Centre d’histoire économique et sociale
Center for Economic and Social History
François Simiand

The 1929 Crash of the New York Stock Exchange as a Liquidity Crisis

Le Krach de 1929 du New York Stock Exchange comme crise de liquidité

Jean-Laurent Cadorel
EBS Paris, Paris School of Economics, and EHESS.
E-mail: jean-laurent.cadorel(at)psemail.eu

WORKING PAPER N° 09
OCTOBER 2023

Résumé[1]

Quelles sont les causes immédiates du krach boursier de 1929 à la Bourse de New York ? Cet article présente une étude quantitative de la liquidité dans le krach de 1929 et prouve que le krach était bien une crise de liquidité due à des appels de marge sur des prêts des courtiers.

En utilisant des estimateurs issus de la littérature financière moderne, cet article met en évidence la sévère détérioration des conditions de marché. Au niveau agrégé, les spreads ont été multipliés par 4. Au niveau des actions individuelles, les écarts entre la meilleure offre et la meilleure vente suggèrent que la liquidité explique un cinquième de la variance des rendements quotidiens des actions au cours de la crise. Grâce à des données intra journalières sur les 80 plus grandes actions, cet article montre que les chutes ont eu lieu aux horaires fixes d'appels de marge.

Mots-clés : Krach, 1929, New York, NYSE, crise financière, crise de liquidité

Abstract

What caused the 1929 crash of the New York Stock Exchange? This paper provides a quantitative study of liquidity in the 1929 crash of the New York Stock Exchange. I provide evidence the crash was indeed a liquidity crisis due to the liquidation of brokers' margin loans.

Applying recent estimators of effective spreads and liquidity conditions from the modern finance literature suggests a 4-fold increase in spreads during the crash at the aggregate level. At the individual stock level, quoted bid-ask spreads suggest liquidity explains a fifth of the variance in daily stock returns in the crash.

Keywords: 1929 crash, stock market, NYSE, financial crisis, liquidity crises

JEL Codes: G01, N20

[1] *Thanks to Pierre-Cyrille Hautcoeur, Angelo Riva, Eric Monnet, Matthias Morys, Eugene White, Gary Richardson, Eric Hilt, Kilian Rieder, Adam Brzezinski, Jonathan Levy, and seminar participants at the European Historical Economics Society conference (2019), the Economic History Association annual meeting (2020), the PSE Economic History seminar (2020), the PSE Financial History seminar (2020), the Economic History Society conference (2021), the 3rd European Macrohistory workshop (2021), the KU Leuven Financial History workshop (2021), the YSI-EHES Economic History graduate webinar (2021), and the Antwerp University Economic History seminar (2022). I thank the Data for Financial History team at the Paris School of Economics for its support, the European Business School for financial assistance, and Bank of England, Rothschild, and New York Stock Exchange archivists for their precious help. This work has been funded by a French government subsidy managed by the Agence Nationale de la Recherche under the framework of the Investissements d'avenir programme reference ANR-17-EURE-001. The author declares no other interests that relate to the research described in the paper.*

What caused the 1929 crash of the New York Stock Exchange? Galbraith (1955) and Kindleberger (1978) explain the crash as a fire sale due to the sudden removal of brokers' margin loans based on qualitative evidence, but we lack quantitative evidence the crash was a liquidity crisis and due to brokers' margin loans. Most papers have instead focused on whether there was a bubble (Rappoport and White 1993, De Long and Shleifer 1991, Santoni and Dwyer 1990, McGrattan and Prescott 2004, Sirkin 1975), or on the link between the Great Crash and the Great Depression (Romer 1990, Mishkin 1978, Temin 1976), but they have not provided evidence supporting an explanation of the crash (White 1990, Klein 2001). The most recent study on the crash has reemphasized the role of leverage in the crash (Borowiecki, Dzieliński and Tepper 2022). The authors find that the degree of leverage was sufficiently important for modest shocks to cause a liquidation.

This paper quantitatively documents the collapse of liquidity on the New York stock market using common variables readily observable, estimators of effective spreads, and measures of liquidity from the modern finance literature. All measures point to a liquidity crisis. Finally, I quantify the decrease in liquidity's effect on stock returns. Common variables providing evidence of a liquidity crisis include the proportion of stocks without bids and quoted bid-ask spreads spiking on crash days, significant deviations from the law of one price on cross-listed stocks, and intradaily returns collapsing only after margin call hours - the first time intradaily prices have been available. The modern finance literature provides estimators of effective spreads and liquidity using transformations of closing prices (Roll 1984), high and low prices (Corwin and Schultz 2012), mid-range prices (Abdi and Ranaldo 2017), or from volume and returns (Amihud 2002).

At the aggregate level, estimates of effective spreads indicate spreads were multiplied by a factor of 4 during the crash, suggesting a significant collapse in liquidity on the New York stock market. At the individual stock level, regressing daily returns on the level or change in proportional quoted bid-ask spreads yields coefficients which are an order of magnitude larger than their standard errors, in other words, spreads indicate liquidity issues were very significantly associated with lower returns at the individual stock level. Changes in quoted bid-ask spreads explain between a fifth and a third of the variance in daily stock returns on crash days, with a single variable. Cross-sections and panels of daily stock returns on measures of quoted or Corwin and Schultz (2012) spreads suggest point estimates of 0.7 to 1 percentage point decrease in daily stock returns for an increase of one percentage point in spreads. Using the Roll (1984) or Abdi and Ranaldo (2017) measures of spreads suggest higher point estimates but sample sizes are significantly diminished by positive covariances.

Proving the 1929 crash was a liquidity crisis changes the usual historical account which considers the Federal Reserve tightening in 1928 and 1929 caused the crash by slowing the global economy, lowering corporate profits, triggering a deflation and a global depression, correctly anticipated by the stock market. Bernanke (2002) defends for instance that "the correct interpretation of the 1920s, then, is not the popular one – that the stock market got overvalued, crashed, and caused a Great Depression. The true story is that monetary policy tried overzealously to stop the rise in stock prices. But the main effect of the tight monetary policy, as Benjamin Strong had predicted, was to slow the economy – both domestically and, through the workings of the gold standard, abroad. The slowing economy, together with rising interest rates, was in turn a major factor in precipitating the stock market crash. This interpretation of the events of the late 1920s is shared by the most knowledgeable students of the period, including Keynes, Friedman and Schwartz, and other leading scholars of both the Depression era and today."

Instead, this paper shows the immediate cause of the crash was a liquidity crisis, but the paper stays silent on the underlying reason for the decrease in liquidity, which may very well include monetary policy. I am merely claiming that - be it caused by monetary policy or not - a liquidity crisis was the reason for the crash, not the anticipation of an economic slowdown. This is a common claim, my contribution is quantifying the liquidity problem. The Federal Reserve Bank of New York shared this view given it extended emergency liquidity during the crash.

The previous literature has mainly focused on whether the crash was only the bursting of a bubble as Galbraith (1955) and Kindleberger (1978) suggested; no consensus has emerged. Proponents of the bubble hypothesis include White (1990) who shows stock prices increased 40 percent faster than dividends without expectations of higher dividends. De Long and Shleifer (1991) also conclude investors were too optimistic by considering the discount or premium at which closed-end funds traded compared to their net asset value as indicators of individual investor sentiment. Rappoport and White (1994) further show the call-loan implied volatility of American stocks surged more than a year before the crash, suggesting stocks were particularly risky.

On the opposite side of the debate, McGrattan and Prescott (2004) compute estimates of the fundamental values of stocks and argue stocks were not overvalued unless firms had no intangible value and only tangible capital. Bubble tests (Santoni and Dwyer 1990) and price to earnings ratios (Sirkin 1975) also seem to indicate stocks were not overvalued. All previous papers pick a side in the bubble debate. In contrast, this paper is agnostic on the presence of a bubble because a liquidity crisis does not require one.

Meltzer (1976), Temin (1976), or Friedman and Schwartz (1963) argue that the Federal Reserve tightening in 1928 and 1929 brought down the stock market and the goal of tightening monetary conditions was to bring down the stock market and to cut off liquidity to brokers. While this paper stays silent on the underlying cause of the decline in liquidity, bringing quantitative evidence the crash was a liquidity crisis opens up an avenue of research to explain why liquidity declined. Explaining why liquidity declined is then a difficult, but relatively easier, question to answer than why did the crash happen.

Instead of considering the crash as the counterpart phenomenon to the bubble which may have preceded it, the inevitable panic following the mania, this paper brings fundamental factors (liquidity) back into the debate. Bringing back fundamentals in the discussion is needed because leaving the largest crash in U.S. history (according to some measures) to irrationality and randomness is an undesirable scientific outcome. It would mean that despite the significant advances in theoretical and empirical finance over the last decades, we would still be unable to explain the largest of the phenomena in our field. Arguably, liquidity is a multi-dimensional and hard-to-quantify concept, but the various measures presented in the paper, particularly in the first section of the paper, are nearly all independent from each other in their measurement and should convince even the most skeptical readers the crash was indeed a liquidity crisis.

From the point of view of policy, proving the crash was a liquidity crisis suggests monetary policy was suboptimal in October 1929 from the point of view of financial markets too. Irrespective of whether the Federal Reserve wanted to or was able to cause the crash, once liquidity concerns arose, the Federal Reserve should have intervened because Americans losing their savings in a disorderly fashion auctioned off to the few banks with remaining liquidity cannot be optimal.

This study contributes to a growing body of literature linking liquidity, crashes, and bubbles. Recently in this review, Borowiecki, Dzieliński and Tepper (2022) show with a model the amount of "leverage in the US stock market was indeed high enough to explain why stocks crashed with such ferocity". I bring high-frequency market data and apply state-of-the-art measures of liquidity to confirm this diagnosis. More generally, Quinn and Turner (2020) show across three centuries of financial folly, that while loose monetary policy and speculation are necessary for bubbles to emerge and monetary tightening often breaks bubbles, liquidity also plays a central role. This paper furthers this claim using the prime example of a crash: the 1929 crash of the New York Stock Exchange.

I. Model-Free Evidence of a Liquidity Crisis

During the Roaring Twenties, the United States enjoyed a period of prosperity with high growth and record low unemployment. Economic prosperity translated to higher investment in financial markets through a variety of channels. Americans eager to invest their savings benefited from the democratization of financial innovations such as investment trusts which allowed them to diversify their investments. In the years preceding the crash, trusts raised record sums in equity. These sums were invested in securities, but also were very profitably employed to fund brokers' loans - speculative funds for margin lending. Corporations experienced increases in profits and some of the retained earnings funded loans to brokers. Banks witnessed increases in deposits over the years and therefore they could extend more loans, some of which found their way to brokers and ultimately speculators. By 1929, margin accounts represented 40 percent of trading accounts at firms member of the New York Stock Exchange.[1] As the demand for speculative funds increased, so did the rates on brokers' loans. Starting 1928, call loan rates increased to exceptional levels (Rappoport and White 1993).

Suppliers of brokers' loans, to the exception of New York City banks, suddenly withdrew their funds during the crash. In the week of the crash, loans to brokers by New York City bank clients (non-New York banks, investment trusts, foreign banks, corporations, and individuals) decreased by $2.1 billion. To give a sense of the scale of withdrawals, non-New York banks' supply of brokers' loans decreased by 2 percent of U.S. gross domestic product or 15 percent of all U.S. member bank demand deposits in a week.

Galbraith (1955) interprets this removal causally, arguing the removal of brokers' loans (from suppliers to brokers) caused the removal of margin loans (from brokers to clients). White (1990, p.76) counters that "Brokers' loans did not contribute to the stock market boom. Instead, the demand for credit to buy stock pulled funds into the market, forcing a major reallocation of credit in the money and capital markets" and conversely their removal cannot be interpreted causally because suppliers may have only pulled funds in

[1] Pecora Report, p. 9.

response to the crash. I am not entering this debate; what matters is that stocks trading on the New York Stock Exchange simultaneously became less liquid assets as an increasing proportion of shares could not find buyers. The proportion of NYSE stocks without a bid increased tenfold from on average 1 to 2 percent during the year to 17 percent, as shown in figure 1.

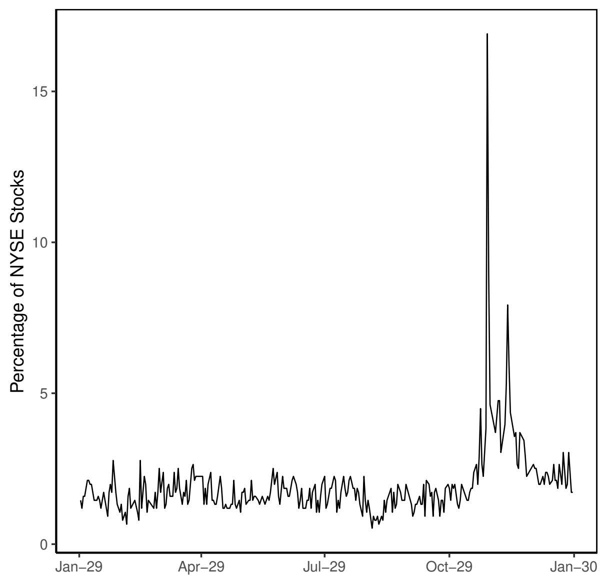

FIGURE 1. BIDLESS NYSE STOCKS IN 1929

Note: Proportion of stocks without a bid in 1929 in daily frequency.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

Bankers mentioned the stock market occasionally experienced "air pockets" those are "a perfectly empty no-bid market"[2] as "blocks of stock were

[2]George Whitney (J.P. Morgan), Hearings before the committee on banking and currency, US Senate, 1933, part 2, p.542: "[financiers intervened to] prevent or to try to prevent having what the papers called air pockets. In other words, to have some bids — some basis upon which these very large bodies of loans which were then in existence and the loans by customers, would have some basis on which to stand, and not have a perfectly empty no-bid market, which is what existed periodically during this period."

thrown overboard irrespective of what they would fetch and in some cases reached absurdly low market prices because of lack of buying orders. It was not so much that those in a position to buy were unwilling to do so as that the avalanche of selling orders was so great that no reasonable purchasing could stem the tide."[3] so the absence or insufficiency of bids was sufficiently abnormal to be noticed by market makers.

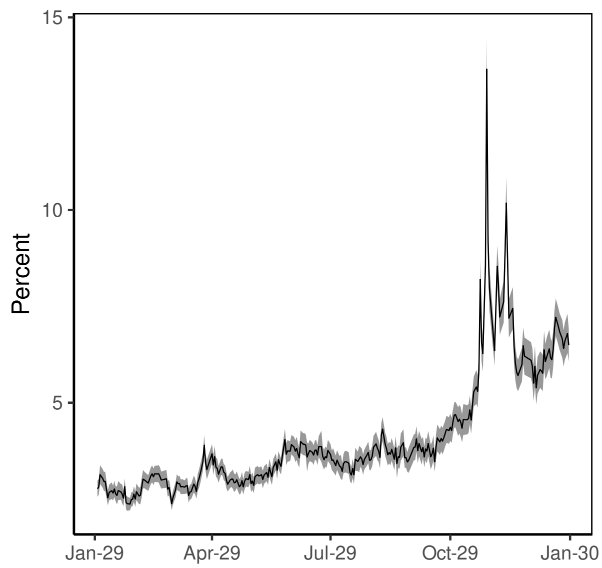

FIGURE 2. PROPORTIONAL QUOTED BID-ASK SPREADS OF NYSE STOCKS IN 1929

Note: Proportional quoted bid-ask spreads are differences between ask and bid quotes divided by mid-quotes, which are the average of the bid and the ask quotes. The mean spread across all stocks is reported in daily frequency. The shaded areas represent standard errors.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

The lack of liquidity was also reflected in the price of liquidity as the remaining 83 percent of stocks with bids saw bid-ask spreads increase on

[3]Mortimer Schiff of Kuhn, Loeb & Co to Anthony de Rothschild, Nov. 1st 1929.

average from 3.3 percent of the mid-quote to 13.7 percent.

Keeping absolute bid-ask spreads constant and seeing stock prices fall implies an increase in the proportional quoted bid-ask spread. Therefore, proportional bid-ask spreads are insufficient on their own to conclude there was an increase in the price of liquidity. Absolute levels of bid-ask spreads however, also increased, and were multiplied by three from on average 2 dollars during the year to 6 dollars.

Further quantitative evidence of an increase in demand for liquidity can be found thanks to mispricings. Under stressful conditions and during liquidity shortages, asset mispricings may occur (Pasquariello 2014), as arbitrageurs may lack the liquidity to eliminate arbitrage opportunities. One of the simplest arbitrage opportunities lies in cross-listings. A stock trading on two exchanges should have the same price. Comparing closing prices of stocks cross-listed on the NYSE and on regional exchanges, in Boston and Chicago, reveals significant mispricings during the crash up to an average absolute difference of 8 percent across 30 stocks. Stocks listed on the NYSE suffered closing prices lower than their regional counterparts. The average simple deviation between NYSE and regional closing prices was of 0% from August to September and up to negative 5 percent in the crash.

The next question is whether the liquidity crisis can be attributed to brokers' margin loans. Intradaily returns on 80 of the most active stocks on crash days compared to non-crash days allows us to attribute the liquidity crisis to margin loans because investors had to respond to margin calls at specific times: bankers "came to look for the hours of 11:15 and 2:15 with a great deal of anxiety, because those were the hours when margin calls have to be responded to in the general practice of stock-exchange houses, so right

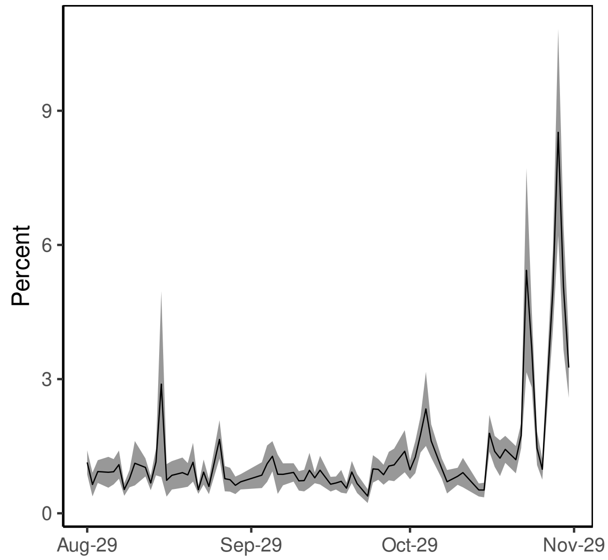

FIGURE 3. MISPRICINGS ON THE NYSE AUGUST TO OCTOBER 1929

Note: Average absolute difference between NYSE and regional closing prices in percent of NYSE prices across 30 cross-listed stocks on the NYSE and either in Boston or Chicago, in daily frequency. Shaded areas represent standard errors.
Source: Data are from CRSP for NYSE stocks and from the New York Times for Boston and Chicago. The CRSP dataset contains the universe of stocks trading on the NYSE. The New York Times listing for Chicago and Boston may not be comprehensive and may contain selection issues yet the New York Times is considered as the leading provider for regional exchanges at the time (O'Sullivan 2007).

after that we would get the immediate reflection of that call."[4]

Intradaily returns on 80 of the most active and largest NYSE stocks indicate stocks on crisis days dropped mostly after margin call hours (figure 4). The onset of the crash is mainly remembered through three days: Black Thursday Oct. 24th, Black Monday Oct. 28th, and Black Tuesday Oct. 29th. On the first of these crash days, stocks opened at negative 2 percent and declined 3 percent after the first margin call to the lowest level for the

[4]George Whitney (J.P. Morgan), Hearings before the Committee on Banking and Currency, United States Senate, 1933, part 2, p.542.

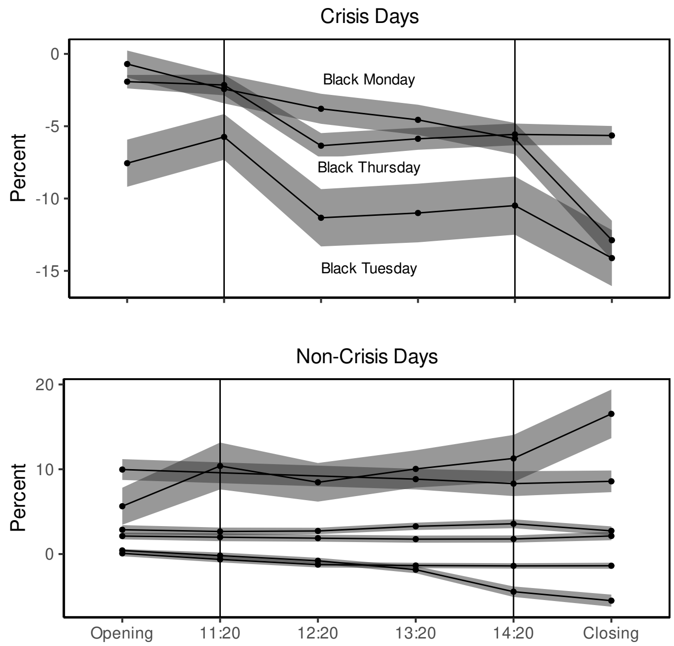

Figure 4. Intradaily Returns of 80 NYSE Stocks in the Crash

Note: The average return across 80 of the most active NYSE stocks in percent of the previous day's closing price is reported by the hour in the fortnight of the crash: from Monday, October 21st to Friday, November 1st, 1929. Vertical solid lines represent margin call hours. The economic history literature has identified crisis days as Black Thursday, October 24th, Black Monday, October 28th, and Black Tuesday, October 29th. The remaining days are non-crisis days. Some days the market was closed and are therefore not represented, but all days in the fortnight when the market was open are represented. Shaded areas represent standard errors.
Source: Data are from the Chicago Daily Tribune. The data are hand-collected from the Chicago Daily Tribune, a paper printed in Paris receiving information by cable from Chicago, conserved at the Bibliothèque Nationale de France. There are selection issues as this newspaper selected the largest and most liquid stocks.

day. On Black Monday, stocks opened at negative 1 percent and declined 7 percent in an hour after the second margin call. On Black Tuesday, stocks opened at negative 7 percent, dropped from negative 5 to negative 11 percent after the first margin call, and collapsed a further 4 percent after the second margin call. All intradaily drops happened after a margin call hour, which is not to say all margin call hours were followed by a sudden drop. In contrast, figure 4 shows there were no such intradaily movements after margin call hours on non-crash days. On Friday the market slightly rebounded. This day is not identified in the literature as a crisis day and therefore it is in the non-crash days. In the next section's estimations, Friday is included in panel estimations and excluded in the repeated cross-sections. Including Friday in the panel estimations does not lead to different estimates.

Figure 4 alleviates concerns of reverse causation. As an anonymous reviewer correctly remarked: "The strong correlation between stock market liquidity and volatility has been well documented in the empirical finance literature but the microstructure literature has also shown how stock price declines can negatively affect liquidity. Was the decline in liquidity of October 1929 a cause or a consequence of increased volatility?" Figure 4 shows margin calls were the cause of declines, because the largest declines in intradaily returns, on any of the crash days, were immediately following margin call hours. All intradaily drops happened after a margin call hour.

II. Estimates of Effective Spreads and Illiquidity

The absence of bids, the mispricings on cross-listed stocks, and the intradaily declines after margin call hours are strong evidence of a liquidity crisis on the New York Stock Exchange. The evidence from bid-ask spreads, proportional or absolute, can be further strengthened using estimators of effective spreads or of liquidity from the modern finance literature. Roll (1984) notes quoted bid-ask spreads are problematic measures because trading is mostly done within the quotes. If the market is informationally efficient and the probability distribution of price changes is stationary, Roll (1984) suggests using the serial dependence in price changes $s = 2\sqrt{-cov(\Delta P_t, \Delta P_{t-1})}$, as a measure of effective spreads, on the basis that negative serial dependence in price changes can be expected if a market maker is involved in transactions. Roll's measure of effective spreads suggests a 4-fold increase in effective spreads from on average 2% to 9% during the crash (figure 5).

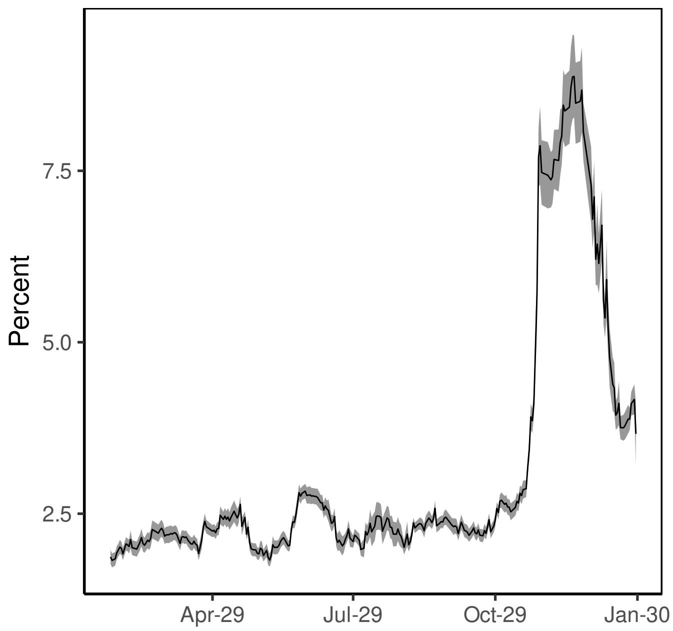

Figure 5. Roll (1984) Effective Spreads of NYSE Stocks in 1929

Note: The average Roll (1984) effective spread across NYSE stocks is reported in daily frequency. Shaded areas represent standard errors. Positive serial covariances treated as missing. Covariances calculated over a 20-day trading window.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

Corwin and Schultz (2012) offer an estimator using extreme prices over a 2-day horizon. The insight for their measure is daily high and low prices reflect both the effective bid-ask spreads and the variance of the day. Increasing the observation window from one day to two and observing the high and low prices over the two-day window is observing a two-day variance but two one-day spreads. Their measure suggests a near 4-fold increase in spreads from on average 1.5% before to 5.2% during the crash (fig. 6).

Harris (1990) shows the Roll (1984) estimator is noisy even in large samples and as a result of Jensen's inequality, spread estimates are downward-biased. George, Kaul and Nimalendran (1991) show the Roll estimator assumes constant expected returns over time and the absence of adverse selection.

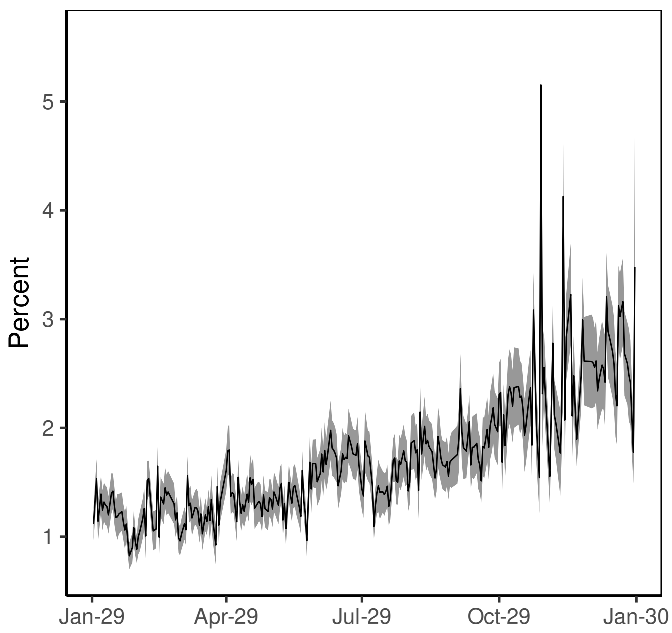

FIGURE 6. CORWIN AND SCHULTZ (2012) SPREADS OF NYSE STOCKS IN 1929

Note: The average Corwin and Schultz (2012) effective spread across NYSE stocks is reported in daily frequency. Shaded areas represent standard errors. Negative spreads set to zero as suggested by authors.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

Time-varying expected returns also lead the Roll estimator to be downward-biased. Given expected returns are likely to decline sharply in a crash of the magnitude of the 1929 crash, it would seem likely the Roll (1984) estimator may be underestimating the true level of effective spreads.

Abdi and Ranaldo (2017) offer an alternative estimator similar to Roll's: $s = 2\sqrt{(E[(c_t - \eta_t)(c_t - \eta_{t+1})])}$ where c_t is the log-closing price and η_t is the average of the log-high and log-low prices of the day. They claim their estimator does not show different estimation errors from Corwin and Schultz (2012)'s estimator. However, the estimates found are closer to the estimates found with Roll (1984)'s estimator of effective spreads than those found with Corwin and Schultz (2012)'s estimator. The Abdi and Ranaldo (2017) estimator suggests a 4-fold increase in effective spreads from on average 1.5% during the year to 6.3% during the crash, as shown in figure 7.

The Amihud (2002) measure of illiquidity, $ILLIQ_{it} = \frac{|r_{it}|}{Volume_{it}}$ also finds a 4-fold decrease in liquidity from on average one dollar of volume being associated to a 0.0057 percent absolute daily return during the year to one dollar of volume being associated with a 0.0217 percent absolute daily return during the crash. Yet, the Amihud (2002) measure does not estimate effective spreads. Irrespective of the estimator used, the various measures indicate a 4-fold decrease in liquidity and thus a significant collapse in liquidity on the NYSE.

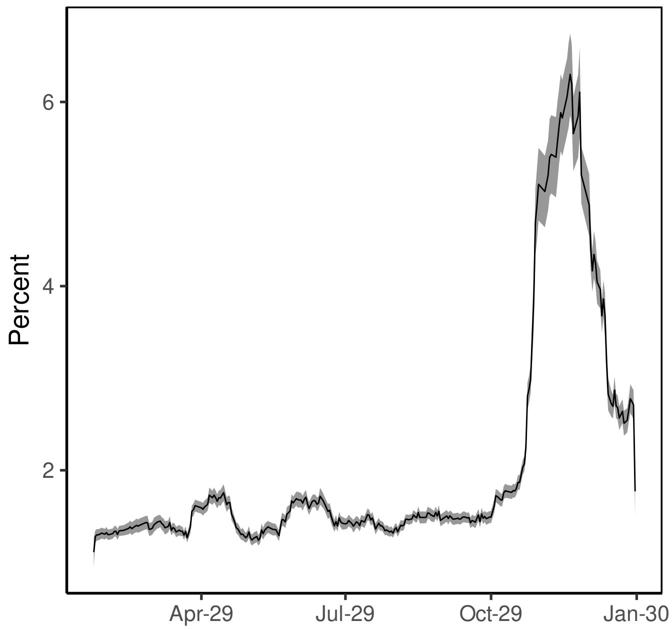

Figure 7. Abdi and Ranaldo (2017) Spreads of NYSE Stocks in 1929

Note: The average Abdi and Ranaldo (2017) effective spread across NYSE stocks is reported in daily frequency. Shaded areas represent standard errors.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

III. Illiquidity and Stock Returns

The final step of this paper is to ask how much of the decline in stock returns does the decrease of liquidity explain. One approach is to perform repeated cross-sections on crash days, regressing daily returns on the levels or changes in proportional or effective spreads. Using the change in spreads and finding a negative coefficient suggests stocks which experienced a larger decline in liquidity suffered lower returns, while using the level of spreads and finding a negative coefficient suggests stocks with low liquidity experienced lower returns.

Coefficients of the level and change in proportional quoted bid-ask spreads are an order of magnitude larger than their standard errors (Table 1). Changes in quoted bid-ask spreads explain between a fifth and a third of the variance in daily stock returns on crash days, with a single variable, as the coefficient of determination (R^2) in column 6 of table 1 indicates. The coefficient -0.470 in column 4 of table 1 reads as follows: on Black Thursday, among the universe of stocks traded on the NYSE and collected in the CRSP database, stocks that saw their liquidity decline, therefore their proportional quoted bid-ask spread increase, by one percentage point (e.g. from 5% to 6% of their midquote) suffered on average a -0.470% lower return than stocks which did not experience an increase in spreads on that day.

Using the Roll (1984) estimator of effective spreads is underwhelming because the sample size decreases signifcantly as serial covariances become positive in the crash and the Roll spreads therefore become undefined. The only significant estimates are correctly negatively signed. Applying Corwin and Schultz (2012)'s estimator of effective spreads, the only significant estimates are strictly negative, but explain a tenth of the variance of stock returns. The estimates using the Abdi and Ranaldo (2017) estimator suffer from data limitations, similar to Roll (1984)'s estimator, but point estimates are again usually an order of magnitude larger than their standard errors, despite the reduced sample sizes. These estimations are relegated to Appendix A.

A different approach is to simply apply a panel data model with stock-fixed effects as shown in table 2. Stock-fixed effects capture various stock-level unobservables including the average level of liquidity of the stock.

When proportional quoted spreads increased by one percentage point dur-

TABLE 1—CROSS-SECTIONS OF NYSE STOCK RETURNS AND QUOTED SPREADS

	Constant	Spread	Δ Spread	N	R^2	F Statistic
Black Thursday	-3.501^{***}	-0.445^{***}		597	0.228	175.8
	(0.349)	(0.034)				
	-5.120^{***}		-0.470^{***}	597	0.240	187.4
	(0.293)		(0.034)			
Black Monday	-8.627^{***}	-0.329^{***}		571	0.123	79.7
	(0.431)	(0.037)				
	-9.472^{***}		-0.456^{***}	571	0.184	128.2
	(0.370)		(0.040)			
Black Tuesday	-9.575^{***}	-0.420^{***}		508	0.074	40.71
	(1.154)	(0.066)				
	-10.195^{***}		-0.879^{***}	508	0.355	279
	(0.819)		(0.053)			

Note: Repeated cross-sections of daily stock returns on proportional quoted bid-ask spreads on crash days. Standard errors in parentheses. Asterisks denote significance levels: ***,**,* respectively denote 1%, 5%, and 10% levels.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

ing the crash, on any given crash day, daily returns decreased by 0.764 percentage point on average across stocks. The decline in liquidity in this panel estimation again explains about a fifth of the variance in stock returns, as indicated by the adjusted-R^2, in column 5. The adjusted-R^2 is used instead of the R^2 because stock-level fixed effects are included which mechanically increases the R^2. Adjusted-R^2 is the appropriate measure when there are stock-level fixed effects. In repeated cross-sections, when there are no fixed-effects, the R^2 is also the adjusted-R^2 and so these terms can be used interchangeably. The estimates using the Roll (1984) and Abdi and Ranaldo (2017) estimators yield significant negative estimates but then the point es-

Table 2—Panels of NYSE Daily Stock Returns and Spreads (Crash days)

	Δ Spread	N	R^2	Adj.-R^2	F Statistic
Quoted Spreads	-0.765^{***}	2868	0.470	0.313	2.990
	(0.026)				
Roll (1984)	-2.091^{***}	1870	0.433	0.187	1.760
	(0.104)				
Corwin and Schultz (2012)	-0.951^{***}	2948	0.335	0.142	1.737
	(0.062)				
Abdi and Ranaldo (2017)	-3.902^{***}	1398	0.448	0.196	1.776
	(0.220)				

Note: Panel data in daily frequency from Black Thursday to Black Tuesday using various measures of spreads as regressors and daily stock returns as regressands, applying the least squares dummy variable model. Stock-fixed effects only. Standard errors in parentheses. Asterisks denote significance levels: ***,**,* respectively denote 1%, 5%, and 10% levels.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

timates are very different from those using quoted spreads and Corwin and Schultz (2012), even though the aggregate measures are similar. Increasing the sample size to cover the entire month of October instead of only the crash days as done in table 3 reduces the explanatory power of spreads, which is to be expected given non-crash days, days without liquidity issues, are now included. More importantly, coefficients on the Corwin and Schultz (2012) and Abdi and Ranaldo (2017) effective spreads decrease in absolute value while the coefficient on quoted spreads barely moves, which would suggest quoted spreads are closer to the true value of the elasticity. The Roll (1984) and Abdi and Ranaldo (2017) spreads may be over-estimating the strength of the relationship because of time-varying expected returns. George, Kaul and Nimalendran (1991) show the Roll estimator assumes constant expected returns over time and the absence of adverse selection.

Time-varying expected returns are the likely culprit first because this is a crash and expectations are likely to be revised down.

Table 3—Panels of NYSE Daily Stock Returns and Spreads (October)

	Δ Spread	N	R^2	Adj.-R^2	F Statistic
Quoted Spreads	-0.780^{***} (0.014)	14165	0.204	0.163	4.983
Roll (1984)	-1.758^{***} (0.052)	9511	0.150	0.088	2.422
Corwin and Schultz (2012)	-0.698^{***} (0.029)	14386	0.067	0.020	1.424
Abdi and Ranaldo (2017)	-2.671^{***} (0.107)	8866	0.113	0.044	1.624

Note: Panel data in daily frequency during the month of October 1929 using various measures of spreads as regressors and daily stock returns as regressands, applying the least squares dummy variable model. Stock-fixed effects only. Standard errors in parentheses. Asterisks denote significance levels: ***,**,* respectively denote 1%, 5%, and 10% levels.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

Second, table 4 shows how the sample size varies when imposing the various restrictions necessary for each estimation. The sample sizes are different between table 1 and table 2 because table 1 is a cross-section while table 2 is a panel from Black Thursday to Black Tuesday, so table 2 reports results using five trading days of data as Saturday is included. There are 726 stocks on Black Thursday, 725 stocks each day from Friday to Tuesday in the database. The sum makes 3626. Table 4 explains how we go from 3626 to each sample size in table 2. Each measure uses different information and therefore the final sample size varies. The sample sizes are lower mostly due to positive serial covariances. Positive serial covariances are likely to happen when expectations change and in any case show that the Roll (1984) and

Abdi and Ranaldo (2017) measures experience some difficulties in the crash. This is to be expected given they assume well-functioning efficient markets. In conclusion, the most robust measures are those using the quoted spreads and the Corwin and Schultz (2012) spreads. The coefficients associated to these measures suggest a 0.7 to 1.0 percentage decrease in daily returns for a one percentage point increase in spreads (as shown in table 2). Those are the coefficients this study puts forth as its headline result. Quoted bid-ask spreads suggest increases in spreads explain a fifth to a third of the variance in stock returns on any given crash day in repeated cross-sections, while explaining about a fifth of the variance on average during the crash when applying panel data models.

Table 4—Decomposition of sample size variance

	Quoted	Roll	Corwin & Schultz	Abdi & Ranaldo
Original sample	3626	3626	3626	3626
w/ daily returns	2949	2949	2949	2949
w/ quoted bid-asks	2868			
w/ high and low			2948	2948
w/ $\geq$ 20 obs.		2901		2915
w/o positive cov.		1872		1398
w/ spread changes		1870		
Final sample	2868	1870	2948	1398

Note: Sample sizes after imposing required constraints to obtain spreads. Original sample represents stock-day observations in the Crash days panel (24/10-29/10/1929), Friday and Saturday are not dropped.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

How much can we trust spreads are an effective measure of liquidity? While it is true that the levels of spreads are affected by many factors, they are the reference measure of liquidity in modern finance. The size of spreads, in levels, depends on (1) order processing costs, those are the costs related to ensuring information production and dissemination, order transmission and execution, and settlement and delivery (Bessembinder and Venkataraman 2010), (2) market power, or liquidity providers who collude to raise spreads and thus margins (Stoll 2003), (3) market makers' inventory risk, or costs related to suboptimal diversification that a market maker could bear after a trade when adverse public information hits the market (Amihud and Mendelson 1980, Ho and Stoll 1983), and (4) asymmetric information, because liquidity providers may protect themselves from risks associated with negotiating with an investor who has private information (Kyle 1985, Glosten and Milgrom 1985, Admati and Pfleiderer 1988). In the finance literature, spreads are used as the benchmark measure of liquidity and economic historians also use them in historical contexts, for example in Hautcoeur, Rezaee and Riva (2023). Authors argue over the biases present in this measure and present alternative measures of the true or effective spread, for example Hagströmer (2021) provides a recent review. This is what has motivated this paper to measure alternative measures of spreads. The argument in this paper is that regardless of the measure, liquidity as measured by spreads, quoted or effective, severely deteriorated both at the aggregate and individual stock level.

What pushes this study to present the estimates using quoted spreads and Corwin and Schultz effective spreads as the estimates most likely to be close to the true effect of liquidity on stock declines is (1) those measures are the least affected by sample selection issues as shown in table 4 – the Roll measure loses half of the sample and the Abdi and Ranaldo measure loses two-thirds of the sample by imposing restrictions (2) those are the most precise estimates based on the standard errors in tables 2 and 3 -which really is a consequence of larger sample sizes- (3) those are the estimates that are the least affected by increasing the sample size to cover the month of October as shown in table 3. The Roll and Abdi and Ranaldo measures are excessively excluding observations because of the restrictions they impose and relaxing the constraint by increasing the observation window brings them closer to the estimates of the quoted spreads and Corwin and Schultz effective spreads, whereas the estimate using the quoted spreads barely moves.

The four determinants of spreads mentioned above imply that extracting expectations from spreads is an arduous task. Given order-processing costs, market power, and market makers' inventory are hardly measurable in this period, I would be surprised if expectations of the crash were recoverable from spreads in order to test whether the crash may have been forecastable, at least in the sense of Dominguez, Fair and Shapiro (1988).

A limitation of these exercises is bid-ask spreads, quoted or effective, only reflect liquidity problems that are priced by market makers. A significant number of stocks did not enjoy a bid at all, and are thus excluded from the sample. If anything, stocks which became truly illiquid in the sense there were no bids and no transactions likely experienced a sharper loss of value, and thus the coefficients found are likely to be an underestimate of the true size of the liquidity problem's effect on NYSE stock returns.

All intradaily data are new, used for the first time in study, and personally hand-collected from the Chicago Daily Tribune. All daily data have been used before but not to measure liquidity in this fashion, as far as I am aware. The daily data were obtained from CRSP, to the exception of the data in figure 3 on the mispricings using cross-listed stocks, where the daily data for Boston and Chicago come from the New York Times as indicated in figure 3's data source note.

There is no data selection issue for CRSP data as they constitute the universe of stocks trading on the NYSE. There is a data selection issue for the intradaily data as the Chicago Daily Tribune selected the most active stocks according to their, unknown, criteria. There also is a data selection issue for regional exchange data as the listings are not comprehensive.

The econometrics in the paper (tables 1 to 3) only use the daily data from CRSP and are therefore unaffected by data selection issues. The intradaily data are only used in figure 4 to understand intradaily movement of these stocks.

Concerning regional exchanges, the leading expert on the topic Mary O'Sullivan writes (2007, p.493): "Although newspapers often reported the most actively traded stocks on these markets, comprehensive listings were rarely provided therein. However, for the period 1885-1915, the Manual of Statistics, a stock exchange handbook compiled by the Manual of Statistics Company of New York, contained substantially complete lists of the stocks traded on the country's leading stock exchanges. The Manual of Statistics ceased publication in 1921, so for the period 1918-1929 I relied primarily on The Annalist, an annual publication compiled by The New York Times Company, which provided data on securities traded on the leading stock exchanges."

Therefore, when I provide data from the New York Times for Chicago and Boston as in figure 3, I am also using the leading data provider also used by O'Sullivan (2007): the New York Times.

Concerning the intradaily data, the data are hand-collected from the Chicago Daily Tribune, a paper printed in Paris receiving information by cable from Chicago, conserved at the Bibliothèque Nationale de France. There are selection issues as this newspaper selected the largest and most liquid stocks but this only strengthens the argument: large intradaily drops after margin call hours are observed on the largest stock market capitalizations, not the small ones. The full list of stocks is given in Appendix B. Financial historians will recognize the largest stocks in the country of the time. The Chicago Daily Tribune very much selected the blue-chip stocks to report on.

I found these 80 stocks in the CRSP database and therefore we can compare these stocks' characteristics to the rest of the universe of NYSE stocks. During the year of 1929, these 80 stocks (out of the universe of roughly 700 stocks) represent 48% of total volume, during the crash they represent between 40-50%. The 80 stocks have 4 times the average daily volume of the universe of stocks, they are 3 times more valuable on a per-share basis, and have 4 to 5 times lower quoted bid-ask spreads as shown in table 5.

Average across shares	Active 80	All CRSP
Daily volume Jan.-Sep.	$19009	$5130
Daily volume Oct.	$28569	$7362
Market price Jan.-Sep.	$117	$46
Market price Nov.	$84	$31
Quoted bid-ask spreads Jan.-Sep.	0.7%	3.3%
Quoted bid-ask spreads Nov.	1.5%	6.7%

Source: Data are from CRSP for the "All CRSP" column. This dataset contains the universe of stocks trading on the NYSE. Data are from the Chicago Daily Tribune for the "Active 80" column. This dataset is a sample and contains selections issues which we just explained.

IV. Extension: Industry Breakdown of Liquidity

Sections 2 and 3 of this paper provided evidence that liquidity was a major force behind the crash at the aggregate level and at the individual stock level. Between these two levels, disaggregating by industry groups is valuable to test certain hypotheses advanced in recent strands of the literature on the onset of the Great Depression, as pointed out by an anonymous referee.

A recent wave of literature has argued that the collapse of the real estate sector in the late 1920s and early 1930s played an important role in the onset and severity of the Great Depression (Gjerstad and Smith 2014, Cortes and Weidenmier 2019). Recent contributions focused on the mid-1920s Florida Land Boom as a precedent of excessive speculation that led to the Great Crash (Calomiris and Jaremski 2023). An interesting hypothesis would therefore be to test if liquidity decreases more strongly for sectors associated with real estate such as construction, materials, and steel.

A second interesting hypothesis concerns the deterioration of financial intermediaries. A popular explanation for the onset and long-lasting nature of the Depression is based on the deterioration of credit conditions extended to firms by banks. This literature starts at least with Bernanke (1983), with more recent contributions by Anari, Kolari and Mason (2005) and Cortes, Taylor and Weidenmier (2022). Specifically, Cortes, Taylor and Weidenmier (2022) find that a bank stock index is better at predicting the onset of the

Great Depression than the aggregate stock market or failed bank deposits. An interesting hypothesis would then be to test if liquidity decreases more strongly for financial sectors such as banks, investment trusts, or insurance companies.

Thankfully, the CRSP database has already classified stocks using the Standard Industrial Classification (SIC) Code. Figure 8 shows the decomposition of quoted spreads by industry over the entire year of 1929 for the five sectors with at least 20 stocks. Those are finance, insurance and real estate; manufacturing; mining; retail trade; and transportation, communications, electric, gas and sanitary services. There are only 5 stocks in the construction sector therefore we cannot test the first hypothesis. The finance, insurance, and real estate sector contains 41 stocks. This sector does not allow to separate between the two hypotheses. Figure 8 shows all 5 sectors' proportional quoted spreads all spike in October. Therefore, we find at the industry level the similar phenomenon we observed at the aggregate level.

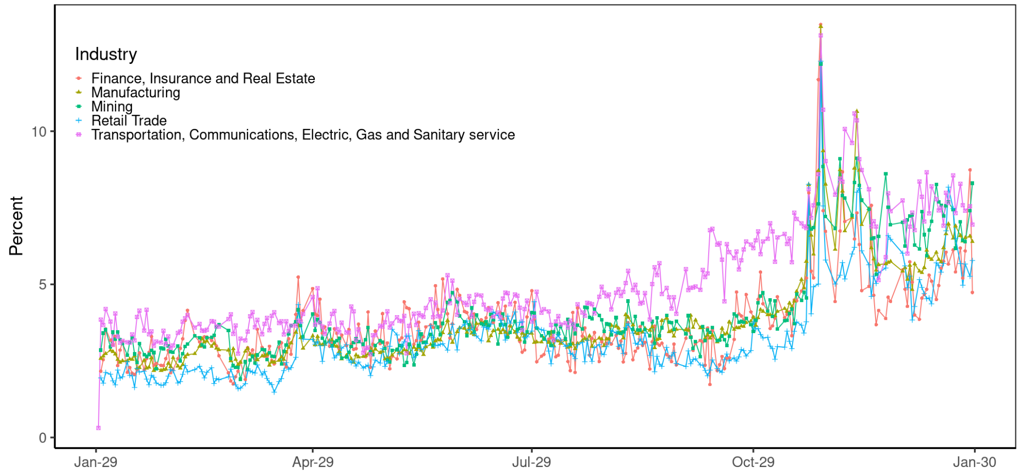

Figure 8. Proportional Quoted Bid-Ask Spreads of NYSE Stocks in 1929 By Industry

Note: Proportional quoted bid-ask spreads are differences between ask and bid quotes divided by mid-quotes, which are the average of the bid and the ask quotes. The mean spread across stocks aggregated by sector is reported in daily frequency. Sectors with minimum 20 stocks included.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

Figure 9 zooms in on the month of October and shows remarkable convergence across industries in the levels of spreads in the week of the crash. What is fascinating is that we observe again the double spike we had seen on figure 3 with the mispricings. The two spikes correspond to Black Thursday and Black Tuesday. The two most famous crash days. Black Thursday is famous for being the first of the crash days, while Black Tuesday is the worst of the crash days in terms of daily returns. In measures of effective spreads we did not see as clearly the double spike because there is to some degree a smoothing of observations: either a rolling window of observation is used (Roll) or a combination of open, close, high, and low prices over multiple days are used (Corwin and Schultz and Abdi and Ranaldo).

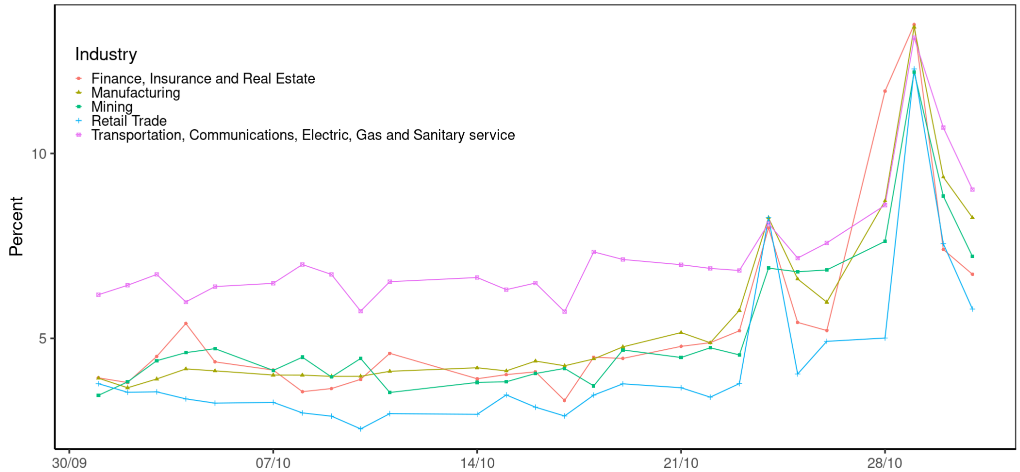

Figure 9. Proportional Quoted Bid-Ask Spreads of NYSE Stocks in October 1929 By Industry

Note: Proportional quoted bid-ask spreads are differences between ask and bid quotes divided by mid-quotes, which are the average of the bid and the ask quotes. The mean spread across stocks aggregated by sector is reported in daily frequency. Sectors with minimum 20 stocks included.
Source: Data are from CRSP. This dataset contains the universe of stocks trading on the NYSE.

Instead of finding any evidence of industry heterogeneity, these two graphs reveal a stunning degree of homogeneity. Quoted spreads do not suggest any sector was worse off. Arguably, this strengthens the case that there was a systemic event, not a sector-specific event.

Using Corwin and Schultz spreads instead of quoted spreads in figure 10, again allows us to observe the spikes in spreads over the year of 1929. The spikes are also present at a disaggregated industry level and if we zoom in for the month of October in figure 11 we see the same convergence across sectors on Black Thursday, the first spike, and slightly less convergence across sectors on the second spike, Black Tuesday. The measures are however remarkably close one to another. I would argue therefore there is no industry heterogeneity in liquidity during the crash, but truly a homogeneous decline in liquidity across sectors. If we recall figure 2, the standard error bands were also extremely tight around the mean quoted spreads so the evidence presented seems to be conclusive.

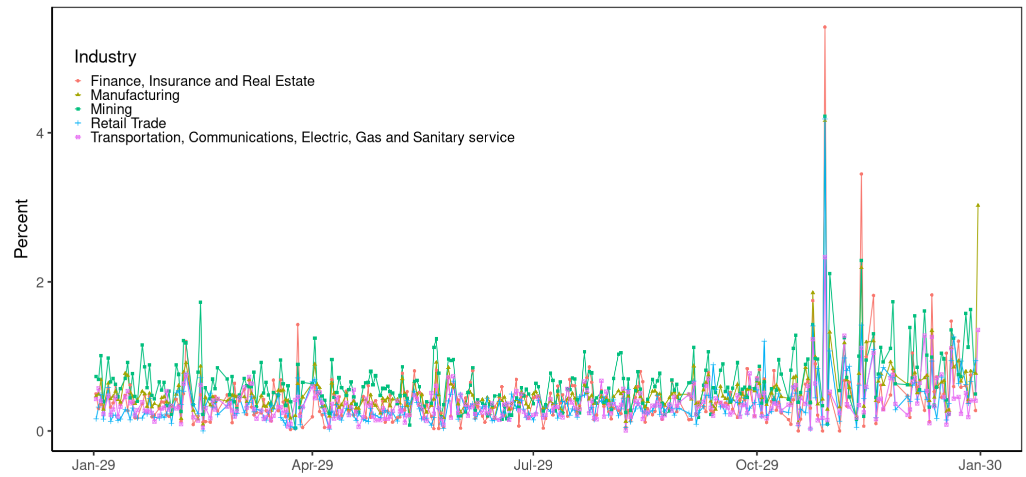

Figure 10. Corwin and Schultz (2012) Effective Bid-Ask Spreads of NYSE Stocks in 1929 By Industry

Note: Corwin and Schultz (2012) effective spreads. The mean spread across stocks aggregated by sector is reported in daily frequency. Sectors with minimum 20 stocks included.
Source: Data are from CRSP which is the universe of stocks trading on the NYSE.

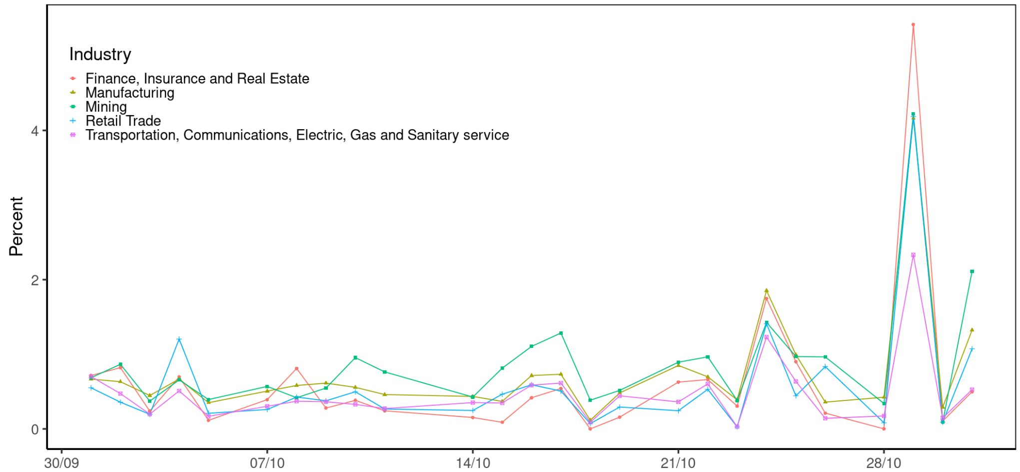

Figure 11. Corwin and Schultz (2012) Effective Bid-Ask Spreads of NYSE Stocks in October 1929 By Industry

Note: Corwin and Schultz (2012) effective spreads. The mean spread across stocks aggregated by sector is reported in daily frequency. Sectors with minimum 20 stocks included. *Source:* Data are from CRSP which is the universe of stocks trading on the NYSE.

V. Conclusion

This paper quantitatively confirms the common wisdom the 1929 crash was a liquidity crisis. At the aggregate level, proportional quoted spreads, Roll (1984), Corwin and Schultz (2012), Abdi and Ranaldo (2017) effective spreads, and the Amihud (2002) measure of illiquidity were multiplied by four in the crash, while absolute quoted spreads were multiplied by three. The incidence of zero returns is a common measure of liquidity which was not tested, as it did not seem relevant because the crash is a case of illiquidity associated to an excess of trading and volume, rather than an inactivity of financial markets. At the individual stock level, changes in quoted spreads explain a fifth of the variation in stock returns in repeated cross-sections and in panels and point estimates suggest a 0.7 to 1.0 percentage point average decrease in daily stock returns for an increase of one percentage point in spreads when applying panel data models.

Now we are sure the 1929 crash was a liquidity crisis, that we can quantify the decrease in liquidity at the aggregate level, and link the decrease in liquidity at the stock level to negative stock returns, we can turn to explaining the crash by explaining the decrease in liquidity.

Some of the remaining questions open for further study include: why is the explanatory power of liquidity so low? This is a liquidity crisis but liquidity across various measures only explains about a fifth of the variance in stock returns. We know Charles E. Mitchell, president of National City Bank (now Citibank) and a coalition of bankers tried to support the market by publicly purchasing stocks at market prices and they supported only some stocks. Is this driving heterogeneity between stocks or across certain days? Rising heterogeneity between stocks over time may be due to bankers intervening in reaction to the crash to try to stabilize the market. Bankers were more likely to do so, first by buying their own stock, second by buying the highest quality stocks. Further, leverage is likely to have affected some stocks more than others and severe deleveraging is likely to have taken place. Leverage is very much the other side of the coin of liquidity: by taking on leverage, investors create liquidity, beyond the capital they bring to invest. As an anonymous reviewer remarked: “Liquidity is not necessarily a problem on its own; it can become however a major problem if it is in connection with leverage.” A future avenue for research is perhaps to examine whether investment trusts, which are known to have taken on leverage, did so in specific stocks. A further research question is whether we can recover intradaily data for all stocks, instead of only the 80 I have found? How can we include stocks which became completely illiquid, without any bids or transactions? Part of the greatness of this crash is certainly due to the opaqueness surrounding it. Contrary to the Brady Commission for the 1987 crash, the Senate Commission and the Pecora Report did not answer the most pressing questions, but this study and hopefully following ones progressively shed some light on the causes of the greatest crash of the 20th century.

REFERENCES

Abdi, Farshid, and Angelo Ranaldo. 2017. "A simple estimation of bid-ask spreads from daily close, high, and low prices." *The Review of Financial Studies*, 30(12): 4437–4480.

Admati, Anat R, and Paul Pfleiderer. 1988. "A theory of intraday patterns: Volume and price variability." *The review of financial studies*, 1(1): 3–40.

Amihud, Yakov. 2002. "Illiquidity and stock returns: cross-section and time-series effects." *Journal of Financial Markets*, 5(1): 31–56.

Amihud, Yakov, and Haim Mendelson. 1980. "Dealership market: Market-making with inventory." *Journal of financial economics*, 8(1): 31–53.

Anari, Ali, James Kolari, and Joseph Mason. 2005. "Bank asset liquidation and the propagation of the US Great Depression." *Journal of Money, Credit and Banking*, 753–773.

Bernanke, Ben. 2002. "Asset Price "Bubbles" and Monetary Policy. Remarks before the New York Chapter of the National Association of Business Economics, New York."

Bernanke, Ben S. 1983. "Non-monetary effects of the financial crisis in the propagation of the Great Depression." National Bureau of Economic Research.

Bessembinder, Hendrik, and Kumar Venkataraman. 2010. "Bid-ask spreads: Measuring trade execution costs in financial markets." *Encyclopedia of quantitative finance*, 184–190.

Borowiecki, Karol Jan, Michał Dzieliński, and Alexander Tepper. 2022. "The great margin call: The role of leverage in the 1929 Wall Street crash." *The Economic History Review.*

Calomiris, Charles W, and Matthew Jaremski. 2023. "Florida (Un) Chained." *Journal of Financial Intermediation*, 101043.

Cortes, Gustavo S, and Marc D Weidenmier. 2019. "Stock volatility and the Great Depression." *The Review of Financial Studies*, 32(9): 3544–3570.

Cortes, Gustavo S, Bryan Taylor, and Marc D Weidenmier. 2022. "Financial factors and the propagation of the Great Depression." *Journal of Financial Economics*, 145(2): 577–594.

Corwin, Shane A, and Paul Schultz. 2012. "A simple way to estimate bid-ask spreads from daily high and low prices." *The Journal of Finance*, 67(2): 719–760.

De Long, J. Bradford, and Andrei Shleifer. 1991. "The Stock Market Bubble of 1929: Evidence From Closed-End Mutual Funds." *The Journal of Economic History*, 51(3): 675–700.

Dominguez, Kathryn M, Ray C Fair, and Matthew D Shapiro. 1988. "Forecasting the depression: Harvard versus Yale." *The American Economic Review*, 595–612.

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

Galbraith, John Kenneth. 1955. *The Great Crash, 1929.* Boston:Houghton Mifflin Harcourt.

George, Thomas J, Gautam Kaul, and Mahendrarajah Nimalendran. 1991. "Estimation of the bid–ask spread and its components: A new approach." *The Review of Financial Studies*, 4(4): 623–656.

Gjerstad, Steven D, and Vernon L Smith. 2014. *Rethinking housing bubbles: The role of household and bank balance sheets in modeling economic cycles.* Cambridge University Press.

Glosten, Lawrence R, and Paul R Milgrom. 1985. "Bid, ask and transaction prices in a specialist market with heterogeneously informed traders." *Journal of financial economics*, 14(1): 71–100.

Hagströmer, Björn. 2021. "Bias in the effective bid-ask spread." *Journal of Financial Economics*, 142(1): 314–337.

Harris, Lawrence. 1990. "Statistical properties of the Roll serial covariance bid/ask spread estimator." *The Journal of Finance*, 45(2): 579–590.

Hautcoeur, Pierre-Cyrille, Amir Rezaee, and Angelo Riva. 2023. "Competition between securities markets: stock exchange industry regulation in the Paris financial center at the turn of the twentieth century." *Cliometrica*, 17(2): 261–299.

Ho, Thomas SY, and Hans R Stoll. 1983. "The dynamics of dealer markets under competition." *The Journal of finance*, 38(4): 1053–1074.

Kindleberger, Charles P. 1978. *Manias, Panics, and Crashes: a History of Financial Crises.* New York:Palgrave Macmillan UK.

Klein, Maury. 2001. "The Stock Market Crash of 1929: A Review Article." *The Business History Review*, 75(2): 325–351.

Kyle, Albert S. 1985. "Continuous auctions and insider trading." *Econometrica: Journal of the Econometric Society*, 1315–1335.

McGrattan, Ellen R., and Edward C. Prescott. 2004. "The 1929 Stock Market: Irving Fisher Was Right." *International Economic Review*, 45(4): 991–1009.

Meltzer, Allan H. 1976. "Monetary and Other Explanations of the Start of the Great Depression." *Journal of Monetary Economics*, 2(4): 455–471.

Mishkin, Frederic S. 1978. "The Household Balance Sheet and the Great Depression." *The Journal of Economic History*, 38(4): 918–937.

O'Sullivan, Mary. 2007. "The expansion of the US stock market, 1885–1930: historical facts and theoretical fashions." *Enterprise & Society*, 8(3): 489–542.

Pasquariello, Paolo. 2014. "Financial Market Dislocations." *The Review of Financial Studies*, 27(6): 1868–1914.

Quinn, William, and John D Turner. 2020. *Boom and bust: A global history of financial bubbles.* Cambridge University Press.

Rappoport, Peter, and Eugene N. White. 1993. "Was There a Bubble in the 1929 Stock Market?" *The Journal of Economic History*, 53(3): 549–574.

Rappoport, Peter, and Eugene N. White. 1994. "Was the Crash of 1929 Expected?" *The American Economic Review*, 84(1): 271–281.

Roll, Richard. 1984. "A simple implicit measure of the effective bid-ask spread in an efficient market." *The Journal of Finance*, 39(4): 1127–1139.

Romer, Christina D. 1990. "The Great Crash and the Onset of the Great Depression." *The Quarterly Journal of Economics*, 105(3): 597–624.

Santoni, Gary, and Gerald P. Dwyer. 1990. "Bubbles vs. Fundamentals: New Evidence from the Great Bull Markets." In *Crises and Panics: The Lessons of History.* , ed. Eugene N. White. Homewood, IL.

Sirkin, Gerald. 1975. "The Stock Market of 1929 Revisited: A Note." *Business History Review*, 49(2): 223–231.

Stoll, Hans R. 2003. "Market microstructure." In *Handbook of the Economics of Finance.* Vol. 1, 553–604. Elsevier.

Temin, Peter. 1976. *Did Monetary Forces Cause the Great Depression?* Norton.

White, Eugene N. 1990. "The Stock Market Boom and Crash of 1929 Revisited." *Journal of Economic Perspectives*, 4(2): 67–83.

VI. Appendix A: Cross-sections of stock returns and measures of effective spreads

TABLE 5—CROSS-SECTIONS OF NYSE STOCK RETURNS AND ROLL (1984) SPREADS

	Constant	Spread	Δ Spread	N	R^2	F Statistic
Black Thursday	−2.786	−0.853		423	0.15	74.31
	(0.546)	(0.099)				
	−4.450		−1.952	423	0.428	315.00
	(0.330)		(0.110)			
Black Monday	−5.246	−0.680		217	0.183	48.15
	(0.882)	(0.098)				
	−8.581		−0.989	217	0.244	69.43
	(0.660)		(0.118)			
Black Tuesday	−16.769	0.221		401	0.006	2.37
	(1.662)	(0.144)				
	−9.601		−1.432	401	0.158	75.11
	(1.298)		(0.165)			

Note: Repeated cross-sections of stock returns on Roll (1984) estimates of effective spreads on crash days. Roll spreads calculated over a 20-trading day window. Positive covariances for Roll estimator treated as missing data. Standard errors in parentheses.
Source: Data are from CRSP.

Table 6—Cross-Sections of NYSE Stock Returns and Corwin and Schultz (2012) Spreads

	Constant	Spread	Δ Spread	N	R^2	F Statistic
Black Thursday	−4.960	−0.645		700	0.061	39.81
	(0.366)	(0.102)				
	−4.763		−0.884	700	0.132	92.45
	(0.333)		(0.092)			
Black Monday	−10.236	−1.106		706	0.083	52.45
	(0.375)	(0.153)				
	−10.700		−1.251	706	0.125	82.87
	(0.363)		(0.137)			
Black Tuesday	−14.436	0.128		632	0.002	0.98
	(1.069)	(0.129)				
	−12.234		−0.431	632	0.021	11.71
	(1.035)		(0.126)			

Note: Repeated cross-sections of stock returns on measures of spreads on crash days. Negative Corwin and Schultz (2012) effective spreads set to zero as recommended by authors. Standard errors in parentheses.
Source: Data are from CRSP.

Table 7—Cross-Sections of NYSE Stock Returns and Abdi & Ranaldo (2017) Spreads

	Constant	Spread	Δ Spread	N	R^2	F Statistic
Black Thursday	−2.974	−1.023		361	0.100	36.67
	(0.660)	(0.169)				
	−4.003		−2.620	361	0.325	159.2
	(0.427)		(0.208)			
Black Monday	−3.228	−0.912		213	0.175	35.90
	(0.965)	(0.152)				
	−6.669		−1.206	213	0.222	48.18
	(0.731)		(0.173)			
Black Tuesday	−19.658	1.537		239	0.077	18.92
	(2.693)	(0.354)				
	−8.505		−2.603	239	0.084	20.83
	(2.172)		(0.570)			

Note: Repeated cross-sections of stock returns on Abdi and Ranaldo (2017) estimates of effective spreads on crash days. Standard errors in parentheses.
Source: Data are from CRSP.

VII. Appendix B: List of 80 stocks included in the Chicago Daily Tribune and used in figure 4

Air Reduction, Allied Chemical, Amer Foreign Power, American Can, Amer Smelting, Am Tel Tel , Amer Water Works, Anaconda Copper, Andes Copper, Atchison Top , Balt Ohio, Bethlehem Steel, Brooklyn Man Tr , Canadian Pacific, Chesapeake Ohio, Chic St Paul Com, Chic St Paul Com pfd, Chic Rock Island, Col Carbon, Com Inv Trust, Columbia Gas, Com Solvents old , Com Solvents new , Cons Gas, Corn Products, Du Pont, Gen Amer Tank, General Electric, Gen Foods Corp , General Motors, Goodrich Tire, Great North Pfd, Int Combustion, Int Harvester, Int Nickel, Johns Manville, Lambert, Mack Truck, May Dept , National Biscuit, Mont Ward, National Dairy Prods, National Lead, Nat Power Light, Nevada Copper, N Y N H Hartford, North American, Northern Pacific, Packard new , Pan American B , Pub Serv New Jer , Radio, Republic Iron Steel, Simmons, So Pacific, Standard Brands, Stand Gas Elec , St Oil New Jersey, Studebaker, Superior Oil, Texas Corp, Texas Gulf, Timen R B , Union Carbide, Union Pacific, United Air Craft, United Corporation, U S Steel, Western Union, West Electric, Woolworth, Wright Curtiss.