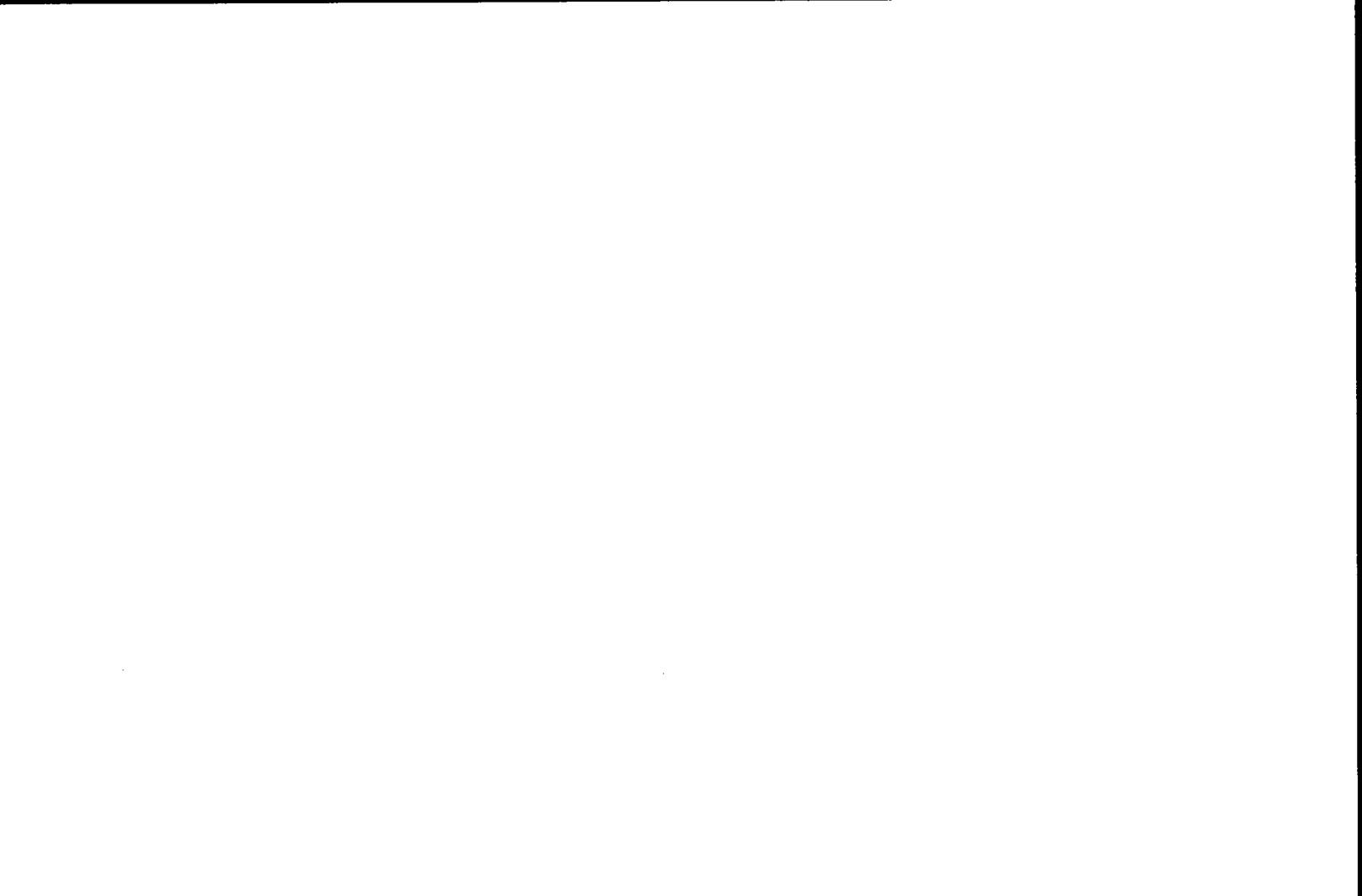
Some British firehouses met early claims by selling assets held by New York trust companies. Norwich Union, for example, liquidated its portfolio in July 1906.<sup>11</sup> In the following months, the company utilized financial bills of exchange and even borrowed from London banks to settle insurance liabilities. Consider the following cablegrams from Mr. Hare of Norwich Union:



shown in Figure VI, England exported \$30 million in gold to the United States in April and May; this was followed in September and October by a further \$35 million in specie. In total, quake-related payments to the United States represented *40 percent* of seasonally-adjusted British gold exports for all of 1906<sup>12</sup> and over 80 percent of seasonally-adjusted gold imports into the United States that year.<sup>13</sup>

Confirmation of the importance of insurance payments comes from gold imports into the port of San Francisco. Typically, the city accounted for a negligible amount of American gold imports in any given month. This was not the case in the fall of 1906, however. As shown in Figure VII, the city of San Francisco *alone* imported approximately \$11 million in the late summer and early fall of 1906. This accounted for approximately 9 percent of all seasonally-adjusted U.S. gold imports in 1906.

The magnitude of the British funds flows can be put into stark perspective by noting that



to protect their domestic gold supplies. The United States exported over \$30 million in gold during the summer of 1907. New York financial institutions entered the fall low on gold reserves and primed for a panic, and American financial markets collapsed with a run on the Knickerbocker Trust Corporation in 1907. Specie poured into the United States, draining London and other European centers of gold. An international crisis followed shortly thereafter.

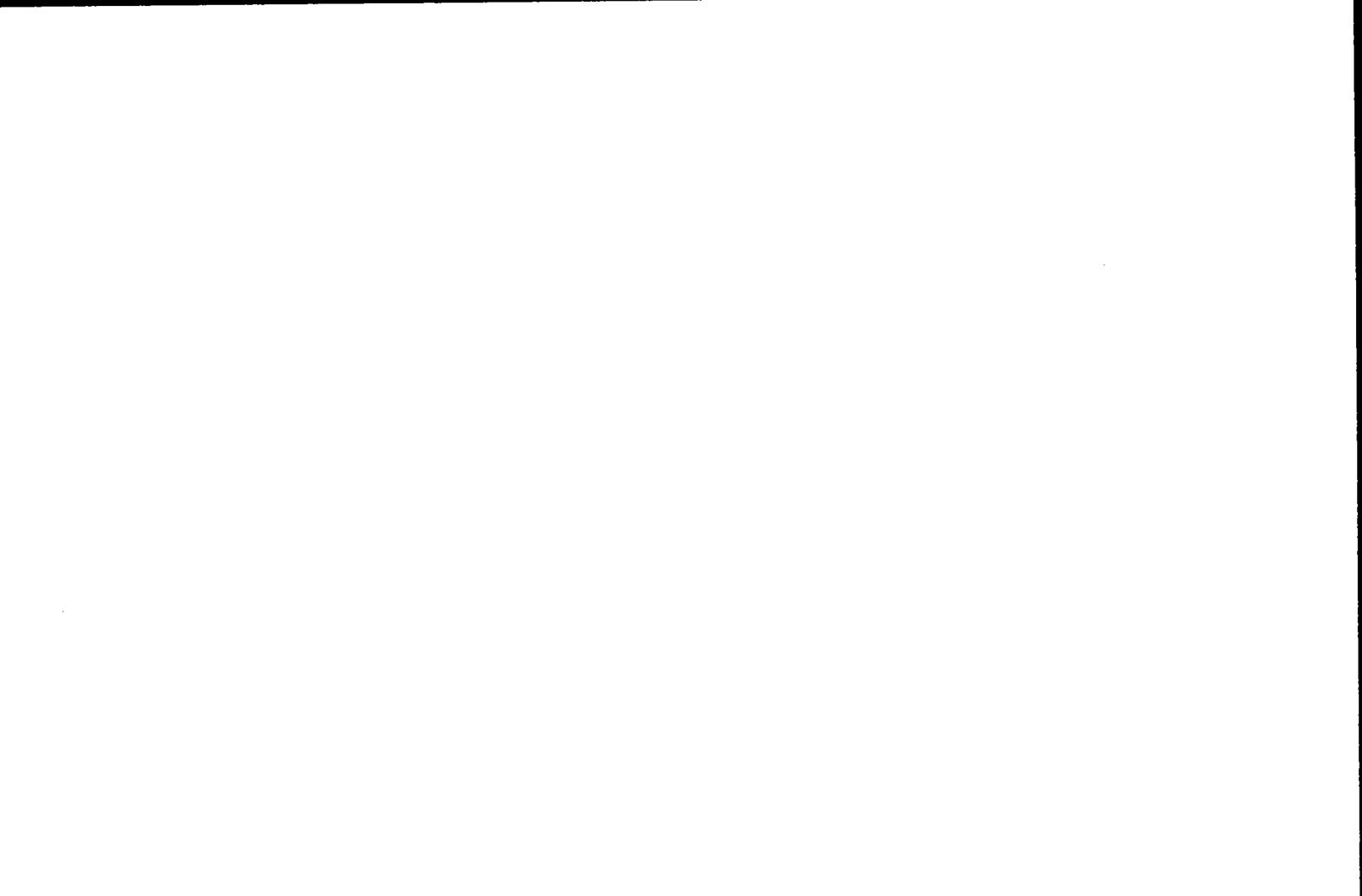
## **V. Conclusion**

Economists have developed a number of theories to explain how real shocks affect the financial and monetary sectors of an economy. Empirical evidence on the links between real and monetary shocks, however, is often difficult to uncover given the endogenous interaction of the two factors. The San Francisco earthquake, on the other hand, is an identifiable exogenous real



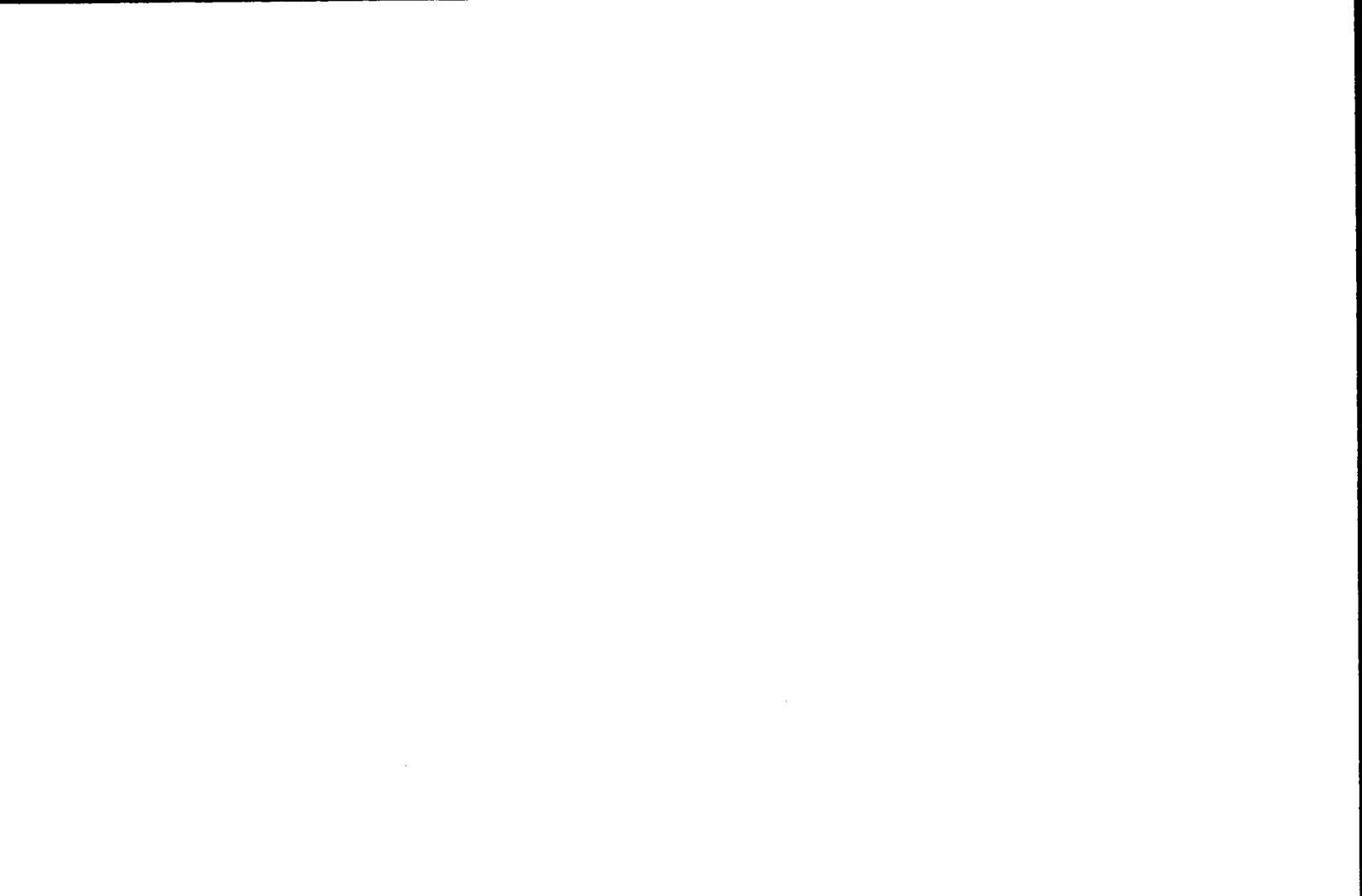
shortest, but most severe recessions in United States history and set the stage for an international financial crisis over a year later.

Historically speaking, the San Francisco earthquake was an important catalyst for reform of America's financial architecture. As noted by London's *Financial Times* of July 6, 1906, "San Francisco's \$200,000,000 'ash heap' involves complications which will be felt on all financial markets for many months to come [and] the payment of losses sustained . . . represents a financial undertaking of far-reaching magnitude. . . ." Just how far-reaching the impact of the earthquake and the following panic were can be seen in a modern monetary power: the Federal Reserve System. In response to the panic, Congress passed the Aldrich-Vreeland Act in March 1908; this authorized banks to issue emergency currency backed by commercial paper in time of crisis. More importantly, the Act also created a National Monetary Commission to investigate the American banking and financial system and to make recommendations for reform. The



## References

- Bureau of Domestic and Foreign Commerce. *Monthly Summary of Commerce and Finance of the United States*. (Washington: GPO, 1905-1908).
- Calomiris, Charles, and Gary Gorton. "The Origins of Banking Panics: Models, Facts, and Bank Regulation." In R. G. Hubbard (Ed.), *Financial Markets and Financial Crises*. (Chicago: Chicago University Press, 1991).
- Calomiris, Charles, and R. Glenn Hubbard. "Price Flexibility, Credit Availability, and Economic Fluctuations: Evidence from the United States, 1894-1909." *Quarterly Journal of Economics* CIV (1989), 429-452.
- Canova, Fabio. "The Sources of Financial Crisis: Pre- and Post- Fed Evidence." *International Economic Review* XXXII (1991), 689-713.
- Capie, F. and A. Webber. *A Monetary History of the United Kingdom, 1870-1982*. (London: George Allen and Unwin, 1985).
- Clapham, John. *The Bank of England*. Volume II. (Cambridge: Cambridge University Press, 1944).
- Clapham, John. *An Economic History of Modern Britain: Free Trade and Steel*. (Cambridge: Cambridge University Press, 1952).



*Financial Times*. London, 1906.

Friedman, Milton and Anna Schwartz. *A Monetary History of the United States 1867-1960*. (Princeton: Princeton University Press, 1963).

Goodhart, Charles E. *The New York Money Market and the Finance of Trade*. (Cambridge: Harvard University Press, 1969).

Haas, J. Eugene, Robert W. Kates, and Martyn J. Bowden, eds. *Reconstruction Following Disaster*. (Cambridge: The MIT Press, 1977).

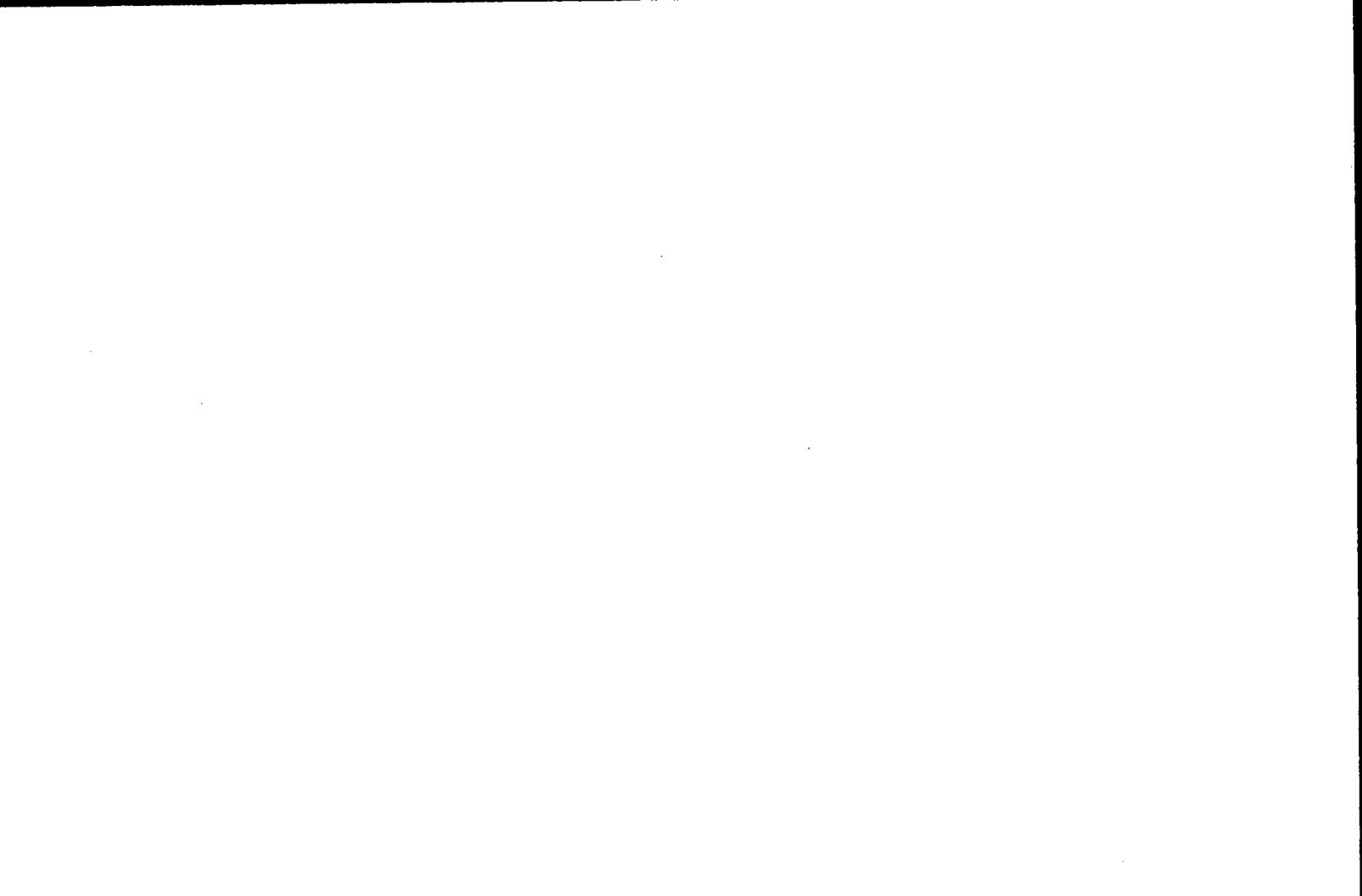
Kennedy, John Castillo. *The Great Earthquake and Fire, San Francisco, 1906*. (New York: William Morrow and Company, 1963).

Kindleberger, Charles. *Manias, Panics, and Crashes: A History of Financial Crises*. (New York: Basic Books, 1978).

Kirschner, Herbert A. *Fire Insurance Development on the Pacific Coast*. (San Francisco: Underwriters' Report, 1922).

*Los Angeles Times*, various issues.

Moen, Jon, and Ellis Tallman. "Lessons from the Panic of 1907" *Federal Reserve Bank of*



Sayers, R. S. *The Bank of England 1891-1944*. (Cambridge: Cambridge University Press, 1976).

Sprague, O.M. *History of Crises under the National Banking System*. (Washington, D.C.: National Monetary Commission, 1910).

Tallman, Ellis, and Jon Moen. "Gold Shocks, Liquidity, and the United States Economy during the National Banking Era." *Explorations in Economic History XXXV* (1998), 381-404.

Temin, Peter. "The Causes of American Business Cycles: An Essay in Economic Historiography." Federal Reserve Bank of Boston XCII (1998), 37-59.

*The Times*. London, 1905-1908.

Thomas, Gordon, and Max Morgan Witts. *The San Francisco Earthquake*. (New York: Stein and Day, 1971).

United States Bureau of the Census. *Report on Insurance Business in the United States*. Eleventh Census, Extra Census Bulletin no. 6, 1891.

United States Comptroller of the Currency. *Annual Reports*, various years.

United States Secretary of the Treasury. *Annual Report on the State of the Finances for the Fiscal Year Ended June 30, 1906*. (Washington: GPO, 1906).



## Endnotes

<sup>1</sup> Temin [1998] surveys the causes of American business cycles from 1890-1990. He discusses the endogeneity problem confronting researchers when they try to identify the effects of real and monetary disturbances.

<sup>2</sup> Neal [2000] suggests that economists should pay closer attention to the economic effects of natural disasters and climate changes.

<sup>3</sup> The GNP data are taken from Romer [1989].

<sup>4</sup> In addition to standard sources, we also searched *The Times*, *The Economist*, *The Commercial and Financial Chronicle*, and *The Financial Times* for non-U.S. factors that might account for the stringency in the London money market during 1906. These periodicals also indicated that tightness in the New York money market was the key source of both the London liquidity crisis and the large gold outflows from England. For example, in the fall of 1906, *The Economist*

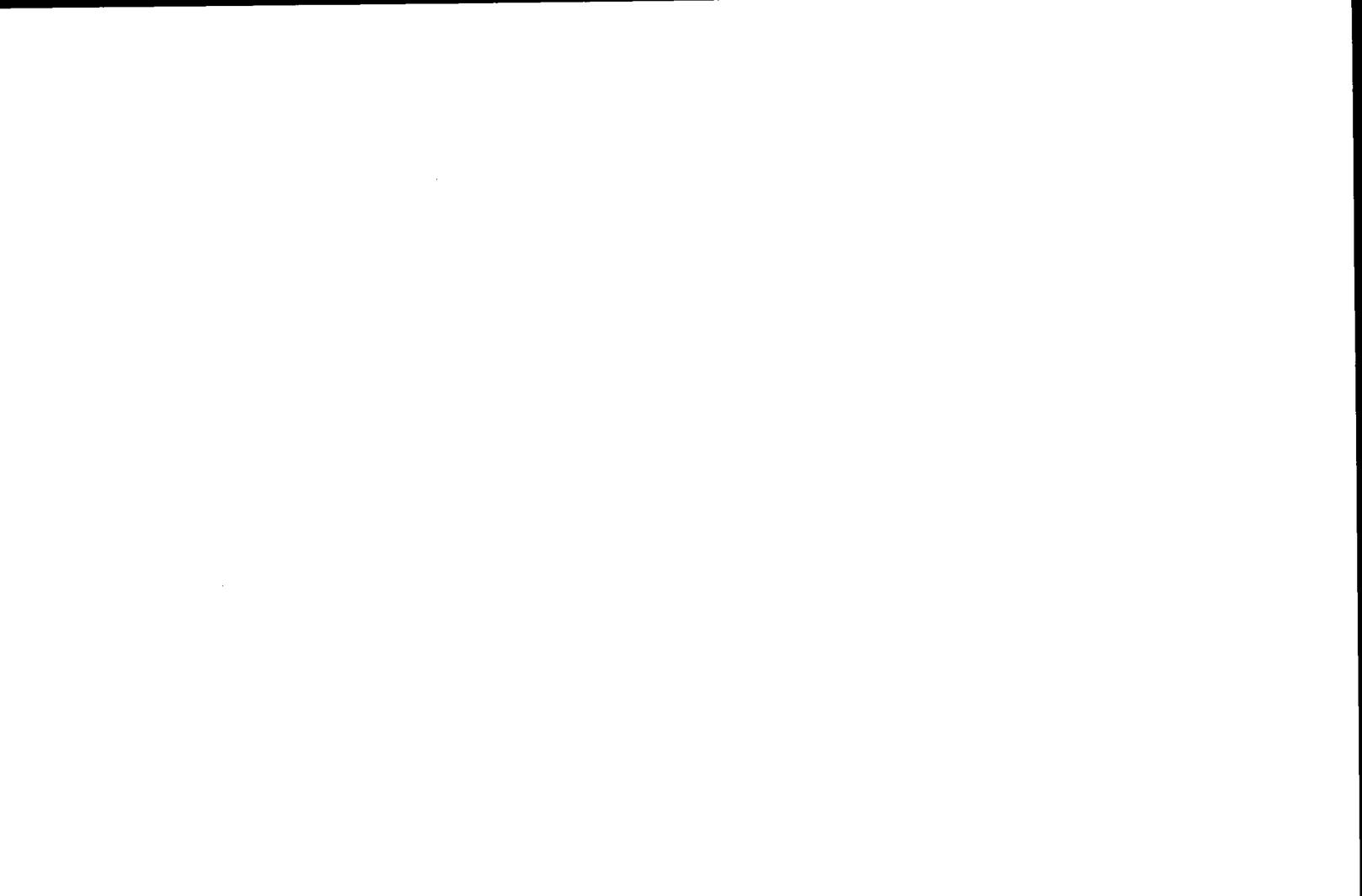


the Fed. Our analysis identifies the San Francisco earthquake and fire as the real shock that caused large gold flows and primed the New York market for the Panic of 1907.

<sup>7</sup>This was anticipated by the editor of the *Los Angeles Times* who wrote, on May 1, that "It is going to tax the ability, not only of the United States, but of the civilized world under existing circumstances, to finance the enormous project of rebuilding the city of San Francisco. . . ."

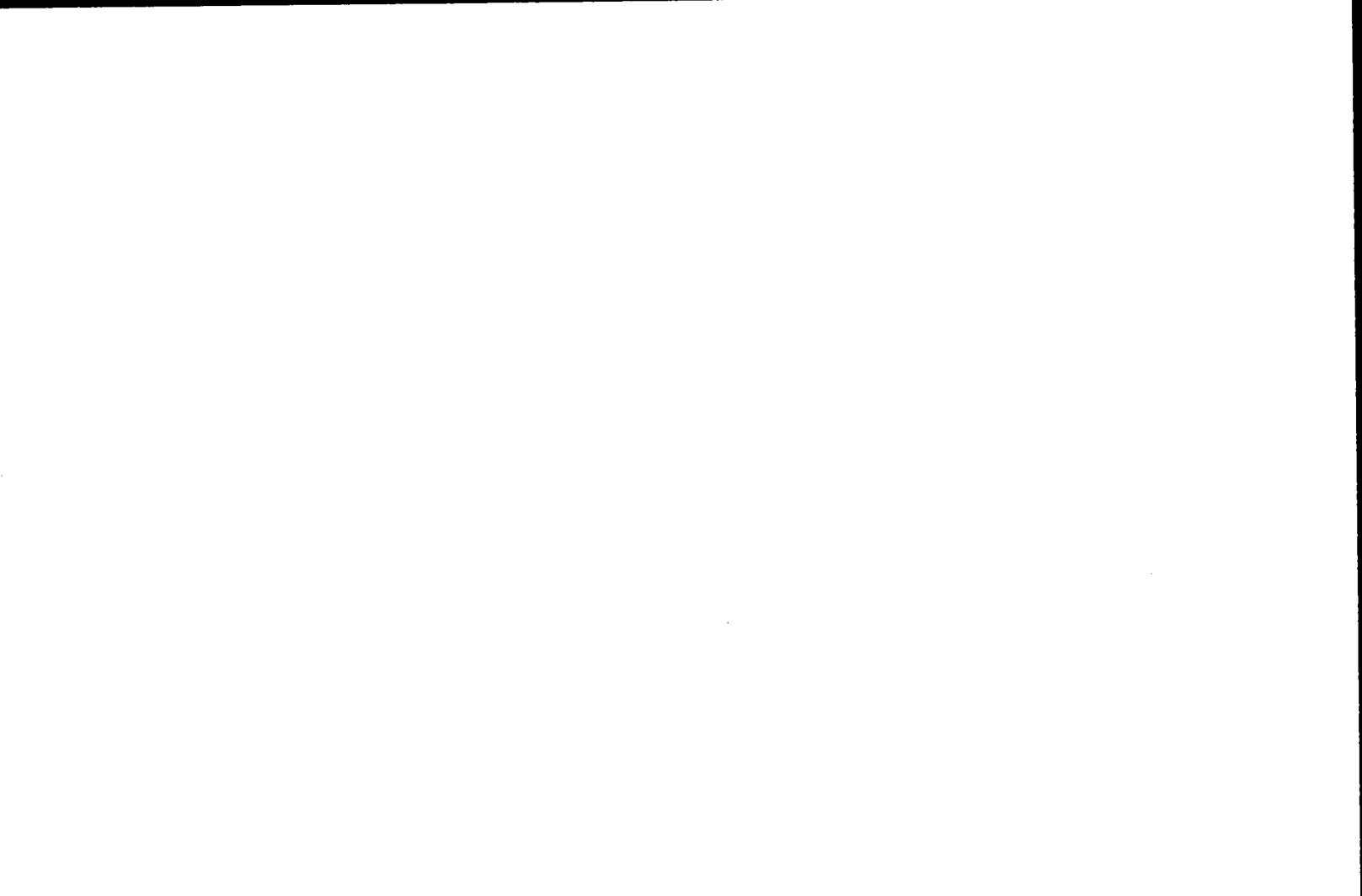
<sup>8</sup> The *New York Times* of April 26, 1906 reported that "If it were possible to show the shrinkage that has occurred in the market valuation of securities as a result directly or indirectly of the San Francisco disaster, it would probably be found to greatly exceed \$1,000,000,000. (. . . and these data) support the assertion that the immediate effect of the San Francisco calamity has been sufficiently discounted in the security markets for the time being, with allowance, of course, for liquidation in special securities for special reasons."

<sup>9</sup>Liquidation of insurance company assets drove down stock prices in general; at the same time.



British gold exports were quake related, and such payments to the United States would account for more than 2.5 times the British gold exports to any other country in 1906. (British gold exports were deseasonalized using the Holt-Winters exponential smoothing algorithm).

<sup>13</sup> If insurance payments by all foreign companies are totaled, the *Times* estimated that over \$55 million in claims were paid out in later summer and early fall. Although Britain was by far the largest foreign insurer in San Francisco, there were substantial amounts insured by France and, especially, Germany. (A few German firms were forced into bankruptcy by the disaster.) The *Times* estimated that non-British firms accounted for ten percent of foreign insurance payments made. The *Times* can also be used to pinpoint when insurance companies paid out most of their claims. It noted on August 9, 1906 that "[insurance] losses *will be paid out of home funds.*" nearly three weeks later, on August 29, it reported that "thirty-five companies of the 120 involved in the San Francisco disaster have paid an aggregate of \$55,000,000 in claims." Finally, on



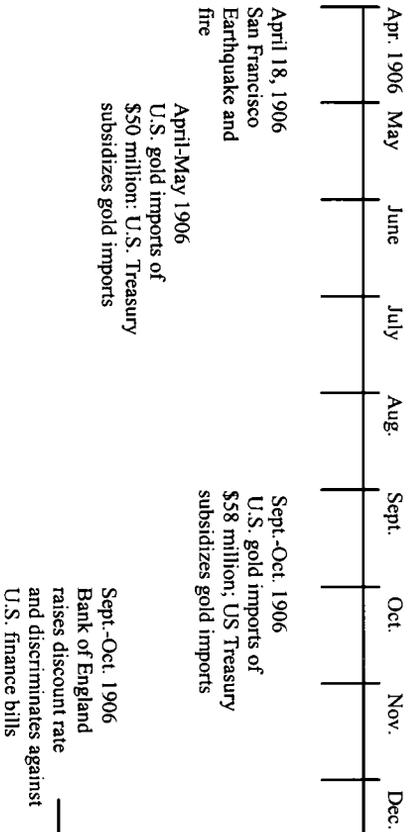
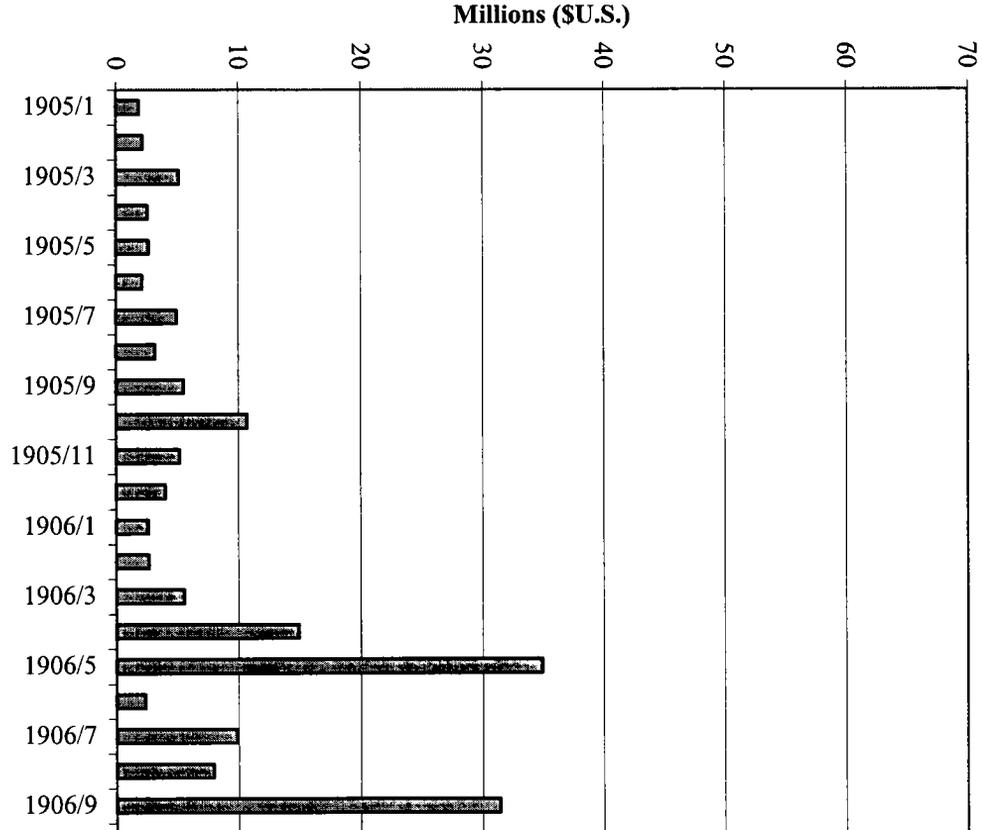


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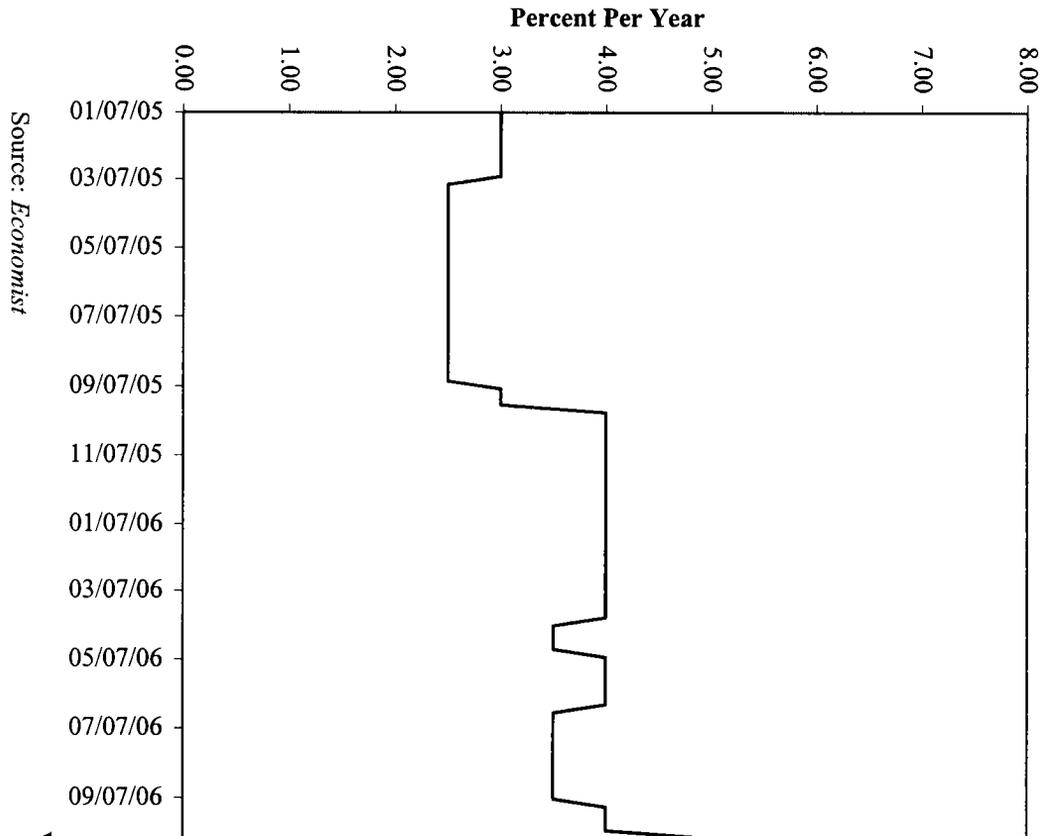
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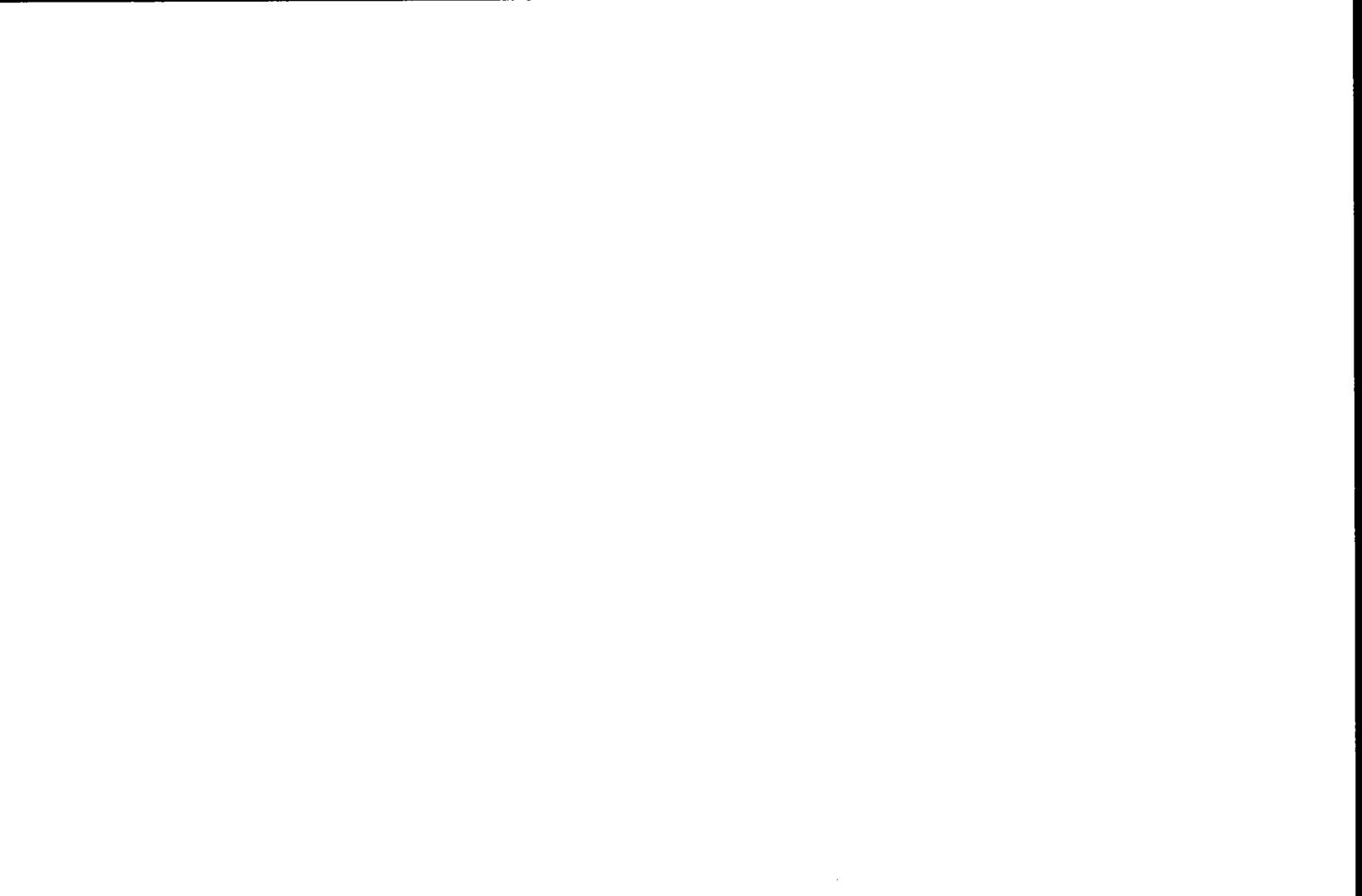
Source: Monthly Summary of Commerce and Finance



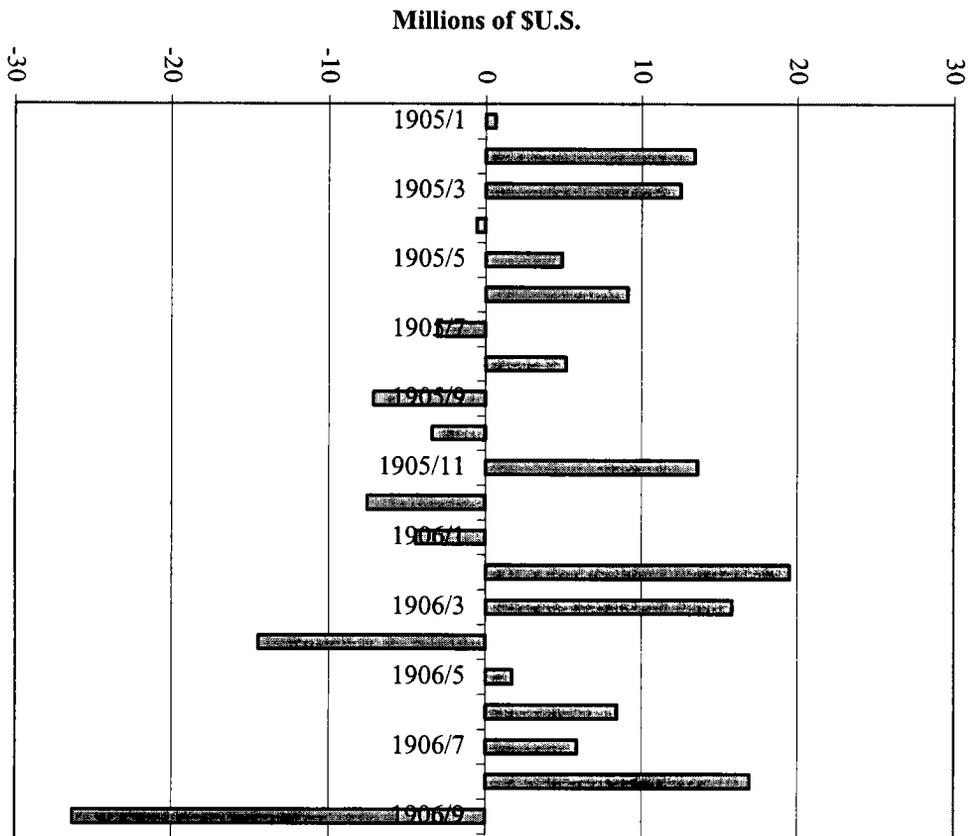
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**Bank of England I**



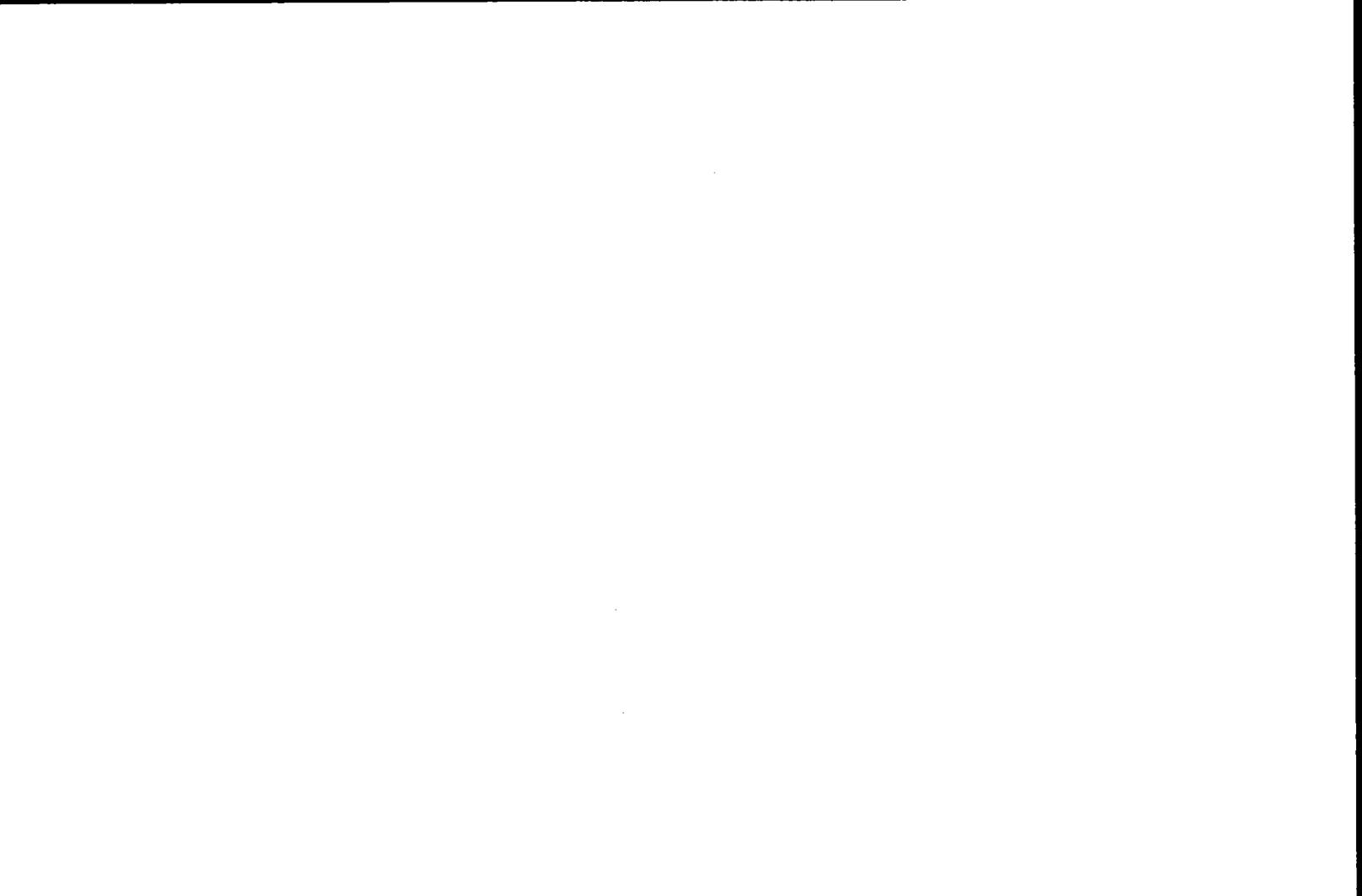
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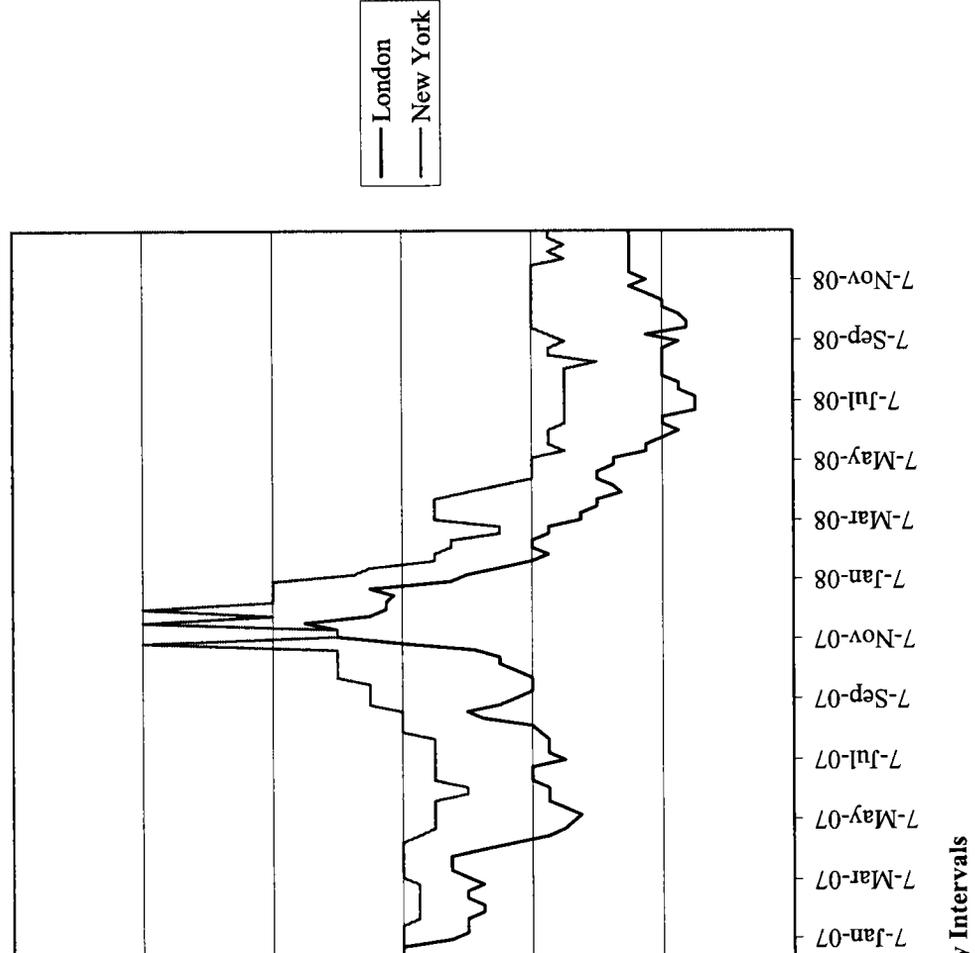
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**British Net Gold Imports**

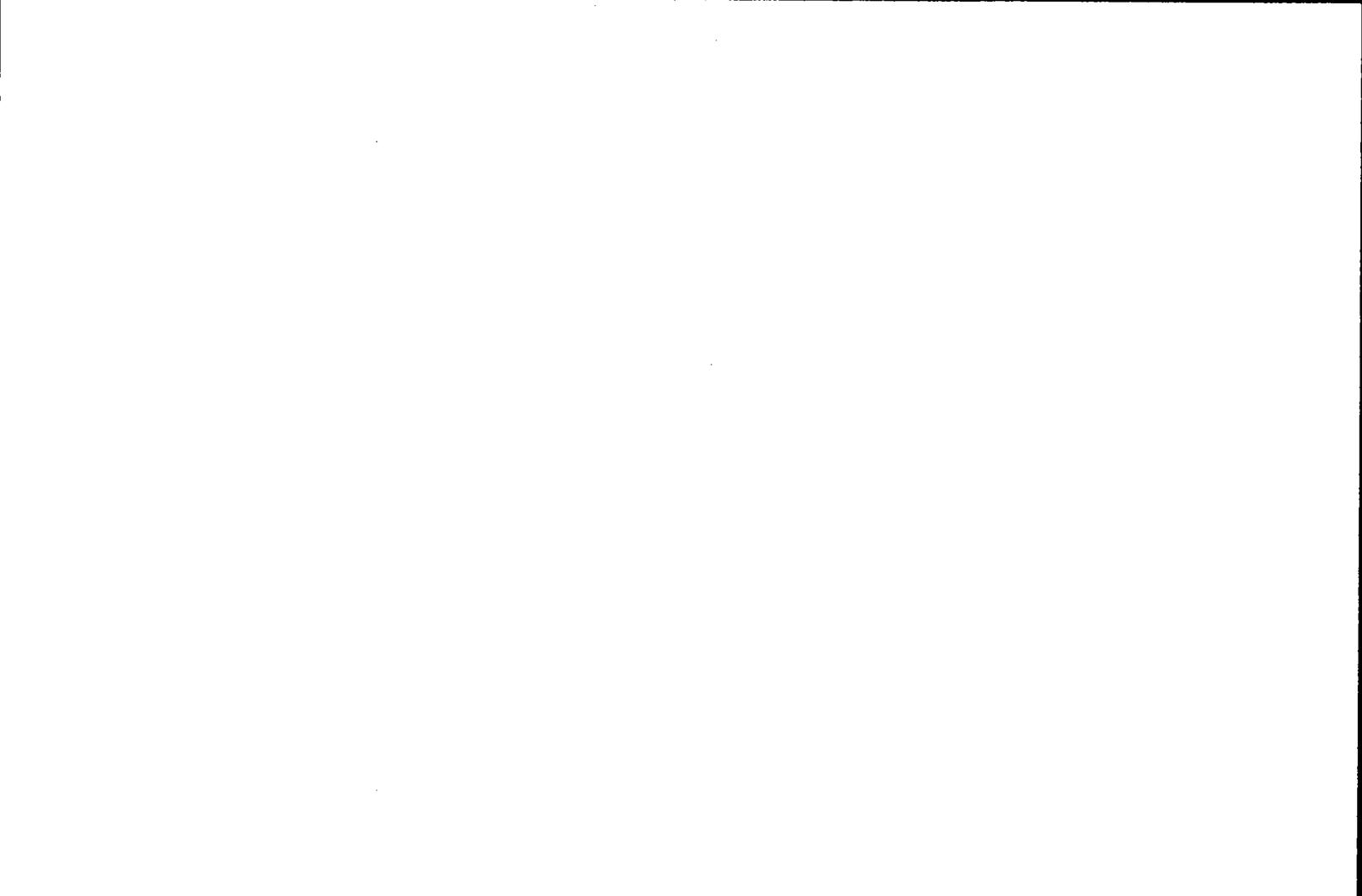


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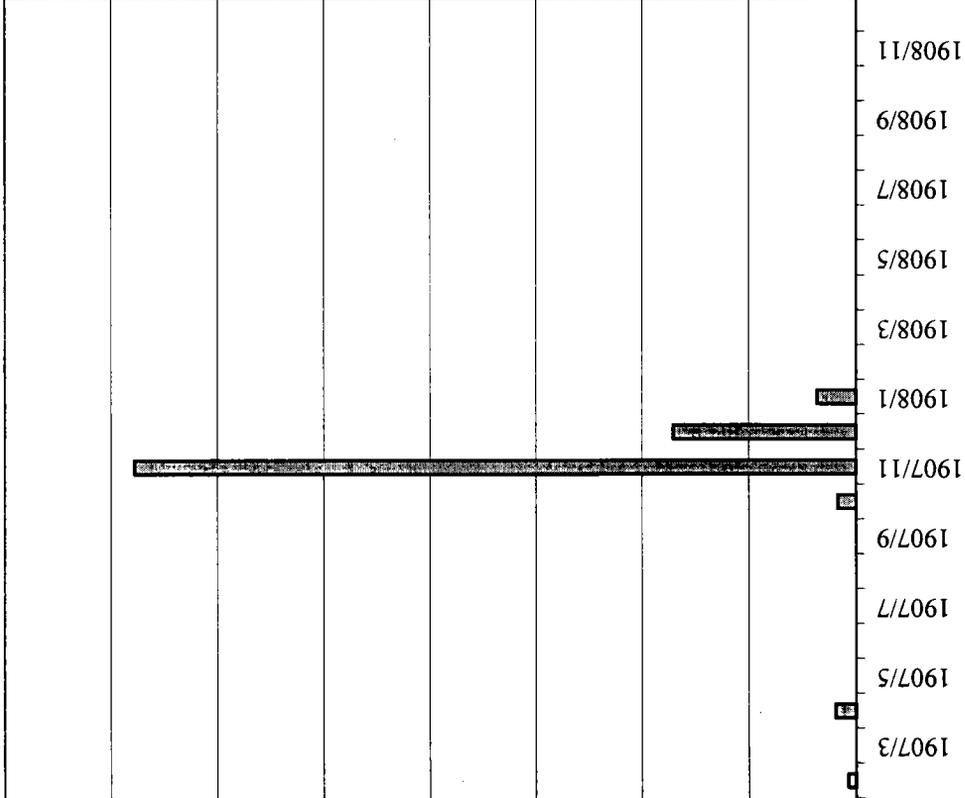


**Figure V**  
**Term Interest Rates 1905 - 1908**

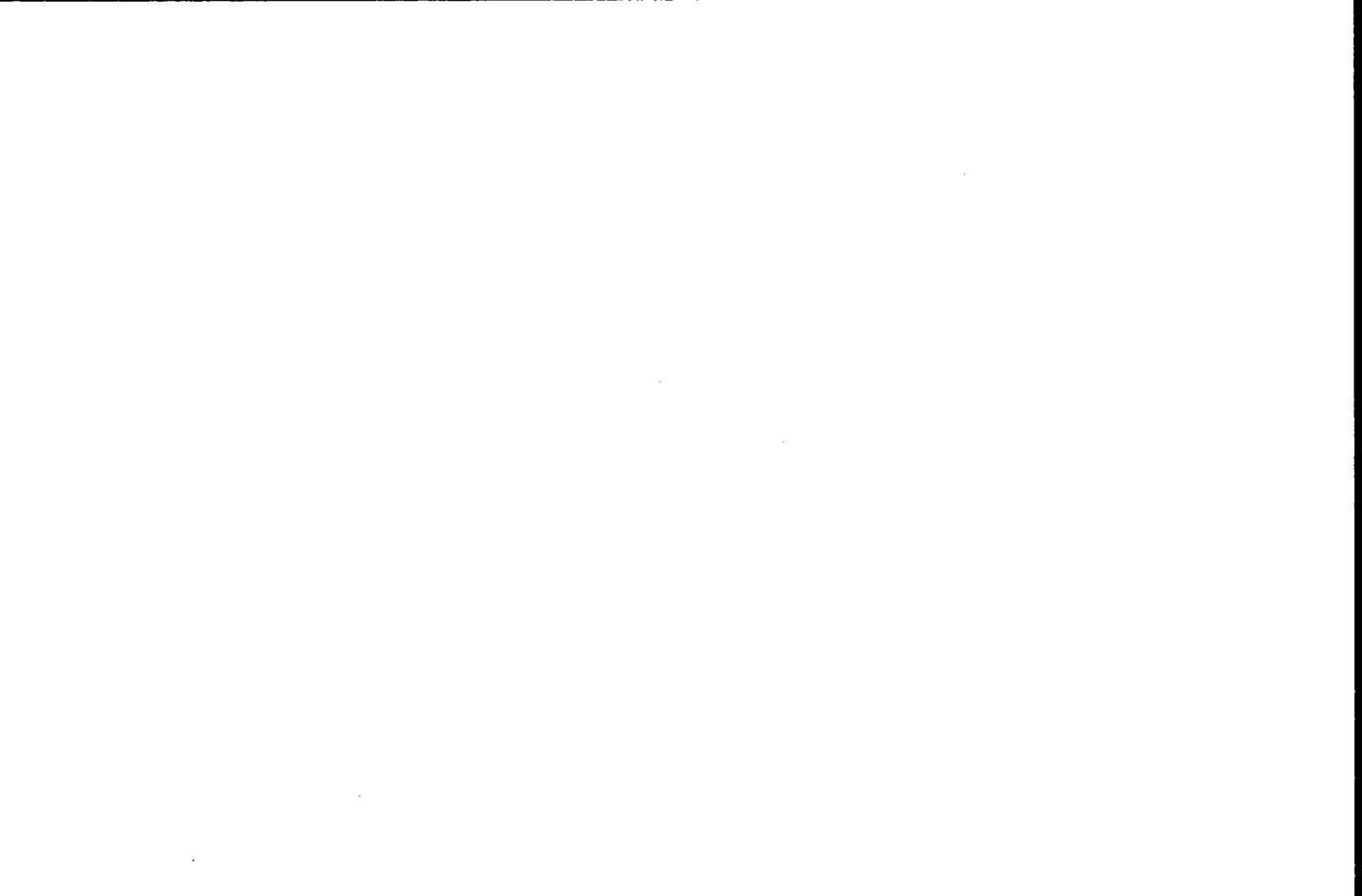




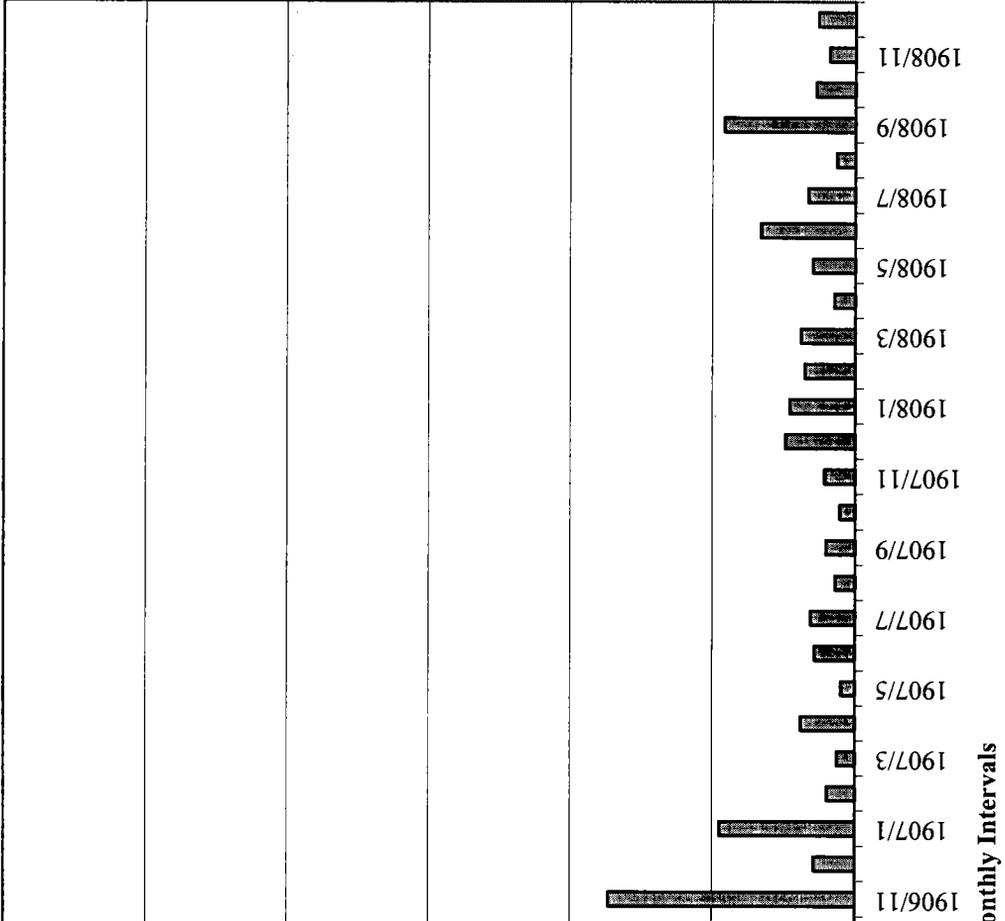
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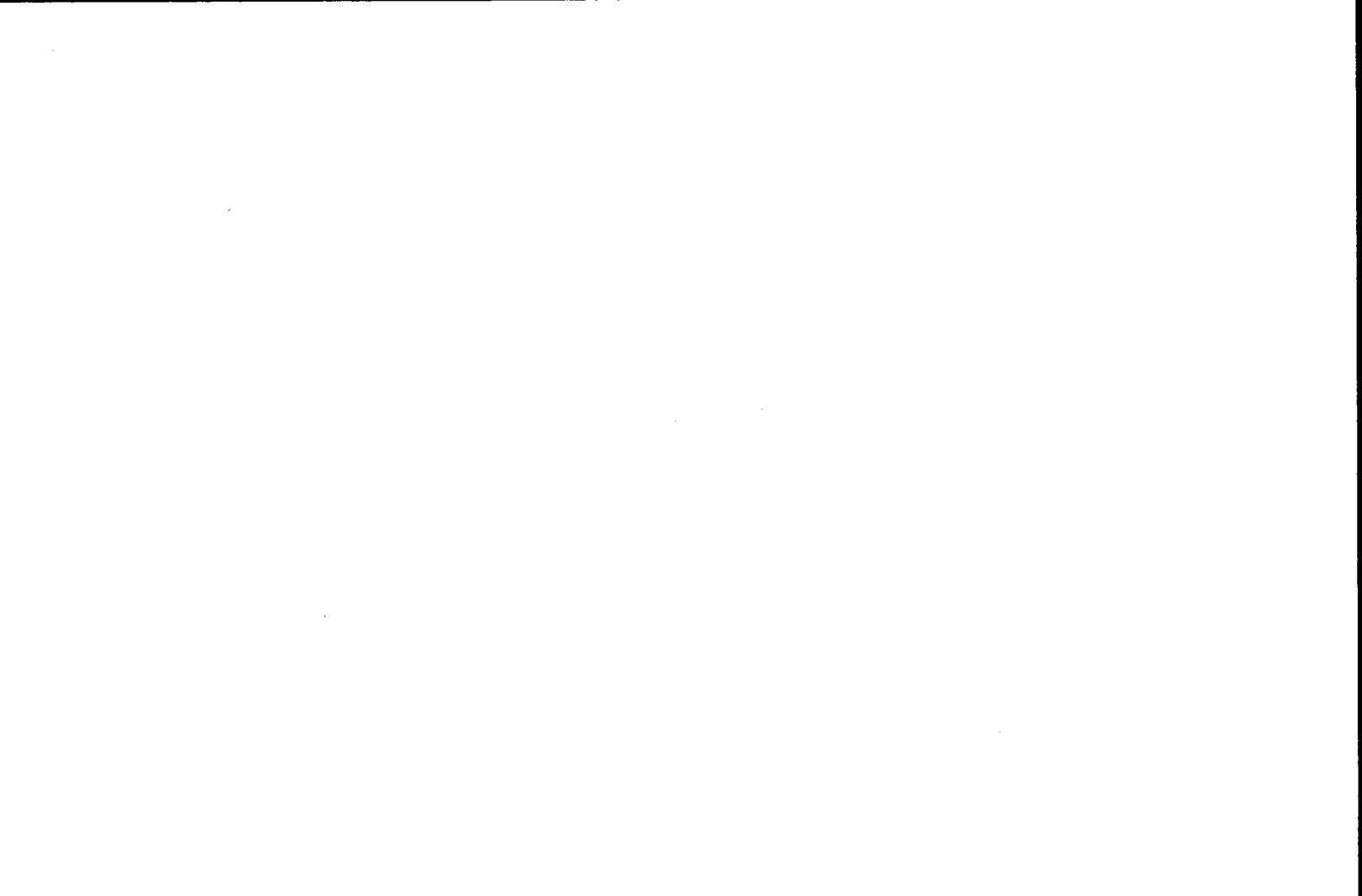


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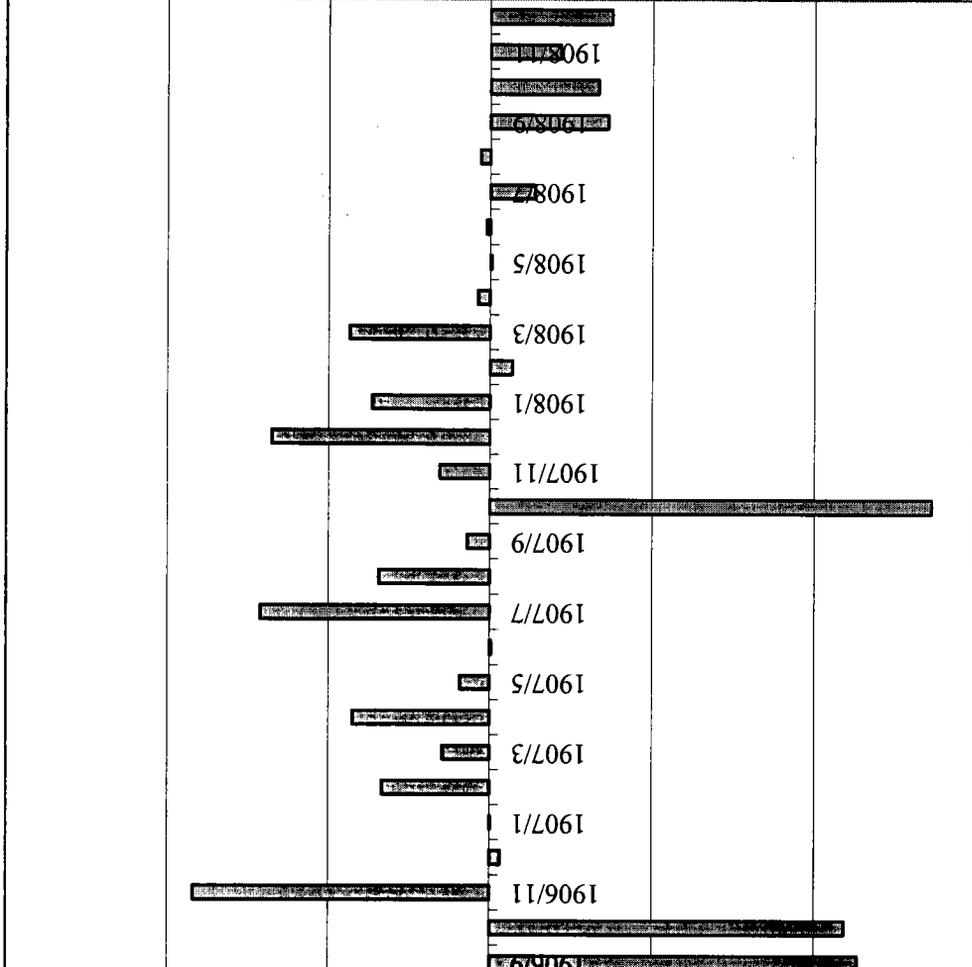


**Figure VII**  
**World Imports 1905 - 1908**





**Figure VIII**  
**Net Gold Flows 1905 - 1908**



Monthly Intervals

