“Will the market P/E ratio revert to its mean?”

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Will the market P/E ratio revert to its mean?

Abstract

Changes in the market Price to Earnings (P/E) ratio have been shown to have a significant effect on the US equity returns. The prevailing model of the behavior of the market P/E ratio was put forth by Campbell and Shiller (1998, 2001), which states that the market P/E is a ratio of cointegrated variables, and therefore the ratio itself is stationary and mean-reverting. The authors show that the time series behavior of the market P/E ratio has changed and is no longer mean-reverting, indicating a fundamental change in the economic relationship between prices and earnings. This change suggests that the market P/E ratio (and its inverse, the market earnings yield) may no longer be useful in forecasting market returns.

Keywords: Fed model, P/E ratio, bond yields, mean reversion, unit roots, nonstationarity, cointegration.
JEL Classification: C22, C53, E39, G14.

Introduction

Background and prior literature. The financial literature fully recognizes the idea that extreme (high or low) market valuation ratios lead to large changes in future stock prices. Campbell and Shiller (1998, 2001) attribute the reliability of the forecast to the ratio's mean reversion. They show that unusually high market P/E ratios forecast low future stock returns, based on the inevitable correction in the market price; i.e., the decline in the ratio occurs almost exclusively from an adjustment in prices rather than in earnings.

In the mean-reverting model of the market P/E ratio, prices and earnings are understood to be nonstationary time series connected by a unique relationship known as cointegration (Campbell and Shiller, 1987; Lee, 1996). Cointegration implies that the variables in question share similar stochastic trends, and therefore the creation of residuals ($e_t = y_t - \alpha - \beta_1 x_t$) from a regression model containing cointegrated dependent and independent variables is a stationary $I(0)$ process. Hence the model proffers that, since it is a linear combination of two cointegrated variables, the market P/E ratio will be a stationary (and therefore mean-reverting) time series. Stock prices and earnings, by themselves, are nonstationary time series, and therefore will take "long walks" away from prior values. Given long enough horizons, these non-stationary time series may never revert back to their prior values. In a ratio, however, prices and earnings are held to be stationary, and therefore mean-reverting. This mean-reversion model of stock returns was supported by the data until recently.

Carlson, Pelz and Wohar (2002) find what they believe to be an upward shift in the mean of the market P/E ratio, from its historical mean of around 15 to a new mean (in the 1990s) somewhere between 20 and 25. Subsequently, Weigand and Irons (2008) argue that, in fact, investors have been benchmarking the market earnings yield (E/P, the inverse of the market P/E ratio) to 10-year Treasury note yields since around 1960 (as decried by Asness, 2003), implying the two time series have become cointegrated. As the yield on 10-year T-notes is known to be nonstationary (e.g., Bradley and Lumpkin, 1992; Mehra, 1996; and Tatom, 2002), the market earnings yield has adopted nonstationary characteristics since that time. So what Carlson, Pelz and Wohar interpret as a regime shift, Weigand and Irons construe (using an additional four years of monthly data) to be a change in the econometric relationship between the market earnings yield and the yield on 10-year T-notes. They argue that the market P/E ratio no longer has a relevant long-term mean, and can therefore remain above trend for extended periods.

The reason given for this change in the data by Weigand and Irons (2008) is that investors have been benchmarking the market earnings yield off the yield on 10-year Treasury notes since at least 1960, a paradigm referred to as the "Fed Model". The idea behind the Fed Model is that stocks and bonds compete for investment funds, and money flows toward the asset with the higher yield. The Fed Model has been criticized (Asness, 2003) because it requires that investors suffer from inflation illusion, as they are comparing a real variable (E/P) to a nominal one (10-year T-note yields). Despite the lack of theoretical underpinning, the model has been given support from academia as an accurate depiction of how the market P/E is determined (e.g., Shen, 2003; Malkiel, 2004; and Weigand and Irons, 2008).

While Weigand and Irons find evidence of a change in the relationship between the market earnings yield and the yield on 10-year T-notes, they do not pinpoint the time period in which the change occurred. Nor do they specifically test the data for evidence of cointegration. In this paper we investigate the time series characteristics of the market P/E ratio to determine if prices and earnings are still cointegrated, and if not, when the relationship may have changed. We find that the market prices and earnings were cointegrated through approximately 1949, after which the variables no longer display the characteristics of cointegration. We

further find evidence of cointegration between the market earnings yield and the yield on 10-year T-notes in the data from 1950 forward.

1. Data and terminology

The monthly stock price index, P/E ratio, and earnings data used in the study are taken from the database generously maintained by Robert Shiller of Yale. The data used for this study extend from January 1871 through December 2008. The data are adjusted for inflation as shown by Shiller (2011). Unless otherwise specified, all references to stock returns and earnings refer to real stock returns and earnings.

The analysis that follows is based on monthly P/E ratios calculated using each month's real price and trailing annual earnings (P/E1), as well as a P/E ratio calculated using earnings smoothed over the trailing 10-year period (P/E10) as in Campbell and Shiller (1998, 2001). The first metric is widely referenced by every market participants, while the second is held to be computationally superior as it is less affected by short-term fluctuations in earnings.

2. The time series behavior of the market P/E ratio

The mean-reverting model of the market P/E ratio (as per Campbell and Shiller, 1987, 1998, 2001; and Lee, 1996) states that prices and earnings are nonstationary time series connected by a relationship known as cointegration. Cointegration defines a unique long-term relationship between two (or more) nonstationary series, where the economic (or, in this case, behavioral, as proposed by Weigand and Irons (2008)) forces that cause the series to be nonstationary also result in their moving together through time.

Theory espouses that prices are the present value of future earnings, reflected in such models as the Dividend Discount Model, the Free Cash Flow Model and the Residual Income Model. Therefore, the forces that drive volatility in prices are the same forces that drive volatility in earnings. This relationship results in the series' cointegration: even though each time series individually is nonstationary, their ratio is stationary. This has been the dominant model of the P/E ratio (and therefore the market earnings yield) up to now. Weigand and Irons (2008) show that the earnings yield was stationary until sometime around 1960, where upon the earnings yield began to display non-stationary characteristics, resulting in a stronger relationship with the yield on 10-year T-notes.

Figure 1 graphs the market P/E ratio from 1881 through 2008 using annual earnings (P/E1) and 10-year smoothed earnings (P/E10). The ratios display different time series characteristics before and after the period 1950-1960. Prior to this period, the P/E1 ratio reverts to its long-term mean of 15 (16 for the P/E10) with distinct regularity. The time between crossings of the mean are short compared with the period after 1960. At some point between 1950 and 1960, the market P/E ratio begins to deviate from its mean for longer periods of time. Between 1960 and 1989, the P/E1 wanders away from its mean for periods of 8, 4, 3, and 12 years. After approaching the mean of 15 in January of 1991, the P/E1 did not return to its mean again until August of 2011. Weigand and Irons (2008) hypothesize that both of the P/E ratios were stationary prior to 1960 and nonstationary thereafter. Unit root tests on both P/E ratios post-1959 support this hypothesis.

In this same paper the authors argue that investors have been equating the yield on stocks to the yield on 10-year T-notes since around that same time period, causing the market earnings yield and the yield on 10-year T-notes to become cointegrated, and thus inducing nonstationarity into the earnings yield (since the yield on 10-year T-notes has been known to be nonstationary for some time (e.g., Bradley and Lumpkin, 1992; Mehra, 1996; and Tatom, 2002)). This claim is tested using unit root tests on the linear combination of the two series, and the authors find that the ratio of the two is nonstationary after 1959, implying that the two series are in fact cointegrated.

Figure 2 graphs the 10-year T-note yield and the market earnings yield for the period of 1881-2008, using E1/P (the inverse of P/E1) in Panel A and E10/P (the inverse of P/E10) in Panel B. The visual evidence indicates that the two series had no real relationship prior to around 1950, but that since that point they have moved closely together[1]. This further supports the idea that the two series are now cointegrated. It follows that this change in the functional form of the P/E ratio (and its inverse, the earnings yield) reveals a change in the fundamental economic relationship between the variables in the ratio, namely prices and earnings.

If in fact investors have been pegging the market earnings yield to the yield on 10-year T-notes, this could cause the relationship between prices and earnings to change. If that is the case, the market P/E ratio (and the earnings yield) would no longer be cointegrated. This hypothesis is tested in this paper by examining the data for nonstationarity, and the most common tests for nonstationarity come from Dickey and Fuller (1979). The Augmented Dickey-Fuller (ADF) procedures test whether a time series can be modeled as an autoregressive (AR) series, including testing for a unit root in the presence of drift (allowing for an intercept term in the regression) and a time trend, and accounting for autoregressive lags of the independent variable:

[1] Weigand and Irons (2008) show that the correlation between the E1/P and the yield on 10-year T-notes is 0.02 from 1881-1959, but increases to 0.72 for the period of 1960-2004.

$$Y_t = \alpha + \beta T + \rho Y_{t-1} + \sum_{i=1}^{n} \lambda_i Y_{t-1} + u_t,$$

where the regression coefficient on the first lag of the series equals 1.0 (thus the term "unit root"). Notice that if $\rho = 1$, the effects of prior realizations in the time series never fully die out. For this reason, nonstationary time series are sometimes referred to as "long memory processes". For ease of testing, the ADF tests are usually rewritten as:

$$\Delta Y_t = \alpha + \beta T + \delta Y_{t-1} + \sum_{i=1}^{n} \lambda_i \Delta Y_{t-1} + u_t.$$

In this case, the null hypothesis of H_0: $\delta = 0$ (the series has a unit root, i.e., is nonstationary) is tested vs. the alternative hypothesis of H_1: $\delta < 0$ (series is stationary).

This paper extends the work done by Weigand and Irons (2008) by better estimating the date at which the change in the market P/E ratio occurred. To pin down the approximate date at which the prices and earnings ceased to be cointegrated, a correlation analysis is performed on the earnings yield and the 10-year T-note yield for the period of 1872-2008, based on the finding in Weigand and Irons (2008) that the market P/E ratio has been nonstationary since at least 1960. The two variables are compared for their correlation before the year in question versus from that year forward for the period 1945 to 1965. The difference in the correlation coefficients before the year and after (given as the Spread in Figure1), as well as the change in the spread (given as Delta Spread in Figure 1) are calculated to determine where the biggest change in the spread between correlations occurs. Determining the point at which the spread changed the most is a simple way to approximate the year in which the two variables began to behave similarly. It naturally follows that the point at which the earnings yield and the T-note yield became cointegrated is the same point at which prices and earnings lost their cointegration.

Table 1 reveals that the spread between the correlations is negative before 1949 (meaning that the data prior to that year had a higher correlation than the data from that year forward), and becomes slightly positive as of 1949. As of 1950, however, the correlation coefficient moving forward is more than twice that of the data prior to 1950. The spread between the correlation coefficients as of 1949 is 0.0273, while the spread as of 1950 is 0.2046, an increase in the spread of almost 650%. This shows that the biggest change in the correlation before and after occurs as of the year 1950[1]. In addition, the After coefficients climb steadily in value from 1950 on. Based on these results, the unit root analysis is performed on the earnings yield before 1950 and from 1950 forward.

Table 1. Correlation analysis of market earnings yield and 10-year T-Note yield

Year	Correlation coefficients E1/P-LTB			
	Before	After	Spread	Delta spread
1945	0.3049	0.2237	-0.0812	
1946	0.3115	0.2221	-0.0894	0.10190
1947	0.3270	0.2138	-0.1132	0.26543
1948	0.3050	0.2327	-0.0723	-0.36134
1949	0.2527	0.2801	0.0273	-1.37774
1950	0.1699	0.3745	0.2046	6.49132
1951	0.1201	0.4622	0.3420	0.67209
1952	0.0952	0.5294	0.4342	0.26939
1953	0.0865	0.5698	0.4834	0.11327
1954	0.0775	0.6182	0.5407	0.11863
1955	0.0714	0.6600	0.5885	0.08846
1956	0.0715	0.6882	0.6167	0.04779
1957	0.0720	0.7108	0.6388	0.03595
1958	0.0715	0.7316	0.6601	0.03325
1959	0.0715	0.7463	0.6748	0.02233
1960	0.0604	0.7482	0.6879	0.01933
1961	0.0531	0.7525	0.6994	0.01674
1962	0.0462	0.7506	0.7044	0.00715
1963	0.0407	0.7544	0.7137	0.01331
1964	0.0344	0.7574	0.7230	0.01291
1965	0.0253	0.7586	0.7333	0.01432

Notes: The table calculates the correlation coefficient between the market earnings yield (E1/P) and the yield on 10-year T-notes for the data over the period of 1872-2008. The second column (Before) contains the correlation coefficient for the period before the year in question, while the third column (After) contains the correlation coefficient for that year and beyond. For the first row, the Before coefficient (0.3049) is the correlation from 1872-1944, while the After coefficient (0.2237) is the correlation from 1945-2008. The fourth column (Spread) contains the difference between the two coefficients in the Before and After columns (for the first row, 0.2237 − 0.3049 = -0.0812). The fifth column (Delta spread) is the percentage change in the spread between rows, calculated as $Spread_t/Spread_{t-1} - 1$. In the second row of data (for the year 1946), -0.0894/-0.0812 − 1 = 0.1019, indicating that the spread changed by 10.19% between 1945 and 1946.

Table 2 shows the results of the ADF tests on the market P/E1 and P/E10 data pre-1950 (on the left) and from 1950 forward (on the right). The exhibit shows that the null hypothesis of nonstationarity is consistently rejected for the pre-1950 P/E1 data using either ADF test, and for all but the 6-lag model for the pre-1950 P/E10 data in Panel B (using the ADF test with trend and drift). Conversely, the exhibit also shows that the null hypothesis of nonstationarity cannot be rejected for either the P/E1 data or the P/E10 data after 1949 at any of the reported lag lengths, and with either test.

[1] The same analysis for the E10/P ratio showed that the biggest change in the spread occurred in 1948.

Figure 2 clearly shows that the market P/E1 and P/E10 ratios are stationary prior to 1950, but display nonstationary characteristics from 1950 on. Since the market P/E ratios show these characteristics, the market earnings yield (the inverse of the market P/E ratio) must also contain those characteristics.

Table 2. Unit root analysis of market P/E1 and P/E10 ratios pre-1950 and post-1949

		1872-1949			1950-2008		
Lags		P/E1	P/E10	5% critical	P/E1	P/E10	5% critical
Panel A. Augmented Dickey-Fuller tests with drift							
6	δ	-0.0265	-0.0159		0.0022	-0.0059	
	t-statistic	-4.28	-3.09	-2.86	0.36	-1.78	-2.86
8	δ	-0.0292	-0.0176		0.0003	-0.0063	
	t-statistic	-4.60	-3.40	-2.86	0.04	-1.90	-2.86
10	δ	-0.0314	-0.0180		0.0010	-0.0066	
	t-statistic	-4.82	-3.41	-2.86	0.16	-1.98	-2.86
12	δ	-0.0273	-0.0188		0.0008	-0.0071	
	t-statistic	-4.09	-3.51	-2.86	0.14	-2.11	-2.86
Panel B. Augmented Dickey-Fuller tests with trend and drift							
6	δ	-0.0269	-0.0183		-0.0040	-0.0060	
	t-statistic	-4.33	-3.32	-3.42	-0.57	-1.57	-3.42
8	δ	-0.0296	-0.0205		-0.0071	-0.0068	
	t-statistic	-4.66	-3.68	-3.42	-0.99	-1.76	-3.42
10	δ	-0.0319	-0.0210		-0.0061	-0.0072	
	t-statistic	-4.87	-3.71	-3.42	-0.84	-1.86	-3.42
12	δ	-0.0278	-0.0222		-0.0066	-0.0079	
	t-statistic	-4.14	-3.86	-3.42	-0.90	-2.03	-3.42

Notes: This table reports the results of Augmented Dickey-Fuller tests for the presence of a unit root in the time series of the market P/E1 and P/E10 ratios for the period prior to 1949 and the period of 1950-2008. The null hypothesis is that the time series has a unit root (i.e., failing to reject $\delta = 0$ implies nonstationarity).

This paper further extends the work performed by Weigand and Irons (2008) by testing for evidence to confirm cointegration between the market earnings yield and the 10-year T-note yield. To corroborate the fact that the earnings yield and the 10-year T-note yield are cointegrated between 1950 and 2008, three different tests are performed on the data. The results of those tests are offered in Table 3. Panel A of Table 3 contains the results for the Johansen tests for cointegration between the variables. The Johansen method depends on the calculation of maximum eigenvalue and trace statistics using a maximum likelihood estimating procedure to identify the number of cointegrating vectors. Panel A of Table 3 shows that the null hypothesis of zero cointegrating vectors is rejected in both tests for the relationship between the E1/P and 10-year T-note yield, while the null hypothesis cannot be rejected when using the E10/P. Thus the Johansen tests find evidence of cointegration between E1/P and the 10-year T-note yield for the period of 1950-2008.

Panel B of Table 2 holds the results for tests of the residuals for simple regression models regressing both the E1/P and the E10/P on the 10-year T-note yield. If E/P and Y are cointegrated, the nonstationarity contained in the variables will not pass through to the residuals, and thus the residuals will be stationary. The Augmented Dickey-Fuller test was performed on the residuals for each regression model to establish the existence of a unit root. Panel B shows that the null hypothesis of nonstationarity is rejected at lags of 6, 8 and 10 for the E1/P, but not for the E10/P. Thus, for the regression using E1/P and Y, the residuals are stationary, indicating that E1/P and Y are cointegrated. The results of the residuals test and the Johansen tests together corroborate that the trailing twelve-month earnings yield and the 10-year T-note yield are cointegrated for the period of 1950-2008.

Table 3. Cointegration tests for earnings yield and 10-year T-note yield (1950-2008)

Panel A. Johansen trace and max eigenvalue tests					
Variable 1	Variable 2	Johansen trace statistic		Johansen max eigenvalue	
		$r = 0$	$r = 1$	$r = 0$	$r = 1$
E1/P	Y	14.13*	0.99	13.14*	0.99
E10/P	Y	17.31	2.8	14.51	2.8

Table 3 (cont.). Cointegration tests for earnings yield and 10-year T-note yield (1950-2008)

Panel B. Unit root analysis of residuals for model regressing E1/P on Y $E1/P = \alpha + \beta_1(Y)$				
Lags		E1/P	E10/P	5% critical
Augmented Dickey-Fuller test with drift				
6	δ	-0.0170	-0.0122	
	t-statistic	-3.56	-2.12	-2.87
8	δ	-0.0153	-0.0105	
	t-statistic	-3.15	-1.8	-2.87
10	δ	-0.0152	-0.0106	
	t-statistic	-3.06	-1.79	-2.87
12	δ	-0.0136	-0.0099	
	t-statistic	-2.72	-1.67	-2.87

Notes: $r = 0$ denotes the null hypothesis of zero cointegrating vectors, * the null hypothesis is rejected at the 0.05 level. This table reports the results of tests run to confirm that the market earnings yield and the yield on 10-year T-notes are cointegrated for the period of 1950-2008. Panel A has the results from the Johansen tests, while panel B has the results from a unit root test of the residuals from a model regressing both the trailing twelve-month earnings yield (E1/P) and the 10-year smoothed earnings yield (E10/P) on the T-note yield (Y).

Weigand and Irons (2008) interpret their findings to indicate that as long as investors continue to believe in the Fed model, the market P/E ratio will be a slave to nominal interest rates. However, as the model appears to be driven by cognitive error rather than economic fundamentals, investors could eventually abandon their belief in the model if interest rates rise dramatically, causing a reverse repricing effect (driven by falling P/E ratios) that threatens to exert a negative influence on stock returns. For now, we find (as Weigand and Irons (2008) find) that the Fed model does a better job of explaining changes in the market P/E in the latter half of the 20th century than the mean reverting model posited by Campbell and Shiller (1987, 1998, 2001).

Conclusion

We investigate the relationship between prices and earnings based on the findings of Weigand and Irons (2008) that the market earnings yield (E/P) and the yield on 10-year T-notes became cointegrated at some time during the middle of the 20th century. We find that the cointegration occurred at approximately 1950. We perform a time series analysis of the market P/E ratio using both 10-year smoothed earnings (P/E10) and one year trailing earnings (P/E1) before 1950 and from 1950 on, and show that the P/E ratios are stationary pre-1950 but display nonstationary characteristics post-1949. We posit that the change in the relationship between these two variables indicates a change in the fundamental economic relationship between prices and earnings.

Weigand and Irons (2008) opine that the market earnings yield became cointegrated with the yield on 10-year Treasury notes in the latter half of the 20th century. This is confirmed in the current study using formal cointegration testing. Weigand & Irons attribute this result to the rise of the Fed model, in which investors equate the return on stocks to the yield on bonds. They show that the relationship between the market earnings yield and the yield on 10-year T-notes strengthened significantly at or before the year 1960. This study shows that the relationship in fact changed circa 1950, at which point the market P/E ratio (and therefore the market earnings yield) became nonstationary. This nonstationarity is indicative of a change in the relationship between market earnings and market prices. This fundamental change requires researchers to change their approach in using ether the E1/P or the P/E1 ratios for forecasting purposes when using post-1949 data.

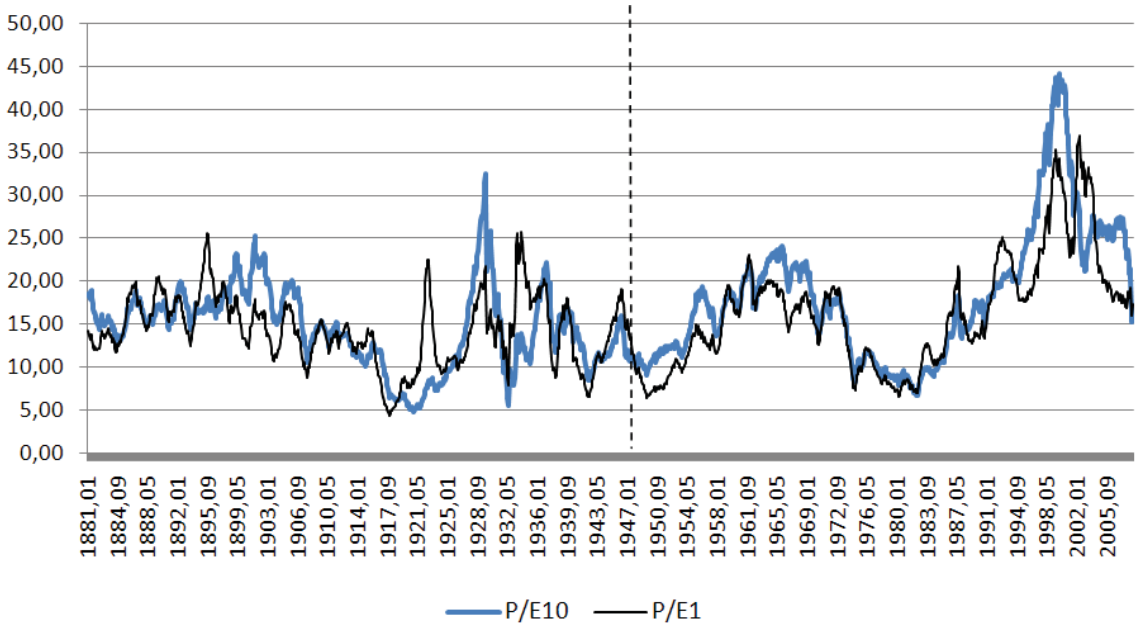
It is possible that, in the future, investors may abandon their belief in the Fed model, and that the earnings yield may become stationary once again. For now, widespread acceptance of the Fed model by investors has created conditions in which the market P/E ratio can deviate from its historic mean value for long periods of time without reverting. It may indeed be different this time.

References

1. Asness, C. (2003). Fight the Fed model: The relationship between stock market yields, bond market yields, and future returns, *Journal of Portfolio Management*, 30, pp. 11-24.
2. Bradley, M. and S. Lumpkin (1992). The treasury yield curve as a cointegrated system, *Journal of Financial and Quantitative Analysis*, 27, pp. 449-463.
3. Campbell, J. and R. Shiller (1987). Cointegration and tests of present value models, *Journal of Political Economy*, 95 (5), pp. 1062-1088.

4. Campbell, J. and R. Shiller (1988). Stock prices, earnings, and expected dividends, *Journal of Finance*, 43 (3), pp. 661-676.
5. Campbell, J. and R. Shiller (1998). Valuation ratios and the long-run stock market outlook, *Journal of Portfolio Management*, 24 (4), pp. 11-26.
6. Campbell, J. and R. Shiller (2001). Valuation ratios and the long-run stock market outlook – an update. Cowles Foundation Discussion Paper No. 1295, March. Cowles Foundation for Research in Economics, Yale University. http://cowles.econ.yale.edu/.
7. Carlson, J., E. Pelz and M. Wohar (2001). Will valuation ratios revert to historical means? *Journal of Portfolio Management*, 28 (4), pp. 23-35.
8. Dickey, D. and W. Fuller (1979). Distribution of the estimators for autoregressive time series with a unit root, *Journal of the American Statistical Association*, 74 (366), pp. 427-431.
9. Ibbotson, R., and P. Chen (2003). Long-run stock returns: participating in the real economy, *Financial Analysts Journal*, 59 (1), pp. 88-98.
10. Ilmanen, Antti (2003). Expected returns on stocks and bonds, *Journal of Portfolio Management*, 29, pp. 7-27.
11. Lee, B.S. (1996). Comovements of earnings, dividends, and stock prices, *Journal of Empirical Finance*, 3 (4), pp. 327-346.
12. Malkiel, B. (2004). Models of stock market predictability, *The Journal of Financial Research*, 27, pp. 449-459.
13. Mehra, Y. (1996). Monetary policy and long-term interest rates, *Economic Quarterly*, 82, pp. 27-49.
14. Shen, P. (2003). Market timing strategies that worked, *Journal of Portfolio Management*, 29, pp. 57-68.
15. Shiller, R. (2011). http://www.econ.yale.edu/~shiller/data.htm.
16. Tatom, J. (2002). Stock prices, inflation, and monetary policy, *Business Economics*, 37 (4), pp. 7-19, October.
17. Weigand, R.A. and R. Irons (2007). The market P/E ratio, earnings trends, and stock return forecasts, *Journal of Portfolio Management*, 33 (4), pp. 87-101.
18. Weigand, R.A. and R. Irons (2008). Compression and expansion of the market P/E ratio: the fed model explained, *Journal of Investing*, 17 (1), pp. 55-64.

Appendix

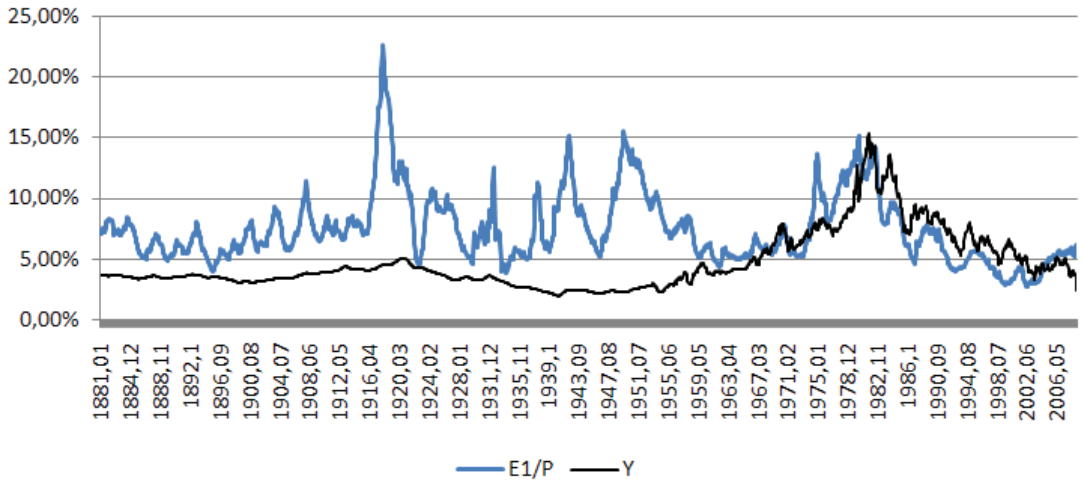


Notes: The figure below shows the level of the market P/E ratio for the period of 1881-2008 using two different earnings calculations: with earnings averaged over the prior year (P/E1), and with earnings averaged over the prior 10-year period (P/E10). The first metric is more popular with investors and money managers, while the second is held in higher regard by academics, as it smooths out the impact of short-term changes in earnings.

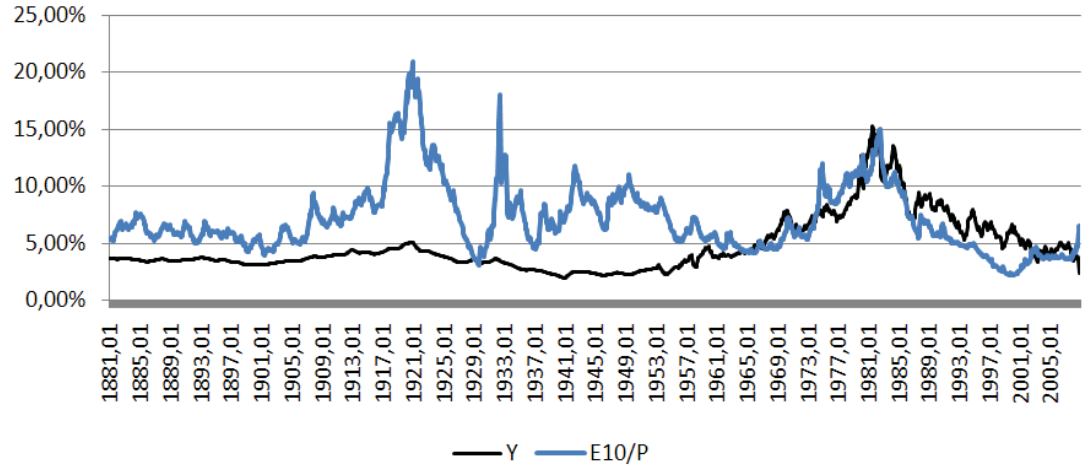
Both forms of the P/E ratio show different behavior before and after the period of 1950-1960 per the graph below. Prior to that period, the ratios appear to be mean-reverting. After that period, the ratios appear to trend for long periods of time, no longer seeming to have a relevant mean.

Fig. 1. The market P/E1 and P/E10 ratios, 1881-2008

Panel A: E1/P and yield on 10-year T-notes, 1881-2008



Panel B: E10/P and yield on 10-year T-notes, 1881-2008



Notes: Panel A shows the 1-year earnings yield (E1/P) and the yield on 10-year T-notes (Y) for of the period 1881-2008, while Panel B shows the 10-year earnings yield (E10/P) and the yield on 10-year T-notes (Y) for the same period. Both graphs indicate a change in the relationship between the two variables some time during the period of 1950-1960. Prior to that period, the two variables behaved independently. After that period, the two variables appear to have a much stronger positive relationship.

Fig. 2. The market earnings yield and the yield on 10-year T-notes, 1881-2008