



American Finance Association

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Source: *The Journal of Finance*, Vol. 52, No. 4 (Sep., 1997), pp. 1707-1723

Published by: Blackwell Publishing for the American Finance Association

Stable URL: <http://www.jstor.org/stable/2329454>

Accessed: 25/11/2009 10:11

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The Market for Equity Options in the 1870s

JOSEPH P. KAIRYS JR. and NICHOLAS VALERIO III*

ABSTRACT

The introduction of exchange-traded options in 1973 led to explosive growth in the stock options market, but put and call options on equity securities have existed for more than a century. Prior to the listing of option contracts, trading was conducted in an order-driven over-the-counter market. From 1873 to 1875, quotes for options contracts were published weekly in *The Commercial and Financial Chronicle* during a period that saw extensive marketing efforts by a number of brokerage firms. In this article we examine these quotes to determine why this seemingly sophisticated market existed for only a brief period in financial history.

IN 1973 EXCHANGE-TRADED OPTIONS were introduced, and for the first time a central marketplace was available for the trading of standardized option contracts. In addition, the creation of the Options Clearing Corporation provided an intermediary to all contracts. The volume of options traded has exploded during the past twenty-three years, as has our understanding of the pricing of options and other derivative securities.

Put and call options on equity securities, however, have been available to American investors for more than a century. Following the Civil War, an active market in “privileges” (the term then used for options¹) developed in New York City with numerous brokerage firms offering “put,” “call,” and “double privilege” contracts. This market reached the height of its activity in the period from 1873 through 1875. During that time indicative price quotes from a particular broker, for options on about a dozen equity securities, were generally published every Saturday in *The Commercial and Financial Chronicle*. These quotes were placed along with the other financial data for the week, including daily high and low stock prices, bond prices, gold prices, money

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¹ In the 1870s the term “option” was reserved for the extension of settlement terms for trades on the New York Stock Exchange. See Medbery (1871) for a discussion of trading conventions. Within the framework of this article we will use the word “option” not in reference to this settlement feature, but instead to the equity options termed “privileges.”

market rates, and foreign exchange rates. Occasionally, other privilege brokers would place advertisements giving their own quotes for options contracts. In June 1875, however, these privilege quotes ceased to be published without any comment as to why this occurred.

In this article, we use these option data, along with data for the underlying stocks, in an empirical analysis aimed at learning why this market—seemingly sophisticated even by today's standards—suddenly disappeared. We first compare the actual option prices with estimates of their theoretical values. We find that options were persistently mispriced relative to a theoretical valuation model. Our analysis shows that option contracts were generally overpriced and were unattractive for retail investors to purchase. We then examine the ex post exercise values to determine how much of the money investors were paying for these contracts was returned at expiration through in-the-money contracts. We find that trades executed at the quoted prices would have led to a substantial portion of the contracts expiring out-of-the-money. By undertaking an historical study of this nature, we hope to gain a better perspective on the success and failure of an early financial market and derive lessons applicable to modern financial innovations.

The remainder of this article is organized as follows. Section I describes the options market in the 1870s and provides a historical context for the article. Section II describes the data used in the present study and introduces the valuation procedure employed. Section III presents the empirical results of current valuation techniques applied to data from the 1870s. Section IV examines the exercise values of stock privileges, and Section V summarizes and concludes.

I. Historical Context

Option contracts have a long and well-documented history going back as far as ancient Greece. As told by Malkiel and Quandt (1969, p. 8), Aristotle reported in his *Politics* that the philosopher Thales earned a fortune in option contracts on the use of olive presses. In the 1600s in Amsterdam, both call and put contracts were written on tulip bulbs during the legendary tulip-bulb craze (see Filer (1959, p. 12)). The earliest mention of options in the United States dates back to the 1790s at the same time that the New York Stock Exchange was established (see Davis (1917, p. 196)).

During the period 1873 through 1875 indicative option quotes were generally published every Saturday. This was not the ex post reporting of transaction prices, but rather the reporting of bids and offers from a single broker to buy and sell, with the standard contract covering 100 shares and having 30 days to expiration.² All quotes were advertised as good for the following week. This was a primary market and it appears that there was no attempt by this single broker or others—at least publicly—to make a secondary market for these contracts.

² This was by far the most common contract although terms of 60 or 90 days were also available.

The market for stock options that emerged in this period involved a number of brokerage firms that actively courted clients for their product. Marketing brochures, such as *Men and Idioms of Wall Street* by John Hickling and Company (1875), discussed “puts,” “calls,” and “double privileges” (bottom combinations) in substantial detail. They also provided advice as to how options might be used as part of a hedging strategy. The wording of a call contract, for example, is easily recognizable today:

The bearer may call on the undersigned for one hundred shares of Atlantic and Pacific Telegraph Company capital stock, at 19½, at any time within 30 days from date.

Likewise, the wording of a put contract is familiar:

The bearer may put or deliver to the undersigned one hundred shares of Toledo and Wabash common stock, at 22, any time within thirty days from date.

(Hickling (1875, pp. 41–42.)) Exercise was possible at any time during the life of the contract; hence all contracts were “American-style” options.

A major difference of these early option contracts from the options of today is the convention by which prices were quoted.³ Whereas current option prices are quoted after fixing the strike price, the cost of a privilege was fixed at \$1.00 per share for all contracts and the strike price was adjusted to reflect current market conditions. Furthermore, the strike price was expressed as a spread from the current spot price of the underlying stock with the understanding that the option was always out-of-the-money at the time of issuance. This spread was then the “price” that was quoted for the privilege contract. For example, if a call was quoted at a price—or spread—of \$2.50 when the underlying stock price was \$85 per share, the strike price would be \$87.50. In addition, brokerage commissions of 6.25 percent were added to all transactions, so a call or put contract on 100 shares, with 30 days to expiration, would cost the retail customer \$106.25. A purchaser of the call in our example would not break even until the share price rose above \$88.5625. Since all quotes were advertised as good for the following week, this convention of quoting a fixed spread for the strike price gave the brokers an approximate hedge for subsequent days if the underlying stock price moved against them.⁴

Interestingly, the accent of the marketing brochures was on the purchase of option contracts by clients. The writing of option contracts was not explicitly discussed. In many brochures the profit potential of buying options—often illustrated with numbers—was distinctly emphasized. For example, a booklet of Tumbridge and Company from 1875 (selected pages reprinted in Filer (1959, pp. 85–94)) advertised in large typeface along the left margin of one of the

³ See Hickling (1875) for a detailed discussion of conventions used in the market for stock privileges.

⁴ This hedge is not exact since the strike price is altered by the same dollar amount as the change in the stock price rather than the same percentage amount.

pages "A double privilege pays a profit, no matter which way the market goes, and costs \$212.50." Whether the "profit" covers the cost of the option is not addressed. In the same booklet previous investor successes are touted, such as "Contracts on Lake Shore were settled at a profit of \$1,175" or "During March, as high as \$2,500 profit was made on 100 share calls." The brochure of John Hickling and Company takes great care to address the subject of the source of these profits in a section titled *Who pays the Profits on Privileges*.⁵ The detailed explanation is that calls are written by an owner of the shares who would gain by the difference in the exercise price and the cost basis of the shares, if the calls are exercised, plus the "premium paid to him in the first instance." In a similar manner it is explained that the writer of puts is a short-seller of the stock, who stands to profit from exercise by the difference in the price at which the stock was sold short and the exercise price, in addition to using the "put stock" to cover his short position. The section concludes with the phrase "It will thus be seen that if the holder gains, the maker gains also," which ignores the zero-sum nature of these contracts.

Some of the brokers who made a market in options would also quote prices for "responsible parties" to write options in addition to purchasing them. However, none of the detailed strategies outlined in the marketing brochures dealt with this side of the market. Hence, we cannot ascertain the extent to which individuals were able to write option contracts, and we suspect that in most transactions the writers were institutional investors or brokers who wrote the contracts against their own accounts. At the end of our sample period only ask quotes were published each week, giving further evidence that this was a one-sided market for the retail customer.

After 1875, the over-the-counter market for options continued to exist, but no dealer quotes were reported in the financial press on a regular basis. Advertisements for options with quoted prices appeared sporadically in *Barron's* in the 1960s, and regular option quotes only became available in 1973 with the introduction of exchange-traded options. Occasional references to options, however, can be found throughout the century from 1873 to 1973. Higgins (1896), for example, discusses the option markets in London, Paris, and Berlin as well as provides information on option contracts traded in London written on American stocks. Filer (1959) details the history of option trading in New York during his career, which began in the 1920s. Nowhere, however, do we see the standardized reporting of quotes such as that which appeared for a brief period from 1873 to 1875.

Theoretical discussions of option pricing were limited, and Bachelier's (1900) work on option pricing was one of the earliest. A finance textbook from early in the twentieth century, *Investment and Speculation* (Conway (1913)), summarizes the level of understanding about the factors affecting the price of an option. Conway writes (p. 84) that the privilege value depends

⁵ Note carefully that this is not phrased as a question.

1. *Upon the length of time during which the privilege is to run. If the time is long the risk of fluctuation is larger and the price greater.*
2. *Upon the difference between the prices named in the agreement and those then prevailing in the open market. The greater the difference in the prices, the less likely the seller of the privilege to be called on to fulfill the contract.*
3. *Upon the condition of the market. When the market is wild the seller of the privilege is running a greater risk than when the market is steady.*
4. *In the case of securities the nature of the [underlying asset, e.g., equities, commodities, . . .] must always be taken into consideration.*

It is interesting to note that the partial derivatives of the Black–Scholes (1973) formula are correctly signed, even though no formal analytical argument is presented.

In the 1950s, published research of Franklin and Colberg (1958) and Kruizenga (1959) provide brief descriptions of the options market at that time. Options were viewed as insurance and a means of hedging a position, or as a purely speculative gamble. The theoretical discussion of pricing was primitive by today's standards, but the general finding of these authors and of Boness (1964) was that options were profitable for the writer and unprofitable for the purchaser of options. In a reply, Franklin and Colberg (1959, p. 71) refer to the alleged high rate of return for option sellers and state, "the Puts and Calls market falls far short of being perfectly competitive because not all potential suppliers are allowed to be actual suppliers and because of lack of knowledge on the part of buyers." Our empirical findings suggest that similar conditions were true for the options market in the 1870s.

II. Valuation Procedure

A. Data

During the 1870s *The Commercial and Financial Chronicle* was published each Saturday,⁶ and option quotes from a single brokerage house were reported on a regular basis. For any week, privileges for as many as twenty different stocks were quoted. No depth of the market was reported with these quotes, nor were the prices at which transactions subsequently occurred. For the two-and-one-half-year period from January 1873 through June 1875, there were twelve stocks for which privilege prices were quoted regularly.⁷ These twelve make up our sample and were among approximately 30 on the "active list" for which daily high and low prices of stock trades were reported in each week's edition.⁸ All of the companies in our sample, except for Western Union

⁶ The markets were open for morning trading sessions on Saturdays during this period.

⁷ On September 20, 1873 the Stock Exchange was closed for ten days in the wake of a "financial panic." At that time the privilege quotes disappeared and did not reappear until December 1873. Also, during the first two months of 1875 no quotes were published.

⁸ If a stock sale did not occur on any day, the bid and ask prices were reported and indicated as such.

(a telegraph company) and Pacific Mail (a steamship company), are railroad stocks. For each of these twelve companies, we collect the weekly call and put privilege quotes along with the daily high and low stock prices. Both bid and ask quotes for the privilege contracts are available for the majority (74 percent) of the dates in our sample period, while the remaining observations contain only ask quotes.

The additional data needed for valuing these privileges are interest rates and cash dividend payments. As a proxy for the riskless interest rate, monthly commercial paper rates corresponding to our sample period are obtained from Macaulay (1938). With regard to dividend payments, the terms of both call and put privileges include the provision that, in the event of exercise, any dividends paid during the life of the option go to the ultimate holder of the stock (see Hickling (1875)). This provision effectively reduces the strike price by the amount of the dividend payment, a form of dividend protection.⁹ For this reason we do not account for dividends in the valuation procedure.¹⁰

B. Calculations

The convention by which the contracts were quoted requires an adjustment in the traditional option valuation method. For each privilege quote in the sample, two theoretical option values are calculated and used as lower and upper bounds. These bounds are compared to the standardized price of \$1.00 per share to gauge the reasonableness of the quoted spread. Since there is not a standardized strike price for each privilege contract, the high and low stock prices from the prior trading day are first used to set two strike prices based on the quoted spread for the privilege.¹¹ These calculated strike prices, together with the stock prices, are then used to estimate the lower and upper bounds on the value of the privilege. (For a formal presentation of these steps see the Appendix.)

The theoretical option values are calculated using the binomial model of Cox, Ross, and Rubinstein (1979) applied to a Black–Scholes (1973) economy of stock prices following a geometric Brownian motion.¹² This model allows for the possibility of early exercise of the put privilege contracts. Under the binomial approach, the time to expiration is divided into discrete intervals. The value for the privilege is found by starting at expiration and working backward; this backward recursion is performed until a current value for the privilege contract is determined.

⁹ For an analysis of the effects of dividends on options see Merton (1973).

¹⁰ For the sample period a total of seventeen dividend payments were made by the twelve companies.

¹¹ The prior day's stock prices are used since these would be the most recent available to the broker when setting the quotes for Saturday publication.

¹² An assumption of the binomial model is the absence of transaction costs and taxes. In the 1870s there were no income taxes. The commission for trading stock was one-eighth of one percent of the transaction amount. The standard bid-ask spread was one-quarter of a point or \$0.25 per share, and a minimum bid-ask spread of one-eighth of a point or \$0.125 was required by the New York Stock Exchange (see Stedman (1905, pp. 498–502)).

The method of volatility estimation used is the extreme value method of Parkinson (1980). This estimator is based on the high and low trade prices for a stock each day.¹³ Parkinson's method has been shown to present a slight downward bias due to the discrete sampling of an assumed continuous price process. Garman and Klass (1980) provide an adjustment that corrects for this bias based on the number of intra-day transactions. However, we have no information about the volume of stock trading and therefore cannot perform this correction. Furthermore, a second bias in this estimator results from the assumption of zero drift in stock prices. Since we are working with data from short (daily) intervals, our results should not be greatly affected by this second bias (see Garman and Klass (1980) or Kunitomo (1992)). Any downward biases of the extreme value method will make it more difficult for us to identify underpriced options and easier to identify overpriced options.

Since we cannot observe the "true" volatility of returns, we consider a range of volatility estimates in order to establish whether our findings are a function of our choice of volatility estimator. We calculate theoretical privilege values using three different estimates of volatility based on historical windows of 12 days (two weeks), 24 days (four weeks), and 60 days (10 weeks) of stock prices preceding the quotation date. We have no information about how traders in the 1870s calculated volatility, so we have chosen these three windows in the hope of encompassing the time frame that they might have used.

III. Valuation Results

For the twelve companies in the sample, from January 1873 through June 1875 there are a total of 1,138 ask quotes for call privileges and 1,161 ask quotes for put privileges. For each of these quoted spreads, theoretical lower and upper bounds are estimated and compared to the fixed market price of \$1.00 per share. If the fixed price lies within the bounds, the quoted spread is categorized as "fair." If the \$1.00 price is below the lower bound or above the upper bound, the quote is categorized as "underpriced" or "overpriced," respectively. We find that a majority of these observations are overpriced. That is, the quoted spreads are too large and therefore the strike prices for calls are being set too high—and the strike prices for puts being set too low—to justify the price of \$1.00 per share. Furthermore, since the commission charges from purchasing privileges are fixed at 6.25 percent, the same lower and upper bounds can be compared to a fixed price of \$1.0625 per share to account for that component of transactions costs. The results of this latter comparison are presented in Table I by company. (Summary statistics for the calculated bounds used for the results shown in Table I are presented in Table A.I in the Appendix.)

Focusing on the calls, 86 percent of the 1,138 quoted spreads are set too high. In other words, a call contract with a strike price based on one of these 978

¹³ On days where no trades occurred, we treat the ask price as the high, and the bid price as the low.

Table I
Stock Privilege Ask Quote Distribution

The distribution of observations when theoretical lower and upper bounds are compared to the fixed market price—including commissions—of \$1.0625 per share for buying a stock privilege (option). The bounds are estimated from a binomial option pricing model using ask quotes. The sample comprises all available ask quotes from January 1873 through June 1875 for the companies listed.

Company	Calls				Puts			
	Under	Fair	Over	Total	Under	Fair	Over	Total
NY Central & Hudson	1	8	90	99	1	8	90	99
Lake Shore	2	18	79	99	1	23	74	98
Rock Island	0	7	92	99	0	8	91	99
Erie	6	9	83	98	4	13	81	98
Pacific Mail	8	19	72	99	6	26	65	97
Northwestern	2	13	46	61	1	21	62	84
Western Union Telegraph	3	17	78	98	4	23	71	98
Ohio & Mississippi	0	2	97	99	0	7	92	99
Union Pacific	6	11	81	98	6	18	75	99
Wabash	3	8	86	97	3	12	84	99
Columbus Chicago & Indiana Central	2	3	92	97	2	6	89	97
St. Paul	1	11	82	94	1	15	78	94
Total observations	34	126	978	1,138	29	180	952	1,161
Percentage of total	3%	11%	86%	100%	2%	16%	82%	100%

quotes would be overpriced at \$106.25. Only 3 percent of the observed quotes are set too low, while for the remaining 11 percent of the observations, paying \$106.25 for one of these contracts on 100 shares would be a “fair” transaction based on our estimated lower and upper bounds. Turning to the put options, essentially the same distribution holds, with a slightly higher percentage of observations categorized as fairly-priced. These results for calls and puts are based on bounds calculated with volatility estimates derived from historical windows of 12 days of stock prices. Using volatility estimates from historical windows of 24 and 60 days does not significantly alter these results, with only 1–2 percent of the observations changing categories.

Over the sample period there are also 852 observations of bid quotes for call privileges and 877 bid quotes for put privileges. Again we emphasize that we do not know to what extent individual investors were able to write these contracts. The primary focus of the marketing brochures of the period was the purchase of options and we take this as evidence that retail customers would have encountered difficulty in attempting to be sellers. However, since bid quotes were published for a portion of the period examined, we apply the same procedure that was used for the ask quotes. For each quoted spread, theoretical lower and upper bounds are estimated and then compared to the fixed market price of \$0.9375 per share (the fixed proceeds from writing of \$1.00 less commissions of 6.25 percent). The results from making this comparison are presented in Table II by company.

Table II
Stock Privilege Bid Quote Distribution

The distribution of observations when theoretical lower and upper bounds are compared to the fixed market price—including commissions—of \$0.9375 per share for writing a stock privilege (option). The bounds are estimated from a binomial option pricing model using bid quotes. The sample comprises all available bid quotes from January 1873 through June 1875 for the companies listed.

Company	Calls				Puts			
	Under	Fair	Over	Total	Under	Fair	Over	Total
NY Central & Hudson	4	14	57	75	2	15	58	75
Lake Shore	4	27	42	73	4	27	44	75
Rock Island	1	15	59	75	1	16	58	75
Erie	3	12	59	74	3	10	61	74
Pacific Mail	7	25	43	75	10	30	34	74
Northwestern	1	15	24	40	2	19	41	62
Western Union Telegraph	12	25	36	73	8	35	31	74
Ohio & Mississippi	4	14	57	75	4	13	57	74
Union Pacific	3	22	50	75	4	30	41	75
Wabash	5	22	47	74	5	22	48	75
Columbus Chicago & Indiana Central	2	10	62	74	4	20	50	74
St. Paul	3	20	46	69	2	29	39	70
Total observations	49	221	582	852	49	266	562	877
Percentage of total	6%	26%	68%	100%	6%	30%	64%	100%

As was the case for the ask quotes, the majority of the quoted bid spreads are set relatively too high. However, for both puts and calls the distribution is less skewed toward overpriced quotes; a substantial portion of the quotes are characterized as “fair.” For the calls, 26 percent of the observations fall into this category, while 30 percent of the puts are similarly classified. In these cases the cash inflow of \$93.75 (\$100 net of commissions) from writing a contract would have been a fair transaction relative to the estimated theoretical bounds.

In a companion piece to their theoretical contribution, Black and Scholes (1972) test their model of option pricing using data from an over-the-counter option broker. Here they state (p. 413): “We have also shown that in general writers obtain favorable prices . . .” Similarly, Franklin and Colberg (1958) undertake a detailed description of the over-the-counter option market. They observe (p. 34): “The main problem of the Put and Call brokers seems to be that of finding buyers rather than sellers, suggesting that these options tend to be overpriced.” Franklin and Colberg discuss (pp. 71–72) that option writers were generally “big portfolio investors, individuals, or funds, which maintain a long-term position in securities of their choice.” That is, informed investors. For an individual investor to write option contracts on a regular basis, one could have been required by the options brokers to place up to \$100,000 on open account to cover any possible losses from option writing activities. As an anecdotal example of writing option contracts as a retail investor, Franklin

and Colberg discuss (p. 72) their experience of securing a quote for an option contract on a relatively stable stock. They received only an ask quote. When they requested a bid quote, they were told that "there was no market for this option." Thus, if we observe bid prices that would be attractive to potential writers of option contracts, it is not at all clear that an investor could have found a willing buyer to take the other side of the transaction.

IV. Exercise Values

The results presented in the previous section show that a substantial portion of the quoted bid and ask spreads for both puts and calls were "overpriced." A transaction—at the fixed market price adjusted for commissions—would have been unfavorable for the buyer of the contract. To quantify the disadvantage to a buyer of a privilege contract, a second analysis of the offer side of the market is performed.

The inquiry consists of the following mechanical trading strategy and relies only upon the calculation of a strike price and an exercise value for each contract, not upon estimates of any valuation parameters. Each Saturday when the privilege quotes become available, purchase one call contract and one put contract for each of the twelve companies in the sample with an available quote.¹⁴ Hold these contracts until their expiration 30 days later and record the exercise values, if positive. To set the strike prices for call contracts, the quoted ask spread from any Saturday is added to the same day's high stock price. For puts, the strike prices are set by subtracting the quoted ask spread from the same day's low stock price. The subsequent exercise values at expiration are established by comparing these strike prices to the high stock price (for calls) or the low stock price (for puts) on the expiration date. The results from this naive strategy are displayed in Table III.

For the calls, over the sample period, there are a total of 1,116 quotes for which there are available both the appropriate stock price on the quotation date, to set the strike price, and the appropriate stock price 30 days later to calculate the exercise value. Out of these 1,116 contracts "purchased" only 147 (13 percent) expire "in-the-money," with an average exercise value of \$216.33 per contract. The total proceeds from the 147 contracts are then \$31,800. However, the cost of purchasing the 1,116 contracts (at the fixed market price of \$1.00 per share) is \$111,600, plus commissions—at 6.25 percent—of \$6,975 for a total outlay of \$118,575. Thus, only 27 percent of the cost of purchasing the call contracts is recovered. Turning to the puts, there are 1,139 contracts purchased in this trading strategy, of which 390 (34 percent) expire with a positive exercise value. The total gains from exercising these 390 contracts are \$123,050. The corresponding cost, including commissions, is \$121,018.75, leaving a profit of \$2,031.25.

¹⁴ This strategy contains a survivorship bias, since it assumes that at the beginning of the sample period we can identify with perfect foresight the twelve companies with the most consistent publication of privilege quotes over the sample period.

Table III
Buying Strategy Returns

The exercise values, by company, of stock privileges from a trading strategy based on ask quotes. Column (A) lists the number of contracts purchased, Column (B) lists the number of those contracts in-the-money at expiration, Column (C) is the average exercise value per contract in (B), and Column (D) is the total proceeds from exercise. All dollar amounts are per share. The sample comprises all available quotes from January 1873 through June 1875 for the companies listed.

Company	(A)	(B)	(C)	(D)
Calls				
NY Central & Hudson	97	19	\$1.39	\$ 26.375
Lake Shore	97	14	2.18	30.500
Rock Island	97	13	0.92	12.000
Erie	96	7	2.14	15.000
Pacific Mail	97	9	1.72	15.500
Northwestern	60	8	2.88	23.000
Western Union Telegraph	96	17	1.53	26.000
Ohio & Mississippi	97	12	1.98	23.750
Union Pacific	96	22	4.24	93.250
Wabash	95	5	1.03	5.125
Columbus Chicago & Indiana Central	96	6	1.46	8.750
St. Paul	92	15	2.58	38.750
Totals	1,116	147	\$2.16	\$ 318.00
Puts				
NY Central & Hudson	97	27	\$2.08	\$ 56.125
Lake Shore	96	38	2.85	108.375
Rock Island	97	24	3.66	87.750
Erie	96	29	2.92	84.750
Pacific Mail	95	32	4.73	151.500
Northwestern	83	35	3.40	118.875
Western Union Telegraph	96	20	5.08	101.500
Ohio & Mississippi	97	37	2.28	84.500
Union Pacific	97	36	1.92	69.250
Wabash	97	46	3.64	167.250
Columbus Chicago & Indiana Central	96	35	3.09	108.125
St. Paul	92	31	2.98	92.500
Totals	1,139	390	\$3.16	\$1,230.50

It seems that for an investor in the 1870s the habitual purchase of put privileges would have been a better strategy than the purchase of calls. However, the put contracts benefit from the “financial panic” that hit the stock market in September, 1873.¹⁵ Viewing this as a “one-time” event, we repeat the analysis for puts excluding any unexpired contracts written before the stock

¹⁵ From September 16 to 19, an equally-weighted stock price index of the twelve companies in our sample fell 19.4 percent. On the morning of September 20 “at the Stock Exchange excitement was so high, and prices were declining so rapidly, that the Governing Committee met about 11 o’clock A.M., and decided to close the Exchange immediately until further notice, which was

market panic. This eliminates 45 contracts from the sample, of which 22 have positive exercise values at expiration. Of the remaining 1,094 contracts 368 (34 percent) have a positive exercise value at expiration. The total cash inflows from exercising are \$98,325 while the cost is \$116,237.50 (including commissions.) Consequently, our mechanical strategy leads to losses for the regular buyers of call or put privileges.¹⁶ These findings are consistent with earlier studies of the put and call markets. In a publication of The Moody Corporation titled *The Cycles of Speculation* (1907), Thomas Gibson wrote:

The writer kept account of the transactions in "puts and calls" handled through a large concern for almost two years and found that only about 35% of the money paid for these privileges returned to the purchasers. . . . It would appear from these facts, that the purchasing of privileges is a poor business proposition, while the selling of privileges is a money making affair. This is true.

In a similar fashion Black and Scholes (1972) point out (p. 413):

Other researchers (Boness (1964) Katz (1963) Kruizenga (1964) and Malkiel and Quandt (1969)) have compared the realized returns to options buyers and option writers. The conclusions from these studies tended to suggest that writing options was more profitable than buying . . .

Galai (1977) examined the newly-formed market for call options, the Chicago Board Options Exchange (CBOE), and found that trading rules based on the Black-Scholes (1973) model exhibited "above-normal profits." Although these profits would not be exclusive to market makers, he states (p. 195) that ". . . it does not seem that a nonmember of the CBOE can expect to achieve 'above-normal profits' consistently." Once again, informed investors with superior resources seem to have had an advantage over individual investors.

V. Summary and Conclusion

The financial markets of the 1870s exhibited a degree of sophistication that would be easily recognized by investors of today. For the market participant at that time interested in put and call options, the 'privilege' market from 1873 to 1875 offered seemingly abundant opportunities. The regular reporting of bid and ask quotes for options on a broad range of stocks was complemented by extensive marketing efforts by brokerage firms. The contracts were normally written to cover 100 shares with 30 days to expiration. A major difference from options of today was in the pricing convention. The market price of the option was fixed for all contracts (as was the commission.) Market conditions were

accordingly done." (*The Commercial and Financial Chronicle*, September 27, 1873, p. 410.) The exchange was reopened on September 30.

¹⁶ Note that our results presented in this section do not adjust for the risk inherent in a long options position. This is not necessary, as doing so would only reinforce the conclusion that this market was unfavorable for the retail investor.

then reflected by adjusting the strike price, which was quoted as a spread from the current spot price for the stock and was always set "out-of-the-money."

Empirically we find that both put and call options were regularly overpriced relative to a theoretical valuation model. Options were attractive for the brokers that sold them, but did not represent an attractive investment vehicle for investors, a finding that is consistent with previous empirical studies of option pricing from the 1950s, 1960s, and 1970s. Furthermore, our evidence suggests that one could not transact freely on both sides of the market. The direct emphasis of the marketing brochures on the purchase of options by the public, together with the publication of bid quotes only for a subset of our sample period, indicate that a retail investor likely would have had difficulty in writing options. As we show in Section IV, the role of an exclusive purchaser of options in a mechanical trading strategy would not have been a profitable one. Furthermore, this was a primary market with no apparent attempt by the brokers at making a secondary market. In fact, the pricing protocol of the time would have precluded the existence of a secondary market for a contract once the strike price was set.

Why did the options market fail to further develop given this apparent level of refinement in the 1870s? In this article we present empirical and anecdotal evidence supporting the hypothesis that the market at that time was essentially inefficient. However, an alternative hypothesis is that the interest in privileges arose in response to fundamental changes in stock market volatility. Differences in market volatility across historical periods have been documented and analyzed by Black (1976), French, Schwert, and Stambaugh (1987), and Schwert (1989) among others. If, in the 1870s, the view was widely held that market volatility was shifting to a higher level, then it is possible that privileges gained popularity as a vehicle for hedging the expected higher level of risk, or as a mechanism for speculating in this new environment, as we frequently observe today. Subsequently, if the realized volatility did not meet expectations, then it is likely that these contracts fell out of favor with the investors in the 1870s.

To investigate this possibility we plot in Figure 1 the volatility calculated from a spliced time series of monthly returns to a stock portfolio.¹⁷ Here we see that the volatility that prevailed (as estimated from these data) from the 1860s through the 1870s was not atypical *ex post* and was within the long-term range of 2 to 7 percent per month encompassing 88 percent of the observations in the entire series. This would seem to suggest that the brief popularity of privileges that we document in this article is not volatility driven. Indeed, Figure 1 shows the mid-1860s, the mid-1890s, and, most distinctly, the 1930s as periods of unusually high volatility, none of which spawned a level of interest in options that matches the early 1870s.

¹⁷ The series is constructed by combining data, from 1834 through 1925, from Schwert (1990) with the value-weighted index of the Center for Research in Securities Prices from 1926 to 1994. We are grateful to G. William Schwert for making his data available.

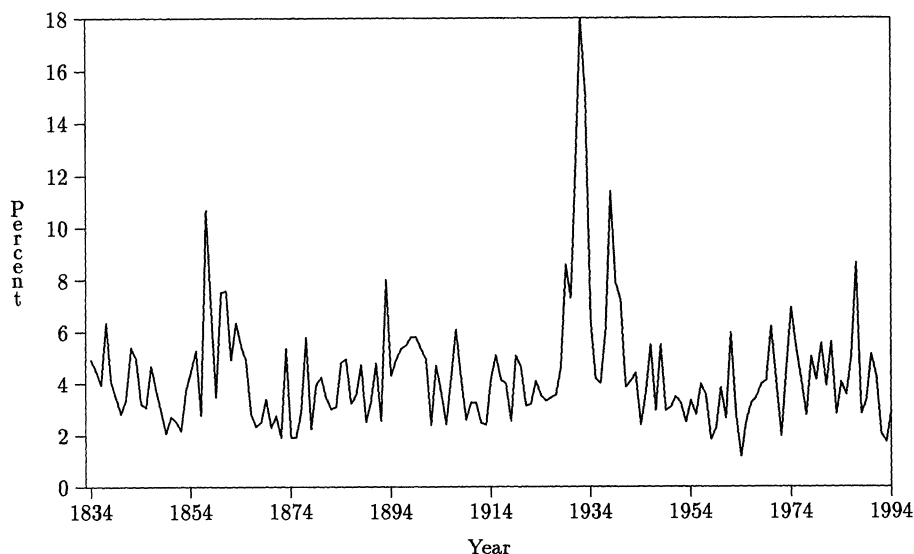


Figure 1. Stock Market Volatility, January 1834–December 1994. Estimated monthly standard deviations of returns, by year, from a stock portfolio. The observation for each year is calculated from the 12 monthly returns for that year.

Thus, we propose that as investors realized their systematic disadvantage in the options market (the majority of calls and puts overpriced and expiring out-of-the-money), they ceased to buy privileges. This necessitated further marketing efforts by the brokers to attract new purchasers. When new buyers could no longer be found, the options market moved to the fringes of the financial markets. Only with the introduction of exchange-traded options was the playing field leveled for the retail investor and explosive growth has ensued.

Appendix

Denoting the quoted bid and ask spreads from date t for the privilege as Q_t^B and Q_t^A respectively ($Q_t^B < Q_t^A$) and the daily high and low stock prices from the prior trading day S_{t-1}^H and S_{t-1}^L , lower and upper bounds on the \$1.00 fixed market price of the privilege can be described as functions of the stock prices and strike prices by the following relationships. For calls the lower and upper bounds, respectively, are

$$C_t^L = C(S_{t-1}^L, K_t^H) \quad \text{and} \quad C_t^U = C(S_{t-1}^H, K_t^L)$$

where, for the call privilege ask quote

$$K_t^H = S_{t-1}^H + Q_t^A \quad \text{and} \quad K_t^L = S_{t-1}^L + Q_t^A$$

and for the call privilege bid quote

$$K_t^H = S_{t-1}^H + Q_t^B \quad \text{and} \quad K_t^L = S_{t-1}^L + Q_t^B.$$

By making the lower bound a function of the low stock price and the high strike price a relatively low value for this bound is calculated. Since the upper bound is a function of the high stock price and the low strike price a relatively high value is calculated.¹⁸

In an analogous manner the lower and upper bounds, respectively, for puts are

$$P_t^L = P(S_{t-1}^H, K_t^L) \quad \text{and} \quad P_t^U = P(S_{t-1}^L, K_t^H)$$

where, for the put privilege ask quote $K_t^H = S_{t-1}^H - Q_t^A$ and $K_t^L = S_{t-1}^L - Q_t^A$, and for the put bid quote $K_t^H = S_{t-1}^H - Q_t^B$ and $K_t^L = S_{t-1}^L - Q_t^B$.

Summary statistics for the calculated bounds used to obtain the results shown in Table I in Section III are presented in Appendix Table A.I.¹⁹

¹⁸ The average range between the upper and lower bounds across all observations for all companies in the sample is \$0.25 for the calculations reported in Table A.I. This average is the same for both classes of privileges.

¹⁹ Note that a majority of the minimum calculated bounds are zero. This is due to the discrete nature of the binomial valuation procedure, and in a continuous-time framework an option would only be worthless if the stock price were zero.

Table A.I
Theoretical Bounds Statistics

Summary statistics for estimated theoretical bounds for stock privileges (options). The fixed market prices of privileges are compared to the bounds to determine over-, under-, or fairly-priced contracts. The bounds are estimated from a binomial option pricing model using ask quotes; the units are dollars per share. The sample comprises all available ask quotes from January 1873 through June 1875 for the companies listed.

Company	Lower Bound			Upper Bound		
	Min.	Ave.	Max.	Min.	Ave.	Max.
Calls						
NY Central & Hudson	0.00	0.19	1.11	0.00	0.41	2.08
Lake Shore	0.01	0.30	1.27	0.02	0.73	3.33
Rock Island	0.00	0.14	0.85	0.00	0.39	2.72
Erie	0.00	0.24	1.63	0.00	0.50	2.77
Pacific Mail	0.00	0.34	2.55	0.00	0.84	4.07
Northwestern	0.01	0.31	1.21	0.03	0.74	2.68
Western Union Telegraph	0.00	0.30	1.93	0.00	0.75	4.33
Ohio & Mississippi	0.00	0.21	0.91	0.00	0.47	1.32
Union Pacific	0.01	0.32	3.04	0.03	0.73	4.47
Wabash	0.00	0.25	1.81	0.00	0.56	2.70
Columbus Chicago & Indiana Central	0.00	0.14	1.85	0.00	0.29	2.34
St. Paul	0.00	0.20	1.09	0.01	0.50	1.98
Puts						
NY Central & Hudson	0.00	0.19	1.09	0.00	0.44	2.03
Lake Shore	0.01	0.29	1.13	0.03	0.74	2.93
Rock Island	0.00	0.15	0.83	0.00	0.42	2.52
Erie	0.00	0.20	1.47	0.00	0.45	2.73
Pacific Mail	0.00	0.35	1.88	0.01	0.92	4.41
Northwestern	0.00	0.29	1.30	0.00	0.75	3.73
Western Union Telegraph	0.00	0.33	1.94	0.01	0.84	4.53
Ohio & Mississippi	0.00	0.23	1.06	0.01	0.54	1.88
Union Pacific	0.02	0.37	2.97	0.06	0.86	4.58
Wabash	0.00	0.25	1.95	0.01	0.61	2.97
Columbus Chicago & Indiana Central	0.00	0.18	1.44	0.00	0.43	2.05
St. Paul	0.01	0.24	1.26	0.04	0.60	2.26

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