Atactical implication of predictability

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A tactical implication of predictability:

fighting the FED model

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Abstract

This paper confirms that high earnings yield portend high equity returns. Absolute valuation levels of equity have predictive power over future long run equity returns. The predictability is far less powerful in the short term. On a tactical investment horizon, investors tend to rely on the relative valuation of equity versus bonds to gauge whether equity markets are attractive. The FED model, which compares earnings yield and bond yield, is the preferred yardstick in the finance profession. First, this paper examines the FED model and shows that is not only theoretically flawed, but also not able to predict equity returns over long sample periods. Second, we improve the model by adding corrections for perceived risk enabling a better fit of the data. Third, the main innovation is testing a tactical asset allocation model constructed on the basis of the improved model. A model portfolio taking advantage of the short-term deviation in relative value, corrected for risk, leads to superior performance.

Keywords: predictability, equity returns, money illusion and tactical asset allocation.
JEL Classifications: G12, G14

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[*] Salomons is at University of Groningen and AEGON Asset Management, The Netherlands. Correspondence: r.m.salomons@eco.rug.nl. The subtitle is taken from a paper by Asness [2003], which inspired this study. Comments and suggestions by Cliff Asness are mostly appreciated.

1. INTRODUCTION

Investors for the long run, say ten years and beyond, can benefit from the notion that equity returns can to some extent be forecasted on the basis of absolute valuations, be it earnings yields or dividend yields (see Campbell and Shiller [1988a, b, 1998, 2001], Fama and French [1988], Philips [1999], Siegel [1998, 1999] and Ritter [2003]). Obviously, strategic asset allocation needs to take this predictability into account. Barberis [2000] provides a model for long horizons when returns predictable. Campbell and Viceira [2002] provide a textbook treatment for strategic asset allocation. This paper builds on this predictability focussing on one main issue. Here we do not take the long-term strategic view, but focus on the short-term predictability, say from one month to one year. We aim to develop a tactical asset allocation (TAA) model to benefit from relative value differences in bond and equity markets in the short run.

The slow movement in valuation ratios means also that trading strategies on these variables do not make much sense if investors have a short horizon. High earnings yields and dividend yields do signal rising returns and vice versa, but only at longer horizons. The low yields on equity in the middle of the 1990s pointed towards lower returns, but anyone who took the advice missed out on a dramatic surge in the late 1990s. It is painstakingly clear that longer-term tendencies are still subject to enormous short-term fluctuation. In practice, the FED model, based on the difference between earnings yield and bond yield, is often used as a shorthand measure for the attractiveness of equity and as timing device for allocating funds between equity and bonds. The conventional view is that when the earnings yield is above the bond yield, equity is more attractive. For investors who allocate funds to equity and bond markets, this is their buy signal.

In this paper we will describe the FED model and show that it is theoretically flawed as inflation impacts earnings yields and bond yields differently. We will provide empirical evidence that the predictive power of the FED model is weak. Still it is an intuitively appealing model as it explains investor behaviour over time. As most people, investors may suffer from money illusion, confusing real and nominal values. Interestingly, over the last 40 years bond yields and earnings yields have moved in sync. The relation does not hold for the entire century. It will be shown this is because of changes in the perception of risk regarding the two asset classes. We improve the FED model to take the changes in relative risk into account. Without these adjustments most tactical asset allocation models using earnings yield and bond yield do not make much sense. With the adjustment, the models capture important behavioural aspects. Moreover, we test the economic significance and show that employing tactical asset allocation generates incremental returns in out-of-sample tests.

The outline is as follows. In the next section we describe the FED model. Section 3 puts the model to the test. In section 4 we explain equity valuation using bond yields and a proxy for risk, which are subsequently used to improve the model in section 5. Before summarising, section 6 presents the result of the tactical asset allocation model.

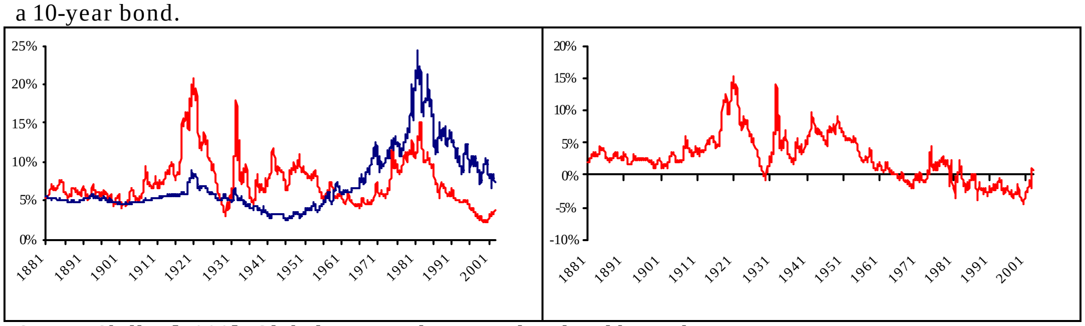
2. THE FED MODEL

Given the time variation in expected return, market based valuation indicators provide useful estimates of market prospects. The difference (or ratio) between the earnings yield and bond yield is a shorthand measure for expected returns and the basis of several tactical asset allocation models. Earnings yield are compared to bond yield and investors determine which asset class is likely to deliver higher returns. The widespread version of comparison of equities and bonds is deemed the "Fed Model". [1] It assumes a fixed relationship between bond yields and earnings yield based on 1) the fact that the two are competing asset classes, 2) the present value of equity rises as the risk free rate falls and 3) based on stylised facts; the recent 40-year history demonstrates the existence of a

[1] Wall Street strategist Ed Yardeni introduced the name after a report by the Federal Reserve to Congress in July 1997 suggested the bank was following it, not because of any official Fed endorsement.

relationship. The historical relation between the two yields and the current yield determines allocations between the asset classes. When the difference between earnings yield and bond yield is positive, equity is more attractive and vice versa. Our measure of earnings yield is based on trend earnings yield as in Campbell and Shiller [1998, 2001] and Ritter [2003]. This measure follows the suggestion by Graham and Dodd [1934] and smoothes the business cycle effects on earnings yield by taking the recent 10-year history of earnings.

Figure 1: Earnings yield and bond yield. This figure gives the trend earnings yield and the (nominal) bond yield on the left hand side. The dark line that starts its ascent in the 1950s is for bond yields. The right hand side figure gives the difference between earnings yield and the (nominal) bond yield. Data is for US equity and bond markets with sample period 1881 – 2002. Equity market data is for the S&P500; bond yields are for a 10-year bond.



Source: Shiller [2000], Global Financial Data and updated by author.

While not unanimous there is a broad consensus in the non-academic investing community that the basic comparison underlying the FED model is valid, which makes Figure 1 interesting in two respects. First, it is clear that the relationship between earnings yield and bond yield is not stable across time. Since 1955, the correlation between the two series is an impressive 75%. It is only 19% in the full sample period 1881 – 2000. The assumption of a fixed relation is not valid in the long run. Second, the earnings yield was generally higher compared to the bond yield in the pre-war period. When the bond yield shifted above the earnings yield during the 1950s this was a landmark event in capital market history. It clearly seemed anomalous at the time. [2] Only in the last 40 years of data is the one-to-one relation between earnings yield and bond yield somewhat justifiable. However, from a theoretical point of view, the relation between earnings yield and bond yield is erroneous as it compares a real number (equity) with a nominal one (bond). It can be rejected based on first principles. Both numerator (earnings) and denominator (prices) of the earnings yield are impacted by inflation, while the coupon of a bond is fixed. In theory, inflation only impacts bond yield, without affecting the earnings yield. Still, many investors believe in a negative correlation between equity valuations and inflation; specifically, when inflation is high, earnings yields are high and vice versa. [3] Campbell and Vuolteenaho [2003] explain this behaviour by returning to a theory first put forward by Modigliani and Cohn [1979]. Investors are irrational and suffer from money illusion; they tend to confuse nominal and real variables. Modigliani and Cohn [1979] examined the relationship during high inflation periods and stated that investors overestimated the negative effects of inflation, leading to high earnings yields. Ritter and Warr [2002] explain part of the recent rise in equity valuation as a correction of the previous misperception. [4]

[2] For anecdotal evidence we refer to an interesting discussion between several "living legends" of investment management in CFA magazine, January 2003. Siegel [1998] also provides an extensive discussion on this inflection point.

[3] This relation is sometimes expressed as the "rule of 20". Adding the price-to-earnings ratio and inflation rate should total 20 – that is, an inflation rate of 3% would justify a price-to-earnings ratio of 17.

[4] Modigliani and Cohn [1979] and Ritter and Warr [2002] do however present evidence that inflation does impact earnings to some extent beyond the impact on prices. The argument centers around the fact that capital gains tax is not indexed for inflation, supply side causes of inflation, effects on depreciation and interest costs and finally the Okun [1971] and Friedman [1977] argument that higher inflation induces higher uncertainty, driving up the equity risk premium (see Brandt and Wang [2003]). Still, in a monthly regression of rolling 10-year historical inflation and 10-year nominal earnings, the coefficient is 0.93, only just below 1. There is almost perfect pass-trough of inflation to earnings.

A simple example might be illustrative to explain investors' money illusion and why it is misleading to compare earnings yield (a real variable), with bond yield (a nominal variable). Assume a price-to-earnings ratio of the market is 20 (an earnings yield of 5%), a payout ratio of 50% and a resulting dividend yield of 2.5%. Say the nominal bond yield is 5%, inflation is 3% and expected real earnings growth is 2% (slightly more than historic average). This leads to a real bond yield of 2% and an expected nominal growth rate is 5% per annum. In this case the expected nominal return on equity is 7.5% (dividend yield and nominal growth rate) and stocks carry a 2.5% risk premium over bonds. Now assume that long-term expected inflation and bond yields decline to 2% and 4% respectively, which leaves real bond yields at 2%. In line with the fall in inflation, nominal earnings growth slows to 4%. FED fund modellers would assume a correct price-to-earnings ratio of 25 (an earnings yield of 4%). Assuming a similar payout, this case lowers the expected nominal returns on equity rises to 6% (2% dividend yield and 4% earnings growth). All of a sudden stocks have a lower risk premium over bonds, while nothing changes in real terms. To garner the same risk premium, equity needs to return 6.5% (the bond yield of 4% plus 2.5% premium). In a theoretical world, when nominal growth slows, but real growth and payout rates stay the same, the earnings yield should stay the same. In the real world, this is often not the case.

3. TESTING THE FED MODEL

The logic behind the relative valuation argument is straightforward. Based on money illusion, higher valuation levels of equity can be explained by lower bond yield. The acid test is whether the FED model has any predictability of future returns. Asness [2003] presents a set of simple regressions for several sub-periods to examine this. In the regressions combinations of earnings yield (*E*Y) and bond yield (*BY*) are used to predict subsequent equity returns (*R*). Predictability is examined for several investment horizons,

i, ranging from one month, three months, one year, five years, ten years and twenty years. The following regressions are estimated for different sample periods:

$$R_{t+i} = g_0 + g_1 EY_t + e_t \quad (1)$$

$$R_{t+i} = g_0 + g_1 (EY_t - BY_t) + e_t \quad (2)$$

$$R_{t+i} = g_0 + g_1 EY_t + g_2 BY_t + e_t \quad (3)$$

If earnings yield has predictive power over future returns, the g_1 should be positive in (1). If the difference between earnings yield and bond yield really has predictive power over future returns g_1 should be positive in (2). The logic of the FED fund model calls for higher subsequent equity returns when the earnings yield is substantially above the bond yield. We also estimate (3), as the FED model might simply be a noisy measure of genuine earnings yield. If so g_2 won't be significant. We provide sample statistics for four sample periods: 1) 1881 – 2002, the full sample period using trend earnings, 2) 1926 – 2002, the Ibbotson sample period, 3) 1955 – 2002, the modern era in which interest rates have been freely floating, and 4) 1980 – 2002, the great bull market, that for many, has shaped so much of our knowledge of financial markets. Table 1 and Table 2 give the regression results for the predictability regressions using 10-year and 1-year subsequent returns respectively. For lack of data, results for the most recent period are omitted for 10-year subsequent return.

Table 1 confirms earlier research that earnings yield does predict 10-year real total annualised equity returns (1). It seems the FED model (2) has some success in forecasting equity returns. For the full period, the t-statistic is significant and R^2 is reasonable. Statistics for (3) show that this is because earnings yield is part of the FED model. Adding bond yields does not add much to the predictability.

Table 1: Trend earnings yield, bond yields and 10-year real total equity returns. This table gives the statistics for the predictability of combinations of earnings yield and bond yield for subsequent 10-year returns. For each sample period, the results of three regressions are shown. The regressions are GMM regressions to correct for overlapping samples and serial correlation. The top line displays the result for the earnings yield model (1). The next line displays results for the FED model (2), while the final row shows (3). Sample periods are 1881 – 2002, 1926 – 2002 and 1955 – 2000. T-statistics are shown in parenthesis.

Sample period	Equation	g_0	EY	BY	EY-BY	R^2
1881 – 2002	(1)	-0.7%	0.99			30.6%
		(-0.55)	(5.89)			
	(2)	5.0%			0.58	13.9%
		(2.54)			(1.52)	
	(3)	-0.7%	0.99	0.00		30.7%
		(-0.64)	(3.86)	(0.00)		
1926 – 2002	(1)	-2.7%	1.35			32.8%
		(-1.04)	(4.12)			
	(2)	6.0%			0.59	11.5%
		(2.68)			(1.09)	
	(3)	-2.3%	1.45	-0.22		34.2%
		(-1.20)	(2.99)	(-0.50)		
1955 – 2002	(1)	-2.0%	1.18			28.5%
		(-0.52)	(3.55)			
	(2)	6.5%			-0.13	0.0%
		(2.79)			(-0.14)	
	(3)	-2.3%	0.86	0.36		29.9%
		(0.60)	(0.71)	(0.35)		

At one-year forecast periods earnings yield help to predict real equity returns, though the R^2 is less impressive in comparison to the longer horizons. The FED model also seems to have forecasting predictability, but its forecasting power is determined primarily by the fact that it is a poor man's earnings yield. Not even during the bull market period, when the FED model rose to prominence, is there any evidence of significant predictability of equity returns from the difference in earnings and bond yield. However, for that period (2) does a better job than (1), has the "correct" signs and a high R^2 for one-year forecasts. Adding bond yield does add something, but it is not very significant. In addition, we must note that the intercept, g_0, is very high. This means that if we knew that equity returns would be high over the 1980 – 2002 period, the difference between earnings yield and bond yield help to explain some variation in return. If we had known the trend, we would have been able to explain the cyclical deviations. Clearly this assumption is dubious.

Table 2: Trend earnings yield, bond yields and 1-year real total equity returns. This table gives the statistics for the predictability of combinations of earnings yield and bond yield for subsequent 1-year returns. For each sample period, the results of three regressions are shown. The regressions are GMM regressions to correct for overlapping samples and serial correlation. The top line displays the result for the earnings yield model (1). The next line displays results for the FED model (2), while the final row shows (3). Sample periods are 1881 – 2002, 1926 – 2002, 1955 – 2000 and 1980 – 2002. T-statistics are shown in parenthesis.

Sample period	Equation	g_0	EY	BY	EY-BY	R^2
1881 – 2002	(1)	-3.7%	1.64			5.7%
		(-0.65)	(1.99)			
	(2)	5.2%			1.15	4.1%
		(2.08)			(1.74)	
	(3)	-2.7%	1.69	-0.29		5.9%
		(-0.53)	(1.90)	(-0.43)		
1926 – 2002	(1)	-10.3%	2.80			10.4%
		(-1.11)	(2.21)			
	(2)	6.3%			1.69	7.1%
		(2.08)			(2.05)	
	(3)	-7.8%	3.02	-0.77		11.7%
		(-0.87)	(2.39)	(-0.93)		
1955 – 2002	(1)	1.1%	1.00			2.4%
		(0.16)	(1.19)			
	(2)	7.9%			0.87	1.4%
		(3.45)			(0.76)	
	(3)	1.9%	1.26	-0.37		3.0%
		(0.35)	(0.86)	(-0.33)		
1980 – 2002	(1)	3.9%	1.08			4.0%
		(0.43)	(1.06)			
	(2)	16.1%			2.86	7.2%
		(5.65)			(1.30)	
	(3)	10.2%	2.36	-1.76		7.6%
		(0.96)	(1.21)	(-0.79)		

All considered, the only support for the FED model is in forecasting the short horizon return. This return comes with low R^2. Only during the 1980 – 2002 period does adding bond yields add anything and as the intercept is high, the usefulness is low. Meanwhile, traditional absolute valuation models based on trend earnings yield predict long-horizon returns. The message is clear: when the earnings yield is low, the subsequent long run returns are low, regardless of the interest rate.

4. EXPLAINING EQUITY VALUATIONS

Though the relationship between earnings yield and bond yield is not stable, it can be used as a descriptive tool for how investors set the earnings yield. In the last forty years, the correlation was high, but using longer data, it vanishes. Why the change? Seeing that money illusion is not considered to be time dependent, it seems a variable is missing. Based on Merton [1980] and French, Schwert and Stambaugh [1987] who have tested the link between expected equity returns and volatility, Asness [2000, 2002] argues perceived risk is the missing link. If investors set the earnings yield of the equity markets as a function of nominal rates (even while on a flawed theoretical basis), it is reasonable that they demand more return (a higher earnings yield) for a given level of interest rates when equity is perceived to be more risky than bonds. The richening of equity versus bonds is based on changes in this perception. Following Asness [2000, 2002] we evaluate the risk (as measured by standard deviation) of each asset class. [5] We assume that the collective wisdom of investors is based on their experience and follow the 20-year period suggested to resemble a generation. Unsurprisingly, even barring the extreme volatility that occurred during the 1930s, equity is more volatile. Bond market volatility was stable until inflation took hold in the late 1960s and early 1970s. Relative volatility (equity over bonds) was on a gradually rising trend before the Second World War, but since then, there was an obvious change in the risk profile of equity versus bonds; bonds clearly got more volatile and relative volatility fell.

[5] Alternative proxies for risk are suggested by Polk, Thompson and Vuolteenaho [2004] who focus on a cross-sectional beta premium within equity markets.

A simple model based on Asness [2000] is below, with the exception that we use earnings yield instead of dividend yield. The intuition of the model, somewhat similar to Kane, Marcus and Noh [1996], is that investors set earnings yield as a function of nominal interest rate (due to money illusion), but also require a higher earnings yield when their generation has experienced relatively more volatility in equity, s^e, versus bonds, s^b. The money illusion relation is captured in (4); this is the FED model where the earnings yield move in sync with bond yields. Adjustments for risk enter in (5), where we expect g_1 and g_2 to be positive, while g_3 will have a negative sign.

$$EY_t = g_0 + g_1 BY_t + e_t \tag{4}$$

$$EY_t = g_0 + g_1 BY_t + g_2 s_t^e + g_3 s_t^b + e_t \tag{5}$$

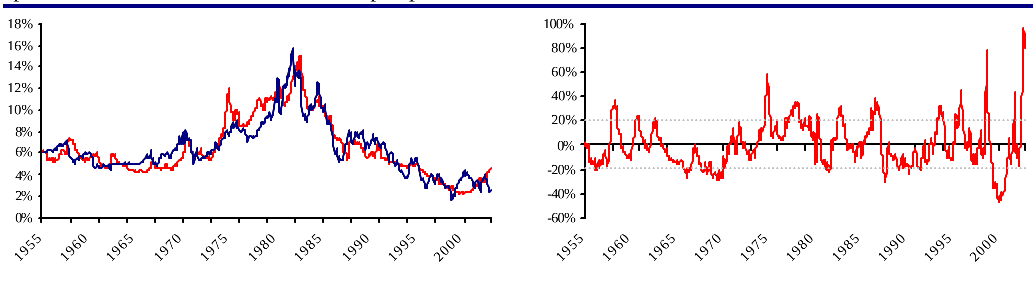
Table 3 presents the results of the regressions, again for the main sub periods. As shown, the FED model relation (4) is evident in the latter period, but unable to explain earnings yield over longer periods (see also Figure 1). Incorporating volatility enables a better fit of the data. A significant amount of the variation in the earnings yields is explained by changes in bond yields, equity volatility and bond volatility. The improved model is able to explain the data for the longer periods as well and beats the FED model for all periods. Based on the relative risk measure using 20 years of data, the relationship has an R^2 of 38% for the full sample period. When estimated for the Ibbotson period, it captures 64% of the variation in earnings yield. For the modern period, the fit is even 82%. In addition, the improved model survives numerous robustness checks (see Asness [2000]).

As Figure 2 shows, the fitted values for earnings yield based on (5) match the actual values nicely in the modern period. It has a correlation of 91% and the standard deviation of the error terms is only 20%. Bond yields alone do not explain equity yields, but when risk perceptions are added the explanatory power improves markedly. Money illusion and risk explains equity valuations.

Table 3: Earnings yield, bond yield and perceived risk. In this table we report the regression statistics of regression (4) and (5). T-values are in parenthesis. The top row gives the results of (4). The bottom row gives (5) with adjustment for perceived risk. Four different sample periods are used: 1891 – 2002, 1926 – 2002, 1955 – 2002 and 1980 – 2002.

Sample period	Equation	g_0	g_1	g_2	g_3	R^2
1891 – 2002	(4)	6.37%	0.22			
		(5.97)	(1.43)			3.1%
	(5)	1.00%	1.17	0.28	-0.58	
		(0.65)	(6.39)	(4.25)	(0.00)	38.2%
1926 – 2002	(4)	5.79%	0.22			
		(4.03)	(0.90)			6.0%
	(5)	-1.80%	1.05	0.38	-0.38	
		(-1.62)	(16.81)	(6.82)	-7.57)	63.6%
1955 – 2002	(4)	1.14%	0.78			
		(0.85)	(4.62)			55.2%
	(5)	-6.34%	1.10	0.72	-0.37	
		(-3.21)	(19.65)	(4.67)	(-9.86)	82.3%
1980 – 2002	(4)	-3.05%	1.16			
		(-4.29)	(15.84)			85.4%
	(5)	-3.17%	1.01	0.60	-0.45	
		(0.93)	(14.82)	(2.22)	(-4.36)	88.6%

Figure.2: Actual and fitted earnings yield and deviations. This figure gives the actual and fitted earnings yield on the left hand side. Percentage deviations are on the right hand side. Deviations are displayed as perceived overvaluation. The sample period is 1955 – 2002.



5. IMPROVING THE FED MODEL

The relation between earnings yield and bond yield is not stable, has no theoretical basis, but exists because investors suffer from money illusion. As such, it is not surprising that it lacks predictive power over equity returns at long forecast horizons. When volatility of the asset classes is taken into account, as proxy for perceived risk, the relation between bond yield and earnings yield improves. This is a subtle though crucial point demonstrating that while the relation is theoretically flawed, it describes investor behaviour and has explanatory power. Investors do set earnings yield based on bond yield, but they do so in error. "Money illusion makes people believe earnings yields should follow bond yields, and when they deviate from their "normal" (even if wrong) relationship, the market corrects its error (by moving to a new error!)." [6]

To test the predictability we introduce two new variables: a regression fitted value, EY^f from (5) and an error term called, EY^e: $EY = EY^f + EY^e$. We run three different sets of regressions (6), (7) and (8) to test predictive power:

$$R_{t+i} = g_0 + g_1 EY_t \tag{6}$$

$$R_{t+i} = g_0 + g_1 EY_t^f \tag{7}$$

$$R_{t+i} = g_0 + g_1 EY_t^e \tag{8}$$

In each of the equations we regress our independent variable on the subsequent equity returns for several investment horizons. In case of (6) this is simply (again) testing the predictive power of earnings yield. Equation (7) shows the predictability of the model fitted earnings yield considering the level of bond yields and equity and bond volatility; we call this the perceived correct earnings yield. The final regression (8) tests the

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[6] Private communication with Cliff Asness.

relationship between the earnings yield in excess (or deficit) of fitted values, the error terms. Table 4 presents the results for the modern period.

Table 4: Predictability of earnings yield, perceived correct yield and errors. In this table we report the regression statistics of regression (6), (7) and (8) on subsequent annualised equity market returns. We report statistics for 1-month, 3-month, 1-year, 5-year, 10-year and 20-year subsequent returns. T-values are in parenthesis. Sample period 1955 – 2000.

Equation		1-month	3-month	1-year	5-year	10-year	20-year
(6)	g_0	5.8%	2.0%	1.1%	3.3%	-2.0%	-3.6%
		(0.80)	(0.29)	(0.16)	(0.65)	(-0.52)	(-3.77)
	g_1	1.51	1.29	1.00	0.57	1.18	1.28
		(1.30)	(1.32)	(1.19)	(1.38)	(3.55)	(12.23)
	R^2	0.2%	0.9%	2.4%	3.6%	28.4%	86.2%
(7)	g_0	17.0%	11.2%	5.3%	3.8%	-3.0%	-4.3%
		(2.38)	(1.53)	(0.75)	(0.60)	(-0.70)	(-3.09)
	g_1	0.00	0.00	0.00	0.01	0.01	0.01
		(-0.21)	(-0.12)	(0.36)	(0.74)	(3.49)	(6.49)
	R^2	0.0%	0.0%	0.0%	1.7%	25.4%	74.5%
(8)	g_0	15.5%	10.4%	7.6%	7.2%	6.5%	5.4%
		(6.48)	(4.17)	(3.00)	(2.80)	(2.93)	(3.61)
	g_1	0.10	0.09	0.04	0.01	0.01	0.01
		(3.74)	(3.41)	(2.51)	(0.93)	(0.95)	(4.74)
	R^2	6.8%	11.5%	11.8%	2.1%	3.9%	17.1%

The results for (6) confirm earlier results that using earnings yield to predicting next months or next years return is virtually impossible, but that this power increases as the investment horizon lengthens. The perceived correct earnings yield, the fitted values (7), tell a similar story, though they are less successful at long horizons. The interesting point arises when using (8). Comparing the results for (8) with (6) show that the model using the error terms has far more predictive power than actual earning yie lds at short horizons, while at longer horizons, the exact reverse is true. It is abundantly clear that in the long run earnings yield drive returns, but that in the short run deviations occur. The power of EY^e to forecast short-horizon returns can be interpreted as either picking up time-varying risk aversion or as market mispricing. In either case, if EY^e is high, then equity sells at lower prices than normal during same interest and volatility environments. These low prices indicate higher short-term expected returns.

The message from our exercises is insightful: variations in earnings yield can be explained upon assuming that investors suffer from money illusion and demand a premium yield to compensate for risk. Based on these assumptions it not hard to understand why investors were happily chasing stocks in the late 1990s. With interest rates falling and the relative volatility of equity declining, investors pushed equity to ever lower earnings yields. [7] Unfortunately, this does not bode well for long-run expected returns. In the long run, only absolute valuation forecast return. In the short run, relative valuation explains behaviour of investors. While useless in predicting long-run returns, this can be used for short-term oriented models.

6. TAA MODELLING

The results obtained in the earlier regressions lend themselves for tactical asset allocation models. Our tactical model is based on (7) and (8). Table 4 indicates that our improved model has the best predictability on either a 3-month or a 1-year horizon. In this strategy we use show the results for the 3-month investment horizon and refer to the Appendix for test on other investment horizons. In order to make the results robust, we expand our sample period to include pre-war data. In addition, to eliminate look-ahead bias, we form out-of-sample forecasts for earnings yield. Our results are based on the sample data for 1911 – 2002 since we need 20 years of data for the volatility data and another 20 years of data is needed for the first predictive regression. The regressions used an expanding window to estimate regression (5). They always start in January 1891 and went up to the month before the forecast. Our procedure is as follows:

[7] The Glassman and Hassett [1999] view that equity contains no risk was a popular view just a few years ago.

1. At the start of each month we use all historical data up to period *t*-1 to estimate regression (5).
2. Inserting the earnings yield, bond yield, equity and bond volatility at period *t* results in a fitted earnings yield for period *t*.
3. We compare the fitted earnings yield based of the regression, EY^f, with the actual earnings yield, *EY*, and note the difference, EY^e.
4. If the error term, EY^e, is positive and the markets are perceived to be undervalued in the short run, our portfolio is fully invested in equity. If the error term indicates overvaluation of equity in the short-run, the resulting portfolio is fully invested in bonds.
5. We record the return on our portfolio for the subsequent *i* months as well as the return of a benchmark portfolio, which is equally weighted between equity and bonds. It is assumed that trades are implemented using an inexpensive future overlay, meaning we abstract from transaction costs.
6. We repeat step 1 through 5 for all months in the sample to get time series for the model portfolio and benchmark portfolio.

Table 5: Sample statistics of TAA model. This table presents sample statistics of 3-month returns for the TAA model and the benchmark portfolio. We present the number of observations, average, standard deviation, minimum, maximum, skewness, kurtosis, median and downside deviation (2nd moment) of nominal total returns for the sample period 1911 – 2002.

	Model portfolio	Benchmark
No. observations	1101	1101
Average	2.79%	2.05%
Volatility	7.69%	5.21%
Min	-40.05%	-18.78%
Max	76.62%	40.44%
Skew	1.54	0.92
Kurtosis	15.85	7.22
Median	1.60%	2.11%
Downside deviation	3.48%	2.32%

Table 5 shows that the resulting portfolio has a higher return than the benchmark portfolio. On average, it returns 2.79% per three months, which is significantly more than the 2.05% for the benchmark portfolio. The return of the TAA portfolio is above the return of the benchmark portfolio in 55% of all months. Such a hit ratio is satisfactory result and, based on a Wilcoxon test, different from 0.5. The portfolio generates an Information Ratio, IR, of 0.35 The fundamental law of active management (see Grinold and Kahn [1999]) states that such an IR is reasonable for an active strategy that has only two choices of assets and twelve decisions per year, i.e. a strategy suffering from breath. [8] However, we must note that the return distribution is asymmetric and the median return of the TAA strategy is below the median return of the benchmark portfolio. Downside deviation points towards the asymmetry of risk.

The portfolio strategy described above to test the economic relevance of our TAA model is not likely to be employed in practice. First, investors are unlikely to change portfolio structure on minor deviations from what is considered fair valuations. We assume they only when actual valuations deviate more than 20% (the standard deviation of errors in the modern period) from fitted value. Second, for arguments of total risk, portfolios will never be fully invested in one asset class. In order to make the results more practically relevant, we make a small adjustment to the portfolio construction described above and adjust line (4) accordingly:

4) If the error term, EYe, is more than 20% from actual, we change the relative allocations between equity and bonds. When the markets are perceived to be

[8] The fundamental law of active management states that the Information Ratio of an active manager is determined by the skill of a manager (what is his hit ratio?) and the breadth of a manager (how often can he independently exercise this skill?). A classic example is the casino example when betting red versus black on roulette. In Grinold and Kahn's example the casino has a hit ratio of 19/37=51.3% thanks to the green slot. Casinos are great business not because of overwhelming skill but, rather, because of overwhelming breadth. Taking 1,000,000 red/black bets gives the casino a whooping IR of 27.

undervalued in the short-run, we shift funds toward 75% invested in equity and 25% in bonds. If the error term indicates overvaluation of equity in the short-run, the resulting portfolio is for 25% invested in equity and 75% in bonds. In all other cases, for which "valuation errors" are not extreme, we simply hold the benchmark portfolio; we do not view all under or overvaluation as equal.

Table 6: Sample statistics of TAA model using a practically relevant strategy. This table presents sample statistics of 3-month returns for the TAA model and the benchmark portfolio. We present the number of observations, average, standard deviation, minimum, maximum, skewness, kurtosis, median and downside deviation (2[nd] moment) of nominal total returns for the sample period 1911 – 2002.

	Model portfolio	Benchmark
No. observations	1101	1101
Average	2.33%	2.05%
Volatility	5.78%	5.21%
Min	-21.56%	-18.78%
Max	58.53%	40.44%
Skew	1.47	0.92
Kurtosis	12.48	7.22
Median	1.98%	2.11%
Downside deviation	2.33%	2.05%

The more relevant portfolio strategy is well behaved over time. Our resulting TAA portfolio has a neutral position between equity and bonds in 50%, a preference for equity in 26% and a preference for bonds in 23% of all months. The sample statistics of the TAA portfolio and the benchmark portfolio for a 3-months investment horizon are in Table 6. From the sample statistics it is clear that the TAA portfolio is slightly more risky. Both standard deviation and downside risk are higher than for the benchmark portfolio. The positive skewness is also worth noting. Several other points are of interest. First the model is underweight equity during the major crash in 1929, is neutral during the October 1987 crash and only missed a small part of the bubble in late 1999 and early 2000. Second, on a monthly basis, it outperforms the benchmark portfolio in 29% of all months, while it is neutral in 50% of the 1101 months. Third, the longest period when the model portfolio was correct was in late 1940s and during 1953 – 1954. In both cases the model was correctly positive on equity, resulting is an outperformance of 17 months. In contrast, the longest losing streak was “only” 11 months. This occurred in the late 1950s, when the model portfolio had a premature preference for bonds.

A test with t-statistics for the difference between the two portfolios is not relevant for examining the economic significance of the TAA model as the TAA portfolio is equal to the benchmark portfolio in 50% of all months. Better is to examine the excess return of the portfolio versus the benchmark and focus on the months during which deviations from benchmark occur. The model shows potential. First, when we decide to deviate allocations, we are correct in 58% of all cases. A Wilcoxon test shows that this hit ratio is better than sheer luck. Second, the average excess return of 3-month returns is 0.57% with standard deviation of 2.44%. This is significantly different from 0%. Finally, we note that this portfolio strategy generates an Information Ratio, IR, of 0.53. [9]

7. SUMMARY

In the long run only absolute valuations (earnings yield) have predictive power over subsequent returns, but in the short run this is like rolling dice. For short term forecasting the well-known FED model, a relative valuation model that compares earnings yield and bond yield is popular, but theoretically flawed. Because it compares a real with a nominal variable, it can be rejected on first principles. [10] Despite this fact, the model explains the

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[9] The investment horizons used here correspond nicely with the investment horizons asset managers claim to use for TAA. However, this not completely true as in practice asset managers often have monthly investment policy committee meetings. While the objective might still be to add value on a three-month horizon, we claim that the period is often only one month. Testing this model with a monthly horizon leads to only slightly less promising results. This strategy has i) a hit ratio of 54%, ii) an excess return of 0.16% per month and iii) an IR of 0.29.

[10] To be complete in our criticism on the FED model we need to highlight that the adopted model in practice is at times even more flawed. Investors often use expected operating earnings from analysts as input. These expectations are known to be overly optimistic, so to avoid disillusionment, it's better to look at actual earnings. In addition, they focus on the wrong kind of

variation of earnings yield to some extent. This is due to the fact that investors suffer from money illusion and consistently confuse real and nominal variables. When risk perceptions are added, it shows how investors set the earnings yield as a function of bond yields and the relative volatility of equity versus bond. Basically, it describes what valuation investors are willing to pay for equities. When the actual earnings yield is substantially above the perceived yield, expected returns for the short-run are high and vice versa. A tactical asset allocation model aimed at benefiting from these observations has persistent positive excess returns.

Strategic asset allocators, who invest for the long run, should disregard relative valuation models and only focus on absolute earnings yield. Seeing that earning yields are below their historic average, expected long-run returns are low. Still tactical asset allocators can pick up some additional short-term returns when risk adjusted relative valuations are diverging.

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earnings. Owners of risk capital (equity) are not being paid from operating earnings. Investors pick up the bill for the costs of the adjustments (restructuring costs, inventory adjustment and asset write downs). It's better to look at reported earnings. A final note of critique, but less of an issue to us, is the fact that the FED model compares assets with, in theory, infinite maturity (equity) to an asset with short, say 10-year, maturity (bond).

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APPENDIX

Table A 1: Sample statistics of TAA model using 20% threshold. This table presents sample statistics of 1-year returns for the TAA model and the benchmark portfolio. We present the number of observations, average, standard deviation, minimum, maximum, skewness, kurtosis, median and downside deviation (2nd moment) of nominal total returns for the sample period 1911 – 2002.

	Model portfolio	Benchmark
No. observations	1092	1092
Average	9.76%	8.70%
Volatility	13.57%	12.09%
Min	-47.04%	-32.19%
Max	106.10%	73.15%
Skew	0.84	0.51
Kurtosis	5.24	1.94
Median	8.04%	7.93%
Downside deviation	4.27%	3.77%

Deviations from benchmark occurred in 540 and were correct in 63% of all cases. The average excess returns was signficatly different from zero (average 2.15%, standard deviation of 5.78%). The Information Ratio of this active strategy is 0.87.

Table A 2: Sample statistics of TAA model using 20% treshold. This table presents sample statistics of 1-month returns for the TAA model and the benchmark portfolio. We present the number of observations, average, standard deviation, minimum, maximum, skewness, kurtosis, median and downside deviation (2nd moment) of nominal total returns for the sample period 1911 – 2002.

	Model portfolio	Benchmark
No. observations	1103	1103
Average	0.74%	0.66%
Volatility	2.87%	2.55%
Min	-10.86%	-11.62%
Max	38.62%	26.27%
Skew	2.09	0.79
Kurtosis	30.29	11.85
Median	0.67%	0.71%
Downside deviation	1.43%	1.34%

Deviations from benchmark occurred in 546 and were correct in 54% of all cases. The average excess returns was signficatly different from zero (average 0.16%, standard deviation of 1.32%). The Information Ratio of this active strategy is 0.29.