PROJECTIONS OF GDP-DEPENDENT LONG-RUN EQUITY RETURNS

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Abstract

This paper provides an analysis of long-run equity returns based on simulations that account for stochastic real GDP growth projections, alternative relative equity valuations compared to GDP, and estimated relationships between adjusted dividend returns and relative equity valuations. Data for total corporate equities and nonfarm nonfinancial corporate equities were drawn from the Flow of Funds Accounts and from the National Income and Product Accounts. Data for the S&P500 index also were used. Simulation results point to projected long-run centered broad-based real equity returns over the next 45 years in the range of about 5½ to 6¼ percent. Outcomes based on a projected distribution of real GDP growth centered on the Social Security Trustees' intermediate real GDP growth assumption – real GDP growth averaging 2.1 percent over the next 45 years – point to projected long-run, broad-based real equity returns over the next 45 years centered at about 5½ percent. An assumption of higher real GDP growth such as that made by Robert Gordon or by public and private consensus forecasts yields a centered real equity return in roughly the 6 percent to 6¼ percent range.

I. INTRODUCTION

The issue of long-run rates of return to equity investments has received much attention over the past decade, with specific events in recent years leading to an even greater focus on the issue. Sharp increases in corporate equity prices in the late 1990s – and the subsequent decline over the 2000-2002 period – generated debate about the relative valuation of broader stock market indexes, and whether there was "irrational exuberance" and a "bubble" in the markets. More recently, interest in likely long-run yields has been further piqued because of proposals for creating individual accounts with equity investments as part of the Social Security program.

Jeremy Siegel (2002) addressed the issue of long-run real equity returns in the United States in his book *Stocks for the Long Run* and in earlier research. The first chapter of Siegel's book lays out the historical evidence for ongoing long-run returns to equity investments:

> "The real return on equities has averaged 6.9 percent per year over the past 200 years. … Note the extraordinary stability of the real return on stocks over all major subperiods: 7.0 percent per year from 1802 through 1870, 6.6 percent from 1871 through 1925, and 6.9 percent per year since 1926."

The remarkable consistency of the rate of return across diverse historical periods – a real return of 6½ to 7 percent per year – has led some to refer to that as "Siegel's constant."[1] Looking forward, however, even Siegel does not anticipate returns continuing at such a high rate, but rather at around 6 percent. Other analysts expect even lower long-run real equity returns.

Ultimately, the reliance on historical rates of return for making projections of future rates of return presents difficulties. Specifically, it is incorrect to assume that equity rates of return are determined independent of the performance of the economy, and projections generated on a basis independent of projected gross domestic product (GDP) growth likely are unreliable.

[1] The nomenclature of "Siegel's constant" is attributed to Andrew Smithers and Steven Wright.

This paper addresses the issue of making long-run real equity return projections on a basis consistent with real GDP growth projections. Siegel (2002) and Peter Diamond (2000, 2001) discussed the relationship between equity returns and GDP growth and Dean Baker, Brad DeLong and Paul Krugman (2005) addressed the issue in theoretical analysis. This paper provides empirical analysis for projections of the distribution of future equity returns, and the estimates support the views that: (1) projections of real equity returns over time cannot be based on historical performance and in isolation of projections of other key economic variables, especially projected real GDP growth rates; and (2) current projections of real GDP growth rates are lower than the historical average real GDP growth rates and, as a result, projected real equity returns likewise would tend to be lower than their observed historical average.

Historical performance cannot be totally dismissed as, ultimately, it represents the extent of our knowledge of the performance of key variables over time. For variables such as labor productivity growth – a key building block for real GDP growth – historical performance establishes useful benchmarks. But care must be taken in determining the variables for which historical references are assumed to have more validity. For example, the Social Security Administration (SSA) actuaries don't use historical real GDP growth as the determinant for their long-run projections of real GDP growth, but rather base GDP growth projections on analysis of key building blocks, including labor force and labor productivity growth components. In a similar vein of using components to generate a forecast, rather than use historical real equity returns, this paper derives projected equity returns on the basis of using a likely distribution of projected real GDP growth rates and the historic patterns for the distribution of the valuation of equities relative to GDP. An important step in the analysis is to account for the relationship between adjusted dividend returns and the relative equity valuation. The adjusted dividend return – adjusted to account for share repurchases – is observed to be inversely related to the relative equity valuation, and that effect must be accounted for in making projections of total returns from equities.[2] Using those building blocks, simulations were produced of projected stochastic equity returns for the assumed distribution of projected real GDP growth rates. To produce a full distribution, 27,000 observations were generated for three cases (total corporate, nonfarm nonfinancial corporate, and the S&P500) of long-run real equity yields – representing 500 stochastic GDP growth projections for 54 relative equity valuation outcomes for each GDP growth projection.

The results indicate that a projected long-run real equity yield approaching the value of "Siegel's constant" and that assumed by the SSA actuaries in recent years – that is, at around 6½ percent – would require a much higher projection for real GDP growth than currently assumed by the SSA actuaries in their range of GDP growth projections for the annual Trustees reports. The estimates in this paper show that, if we assume a distribution for projected real GDP growth rates similar to that assumed by the Social Security actuaries for the Trustees Reports, then projected broad-based real equity yields over a 45-year period would be centered at about 5½ percent.

The results also indicate that the real GDP growth projection is a key variable determining the long-run returns observed. For example, even if we assume a high relative equity valuation compared to historical observations, the projected real equity yield would be in the 5.7 percent to 6.0 percent range for the SSA actuaries intermediate real GDP growth path (2.1 percent over the next 45 years). Raising the real GDP growth projection to 3.7 percent (equal to the historical average) would yield an average projected equity yield based on the full

[2] One of the criticisms Mankiw (2005) makes of the Baker, DeLong and Krugman (2005) analysis concerns the inability to determine the likely dividend yield; the approach adopted in this paper includes estimates of the dividend yield on a historically consistent basis.

historical relative equity valuation distribution in the range of 6.9 percent to 7.2 percent. An intermediate case based on real GDP growth projections roughly consistent with those hypothesized by Robert Gordon (2003) yields estimates of real equity yields of about 6.0 to 6.3 percent.

II. CURRENT VIEWS OF THE LONG-RUN REAL EQUITY RETURN

The Social Security Administration (SSA) actuaries have made assumptions about projected long-run real equity returns as part of their estimation of the financial effects for alternative social security reform proposals, including those from the President's Commission to Strengthen Social Security. In considering such estimates, however, we must be careful as the economic assumptions used by the SSA actuaries in producing the projections for the annual Trustees Reports are not always determined in an economically consistent fashion. Rather, the economic assumptions usually are based primarily on the historical performance of the key indicators and, in most cases, not on theoretical or model-based interactions. Projections of real GDP growth do take account of projected changes in population growth, which in turn affect labor force growth projections. Real GDP growth projections are then based on the projected labor force growth and historically-based labor productivity growth assumptions. Hence, projected real GDP growth rates are not based solely on history – labor productivity growth projections are. But many key indicators, including interest rates and inflation rates, are based primarily on historical averages.

The historical basis for assumed projected values extends to the SSA actuaries projected long-run real equity yields: "The long-term ultimate average real yield on stock investments made in the future is assumed to be 6.5 percent, somewhat less than the 7-percent real yield that was assumed for the 1994-96 Advisory Council" (p. 18, Steve Goss and Alice Wade (2002)). Potentially significant problems emerge in basing equity yields on the historical performance without taking account of the potential interaction with other key economic assumptions used in the projections – notably the assumptions for projected long-run real GDP growth.

At first glance, the Social Security assumptions about equity yields may appear to be on firm footing. In a respected and widely recognized analysis of historical data, Siegel (2002) has presented evidence of sustained performance for real equity annual returns in the range of 6½ to 7 percent for a variety of investment horizons over the past 200 years. Joel Smith and John Sabelhaus (2003) presented analogous measures of equity returns over long-run horizons – for periods since 1926 – in the range of about 6½ percent to 8 percent.

But a number of issues arise in considering the application of historical returns to future periods. At the forefront is the issue of mean-reversion of stock market valuation measures – such as dividend-price ratios – addressed by a number of authors in the context discussed here, including John Campbell and Robert Shiller (2001), Peter Diamond (2000, 2001), and Smith and Sabelhaus (2003). Diamond (2000) – writing when stock valuations were near their peak – discussed the role that high initial valuations would play in restricting the likely future rates of return. Diamond stated:

> "To eliminate the inconsistency posed by the assumed 7.0 percent return, one could assume higher GDP growth, a lower long-run stock return, or a lower short-run stock return with a 7.0 percent return on a lower base thereafter. … Either the stock market is overvalued and requires a correction to justify a 7.0 percent return thereafter, or it is correctly valued and the long-run return is substantially lower than 7.0 percent (or some combination). … Although [the Office of the Chief

> Actuary of the SSA] could adopt a lower rate for the entire 75-year period, a better approach would be to assume lower returns over the next decade and a 7.0 percent return thereafter." (Diamond (2000), p. 39)

At a later date, Diamond (2001) discussed the issue further with updated information and concluded:

> "… the implied ratios of stock market value to GDP at the end of the 75-year projection period … [suggest] that the 7 percent assumption throughout the next 75 years is not plausible in that it requires a rise in stock values to GDP that is not plausible."

Analogously, Smith and Sabelhaus (2003, p. 21) find that: "The mean reversion models are favored as the model of choice since they allow the value of the stock market to be consistent with economic fundamentals in the long run." Hence, these analyses take account of the interaction of future stock returns and the current relative valuation of the stock market, and from the perspective of the projected long-run real equity returns in a steady growth state similar to the historical performance as in Siegel (2002) and as used by the SSS actuaries.

More recent analyses provide additional views from making projections based on historical performance. For example, Robert Shiller (2005) evaluated projected real equity returns in the context of proposals for "life-cycle" accounts for Social Security reform. Shiller conducted simulations based on historical returns for U.S. stocks, bonds, and money market assets over long-run periods. He used two alternative bases for long-run equity returns: the higher observed rates of the U.S. historical experience consistent with those of Siegel; and, a lower alternative based on long-run experience for international stock market returns. In a *Wall Street Journal* article, Mark Whitehouse (2005) presented a table with a survey of selected economists' views of the "after-inflation return on stocks and bonds for the next 44 years" (see Table 1). No descriptive evidence was provided as to how these specific forecasts were formed, but the following paragraph from the article discusses the perceived linkage to real GDP growth:

> "The long-term return on stocks comes from two main sources: growth in corporate earnings and payouts to shareholders, which includes dividends and share buybacks. Earnings tend to grow in line with the economy, which means that 1.9% GDP growth typically would produce 1.9% earnings growth. Add to that dividends, which in recent years have averaged about 1.7% of a stock's price, and buybacks, which have averaged about 1%, and the total return for stocks comes to about 4.6%. Most economists who predict higher stock returns assume higher GDP growth as well." (Whitehouse, *Wall Street Journal* (2005))

Baker, DeLong and Krugman (2005) examined various theoretical explanations for the relationship between expected real returns on equity and the expected growth in real growth in

Table 1 -- Surveyed Expectations for Real Returns Over the Next 44 Years

Percent per year

	Stocks	Government Bonds	Corporate Bonds
Joseph LaVorgna (Deutsche Bank)	6.5	4.0	5.0
Jeremy Siegel (Wharton)	6.0	1.8	2.3
David Malpass (Bear Stearns)	5.5	3.5	4.3
William Dudley (Goldman Sachs)	5.0	2.0	2.5
Robert Shiller (Yale)	4.6	2.2	2.7
Parul Jain (Nomura)	4.5	3.5	4.0
David Rosenberg (Merrill Lynch)	4.0	3.0	4.0
Ethan Harris (Lehman Brothers)	4.0	3.5	2.5
John Lonski (Moody's)	4.0	2.0	3.0
James Glassman (J.P. Morgan)	4.0	2.5	3.0
Median	4.6	2.8	3.0

Source: Whitehouse, *Wall Street Journal* (2005) the economy over long-run periods of time. Their particular focus was on the issue of likely future equity returns given that the long-run Social Security intermediate projections show slower real GDP growth than for historical periods:

> "We conclude that *if* economic growth over the next century falls as far as forecasts like those contained in the Social Security *Trustees Report* (2005) are envisioning, *then* it is possible but not likely that asset returns will match historical experience. … Economic growth and asset returns are linked. Falls in growth rates are very likely to be accompanied by declines in asset returns." (Baker, DeLong and Krugman (2005), p. 5)

Such relationships between equity valuations and GDP are analogous to the "stylized facts" of macroeconomics observed by Nicholas Kaldor (1961) and discussed in more detail by Paul Romer (1989). These relationships and the theoretical discussion in Baker, DeLong and Krugman (2005) paper provide a basis for the simulations and results presented in this paper.

The analysis in this paper is intended to expound on the observations of a relationship between the valuation of the stock market and GDP, and then derive projected real equity returns based on projected real GDP growth rates and observed relationships between relative market valuation and adjusted dividend returns. The next section discusses the data used in the analysis and examines the range and distribution of historical equity valuations relative to GDP.

III. Historical Relationship between Equity Valuation and GDP

Data used in the analysis described in this paper come from the *Flow of Funds Accounts of the United States* (FOF) produced by the Board of Governors of the Federal Reserve System and the *National Income and Product Accounts* (NIPAs) produced by the Bureau of Economic

Analysis (BEA). Specifically, those sources provide measures of the market value of corporate equities, dividend payments, and net equity issues/purchases by corporations. The Flow of Funds data are of specific value because of the availability of comprehensive data for net equity issues – which allows for calculations of “adjusted dividends” to account for equity repurchases. Data for two alternative measures were used: total corporate equities and nonfarm, nonfinancial corporate equities. The data are available from the first quarter of 1952 through the fourth quarter of 2005.[3] For purposes of comparison, the analysis is also performed over the same period for data for the S&P500 index and per-share dividends; recent data for share repurchases are also used.[4]

The historical series for the quarterly values of the ratio of the equity market value to GDP are shown in Chart 1 for total corporate equities, and in Chart 2 for nonfarm nonfinancial corporate equities. As should be expected, the general behavior of the measures is very similar over the historical range. For the total corporate equity valuation ratio to GDP, the range of the observed relative valuation is from a low of 34.5 percent (second quarter 1982) to a high of 193.3 percent (first quarter 2000), and the average over the full period is 78.9 percent. For nonfarm nonfinancial corporations, the range is from a low of 31.0 percent to a high of 167.7 percent, and the average over the full period is 66.6 percent. Analogous behavior is shown for the S&P 500 index in Chart 3, with the relative equity valuation shown in the chart calculated on the basis of an index with the value in 2005 set to 100. The distributions for the annual relative valuation ratios for the three cases are shown in Charts 4, 5, and 6.

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[3] See the Data Appendix for more information on the specific sources.

[4] Differences exist between the data from the Flow of Funds and the S&P 500 index. The Flow of Funds data is the market value of corporate equities while the S&P500 index is a measure of the prices of a select (large) group of company stocks. For the S&P 500 index, the effect of share offerings and repurchases is accounted for in the index calculation; the flow of funds data includes the value of net issues in the equity values. That difference introduces a potential complication for the comparison of the results from the alternative measures. In practice, however, it turns out that the value of net domestic new issues is very small – averaging about -0.1 percent of GDP annually – reflecting the role of share repurchases relative to new issues.

Chart 1

RATIO OF MARKET VALUE OF CORPORATE EQUITIES TO GDP

Total Corporate Equities, 1952-2005

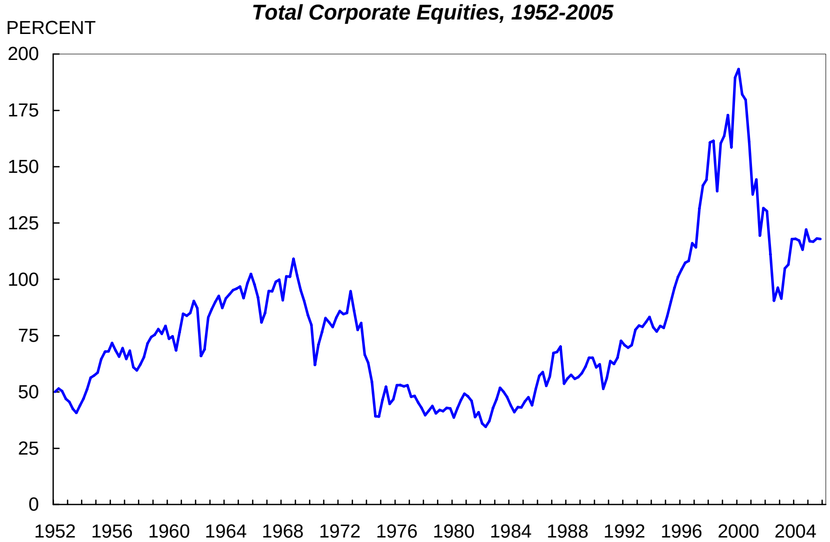


Chart 2

RATIO OF MARKET VALUE OF CORPORATE EQUITIES TO GDP

NonFarm NonFinancial Corporate Equities, 1952-2005

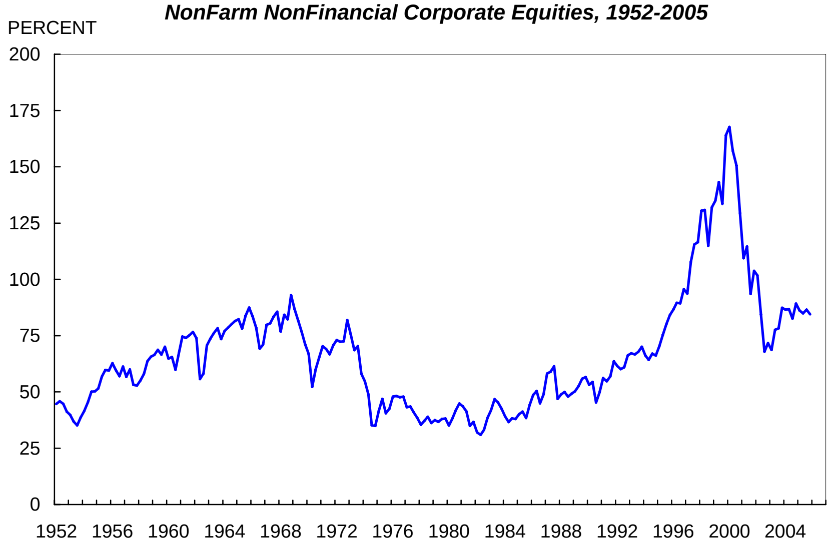


Chart 3

RATIO OF S&P500 INDEX TO GDP, 2005=100

1952-2005

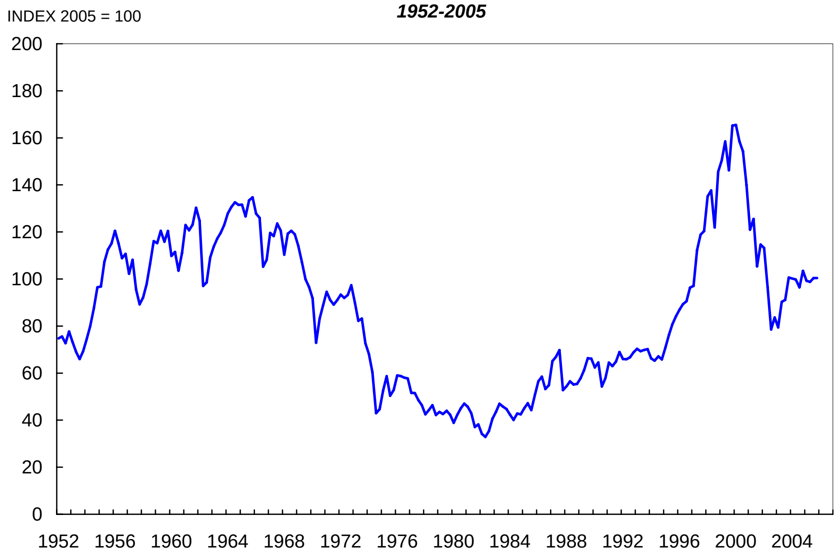


Chart 4

RELATIVE EQUITY VALUE RATIO DISTRIBUTION

TOTAL CORPORATE EQUITIES

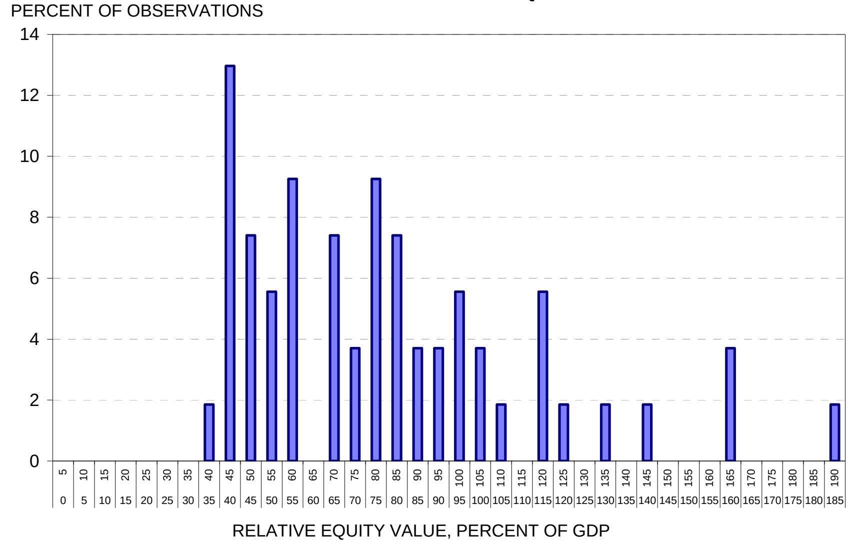


Chart 5

RELATIVE EQUITY VALUE RATIO DISTRIBUTION

NONFARM NONFINANCIAL CORPORATE EQUITIES

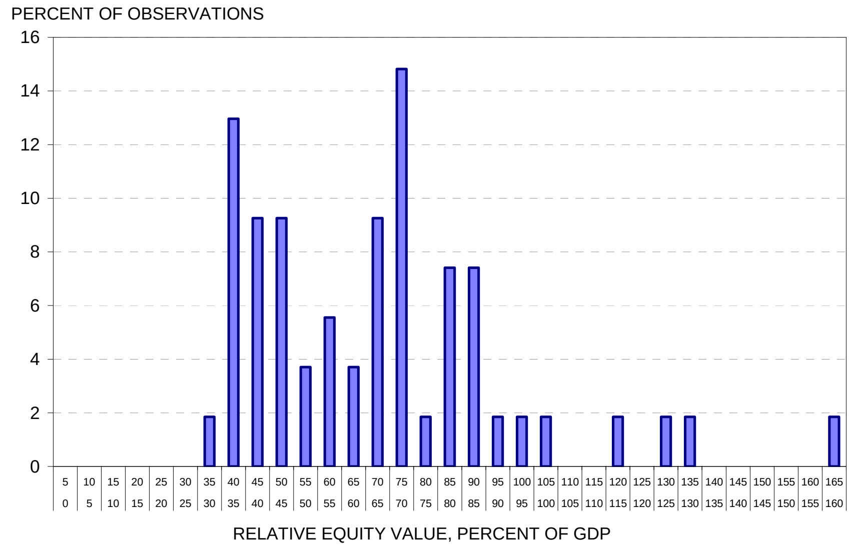
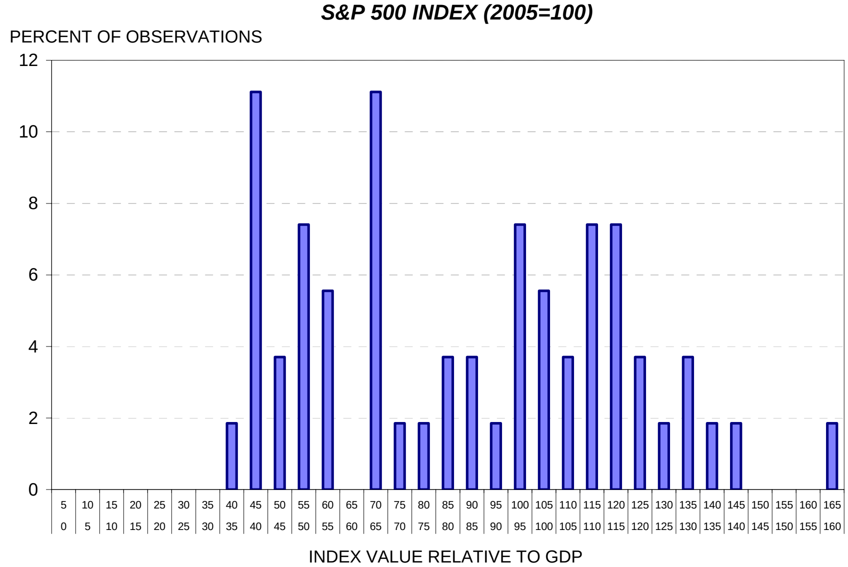


Chart 6

RELATIVE EQUITY VALUE RATIO DISTRIBUTION

S&P 500 INDEX (2005=100)



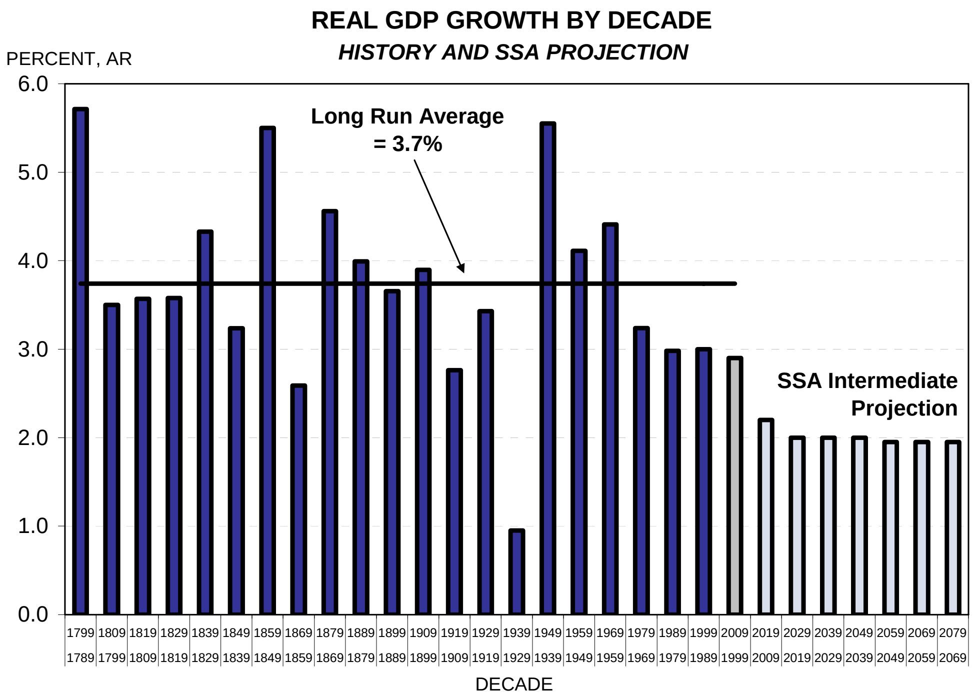
IV. Historical Real GDP Growth – and Social Security Trustees Projections

Across historical and projection periods, real GDP growth rates vary substantially, reflecting large differences across time in the rates of productivity growth and population and labor force growth. Nonetheless, as is the case for long-run equity yields, the *historical* long-run average for real GDP growth has been remarkably steady. The long-run historical average over the past two centuries for annual real GDP growth is about 3.7 percent (see Chart 7).[5] The data show real GDP per capita growth averaging about 1.7 percent and population growth averaging about 2 percent. But substantial variation has occurred in the underlying relationships over time. For example, in the first half of the nineteenth century the estimates show average annual real GDP growth at a 3.6 percent annual rate, with real GDP per capita growing at 0.6 percent and population at about 3.0 percent. Over the second half of the twentieth century, the estimates show average annual real GDP growth at 3.5 percent, with real GDP per capita growing at 2.3 percent and population at 1.2 percent. Similarly, but based on a more detailed analysis, the Congressional Budget Office (CBO) (2006, p. 44) reports that potential real GDP growth averaged 3.4 percent for the 1950 to 2005 period, with total economy labor productivity growth at 1.8 percent, and labor force growth at 1.6 percent (population growth was 1.2 percent per year over that period).

Looking forward, however, it is generally assumed that the projected rates of increase in labor force will be much lower than observed historically, as the aging of the baby boom generation leads to slower growth in the labor force from slower growth in the working-age population and lower labor force participation. For example, CBO (2006) shows projections for the 2006-2016 period of potential real GDP growth of 2.8 percent with potential labor force

[5] Data on historical real GDP growth are from the Bureau of Economic Analysis (BEA) and Lewis Johnston and Samuel Williamson (2004), with earlier historical results derived from data from Nathan Balke and Robert Gordon (1989), Thomas Berry (1988), and Thomas Weiss (1992).

Chart 7


REAL GDP GROWTH BY DECADE
HISTORY AND SSA PROJECTION
PERCENT, AR
Long Run Average = 3.7%
SSA Intermediate Projection
DECADE

growth of 0.7 percent – and total economy labor productivity growth of 2.1 percent. The SSA actuaries assume, for the intermediate projection from the 2006 Trustees Report, ultimate long-run projection values for the 75-year projection period of 1.9 percent real GDP growth from 0.3 percent growth for the labor force and 1.7 percent growth for total economy labor productivity (see Chart 5). The SSA actuaries also report alternative "low cost" and "high cost" scenarios with ultimate long-run real GDP growth rates of about 2.8 percent and around 1.0 percent. The SSA actuaries assume a transition to the ultimate long-run rates so that over a shorter horizon, the observed average annual growth rate would be higher than the ultimate value. For example, over the 45-year horizon used in the simulations for this analysis, the average real GDP growth is 2.1 percent, slightly higher than the ultimate 1.9 percent rate.[6]

V. Projections of GDP-Dependent Real Equity Returns Based on Historical Relative Valuations

This section describes the primary analysis of this paper – the derivation of the projected equity returns. The simulations were based on the distribution of projected real GDP growth rates, the historic patterns for the range and distribution of the valuation of equities relative to GDP, and the historical relationship between (adjusted) dividend returns and the relative equity valuation. The SSA real GDP growth assumptions are used in the base analysis for purposes of comparison to the assumptions about real equity returns employed by the SSA.

The rate of return on a stock is defined as the rate of appreciation of the price of the stock from the base period plus the dividend return measured relative to the base period price of the stock (see John Campbell, Andrew Lo and Craig MacKinlay (1997), pp. 254ff for further

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[6] Not all analysts accept the projection of a sharp slowdown in long-run real GDP growth. In particular, see the discussion in section VI below that addresses the higher real GDP growth projections of Robert Gordon (2003).

discussion). Because firms can choose to return capital to equity investors through dividends or by repurchasing outstanding shares of stock, an "adjusted dividend" measure is used – dividends paid plus net share buybacks.[7] The Flow of Funds data used in this analysis allows for the calculation of "adjusted dividends" from available data on corporate net equity flows. For the S&P 500 index data, the effect of changes in shares outstanding is included in index adjustments; data for repurchases of stock are available for the period from 1998 forward.[8]

An important step in the analysis is to account for the relationship between returns from dividend and stock repurchases and the relative equity valuation. Charts 8 and 9 show the scatter plots for quarterly data for the real adjusted dividend yield and the relative equity valuation for the FOF data for the total corporate and nonfarm nonfinancial corporate cases. Chart 10 shows an analogous relationship for the relative S&P 500 index valuation and the real (not "adjusted") dividend yield. Chart 11 shows the equivalent chart for the S&P 500 index relationship for the adjusted dividend yield for the 1998-2005 period.[9] The real adjusted dividend return is observed to be inversely related to the relative equity valuation, and that effect must be accounted for in making projections of total returns from equities. The fitted curves in the charts are nonlinear, of the form $Y = a X^{b}$. The observed negative relationship here is similar – albeit not precisely the same – to prior observations of a relationship between equity returns and dividend-price ratios (Campbell, Lo, and MacKinlay (1997) and Smith and Sabelhaus (2003)).

Table 2 shows nonlinear least squares estimation results for the fitted relationships for the three cases. Results are shown for quarterly and annual frequencies for the total corporate,

[7] See Franklin Allen and Roni Michaely (2002) for more information on firm "payout policy" and Baker, DeLong and Krugman (2005), for more discussion on the underlying relationships.
[8] Thanks go to David Blitzer for information and discussions on this issue and to Howard Silverblatt for providing the S&P500 stock repurchase data.
[9] As described in the text, the data for repurchases for the S&P 500 index are available only for the period 1998 forward.

Chart 8

SCATTER OF ADJUSTED DIVIDEND YIELD TO MARKET VALUATION

TOTAL CORPORATE, QUARTERLY DATA 1952-2005

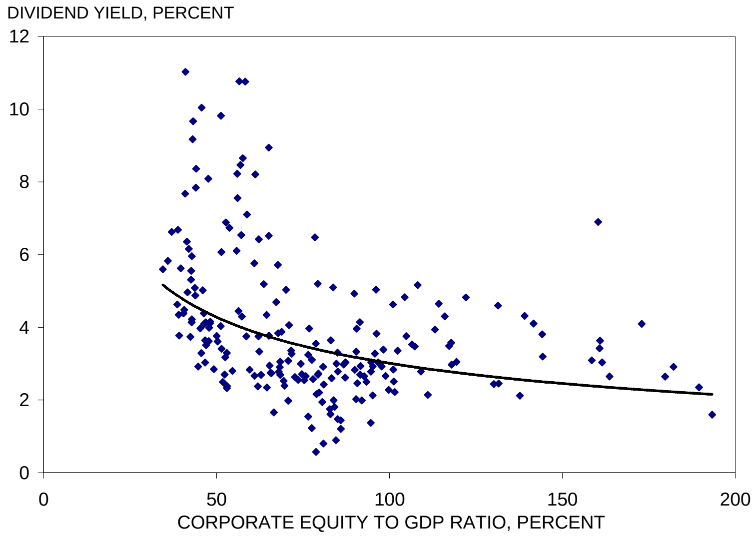


Chart 9

SCATTER OF ADJUSTED DIVIDEND YIELD TO MARKET VALUATION

NONFARM NONFINANCIAL CORPORATIONS, QUARTERLY DATA 1952-2005

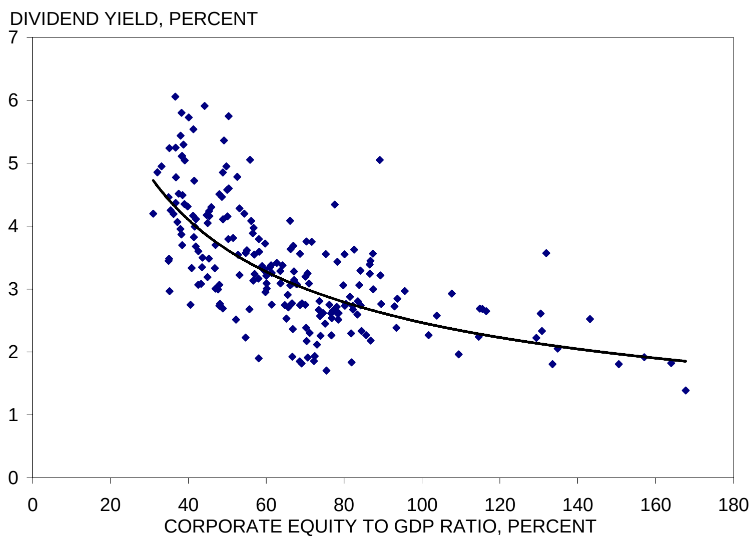


Chart 10

SCATTER OF DIVIDEND YIELD TO MARKET VALUATION

S&P 500 INDEX

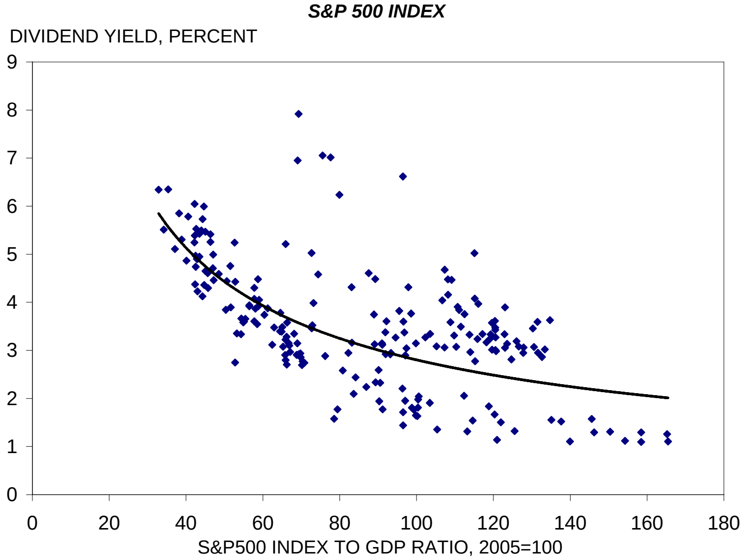
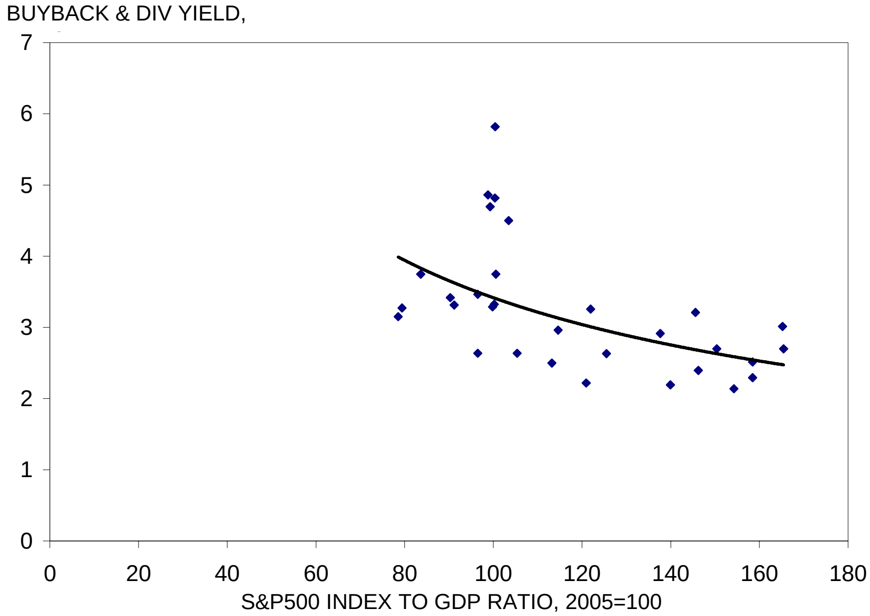


Chart 11

SCATTER OF ADJUSTED DIVIDEND YIELD TO MARKET VALUATION

S&P 500 INDEX, QUARTERLY DATA 1998-2005



nonfarm nonfinancial corporate, and S&P 500 index cases. A significant negative relationship is observed between the real (adjusted) dividend yields and the relative equity valuation ratios; the one exception is the result for the shorter annual sample results for the adjusted dividends case for the S&P500 for which the coefficient is still negative as hypothesized, but with a p-value of 0.15. The second version of the equations includes a dummy variable that is equal to one for 1983 and prior years and zero post-1983. The use of this dummy accounts for the change in payout behavior on the part of firms in and after 1983:

> "After the [Securities and Exchange Commission] adopted a safe-harbor rule (Rule 10b-18) in 1982 that guaranteed that, under certain conditions, the SEC would not file manipulation charges against companies that repurchased shares on the open market, repurchase activity experienced an upward structural shift."
>
> (Allen and Michaely (2002), p. 90)

The estimated coefficient on the dummy variable is negative and highly significant at usual levels in the total corporate and nonfarm nonfinancial cases, consistent with the hypothesized effect of an "upward structural shift" in corporate payouts, apparently reflecting the incorporation of higher net repurchases by corporations in the adjusted dividends. The availability of data for share buybacks for the S&P500 case for only the 1998 period forward limits the application of the estimation accounting for the shift in firm payout policy; the first set of regressions, estimated using only dividend returns show a significant *positive* coefficient for the pre-1983 dummy for the S&P500 case. The S&P 500 dividend-only results are consistent with the view that the dividend yield was higher in the pre-1983 period and then was smaller in the post-1983 period as firm payout policy shifted toward more share repurchases.

Table 2 -- Estimated Relationship, Adjusted Dividend Return and Relative Equity Valuation

Nonlinear Least Squares Estimation

REAL ADJUSTED DIVIDEND YIELD = C(1) * EQUITY VALUATION ^ C(2) + C(3) PRE1983DUMMY

Equation	Frequency	C(1)	C(2)	C(3)	Adj. R-squared	SE
TOTAL CORPORATE						
1	Quarterly	49.793	-0.594		0.181	1.80
		(17.426)	(0.085)			
2	Quarterly	79.715	-0.628	-2.567	0.564	1.32
		(14.860)	(0.045)	(0.195)		
3	Annual	31.369	-0.478		0.124	1.85
		(21.729)	(0.166)			
4	Annual	62.903	-0.561	-2.840	0.567	1.30
		(22.293)	(0.084)	(0.389)		
NONFARM NONFINANCIAL CORPORATE						
5	Quarterly	34.921	-0.573		0.476	0.69
		(5.881)	(0.042)			
6	Quarterly	43.541	-0.591	-0.897	0.668	0.55
		(5.116)	(0.029)	(0.081)		
7	Annual	21.861	-0.454		0.318	0.79
		(8.263)	(0.093)			
8	Annual	30.172	-0.496	-0.930	0.520	0.66
		(8.455)	(0.068)	(0.196)		
S&P 500 INDEX						
Dividends only (1952-2005)						
9	Quarterly	43.637	-0.580		0.405	1.01
		(8.801)	(0.048)			
10	Quarterly	71.578	-0.761	-0.145	0.710	0.70
		(13.539)	(0.047)	(0.098)		
11	Annual	27.249	-0.418		0.335	0.95
		(10.656)	(0.093)			
12	Annual	34.103	-0.589	1.210	0.599	0.74
		(277.08)	(0.095)	(0.208)		
Adjusted Dividends (1998 -2005)						
13	Quarterly	59.496	-0.616		0.235	0.78
		(56.492)	(0.203)			
14	Annual	127.52	-0.750		0.216	0.94
		(277.08)	(0.463)			

Standard errors in parentheses.

To better understand the role of these relationships, consider examples of point estimates for the adjusted dividend yields for given relative equity valuations. If relative equity values were to continue at the levels of the end of 2005 the estimated regression relationships from the annual data show adjusted dividend yields of 4.3 percent for total corporate equities; 3.3 percent for nonfarm, nonfinancial equities; and 4.0 percent for the S&P 500 index. If the relative equity values rose to be 20 percent higher than at the end of 2005 the estimated adjusted dividend yields would be: 3.9 percent for total corporate equities; 3.0 percent for nonfarm nonfinancial equities; and 3.5 percent for the S&P500.

Using the relationships discussed above, simulations were produced of projected stochastic equity returns for the assumed distribution of projected real GDP growth rates.[10] In this analysis, the real GDP growth projections were assumed to be generated according to a normal distribution centered on the SSA real GDP intermediate growth projection (average of 2.1 percent over the 2006 to 2051 period) and a standard error of 0.5 percentage point.[11] With a standard error of 0.5 percentage point, the range from 1.6 percent average growth (the SSA high cost real GDP growth assumption over 45 years) to 2.8 percent average growth (the SSA low cost real GDP growth assumption over the 45-year period) includes about 80 percent of the growth outcomes. The assumed distribution for the real GDP growth projections therefore provides a rough approximation of the SSA real GDP growth range but also allows for about 20 percent of growth outcomes that would be less than or greater than the range assumed by SSA.[12]

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[10] Programs for the simulations were run in EViews 4.1 software.

[11] The standard error of 0.5 percentage point is similar to that assumed by the CBO in its long-run macroeconomic projections. CBO (1997) described the basis of its assumptions for determining key components used for constructing long-run real GDP growth projections.

[12] Note that the simulations do not account for any variation in the inflation assumptions and are based on the intermediate inflation assumptions for the GDP price index and the consumer price index (CPI). If GDP price inflation and CPI inflation move together, then the real equity valuations in the simulations would be unaffected by variations in inflation – the nominal equity valuations would change with the GDP price index and then be deflated

To produce a full distribution for the simulations, 27,000 observations for the long-run projected real equity yields were generated – accounting for 500 stochastic real GDP growth projections and 54 ultimate relative equity valuation outcomes for each real GDP growth projection. Relative equity valuations were assumed to evolve smoothly from the original year value through the annual observations to reach the ultimate value in the 45th year (2051). In running the simulations, adjusted dividend returns were determined on an annual basis for the given relative equity valuation in accordance with the annual equations in Table 2 (equations 4, 8 and 14) – as described briefly in the examples above – but also including random error terms for the relationships as in the estimation results (assumed normal with a mean of 0 and standard deviations from the standard errors of the regressions).

The resulting distributions of outcomes are shown in Charts 12, 13, and 14. Based on the assumptions used – notably that projected real GDP growth rates will be similar to those assumed by the Social Security actuaries for the Trustees Reports – the simulation results show projected real equity yields over the 45-year period lower than the 6.5 percent yield assumed by the SSA and lower than the 6½ percent to 7 percent of "Siegel's constant." For the total corporate equity case, the mean of the distribution is about 5.4 percent and the standard deviation is 0.55 percentage point. The central 80 percent of the observations fall between 4.7 percent and 6.1 percent. For the nonfarm nonfinancial case, the mean of the distribution is about 4.6 percent and the standard deviation is about 0.62 percentage point. The central 80 percent of the observations fall between 3.8 percent and 5.4 percent. For the S&P 500 index case, the mean is about 5.6 percent with a standard deviation of 0.57 percentage point; the 80 percent range is from 4.9 percent to 6.3 percent.

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by the similarly-changed CPI index. What would matter would be variation in the projected spread between GDP price inflation and CPI inflation. Such an effect is not included in this analysis.

Chart 12

REAL EQUITY RETURN DISTRIBUTION FOR SIMULATIONS

TOTAL CORPORATE EQUITIES, FLOW OF FUNDS DATA

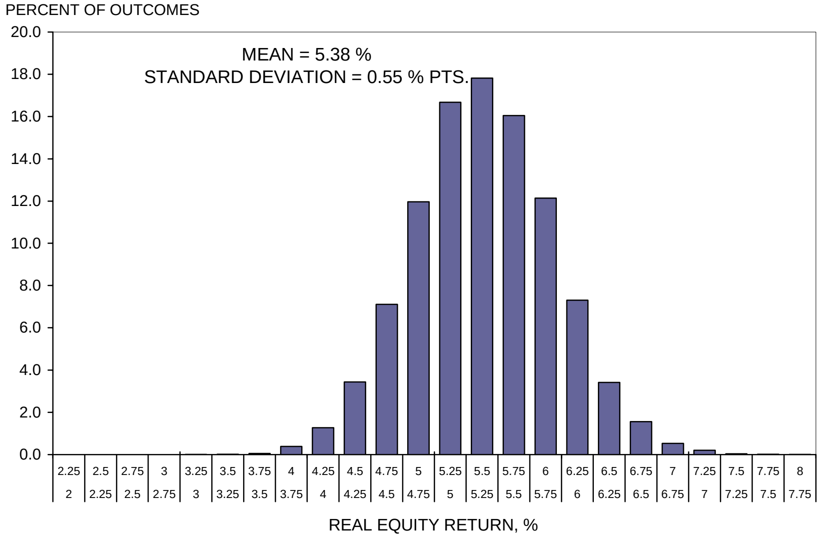


Chart 13

REAL EQUITY RETURN DISTRIBUTION

NONFARM NONFINANCIAL CORPORATE EQUITIES

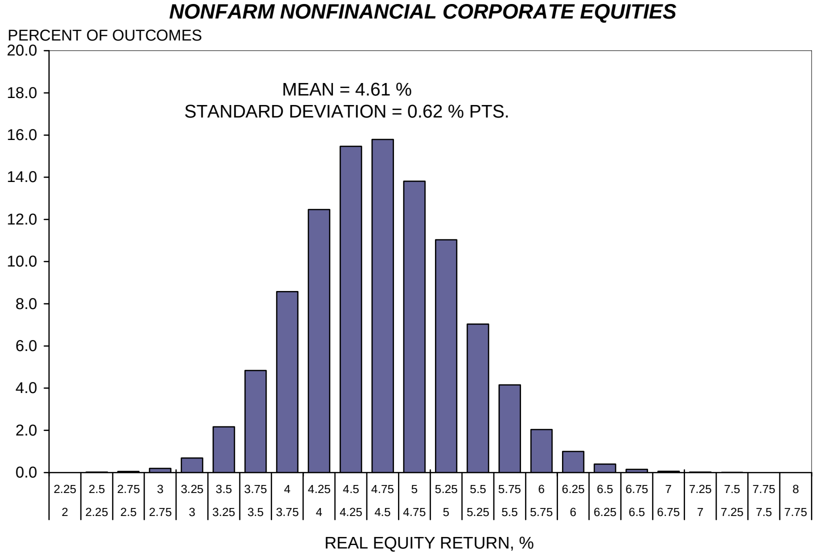
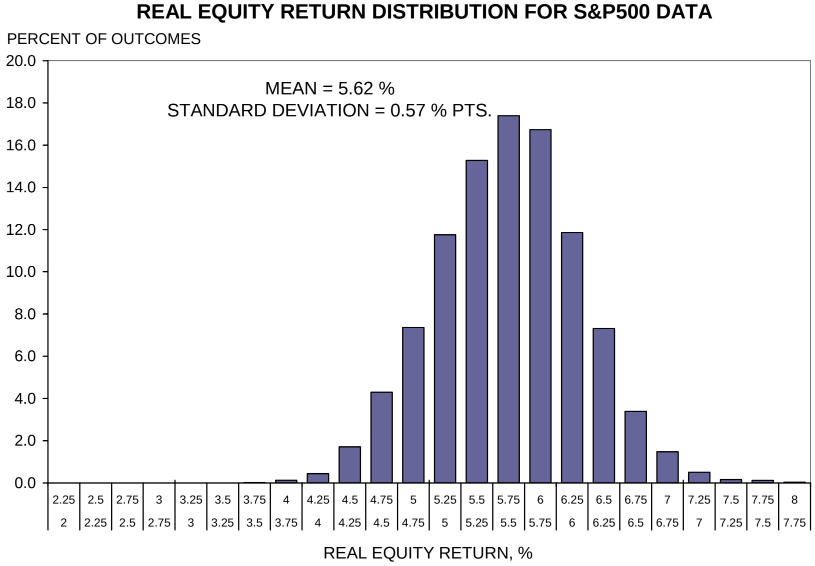


Chart 14

REAL EQUITY RETURN DISTRIBUTION FOR S&P500 DATA



Note that the standard deviations may appear to be quite small – especially in comparison to the very large variation observed for annual rates of return. But it is important to recognize that these standard deviations are for 45-year rates of return, and because of the methodology employed they implicitly account for offsetting high and low return observations from the annual distributions over time. Smith and Sabelhaus (2003) show a declining variance for mean returns as the number of years in the holding period increase, and Siegel (2002) shows a similar result in his Figure 2-6 (page 37). It is also the case that price valuation changes and adjusted dividend yields are negatively correlated (as shown in the examples above), so the effect on returns from variation in one is at least partially offset by variation in the other.

Table 3 shows a collection of results for alternative simulation runs – covering three real GDP average growth rates for the 45-year period (2.1 percent base case; 2.8 percent; and 3.7 percent historical average) and two different relative equity valuations (historical base case and high relative valuations). The boxed cases of the first column are the base cases discussed above – real GDP growth at the SSA intermediate assumption and historical relative equity valuations. The results in the last columns of Table 3 show that if real GDP growth were to be at the historical average of 3.7 percent, then real equity rates of return would be close to the historical averages and "Siegel's constant."

As shown in the second row for each case, even if we assume a high relative equity valuation compared to the historical observations (based on the top 6 of the 54 historical annual relative equity valuations – similar to the valuations of the second half of the 1990s), the projected real equity yields would be higher, but still below historical rates and the SSA assumption of 6.5 percent for the 2.1 percent growth case.

Table 3 -- Summary Statistics for Simulations of Long-Run Real Equity Returns

Real rates of return (percent) and standard deviations (percentage points)

	Assumed Average Real GDP Growth Rate in Simulation					
	2.1		**2.8**		**3.7**	
	Mean return	Std. dev	Mean return	Std. dev	Mean return	Std. dev
Total Corporate						
Historical Equity Value Distribution	5.4	0.6	6.0	0.6	6.9	0.6
High Relative Equity Value	5.7	0.6	6.3	0.6	7.3	0.5
Nonfarm Nonfinancial Corporate						
Historical Equity Value Distribution	4.6	0.6	5.3	0.6	6.3	0.7
High Relative Equity Value	5.3	0.6	6.0	0.6	7.0	0.6
S&P 500 Index						
Historical Equity Value Distribution	5.6	0.6	6.3	0.6	7.2	0.6
High Relative Equity Value	6.0	0.5	6.7	0.5	7.5	0.5

Note: Boxed results are the base cases with primary focus in the text.

Why would a high valuation scenario fail to generate a higher effect on projected yields than the 0.3 percentage point to 0.7 percentage point range shown in Table 3? In this analysis, the answer is primarily attributable to the negative relationship between the (adjusted) dividend yield and the relative equity valuation. Hence, in the simulations generating the projections, the adjusted dividend yield acts as a moderating force in the determination of the projected equity returns. Adjusted dividend yields are higher when the relative equity valuation is lower, and lower when the relative valuation is higher.

VI. Possible Limitations of the Analysis

A number of potential concerns exist for the analysis and the applicability of the results, including: the use of the Flow of Funds data for the total corporate and nonfarm nonfinancial cases; the methodology of using measures of historical equity valuations relative to GDP; and the use and reliability of the SSA intermediate GDP growth projections for the base case analysis.

Flow of Funds Data and Actual Portfolios

Data and coverage differences from the use of the Flow of Funds (FOF) data may limit the applicability of the results presented in this study for comparisons to the returns to a broad equity index that investors would hold, for example, the S&P500 index. One difference is that the FOF data used in this analysis applies to all corporate equities – including privately and closely-held corporations. Even so, the results presented above in Section V show similar estimated returns for the case of total corporate equities from the FOF-based measures compared to the S&P 500, but a much lower estimated return for nonfarm nonfinancial equities. These results conform to the evidence reported by Houston and Stiroh (2006) that shows higher relative rates of return – and higher volatility of those returns – for the financial sector relative to the nonfinancial sector, and with increases in relative financial returns and volatility over time. They report, for example, that annualized daily excess returns were 11.6 percent for the financial sector compared to 6.9 percent for nonfinancials for the 1975 to 1984 period; for the 1995 to 2005 period, excess returns for the financial sector rose to 17.7 percent compared to 6.2 percent for the nonfinancial sector. Further, the financial sector share of total market returns has increased from 9 percent in the 1975-1984 period to more than 15 percent for the 1995-2005 period. Although the results presented in this study for nonfarm nonfinancial corporate equities help to confirm the methodology and provide useful information, the increasing relative role and the higher relative rates of return for financial equities reveal that the nonfarm nonfinancial results are not a reliable measure for estimates of likely *broad-based* equity returns over time. For purposes of comparison and use for likely future equity returns, the focus should be on the results for total corporate equities, which are close to the results for the S&P 500 index.

Historical Equity Valuations Relative to GDP

The use of the historical distribution of relative equity valuations relative to GDP begs the question of whether the historical period provides an accurate description of what we should expect to see for the future. For example, the relatively low equity valuations of the mid-1970s through the early 1980s reflected a high-inflation, low productivity environment. Some might argue that the Federal Reserve has learned from prior mistakes and that policy makers will be successful in the future in maintaining and promoting a relatively low-inflation, high productivity environment, or at least one that is not characterized by double-digit inflation and interest rates as occurred in the late 1970s and early 1980s. Alternatively, an argument could be made that the extraordinary high relative equity valuations of the late 1990s are unlikely to be repeated. From the perspective of this analysis, if the low and high relative equity valuations were thrown out, the central tendency of the projected distributions for equity returns would persist and the results would be similar, albeit with somewhat lower variation in the distribution of projected returns.

A related concern is that the time horizon for data used here – 1952 to 2005 – could artificially limit the range and distribution of the relative valuation to GDP. The use of data from the past half century – for the post-WWII period – may be viewed as more reliable for comparison to the performance over the next half century, rather than going further back in history and using valuations from periods such as the Great Depression and two world wars – or even prior periods of time in the nineteenth century when financial panics were a regular occurrence. Also, we have less confidence in the reliability of reconstructed data for earlier periods, especially for measures such as GDP and CPI inflation.

Siegel (2000, pp. 99-109) addressed the issue of the valuation of equities relative to GDP, stating that "It would be reasonable to assume that the market valuations of firms should bear some relation to that output." But he also discussed the limitations:

> "The ratio of the market value of equity to GDP can both theoretically and empirically exceed 1. Equity valuation is a balance-sheet item, whereas GDP is an annual flow. Many firms have capital that far exceeds their annual sales, so it is not at all unusual for the value of an economy's capital to be greater than its output. More important, however, equity capital is only a part of total capital. Both debt and equity finance the capital stock, and the ratio between them changes over time. … Moreover, the ratio of market capitalization to GDP differs

> widely among countries. … As international trade increases, it should not be surprising if market value shows less and less relation to the GDP of any one country." (pp. 103 – 104)

Siegel (2002) also discussed some of the limits of using the S&P 500 index relative to GDP. Ultimately, arguments can occur over what the "proper" relative equity value to GDP should be, whether the observed historical distribution or some subset is appropriate, or if such a measure is proper for analysis at all. Lacking any useful alternatives, however, the use of the historical distributions of relative equity valuations provides a distribution of outcomes with substantial variation in the relative valuation of the market; this analysis assumes that is a good basis for examining the likely distribution of outcomes in the future.

How Reliable are the SSA Economic Assumptions? Should We Expect Higher Growth?

Gordon (2003) presents a comprehensive analysis of the historical and prospective outlook for growth in productivity and real GDP in the United States for the next 2 decades. Although Gordon (2003, p. 211) stated his goal as being "intended to focus subsequent discussion rather than to provide precise and definitive answers," he arrived at a point estimate for projected real GDP growth of 3.28 percent at an annual rate over the 2 decade period from 2003 to 2023. That estimate is 0.8 percentage point above the corresponding real GDP growth rate for the intermediate case from the 2006 Social Security Trustees report, resulting in particular from assumptions of higher productivity growth and higher population growth (especially higher immigration). Even so, Gordon views his result as a central outcome compared to other forecasts and the "pathetic" (p. 207) Social Security Trustees real growth assumption, stating:

> This is much slower than the rate forecast by the optimists cited at the beginning of this paper, who thought (or still think) that 4.0 percent annual growth of potential output is feasible, but more optimistic than the future growth assumptions embodied in the annual report of the trustees of the Social Security Administration. (Gordon (2003), p. 274)

Recent CBO economic projections (Congressional Budget Office (2006)) also show higher growth than assumed by the SSA for comparable periods: CBO projects real GDP growth to average 3.0 percent over the 2006 to 2016 period, compared to 2.6 percent real GDP growth for SSA's "transition path" over that time frame for its intermediate assumptions case. Similarly, the Administration's (Office of Management and Budget (2006)) economic assumptions show real GDP growth higher than the SSA's by about 0.3 percentage point over the 2006-2011 period, and the Blue Chip projection (*Blue Chip Economic Indicators* (March 2006)) shows real GDP growth at 3.0 percent over the 2006-2017 period compared to the SSA's 2.5 percent. These projections show real GDP growth higher relative to the SSA projection by roughly 0.3 percentage point to 0.5 percentage point, with the higher end of the range a likely more reliable measure for the persisting difference.[13]

These comparisons suggest the real growth assumptions easily could be higher than the SSA intermediate case by as much as 0.5 percentage point to 0.8 percentage point – that is, closer to the SSA low cost alternative result of 2.8 percent over the next 45 years. A change in the assumed real growth rate of that magnitude would boost the projected real broad equity returns in this analysis to roughly the 6 percent to 6¼ percent range (i.e., roughly consistent with

[13] The SSA assumptions use higher real GDP growth rates closer to the public and private consensus forecasts in the initial years of the projections, but then quickly reduce the real GDP growth rates in subsequent years to transition to the lower long-term growth rate.

the total corporate and S&P 500 results shown in the middle column of Table 3). That range of results is very similar to the real equity return of 6½ percent that has been assumed by the SSA actuaries in recent analyses and by analysts in the upper range of survey expectations (see Table 1, for example).

VII. SUMMARY

The results presented in this study point to projected long-run real equity returns over the next 45 years centered in the range of about 5½ to 6¼ percent. The simulations used to generate the estimated real equity returns distributions are based on (1) alternative assumptions about the outlook for real GDP growth; (2) the historical distribution of relative equity valuations and the ultimate assumed relative equity valuation; and (3) the estimated relationships for adjusted dividend returns – accounting for dividends and share repurchases – and the relative stock market valuation.

The results of the simulations indicate that real equity yields as high as the historical average are likely to be observed only with a higher real GDP growth assumption than the Social Security Trustees intermediate assumptions. The Trustees assume real GDP growth averaging about 2.1 percent over the next 45 years – a rate of growth well below the historical average of 3.7 percent. At a projected real GDP growth rate of 2.1 percent over the next 45 years, the projected real equity returns would fall short of the historical average even if high relative equity valuations are assumed to occur. A result in the lower end of the range (5½ percent) is consistent with the Social Security Trustees intermediate real GDP outlook, and a result in the upper end (6 percent to 6¼ percent) more consistent with real GDP growth projections such as that from Gordon (2003) and implied projections for public and private consensus forecasts. The estimated range for real equity returns is just below the 6.5 percent rate assumed by the Social Security actuaries in recent analyses and the long-run historical average returns of about 6½ percent to 7 percent observed by Siegel (2002).

DATA APPENDIX

DATA SOURCES:

Corporate equities:

- *Market value of corporate equities*: Flow of Funds (FOF) tables, table L.213 line 1 (corporate equity issues at market value) minus FOF table L.213 line 3 (rest of world).
- *Dividends and Net Purchases/Buybacks*: Bureau of Economic Analysis, National Income and Product Accounts (NIPAs), Table 1.12. National Income by Type of Income line 16 (corporate net dividends) minus { FOF table F.213 line 1 (corporate equity net issues) minus FOF table F.213 line 3 (corporate equity net issues to rest of the world) }

Nonfarm, nonfinancial corporate equities:

- *Market value of corporate equities*: FOF tables, table B.102 line 35 (market value of equities outstanding, nonfarm nonfinancial corporate business).
- *Dividends and Net Purchases/Buybacks*: FOF tables, table F.102 line 3 (net dividends, nonfarm nonfinancial corporate business) minus FOF table R.102 line 11 (net corporate equity issues, nonfarm nonfinancial corporate business)

GDP:

- Nominal dollar potential gross domestic product as estimated by the Congressional Budget Office (CBO).
- Chain-weighted price index for GDP was used as the GDP price index.

Consumer Price Index

- Bureau of Labor Statistics, CPI-U.

Social Security Assumptions and Data:

- Actuary publications and data for the *2006 Annual Report Of The Board Of Trustees Of The Federal Old-Age And Survivors Insurance And Disability Insurance Trust Funds* : http://www.ssa.gov/OACT/TR/TR06/index.html .

Standard & Poor's 500 Index:

- S&P 500 price index data is for the last business day of the period.
- Quarterly S&P 500 dividend per share data were acquired from Haver Analytics database.
- Quarterly buyback data for the S&P 500 were provided by Howard Silverblatt of Standard & Poors.

For more information on the flow of funds data, see Board of Governors of the Federal Reserve System, *Guide to the Flow of Funds Accounts* (2000) and http://www.federalreserve.gov/releases/z1/ .

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