Long-Horizon Stock Predictability: Evidence and Applications

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Abstract

This study updates prior studies and presents new evidence on the predictability of stock market returns. It examines the ability of two earnings yields to predict one- through 10-year real S&P 500 returns for 1881-2008 and 1953-2008. The upshot is that, as of year-end 2008, stock prospects look better than they have since at least the early 1990s. Based on evidence from Shiller's (2000) model and a variant of that model, long-horizon stock prospects appear to be in line with historical averages, where stocks significantly outperform Treasury bonds and bills. Finally, this study discusses investment implications and applications of this research.

Long-Horizon Stock Predictability: Evidence and Applications

This study revisits the long-horizon stock market predictability literature. Most of this research was published between 1988 and 2001. The earlier studies such as Fama and French (1988, 1989) and Campbell and Shiller (1988) concluded that today's dividend yield and earnings yield have some ability to predict multi-year stock market returns. Based on this research, around the turn of the century several studies warned investors that long-horizon stock prospects looked well below average.[1] *Irrational Exuberance* (2000, 2005) by Robert Shiller is the best known of these studies. These studies' predictions proved right.

This study updates prior studies and presents new evidence on the predictability of stock market returns. The upshot is that, as of year-end 2008, stock prospects look better than they have since at least the early 1990s. Based on evidence from Shiller's model and a variant of that model, long-horizon stock prospects appear to be in line with historical averages, where stocks significantly outperform Treasury bonds and bills. Finally, this study discusses investment implications and applications of this research.

THEORY

The theory behind long-horizon stock predictability is simple. It says that the stock market's equity risk premium varies through time, where the equity risk premium is the additional expected return beyond Treasuries that investors demand before they are willing to accept stock market risk. When it is above average, the additional long-

[1] See Asness (2000), Brown (2000), Campbell and Shiller (1998), Chan, Karceski, and Lakonishok (2000), Cornell (1999), Hirschey (2001), Philips (1999), Reichenstein (2001), Shiller (2000), Siegel (1999), and White (2000).

horizon returns on stock compared to Treasuries will probably be above average, and vice versa.

For simplicity, consider the zero-growth version of the dividend discount model. It implies the following relationship:

$$E_1/P = D_1/P = R_f + ERP. \quad (1)$$

E_1 is year-ahead earnings forecast, P is today's stock price, and E_1/P is the earnings yield and also the inverse of the market's forward price-earnings ratio. D_1 is year-ahead dividends, and D_1/P is the market's dividend yield. R_f denotes the risk-free rate and ERP is the equity risk premium.

Although we could use more complex versions of the dividend discount model, the key conclusions remain the same: Today's earnings yield and dividend yield—whether defined on leading or lagging observations of the numerators—should be positively related to future stock returns.[2] Recall that the key variable is ERP, the equity risk premium. Unfortunately, we cannot directly observe the equity risk premium. However, we can observe E/P and D/P, and theory suggests that these variables should be able to predict long-horizon returns to the degree that they reflect movements in the unobservable equity risk premium. Thus theory suggests that the predictive contents of E/P and D/P ratios are due to their tendency to proxy for the equity risk premium.

EVIDENCE

Although theory suggests that both earnings yield, E/P, and dividend yield, D/P, should be able to predict stock returns, we concentrate on earnings yields. In our opinion, the dividend yield is a less reliable predictor of future returns because there are other

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[2] Henceforth, we use the terms E/P and D/P to denote the market's earnings yield and dividend yield, whether the numerator is defined on leading or lagging observations.

factors that influence the dividend yield besides movements in the equity risk premium. For example, for the past two decades, the average US firm has reduced its dividend payout ratio. Many firm managers believe investors would prefer to see earnings reinvested in the firm or distributed to shareholders via share repurchases rather than distributed as dividends due to their associated tax liabilities. This reduction in the average payout ratio has nothing to do with movements in the equity risk premium. This same problem does not apply to E/P or P/E ratios. Despite its limitation, today's S&P 500 dividend yield is at its highest level since 1991. We believe this suggests long-term stock prospects are at least average. See Cochrane (2008) for a recent discussion of the dividend yield as a predictor of future returns.

In this study, we consider the ability of Shiller's E/P ratio (the inverse of his P/E ratio) and a variant thereof to predict real S&P 500 returns. The numerator of Shiller's E/P model is the average real earnings for the past 10 years. The denominator is the current real level of the S&P 500. The use of a 10-year average for earnings is designed to better reflect movements in the market's normal earnings, where normal earnings are the level of earnings that excludes the impact of the business cycle.

In this study, we also consider a variant of Shiller's E/P model. We call it E^{hi}/P, where E^{hi} is the highest level of real earnings over the prior ten years and P is the current real level of the S&P 500. Variations in E^{hi} may reflect variations in normalized earnings better than variations in Shiller's E/P.

Although not reported here, we examined the predictive ability of other variables/strategies recommended in Reichenstein and Rich (1994). These other predictive variables/strategies included 1) the Baa-Aaa credit spread as suggested by

Fama and French (1989),[3] 2) a measure of the equity risk premium based on Value Line forecasts as suggested by Reichenstein and Rich (1993), and 3) a strategy to buy stocks or increase the stock exposure after two "bad" years (defined as returns below the prior 20-year average) and to sell stocks or reduce the stock exposure after two "good" years as suggested by McQueen and Thorley (1991). However, Shiller's E/P and our variant of his theme proved much better than these other variables/strategies at predicting stock returns.

An earnings yield, E/P, could be low due to 1) a cyclically low level of earnings or 2) an unusually high level of prices relative to normal earnings. Long-run stock predictability studies try to forecast future returns based on the second relationship: today's prices being unusually low or high relative to the market's normalized earnings. Suppose real earnings fall substantially below prior peak earnings due to cyclical factors and remain well below prior peak earnings for several years. E^{hi} would suggest that the market's normal earnings remains constant through this cyclically weak earnings period, while Shiller's E may suggest that normal earnings were falling, potentially substantially, during this multi-year period. From June 1982 through December 1992, Shiller's E fell by 11.2%, while E^{hi} rose modestly by 4.1%. We believe that the market's true normalized earnings would not fall by 11.2% for a 10.5 year period. This suggests that variations in E^{hi} may better reflect variations in the market's normal earnings. Another potential disadvantage of Shiller's E is it uses a 10-year average so it should be unusually low or high depending upon whether the past decade's earnings growth rate has been fast

[3] They presented the results using another credit spread but reported that the results were economically the same when they substituted the Baa-Aaa spread.

or slow, respectively. In contrast, E^{hi} should be less affected by variations in the past decade's growth rate.

Table 1 presents summary statistics for Shiller's E/P and E^{hi}/P for 1881-2008 and 1953-2008, which is the period since the Treasury-Federal Reserve Accord. By construction, E^{hi}/P will be higher than Shiller's E/P. For 1881-2008, Shiller's E/P averaged 0.0716 with a median value of 0.0638, while E^{hi}/P averaged 0.1021 with a median of 0.0850. For 1953-2008, the average and median values of Shiller's E/P were 0.0624 and 0.0554, while the mean and median values of E^{hi}/P were 0.0792 and 0.0707.

Tables 2 and 3 summarize regressions of one- to 10-year-ahead real S&P 500 returns on, respectively, Shiller's E/P or E^{hi}/P for 1881-2008 and 1953-2008. The R^2 values indicate the percent of variance of S&P 500 real returns that can be explained by the independent variable, Shiller's E/P or E^{hi}/P.

For 1881-2008 in Table 2, Shiller's E/P predicts 6.0% of one-year returns, 24.1% of six-year returns, and 34.4% of ten-year returns. For 1881-2008, E^{hi}/P predicts 5.3% of one-year returns, 29.0% of six-year returns, and 30.0% of ten-year returns. Shiller's E/P had a larger predictive content for horizons of one, eight, and ten years, while E^{hi}/P had a larger predictive content for two, four, and six year horizons. The average R^2 was 0.009 higher for E^{hi}/P than for Shiller's E/P.[4]

Table 3 summarizes the results for 1953-2008. For this period, the R^2 values are much lower for horizons of one through eight years than for 1881-2008. For example,

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[4] Since the dependent variable is returns for anywhere from the next 12 to 120 months, there is substantial autocorrelation in errors. This autocorrelation does not bias the parameter estimates and thus the forecasts, but the standard errors from ordinary least squares regressions are no longer valid. We measure the statistical significance of the regression coefficients using the Newey and West (1987) procedure, which corrects for this autocorrelation. However, neither we nor the many statistics professors we contacted knew of a statistical test of whether one independent variable—that is, Shiller's E/P or E^{hi}/P—provided statistically more predictive ability than the other independent variable. For the same horizon, the differences in R^2 values are always larger for 1953-2008 than for 1881-2008.

for the six-year horizon the predictive content of E^{hi}/P is 29.0% for 1881-2008 but only 20.4% for 1953-2008. Separately, the average R^2 value across all horizons is 0.064 higher for E^{hi}/P than for Shiller's E/P. Moreover, E^{hi}/P predicts a larger percentage of stock returns than Shiller's E/P for all horizons. For example, E^{hi}/P explains 20.4% of six-year returns compared to 12.7% for Shiller's E/P.

Figures 1 presents a graph of the actual returns and predicted six-year cumulative real returns for 1881-2008. Not surprisingly, the predicted returns based on both Shiller's E/P and E^{hi}/P are strongly correlated.[5] They over-predicted cumulative real returns by at least 50% in much of 1911-1920, 1925-1929, 1935-1937, 1968-1969, and 1971-1976, while they under-predicted returns by at least 50% in much of 1895-1896, 1922-1924, 1948-1954, 1958, 1981, and 1990-1995.[6] In terms of comparative accuracy, E^{hi}/P provided a forecast of six-year cumulative real returns that was at least 20% more accurate for much of 1921-1925, 1974-1975, and 1977-1979, while Shiller's E/P provided forecasts that were at least 20% more accurate for much of 1920, 1925-1927, and 1981-1984.[7] The last observation for actual six-year returns is dated December 2002, which reflects returns for January 2003-December 2008.

Figures 2 present a graph of the actual returns and predicted returns for 10-year horizon for 1953-2008. Shiller's E/P and E^{hi}/P both over-predicted cumulative returns by at least 50% in much of 1964-1976, 1978, and 1980, while they both under-predicted returns by at least 50% in much of 1953-1955, 1986-1992, and 1994. In terms of

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[5] The correlation coefficients between Shiller's E/P and E^{hi}/P are 0.933 for 1881-2008 and 0.985 for 1953-2008.

[6] By over predicted cumulative returns by at least 50% we mean (predicted cumulative return - actual cumulative return) ≥ 0.5, while under predicted returns by at least 50% means (actual cumulative return – predicted cumulative returns) ≥ 0.5.

[7] By at least 20% more accurate, we mean ABS(actual return – predicted return from Shiller's E/P) - ABS(actual return – predicted return from E^{hi}/P) ≥ 0.20, where ABS denotes absolute value.

comparative accuracy, E^{hi}/P provided a forecast of 10-year cumulative real return that was at least 20% more accurate for much of 1953-1954 and parts of 1972-1973, while Shiller's E/P provided forecasts that were at least 20% more accurate in parts of 1979-1980. The differences in the models' predictions of 10-year returns for 1998-2007 through 2002-2011 are unusually large. Unless the stock market rebounds sharply in 2009-2011, the E^{hi}/P model's forecasts will prove more accurate. The last observation for actual 10-year returns is dated December 1998, which reflects returns for January 1999-December 2008.

Today's Stock Prospects

Table 4 presents forecasts of six-year and 10-year cumulative returns from the E^{hi}/P and Shiller's E/P models as of December 2008. Both models forecast approximately average six-year real returns. For example, the E^{hi}/P and Shiller's E/P models predict cumulative six-year real returns of 49% to 70%, while actual returns since 1881 averaged 58%. For the 10-year horizon, the models predict cumulative 10-year real returns of 93% to 135%, while actual returns since 1881 averaged 113%. All forecasts for six- and 10-year returns are within 0.3 standard deviations of their means. Therefore, these forecasts suggest average long-horizon returns. From Table 4 and Figures 1 and 2, the E^{hi}/P model currently predicts slightly higher six-year cumulative returns but moderately higher 10-year cumulative returns than Shiller's E/P model.

Today's relative returns appear better than they have in a long time. As of December 2008, Shiller's E/P is 0.0647 (corresponding to a Shiller P/E of 15.46), which is the highest value of Shiller's E/P since November 1990. The relative forecast from the E^{hi}/P model is even more optimistic. As of December 2008, E^{hi}/P is 0.0967. Except for a slightly higher value in November 2008, this is the highest it has been since February 1986.

During the 1983-1999 bull market and especially in the 1990s, stock valuations relative to earnings and dividends reached unprecedented levels. Based on these valuations, we earlier noted numerous studies around the turn of the century that correctly predicted below-average long-horizon stock returns. The good news is that, after nearly a decade of poor returns, today's long-horizon prospects appear about average. The excesses of the stock bubble appear to be over. Although the models are far from perfect, they suggest that future stock returns likely will return to their higher long-run average levels.

IMPLICATIONS AND APPLICATIONS

This section discusses some of the investment implications and applications of this research. First, the predictive content of stock returns generally rises with the investment horizon. For example, for 1953-2008 the R^2 values for the E^{hi}/P regressions are 6.4% for a one-year horizon, 8.7% for two years, 11.2% for four, 20.4% for six, 29.6% for eight, and 35.6% for a 10-year horizon.

Second, the evidence rejects the random walk theory, which says future stock returns are not predictable. In Tables 2 and 3 the independent variable is significant at the 1% level in 11 of 12 six- through 10-year regressions and significant at better than the 5% level in the other regression. Furthermore, the independent variable is statistically significant at the 5% level in three of four one-year regressions.

Third, stated negatively, "only" about 5% of the variance of one-year stock returns appears predictable, with the predictable component rising to about 30% in most 10-year regressions. These results suggest that some 95% of the variance of one-year returns and 70% of the variance of 10-year returns appears unpredictable. This reminds us that prediction bases on E^{hi}/P and Shiller's E/P do not guarantee strong stock returns; market risk remains.

Average Investor vs Strategic and Tactical Asset Allocation. The average investor buys high and sells low. His purchases often come at or near the end of a bull market and his sales often occur at or near the end of a bear markets. Frieson and Sapp (2007) examine the timing ability of equity fund investors. For 1991-2004, they conclude that the average investor lost 1.56% per year compared to a buy-and-hold strategy. For example, there were substantial net cash flows into stocks in 1999, out of stocks in 2002, and out of stocks in the last half of 2008. The average investor appears to let emotions rule the day, which causes them to follow this buy-high-and-sell-low strategy. It is tough to be objective, especially in bear markets.

Let's contrast the timing of the average investor against those that follow strategic and tactical asset allocation strategies. A strategic asset allocator may follow the traditional fixed-weight strategy. This investor selects a long-run normal asset allocation and periodically rebalances back to it.[8] For example sake, a company pension may select a strategic asset allocation that is 50% stocks, 35% bonds, and 15% other asset classes. It may rebalance this portfolio whenever its actual allocations deviates more than a threshold amount from this strategic mix.

By its nature, this fixed-weight strategy is contrarian. After a good year for the stock market, the investor must sell stocks and buy other assets. After a bad year, the

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[8] For more on strategic models, see Arnott, Burns, Plaxco, and Moore (2007).

investor must sell other assets and buy stocks. One advantage of a fixed-weight strategy is that it helps investors overcome inertia. Since it is never clear whether a recent period of good or bad stock market returns will continue, many investors are frozen with inertia and do nothing. The fixed-weight strategy requires the discipline to rebalance, that is, to overcome inertia.

In practice, tactical asset allocation (TAA) is more contrarian than the traditional strategic asset allocation. TAA not only requires investors to periodically rebalance their portfolios, but it may also require them to move their stock allocation slightly beyond the strategic stock weight. For example, consider a company pension plan that has a 50% target stock allocation. After a bull market, TAA may require the plan to not only sell enough stocks to return the stock allocation to 50%, but it may also require it to sell enough stocks to lower the stock allocation perhaps to 45%. Similarly, after a bear market, TAA may require the plan to sell enough other assets to not only increase the stock allocation back to 50% but to increase it to perhaps 55%. As long as the TAA bets—that is, how far an asset class' tactical allocation can vary from its strategic weight—are "small," TAA should be viewed as a variant of a fixed-weight strategy. It is fundamentally different from market timing, which we define as allowing "large" deviations from strategic weights based on near-term market prospects.

Advocates of TAA also must determine how far they should allow their stock allocation to deviate from its strategic weight; that is, if TAA encourages "small" deviations from strategic weights, while market timing encourages "large" deviations, then how do we define small and large? If returns followed a random walk then returns would be unpredictable. This would suggest that, in the absence of a change in risk tolerance, investors should follow the fixed-weight portfolio advocated by strategic asset allocation. If returns were perfectly predictable then we would move the entire portfolio to the best performing asset class. Obviously, reality is closer to the random walk theory. Nevertheless, returns appear to be partially predictable. So, some deviation from the strategic weight seems justified. Nobel-Laureate Paul Samuelson (1990) suggested that investors limit tactical bets to perhaps plus or minus 10% from the strategic asset allocation.

Tactical strategies are not easy to follow. For example, at the end of 1996 after two straight years of over 23% returns on the S&P 500, E^{hi}/P and Shiller's E/P were 5.09% and 3.61%, which were in the lowest quartile for both 1881-2008 and 1953-2008. Based on these low values, suppose the pension plan reduced its stocks to 45%, 5% below its 50% strategic weight. The S&P 500 registered a 33.4% return in 1997. At the end of 1997, E^{hi}/P and Shiller's E/P were 4.24% and 3.03%. So, the pension plan might have lowered its target stock weight to 40%. In 1998, the S&P 500 had another stellar year clocking returns of 28.6%. At the end of 1998, E^{hi}/P and Shiller's E/P were 3.48% and 2.58%. So, the pension might have rebalanced back to the 40% target. In 1999, the S&P 500 earned 21.0%. The TAA strategy reduces the pension's returns for three straight years. Based on year-end 1999 values of E^{hi}/P and Shiller's E/P, long-horizon stock prospects looked even worse. What should the pension fund do?

After the fact, the answer is clear. It should stick to its tactical strategy and retain the below-normal stock allocation. Although the answer is clear, after the fact, it would not have been clear before the fact. Some pension managers would have lost faith in tactical asset allocation and abandoned the strategy.

To repeat, the traditional strategic asset allocation strategy is contrarian in nature. It forces investors to reduce their stock exposure after good times and to increase their stock exposure after bad times. For those who can tolerate the sometimes gut-wrenching decisions to follow tactical asset allocation, historical evidence suggests that they may be able to improve their long-run returns.

SUMMARY

As long as the equity risk premium varies through time, long-horizon stock returns should be partially predictable. Although the equity risk premium is unobservable, theory suggests that it should vary directly with the market's earnings yield and dividend yield. Therefore, it should not be surprising that these variables have some ability to predict long-horizon returns.

This study examined the ability of two earnings yields to predict one- through 10-year real S&P 500 returns for 1881-2008 and 1953-2008. The first variable is Shiller's E/P, where the numerator is the average real earnings for the past 10 years and the denominator is the current real level of the S&P 500. The second variable is E^{hi}/P, where the numerator is the highest level of real earnings for the past 10 years and the denominator is the current real level of the S&P 500. The empirical evidence suggests that both variables have some ability to predict returns, with the predictive ability generally increasing with the length of the investment horizon. Moreover, E^{hi}/P usually predicts a slightly larger portion of returns than Shiller's E/P, especially for 1953-2008.

By the last half of the 1990s, E^{hi}/P and Shiller's E/P and valuation metrics based on the market's dividend yield reached unprecedented low levels. Based on these and other valuation metrics, many scholars correctly predicted below-average long-horizon stock prospects. The good news is that, based on December 2008 observations of E^{hi}/P and Shiller's E/P, long-horizon stock prospects now appear average.

This study also suggests applications of this research. First, it suggests that stock returns are partially predictable. So, it rejects the random walk model. Second, it supports tactical asset allocation strategies that allow the investor's target stock allocation to vary in a narrow range around the strategic stock allocation. There is a lot to be said for a strategy of following a fixed weight strategy, where the portfolio is periodically balanced back to the strategic asset allocations. However, since returns appear partially predictable, some tactical bets around the strategic stock allocation are justified.

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Table 1. Summary Statistics for Shiller's E/P and E^{hi}/P, 1881-2008 and 1953-2008

Percentile	Shiller's E/P	E^{hi}/P
1881-2008		
Average	0.0716	0.1021
Standard deviation	0.0305	0.0558
Minimum	0.0226	0.0305
25	0.0513	0.0685
50	0.0638	0.0850
75	0.0863	0.1188
Maximum	0.2090	0.3757
1953-2008		
Average	0.0624	0.0792
Standard deviation	0.0266	0.0293
Minimum	0.0226	0.0305
25	0.0441	0.0587
50	0.0554	0.0707
75	0.0740	0.0955
Maximum	0.1506	0.1748

Data used in this study are generously provided by Robert Shiller at www.irrationalexuberance.com.

Table 2: Regression Results, 1881-2008

Horizon (Years)	Constant	Shiller's E/P	R^2
1	-0.033	1.587	0.060
	(-0.82)	(2.84)	
2	-0.028	2.744	0.084
	(-0.39)	(2.82)	
4	-0.107	6.497	0.170
	(-0.68)	(2.91)	
6	-0.201	10.692	0.241
	(-0.96)	(3.76)	
8	-0.464	17.676	0.352
	(-1.73)	(5.55)	
10	-0.397	20.461	0.344
	(-1.41)	(7.20)	

Horizon (Years)	Constant	E^{hi}/P	R^2
1	-0.003	0.819	0.053
	(-0.09)	(2.75)	
2	0.004	1.614	0.098
	(0.07)	(2.87)	
4	-0.048	3.996	0.218
	(-0.35)	(2.87)	
6	-0.080	6.342	0.290
	(-0.48)	(4.33)	
8	-0.145	9.369	0.342
	(-0.70)	(6.30)	
10	0.048	10.174	0.300
	(0.17)	(4.70)	

t-statistics are in parentheses. Standard errors are corrected for the autocorrelation produced by the overlapping forecast horizons, using the method of Newey and West (1987).

Table 3: Regression Results, 1953-2008

Horizon (Years)	Constant	Shiller's E/P	R^2
1	0.001	1.277	0.040
	(0.03)	(1.80)	
2	0.041	2.066	0.045
	(0.40)	(1.45)	
4	0.102	3.857	0.062
	(0.46)	(1.34)	
6	0.049	7.957	0.127
	(0.16)	(2.24)	
8	-0.052	13.045	0.202
	(-0.14)	(3.46)	
10	-0.160	18.762	0.256
	(-0.30)	(3.78)	

Horizon (Years)	Constant	E^{hi}/P	R^2
1	-0.035	1.460	0.064
	(-0.64)	(2.24)	
2	-0.035	2.591	0.087
	(-0.30)	(1.84)	
4	-0.029	4.681	0.112
	(-0.13)	(1.98)	
6	-0.173	9.048	0.204
	(-0.55)	(3.10)	
8	-0.361	14.129	0.296
	(-0.93)	(4.39)	
10	-0.574	19.871	0.356
	(-0.99)	(4.14)	

t-statistics are in parentheses. Standard errors are corrected for the autocorrelation produced by the overlapping forecast horizons, using the method of Newey and West (1987).

Table 4. Predictions of Long-horizon Cumulative Real Stock Returns

Regression Model	Six-year Horizon		10-Year Horizon	
	Shiller's E/P	E^{hi}/P	Shiller's E/P	E^{hi}/P
1881-2008	49%	53%	93%	103%
1953-2008	56%	70%	105%	135%

The average cumulative six-year real return for 1881-2002 (with the last observation covering January 2003-December 2008) was 58% with a standard deviation of 66%. For 1953-2002, it was 57% with a standard deviation of 60%.

The average cumulative 10-year real return for 1881-1998 (with the last observation covering January 1999-December 2008) was 113% with a standard deviation of 90%. For 1953-1998, it was 112% with a standard deviation of 78%.

Figure 1. Actual vs Predicted Six-Year Cumulative Real Returns, 1881-2008

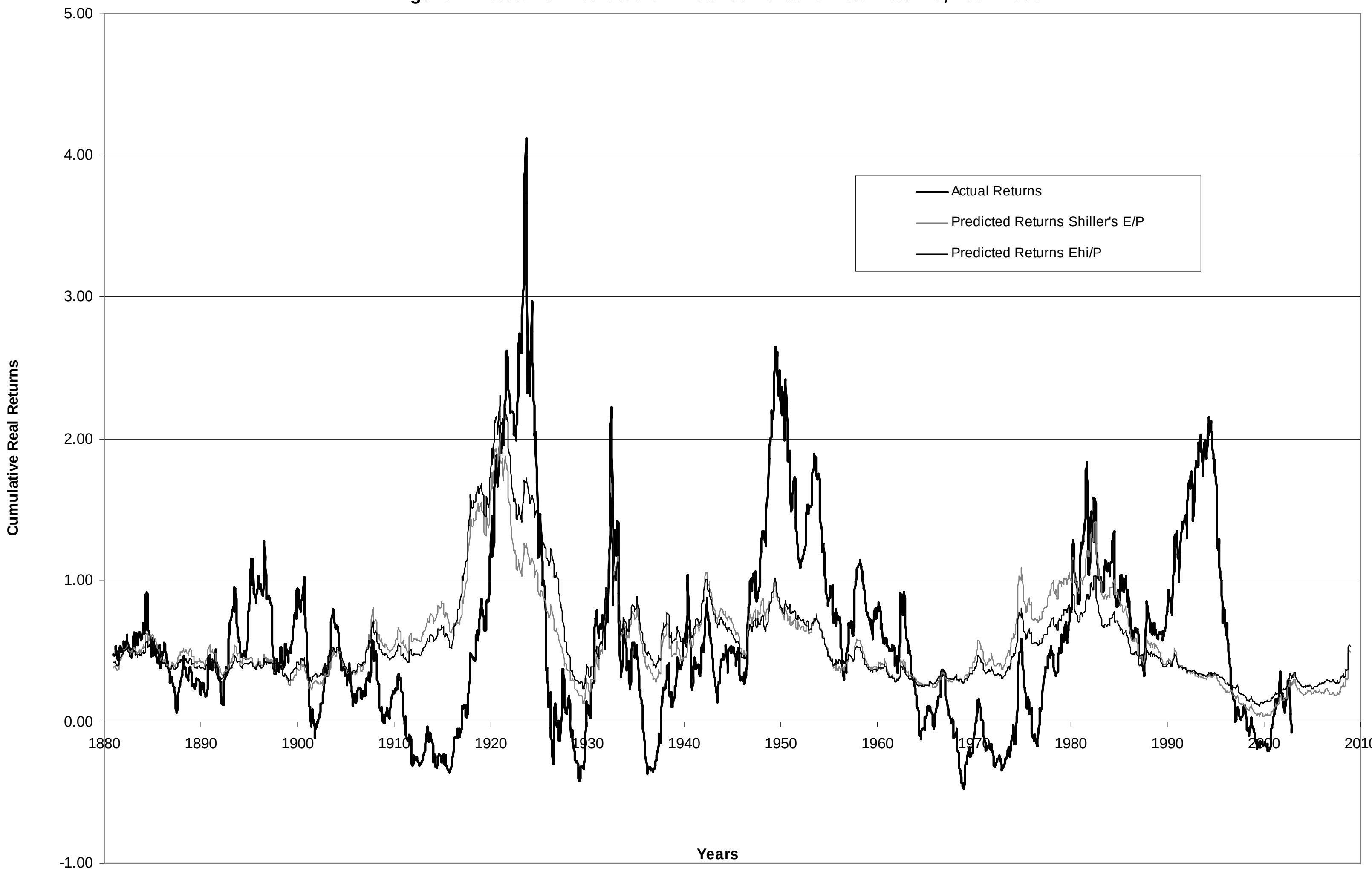

Figure 2: Actual vs Predicted 10-Year Cumulative Real Returns