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RETURNS ON STOCKS, BONDS, AND COMMERCIAL PAPER:
LONG-TERM CONSTRUCTION, ANALYSIS, AND COMPARISONS

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Faculty Working Paper No. 117 April 1988

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Abstract

We report on the results of the construction of consistent monthly returns for two alternative measures of common stocks, for Aaa bonds, and for commercial paper from December 1870 through December 1987. The annual yields, on the assumption of monthly reinvestment of income returns, are analyzed and compared in both nominal and inflation-adjusted terms. The average returns for each series are reported by return components for the complete 1871-1987 period as well as for the two subperiods 1871-1925 and 1926-1987. The purpose of this paper is to extend return data back in time as far as possible, and to provide alternative data series for research purposes.

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RETURNS ON STOCKS, BONDS, AND COMMERCIAL PAPER: LONG-TERM CONSTRUCTION, ANALYSIS, AND COMPARISONS

I. Introduction

Ibbotson and Sinquefield (1976, 1977, 1979, 1982) and Ibbotson Associates (1984, 1985, 1986, 1987, 1988) have constructed returns on stocks, bonds and bills, beginning in 1926 and updated regularly. Recently, Wilson and Jones (1987) extended the stock return series back to January 1871 using data from the Cowles Commission study. Such a doubling of the time series for stock returns provides the basis for new analyses of the long-run performance of the equity market in general, and this equity market proxy in particular, under widely varying economic conditions.

In this paper we extend the fixed-income return data back in a comparable manner by calculating annual returns on Aaa corporate bonds and commercial paper, in both nominal and real terms, from 1871 through 1987.[1] These data provide the basis for the same types of analyses for fixed-income securities as for equities and makes possible very long-run comparisons among the major asset categories. In addition to these two fixed-income return series, we also construct an alternative stock return series that is broader than that of Wilson and Jones (1987), who spliced the Cowles series for the early period to the Ibbotson-Sinquefield series.

Current data available from Federal Reserve System sources allow both continuing monthly updates of the current rates on paper and bonds and the recalculation of cumulative wealth from these assets; furthermore, the stock return series can be updated regularly. Our returns series for all three assets are completely replicable from the data in the sources listed. These results are not intended as a substitute for, but as a complement to, the results of the Ibbotson-Sinquefield studies by almost

doubling the time series of returns as well as providing estimates for a risky short-term asset, commercial paper.

II. A Review of Earlier Estimates of Asset Returns

The most widely used measure for stock performance is the Standard & Poor's "500," popularized by Ibbotson and Sinquefield, and currently updated in a regular and timely fashion by Ibbotson Associates. As noted in Wilson and Jones (1987), Alfred Cowles (1939) chronicled the monthly returns of common stocks based on the definitions and formula used by the Standard Statistics Company (which merged wih Poor's in 1941), carrying the data back to January 1871. Wilson and Jones (1987) compared monthly returns reconstructed from the Cowles series for 1871-1925 with the Ibbotson and Associates data from 1926-1985, and found differences in nominal returns between the two periods, as well as differences in the proportion of the total returns derived from appreciation and dividends.[2]

The two time periods were quite different in terms of general economic conditions. Further, given the differing definitions of stock returns by Cowles and by Ibbotson and Sinquefield, some differences in results should probably be expected even if everything else were held constant. For example, Cowles attempted to cover all common stocks listed on the New York Stock Exchange (NYSE), while Ibbotson Associates report the Standard & Poor 500 returns. To determine if these differing definitions affect the overall results, we splice the Cowles data to a NYSE-measure of stock returns starting in 1926.

No long-term series of monthly returns on commercial paper seems to have been described in the literature. However, Friedman and Schwartz

(1982, pp. 122-129) present annual average commercial paper interest rates from 1867-1975 based on essentially the same data sources that we have used in constructing the monthly return series.

Annual bond returns have been analyzed in previous studies. Roman Weil (1970) presented an annual returns series from 1900 to 1968, in real and nominal terms, based on Standard and Poor's Aaa corporate bond yields. He calculated calendar year holding-period returns using the assumption of a 4% coupon with 20 years to maturity (compounded semiannually). He was attempting to answer the following questions: "What have real interest rates been throughout this century?", and "What have been the real returns to bondholders?" Weil carefully considered the potential bias of the 4% coupon-20-year-maturity assumption and concluded on the basis of empirical estimates that the bias from the coupon assumption was small relative to the bias from the maturity assumption.

Fisher and Weil (1971) compared the investment performance of Aaa corporate bonds (Standard and Poor's yields) with common stocks for the period 1925-1968. They also used the assumption of the 4's with 20 years to maturity, and, as in Weil's earlier computations, assumed annual reinvestment. Their conclusion was that the performance of bonds was inferior to the performance of common stocks over the period surveyed.

Friedman and Schwartz (1982, pp. 122-128) construct an annual series of yields on high grade corporate bonds from 1867 to 1975. Their series is based on Macaulay's yields adjusted for "drift," spliced to Durand's series in 1900-1902 (1982, pp. 109-110). Ibbotson and Sinquefield and Ibbotson Associates have reported monthly returns for U.S. government bonds, corporate bonds, and Treasury bills from 1926 to the present. They also

have used the 4's with 20 years to maturity in their calculation of corporate bond returns but have assumed monthly reinvestment to provide a better comparison of bond returns with common stock returns. Since 1969, the Ibbotson data are based on actual transactions available from Salomon Brothers. Prior to 1949, the Ibbotson data used the Standard and Poor's high-grade corporate bond yields, assuming the 4% coupon and a 20-year maturity.[3] The Ibbotson data on corporate bond returns appear to contain splices over time between several data sources that are not consistently defined.

III. Data and Methodology

A. Stock Return Data

It would seem natural to splice the Cowles data to the Ibbotson data at either 1926, the beginning of the Ibbotson series, or in 1938 when the Cowles series ended. Wilson and Jones followed the former procedure, creating a stock return series covering 1871-1985. However, an alternative series from 1926 is available from the Chicago Research on Security Prices (CRSP) data covering all common stocks listed on the NYSE. Regardless of the splice point, therefore, a legimate question remains--To which stock returns series should the Cowles data be spliced?

Cowles based his reconstruction of the Standard Statistics Company data on their weekly definition of coverage, which included approximately 90% of the market value of all stocks traded on the New York Stock Exchange. Ibbotson and Sinquefield based their coverage on the readily available historical data of Standard and Poor's, which stated (1985, p. 2) "To avoid confusion, Standard & Poor's has standardized on its former daily

price index (50 Industrial, 20 Rails, 20 Utilities, 90 Composite) for the back record." It was not until February 28, 1957 that S&P moved to the 500 securities (425 Industrial, 60 Utilities, and 15 Rails). The composition of the S&P data was changed again in July 1976 to 400 Industrials, 40 Utilities, 20 Transportation, and 40 Financial for the 500 composite. Definitionally, the Cowles data are more comparable to the CRSP data than are the Ibbotson data. For example, there is a closer correspondence in the 1926-1938 overlap of the Cowles return data to the CRSP-NYSE data than with the S&P 90, and the CRSP coverage always is broader than that of S&P.

Wilson and Jones [1987] constructed the monthly returns using the Cowles "All Stock Price Index" [1939, Table P-1, pp. 67-68] and the "Stock Prices Including Cash Dividends Index" [1939, Table C-1 pp.168-169], deriving monthly dividends as the difference in the two indexes. Those months with negative dividend yields were corrected by comparing adjacent months and substituting the mean dividend yield between those relevant months; however, median dividend yields had to be substituted for several other months where negative dividend yields were not adjacent to extremely high yields. This can lead to small errors in the data.

An alternative method of constructing the Wealth Index from the Cowles' data exists from the monthly annualized dividend yield series that is provided in his monthly "Yield Expectations" series [1939], Table Y-1, pp. 270-271]. This monthly series is described as:[4]

> "For this series d, is computed as four times the quarterly rate last declared, unless the corporation announces that a change in rate is to be made, or a so-called extra dividend forms a regular feature of the company's dividend policy, in which cases the last declared rate is adjusted accordingly. When an extra dividend is paid irregularly, it is allocated only among the months to which the payment is assumed to pertain." [1939, p. 15]

Having worked with these series, it is our feeling that errors are likely from a construction using either definition--with the Wilson-Jones series probably overstating dividend yields and increasing the variance of returns, and the "Yield Expectations" series probably understating those yields with a smaller variance of returns. The "truth" probably lies somewhere between these alternative series.

That neither of the series from 1871 to 1926 can be expected to be exact--that is, there are reconstruction problems--is not unprecedented, since Ibbotson and Sinquefield [1976, fn. 5, p. 12] encountered a similar problem with the S&P published quarterly dividend data in the post-1925 period in the second quarter of 1949 and the first quarter of 1959, and had to make adjustments to eliminate the post-diction of monthly dividend returns. In an attempt to replicate the Ibbotson-Sinquefield estimates, we encountered exactly the same problems at the same times. For the more recent period, CRSP still revise their estimates and definitions on a continuous basis. A recent and significant revision by CRSP was to eliminate ADR's from their measure along with other minor changes [1987, pp, 3-4].

We have elected to create two separate stock return series for comparison. The first series splices the Wilson-Jones version of Cowles' returns to the CRSP returns, and the second series generates an alternative Cowles' wealth series using his dividend yields, splicing that series to S&P returns. For each series, the splice date is January 1926, and the completed series extends from December 1870 through December 1987.[5] Average returns are estimated for appreciation, dividend, and total returns

for both series for the complete period, and the subperiods 1870-1925 and 1926-1987.

B. Interest Return Series

Macaulay (1938) went into great detail about the difficulty of comparing yields over long periods of time. The basic problem is in the changing risks associated with bonds (or paper). Macaulay adjusted his bond yields for "drift," and provides monthly values of both the adjusted and unadjusted yields. Similar problems of long-term comparisons apply to the measure of consumer prices. The consumer market basket has changed considerably over the period 1871-1987; therefore, adjustment for quantity weights presents difficult problems. We have used Macaulay's unadjusted bond yields because they seem more comparable to the latter data and are more compatible with the concept of what an interest rate is (or was).

Both Weil (1970) and Fisher and Weil (1971) point out the biases associated with the consistent use of the Aaa rating. Bonds of higher risk should be expected to have higher yields. Therefore, a bond included in the Aaa category in a particular month, which was downrated, would not be included in subsequent months. This is quite similar to Macaulay's concept of "drift," and also is similar to the bias encountered in measuring returns on common stocks where stocks enter or exit the index because of their successes or failures. Furthermore, it is obvious that the bonds included in the estimation of the yield to maturity are not all of 20-year maturity with a 4% coupon and, as we have learned from Durand (1942), the yield on corporate bonds varies with maturity, and the maturity mix of the bonds can affect the average monthly yields.

The data are briefly described below.

Corporate Bonds

The annual returns and cumulative wealth of high-quality and Aaa corporate bonds are based on monthly interest rates on this type of asset from Moody's data as published in Federal Reserve Board of Governors sources from July 1919 through 1986.[6] For the period 1919-1933, yields were monthly averages, but from 1934 the averages are for the last week in each month.[7]

From June 1919 back to December 1870, Macaulay's railroad bond yield series unadjusted for "drift" is used.[8] Macaulay did not provide yields for the four months during which the New York Stock Market was closed (August through November, 1914). We have interpolated arithmetic trend estimates for these four months (where the yield moved from 4.441% in July to 4.657% in December).[9] The two series were spliced in June 1919, using the overlap ratio of 1.0384455 to inflate the Macaulay series to match Moody's yields.[10]

The methodology of calculating monthly returns is based on the assumption of a $100 par, 4% coupon bond, with a 20-year maturity, making semiannual payments of $2.[11] The standard formula is used to calculate the price of the bond (P), based on the current yield to maturity (r):

$$P = (2/.5r)\ [1 - (1 + .5r)^{-m}] + 100\ [1 + .5r)^{-m}]$$

For each month an acquisition price (A) is calculated with m = 40, and a sale price (S) is calculated with m = 39 5/6:

The appreciation return is calculated as S(t)/A(t-1),

The interest return is calculated as 33 and 1/3 cents over A(t-1), and

The total monthly return is equal to the appreciation return plus the interest return.

This approach is a close approximation to the monthly return but, as Whitmore (1985) shows, is not "exact." Whitmore points out that degrees of upward and downward biases vary with the yield.[12]

Commercial Paper

The sources for the monthly Commercial Paper interest rates are the same as the sources listed for Corporate Bonds. Macaulay's rates are used until January 1919, when the Federal Reserve series became available.[13] From January 1871 to December 1923, Macaulay used "choice two name paper" and from January 1924 to the splice date, "4 to 6 month prime double and single name paper."[14] Macaulay's series meshed smoothly with the Federal Reserve data, and no adjustment was needed when the two series were merged.[15] For most of the Federal Reserve System's period, the rates are for 4-6 month paper and since 1970, those rates are for 6-month paper.[16]

Friedman and Schwartz have pointed out that commercial paper as an instrument has changed over time:

> "However, commercial paper has changed in composition since the nineteenth century. Formerly, it consisted of trade notes received by manufacturers, wholesalers, or jobbers in payment for shipments to other firms. Denominations were in odd amounts related to the value of particular shipments. Dealers who bought the notes in turn sold them to banks. In recent decades, commercial paper has been in round denominations, unrelated to shipments of goods, usually by a finance company. As a result, the level of commercial paper rates before World War I is not continuous with the level since. . . . In addition, the eligibility of commercial paper for rediscount at Federal Reserve banks under the Federal Reserve Act of 1913 persumably also lowered commercial paper rates relative to other short-term rates." (1982, pp. 108-109)

This concern about changes in the nature of the instrument is similar to Macaulay's caution about comparing bond interest over long periods of time.[17]

Monthly returns are calculated similarly to bond returns. The basic formula for calculating the monthly price is based on the bank discount rate formula:

$$P = 100 - [100r / (360/d)],$$

where d is days to maturity.[18] An acquisition price (A) and a sales price (S) are calculated for each month. The monthly return is calculated as S(t) divided by A(t-1).[19]

Consumer Price Index

From 1913 to the present, these data are December values. Prior to 1913, the values were constructed to represent December values. A detailed description of the pre-1913 construction is available in Wilson and Jones (1987).

IV. An Analysis of Stock Returns

Appendix Table 1 contains the complete set of annual nominal total returns for the two measures of stock prices, Aaa bonds, commercial paper, and inflation from 1871 through 1987. The first stock return series shown is that of Cowles--CRSP, while the second is the alternative Cowles--S&P. Appendix Table 2 contains the complete set of cumulative wealth indices for the same five series for the complete time period, with December, 1870 set equal to 1.0.

Table 1, following the Ibbotson Associates' format, shows the geometric mean, arithmetic mean and standard deviation for both the Cowles--S&P series and the Cowles--CRSP series for the entire period 1871-1987 and two major subperiods, 1871-1925 and 1926-1987. Subperiod dates are chosen to permit comparisons with stock returns from 1871 to 1925 by Wilson and

Jones, and from 1926 to 1987 to compare the CRSP returns with those of Ibbotson and Sinquefield.

Part A of Table 1 shows that the Cowles-CRSP measure of stock returns outperformed the Cowles-S&P measure in the 1870-1925 subperiod but underperformed the Cowles-S&P measure over the subperiod 1926-1987.[20] The geometric means for the later subperiod were, respectively, 9.617% and 9.908%, while the arithmetic means were, respectively, 11.720% and 12.017%.[21] However, closer examination of the arithmetic and geometric means show that these differences between the S&P and CRSP definitions primarily arise from differences in the 1926-1956 period as opposed to the post-1956 periods.

From December 1925 to December 1938 the total cumulative appreciation from Ibbotson and Sinquefield, using the Daily definition of the S&P 90, was 3.5%, with a total cumulative wealth (with dividends reinvested monthly) of 101.6%; comparable returns from the CRSP files were -10.2% in total appreciation, and 67.3% in total wealth.[22] For the same period the Cowles cumulative appreciation return, based on the Weekly definition, was -8.3%, with a total wealth return of 67.4%. This comparison for the period encompassing the Great Depression suggests that the S&P Daily index of 90 stocks outperformed both the Weekly index as measured by Cowles and the CRSP index. Comparison of the Cowles returns and the CRSP returns for this period suggests a much closer correspondence in appreciation and total returns because of the closer relation in the coverage definitions.[23]

Standard and Poor's moved to the definition from the "90" to the "500" on March 1, 1957. Comparing the appreciation and total returns for the S&P 90 with the CRSP returns for the period December 1938 through February 1957

also shows some differences between the two measures. From the series constructed by Ibbotson and Sinquefield, the appreciation over this period was 227.5% and the total wealth accumulation was 816.7%, whereas for the CRSP measures the appreciation was 229.7% and the wealth accumulation was 782.9%. Although the S&P coverage during this period tracks much more closely with the CRSP coverage, the S&P portfolio again outperforms the securities included in the broader NYSE definition on the wealth accumulation measure.

For the periods March 1, 1956 to July 1976 and July 1976 to December 1987, which include the initiation of the S&P "500," the appreciation returns for the S&P redefined coverages were 141.1% and 136.9% respectively, and the wealth accumulation returns were 366.2% and 305.9%. The appreciation returns for the CRSP for the two periods were 142.1% and 152.2%, respectively; for the cumulative wealth measures, the results for the two periods were 365.2% and 331.7%, respectively. Therefore, over the period 1956-1987, the S&P "500" portfolios performed similarly with regard to appreciation returns but underperformed the broader CRSP definition when wealth accumulation returns are considered.

In summary, for the total period from December 1925 through December 1987, the capital appreciation for the S&P was 19.3636 and the wealth accumulation figure was 349.7888, while for the CRSP the corresponding figures were 18.0892 and 296.7246, respectively (December 1925 = 1.00). The superior performance of the S&P measures over the complete period 1926-1987 was due to the use of the S&P 90 during the 1926-1956 period when the superior performance of the S&P 90 overstated the returns to stocks relative to the broader measure.

The monthly cumulative nominal returns on stocks, bonds, commercial paper, and inflation are shown in Figure 1. Only the CRSP stock series is shown, since the S&P index lies almost concident with the CRSP, crossing it several times over the period. The ratio of the SP index relative to the CRSP is plotted, and ends at a value of 1.056. The strong performance of the S&P in the 1920s and 1930s can be seen in this ratio plot.

Part B of Table 1 shows the summary statistics for the two components of total return, dividend return and capital change, for the overall period and the two subperiods. Using either measure, the two components of total return are very close to each other on an arithmetic mean basis for the entire period. On a geometric mean basis, the dividend return component dominates the capital change component because of the large variability in the latter.

For the two subperiods, on an arithmetic mean basis, the relative importance of the two components reverse, with the dividend return being more important in the earlier period and less important in the later period for both Cowles-S&P and Cowles-CRSP. On a geometric mean basis, however, the dividend return component is larger than the capital change component in both subperiods for both measures of stock returns.

V. Annual Returns on Aaa Bonds

The returns on the 20-year, 4% coupon bond have been calculated with monthly reinvestment to make the returns comparable to the preferred method of calculating returns on common stocks. This procedure follows the method of Ibbotson and Sinquefield. Total return is broken down into its two components, price change and the return from the monthly coupon payment.

These results are shown in Table 2, with Appendix Tables 1 and 2 containing the complete year-by-year results for both returns and cumulative wealth.

Table 2 shows the geometric mean annual returns on Aaa bonds over the complete period, and by the subperiods 1871-1925 and 1925-1987 (along with the associated standard deviations), broken down by price returns, interest returns, and total returns. Over the period 1871-1987, the compound annual average total return is 5.318% with a standard deviation of return of 7.469%.

The interest return completely dominates the price return for both the entire period and the two subperiods. The geometric mean interest return over the complete period is 5.094%, and the mean price return is .246%. In addition, the variability of the price return far exceeds the variability of the interest return for the complete period and for each subperiod. The mean price return was negative for the 1926-1987 subperiod while the mean interest return was higher than for the earlier subperiod or for the entire period.

As would be expected, for the 1926-1987 period the geometric mean annual return for the Aaa bonds exceeds the comparable return calculated by Ibbotson Associates for U.S. government bonds, 4.3%, by some 34 basis points--and the variance of the returns of the Aaa bonds is higher. On the other hand, the geometric mean total return for the Moody Aaa bonds of 4.6% is some 30 basis points less than the geometric mean annual return on corporate bonds reported by Ibbotson Associates of 4.9% but with a higher standard deviation--9.4% compared to 8.5%.

Figure 1 shows the performance of bonds over the entire period 1871-1987. On a cumulative basis, bonds outperform commercial paper, but only a

strong boost in the last few years allowed the cumulative line for bonds to rise above that for paper. Cumulative stock returns, of course, dwarf bond returns.

VI. Annual Returns on Commercial Paper

Since commercial paper has no interest return but trades at a discount from "par," we report only the total return. The returns are calculated in "coupon equivalent" terms, having been translated from the bank discount basis of the quotes.

The annual returns are summarized in Table 3 for the complete period as well as for the same subperiods as the Aaa bonds (see Appendix Tables 1 and 2 for year-by-year results). As expected, overall, and for each of the subperiods, the geometric mean returns are lower than for Aaa bonds, as are the standard deviations. Also, as would be expected, for 1926-1987 the geometric mean return on commercial paper of 4.551% is greater than the geometric mean return for Treasury bills of 3.5% as reported by Ibbotson Associates; furthermore, the risk associated with commercial paper is greater than for bills based on a simple comparison of the measures of variability, although the difference is relatively small--3.9% vs. 3.5%.

VII. Inflation-Adjusted Returns on Aaa Bonds and Commercial Paper

Inflation-adjusted returns are calculated by division as opposed to the subtraction of the inflation rate from the nominal return.[24] Real wealth accumulation is derived by dividing the decimal of the nominal return (n) by the decimal of the inflation rate (inf), and subtracting 1.

$$(1+n) / (1+inf) = (1+real)$$

The annual inflation-adjusted returns for the four asset series, two stock return measures, Aaa bonds, and commercial paper are shown in Appendix Table 3, while Appendix Table 4 shows the four series on an inflation-adjusted cumulative wealth index basis.

Common stocks registered a negative inflation-adjusted return in 36 of the 117 years for which data are available. Bonds registered a negative inflation-adjusted return in 30 of these years and real returns on paper were negative in 24 of those years.

The geometric means and standard deviations for the complete period and for various subperiods are shown in Table 4 for inflation, the two alternative measures of stock returns, bonds, and paper. The inflation rate for the later subperiod was more than four times that for the earlier subperiod on a geometric mean annual average basis, and more than a full percentage point higher than that for the entire period.

The real return on common stocks for the entire period, as measured by the geometric mean annual average, was 6.49% using the S&P measure and 6.44% using the CRSP measure. As we know from the analysis of nominal returns, the S&P return was higher than the comparable CRSP return for the 1926-1987 subperiod because of the early "S&P 90" effect.

As would be expected, for the complete period and for each of the subperiods, the inflation-adjusted mean return as well as the standard deviation is higher for Aaa bonds than for commercial paper. What is perhaps surprising, however, is that the differentials are quite small, particularly on a geometric mean basis. Thus, for the entire period the geometric mean real annual return for bonds was 3.32%, while the comparable figure for commercial paper was 2.99%, and for the later subperiod the

differential between the two means was only 8 basis points. There were many years in which the annual real return of bonds was less than for commercial paper. It would appear that holders of long-term and short-term debt instruments were unsuccessful in anticipating inflation, and during wartime and post-war periods were especially overly optimistic with regard to the inflation-adjusted return.

The standard deviation for bonds of 9.84% is considerably higher than that for paper, 5.47%, over the complete period. Inflation-adjusted returns for both bonds and paper varied widely over the subperiods, as did the inflation rate.

The inflation-adjusted cumulative wealth series from holding bonds and paper are considerably less impressive than their nominal counterparts because the Consumer Price Index increased by almost 9.5-fold over the complete 1871-1987 period. The summary measures of the inflation rate show considerable variability, indicating that inflation is difficult to anticipate.

VIII. Summary and Conclusions

This research has sought to generate a consistent series of monthly interest returns on both long-term and short-term debt instruments that are both replicable and readily updatable with publicly available data. The annual data have been presented on the basis of monthly reinvestment so the results can be compared with the preferred method of calculating returns on common stocks. In this process a series of returns on long-term and short-term debt instruments has been generated from January 1871 that complements the returns provided by Ibbotson and Sinquefield from 1926 to the present.

In addition, two alternative measures of common stock returns have been calculated. Although caution should be exercised in any comparison of returns over long periods of time because of changes in the nature of the instruments and their relative degree of risk, we believe these data to be of high quality.

Generally, the returns of the higher risk instrument, the 20-year Aaa bonds, averaged higher than the returns on commercial paper in both nominal and inflation-adjusted terms. The returns on debt instruments are inferior to the returns on equity instruments both in nominal and inflation-adjusted terms.

Table 1. Summary Statistics of Annual Returns on Two Stock Index Measures 1871-1987 and Two Subperiods, 1871-1925 and 1926-1987

Part A: Summary Statisitics on Total Return

	Geometric Mean	Arithmetic Mean	Standard Deviation
I. Cowles--S&P			
1871-1987	8.55369	10.26956	19.03323
1871-1925	7.04707	8.30006	16.43691
1926-1987	9.90795	12.01670	21.05056
II. Cowles--CRSP			
1871-1987	8.50238	10.22171	18.98879
1871-1925	7.25982	8.53323	16.58780
1926-1987	9.61669	11.71956	20.91056

Part B: Summary Statisitics on the Components of Total Return

	Geometric Mean	Arithmetic Mean	Standard Deviation
I. Cowles--S&P			
1871-1987			
Dividend Return[1]	5.09789	5.10697	1.39172
Capital Change	3.47675	5.16259	18.37715
1871-1925			
Dividend Return	5.14232	5.14851	1.15377
Capital Change	1.90016	3.15155	15.98030
1926-1987			
Dividend Return	5.05849	5.07013	1.58174
Capital Change	4.89574	6.94657	20.23054
II. Cowles--CRSP			
1871-1987			
Dividend Return	5.11455	5.12322	1.35751
Capital Change	3.41656	5.09850	18.31914
1871-1925			
Dividend Return	5.37469	5.38168	1.22815
Capital Change	1.90016	3.15155	15.98030
1926-1987			
Dividend Return	4.88433	4.89394	1.43370
Capital Change	4.78062	6.82563	20.14096

[1]For ease of exposition, reinvestment returns are contained in the dividend return component for each series and for each time period.

Table 2. Means and Standard Deviations of Price Returns, Interest Returns, and Total Returns for Aaa Corporate Bonds, 1871-1987, and by Subperiods

Period	Price Return	Interest Return	Total Return
1871-1987			
Geometric Mean	.24601	5.09402	5.31848
Arithmetic Mean	.45021	5.11221	5.56242
Standard Deviation	6.50822	1.99516	7.46876
1871-1925			
Geometric Mean	1.22123	4.87688	6.08566
Arithmetic Mean	1.29293	4.88032	6.17325
Standard Deviation	3.83873	.86159	4.35755
1926-1987			
Geometric Mean	-.61124	5.28702	4.64256
Arithmetic Mean	-.29736	5.31792	5.02055
Standard Deviation	8.14213	2.61173	9.41456

Table 3. Means and Standard Deviations of Returns on 4-6 Month Commercial Paper, 1871-1987, and by Subperiods

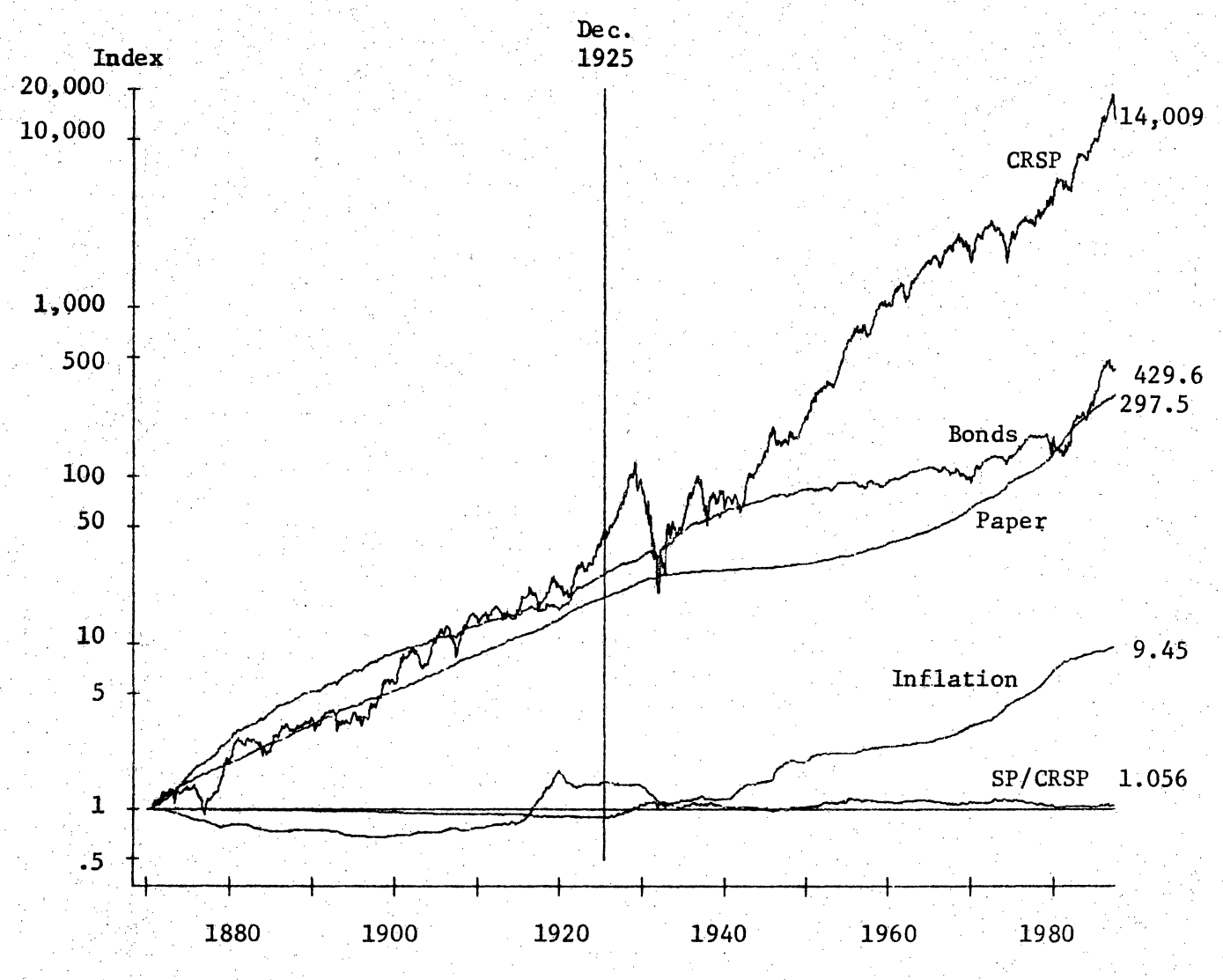
Period	Total Return
1871-1987	
Geometric Mean	4.98824
Arithmetic Mean	5.03155
Standard Deviation	3.06259
1871-1925	
Geometric Mean	5.48370
Arithmetic Mean	5.49556
Standard Deviation	1.60755
1926-1987	
Geometric Mean	4.55067
Arithmetic Mean	4.61993
Standard Deviation	3.89646

Table 4. Means and Standard Deviations for Inflation, and Inflation-Adjusted Return Total Returns for Stocks, Bonds, and Paper, 1871-1987, and by Subperiods

	Geometric Mean	Arithmetic Mean	Standard Deviation
Inflation			
1871-1987	1.93834	2.05999	5.07637
1871-1925	.70063	.81915	5.09010
1926-1987	3.04904	3.16073	4.84239
Cowles-S&P			
1871-1987	6.48904	8.27322	19.28202
1871-1925	6.30118	7.67416	16.99589
1926-1987	6.65597	8.80464	21.22968
Cowles-CRSP			
1871-1987	6.43922	8.21423	19.18360
1871-1925	6.51356	7.90242	17.12215
1926-1987	6.37332	8.49083	20.97932
Aaa Bonds			
1871-1987	3.31586	3.77281	9.84403
1871-1925	5.34756	5.65889	8.07426
1926-1987	1.54637	2.00968	10.97784
Commercial Paper			
1871-1987	2.99191	3.13789	5.46657
1871-1925	4.74980	4.89736	5.52006
1926-1987	1.45720	1.57706	4.95840

Figure 1.

Monthly Cumulative Returns on CRSP, Aaa Corporate Bonds, Commercial Paper, Inflation and the Cumulative Differential of SP to CRSP, December 1870 - December 1987



Appendix Table 1. Nominal Total Returns on Common Stocks, Aaa Corporate Bonds, 4-6 Month Commercial Paper, and Inflation, 1870-1987

Year	CRSP	SPIS	Aaa Bonds	Com. Pap.	Inflation
1871	13.3032%	13.0683%	10.5731%	6.9981%	-2.1739%
1872	12.5614	12.9259	8.7566	9.0638	-0.7407
1873	-7.3430	-6.4648	5.6609	12.0582	-2.2388
1874	10.4007	9.2872	16.3470	8.1916	-3.8168
1875	2.2452	2.4360	13.9805	5.5259	-3.9682
1876	-12.0846	-12.1728	10.0671	5.7939	-2.0661
1877	-3.6964	-3.7770	8.5104	5.6301	-3.3755
1878	11.7700	11.2429	9.9878	5.3463	-4.3668
1879	50.2411	49.3110	12.6763	4.9719	-0.4566
1880	24.7191	24.1494	15.2039	5.5364	1.3761
1881	7.8936	7.4792	5.4234	5.4160	0.9050
1882	2.3062	2.1759	5.5716	6.1972	-1.7937
1883	-3.1092	-3.0431	6.4871	6.1805	-3.6530
1884	-13.1776	-13.3541	6.2108	5.7617	-2.3697
1885	26.3329	26.3881	11.2196	4.4994	-0.9709
1886	12.4037	12.6075	6.7327	4.3804	0.0000
1887	-2.5792	-2.7076	3.1705	6.1326	0.9804
1888	1.8432	1.9848	7.2625	5.6534	0.9709
1889	7.7420	7.5014	5.5657	4.6490	-0.4808
1890	-10.1486	-10.1311	1.4084	5.4296	-0.4831
1891	23.0823	22.8048	6.4875	6.8919	0.0000
1892	6.0892	5.7166	5.8604	4.0310	-0.5495
1893	-15.9526	-15.8123	4.9642	8.2061	-2.7624
1894	1.8596	2.0122	8.3935	3.5243	-3.4091
1895	5.0362	4.7361	4.9737	3.0238	-1.1965
1896	1.9479	1.7672	4.5446	6.6858	-0.5952
1897	17.4309	16.9764	8.1704	3.8057	-0.5988
1898	23.1790	23.0449	5.8744	4.1851	0.0000
1899	10.5873	9.9343	3.3572	3.1053	0.6024
1900	18.9820	18.5043	5.9267	5.1399	1.1976
1901	20.3243	19.6915	4.2566	4.4320	1.1834
1902	5.1727	4.9314	2.5385	4.7399	1.7544
1903	-14.6449	-14.7347	2.5236	5.9030	1.7241
1904	31.1982	31.0176	6.1764	5.1425	0.0000
1905	20.2049	19.6390	3.9994	3.9583	0.5650
1906	7.2529	6.8150	2.3233	5.8651	3.3708
1907	-29.8732	-29.6016	-1.4332	6.0858	1.0870
1908	44.7686	44.3916	10.3325	6.4383	-1.6129
1909	19.9833	19.0431	3.8217	3.6204	1.6393
1910	-8.0500	-7.8997	3.4352	5.5286	2.1505
1911	5.8113	5.7709	4.2765	4.2547	1.0526
1912	8.2739	7.9957	3.0921	4.3991	2.0833
1913	-9.2227	-9.5736	1.2441	6.0997	2.3810
1914	-3.7010	-3.5279	2.9736	5.6887	0.9967
1915	35.4936	35.2827	7.3142	4.1703	1.9737
1916	10.2336	8.9561	5.4782	3.2174	11.6129
1917	-24.4198	-25.1151	-5.8831	4.2994	18.4971
1918	25.4340	25.0637	9.5131	6.1347	20.4878
1919	19.7445	19.6601	-1.7519	5.6420	14.7773
1920	-18.8000	-18.6742	-0.5840	7.3201	2.2928
1921	14.4499	14.4313	16.8498	8.3506	-10.6897
1922	27.2119	26.8101	11.1192	4.9188	-2.5097
1923	3.5338	3.1864	5.0998	5.4039	2.5743
1924	25.7807	25.4209	7.0666	4.7074	-0.1931
1925	29.3014	28.9315	6.3780	3.9199	3.8685

APPENDIX TABLE 1 (CONTINUED)

Year	CRSP	SPIS	Aaa Bonds	Com. Pap.	Inflation
1926	9.5938%	11.6239%	7.2234%	4.5215%	-1.4898%
1927	33.4509	37.4884	7.7900	4.5247	-2.0794
1928	38.8926	43.6085	2.5590	4.5488	-0.9653
1929	-14.3639	-8.4153	3.9900	6.4168	0.1949
1930	-28.0871	-24.8971	6.7587	4.6309	-6.0311
1931	-44.2878	-43.3366	-5.8079	2.3353	-9.5238
1932	-9.0262	-8.1928	15.7250	3.8719	-10.2975
1933	57.7764	53.9900	5.8484	1.6892	0.5102
1934	4.5448	-1.4428	14.4533	1.2946	2.0305
1935	44.2897	47.6690	9.1232	0.8216	2.9851
1936	32.3178	33.9214	8.0354	0.7660	1.2077
1937	-34.5543	-35.0265	2.0121	0.8633	3.1026
1938	28.0618	31.1217	5.1562	0.9699	-2.7778
1939	2.1676	-0.4107	5.2694	0.6291	-0.4762
1940	-7.5463	-9.7845	5.8620	0.5710	0.9569
1941	-9.4944	-11.5921	1.0625	0.5403	9.7156
1942	16.1121	20.3404	3.3080	0.6232	9.2873
1943	28.0302	25.8999	3.8038	0.7044	3.1621
1944	21.4225	19.7524	3.3533	0.7250	2.1073
1945	38.3514	36.4360	4.1430	0.7660	2.2514
1946	-6.0064	-8.0713	2.5617	0.7312	18.1651
1947	3.3683	5.7081	-1.1033	0.9586	9.0062
1948	2.3127	5.5013	4.0369	1.3523	2.7066
1949	20.1098	18.7925	5.8355	1.6287	-1.8031
1950	29.8782	31.7130	1.3390	1.3171	5.7910
1951	20.8694	24.0164	-2.3844	1.9960	5.8745
1952	13.3242	18.3676	3.7348	2.4418	0.8827
1953	0.3151	-0.9891	1.2281	2.6327	0.6250
1954	50.2735	52.6237	6.0509	2.0146	-0.4969
1955	25.3015	31.5627	-0.4769	1.5670	0.3745
1956	8.3919	6.5561	-5.2661	3.1888	2.8607
1957	-10.5484	-10.7826	4.8173	3.9533	3.0230
1958	44.8075	43.3639	-1.1439	2.7617	1.7606
1959	13.0842	11.9550	-2.3373	3.5527	1.4994
1960	0.8580	0.4695	7.9131	4.7947	1.4773
1961	27.4376	26.8884	3.1806	3.0115	0.6719
1962	-9.9590	-8.7285	7.4058	3.3554	1.2236
1963	21.4226	22.8010	2.3911	3.4548	1.6484
1964	16.3817	16.4828	3.6542	4.0679	1.1892
1965	14.0595	12.4511	0.7474	4.4160	1.9231
1966	-8.8488	-10.0633	-3.8411	5.3701	3.3543
1967	26.8266	23.9756	-5.0405	5.6030	3.0426
1968	12.7556	11.0613	2.6029	6.0140	4.7244
1969	-9.8127	-8.4451	-8.2646	7.3855	6.1090
1970	1.2836	3.9389	12.5774	9.7794	5.4916
1971	15.8544	14.3127	11.2388	5.7919	3.3585
1972	17.6418	18.9761	8.9950	4.6345	3.4119
1973	-16.9005	-14.6614	0.0939	7.3491	8.7981
1974	-26.7487	-26.4680	-4.6087	10.9155	12.2022
1975	37.6514	37.2031	11.3514	8.1832	7.0142
1976	26.2510	23.8432	19.1677	6.2291	4.8106
1977	-4.8521	-7.1842	3.8191	5.1193	6.7699
1978	7.3636	6.5598	-2.2483	6.9564	9.0274
1979	21.8868	18.4411	-6.7710	11.2559	13.3070
1980	32.6728	32.4272	-6.9369	12.5999	12.3967
1981	-4.1868	-4.9221	1.5033	18.3708	8.9396
1982	21.0584	21.4094	43.3027	15.4121	3.8721
1983	23.1246	22.5137	5.1857	9.2901	3.7962
1984	5.7925	6.2777	18.8636	11.8333	3.9539
1985	31.2633	32.1510	37.4222	8.9846	3.7718
1986	16.8416	18.4618	28.5737	7.5466	1.1301
1987	6.3611	5.7922	-7.5650	6.8014	4.4095

Appendix Table 2. Cumulative Value of Common Stocks, Aaa Corporate Bonds, 4-6 Month Commercial Paper, and the Consumer Price Index, 1870-1987

Year	CRSP	SPIS	Aaa Bonds	Com. Paper	CPI
1870	1.0000	1.0000	1.0000	1.0000	1.0000
1871	1.1330	1.1300	1.1057	1.0700	0.9783
1872	1.2754	1.2761	1.2026	1.1670	0.9710
1873	1.1817	1.1936	1.2706	1.3077	0.9493
1874	1.3046	1.3045	1.4783	1.4148	0.9130
1875	1.3339	1.3362	1.6850	1.4930	0.8768
1876	1.1727	1.1736	1.8547	1.5795	0.8587
1877	1.1294	1.1293	2.0125	1.6684	0.8297
1878	1.2623	1.2562	2.2135	1.7576	0.7935
1879	1.8965	1.8757	2.4941	1.8450	0.7899
1880	2.3653	2.3286	2.8733	1.9471	0.8007
1881	2.5520	2.5028	3.0291	2.0526	0.7080
1882	2.6108	2.5573	3.1979	2.1798	0.7935
1883	2.5296	2.4794	3.4053	2.3145	0.7645
1884	2.1963	2.1483	3.6168	2.4479	0.7464
1885	2.7747	2.7152	4.0226	2.5580	0.7391
1886	3.1188	3.0575	4.2935	2.6701	0.7391
1887	3.0384	2.9748	4.4296	2.8338	0.7464
1888	3.0944	3.0338	4.7513	2.9940	0.7536
1889	3.3339	3.2614	5.0157	3.1332	0.7500
1890	2.9956	2.9310	5.0864	3.3033	0.7464
1891	3.6870	3.5994	5.4163	3.5310	0.7464
1892	3.9116	3.8051	5.7338	3.6733	0.7423
1893	3.2876	3.2035	6.0184	3.9748	0.7218
1894	3.3487	3.2679	6.5236	4.1148	0.6971
1895	3.5173	3.4227	6.8480	4.2393	0.6890
1896	3.5859	3.4832	7.1592	4.5227	0.6849
1897	4.2109	4.0745	7.7442	4.6948	0.6808
1898	5.1869	5.0134	8.1991	4.8913	0.6808
1899	5.7361	5.5115	8.4743	5.0432	0.6849
1900	6.8249	6.5314	8.9766	5.3024	0.6931
1901	8.2120	7.8175	9.3587	5.5374	0.7013
1902	8.6368	8.2030	9.5963	5.7999	0.7136
1903	7.3720	6.9943	9.8384	6.1422	0.7259
1904	9.6719	9.1638	10.4461	6.4581	0.7259
1905	11.6261	10.9634	10.8639	6.7137	0.7300
1906	12.4693	11.7106	11.1163	7.1075	0.7546
1907	8.7443	8.2441	10.9570	7.5401	0.7628
1908	12.6591	11.9037	12.0891	8.0255	0.7505
1909	15.1888	14.1706	12.5511	8.3161	0.7628
1910	13.9661	13.0512	12.9823	8.7758	0.7792
1911	14.7777	13.8043	13.5375	9.1492	0.7874
1912	16.0004	14.9081	13.9561	9.5517	0.8038
1913	14.5247	13.4808	14.1297	10.1343	0.8229
1914	13.9871	13.0052	14.5498	10.7108	0.8311
1915	18.9517	17.5938	15.6140	11.1575	0.8475
1916	20.8911	19.1696	16.4694	11.5165	0.9460
1917	15.7896	14.3551	15.5005	12.0116	1.1209
1918	19.8055	17.9530	16.9751	12.7485	1.3506
1919	23.7160	21.4826	16.6777	13.4678	1.5502
1920	19.2574	17.4709	16.5803	14.4537	1.5857
1921	22.0400	19.9922	19.3740	15.6606	1.4162
1922	28.0375	25.3521	21.5283	16.4309	1.3807
1923	29.0283	26.1599	22.6262	17.3188	1.4162
1924	36.5121	32.8100	24.2251	18.1341	1.4135
1925	47.2106	42.3024	25.7701	18.8450	1.4681

APPENDIX TABLE 2 (CONTINUED)

Year	CRSP	SPIS	Aaa Bonds	Com. Paper	CPI
1926	51.7399	47.2196	27.6316	19.6970	1.4463
1927	69.0473	64.9214	29.7841	20.5883	1.4162
1928	95.9016	93.2327	30.5463	21.5248	1.4025
1929	82.1264	85.3870	31.7651	22.9060	1.4053
1930	59.0594	64.1281	33.9120	23.9667	1.3205
1931	32.9033	36.3372	31.9424	24.5264	1.1947
1932	29.9334	33.3602	36.9654	25.4761	1.0717
1933	47.2278	51.3713	39.1273	25.9064	1.0772
1934	49.3742	50.6301	44.7824	26.2418	1.0991
1935	71.2419	74.7650	48.8680	26.4574	1.1319
1936	94.2658	100.1263	52.7947	26.6601	1.1455
1937	61.6929	65.0555	53.8570	26.8902	1.1811
1938	79.0050	85.3019	56.6340	27.1510	1.1482
1939	80.7175	84.9515	59.6183	27.3218	1.1428
1940	74.6264	76.6395	63.1131	27.4778	1.1537
1941	67.5410	67.7553	63.7837	27.6263	1.2658
1942	78.4233	81.5370	65.8937	27.7985	1.3834
1943	100.4055	102.6550	68.4001	27.9943	1.4271
1944	121.9150	122.9319	70.6938	28.1972	1.4572
1945	168.6711	167.7233	73.6226	28.4132	1.4900
1946	158.5399	154.1858	75.5086	28.6210	1.7607
1947	163.8800	162.9869	74.6755	28.8953	1.9192
1948	167.6700	171.9532	77.6900	29.2861	1.9712
1949	201.3881	204.2675	82.2236	29.7631	1.9357
1950	261.5593	269.0468	83.3246	30.1551	2.0478
1951	316.1451	333.6622	81.3378	30.7570	2.1680
1952	358.2688	394.9479	84.3756	31.5080	2.1872
1953	359.3976	391.0414	85.4118	32.3375	2.2009
1954	540.0793	596.8220	90.5799	32.9890	2.1899
1955	676.7275	785.1954	90.1479	33.5059	2.1981
1956	733.5175	836.6736	85.4006	34.5743	2.2610
1957	656.1431	746.4585	89.5147	35.9411	2.3294
1958	950.1444	1070.1517	88.4907	36.9337	2.3704
1959	1074.4632	1198.0881	86.4224	38.2459	2.4059
1960	1083.6820	1203.7129	93.2611	40.0796	2.4414
1961	1381.0182	1527.3726	96.2274	41.2866	2.4578
1962	1243.4831	1394.0566	103.3538	42.6719	2.4879
1963	1509.8698	1711.9156	105.8250	44.1462	2.5289
1964	1757.2124	1994.0880	109.6921	45.9420	2.5590
1965	2004.2679	2242.3736	110.5119	47.9708	2.6082
1966	1826.9147	2016.7160	106.2670	50.5469	2.6957
1967	2317.0141	2500.2357	100.9107	53.3790	2.7777
1968	2612.5623	2776.7946	103.5373	56.5892	2.9090
1969	2356.1986	2542.2911	94.9803	60.7686	3.0867
1970	2386.4417	2642.4287	106.9264	66.7115	3.2562
1971	2764.7967	3020.6324	118.9437	70.5753	3.3655
1972	3252.5576	3593.8310	129.6427	73.8461	3.4804
1973	2702.8586	3066.9248	129.7644	79.2732	3.7866
1974	1979.8785	2255.1706	123.7840	87.9262	4.2486
1975	2725.3314	3094.1640	137.8353	95.1214	4.5466
1976	3440.7591	3831.9105	164.2551	101.0466	4.7653
1977	3273.8104	3556.6181	170.5281	106.2195	5.0879
1978	3514.8823	3789.9254	166.6941	113.6085	5.5472
1979	4284.1789	4488.8298	155.4072	126.3962	6.2854
1980	5683.9381	5944.4321	144.6268	142.3220	7.0646
1981	5445.9631	5651.8397	146.8010	168.4677	7.6962
1982	6592.7972	6861.8662	210.3698	194.4322	7.9942
1983	8117.3553	8406.7258	221.2791	212.4952	8.2976
1984	8587.5499	8934.4707	263.0202	237.6404	8.6257
1985	11272.3014	11806.9913	361.4482	258.9914	8.9511
1986	13170.7319	13986.7723	464.7272	278.5364	9.0522
1987	14008.5401	14796.9078	429.5704	297.4807	9.4514

Appendix Table 3. Inflation-Adjusted Total Returns on Common Stocks, Aaa Corporate Bonds, and 4-6 Month Commercial Paper, 1870-1987

Year	CRSP	SPIS	Aaa Bonds	Com. Pap.
1871	15.8208%	15.5152%	13.0303%	9.3758%
1872	13.4019	13.7679	9.5682	9.8777
1873	-5.2211	-4.3222	8.0806	14.6245
1874	14.7811	13.6237	20.9640	12.4849
1875	6.4701	6.6692	18.6905	9.8865
1876	-10.2293	-10.3201	12.3892	8.0259
1877	-0.3323	-0.4158	12.3011	9.3202
1878	16.8731	16.3224	15.0100	10.1567
1879	50.9308	49.9959	13.1931	5.4534
1880	23.0261	22.4641	13.6401	4.1038
1881	6.9262	6.5156	4.4779	4.4706
1882	4.1747	4.0422	7.4999	8.1369
1883	0.5642	0.6330	10.5245	10.2063
1884	-11.0700	-11.2512	8.7887	8.3287
1885	27.5715	27.6272	12.3100	5.5239
1886	12.4034	12.6074	6.7327	4.3804
1887	-3.5250	-3.6520	2.1688	5.1022
1888	0.8642	1.0041	6.2311	4.6375
1889	8.2623	8.0208	6.0757	5.1545
1890	-9.7122	-9.6947	1.9007	5.9414
1891	23.0823	22.8047	6.4875	6.8919
1892	6.6753	6.3006	6.4453	4.6057
1893	-13.5648	-13.4206	7.9462	11.2802
1894	5.4545	5.6126	12.2191	7.1781
1895	6.2867	5.9829	6.2233	4.2503
1896	2.5582	2.3767	5.1706	7.3247
1897	18.1384	17.6809	8.8220	4.4311
1898	23.1789	23.0449	5.8744	4.1851
1899	9.9252	9.2760	2.7383	2.4879
1900	17.5738	17.1018	4.6731	3.8956
1901	18.9170	18.2917	3.0372	3.2105
1902	3.3593	3.1222	0.7706	2.9340
1903	-16.0916	-16.1799	0.7859	4.1080
1904	31.1982	31.0175	6.1764	5.1425
1905	19.5296	18.9670	3.4152	3.3743
1906	3.7555	3.3318	-1.0133	2.4129
1907	-30.6273	-30.3586	-2.4930	4.9451
1908	47.1419	46.7586	12.1413	8.1832
1909	18.0481	17.1230	2.1472	1.9491
1910	-9.9858	-9.8386	1.2576	3.3069
1911	4.7092	4.6691	3.1903	3.1687
1912	6.0642	5.7917	0.9882	2.2685
1913	-11.3338	-11.6766	-1.1105	3.6323
1914	-4.6513	-4.4799	1.9575	4.6458
1915	32.8712	32.6643	5.2371	2.1541
1916	-1.2358	-2.3803	-5.4964	-7.5220
1917	-36.2177	-36.8044	-20.5745	-11.9815
1918	4.1051	3.7978	-9.1086	-11.9125
1919	4.3277	4.2541	-14.4011	-7.9592
1920	-20.6200	-20.4970	-2.8123	4.9146
1921	28.1485	28.1277	30.8357	21.3192
1922	30.4867	30.0745	13.9797	7.6197
1923	0.9355	0.5967	2.4621	2.7586
1924	26.0240	25.6636	7.2737	4.9100
1925	24.4857	24.1295	2.4160	0.0495

APPENDIX TABLE 3 (CONTINUED)

Year	CRSP	SPIS	Aaa Bonds	Com. Pap.
1926	11.2512%	13.3120%	8.8450%	6.1021%
1927	36.2848	40.4080	10.0790	6.7443
1928	40.2463	45.0082	3.5586	5.5678
1929	-14.5305	-8.5935	3.7877	6.2097
1930	-23.4716	-20.0768	13.6107	11.3463
1931	-38.4234	-37.3720	4.1071	13.1074
1932	1.4172	2.3463	29.0098	15.7959
1933	56.9755	53.2082	5.3111	1.1730
1934	2.4644	-3.4041	12.1756	-0.7212
1935	40.1074	43.3888	5.9602	-2.1007
1936	30.7389	32.3233	6.7462	-0.4364
1937	-36.5237	-36.9818	-1.0577	-2.1719
1938	31.7207	34.8680	8.1606	3.8547
1939	2.6564	0.0658	5.7731	1.1105
1940	-8.4226	-10.6396	4.8585	-0.3823
1941	-17.5090	-19.4209	-7.8869	-8.3629
1942	6.2449	10.1138	-5.4711	-7.9277
1943	24.1059	22.0409	0.6221	-2.3824
1944	18.9166	17.2810	1.2203	-1.3538
1945	35.3051	33.4319	1.8499	-1.4527
1946	-20.4558	-22.2032	-13.2048	-14.7539
1947	-5.1721	-3.0256	-9.2743	-7.3827
1948	-0.3835	2.7210	1.2953	-1.3186
1949	22.3152	20.9738	7.7788	3.4948
1950	22.7687	24.5030	-4.2083	-4.2290
1951	14.1629	17.1353	-7.8007	-3.6633
1952	12.3326	17.3319	2.8271	1.5454
1953	-0.3080	-1.6041	0.5993	1.9952
1954	51.0239	53.3859	6.5805	2.5241
1955	24.8340	31.0718	-0.8483	1.1880
1956	5.3773	3.5926	-7.9008	0.3190
1957	-13.1732	-13.4005	1.7417	0.9030
1958	42.3022	40.8835	-2.8543	0.9838
1959	11.4136	10.3011	-3.7800	2.0229
1960	-0.6103	-0.9931	6.3421	3.2691
1961	26.5871	26.0416	2.4920	2.3240
1962	-11.0474	-9.8317	6.1075	2.1060
1963	19.4536	20.8096	0.7307	1.7771
1964	15.0140	15.1139	2.4361	2.8449
1965	11.9074	10.3294	-1.1535	2.4459
1966	-11.8070	-12.9822	-6.9619	1.9504
1967	23.0817	20.3149	-7.8444	2.4848
1968	7.6688	6.0510	-2.0258	1.2314
1969	-15.0051	-13.7162	-13.5461	1.2030
1970	-3.9890	-1.4719	6.7170	4.0646
1971	12.0898	10.5983	7.6242	2.3543
1972	13.7605	15.0507	5.3989	1.1823
1973	-23.6205	-21.5624	-8.0003	-1.3318
1974	-34.7149	-34.4647	-14.9826	-1.1468
1975	28.6292	28.2102	4.0530	1.0924
1976	20.4564	18.1590	13.6982	1.3534
1977	-10.8851	-13.0694	-2.7638	-1.5459
1978	-1.5260	-2.2633	-10.3421	-1.8996
1979	7.5722	4.5311	-17.7201	-1.8102
1980	18.0397	17.8213	-17.2012	0.1808
1981	-12.0493	-12.7243	-6.8261	8.6573
1982	16.5456	16.8836	37.9608	11.1098
1983	18.6215	18.0330	1.3388	5.2930
1984	1.7687	2.2354	14.3426	7.5798
1985	26.4923	27.3477	32.4273	5.0233
1986	15.5359	17.1380	27.1369	6.3447
1987	1.8692	1.3242	-11.4689	2.2908

Appendix Table 4. Inflation-Adjusted Cumulative Wealth Index, 1870-1987

Year	CRSP	SPIS	Aaa Bonds	Com. Pap.
1870	1.0000	1.0000	1.0000	1.0000
1871	1.1582	1.1552	1.1303	1.0938
1872	1.3134	1.3142	1.2385	1.2018
1873	1.2449	1.2574	1.3385	1.3776
1874	1.4289	1.4287	1.6191	1.5495
1875	1.5213	1.5240	1.9218	1.7027
1876	1.3657	1.3667	2.1599	1.8394
1877	1.3612	1.3610	2.4255	2.0108
1878	1.5908	1.5832	2.7896	2.2151
1879	2.4010	2.3747	3.1576	2.3359
1880	2.9539	2.9081	3.5884	2.4317
1881	3.1585	3.0976	3.7490	2.5404
1882	3.2903	3.2228	4.0302	2.7471
1883	3.3089	3.2432	4.4544	3.0275
1884	2.9426	2.8783	4.8459	3.2797
1885	3.7539	3.6735	5.4424	3.4608
1886	4.2196	4.1367	5.8088	3.6124
1887	4.0708	3.9856	5.9348	3.7968
1888	4.1060	4.0256	6.3046	3.9728
1889	4.4452	4.3485	6.6876	4.1776
1890	4.0135	3.9269	6.8147	4.4258
1891	4.9399	4.8225	7.2568	4.7308
1892	5.2697	5.1263	7.7246	4.9487
1893	4.5549	4.4383	8.3384	5.5070
1894	4.8033	4.6874	9.3573	5.9023
1895	5.1053	4.9679	9.9396	6.1531
1896	5.2359	5.0859	10.4535	6.6038
1897	6.1856	5.9852	11.3757	6.8964
1898	7.6193	7.3645	12.0440	7.1851
1899	8.3756	8.0476	12.3738	7.3638
1900	9.8475	9.4239	12.9520	7.6507
1901	11.7103	11.1477	13.3454	7.8963
1902	12.1037	11.4957	13.4483	8.1280
1903	10.1560	9.6357	13.5540	8.4619
1904	13.3245	12.6245	14.3911	8.8970
1905	15.9267	15.0190	14.8826	9.1972
1906	16.5249	15.5194	14.7318	9.4192
1907	11.4638	10.8079	14.3645	9.8850
1908	16.8680	15.8615	16.1085	10.6939
1909	19.9123	18.5775	16.4544	10.9023
1910	17.9239	16.7498	16.6614	11.2628
1911	18.7680	17.5318	17.1929	11.6197
1912	19.9061	18.5472	17.3628	11.8833
1913	17.6500	16.3815	17.1700	12.3150
1914	16.8291	15.6476	17.5061	12.8871
1915	22.3610	20.7588	18.4229	13.1647
1916	22.0846	20.2647	17.4103	12.1744
1917	14.0861	12.8064	13.8282	10.7158
1918	14.6643	13.2928	12.5687	9.4393
1919	15.2990	13.8582	10.7586	8.6880
1920	12.1443	11.0177	10.4561	9.1149
1921	15.5628	14.1167	13.6803	11.0582
1922	20.3073	18.3623	15.5927	11.9008
1923	20.4973	18.4719	15.9767	12.2291
1924	25.8315	23.2124	17.1387	12.8295
1925	32.1566	28.8135	17.5528	12.8359

APPENDIX TABLE 4 (CONTINUED)

Year	CRSP	SPIS	Aaa Bonds	Com. Pap.
1926	35.7746	32.6491	19.1054	13.6191
1927	48.7553	45.8419	21.0310	14.5377
1928	68.3775	66.4746	21.7794	15.3471
1929	58.4418	60.7621	22.6043	16.3001
1930	44.7246	48.5630	25.6809	18.1496
1931	27.5399	30.4141	26.7357	20.5285
1932	27.9302	31.1277	34.4916	23.7712
1933	43.8436	47.6901	36.3235	24.0500
1934	44.9240	46.0667	40.7461	23.8766
1935	62.9419	66.0545	43.1747	23.3750
1936	82.2895	87.4055	46.0873	23.2730
1937	52.2343	55.0814	45.5998	22.7675
1938	68.8034	74.2872	49.3211	23.6451
1939	70.6311	74.3361	52.1684	23.9077
1940	64.6821	66.4270	54.7030	23.8163
1941	53.3570	53.5263	50.3887	21.8246
1942	56.6890	58.9398	47.6319	20.0944
1943	70.3545	71.9307	47.9282	19.6157
1944	83.6632	84.3610	48.5130	19.3501
1945	113.2006	112.5645	49.4105	19.0690
1946	90.0445	87.5715	42.8859	16.2556
1947	85.3873	84.9220	38.9086	15.0555
1948	85.0599	87.2327	39.4125	14.8570
1949	104.0411	105.5287	42.4784	15.3762
1950	127.7300	131.3864	40.6908	14.7259
1951	145.8202	153.8999	37.5166	14.1865
1952	163.8036	180.5736	38.5773	14.4057
1953	163.2991	177.6771	38.8085	14.6931
1954	246.6207	272.5316	41.3622	15.0640
1955	307.8664	357.2122	41.0114	15.2430
1956	324.4214	370.0454	37.7711	15.2916
1957	281.6848	320.4576	38.4290	15.4297
1958	400.8437	451.4720	37.3321	15.5815
1959	446.5945	497.9785	35.9210	15.8967
1960	443.8691	493.0330	38.1991	16.4164
1961	561.8809	621.4266	39.1511	16.7979
1962	499.8078	560.3296	41.5422	17.1516
1963	597.0384	676.9321	41.8457	17.4564
1964	686.6777	779.2432	42.8651	17.9531
1965	768.4435	859.7340	42.3706	18.3922
1966	677.7131	748.1219	39.4209	18.7509
1967	834.1410	900.1021	36.3285	19.2168
1968	898.1100	954.5675	35.5926	19.4534
1969	763.3478	823.6370	30.7712	19.6875
1970	732.8981	811.5140	32.8381	20.4877
1971	821.5040	897.5204	35.3417	20.9700
1972	934.5469	1032.6039	37.2498	21.2180
1973	713.8025	809.9494	34.2697	20.9354
1974	466.0066	530.8024	29.1352	20.6953
1975	599.4205	680.5430	30.3160	20.9214
1976	722.0402	804.1230	34.4688	21.2045
1977	643.4454	699.0293	33.5162	20.8767
1978	633.6264	683.2083	30.0499	20.4802
1979	681.6056	714.1652	24.7250	20.1094
1980	804.5654	841.4385	20.4720	20.1458
1981	707.6212	734.3717	19.0746	21.8899
1982	824.7017	858.3599	26.3154	24.3218
1983	978.2737	1013.1476	26.6677	25.6091
1984	995.5760	1035.7954	30.4926	27.5502
1985	1259.3268	1319.0616	40.3805	28.9342
1986	1454.9741	1545.1222	51.3385	30.7700
1987	1482.1700	1565.5830	45.4506	31.4749

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ENDNOTES

1. It would be desirable to have returns on U.S. government bonds and on Treasury bills to extend the Ibbotson and Sinquefield data in a manner comparable to stocks. However, Treasury bills were not issued until December 1929 (and were used sparingly until World War II), and the U.S. government securities market was non-existent in the early period. Therefore, we focus on high quality corporate bonds as a substitute for U.S. government securities, and on commercial paper, which seems to be the lowest risk asset for which data are available, as a substitute for Treasury bills.

2. There was only a small difference in real total returns between the two periods.

3. The average maturity of the Salomon Brothers bonds is around 25 years.

4. Although Cowles provides two other series of dividend yields, they are only on an annual basis, and not usable with monthly compounding.

5. Specifically, we spliced the Cowles data using the difference approach to obtain dividends to the CRSP data and the Cowles data using yield expectations to the S&P data. The latter is consistent with the Ibbotson-Sinquefield approach to estimating dividend yields.

6. From 1919 through 1928 the yields are unweighted arithmetic averages of high and low yields of five securities each in the Industrial, Rail, and Utility categories. From 1928 through 1986, there have been 10 securities in each of the three categories, for a total of 30 securities.

7. The average term to maturity of the Aaa bonds has varied over time but has been in the range of more or less 20 years.

8. Macaulay (1938), Table 10, pp. A141-A157, column 4.

9. Macaulay estimated a monthly geometric mean return for the bonds included in his series, and the number of bonds varied between 13 in 1857 up to 41 in 1919. Prior to 1900, no security was included that did not have at least 10 years to maturity, and from 1900 the minimum maturity was 14 years.

10. From December 1870 until 1934, the interest rates were average rates for the month. From 1934 through 1986, the interest rates are the values for the last week of the month. Several changes in definition in the Moody's coverage occurred between 1919 and 1987, which are documented in the Federal Reserve System sources cited in the Bibliography. Friedman and Schwartz also inflated the Macaulay series in splicing to Durand's yields (1982, p. 128).

11. We have examined Weil's assumption that the 4% coupon assumption makes little difference in total return relative to other coupon assumptions and that the maturity assumption is a more crucial factor. The average observed market yield on Aaa bonds over the period 1871-1987 is approximately 5.4%, which is higher than the assumed coupon of 4%. Using this coupon return instead of 4%, the results are as follows for total return:

	Mean	Standard Deviation	Minimum	Maximum
4's	.4446192	1.553689	-12.3732	15.8604
5.4s	.4446124	1.452821	-11.5121	14.7755

These results indicate that on a total return basis, the coupon assumption makes little difference. However, the choice of coupon does affect the allocation of total return between interest income and capital change. Nevertheless, because of the above analysis and the fact that comparable series have been calculated on the 4% coupon assumption, we continue to use that in our series.

12. The approximation was chosen to lighten the computational burden of dealing with 1404 monthly observations.

13. Historical Statistics reports the monthly interest rates in both original and seasonally adjusted form (1949, App. 26, pp. 346-347). Macaulay's rates reported in this paper are not seasonally adjusted.

14. Based on information in Historical Statistics (1949), Macaulay's 4.48% quote in February 1903, was changed to 4.84%.

15. From 1870-1934 the rates are averages for the month, and for the latter period are the averages for the last week in each month.

16. The rates are for high-quality paper quoted in New York City.

17. An additional caution about commercial paper rates is the possible understatement due to usury laws in New York in the early period, with the additional charge of "commissions" to circumvent the maximum rate charged. It seems that this problem is well handled by Macaulay in the sense that additional charges were accounted for in calculating the monthly interest rate (1938, Appendix E).

18. It is assumed that the paper is 5-month paper, with d=152.1875 at acquisition and after one month d=121.75.

19. There is also an element of approximation in these calculations. All months are not the same length, and indeed all years are not the same length. We have used average lengths for years and months, again to lighten the computational burden.

20. Of course, the Cowles results are identical for the first subperiod, 1871-1926.

21. For the 1870-1925 period, the appreciation return for the Cowles series is the same for both, and the difference is due solely to different dividend returns for the two series.

22. The results discussed here are not presented in the tables but are available from the authors upon request.

23. In December 1925, in terms of coverage of the different measures, the S&P included 90 securities, the Cowles 258, and the CRSP 503. By December 1926 the Cowles coverage had increased to 375 corporations, and the CRSP to 539. In 1938, the historical data for the S&P was still 90, the Cowles included 396, and the CRSP 775 securities.

24. Since all calculations of summary nominal returns have been based on the geometric mean because of compounding, and since the inflation rate is a compounding phenomena, subtraction of the inflation rate is incorrect.