Swedish Stock Returns and the Cyclically Adjusted Price to Earnings Ratio

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Content

1.Introduction

Over the past 30 years, the Swedish equity market has shown an annualized real return of 9,6%.[1] No other asset class provided equal return potential during the same time frame. Hence, it should come as no surprise that a frequently asked question ever since the establishment of the first stock index is the following: is it possible to calculate "the intrinsic value of the index"?[2] In finance, intrinsic value refers to the value of an asset determined through fundamental analysis. For one to answer the question, one has to study aggregate fundamental variables for the particular stock market index. The attitude towards whether it is possible to estimate such an intrinsic value of a stock index through fundamental analysis has changed back and forth amongst economic researchers.

During the Fifties and Sixties the attitude towards this problem changed drastically. It was at this time the Efficient Market Hypothesis (EMH) grew forth, based on empirical evidence that stock prices follow random walks.[3] According to this theory, stock markets are informationally efficient, that is, one cannot "beat the market" on a risk-adjusted basis, given all the information available at the time of the investment. The implication is that the intrinsic value of a stock would be simply its market price. It would be impossible to forecast future stock prices based on valuation ratios, and any other available information for that matter.[4] However, recent and past financials bubbles have resulted in researchers casting more and more doubts on the hypothesis' truth. In one of the most famous books ever written on the stock market, we find Robert Shiller stating: "We are unsure whether the market levels make any sense, or whether they are indeed the result of some human tendency that might be called irrational exuberance".[5] This was right before the IT-crash in 2000, at the time, U.S equities were at all-time high valuation. Since 1988, Campbell and Shiller have directed their attention on average earnings as predictor of future stock prices.[6] In his book, Irrational Exuberance, Shiller demonstrates the appropriateness of using a Cyclically Adjusted Price Earnings ratio (CAPE) when predicting future long-run returns of the

[1] Macrobond platform + own calculations
[2] Myers and Swaminathan (1999)
[3] Samuelsson (1965)
[4] Campbell and Shiller (1988a)
[5] Shiller (2000, pp 14.)
[6] Campbell and Shiller(1988b)

market. His test is quite satisfactory in the case of the U.S market. The study concludes that CAPE alone manages to explain 40% of the variance of 10-year real returns.[7] CAPE is a valuation ratio that puts the current market price in relation to either a 10-year or 5-year inflation-adjusted moving average of aggregate earnings. Simply put, CAPE measures whether an equity market's value is high or low in relation to its adjusted earnings level.

During the same years, Lander and Graham, suggested an alternative way of predicting future stock market returns.[8] Their theory was based on the assumption that many investors are constantly making the choice between stock and bond purchases. As the yield on bonds hikes, they would expect a correspondingly increase in stock returns, and conversely as bond yields decline. Given this assumption they try to determine whether stocks are appropriately valued based on analysts' anticipations of future earnings and returns on alternative investments.[9] In a study by Ali Darrat in 1990, this hypothesis is empirically confirmed. Darrat concludes that lagged monthly changes in the long-term interest rate have a positive, statistically significant impact on monthly changes in stock prices.

Over the years, the predictive power of more and more variables has been tested. The common conclusion is that it is hard to find variables capable of explaining large fractions of future return variance. However, two interesting variables, other than CAPE and interest rates, whose predictive power for future stock returns has turned out statistically significant are the Price-to-Book Ratio(P/B-ratio) and the Purchasing Manager's index (PMI). In an empirical study by Helwege, Laster and Cole, it is clinched that equities on the U.S. market tend to perform poorly when the price-to-book ratio is high.[10] Furthermore, a recent study by Johnson and Watson documents a positive, statistically significant relationship between changes in PMI and stock returns, even after controlling for macroeconomic factors.

The aim of this paper is to see if it is possible to disprove, or at least provide evidence contrary to, the Efficient Markets Hypothesis and the Rational Choice Theory, by finding a statistically significant relationship between the CAPE ratio and future returns on the Swedish equity market. Furthermore, to investigate if one may strengthen an eventual

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[7] Campbell and shiller (1988a)
[8] Lander et al.(1997) Graham (1962)
[9] Graham (1962)
[10] Helwege, Laster, Cole (1995)

relationship by adding more relevant variables. The paper focuses attention on the Swedish stock market to see whether the evidence found for the U.S. is applicable to the Swedish market. Based on this purpose, two relevant questions have been shaped: Is it possible to find a statistically significant relationship between CAPE and the succeeding returns on the Swedish equity market, and is this relationship stronger for long-term returns? May the explanatory power of a model including CAPE and future returns be strengthened by adding secondary regressors? The additional explanatory variables included in the analysis are: long and short interest rates, the purchasing managers' index and the price-to-book ratio, but the main focus will be put on CAPE.

2.Theoretical Framework

Financial economics is a highly empirical discipline. Financial markets are not just inventions of theoretical abstraction, they thrive in practise where they play a crucial role in the global economy. Few theories that tackle the act of stock market prediction have been constructed. One amongst these few is the well-known Efficient Markets Hypothesis.

A generation ago the Efficient Markets Hypothesis was widely accepted by financial researchers.[11] As previously mentioned, it was generally believed that all financial markets were extremely efficient in reflecting available information about individual stocks. The argumentation was that new public information spreads very quickly and is incorporated in prices of securities instantly. For this reason, neither technical analysis, nor fundamental analysis would help investors achieve returns greater than those an average of all constituents included in the index generates, without taking on more risk.

The Efficient Market Hypothesis is associated with the idea of a “Random Walk”. In a simple form the random walk model suggests that day-to-day changes in the price of a stock should have a mean value of zero. The underlying logic is the following, if it is known that a capital gain can be made by buying a share on day *t* and selling it for an expected profit the next day, efficient speculation will drive up the current price. Similarly, no one would like to hold a stock if it is expected to depreciate. Thus, the model asserts that the price of a stock should evolve according to the following stochastic difference equation:

$$\mathbf{Y_{t+1} = Y_t + \varepsilon_{t+1}}$$

Where $\mathbf{Y_t}$ = the price of a stock at time *t,* and $\boldsymbol{\varepsilon_{t+1}}$ = a random disturbance term that has an expected value of zero.[12] The equation suggests that prices fully reflect all available information.

Another appropriate theory to consider is the Rational Choice Theory (RCT), which underlies much of the EMH. It has long been agreed that traditional economic theory assumes rational behaviour. For example, a requirement for the Efficient Markets Hypothesis to hold is that individuals act rationally. All publicly available information has to be rationally incorporated

[11] Malkiel (2003)
[12] Enders(2010)

in stock prices. To act rationally means that all action is fundamentally rational in character and that all individuals calculate the likely costs and benefits of any actions before deciding what to do.[13] The theory suggests that aggregate social behaviour results from the behaviour of individual actors, each of whom is making their individual decisions. However, according to the Arbitrage Pricing Theory (APT) only a small fraction of investors has to act rationally in order for prices to move back to their "motivated" value. The theory asserts that two assets that bear the same level of risk cannot sell at different prices. If this occurs, an arbitrageur will sell short the asset in the high-priced market and purchase a similar asset in the low-priced market. This will eventually bring the price back to its "motivated" value. Obviously, this requires the possibility to short sell assets, which is not always the case. However, according to this theory, financial bubbles occur due to a human attribute known as herd behaviour. Herd behaviour is the tendency for individuals to mimic the actions, in this case irrational actions, of a larger group. Individually, most people would not make the same choice. Thus, it is argued that investors who normally act in a rational manner are pulled into this irrational herd behaviour, which eventually results in a financial bubble.

Historians who have examined the behaviour of financial markets over time have challenged the assumption of rationality. Such historians argue that previous financial bubbles are due to this tendency of irrational herd behaviour amongst investors. This calls for a reminder of Shiller's famous quote: "We are unsure whether the market levels make any sense, or whether they are indeed the result of some human tendency that might be called irrational exuberance".[14]

By finding a statistically significant relationship between the explanatory variables and future stock returns, I will be able to disprove, or at least provide evidence strongly contrary to, the EMH and the RCT. Such a relationship implies that available information may be used to exploit excess profit opportunities, the market is therefore not reflecting available information efficiently. A sensible explanation for why the market is failing to reflect information efficiently, might be as Shiller neatly puts it, "due to some human tendency that might be called irrational exuberance". Hence, this paper is written in contradiction to the EMH and the RCT.

[13] Scott (1995)
[14] Shiller(2000)

3.Previous Research

After 1980, the relationship between firm-level characteristics and stock returns is extensively investigated. The findings of the literature suggest that there is a significant linkage between fundamental factors and stock returns. The section below dedicates itself to a literature review of such findings.

Shiller and Campbell have for a long time, and in various papers, challenged the previously mentioned theories. According to them, when stock market valuation ratios such as Price-to-Earnings, Price-to-Dividends and Price-to-Book ratios, are at extreme levels by historical standards, it is natural and completely logical to assume that stock prices will not drift too far away from their normal relationships to fundamental indicators. They argue that if one accepts the premise of this mean-reversion theory, further discussed by Hillebrand(2003),[15] valuation ratios will continue to fluctuate around their historical means in the future, and not get stuck at one extreme value far from the historical range. Hence, when a valuation ratio is at an extreme level either the numerator or denominator must move in a direction that brings the ratio back to a more normal level. They further argue that something must be forecastable, either the numerator or denominator. If prices relative to earnings are at historically high levels, it must be possible to forecast some form of unusual growth in earnings or decline in prices, or a combination of both. Through a Monte Carlo experiment in 1998, Shiller and Campbell manage to conclude that the mean-reversion takes place not because of changes in earnings, but changes in prices. This truly indicates that the P/E valuation ratio actually should be a valuable predictor of future stock market prices, which strongly challenges the Efficient Markets Hypothesis and the Rational Choice Theory. [16]

In a paper written in 1996, Shiller also argues that the use of one year's earnings in the price-earnings ratio is an unfortunate convention, recommended by tradition and convenience rather than any logic.[17]In the purpose of examining such ratios, one should use an average of earnings of not less than five years. Earnings in any one year tend to be affected by short-run considerations, that cannot be expected to continue.[18] The entire purpose of a moving

[15] Hillebrand (2003)
[16] Shiller and Campbell (1998)
[17] Shiller (1996)
[18] Graham and Dodd (1934)

average is to correct for such short-run considerations, by ensuring that earnings are averaged over more than one earnings cycle.[19]Clear empirical evidence confirming CAPE's superiority over the traditional P/E ratio is provided in a paper written by Shiller in 1988. In this study, Shiller estimates two univariate econometric models consisting of CAPE and the conventional P/E-ratio as regressors, and the future 10-year return as dependent variable. The ultimate conclusion is that the traditional P/E ratio manages to explain 29% of the variance of future 10-year returns, whereas CAPE explains over 40% of this variance.[20] This, along with the findings discussed in the last paragraph, shall give the first motivation for the conduction of this thesis, and a presentation of logical reasons why it is sensible to presuppose that a "price to smoothed earnings" ratio is a useful tool in predicting Swedish stock returns. The hypothesis is that the cyclically adjusted price-to-earnings ratio is a solid predictor of future stock returns in Sweden. The estimated coefficient should be negative, a higher price in relation to smoothed earnings should affect future returns negatively. By assuming this, the "mean-reversion theory" is accepted and the EMH along with the RCT are indirectly rejected. Estimations will be executed on both 5-year and 10-year moving averages of earnings, this enables us to determine the effects of an increase in the number of years used to compute the moving average of earnings. My belief is that a longer moving average should be advantageous, hence result in a larger fraction of the variance being explained.

Studies by Shiller, Fama and French, and Summers also provide empirical evidence that the outlook for the market that is to be forecasted should be a long-run one.[21] In Shiller's study, for example, CAPE explains only 4% of the variance of future one-year returns, whereas the same CAPE explains over 40% of the variance of future 10-year returns. The fact that long-horizon returns are more forecastable may be contrary to one's expectations, one might have thought that it is easier to forecast into the near future than into the distant future, but the data contradict such intuition. These empirical findings have inspired to me run my regressions on future 1, 2 and 5-year returns, with the hypothesis that a larger fraction of

[19] Star Capital (2016)
[20] Shiller (1988)
[21] Shiller(1996), Fama and French (1988), Summers (1986)

variance should be explained as the return-horizon increases. Unfortunately, lack of available data prevents me from examining even longer return-horizons.

The following part is meant to serve as a motivation for my choice of additional explanatory variables by providing previous findings in favour of their predictive power. First of all, I want to see how the estimated equations are affected when long and short interest rates are included. Theoretical analysts, such as Graham and Lander, suggest that total stock returns should be strongly affected by changes in long term interest rates. It is generally believed that investors are making a choice between stock and bond purchases. The idea is that stocks should outperform the risk-free rate over the long-term, through the so called "equity risk premium". It is therefore assumed that as the yield on bonds advances, investors would be expected to demand a correspondingly higher return on stocks, and conversely as bond yield declines.[22]This theory is empirically confirmed by Darrat in 1990, he considers a monthly price index from the Toronto stock exchange for the period January 1972 to February 1987 and achieves a positive relationship between Canadian stock returns and long-term interest rates.[23] I will try to confirm and extend Darrat's findings by also including short interest rates. I justify the addition of short rates primarily given the fact that long-term bond returns are driven almost exclusively by their starting yield.[24][25] My hypothesis is that an increase in long and short interest rates today should have a positive impact on future stock returns, hence positive coefficients are to be assumed.

Economic theory behind how PMI and the P/B ratio should impact future stock market returns is, to the author's knowledge, non-existent. However, previous empirical studies have investigated the relationship, in particular between the P/B ratio and future returns. These papers have all established statistically significant negative relationships between P/B ratios and stock market returns.[26]In a paper written in 1995 by Helwege, Laster and Cole, we find empirical evidence that U.S. equities tend to perform poorly when the P/B-ratio is high, suggesting that a higher P/B ratio induces lower future stock market returns.[27]Further evidence pointing to the relevance of the P/B ratio for returns of U.S. stocks has been

[22] Graham (1962) Lander (1997)
[23] Darrat (1990)
[24] Starting yield in this case refers to the short interest rate.
[25] Carlson (2016)
[26] Fama (1992), Stattman (1980), Laster, Cole, Helwege(1995)
[27] Helwege,Cole,Laster (1995)

provided by multiple authors. All findings confirm the negative association between the P/B-ratio and stock returns.[28] Consequently, it is sensible to believe that the theory of mean reversion, discussed above, is applicable to the P/B ratio. Stock prices should simply not drift too far away from their relationship to aggregate book values.

The PMI on the other hand is a rather recent invention. Previous research on how it affects future stock returns is therefore weak. One paper written in 2011 by Johnson and Watson does however tackle the issue. The authors consider monthly PMI data from January 1973 to December 2009, they document a positive, statistically significant relationship between U.S. stock returns and changes in PMI. The established relationship is however fairly volatile over time, which obviously reduces its credibility.[29]Also, basing a solid motivation for why it is sensible to include the PMI on one empirical paper is hardly enough. My own curiosity about the variable, and my belief that it has bigger impact upon future stock returns than previously thought, constitute a big part of the unified justification of its appearance in the analysis. The variable is a leading fundamental indicator of future economic activity and induces economic optimism. Over the years, I have noticed that each time the media releases positive PMI figures, the stock market tends to react positively. Hence, the formulated hypothesis is that the PMI should have a positive impact on future Swedish stock returns.

[28] Stattman(1980), Rosenberg et al.(1985), Chan et al.(1991)
[29] Johnson and Watson (2011)

4.Criticism of the CAPE approach

Indeed, the previous sections have dedicated themselves to depict the CAPE ratio in a glamorous fashion, but for the sake of achieving objectiveness it is relevant to also highlight potential pitfalls associated with the variable. Criticism of CAPE has increased in recent times. Looking at the S&P500 index over the past 20 years, CAPE has only fallen below its long-term average of 16.6 9 times. Furthermore, the average CAPE since 1995 is about 60% higher than the long-term average. This is the cause for recent suspicions that perhaps altered payout ratios, new accounting standards or other structural changes are making current and historical CAPEs less comparable. These points constitute the base for today's criticism of CAPE.[30]

Payout ratios have changed significantly recent years. In the period 1881-1950, S&P500 companies distributed approximately 65.6% of their earnings in the form of dividends. Since 1990, this fraction has declined to approximately 39.4%. Many companies today have increased their use of share buybacks as a tax-advantage substitute for dividends. Also, lower payout ratios gives companies more room for investments, which indirectly could increase earnings per share growth.[31] The stronger the permanent earnings growth, the further CAPE moves away from its historical mean. Basically, the lower dividend yield seen lately could partially explain the higher CAPE that we have witnessed since 1990.

The second point of criticism is the impact of new accounting standards. CAPE is calculated on the basis of reported earnings. Earnings were for a long time considered the best measure of a company's economic situation. But, in the US accounting policies have become increasingly conservative, which has led to a situation where reported earnings may underestimate the real earnings potential of a company. However, as this study deals with Swedish earnings, we only have to consider Swedish accounting policies. It is therefore important to distinguish this point of criticism between countries and their respective policies.

[30] Star Capital (2016)
[31] Cole, Laster, Helwege(1995)

In addition to these points, the comparability of CAPE can also be limited by structural changes in the index composition. The presumption that a 10- or 5 year moving average of earnings adequately reflects the earnings potential of a market assumes a stable market structure. This assumption fails to hold from time to time, especially in times of structural change or in smaller countries.[32] I will try to explain to make this clearer. A stock market index consists of a certain amount of companies, the amount of companies that constitutes the index may vary substantially over time. The implication is that, at one time the index may reflect aggregate data from two companies, whereas 5 years later it may reflect data from 10 companies, or vice versa. However, this problem is not as prominent for larger, more solid countries, such as Sweden. Strong fluctuations of CAPE in such countries are mainly due to other structural changes such as depression or war.

[32] Star Capital(2016)

5.Data and Methodology

The approach discussed in this essay is based on the advances achieved in recent years by various authors. A quantitative econometric approach, both univariate and multivariate, will be enforced with specific focus on index returns predictability with respect to CAPE. I refer to CAPE5 when a 5-year moving average of earnings was used in the calculation, and CAPE10 when a 10-year moving average was used. Both ratios will be assessed. Due to the lack of available data, I will perform my estimations on monthly data to increase the number of observations. Monthly data spanning the period 1994-06-01 to 2016-12-01 are used in the estimations. Stock prices are measured by MSCI OMX Large Cap, which captures the market capitalization weighted return of all constituents included in the index. Earnings data is measured by MSCI OMX Large Cap, and is earnings per share data adjusted to index.[33] Adjusted to index means that the weighted average of all companies' earnings within the index has been transformed into an earnings index. All series will be inflation-adjusted using CPI with base year 2016.

Inspired by previous authors, prices are converted into log gross returns, also known as compound returns. The reason for doing that is mainly because these returns are easier to model, as they tend to be independent and identically distributed thus time invariant.[34] Another good property is that the compounded return aggregates across time. The procedure is done in the following way: real price of the stock index, measured the first day of each month, at the beginning of time period *t*, is denoted $\mathbf{P_t}$. Real log gross return on the index held from the beginning of time *t* to *t+1* can be written as

$$\mathbf{H_t = Log(P_{t+1}) - Log(P_t)}$$

The realized log gross return over *h* months, from the beginning of month *t* to the beginning of month *t+i* is

$$\mathbf{H_{t,h}} = \sum_{i=0}^{h-1} Ht + i$$

[33] MSCI Index Calculation Methodology(2012)
[34] Meucci (2008)

The approach is to regress cumulative log gross returns on some explanatory variables that are know in advance (at the start of month *t*), these variables will be used to try to predict movements in future 1-year, 2-year and 5-year cumulative log gross returns. These future long-term returns are calculated simply by summing the log gross returns according to the formula above. After this, I will begin the quantitative empirical work by regressing CAPE5 and CAPE10 on these future real stock returns on the Swedish equity market (at the start of month *t*). CAPE5 and CAPE10 are calculated in the following way

$$\mathbf{CAPE5_t = Log(P_t/(E_t+...+E_{t-5})/5) = Log(P_t) - Log(E_t+...+E_{t-5})/5}$$

$$\mathbf{CAPE10_t = Log(P_t/E_t+...+E_{t-10})/10) = Log(P_t) - Log(E_t+...+E_{t-10})/10}$$

Where $\mathbf{E_t}$ = Aggregate earnings at time *t*. The regression models will allow us to conclude if the fraction of variance explained increases as the number of years used to compute the returns increases, which previous studies suggest. It will also allow us to conclude if the fraction of variance explained increases as the length of the moving average of earnings in the CAPE ratio increases. The reason for not looking at even longer return periods is, as previously mentioned, due to the lack of available data.

So far we have only considered forecasting returns from just CAPE. It is sensible to assume that other explanatory variables also have an impact on future stock market returns. The following set of explanatory variables, other than CAPE, will be examined.

Long/short interest rates: The reason for including long/short interest rates is because numerous previous authors have found significant relationships between stock market returns and interest rates.[35] The theory and empirical findings on how interest rates should affect stock returns are further discussed in the section over previous research. Based on the findings discussed in that section, my hypothesis is that long and short interest rates should generate positive coefficients. Logged 10-year governments bonds will serve as a proxy for

[35] Carlson(2016), Darrat(1990), Verbeek(2015)

long interest rates and logged 3-month government bonds for short rates. Both will be assessed in real terms.

Purchasing Managers' Index (PMI): The relationship between PMI and stock market returns is relatively unexplored. PMI is considered by many to be a leading fundamental indicator of future economic activity.[36] PMI is a diffusion index that measures the monthly survey responses of purchasing managers relating to five aspects of their business: production levels, new orders from customers, inventories, employment levels and supplier deliveries. My belief is that PMI is a better indicator of future stock market returns than one may think. It makes sense to believe that an increase in PMI, which indicates future economic expansion, will affect future stock market returns positively. Consequently, my hypothesis is that the PMI should generate a positive coefficient. Empirical evidence in favour of this hypothesis is found in the section over previous research.

Price to book ratio (P/B ratio): The last variable is the P/B ratio. The P/B ratio measures a firm's book value of common equity to its market value. The P/B ratios is a well-known and commonly used fundamental indicator. The reason for including this ratio is mainly, as previously discussed, because various authors have found statistically significant relationships between the P/B ratio and future stock market returns, but also due to the fact that it is a common valuation ratio for financial analysts to monitor.[37] The hypothesis is that the P/B ratio should generate a negative coefficient in the regression analysis, a higher P/B-ratio today should lead to lower future stock returns.

Exactly how the ultimate regression models will take shape is impossible to determine at this point, all that can be said is that both univariate and multivariate models will be estimated. The final model specification has to be based on statistical tests of the included variables. The assumption that the dependent and the independent variables are stationary is crucial for the properties of standard estimation and testing procedures. A variable is said to be stationary when its mean, variance and covariance do not depend upon time. For testing this I will conduct augmented Dickey-Fuller tests (ADF-test) on all variables.

[36] Johnson and Watson (2011)
[37] Fama (1992), stattman (1980)

Furthermore, it is of relevance to conduct residual analysis for detection of potential autocorrelation and/or heteroskedasticity, which imply that the error terms in the model are no longer independently and identically distributed. In such cases, the OLS estimator may still be unbiased or consistent, but may be relatively inefficient and no longer have the Best Linear Unbiased Estimator (BLUE) property. In order to judge whether the OLS estimators in my models are misleading due to heteroskedasticity I will apply the Breusch-Pagan test (BP-test). As for autocorrelation, the Serial Correlation LM-test will be used.

Another requirement for the OLS estimator to be unbiased and consistent is that all explanatory variables are exogenous. If this fails to hold the explanatory variables are said to be endogenous, i.e. correlated with the error term. To detect this problem, I will run correlation tests on each explanatory variable and the respective error term in all models. Furthermore, the multivariate models will work as robustness tests for CAPE. The purpose of a robustness check is to see how a core variable, in this case CAPE, behaves when more explanatory variables are added.

Lastly, we have the problem of multicollinearity. Multicollinearity is used to describe the problem when an approximate linear relationship among the explanatory variables leads to unreliable regression estimates. To avoid this problem, it is important to investigate the correlation between all explanatory variables.

6.Empirical Results

Visualization of CAPE5 and CAPE10

Before beginning the quantitative work, a quick visualization of CAPE5 and CAPE10 together with the long-term development of the Swedish equity market will be provided. Starting with CAPE5. From 1999 to 2016 CAPE5 was frequently between 7 and 35, with a mean of 20.7 (Figure 1). Since 1999, CAPE5 has exceeded its long-term mean 3 times: in 2000, between 2004-2007 and 2014 (grey area in the chart). Each time, significant decreases, or crashes, followed shortly after. And conversely, after periods when CAPE5 was found significantly lower than the long-term average, as in 2002 and 2009, significant price growth followed over the subsequent 5 years. The periods where high CAPEs resulted in significant price decreases are depicted with the arrows in figure 1 and 2.

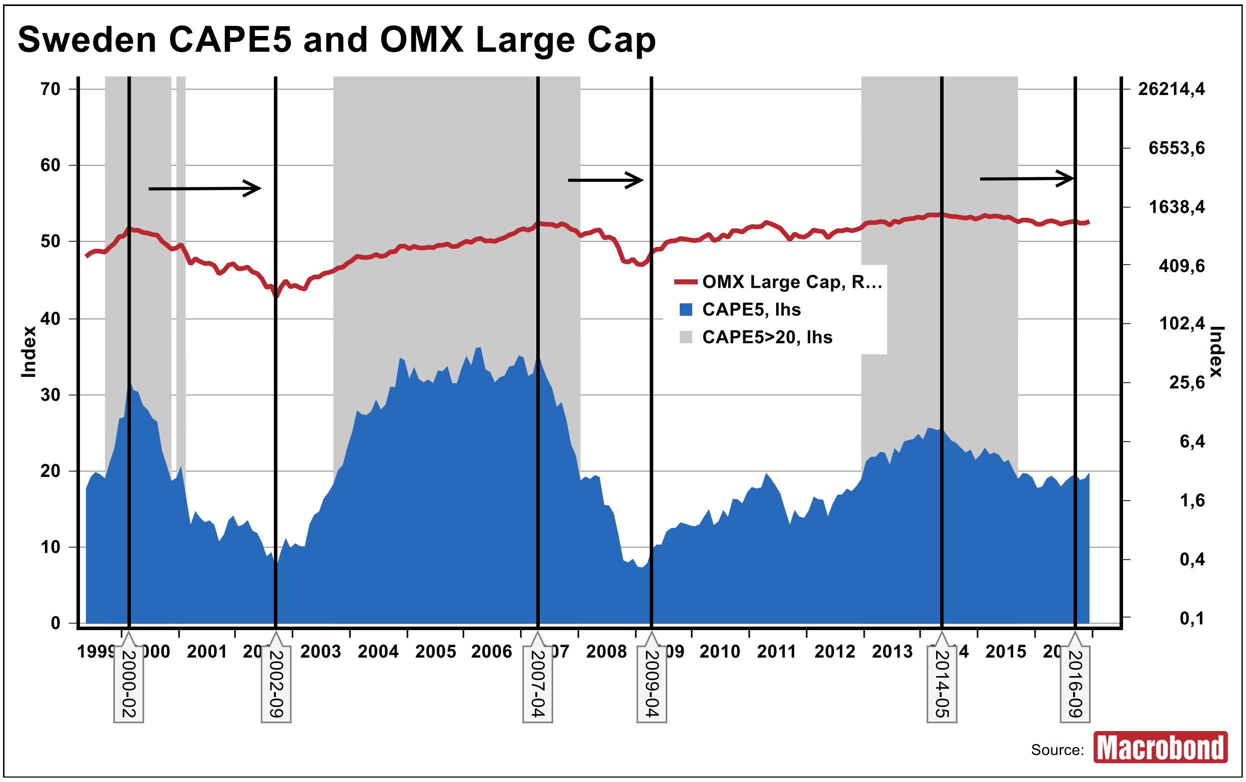

Figure 1

In figure 2 I have replaced CAPE5 with CAPE10. The first thing to notice is that the history of data reaches back only to 2004, instead of 1999. Furthermore, we observe that CAPE10 fluctuates less than CAPE5. From 2004 to 2016 CAPE10 was frequently between 11 and 35, with a mean of 20.3. Finally, we can conclude from the chart that high CAPE10 indicates low future returns, while low CAPE10 indicates above-average returns in the long-term, as was the case also for CAPE5. Looking at the diagrams, it is hard to come away without a feeling that there appears to be a distinct relation. In other words, the hypothesis that CAPE10 and CAPE5 are good indicators of Swedish future stock market returns holds true from a visual perspective. The following step is to see if it is possible to conclude that this relationship is statistically significant.

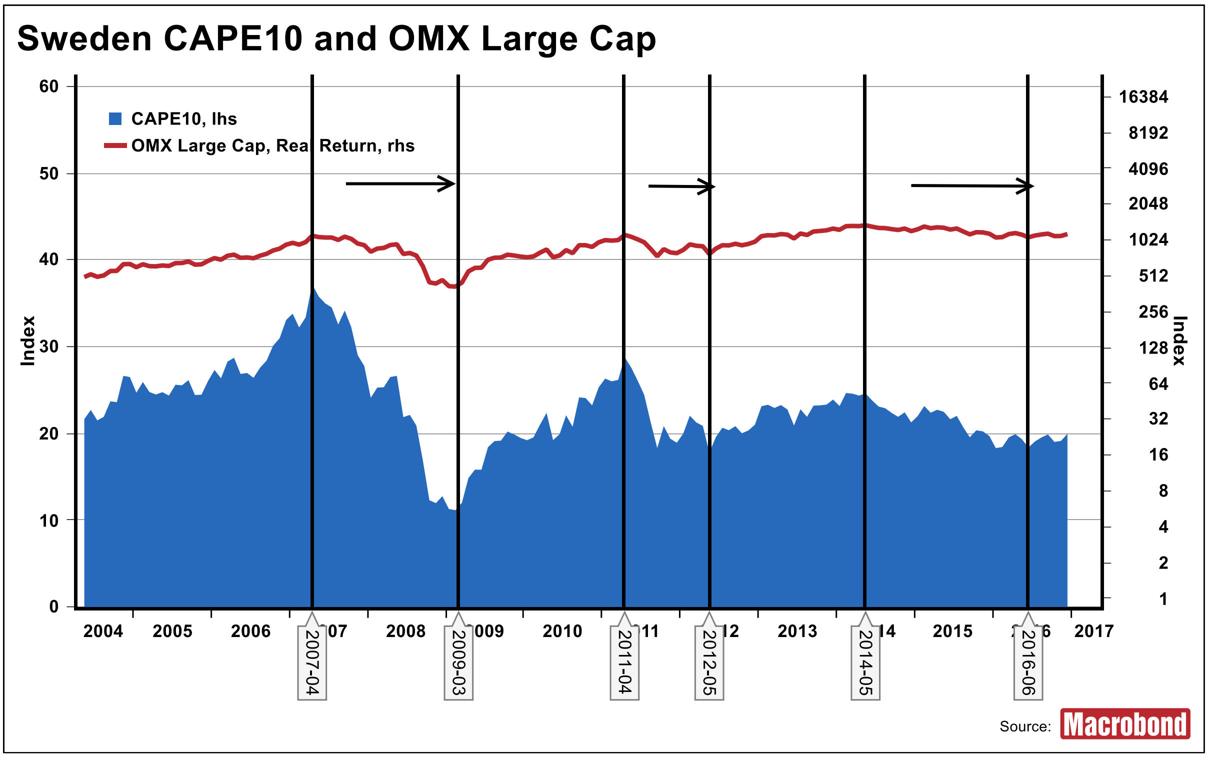

Figure 2

Econometric analysis

We will begin the empirical econometric analysis by investigating the time-related behaviour of each variable's mean, variance and covariance, that is, to see whether the variables are stationary or not. For this I make use of the ADF-test, where the null hypothesis states that the concerned variable has a unit root. Note that all variables have been transformed by the natural logarithm function. The test results are documented below.

CAPE5 (CAPE5) – t-stat: -2.30, P-value: 0.17. The null hypothesis cannot be rejected on the conventional 5% level. The variable is however difference stationary.

CAPE10 (CAPE10) – t-stat: -1.95, P-value: 0.30. We cannot reject the null hypothesis on the conventional 5% level. The variable is however difference stationary.

PMI (PMI) – t-stat: - 6.62, P-value: 0.000. The null hypothesis is rejected, the variable is stationary in levels.

10-year government bond (10YRATE) – t-stat: 1.50, p-value 0.99. We cannot reject the null hypothesis. However, the variable is difference stationary.

3-month government bond (3MRATE) – t-stat: -2.08, P-value: 0.25. We cannot reject the null hypothesis. The variable is however difference stationary.

P/B ratio (PB) – t-stat: -1.92, P-value: 0.32. We cannot reject the null hypothesis on the conventional 5% level. The variable is however difference stationary.

Compounded return of the subsequent year (1YRETURN) – t-stat: -2.68, P-value: 0.0773. We cannot reject the null hypothesis on the conventional 5% level. The variable is however difference stationary.

Compounded return of the subsequent 2 years (2YRETURN) – t-stat: -2.78, P-value: 0.0621. We cannot reject the null hypothesis on the conventional 5% level. The variable is however difference stationary.

Compounded return of the subsequent 5 years (5YRETURN) – t-stat: -2.66, P-value: 0.082. We cannot reject the null hypothesis on the conventional 5% level. The variable is however difference stationary.

These tests indicate that CAPE5, CAPE10 and all dependent variables are non-stationary in levels, but first difference stationary. The arising problem is that I cannot run my estimations in levels given the fact that it would result in “spurious regression”. But, before committing entirely to first difference models, the interesting case of cointegration has to be tested. Cointegration arises when the dependent and independent variables are non-stationary in levels, but the error term in the relationship between them is stationary. The Engle-Granger tests was applied to test for cointegration without success. Thus, all models will undergo first difference transformations, it is the only way forward. It should be noted that the procedure of differencing to achieve stationarity for analysing the relationship between stationary variables results in a loss of valuable long run information in the data. By running our models in first differences we will obtain the short run elasticities, the first difference of a logarithmic variable corresponds to its growth rate. Also, keep in mind that when we model differences the intercept disappears. Because the constant term in a model affects all values of the dependent variable in the same way, taking the difference eliminates it from the equation. For the purpose of easier interpretation, all explanatory variables will undergo first difference transformations. Consequently, our models will only be able to tell us how a monthly percentage change in an explanatory variable today affects the monthly relative change between compounded returns today and compounded returns 1, 2 and 5 years into the future. This information is still very useful for determination of future returns and may be used as a reference point for investments.

Furthermore, the interest rates will be lagged in some models as it makes sense to believe that it takes time for the stock market to fully react to changes in long and short rates. The optimal lag length for the interest rates has been found through a correlation test between the subsequent returns and various past values of the interest rates.

Regression CAPE5 and the subsequent year

We will begin by regressing future one year returns on CAPE5. After this, all explanatory variables will be added to the model. The procedure is then applied to all return horizons, for both CAPE5 and CAPE10.

$$\Delta 1YRETURN_t = -0.93\Delta CAPE5_t + \varepsilon_t \qquad \textit{(Model 1.0)}$$

R^2=0.46 Adj.R^2=0.46

$$\Delta 1YRETURN_t = -0.85\Delta CAPE5_t - 0.09\Delta PB_t - 0.05\Delta 10YRATE_{t-6} - 0.06\Delta PMI_t + \varepsilon_t$$

(Model 1.1)

R^2=0.47 Adj.R^2=0.46

CAPE5 is statistically significant in both models. The 3-month interest rate has been left out of model 1.1 due to the risk of multicollinearity. The 3-month and 10-year rates are too strongly correlated. Due to this, the 3-month rate will hereinafter be left out of all models. All additional variables in model 1.1 are statistically insignificant.

Regression CAPE5 and the subsequent 2 years

$$\Delta 2YRETURN_t = -0.88\Delta CAPE5_t + \varepsilon_t \qquad \textit{(Model 1.2)}$$

R^2=0.48 **Adj.R^2=0.48**

$$\Delta 2YRETURN_t = -0.71\Delta CAPE5_t - 0.06\Delta PMI_t - 0.19\Delta PB_t - 0.077\Delta 10YRATE_t + \varepsilon_t \qquad \textit{(Model 1.3)}$$

R^2= 0.49 **Adj.R^2= 0.48**

CAPE5 is statistically significant in both models. None of the additional variables are statistically significant in model 1.3.

Regression CAPE5 and the subsequent 5 years

$$\mathbf{\Delta 5YRETURN_t = -1.04\Delta CAPE5_t + \varepsilon_t} \qquad \textit{(Model 1.4)}$$

R^2=0.67 **Adj.R^2=0.67**

$$\mathbf{\Delta 5YRETURN_t = -0.82\Delta CAPE5_t - 0.28\Delta PB_t - 0.14\Delta PMI_t - 0.003\Delta 10YRATE_{t-6} + \varepsilon_t}$$

(Model 1.5)

R^2= 0.69 **Adj.R^2= 0.68**

CAPE5 is statistically significant in both models. Both CAPE5 and the PB-ratio are statistically significant in model 1.5. The PMI and the interest rate remain statistically insignificant.

Regression CAPE10 and the subsequent year

$$\mathbf{\Delta 1YRETURN_t = -0.96\Delta CAPE10_t + \varepsilon_t} \qquad \textit{(Model 1.6)}$$

R^2= 0.48 **Adj.R^2= 0.48**

$$\mathbf{\Delta 1YRETURN_t = -1.09\Delta CAPE10_t + 0.22\Delta PB_t - 0.07\Delta PMI_t - 0.0110\Delta YRATE_{t-6} + \varepsilon_t}$$

(Model 1.7)

R^2=0.49 **Adj.R^2=0.48**

CAPE10 is statistically significant in both models. None of the additionally added variables are statistically significant in model 1.7.

Regression CAPE10 and the subsequent 2 years

$$\Delta 2YRETURN_t = -0.96\Delta CAPE10_t + \varepsilon_t$$ *(Model 1.8)*

R^2= 0.49 **Adj.R^2= 0.49**

$$\Delta 2YRETURN_t = -0.76\Delta CAPE10_t - 0.29\Delta PB_t - 0.18\Delta PMI_t - 0.0210\Delta YRATE_t + \varepsilon_t$$

(Model 1.9)

R^2=0.52 **Adj.R^2=0.50**

CAPE10 is statistically significant in both models. All additionally added variables remain statistically insignificant in model 1.9.

Regression CAPE10 and the subsequent 5 years

$$\Delta 5YRETURN_t = -1.04\Delta CAPE10_t + \varepsilon_t$$ *(Model 2.0)*

R^2= 0.66 **Adj.R^2= 0.66**

$$\Delta 5YRETURN_t = -0.83\Delta CAPE10_t - 0.28\Delta PB_t - 0.16\Delta PMI_t - 0.06\Delta 10YRATE_t + \varepsilon_t$$

(Model 2.1)

R^2=0.69 **Adj.R^2=0.68**

CAPE10 is statistically significant in both models. None of the secondary variables are statistically significant.

7.Diagnostic Checks

All models have survived thorough residual diagnostics. The BP-test and the Serial Correlation LM-test were executed on the complete set of models. The test results allow us to conclude that no signs of heteroskedasticity or autocorrelation are present in any of the models. Plots of the residuals were carried out as a tool in checking for outliers, no outliers were observed in these plots. On the basis of these settlements, it is justified to assert that our residuals are at least approximately white noise. Furthermore, all explanatory variables are proven exogenous, that is, none of them show any sign of being correlated with the error term. However, the 3-month interest rate had to be removed from the models, due to the problem of multicollinearity. Multicollinearity should consequently not constitute any concern no more.

The Ramsey RESET test was enforced for detection of possible model misspecification. The Regression Error Specification Test posits the null hypothesis of linearity against a general alternative hypothesis of nonlinearity. If the residuals from a linear model are independent, which we have concluded that they are, they should not be correlated with the regressors in the estimated equation or with the fitted values. Hence, a regression of the residuals on the fitted values should not be statistically significant if the model is truly linear.[38] The performed RESET tests did never generate sample values of the F-statistic that exceeded the critical values, allowing us to conclude that we cannot reject linearity in any model.

Even after the effects of the 10-year interest rate, the PMI and the PB are all taken into account, CAPE5 and CAPE10 still exert a significant impact upon short-run movements in the dependent variable. The coefficients do not vary particularly much between the different models. This strongly suggests that CAPE is a robust variable, and also the most important factor in generating the observed predictability of future stock returns. At last, all explanatory and dependent variables are stationary after transformation, as previously shown. On the basis of these results, I deem all statistically significant estimation coefficients trustworthy.

[38] Enders(2010)

8.Discussion and Analyses

The first thing to notice is that the short-run relationship between CAPE and future stock returns is statistically significant at conventional level in all proposed models. The fraction of variance explained is also surprisingly high for all return horizons. However, as these models are estimated in first differences, they have to be interpreted differently. If we look at model 1.0, the monthly change in **($CAPE5_{t+1}$ – $CAPE5_t$)** explains 46% of the variance of the monthly change in **($Log(P_{t+13})$- $Log(P_{t+12})$) – ($Log(P_{t+1})$- $Log(P_t)$)**. Put in words, the model tells us that a monthly change of 1% in CAPE5 today leads to a monthly change of -0.93%[39] between the monthly compounded return at **t+12** and the monthly compounded return at **t**. This suggests that an increase of 1% in CAPE5 today should make the monthly return in one year 0.93% smaller relative to the monthly return today (negative coefficient). Since monthly changes in CAPE5 and CAPE10 are known to us today, at time **t**, we may use this information to determine in what direction future monthly compounded returns are likely to move, in relation to compounded returns seen today. This information is far from sufficient to base investment decisions on, but it can be used as a reference point. By monitoring monthly changes in CAPE, we cannot say anything about the actual level of the returns in the future, nor how these returns are affected by CAPE in the long run. We may only get a hint of how future returns are likely to behave in relation to returns today on a month-to-month basis.[40] The relationship can be viewed as a short-term relationship between CAPE and long-term monthly returns.

We may also observe that, as the number of years used to compute the return increases, the fraction of variance explained also increases, this is in line with previous authors' findings.[41]For example, more than 67% of the variance of monthly relative changes between compounded returns in 5 years and compounded returns today, can be explained by monthly relative changes in CAPE5 today (Model 1.4). It would however not make any sense to compare R^2-values in this study to R^2-values obtained in previous studies, given the fact that previous authors have been fortunate enough to estimate their regressions in levels.

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[39] Model 1.0

[40] Joakim Westerlund Nationalekonomiska Institutionen (LU) (2017)

[41] Shiller (1996)

Anyway, even the case for a short-run relationship seems to be in line with previous findings that ratios of stock market indices to measures of fundamental value, earnings in this case, as indicators of the outlook of the market appear to be better when they relate properly to the long run. The Findings are also consistent with my hypothesis that CAPE is a better predictor of returns further into the future. However, the inextricable problem is that models estimated in first differences only measure short-term "impulses", to what extent it makes practical sense to study how monthly returns today relate to monthly returns in 5 years is questionable. Even though the forecasting accuracy is better for long-term returns, the practical use of such forecasts is undeniably less interesting, when estimations are executed in first differences. The reason is that the gap between a monthly return today and a monthly return in five years constitutes much higher uncertainty than what a gap between a monthly return today and a monthly return one year ahead does. It is obviously easier to make practical use of information on how short-term variations in CAPE today affect short-term variations between returns today and in the future, when the return-horizon is closer to the time at the forecast. Therefore, forecasting monthly relative movements between returns today and in one year makes considerably more practical sense, than forecasting monthly relative movements between returns today and 5 years into the future, even though the R^2-value is higher in the latter case. I do actually deem CAPE's predictive power over short-term movements between returns today and returns a year ahead quite satisfactory, a R^2 of 46% is not too bad.

Furthermore, Shiller and Graham and Dodd argue, as previously mentioned, that one should use an average of earnings not less than five years when computing CAPE.[42] On the basis of their argumentation, I formulated the hypothesis that the foretelling power of CAPE10 should be superior to CAPE5. My empirical findings do not confirm this. Both CAPE10 and CAPE5 seem to have equal explanatory power for all return-horizons, the differences are only marginal. To say that my findings contradict previous authors' findings would however be incorrect. It is still possible that CAPE10 is superior to CAPE5, when the long-run properties are captured in the data. The only thing that I may assert for certain is that CAPE5

[42] Graham, Dodd (1962) Shiller(1996)

and CAPE10 manage to explain short-term variances between monthly returns today and in the future equally well, at least in the case for Sweden.

My hypothesis that interest rates, the P/B-ratio and the PMI should have statistically significant predictive power is also chiefly inaccurate. The only variables with statistically significant foretelling power are those that include the stock price itself: CAPE and the P/B-ratio. The interest rate and the PMI turn out statistically insignificant in all proposed models. Condemning the predictive power of these variables entirely would however not be fair. Once again, it is possible that their explanatory power is statistically significant and considerably stronger when the long-term properties in the data are taken into consideration properly. The P/B ratio turns out to be statistically significant at conventional level only once (Model 1.5). The goodness of fit of this model is however virtually unchanged, the adjusted R^2 is practically unaffected. By reason of this, it is safe to say that adding the secondary variables touched upon in this paper to the models does not increase their explanatory power by satisfactory amounts.

When I first got the idea of investigating the relationship between future Swedish stock returns and CAPE, I had my hopes on being able to capture the long-run information in the empirical data. This would have allowed me to use today's level of CAPE to foretell the actual level of future returns, also to determine how CAPE affects these returns in the long run. Unfortunately, the nature of the empirical data for Sweden did not allow for estimations in levels, due to the risk of obtaining spurious results. Whether the short-term relationship established in this paper is good enough empirical evidence to base a rejection of the Efficient Markets Hypothesis and the Rational Choice Theory on, is highly disputable. It is a matter of definition. My opinion is that, in order to be able to reject the EMH and the RCT effectively, one has to establish a model that provides exploitable excess profit opportunities over the long run. The models estimated in this paper do not provide such opportunities, given the fact that they can never forecast the actual level of future returns. They may only give us an indication of how future stock returns are likely to move in relation to returns observed today, on a month-to-month basis. This information alone is hardly sufficient for beating the market in the long run. Consequently, I deem the overall result of this thesis far from satisfying, and definitely not in line with my initial expectation. However, it could be so that yearly observations provide stationary time-series, if so, the models should definitely be re-estimated once the data-history for Sweden is sufficient enough. At last, I want to highlight that the inability of my estimated models to reject the EMH and the RCT does not mean that they provide evidence in favour of their acceptance. The inability of a body of data to reject a scientific theory does not mean that the tests prove, demonstrate or even support its validity. As students of elementary statistics are constantly reminded, failure to reject a hypothesis is not equivalent to its acceptance.

9.Conclusion

The aim of this paper was to see if it was possible to provide empirical evidence contrary to the Efficient Markets Hypothesis and the Rational Choice Theory. This was to be achieved by investigating whether a statistically significant relationship between CAPE and future stock returns on the Swedish market could be established. Furthermore, to examine whether a set of secondary explanatory variables could be added to strengthen the predictability. Based on this purpose two research questions were rooted: Is it possible to find a statistically significant relationship between CAPE and the succeeding returns on the Swedish equity market, and is this relationship stronger for long-term returns? May the explanatory power of a model consisting of CAPE and future returns be strengthened by adding additional explanatory variables?

The main results establish that only a short-term relationship between CAPE and future stock returns on the Swedish market is found. This relationship is statistically significant, with quite satisfactory goodness of fit. The applied diagnostic checks do also speak in favour of its credibility. Hence, all significant coefficients are deemed trustworthy. The established short-term relationship grows stronger as the return-horizon increases, but the practical relevance of this knowledge is partly ruined when the equations are estimated in first differences. Furthermore, the models can never foretell the actual level of future stock returns, they may only provide information on how future monthly returns are likely to develop in relation to monthly returns today. Such information is useful as a reference point for investment decisions, but studying it solely would not be enough to consistently "beat the market" in the long run. This results in a failure to reject the Efficient Market Hypothesis and the Rational Choice Theory. The inability of the estimated models to reject the EHM and the RCT does however not mean that they provide evidence in favour of their acceptance.

Further concludable is the fact that all secondary variables turn out statistically insignificant in the majority of the models. Only the P/B-ratio shows statistical significance once, but the adjusted R^2 is virtually unchanged at this occasion. The final conclusion is therefore that no secondary variables, examined in this paper, may strengthen the explanatory power of a model consisting of CAPE and future returns. This does however not imply that the predictive power of these variables is condemned entirely. The results might differ when the long-run properties are captured in the data. At last, even though the results in this paper are far from satisfying, and not in line with expectations, I still find it relevant to re-estimate the models once the data-history for Sweden is sufficient enough to allow for yearly observations.

10.Bibliography

Campbell, John Y., Robert J. Shiller, (1998), *“Valuation Rations and the Long-Run Stock Market Outlook”* Journal of Portfolio Management, Vol. 24, No. 2, pp. 11-26.

Campbell, John Y., Robert J. Shiller, (1988b) *“Stock Prices, Earnings and Expected Dividends”* Journal of Finance, Vol. 43, No. 3, pp. 661-676.

Campbell, John Y., Robert J. Shiller (1988a) *“The Dividen-Price Ratio and Expectations of Future Dividends and Discount Factors”* Journal of Finance, Vol. 1, No. 3, pp. 195-228.

Capital, Star Research, (2016), *“PREDICTING STOCK MARKET RETURNS USING THE SHILLER CAPE”* http://www.starcapital.de/files/publikationen/Research_2016-01_Predicting_Stock_Market_Returns_Shiller_CAPE_Keimling.pdf.

Carlson, Ben, (2016), *“How Interest Rates Affect Stock Market Returns”* http://awealthofcommonsense.com/2016/09/how-interest-rates-affect-stock-market-returns/.

Chan LKC, Hamao Y, Lakonishok J, (1991): *“Fundamentals and Stock Returns in Japan”*. Journal of Finance, 46(5):1739–1764.

Darrat, F. Ali, (1990), *“Stock Returns, Money and Fiscal Deficits”* The Journal of Finance, Vol.25, No.3, pp.387-398.

Enders, Walter, (2010), *“Applied Econometric Time Series”* Applied Econometric Time Series, Third Edition, John Wiley & Sons, Kendallville.

Fama, F. Eugene, Kenneth R. French, (1988), *”DIVIDEND YIELDS AND EXPECTED STOCK RETURNS”.* Journal of Financial Economics 22, pp. 3-25. North-Holland.

Fama, F. Eugene, Kenneth R. French, (1992*) ”The Cross-Section of Expected Stock Returns”.* The Journal of Finance, Vol.47, No.2, pp.427-465.

Graham, Benjamin, David L. Dodd, Cottle, Tatham, (1962), *”Security Analysis”,* Fourth Edition, McGraw-Hill, New York.

Graham, Benjaman, David L. Dodd, (1934), *”Security Analysis”,* First Edition, McGraw-Hill, New York.

Helwege, Jean, David Laster, Kevin Cole, (1995), *“STOCKMARKET VALUATION INDICATORS: IS THIS TIME DIFFERENT?”.* Federal Reserve Bank of New York, Research Paper No. 9520.

Hillebrand, Eric, (2003), Stanford University, *“A Mean-Reversion Theory of Stock-Market Crashes”* p. 3-6. http://www.cofar.uni-mainz.de/dgf2003/paper/paper75.pdf.

Lander, Joel, Athanasios Orphanides, Martha Douvogiannis, (1997), *"Earnings Forecasts and the Predictability of Stock Returns: Evidence from Trading the S&P".* Technical report, Board of Governors of the Federal Reserve System.

Malkiel, G. Burton. (2003), *"The Efficient Markets Hypothesis and Its Critics".* The Journal of Economic Perspectives Vol. 17, No. 1, pp. 59-82.

Meucci, Attilio, (2009), *"Risk and Asset Allocation"*. Springer International publishing AG, Berlin.

MSCI, (2012), *"Index Calculation Methodology",* https://www.msci.com/eqb/methodology/meth_docs/MSCI_May12_IndexCalcMethodology.pdf.

Myers, James, Charles M. C. Lee, Bhaskaran Swaminathan, (1999), *"What is the Intrinsic Value of the Dow?"* The Journal of Finance, Vol. 54, No. 5, pp. 1693-1741.

Rosenberg B, Reid K, Lanstein R, (1985): *"Persuasive evidence of market inefficiency".* Journal of Portfolio Management, 11(3):9–16.

Samuelson, P, (1965*), "Proof that Properly Anticipated Prices Fluctuate Randomly"*, Industrial Management Review, 6:2, pp.41-49.

Scott, W. Richard, (1995), *"Institutions and Organizations. Ideas, Interests and Identities.",* Sage Publications Inc, New York.

Shiller, J. Robert, (1996), *"Price-Earnings Ratios as Forecasters of Returns: The Stock Market Outlook in 1996"*,
http://www.econ.yale.edu/~shiller/data/peratio.html.

Shiller, Robert. (2000). *"Irrational Exuberance".* Princeton University Press, Princeton, New Jersey.

Stattman, D., (1980), *"Book values and stock returns"*, The Chicago MBA: A Journal of Selected Papers, 4:25–45.

Summers, H. Lawrence, (1986), "*Does the Stock Market Rationally Reflect Fundamental Values?"* The Journal of Finance, Vol.41, No.3, pp.591-601.

Verbeek, Marno, (2015), *"A Guide to Modern Econometrics"* Fourth Edition. John Wiley & Sons, Cornwall.

Watson, J. Kevin, Mark A. Johnson, (2011), *"Can Changes in the Purchasing Managers' Index Foretell Stock Returns?" An Additional Forward-Looking Sentiment Indicator".* Journal of Investing. 20(4): 89-98.

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11.Appendix

Model 1.0

Dependent Variable: D1Y
Method: Least Squares
Date: 02/19/17   Time: 11:06
Sample (adjusted): 1999M07 2015M12
Included observations: 198 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE5	-0.933555	0.070805	-13.18492	0.0000

R-squared	0.468557	Mean dependent var	-0.001036
Adjusted R-squared	0.468557	S.D. dependent var	0.051095
S.E. of regression	0.037248	Akaike info criterion	-3.737373
Sum squared resid	0.273328	Schwarz criterion	-3.720765
Log likelihood	370.9999	Hannan-Quinn criter.	-3.730651
Durbin-Watson stat	1.738199		

Model 1.1

Dependent Variable: D1Y
Method: Least Squares
Date: 02/19/17   Time: 22:53
Sample (adjusted): 1999M07 2015M12
Included observations: 198 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE5	-0.849069	0.137917	-6.156356	0.0000
DPMI	-0.061135	0.084396	-0.724384	0.4697
DPB	-0.093288	0.162054	-0.575656	0.5655
D10RATE	-0.050830	0.061012	-0.833117	0.4058

R-squared	0.472745	Mean dependent var	-0.001036
Adjusted R-squared	0.464591	S.D. dependent var	0.051095
S.E. of regression	0.037387	Akaike info criterion	-3.714981
Sum squared resid	0.271174	Schwarz criterion	-3.648551
Log likelihood	371.7831	Hannan-Quinn criter.	-3.688092
Durbin-Watson stat	1.735471		

Model 1.2

Dependent Variable: D2Y
Method: Least Squares
Date: 02/19/17 Time: 11:10
Sample (adjusted): 1999M07 2014M12
Included observations: 186 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE5	-0.880585	0.066764	-13.18959	0.0000

R-squared	0.484584	Mean dependent var	0.000455
Adjusted R-squared	0.484584	S.D. dependent var	0.048640
S.E. of regression	0.034920	Akaike info criterion	-3.866152
Sum squared resid	0.225590	Schwarz criterion	-3.848810
Log likelihood	360.5522	Hannan-Quinn criter.	-3.859125
Durbin-Watson stat	1.781530		

Model 1.3

Dependent Variable: D2Y
Method: Least Squares
Date: 02/19/17 Time: 11:13
Sample (adjusted): 1999M07 2014M12
Included observations: 186 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE5	-0.737804	0.127518	-5.785870	0.0000
DPMI	-0.091059	0.080614	-1.129567	0.2601
DPB	-0.181522	0.153315	-1.183979	0.2380
D10RATE(-6)	-0.070863	0.079441	-0.892026	0.3736

R-squared	0.493319	Mean dependent var	0.000455
Adjusted R-squared	0.484967	S.D. dependent var	0.048640
S.E. of regression	0.034907	Akaike info criterion	-3.850986
Sum squared resid	0.221767	Schwarz criterion	-3.781615
Log likelihood	362.1417	Hannan-Quinn criter.	-3.822874
Durbin-Watson stat	1.810926		

Model 1.4

Dependent Variable: D5Y
Method: Least Squares
Date: 02/19/17 Time: 11:11
Sample (adjusted): 1999M07 2011M12
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE5	-1.046478	0.059612	-17.55492	0.0000

R-squared	0.673919	Mean dependent var	0.001181
Adjusted R-squared	0.673919	S.D. dependent var	0.052494
S.E. of regression	0.029976	Akaike info criterion	-4.170199
Sum squared resid	0.133885	Schwarz criterion	-4.150128
Log likelihood	313.7649	Hannan-Quinn criter.	-4.162045
Durbin-Watson stat	1.826730		

Model 1.5

Dependent Variable: D5Y
Method: Least Squares
Date: 02/19/17 Time: 22:55
Sample (adjusted): 1999M07 2011M12
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE5	-0.821705	0.112455	-7.306973	0.0000
DPMI	-0.142979	0.076519	-1.868548	0.0637
DPB	-0.289552	0.133011	-2.176907	0.0311
D10RATE(-6)	0.003950	0.094251	0.041909	0.9666

R-squared	0.691083	Mean dependent var	0.001181
Adjusted R-squared	0.684735	S.D. dependent var	0.052494
S.E. of regression	0.029475	Akaike info criterion	-4.184271
Sum squared resid	0.126838	Schwarz criterion	-4.103987
Log likelihood	317.8203	Hannan-Quinn criter.	-4.151654
Durbin-Watson stat	1.691965		

Model 1.6

Dependent Variable: D1Y
Method: Least Squares
Date: 02/19/17 Time: 11:11
Sample (adjusted): 2004M07 2015M12
Included observations: 138 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE10	-0.969439	0.084909	-11.41739	0.0000

R-squared	0.487501	Mean dependent var	-0.000523
Adjusted R-squared	0.487501	S.D. dependent var	0.043191
S.E. of regression	0.030920	Akaike info criterion	-4.107597
Sum squared resid	0.130980	Schwarz criterion	-4.086385
Log likelihood	284.4242	Hannan-Quinn criter.	-4.098977
Durbin-Watson stat	1.741068		

Model 1.7

Dependent Variable: D1Y
Method: Least Squares
Date: 02/25/17 Time: 11:22
Sample (adjusted): 2004M07 2015M12
Included observations: 138 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE10	-1.097559	0.140376	-7.818731	0.0000
DPMI	-0.074337	0.085726	-0.867148	0.3874
DPB	0.225336	0.184101	1.223983	0.2231
D10RATE(-6)	-0.011938	0.053185	-0.224453	0.8227

R-squared	0.496854	Mean dependent var	-0.000523
Adjusted R-squared	0.485590	S.D. dependent var	0.043191
S.E. of regression	0.030978	Akaike info criterion	-4.082539
Sum squared resid	0.128589	Schwarz criterion	-3.997691
Log likelihood	285.6952	Hannan-Quinn criter.	-4.048059
Durbin-Watson stat	1.722091		

Model 1.8

Dependent Variable: D2Y
Method: Least Squares
Date: 02/19/17 Time: 11:12
Sample (adjusted): 2004M07 2014M12
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE10	-0.966332	0.087279	-11.07176	0.0000

R-squared	0.494669	Mean dependent var	-0.001315
Adjusted R-squared	0.494669	S.D. dependent var	0.044182
S.E. of regression	0.031408	Akaike info criterion	-4.075632
Sum squared resid	0.123304	Schwarz criterion	-4.053121
Log likelihood	257.7648	Hannan-Quinn criter.	-4.066486
Durbin-Watson stat	1.756081		

Model 1.9

Dependent Variable: D2Y
Method: Least Squares
Date: 02/25/17 Time: 11:26
Sample (adjusted): 2004M07 2014M12
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE10	-0.765261	0.148857	-5.140914	0.0000
DPB	-0.296755	0.193902	-1.530437	0.1285
DPMI	-0.185570	0.088000	-2.108751	0.0670
D10RATE	-0.020146	0.075703	-0.266115	0.7906

R-squared	0.521485	Mean dependent var	-0.001315
Adjusted R-squared	0.509718	S.D. dependent var	0.044182
S.E. of regression	0.030936	Akaike info criterion	-4.082538
Sum squared resid	0.116761	Schwarz criterion	-3.992497
Log likelihood	261.1999	Hannan-Quinn criter.	-4.045957
Durbin-Watson stat	1.656944		

Model 2.0

Dependent Variable: D5Y
Method: Least Squares
Date: 02/19/17 Time: 11:12
Sample (adjusted): 2004M07 2011M12
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE10	-1.041965	0.077953	-13.36665	0.0000

R-squared	0.667269	Mean dependent var	0.001175
Adjusted R-squared	0.667269	S.D. dependent var	0.045056
S.E. of regression	0.025990	Akaike info criterion	-4.451195
Sum squared resid	0.060116	Schwarz criterion	-4.423419
Log likelihood	201.3038	Hannan-Quinn criter.	-4.439994
Durbin-Watson stat	2.175989		

Model 2.1

Dependent Variable: D5Y
Method: Least Squares
Date: 02/25/17 Time: 11:30
Sample (adjusted): 2004M07 2011M12
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCAPE10	-0.831706	0.132315	-6.285824	0.0000
DPMI	-0.165287	0.086334	-1.914512	0.0589
DPB	-0.286806	0.168535	-1.701763	0.0924
D10RATE	-0.068828	0.089654	-0.767707	0.4448

R-squared	0.692374	Mean dependent var	0.001175
Adjusted R-squared	0.681643	S.D. dependent var	0.045056
S.E. of regression	0.025422	Akaike info criterion	-4.462979
Sum squared resid	0.055580	Schwarz criterion	-4.351877
Log likelihood	204.8341	Hannan-Quinn criter.	-4.418176
Durbin-Watson stat	1.991711		