# Changes of Predictive Variables

## In S&P 500 Stock Returns

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## *Abstract*

The performance of the changes in some well documented predictive variables is remarkably different from that of the levels in predicting aggregated stock returns. I use the first difference of the predictive variables that precludes the problem of persistence to examine whether significant predictabilities can be found as they are in the levels of the variables. The changes of dividend yield and earnings yield does not capture any movement in aggregated stock returns, accompanied with weakened predictive power even at the levels of the variables in a recent subsample. The change of the T-bills rate consistently outperforms the level of the T-bills rate at all tested horizon and sample periods. The predictive power of the changes in term spread is significantly reliable at an annual horizon. Whereas the predictability in the level of the term spread exists in the monthly horizon and is weaker after 1990.

## 1.0 Introduction

Testing stock returns' predictability using past prices, valuation ratios, or economic variables is one of the most interesting and popular research subjects in finance and has attracted much attention from many academics and practitioners during the past thirty years. Stock returns have been found to be predictable over long horizons, this having been referred to as a "new fact in finance" (Cochrane, 1999). Significant predictive powers are found from many variables that can be easily measured. Among these predictive variables, the most widely acknowledged ones include: dividend yield, earnings yield, and various measures of interest rates. Although there are arguments claiming that the predictive power tracked from these variables implies potential market inefficiency, a more convincing interpretation is that these variables track the market risk premium which reflects time varying expected returns (Fama and French, 1989).

The conventional method of testing a variable's predictive power is to examine the regression in the form

$$r_t = \alpha + \beta x_{t-1} + \varepsilon_t \quad (1)$$

where $r_t$ is the excess return of the aggregated stock index; and $x_{t-1}$ is the lagged one period tested variables. Inspired by Sir Maurice Kendall's most influential seminar study (Kendall and Hill, 1953) that suggests it is the change, not the absolute value, that provides information for people participating in the market, stating the fact that most variables that are found to have significant predictability is due to their absolute value. This paper examines in detail whether or not changes in these variables can be used to track any movement in future stock returns.

Instead of following the traditional conventions, this article takes the first difference of some well documented predictive variables and tests their predictive power on aggregated stock returns. The variables considered in this paper include dividend yield, earnings yield, the short term t-bills rate and the term spread. In recent years, despite earlier studies' convincing evidence in both theoretical and empirical terms, the predictive power of all of these variables has been seriously doubted due to their persistent nature, complicated econometric problems and a variety of proposed test procedures make the inconsistent conclusions of current studies hard to interpret. Taking the first difference of these variables is a simplified approach that avoids the problem of persistence. Theoretically, if the dividend yield, earnings yield, short term rate, and term spread can track the time varying risk premia, the changes of these variables should be able to track the changes of the risk premium, which should lead to significant t-statistics if the predictive variables actually predict the movement of stock returns. Alternatively, referring to the Market Efficiency Theory, we argue that if a predictive variable has any indication on underpriced or overpriced stocks, the meaningful information should not be observed from the value of the variable itself without comparing to its previous value. Hence, we assert that the change of the predictive variable is appropriate to be applied in the predictive regression.

The main findings of this paper can be summarised as follows: Firstly, the first difference of the dividend yield and the earnings yield, that precludes the high persistence problem, can not capture any movement in future stock returns, with the predictive power of the dividend yield and the earnings yield, even at level, are weaker since the 1990s using a normal t-test. In addition, joint tests on the changes in dividends and the changes in stock prices cannot reject the null hypothesis of no predictability on stock returns. The evidence leans towards a conclusion that does not favour the predictive power of the dividend yield and the earnings yield.

Secondly, the slope coefficient of the t-bills rate, both at its level and first difference, are significantly different from zero over the short horizon up to three months for the level of the t-bills rate, and one year for changes of the t-bills rate. The predictive power of the first difference of the t-bills rate outperforms the level of the t-bills rate at almost all tested holding horizons and in every sample period. Nevertheless, whether the changes of the t-bills rate captures the time varying expected returns, or whether it is evidence of under reaction supported by market inefficiency, is still subject to careful scrutiny and further examination.

Thirdly, changes in term spread reliably predict future stock returns at an annual horizon in all of the tested sample periods. This result is contrary to the results at the levels of term spread, where the most consistent predictive component exists in monthly returns.

This paper is organised as follows. Section 2 is the literature review of the related research area; Section 3 describes the data and the methodology used; Section 4 shows the regression results and the statistical analysis; Section 5 interprets the results; and Section 6 concludes.

## 2.0 Literature Review

Researchers have shown long lasting interest in studying the predictability of broad stock market returns, which is not surprising in light of its importance in asset pricing studies, and in understanding time varying risk premia and market efficiency (inefficiency). Remarkably in the past three decades, statistically significant predictive powers have been found from dividend yields, earnings yields, and various measures of interest rates; such as nominal short term interest rates and term spreads, default spreads, inflation rates and changes in industrial production, among other measures. The typical regression used here is usually in the form of:

$$r_t = \alpha + \beta x_{t-1} + \varepsilon_t \tag{2}$$

where $r_t$ is the excess stock returns on the aggregated stock markets at time t, and $x_{t-1}$ is the lagged one period measure of the predictive variables. The measurement of $r_t$ has been standardised as continuously compounded excess returns $\left(Ln\left(\frac{P_t + D_t}{P_{t-1}}\right) - Ln(R_f)\right)$, or sometimes, nominal returns $\left(Ln\left(\frac{P_t + D_t}{P_{t-1}}\right)\right)$, and studies have shown no significant differences in results. The forms of the explanatory variables have never attracted serious discussion. More specifically, there are limited arguments and empirical studies on whether it is the change of the variable that tracks the movement of stock returns, or whether it is the value of the variable at its level that has predictive power. Whether or not to use the change of the variables, or the absolute value of the variables is still a decision arbitrarily made by researchers.

## 2.1 Change of the variables used in empirical studies

Researches in testing the predictability of stock returns can be tracked back as far as Kendall and Hill (1953), in which he testes the predictability of stock returns using lagged one period changes in commodity prices. Sir Maurice Kendall justified his use of the first difference instead of the original series in that "...it is the change, not the absolute value, which constitutes the fundamental element in the price determination", and found no predictability. Although Kendall and Hill (1953) do not find any predictive power of the commodity prices, Jacobsen, Marshall and Visaltanachoti (2007) revisit Kendall's study agreeing that "...it is not information itself but changes in information that should concern investors". They test the changes of the commodity prices over different intervals and find the opposite conclusion that past changes in prices of many commodities have predictive powers on aggregated stock returns. Similarly, Driesprong, Jacobsen and Maat (2007) find changes in oil prices predict stock market returns worldwide. The authors of these two studies noted that the predictability cannot be explained by time varying risk premia, but can be explained by potential market inefficiency.

The inflation rate is also a commonly tested predictive variable. It is calculated using the first difference of the Consumer Price Index (CPI), which is a measure of the change in information on prices. Instead of using the CPI as a predictive variable, many studies use the inflation rate, which measures the change in the CPI and find statistically significant results. Meanwhile, the change in the inflation rate as a predictive variable can also be seen in the literature.

Industrial production growth is a measure of change in industrial production, which is also found to have predictive power in stock returns, is another popular variable that is often tested in empirical studies. Recent studies that incorporate the inflation rate, the change in the inflation rate, or the change in industrial production, in predictive regressions include

Ferson and Harvey (1993), Pesaran and Timmermann (1995), and Cremers (2002), among others.

## 2.2 Absolute value of variables used in empirical studies

Apart from the studies that find changes in the variables predict stock returns, numerous studies find predictive power in value of the variable itself. I will specifically summarise the documented predictive variables that will be tested in this paper including dividend yield, earnings yield, short term interest rates, and term spreads. These particular variables are arguably the most powerful predictive variables and have been comprehensively studied in the literature over the past three decades.

### 2.2.1 Dividend yield and Earning Yield

Dividend yield is also known as the dividend-to-price ratio. It has been recognised as being the most successful forecasting variable for aggregated stock returns (Campbell, Lo, and MacKinlay, 1997), especially over the longer horizon of between two- to four- years. Remarkable studies in earlier years include Fama and French (1988), and Campbell and Shiller (1988a, 1988b). Fama and French (1988) use the dividend-to-price ratio to forecast returns on NYSE stocks of value-weighted and equally-weighted portfolios for holding periods from one month to four years. They find that the dividend yield explains only about 5% of the movement of monthly and quarterly stock returns, but 25% of the variance of two- to four- year returns (Fama and French, 1988).

The mispricing theory argues against market efficiency that a high dividend-to-price ratio signals that stocks are underpriced relative to its fundamentals. It is predicted that there will be higher future returns as stocks move back to fundamentals. The market efficiency theory interprets this prediction more convincingly, however, in that the dividend-to-price ratio tracks the variation in the market risk premium. In particular, the market efficiency theory states that stock prices are low relative to dividends when the market required risk premium (discount rate) and expected returns are high. Supportive evidence (Fama and French, 1989) shows that the dividend yield predicts both stock and bond returns, which signals that dividend yield tracks common risk in different markets. Fama and French (1989) argue that the trend of dividend yield tracks long term, persistent business conditions that run beyond business cycles.

Theoretically, it can be further illustrated in a discount cash flow model that the dividend yield naturally predicts stock returns. The stock price is the expected value of all future cash flows (measured by dividends), discounted from required risk premium. The relation between the dividend-price ratio and expected stock returns can be observed (although not precisely) in the well-known Gordon growth model:

$$P_t = \frac{D_{t+1}}{R - G} \tag{3}$$

Equation (3) indicates that, when dividend growth is at a constant rate (G) and the discount rate is at a constant rate (R), the current price is the next period's dividend divided by R-G.

Rearranging the equation, we find that:

$$\frac{D_{t+1}}{P_t} = R - G \tag{4}$$

Equation (4) illustrates that the dividend-price ratio tracks the discount rate and the dividend growth rate.

Campbell, Lo, and MacKinlay (1997) illustrated detailed steps transferring the constant growth model into the dynamic Gordon growth model (which is developed by Campbell & and Shiller, 1988a, 1988b) accommodating uncertain future dividends and time varying discount rates[1]. The approximation equation is expressed as:

$$log\left(\frac{D_t}{P_t}\right) = -\frac{k}{1-\rho} + E_t\left[\sum_{j=0}^{\infty} \rho^j\left(-\Delta log D_{t+1+j} + log r_{t+1+j}\right)\right] \tag{5}$$

[1] For detailed illustration see Campbell, Lo, & MacKinlay (1997), Chapter 7. Present-Value Relations, Page 254-265

where $\Delta logD$ is the log dividend growth rate; $logr$ is the log discount rate; ρ and k are linearisation parameters defined by $\rho \equiv \frac{1}{1 + \exp\left(\overline{\log\left(\frac{D}{P}\right)}\right)}$, where $\overline{\log\left(\frac{D}{P}\right)}$ is the average log dividend price ratio; and $k \equiv -\log(\rho) - (1-\rho)\log\left(\frac{1}{\rho}\right) - 1$. Even though it is a complicated formula, the relation between the dividend-price ratio, the dividend growth rate, and expected returns can be easily observed: The log dividend-price ratio is high when dividends are expected to grow slowly, or when discount rates are expected to be high. It can be a good proxy for expected future stock returns under the condition that the expected dividend growth rates are not too volatile. As the expectation term on the right hand side of Equation (5) expresses the discounted value of all returns into an infinite future, the formula explains why the log dividend-price ratio is a better proxy for longer horizon returns as indicated in the empirical studies. Thus, the dividend-price ratio should be a natural predictor of stock returns, if the model holds.

Since Fama and French (1988), the dividend price ratio is constructed using the sum of dividends paid over the previous year in the index under study, divided by the current price level of the index. The use of the summed dividends over a full year removes any seasonal component in the data, and the current price in the denominator features the most recent information in stock prices. Following Campbell and Shiller (1988a, 1988b), excess returns and dividend yield are all measured in log form.

The earnings yield is also known as earnings to price ratio. Its predictive power was discovered approximately about the same time as the dividend yield underlying theoretical notion. The market inefficiency hypothesis explains that earnings, particularly a multiyear, backward moving average of earnings measures the fundamental value of stocks, with future stock returns tend to be high (low) if stocks are underpriced (overpriced) relative to the fundamental values. Market efficiency hypothesis interprets that earnings and dividends are scaling factors for price, which reflects the variation of the risk premium. Fama and French (1988) note that as earnings are more variable than dividends, the earnings yield is a noisier measure of expected returns than is the dividend yield. Campbell & Shiller (1988a) solve this problem with earnings measured using the past ten and thirty years moving average, and find significant predictive power from earnings yields measured from the past year earnings, the past ten years moving average, and the past thirty years moving average. Earlier years' studies recognise that earnings and dividends are more like normalising factors for the stock price, which is the single most important variable in both ratios. In contrast, Lamont (1998) argues that earnings and dividends are more than just normalising variables used to scale price. In fact, he showed that current earnings and prices are both negatively correlated with future returns, while dividends are positively correlated with future returns. Lamont (1998) also interpreted that the current level of earnings reflects current business conditions, which move together with economic activities. As the risk premia is negatively correlated with the current economic condition; that is, when the economic condition is good (bad), the required rate of return is low (high), current level of earnings is, thus, negatively correlated with the risk premia and predicts expected stock returns. As stock price is also negatively correlated with expected returns; that is, when the perspective of the business condition is good (bad), then the required risk premium is low (high), which will result in a lower (higher) stock price; He claimed that earnings yields are not a better predictor than dividend yields, not because earnings are noisy, but because earnings are informative. This is because earnings yield measured by log earnings minus log prices offset the predictability of both variables. Ang and Bekaert (2007) again use t-statistics (as does Hodrick, 1992), finding only weak evidence of predictability in the earnings yield. Campbell and Yogo (2006), in contract, find predictability of the earnings yield at all data frequencies.

Despite the earlier dedicated theoretical and econometric analyses, recent studies on valuation ratios are rather controversial. The difficulties start from the persistent nature of the dividend yield (earnings yield), such that Nielson and Kim (1993) and Stambaugh (1999) questioned its predictability illustrating that when the lagged predictive variable is persistent (close to having a unit-root) and its innovations are highly correlated with returns, the regression result using the traditional t-test will typically over reject the null hypothesis of no predictability and lead to an inaccurate inference. Several studies re-examined the predictability of the dividend yield using tests that are valid, even with persistent explanatory variables. The general consent is that, after post-1952 the predictive component in the dividend yield tends to disappear. Ang and Bekaert (2007) test the dividend yield's predictability using standard errors developed by Hodrick (1992) that enables a stricter t-test to be applied to the data. In the univariate regression, they find no evidence of predictability; t-statistics are all below 1.60 for the three different holding periods for the sample period after 1952. In addition, when the dividend yield is tested in conjunction with a lagged one period short rate in the bivariate regression, the dividend yield's predictive power is significant only at the one year horizon. Campbell & Yogo (2006) create a pre-test to determine whether or not the standard t-test for the proposed predictive variables can lead to a correct inference, and propose an efficient test that can lead to a valid inference. They find that the significant predictability of the dividend yield only exists at an annual frequency if one can rule out explosive autoregressive roots.

More recently, attention has been switched to the poor out-of-sample performance of the variables and the parameter instability of the forecasting regressions. A recent issue of The Review of Financial Studies (2008, v21. N4) extensively addresses this debate on the predictability of equity premium using these variables. The poor out of sample performance of predictive variables are explored by Goyal and Welch (2008), they comprehensively studied the forecasting models documented in the extant literature both in sample and out of sample, and find that the apparent significant predictive powers of many models are only attributed from the periods of Oil Shock 1973-1975. They find that most models fail to outperform the historical mean of returns both in sample and out of sample, and the out of sample test predicts poorly not in the earlier periods but in the later periods. Regarding to dividend yield and earnings yield, they conclude poor performance both in sample and out of sample in the past 30 years. The evidence might be partly explained in Ferson Sarkissian and Simin (2003). They concern that as the returns is the sum of expected return and unpredictable noise, if the true underlying expected returns are persistent, there is a possibility of spurious relation between returns and highly correlated independent predictive variable, and if the independent variable is generated under a spurious mining process, its predictive power would expect to raise and then fail to work out of sample. However, in response to Goyal and Welch (2003, 2008)'s finding, Campbell and Thompson (2008) show that the out of sample prediction can be improved if the coefficient of the predictive regression can be imposed with theoretically justified restrictions. In addition, the forecasting instability of the valuation ratios that results from the poor out of sample is also explored by many articles, for example, Viceira (1997) tests structural break in the US stock market, Paye and Timmermann (2006) document the structural breaks in the parameter of predictive regression in a majority of international indices. Lettau and Van Nieuwerburgh (2008) propose a regime switching approach that allows the structural changes of the economy, instead of modelling the persistent changes in expected returns or valuation ratios, they model the structural changes in the mean of the valuation ratio. They find the instability of forecasting regression is attributed to changes in steady state expected returns and growth rate of fundamentals.

### 2.2.2 Short Term Interest Rate and Term Spread

Fama and Schwert (1977) is the first study to find the level of the three-month t-bills rate is negatively correlated with the expected stock returns. Since that study, many others have confirmed the predictive power of short term rates. Although the persistence problem is also a concern for short term rates, Campbell and Yogo (2006) note that a traditional t-test is valid when the regressor is short term rates, because their innovation has a low correlation with stock returns. Ang and Bekaert (2007) emphasize the significant predictive power of short term rates, and find that the short term rate enhances the dividend yields' predictive power in a bivariate regression.

Fama and French (1989) find that the term spread, measured as the difference between the Aaa yield and the one month t-bill rate, is positively correlated with stock returns, and that the predictability is significant over a short-term monthly holding horizon. They conclude that the term spread predicts stock returns because it measures short-term movements of the business cycle, and moves in the opposite direction to business conditions. In a recent study, Campbell and Yogo (2006) find that the term spread reliably predicts monthly and quarterly aggregated stock returns using post-1952 sample.

## 3.0 Data Description and Methodology

We firstly replicate the procedures described in Ang and Bekaert (2007), using the same US S&P 500 quarterly composite index data, but over a longer horizon from 1935 to 2007. As recent studies tend to suggest that these variables' predictive power is only significant over short return holding periods, we additionally include monthly frequency data for the examined variables from 1935 to 2007. The original data series includes the S&P 500 price index, the annualised S&P 500 composite dividends, the reported earnings, the 90-day t-bills rates, and Moody's Aaa corporate bond yields, which are obtained from Global Financial Data at monthly and quarterly frequencies, while the one month T-bills rates are downloaded from Kenneth R. French's world wide web home page[2] .

This paper concentrates on comparing the results between the regressions:

$$r_t = \alpha + \beta(x_{t-1}) + \varepsilon_t \quad (6)$$

and

$$r_t = \alpha + \beta(x_{t-1} - x_{t-2}) + \varepsilon_t \quad (7)$$

where the dependent variable $r_t$ is the excess return at time t for the holding period of one month, one quarter, one year, and four years, $x_{t-1}$ is the lag one period tested predictive variables; and $(x_{t-1} - x_{t-2})$ is the measure of the lag one period change of the predictive variables.

[2] Kenneth R. French home page: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ . Link for the source data: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/FF_ Research_Data_Factors.zip

## 3.1 Excess Returns

The monthly (quarterly) excess return $r_t = (r_m - r_f)$ is the difference between the continuously compounded monthly (quarterly) total return $Ln\left(\frac{P_t + D_t}{P_{t-1}}\right)$ and the continuously compounded one month risk free t-bills rate (90 days t-bill rate). The one-year and four-year excess returns are the roll over of the quarterly excess returns.

## 3.2 Predictive Variables

The examined predictive variables include the dividend yield (D/P), the earnings yield (E/P), the t-bills rate $(Tbill)$, and the term spread (TERM). All of the examined variables are lagged one period for the regressions.

### *D/P Ratio and E/P Ratio*

The D/P ratio (E/P ratio) is the dividends (earnings) summed over the past year and divided by the current price. Using the full year dividends (earnings) removes any seasonal components. Following the traditional convention, the natural logarithm is taken for both variables $\frac{D_t}{P_t}$ and $\frac{E_t}{P_t}$ and the changes of the variables $Chg(^D/_P) = \frac{D_t}{P_t} - \frac{D_{t-1}}{P_{t-1}}$ and $Chg(^E/_P) = \frac{E_t}{P_t} - \frac{E_{t-1}}{P_{t-1}}$ in the regressions.

Figure 1 shows the time series plot of the D/P ratio, the E/P ratio and the measures of the changes of these variables. The D/P and the E/P share a similar trend, with the plots confirming (Fama and French, 1989) that the D/P (E/P) reflects the prospect of business conditions that tend to persist beyond measured business cycles; It is high during the periods in which economic conditions are pessimistic and exhibit great uncertainty; for example, it persistently increases during 1930 and peaks at 1939 when World War II started, while a similar increasing trend can be found again during 1980s recession, and the early 2000 recession. The plots tend to be decreasing when the economic perspective is optimistic; for example, during the 1990s. As bull and bear stock markets are also associated with the economic, or business conditions, the plots of the D/P (E/P) is resembles a detrended plot of US stock market prices. The changes of D/P (E/P) and excess stock returns are highly negatively correlated (-0.8388 and -0.6667, as shown in Table 1), while the plots of the changes in D/P and E/P almost depict a reversed pattern of the excess stock returns. This relation is expected, as dividends and earnings tend to be persistent; If the differences of dividends are close to zero, the remaining factor in the change of the ratios (i.e. $\mathrm{Ln}(\frac{D_t}{P_t}) - \mathrm{Ln}(\frac{D_{t-1}}{P_{t-1}})$) is effectively the measure of past stock returns.

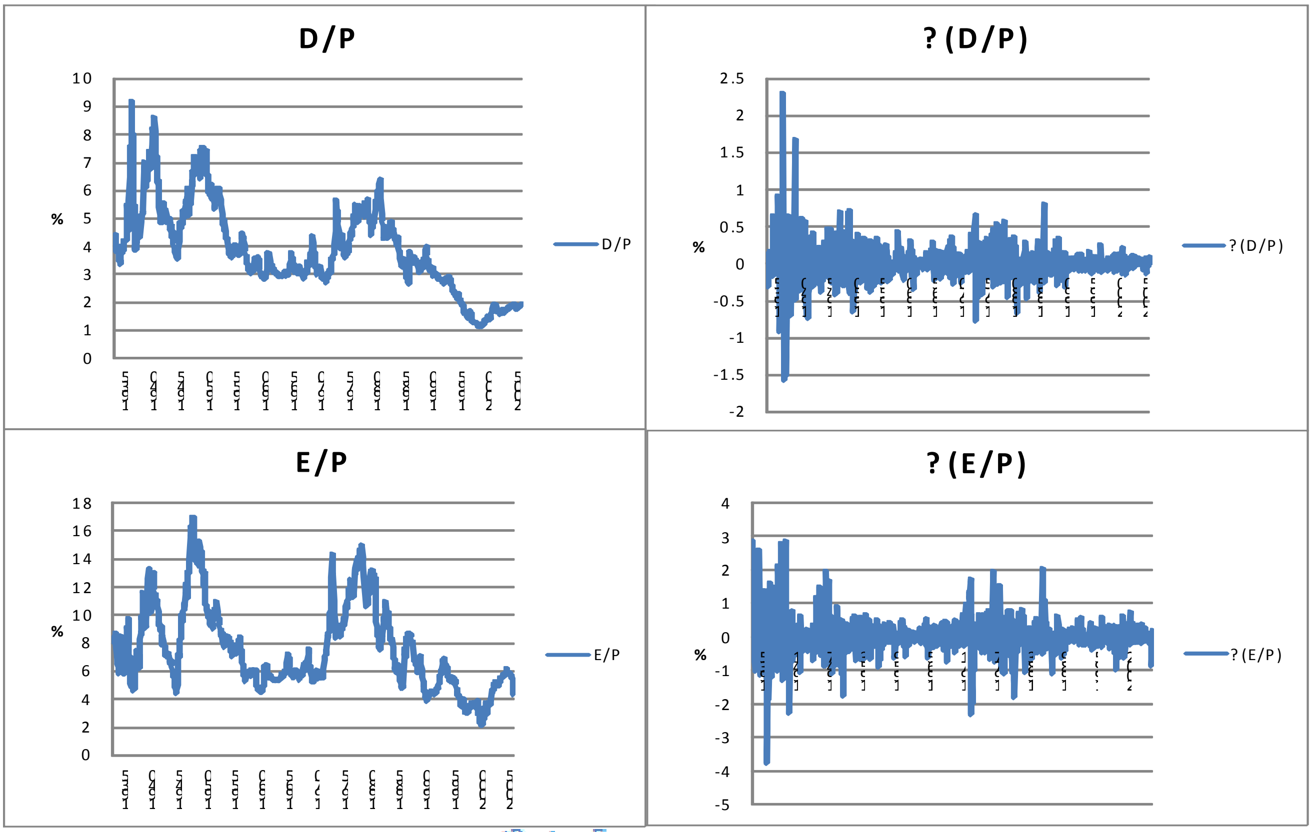


Figure 1: Time series plot of D/P, E/P and $\Delta(D/P)$ $\Delta(E/P)$ for the monthly S&P 500 index data from 1935 to 2007

| Variables | Rm-Rf | D/P | Chg(D/P) | E/P | Chg(E/P) | T-Bill | Chg T-Bill | TERM | Chg TERM |
|---|---|---|---|---|---|---|---|---|---|
| Rm-Rf | 1.0000 | -0.0492 | -0.8388 | -0.0530 | -0.6667 | -0.0882 | -0.0431 | 0.0488 | -0.0675 |
| D/P | -0.0492 | 1.0000 | 0.0829 | 0.8363 | 0.0176 | -0.1662 | -0.0201 | -0.1302 | 0.0332 |
| Chg(D/P) | -0.8388 | 0.0829 | 1.0000 | 0.0955 | 0.6152 | 0.0272 | 0.0502 | -0.0483 | 0.0462 |
| D/Chg P | 0.0336 | -0.0118 | -0.0218 | -0.0182 | -0.0146 | -0.0560 | 0.0788 | -0.0030 | -0.0948 |
| E/P | -0.0530 | 0.8363 | 0.0955 | 1.0000 | 0.0869 | 0.1428 | 0.0046 | -0.2726 | 0.0243 |
| Chg(E/P) | -0.6667 | 0.0176 | 0.6152 | 0.0869 | 1.0000 | 0.0032 | 0.0918 | -0.0298 | 0.0114 |
| E/Chg P | 0.0601 | 0.0445 | -0.0365 | 0.0520 | -0.0226 | -0.0684 | 0.0277 | 0.0144 | -0.0390 |
| T-Bill | -0.0882 | -0.1662 | 0.0272 | 0.1428 | 0.0032 | 1.0000 | 0.0594 | -0.2836 | -0.0055 |
| Chg T-Bill | -0.0431 | -0.0201 | 0.0502 | 0.0046 | 0.0918 | 0.0594 | 1.0000 | -0.2144 | -0.8499 |
| TERM | 0.0488 | -0.1302 | -0.0483 | -0.2726 | -0.0298 | -0.2836 | -0.2144 | 1.0000 | 0.1384 |
| Chg TERM | -0.0675 | 0.0332 | 0.0462 | 0.0243 | 0.0114 | -0.0055 | -0.8499 | 0.1384 | 1.0000 |

Table 1: Shows the correlation matrix between paired variables for the S&P monthly frequency data between Jan 1935 to Dec 2007. $R_m$-$R_f$ is the difference between the continuously compounded one month S&P 500 index return and the continuously compounded one month Treasury bill return. D/P (E/P) ratio is the full year summed dividends (earnings) divided by the current price level. Chg (D/P) and Chg (E/P) are the first difference of D/P and E/P ratios. T-Bill is the 90 days Treasury bills rate and Chg T-bill is the first difference of the 90 days T-bills rate. Term is the difference between the Moody's Aaa corporate bonds rate and the 90 days T-bill rate.

### *T-Bill Rate and Term Spread*

The T-Bill is the 90 day Treasury bill rate, and the ΔT-Bill is the first difference of the 90 days Treasury bill rate. The term spread is the difference between the Moody's Aaa corporate bond yield and the three-month t-bills rate, and Δterm is the first difference of the term spread. Figure 2 is the time series plots of the T-bill rates and the change in the T-bill rates for the period from 1935 to 2007. The plot shows that the T-bill rate always increases during business cycle expansions and decreases during business cycle contractions, as suggested by Fama and French (1989). The change in the T-bill is

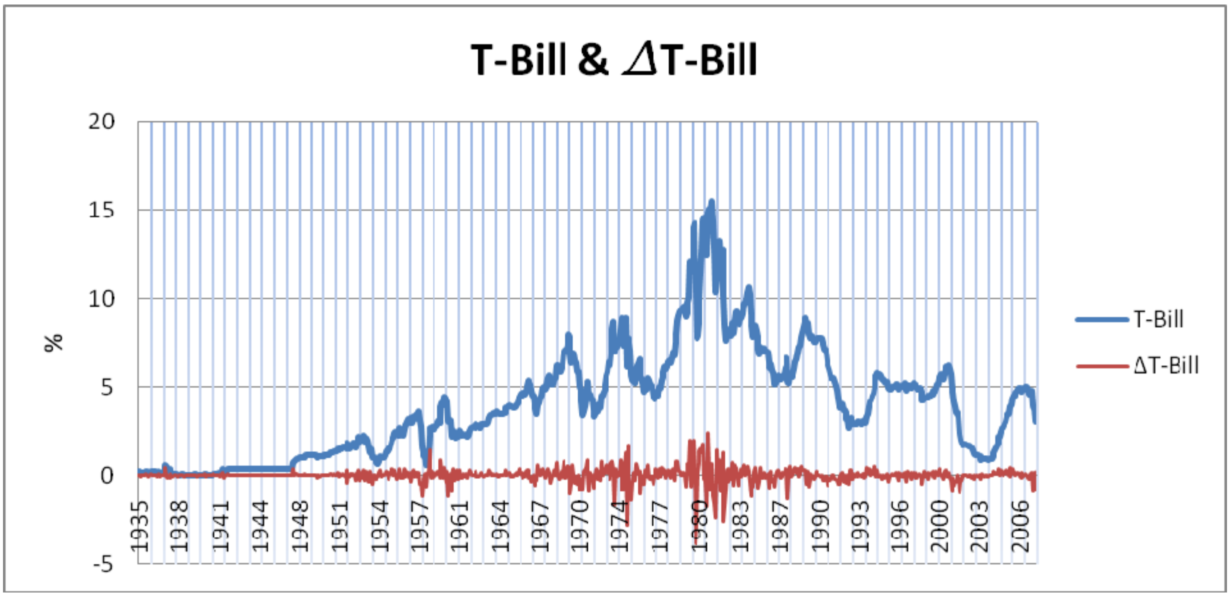


**Figure 2: Time series plots of T-bills rate and the Changes of T-bills rates for the monthly data of the 90 day Treasury bill rate for the period of 1935 to 2007.**

Dates of National Bureau of Economic Research US business cycle peaks (P) and troughs (T)[3] : May 37(P) Jun38 (T) Feb 45(P) Oct 45 (T) Nov 48(P) Oct 49 (T) Jul 53(P) May 54 (T) Aug 57(P) Apr 58 (T) Apr 60(P) Feb 61(T) Dec 69(P) Nov70 (T) Nov 73(P) Mar75 (T) Jan 80(P) Jul 80 (T) Jul 81(P) Nov 82 (T) Jul 90(P) Mar 91(T) Mar01(P) Nov 01 (T)

detrended and less persistent than the T-bill rates. It fluctuates more in periods of recessions; for example, during 1957-1958, 1974-1975, the 1980s, and the early 2000s and it is less variable when economic conditions are good; for example, during the 1990s.

[3] Sourced from the National Bureau of Economic Research website: http://www.nber.org/cycles.html#announcements

The time series plots of term and the change in term spreads are shown in Figure 3. Fama and French (1989) show that the term spread tends to be high near business-cycle troughs, and low near business-cycle peaks, as corporate bond yields tend to decrease less than t-bill rates during economic contractions and increase less during economic expansions. The pattern of Δterm tends to have a common trend with the ΔT-bill but with more fluctuation. This pattern is also indicated by the high correlation (-0.8499) between the Δterm and the

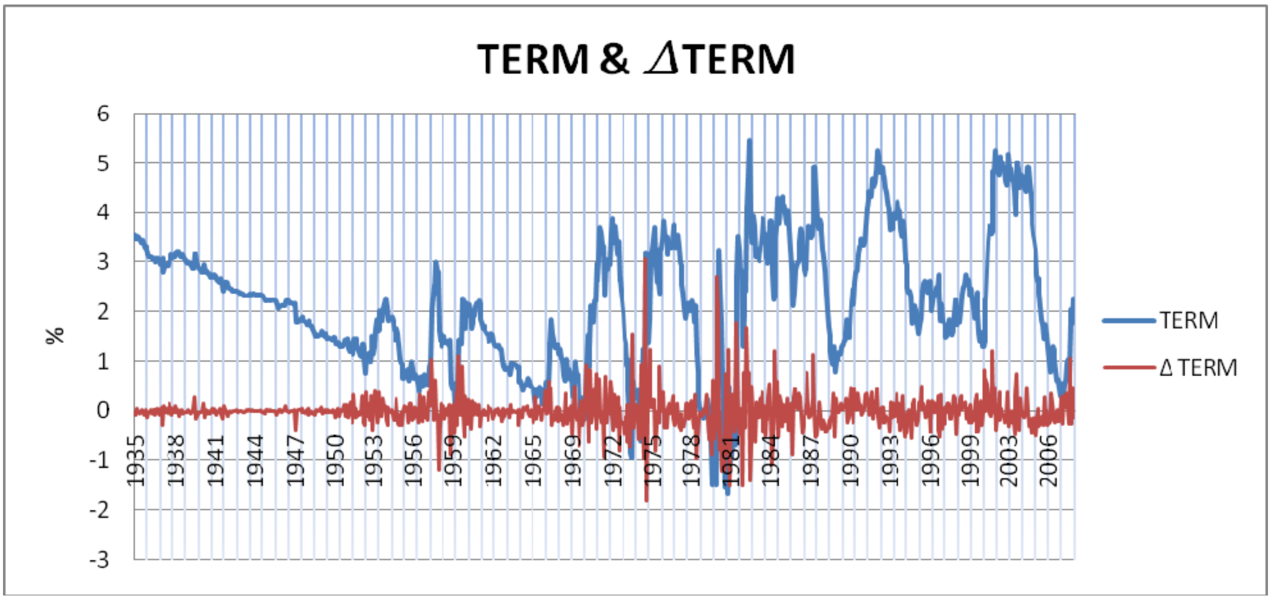


**Figure 3: Time series plots of term spreads and Changes of term spreads. The term spread is calculated using Moody's Aaa corporate bond yield minus the three monthly t-bills rate for the data period from 1935 to 2007 at monthly frequency.**

Dates of National Bureau of Economic Research US business cycle peaks (P) and troughs (T)[4] : May 37(P) Jun38 (T) Feb 45(P) Oct 45 (T) Nov 48(P) Oct 49 (T) Jul 53(P) May 54 (T) Aug 57(P) Apr 58 (T) Apr 60(P) Feb 61(T) Dec 69(P) Nov70 (T) Nov 73(P) Mar75 (T) Jan 80(P) Jul 80 (T) Jul 81(P) Nov 82 (T) Jul 90(P) Mar 91(T) Mar01(P) Nov 01 (T)

[4] Sourced from the National Bureau of Economic Research website: http://www.nber.org/cycles.html#announcements

ΔT-bill shown in Table 1. As the monthly variation of Moody's Aaa corporate bond yield is relatively smaller than the variation of the T-bill rate, it is expected that the change of the T-bill rate will capture most of the component in the Δterm.

### *Summary Statistics and Autocorrelation*

The following table (Table 2) shows the summary statistics of the examined data series for the period from 1935 to 2007[5]. All of the summary statistics are annualised, and calculated based on data of monthly frequency. The mean (standard deviation) of the excess return is annualised by multiplying by 12 ($\sqrt{12}$ ). The mean and standard deviation are expressed as % value. The dividend and the earnings yields are calculated using the past year's total dividends (earnings) divided by the current price.

As can be seen in the table, the D/P, the E/P, the T-bills rate and the term spread are all highly persistent variables with autocorrelation ranging from 0.96 to 0.99. The Phillips-Perron unit root test fails to reject the null of a unit root for the D/P, the E/P and the T-bill rate. In contrast, no unit root problem exists in the first differences of the variables. Testing the predictive power at the first difference of these variables is a straight forward remedy to deal with the possible non-stationarity problem. Following Kendall and Hill's (1953) insight, the theoretical validity of using the changes of the predictive variables is justified.

[5] The summary statistics are very similar with the figures shown in Ang and Bekaert (2007) that the used same dataset, but at quarterly frequency, and over a shorter period.

| Summary Statistics | Sample: S&P 500 Data, Jan 1935-Dec 2007, Monthly Frequency | | | | |
|---|---|---|---|---|---|
| | Rm-Rf | D/P | Chg(D/P) | T-Bill | Chg T-Bill |
| Observations | 876 | 876 | 876 | 876 | 876 |
| Mean | 6.90079 | 3.85155 | -0.00252 | 3.97191 | 0.00353 |
| Std. Dev. | 15.77161 | 1.55662 | 0.24043 | 3.10967 | 0.41617 |
| Autocorrelation | -0.01072 | 0.98806 | -0.07065 | 0.99104 | 0.12366 |
| Unit Root (Phillips-Perron test) | -29.9307*** | -2.183597 | -31.6422*** | -2.2623 | -25.9174*** |
| | | E/P | Chg(E/P) | TERM | Chg TERM |
| Observations | | 876 | 876 | 876 | 876 |
| Mean | | 7.46689 | -0.00073 | 2.16643 | -0.00169 |
| Std. Dev. | | 2.96942 | 0.50729 | 1.29203 | 0.36527 |
| Autocorrelation | | 0.98593 | -0.07042 | 0.96001 | 0.00583 |
| Unit Root (Phillips-Perron test) | | -2.5090 | -32.0949*** | -4.4367*** | -29.5499*** |

**Table 2: Shows the summary statistics of the examined data series at monthly frequency from January 1935 to December 2007, with the mean and standard deviation expressed at % values. All of the summary statistics are annualised; the mean of the excess return (Rm-Rf) is annualised by multiplying by 12, and the standard deviation of the excess return is annualised by multiplying $\sqrt{12}$. D/P and E/P are computed using past year's total dividends and earnings divided by the current price. Chg (D/P) and Chg (E/P) are the first difference of the D/P and the E/P ratio. The T-bill is the annualised 90 day t-bills rate, and the Chg T-bill is the first difference of the T-bill. Term is the difference between Moody's Aaa corporate bond and the 90 day t-bills rate, with Chg term being the first difference of TERM. Phillips-Perron unit root test is applied for each individual variable, with the null hypothesis being that the tested variable has a unit root. *** indicates a significance level at 1%.**

## 4.0 Predictive Regressions

I divided the sample into four periods: The full sample period from 1935 to 2007; and three sub-sample periods, 1935 to 1990, 1952 to 1990, and 1952 to 2007. The sub-samples of 1952 to 1990 and 1952 to 2007 avoid the effect of the period of the 1930s and 1940s, when the Reserve Bank pegged interest rates. The sub-samples of 1935 to 1990 and 1952 to 1990 confirm the earlier years' results on the predictive power of dividend yields and earnings yields.

The excess returns' predictability is examined for the holding periods of one month, one quarter, one year, and five years. Tables 3 and 4 summarise the correlation coefficients and t-statistics of the univariate regressions, using lagged one period predictive variables and the first difference of the lagged one period predictive variables as the regressors. The dependent variables are the annualised, continuously compounded excess returns of the different holding horizons. All regressions are adjusted using Newey-West standard errors.

## 4.1 Results

### Dividend yield and Earnings Yield

With the exception of the sample period 1952 to 2007, the correlation coefficients of the dividend yield shown in Table 3 Column 3 are significant at all frequencies and in all sample periods. Consistent with earlier evidence, the magnitudes of predictability are stronger over longer horizons than over shorter horizons. The predictive component is stronger for the sub-sample periods before the 1990s, and the predictive power is weaker in the sub-period 1952 to 2007. In fact, the predictability disappears for the monthly and quarterly horizons over the period of 1952 to 2007. It is important to note, however, that the longer horizon predictability consistently shown in Column 3 may be subject to a small sample bias and, as dividend yield is highly persistent, the traditional t-test will lead to a biased inference that over rejects the null hypotheses of no predictability even after adjusting the serial correlation with Newey-West standard errors. The correlation coefficients of the first difference of the dividend yield shown in the fourth column is disappointing; not a single t-statistic is higher than 1.96, and even the signs of the correlation coefficients in different sample periods and holding horizons are inconsistent. As a result, there is no evidence of predictability in the changes of dividend yields, as the t-tests fail to reject the null hypothesis of no predictability. The regressions of earnings yields tell a similar story. The slopes of the levels of earnings yields are marginally significant over one-year horizons, and are significant at the 1% to 5% level over five-year holding horizons at all of the sample periods. Whereas the changes of earnings yields are insignificant, all of the slopes are lower than 1.9 standard errors from 0, and the signs of the slopes are inconsistent. This inconsistency is also seen in the changes of dividend yields results.

| S&P 500 Data | | Log Dividend yield | | Log Earnings Yield | |
|---|---|---|---|---|---|
| Sample Period | Horizon | $Ln(D/P)_{t-1}$ | $Ln(D/P)_{t-1}$- $Ln(D/P)_{t-2}$ | $Ln(E/P)_{t-1}$ | $Ln(E/P)_{t-1}$- $Ln(E/P)_{t-2}$ |
| 1935-2007 | Month | 0.0912 | 0.0484 | 0.0957 | 0.2394 |
| | | (2.052)** | (0.101) | (2.016)** | (0.717) |
| | Quarter | 0.0958 | -0.2377 | 0.0869 | -0.2347 |
| | | (2.014)** | (-1.105) | (1.692)* | (-1.335) |
| | Annual | 0.1006 | 0.0029 | 0.1022 | -0.0211 |
| | | (2.465)** | (0.028) | (2.506)** | (-0.178) |
| | 5 Years | 0.0902 | 0.0333 | 0.0771 | 0.0294 |
| | | (5.492)*** | (0.713) | (3.561)** | (0.738) |
| 1952-2007 | Month | 0.0822 | -0.3662 | 0.0778 | -0.1843 |
| | | (1.623) | (-0.769) | (1.325) | (-0.473) |
| | Quarter | 0.0917 | -0.2717 | 0.0864 | -0.2396 |
| | | (1.612) | (-1.230) | (1.388) | (-1.158) |
| | Annual | 0.0960 | 0.0130 | (0.092) | 0.0345 |
| | | (2.049)** | (0.105) | (1.908)* | (0.269) |
| | 5 Years | 0.0936 | 0.0510 | 0.0735 | 0.0428 |
| | | (5.678)*** | (0.937) | (3.387)*** | (0.824) |
| 1935-1990 | Month | 0.2079 | -0.0449 | 0.1051 | 0.0639 |
| | | (2.426)*** | (-0.081) | (1.555) | (0.154) |
| | Quarter | 0.2238 | -0.3241 | 0.0649 | -0.3354 |
| | | (2.727)*** | (-1.282) | (1.051) | (-1.474) |
| | Annual | 0.2371 | 0.0212 | 0.0844 | -0.0911 |
| | | (4.185)*** | (0.173) | (1.667)* | (-0.684) |
| | 5 Years | 0.1788 | 0.0111 | 0.0649 | 0.0111 |
| | | (8.032)*** | (0.212) | (2.179)** | (0.192) |
| 1952-1990 | Month | 0.2561 | -0.7070 | 0.0700 | -0.9080 |
| | | (2.345)*** | (-1.208) | (0.819) | (-1.811)* |
| | Quarter | 0.2978 | -0.4410 | 0.0986 | -0.3782 |
| | | (2.740)*** | (-1.760) | (1.501) | (-1.838)* |
| | Annual | 0.2901 | 0.0526 | 0.1408 | -0.0906 |
| | | (3.777)*** | (0.340) | (3.005)*** | (-0.667) |
| | 5 Years | 0.2020 | 0.0193 | 0.1159 | -0.0107 |
| | | (9.024)*** | (0.284) | (4.624)*** | (-0.232) |

**Table 3: Reports the correlation coefficients and t-statistics of the univariate regressions. The dependent variables are the annualised monthly, quarterly, annual, and five-years continuously compounded excess returns. The predictive variables are the lagged one period log dividend yield (D/P), the first difference of the lagged one period log dividend yield, the lagged one period log earnings yield (E/P), and the first difference of the lagged one period earnings yield. Newey-West standard errors are used for calculating the t-statistics. *p<0.10 **p<0.05 ***p<0.01**

| S&P 500 Data | | T Bill Rate | | Term | |
|---|---|---|---|---|---|
| Sample Period | Horizon | T $Bill_{t-1}$ | $T\text{-}Bill_{t-1}$-$T\text{-}Bill_{t-2}$ | $Term_{t-1}$ | $Term_{t-1}$-$Term_{t-2}$ |
| 1935-2007 | Month | -0.0147 | **-0.1497** | 0.0294 | 0.1169 |
| | | (-2.241)** | **(-2.738)*** ** | (1.891)* | (1.670)* |
| | Quarter | -1.2582 | **-3.3708** | 0.0229 | 0.0004 |
| | | (-1.813)* | **(-1.917)*** | (1.446) | (0.013) |
| | Annual | -0.9100 | **-3.0800** | 0.0170 | **0.0244** |
| | | (-1.519) | **(-2.513)*** ** | (1.318) | **(2.031)** ** |
| | 5 Years | -0.5979 | -0.7105 | 0.0097 | 0.0052 |
| | | (-1.997)** | (-1.580) | (1.728)* | (0.976) |
| 1952-2007 | Month | -0.017799 | **-0.1504** | 0.0306 | 0.1147 |
| | | (-2.603)*** | **(-2.733)*** ** | (2.005)** | (1.621) |
| | Quarter | -1.4667 | **-3.4101** | 0.0245 | 0.0019 |
| | | (-1.808)* | **(-1.901)*** | (1.551) | (0.068) |
| | Annual | -0.9587 | **-2.9653** | 0.0177 | 0.0252 |
| | | (-1.370) | **(-2.456)*** ** | (1.419) | (2.067)** |
| | 5 Years | -0.7300 | -0.7148 | 0.0106 | 0.0052 |
| | | (-2.061)** | (-1.591) | (2.000)** | (0.988) |
| 1935-1990 | Month | -0.0167 | **-0.1519** | 0.0541 | 0.1246 |
| | | (-2.452)*** | **(-2.638)*** ** | (2.635)*** | (1.577) |
| | Quarter | -1.4344 | -3.4271 | 0.0436 | 0.0064 |
| | | (-1.935)* | (-1.794)* | (2.284)** | (0.211) |
| | Annual | -1.0407 | **-3.6501** | 0.0311 | **0.0332** |
| | | (-1.605) | **(-2.827)*** ** | (1.911)* | **(3.033)*** ** |
| | 5 Years | -0.6019 | **-0.8877** | 0.0060 | **0.0091** |
| | | (-1.949)* | **(-1.958)*** | (0.869) | **(1.769)*** |
| 1952-1990 | Month | -0.0223 | **-0.1522** | 0.0590 | 0.1222 |
| | | (-3.262)*** | **(-2.664)*** ** | (2.893)*** | (1.539) |
| | Quarter | -1.8488 | -3.4253 | 0.0481 | 0.0083 |
| | | (-2.179)** | (-1.780)* | (2.609)*** | (0.275) |
| | Annual | -1.1917 | **-3.5006** | 0.0330 | **0.0342** |
| | | (-1.535) | **(-2.782)*** ** | (2.166)** | **(3.111)*** ** |
| | 5 Years | -0.7326 | **-0.8801** | 0.0070 | **0.0092** |
| | | (-1.857)* | **(-1.955)*** | (0.989) | **(1.808)*** |

**Table 4: Reports the correlation coefficients and t-statistics of the univariate regressions. The dependent variables are the annualised monthly, quarterly, annual, and five-years, continuously compounded excess returns. The predictive variables are the lagged one period T-bills rate, the first difference of the lagged one period T-bills rate, the lagged one**

**period term spread and the first difference of the lagged one period term spread. Newey-West standard errors are used for calculating the t-statistics. *p<0.10 **p<0.05 ***p<0.01**

## T-Bills Rate and Term Spread

Table 4 reports the regression results of the T-bills rates and the term spread. The levels of the T-bills rates are negatively correlated with stocks' excess returns, with the most significant slope coefficients captured in monthly returns, all slopes are more than 2 standard errors from 0. Quarterly frequency and the five-year frequency data are marginally significant. The slope coefficients of the annual data are insignificant over all of the sample periods. There are signs that the short term predictive power of the T-bill rate is stronger for the sample periods after 1952, which is expected as the Reserve Bank pegged interest rates during the 1930s and 1940s. More striking evidence is the strengthened predictive power in the changes of T-bill rates; both the magnitude and t-statistics of the slope coefficients at changes of the T-bill rate are larger than the corresponding slope coefficients at the levels of the T-bills rate for all holding horizons and all sample periods and, as the changes of the t-bill rate are not subject to the persistence problem, I am convinced that the changes of the t-bill rate is a better predictor for further stock returns.  Another important piece of evidence is that, contrary to the results on levels of the T-bill rate, the most significant predictive components in the changes of the T-bill rate are seen in the annual returns data; the slope coefficients are all above -3 and the t-tests are reliably significant at the 1% level. This means a 1% decrease in the change of annualised T-bill rate will lead the risk premium to increase 3%.  The predictive power of the monthly returns is also reliably significant at the 1% level, but with a smaller magnitude of around -0.15 for the tested sample periods.

The performance of the term spread, both at its level and at the first difference, is less prominent than that of the T-bill rate. Column 5 of Table 4 shows that the slopes of the term spread are consistently significant over short horizons, but that the predictability weakens after the 1990s.  Analogous with the changes of the T-bill rate, the changes of the term spread have the best explanatory power over the one-year horizon. All of the slopes are more than 3 standard errors from 0, however, the magnitude is small, at only around 0.03.

## 5.0 Interpretation

### Dividend yield and Earnings Yield

The changes of the dividend yield and the earnings yield that preclude the problem of persistency do not capture any movement in the stock returns.

Recall the relation between the dividend yield and the discount rate shown in the log linear approximation Equation (5)

$$log\left(\frac{D_t}{P_t}\right) \approx c + E_t\left[\sum_{j=0}^{\infty}\rho^j(-\Delta log D_{t+1+j} + log r_{t+1+j})\right],$$

where $c$ and $\rho$ are linearisation constants. If the dividend yield tracks the discount rate r, then the first difference of the dividend yield should be able to track the change of discount rates. Does the lack of predictability of the first difference of the dividend yield suffice as an inference of no predictability on the levels of the dividend yield? Is it possible that the predictive component in stock prices, that is often claimed in the literature, is offset when taking the first difference of the dividend yield? More specifically, the first difference of the natural log dividend yield is constructed as

$$Ln(D_t) - Ln(P_t) - \left(Ln(D_{t-1}) - Ln(P_{t-1})\right) = (Ln(D_t) - Ln(D_{t-1})) - (Ln(P_t) - Ln(P_{t-1})).$$

If there are predictive components in both the dividends and stock prices, taking the first difference of the dividend yield may offset the predictability of the variable. In this section, I examine the individual predictability of changes in the dividends (effectively continuously compounded the dividend growth rate) and changes in the stock prices (continuously compounded stock returns), and construct a test that examines the joint predictability of changes in dividends and changes in stock prices using a bivariate regression. The regression results are presented in Table 5, with quarterly frequency sample data used in the regressions, as companies report their dividends on a quarterly basis. Changes of dividends do not appear to have any predictability in stock returns. Even through the test-statistics are significant at 5% level for the sub-sample period from 1952 to 1990 in the univariate and bivariate regressions, the inconsistent signs of the slope coefficients in both univariate regression and the bivariate regression suggest the significant t-statistics are only obtained by chance. There is, apparently, marginal predictive power for changes in stock prices in the bivariate regression for the simple period before 1952, but predictability is generally insignificant. These results are supportive for market efficiency hypothesis, and are consistent with earlier studies in testing the market efficiency hypotheses with past stock returns.

| S&P 500 Quarterly Frequency Data | Univarate Regression | | Bivariate Regression | | |
|---|---|---|---|---|---|
| Sample Period | $Ln(Dividend_{t-1})$- $Ln(Dividend_{t-2})$ | $Ln(Price_{t-1})$- $Ln(Price_{t-2})$ | $Ln(Dividend_{t-1})$- $Ln(Dividend_{t-2})$ | $Ln(Price_{t-1})$- $Ln(Price_{t-2})$ | $R^2$ |
| 1935-2007 | 0.0692 | 0.0832 | 0.0873 | 0.0988 | 0.0105 |
| | (0.405) | (1.591) | (0.523) | (1.832)* | |
| 1952-2007 | -0.2962 | 0.0570 | -0.2826 | 0.0540 | 0.0065 |
| | (-0.980) | (1.026) | (-0.961) | (0.978) | |
| 1935-1990 | 0.0236 | 0.1082 | 0.0513 | 0.1261 | 0.0161 |
| | (0.131) | (1.778)* | (0.770) | (2.018)** | |
| 1952-1990 | -0.7080 | 0.0890 | -0.6693 | 0.0741 | 0.0262 |
| | (-2.172)** | (1.376) | (-2.115)** | (0.249) | |

**Table 5: Column 2 and 3 report the slope coefficients and the t-statistics of the first difference of continuously compounded dividends and the first difference of continuously compounded stock prices in the univariate regressions regressed in the form of $r_t = \alpha + \beta(Ln\,X_{t-1} - Ln\,X_{t-2}) + \varepsilon_t$, Column 3,4 and 5 report the slope coefficients, t-statistics, and $R^2$ of the first difference of continuously compounded dividends and the first difference of continuously prices regressed in the form of $r_t = \alpha + \beta_1(Ln\,D_{t-1} - LnD_{t-2}) + \beta_2(Ln\,P_{t-1} - LnP_{t-2}) + \varepsilon_t$. The dependent variables $r_t$ is continuously compounded quarterly excess returns. The dividends are annualised quarterly observed dividends. Newey-West standard errors are used for calculating the t-statistics. *p<0.10 **p<0.05 ***p<0.01**

Changes of the dividend yield cannot capture any movement of in the stock returns. In the bivariate regression, the joint test neither cannot reject the null of no predictive power for the changes of dividends or for the changes of prices in stock returns. The discovery of the dividend yield (earnings yield)'s predictive power on stock returns leads to the consequent development of the dynamic dividend discount model and the time varying risk premia in the early 1990s. The highly persistent nature of the dividend yield (earnings yield) has, however, become a large hurdle to any further development of this theory. Recent studies apply a variety of sophisticated econometric approaches and still address the problem inconclusively. Taking the first difference is a simple approach to eliminate unit roots. I cannot conclude that the lack of predictive power in changes of the dividend yield can lead to the conclusion that the dividend yield does not predict stock returns, the evidence does, at least, give us some insight into dividend yield (earnings yield), and provide some supportive evidence on why the dividend yield may not predict stock returns.

### T-bills Rate and Term Spread

The first difference of the T-bills rate is consistently, negatively correlated with future excess stock returns of up to one year holding horizons. As always, there are two explanations for the predictability. If the market is efficient, it is possible that the changes of the T-bills rate could be a proxy that captures the changes in the underlying economic fundamentals that affect time varying risk premium. It is convincing that the level of the T-bills rate is related to business conditions, as illustrated in Figure 2, whereby the short term rate is expected to be high during periods in which business conditions are optimistic, and low during periods in which business conditions are pessimistic. Similarly, the short term interest rate is directly related to governmental monetary policy that is consistently adjusted according to current economic conditions intended to maintain a good balance between economic growth and inflation rate. Thus, changes of the T-bills rate may also be a proxy positively correlated with business conditions, while the stock required rate of returns (risk premium) is negatively related to business conditions, the T-bills rate and the changes in the T-bills rate are negatively correlated with excess stock returns.

If the market is inefficient, an increase (decrease) in the T-bills rate indicates a stringent (loose) money supply is bad (good) news for the equity market, a predictable decrease (increase) in stock returns would indicate that the market is inefficient and under-reacts to the news. Schwert (2003) suggests, however, that anomalies often seem to disappear, reverse, or attenuate, once they are documented in the literature. This is because practitioners can implement strategies to take arbitrage profits that eliminate the documented market inefficiency. The negative correlation between the short term rate and stock returns is documented as early as (Fama & Schwert, 1977), as the correlation is still statistically significant subject to the test over different sample periods, it is hard to assume that the correlation is due to the market under-reaction to the news. In addition, the strong predictive power over a one year horizon is also a defence against market inefficiency.

Term spread has always been claimed as a suitable proxy for future interest rates, and is positively correlated to business conditions. The regression results at the level of the term spread show that the predictive power is weaker and is marginally significant at the 5% to 10% level only at the monthly return horizon. However, the slop coefficients of the changes of the term spread that precludes persistence problem are, however, generally unremarkable. Nevertheless, an exception is seen regarding the significant predictive power at an annual horizon. As suggested earlier, the changes of the term spread and the changes of the T-bills rate are highly correlated at -0.8499; It might be worthwhile to examine that how much of the predictability is contributed from this correlation.

## 6.0 Conclusion

This paper examines the predictive power of the first difference of some well documented predictive variables, including the dividend yield, the earnings yield, the short term T-bills rate, and the term spread. The advantage of using the first difference instead of the levels of these predictive variables is that the first difference precludes the persistence problem of these predictive variables. Preceding studies argue that these variables track the time varying risk premium of stock returns. The first difference of these variables is then expected to be able to track the changes of the time varying risk premium.

The performance of the changes of these tested variables is remarkably different from that of the levels. The first difference of the dividend yield and the earnings yield can not predict any movement in future stock returns, while joint tests on the changes in dividends and the changes in stock prices also cannot reject the null hypothesis of no predictability on stock returns. The evidence leans towards a conclusion that does not favour the predictive power of the dividend yield, or that of the earnings yield. Nevertheless, the evidence provided in this paper alone may not suffice to reject the dividends (earnings) yield's predictability on future stock returns. The evidence does, at least, give us some insight into dividend yield (earnings yield), and provides some supportive evidence on why the dividend yield may not predict stock returns.

The striking evidence found in the T-bills rate is that, the T-bills rate, both at its level and at its first difference, can reliably track the movement of stock returns. The predictive power of the first difference of the T-bills rate outperforms the level of the T-bills rate at almost all tested holding horizons and in every sample period. Whether the changes of the T-bills rate captures the time varying expected returns, or whether it is the evidence of under-reaction supported by market inefficiency, this is still subject to careful scrutiny and requires further examination. It will be interesting to determine whether or not the changes of the T-bills rate are correlated with other variables that are recognised as measures of the business conditions. If such correlation exists, the changes of the T-bills rate tracks the time varying risk premia will be more convincing. In addition, event studies might be appropriate in examining whether or not there is an under-reaction to the changes of T-bills rate, as supported by the market inefficiency hypothesis.

Contrary to the results at the levels of the term spread, where the most consistent predictive component exists in monthly returns, the changes in term spread reliably predict future stock returns at an annual horizon in all of the tested sample periods.

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