Macro-Economic Variables
For Use in Asset Return Analysis

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Introduction

In the first paper of this series concentrating on the interplay between the macro environment and the asset pricing world, Kaufhold (2008:1), the CAPM and the three-factor Fama and French models were reviewed. Data was developed on both the original 366 month period used by Fama and French as well as the more comprehensive period of 522 months through 2006. Regressions conducted by the author duplicated Fama and French's initial findings. The more expansive period also produced positive findings on all three F&F factors.

In 2008:2, Carhart's fourth factor of momentum was considered. When momentum was used as an additional factor, both the 366 month and the 522 month data produced significant results over the CAPM and the three-factor model. Reversionary variables also generated favorable results when used as a fourth factor.

In 2008:3 and 2008:4, intertemporal models and macro variables were studied. A literature review showed that various macro factors produced positive results when used in the F&F multi-factor format. Some of these variables include GDP growth and expectations of growth, unexpected inflation, interest rates, and business-related defaults.

In 2009:1, theoretical considerations linking the macro and micro environments were considered. That paper concluded that asset pricing models were incomplete unless macro variables would be fully evaluated as part of asset pricing. An equivalence discount equation was used to provide the linkage between general macro equilibrium models and micro asset pricing equations.

This paper identifies the economic variables used in macro forecasting. Recommendations are made for the use of specific macro variables for portfolio management purposes.

Economic Variables and Returns

Since pricing can be viewed in terms of per share expected discounted cash flows and the required rate of return, macro economic variables that impact future cash flows or required rates of return should also influence asset pricing. The literature has therefore focused on economic data that may affect forward stock and bond pricing.

Fama and French (1989) showed prices that forecast returns are correlated with business cycles, with higher expected returns in bad times. Cochrane (2007) noted that a number of authors, including Ang, Piazzesi, and Wei (2004), document that price variables which forecast returns also forecast economic activity.

Cochrane (2007) believed that almost all stock price movements can be explained in terms of changing expected excess returns rather than changing expectations of future dividend growth. As such, stock market movements should ultimately be tied to the macro-economy.

Variation In Risk and Return over the Business Cycle

Merton (1969) postulated that if investment opportunities were time-varying, then an investor with a multi-year time horizon would differ from that of a single-period investor. The investor would hedge against predictable changes in future investment opportunities. This analysis is consistent with Gollier (2001) who notes that lifetime consumption could be maximized by deliberately changing short-term allocations in response to return predictability and expected returns.

Cochrane (1999a) noted that stocks, bonds and foreign exchange returns are all predictable, with expected returns and volatility of return varying through time. Many others, including Campbell (1987), Campbell and Shiller (1988), Fama and French (1989), have found predictability in asset class returns. Jarjisu, Shilling and Tiwari (2006) found that commodities and real estate offered a hedge during recessions.

Risk and return premias have been found to be time-varying over the business cycle. Grant and Roley (1993) believed that news and surprises flowing from news items may have different impacts at different points in the business cycle. Boyd, Hu, and Jagannathan (2005) also believed that news items have distinctly time-varying effects on equity returns. They examine unemployment surprises, and conclude that such unexpected information has different effects on equity returns over the business cycle.

Sarkar and Zhang (2006) determined that correlation and covariance of excess equity returns and consumption growth varies across the business cycles of the not only the US, but all G7 countries. Correlation and covariance is higher when there is a negative labor income shock (i.e. higher unemployment) and a positive shock to returns. The equity premium, the Sharpe ratio, and correlations between returns and consumption are therefore all countercyclical. In particular, the earnings premium and the Sharpe ratio increase during recessions and peak just before a trough. Further, the Sharpe ratio exhibits large fluctuations. Asset pricing models have a generally positive conditional price of risk when consumption risk is allowed to time-vary. Brandt and Kang (2004) also find that the Sharpe ratio to be countercyclical.

Gorton and Rouwenhorst (2006) found that the diversification benefits of commodities varied across the economic cycle. Huang and Hueng (2007) demonstrated that a time-varying beta model eliminates unexplained returns of a constant beta, single factor CAPM type of model. Wilson and Shailer (2004) proposed the use of a time-varying discount rate that reflects the term structure of the interest rate risk.

Various models have been developed which attempt to exploit return predictability and time variation in risk and return parameters. Dahlquist and Harvey (2001) used tactical asset allocation (TAA) to take advantage of the time-variation in asset classes. TAA can result in an acceleration of a portfolio's risk during economic low points, however.

Vliet and Blitz (2009) determined that the business cycle generates time-variation in risk and return characteristics of asset classes. Also finding that constant percentage allocations exhibit time-varying risk and return parameters, risk actually increased in bad times with a fixed allocation. Vliet and Blitz developed a portfolio with varying allocations across the business cycle so as to maintain stable risk and / or return features. Guidolin, Massimo and Timmermann (2007) used a four regime-based strategic asset allocation strategy. They found strong evidence of time-variations in the joint distribution of returns on a stock market portfolio and portfolios tracking size and value effects. Ang and Bekaert (2004) found that dynamic asset allocation across the cycle improves return for across equities, bonds and cash.

Guidolin and Timmermann (2006) found that optimal asset allocation varies significantly across business cycle regimes. Asset allocations vary over time even in the absence of outside predictor variables such as the dividend yield. Horizon effects also vary across states. Independently of the current state of the cycle however, the overall allocation to stocks declines as risk aversion increases.

Perold (2008) showed that a static allocation will generate time-varying risk in a portfolio, whereas portfolio risk over the business cycle can be controlled by allowing percentage allocations to vary. Perold suggested a stable-risk portfolio and an "optimal" strategy that generates a high Sharpe ratio. Using the volatility index for the signal, a time-varying allocation would allow consistency of portfolios, better control of risk-adjusted performance, and have higher Sharpe ratios.

No studies reviewed to date analyze the tax impact of timing portfolio allocations to the business cycle, however. Bai (2008) studied the effects of transaction expenses on a varying portfolio, but did not analyze the tax impacts. Bai noted sensitivity to transaction costs and risk tolerance.

Bai (2008) developed macro indices that explained short-term variation in future stock returns with more forecasting ability than historical average returns. A strong cyclical pattern was evident, with time-varying economic conditions.

One interesting paper, Ang and Bekaert (2002), engaged in a simple effort at a two regime switching allocation using only the Sharpe ratio as the timing variable. Allocations of international equities, bonds, and cash were used. Whenever the Sharpe is above the historical long-term average of 0.50, the investor chose a mix of cash, bonds, and equities, optimized through MVO. When the Sharpe ratio was below the world market average, the investor switched primarily to cash. The regimes switching opportunity set was found to dominate the average world market set, implying that the regime dependent allocations out-performed the world market portfolio. No extensive search was made for macro variables, and the authors noted that the model could probably be improved upon.

Market Timing

To take advantage of time-varying premias, investors essentially have to correctly identify or time the swings of the business cycle. Sharpe (1975) noted that switching between stocks and bonds could enhance returns, but a high success rate of timing the markets would be necessary. Bauer and Dahlquist (2001) had similar results, with predictive accuracy on the order of 66% being necessary before timing would produce better results than a random choice.

Chang and Lewellen (1984) found little evidence that mutual funds could correctly time the markets. Treynor and Mazuy (1966) found little evidence of timing ability. Henriksson (1984) also came to the same conclusion, with 62% of the 116 mutual funds surveyed between 1968-1980 had negative market timing abilities. More recently, Rozali and Abdullah (2006) looked at Malaysian trust funds from 1995 to 2004 and found that both the selectivity and timing performance of all unit trust funds were negative. Fund managers appeared to possess inferior selection skills and poor market timing abilities.

The Brinson studies (1986, 1991) found that only 1.8% of pension fund returns were attributable to market timing. The biggest risk of any timing method may simply be that the investor is timed out of the market at precisely the time that certain asset classes quickly surge in pricing. For example, Curran (2001) showed that excluding the best 40 pricing days over a 20 year period, S&P 500 returns would have shrank form 14.8% to 2.5%. Hulbert's Investment Digest (1996) found that market timing recommendations had a cyclical pattern of their own, with timing suggestions becoming more pronounced during downturns, and a buy and hold preference during market peaks. Charles Ellis (1998) summed up the available evidence when he stated that "Market timing is a wicked idea. Don't try it, ever."

In spite of warnings to the contrary, attempts at market timing remain popular. Cochrane (1999b) felt that since returns are somewhat predictable, investors can enhance their average returns by moving their assets around among broad categories of investments. Market timing signals are slow-moving however, and uncertainty about the nature and strength of the signals dramatically reduces the optimal amount by which investors can profit from them.

Campbell and Viceira (1999) calculated a theoretical solution to the market timing issue. Using a lifetime consumption model with time-variation of dividend to price as the economic signal, shifting between asset classes (and even leveraging) generates huge increases in returns over both one year and five year horizons. Cochrane (1999b) noted however that uncertainty of parameters and other factors almost entirely eliminated the usefulness of Campbell and Viceira's efforts. Even if enhanced returns do occur with a tactical allocation, Cochrane concluded that obtaining more return in a counter-cyclical manner entails taking on different kinds of risk. The mean average return may increase over a long horizon, but a timing strategy will perform well and badly at very different times from other portfolios, often underperforming a benchmark.

Ferreira and Santa-Clara (2008) used a sum of the parts approach to equity returns, finding that substantial predictability in equity returns existed to the point where it would have been possible to time the market in real time.

Statistical Issues

Several statistical models have been developed over the years to analyze the extent that macro variables can influence asset pricing. Many technical issues arise whenever such models are utilized. Goyal and Welch (2008) note that almost all variables fail out of-sample, and many are not significant in sample. Achuthan and Banerji (2004) also show that many in-sample tests work on past data but will then fail to predict future business cycle turning points.

Unstable forecasting relationships may also exist in some macro variables, with various factors shifting over time in their correlation to general economic conditions. Predictive regressions perform poorly because estimated parameters are unstable over time as demonstrated by Campbell and Thompson (2008). This paper showed however that predictor variables actually perform better out-of-sample than the historical average return forecast, once weak restrictions are imposed on the signs of coefficients and return forecasts. Ferreira and Santa-Clara (2008) separated equity returns into three component parts, dividend yield, earnings growth, and price-earnings ratio growth, and then forecasted the gains and dividend yield components. Using the same data as Goyal and Welch (2008), a sum-of-parts method was found superior to an historical average. The results were robust in subsamples. The authors conclude that there was substantial predictability in equity returns.

With many studies, a small sample bias may be evident from the data. See for instance, Nelson and Kim (1993), Stambaugh (1999), and Ang and Bekaert (2007).

Achuthan and Banerji (2004) believe that successful prediction of business cycles is a complex endeavor with many judgmental decisions being necessary. A strictly statistical and quantitative process may be incapable of shifting through the changing importance of numerous pieces of information.

Several papers suggest that persistence and predictability found in returns might bias the regression coefficients and affect t-statistics. Lewellen (2004) is an example.

Additionally, other papers have pointed to the normality assumption of MVO as causing statistical problems. Post and Vliet (2004) found that portfolios formed by size, value, and momentum were inefficient with means variance criteria, but were efficient when second-order stochastic dominance procedures were used. Post, Vliet, and Lansdorp (2009) then found that downside risk helps explain the cross-section of US stock returns. The explanatory power of downside risk remains after controlling for other stock characteristics, including firm-level size, value and momentum.

Macro Indices

Reilly and Brown (2000) engage in a historical perspective to show that a strong relationship exists between stock prices and the national economy. Siegel (1991) also provides analysis on the relationship between capital markets and the macro environment. Current equity pricing reflects investor expectation of future events, so it is not surprising that the stock market leads business turns.

Macro indices can be developed from a large number of economic series. The presumption is that co-variation among economic time series can be captured by a few unobserved common factors. Stock and Watson (2002) show that common factors constructed by principal components analysis can consistently span the information space of the panel data.

Ludvigson and Ng (2007) found that the use of macro indices eliminates the arbitrary reliance on a small number of exogenous predictors. Stock and Watson (2002) showed that macro indices lead to improvements over smaller regression models. Indices may be more likely to incorporate an investor's unobservable information set.

With the capital markets leading the peaks and troughs of the business cycle, attention is given to the economic indicators which lead the economy by more than the stock market.

<u>Conference Board Leading Indicators.</u> The Conference Board has developed composite indexes of leading, coincident, and lagging indicators. Indicators were first identified in 1938, and various revisions have occurred to the indexes over the years. Composition of the indexes along with weighting consists of:

Leading Economic Index Factors ---

- Average weekly hours, manufacturing 0.2549

- Average weekly initial claims for unemployment insurance 0.0307
- Manufacturers' new orders, consumer goods and materials 0.0774
- Index of supplier deliveries – vendor performance 0.0677
- Manufacturers' new orders, nondefense capital goods 0.0180
- Building permits, new private housing units 0.0270
- Stock prices, 500 common stocks 0.0390
- Money supply, M2 0.3580
- Interest rate spread, 10-year Treasury bonds less federal funds 0.0991
- Index of consumer expectations 0.0282

Coincident Economic Index Factors ---
- Employees on nonagricultural payrolls 0.5439
- Personal income less transfer payments 0.1873
- Industrial production 0.1497
- Manufacturing and trade sales 0.1191

Lagging Economic Index Factors ---
- Average duration of unemployment 0.0371
- Inventories to sales ratio, manufacturing and trade 0.1238
- Labor cost per unit of output, manufacturing 0.0608
- Average prime rate 0.2825
- Commercial and industrial loans 0.1127
- Consumer installment credit to personal income ratio 0.1872
- Consumer price index for services 0.1959

Moore (1986) felt that the following leading indicators had between zero and six month lead on the economy, depending on peak or trough: average weekly hours, weekly initial claims for unemployment, new orders, stock prices, M2, vendor performance, changes in business credit, and consumer expectations. Private housing building permits has between 6 and 9 months lead time. Coincident indicators with 0 to 3 months lead included nonag. payrolls, personal income, industrial production, manufacturing sales. Lagging indicators showed confirming signals between one and 14 months after the turning point.

Reilly and Brown (2000) indicates that the rate of change, the direction of change, and comparison with previous cycles are of interest to the general analysis.

Diffusion indexes report the proportion of reporting units which project growth in the composite index. This is evidence of persuasiveness of a trend. Typically, diffusion indexes peak and trough before the peak and trough of the aggregate series, so a change in the diffusion index indicates increasing or decreasing breadth of economy activity. The trend in the diffusion indexes often are used to predict the overall trend in the aggregate index itself, before the aggregate series changes course.

Since the S&P 500 is within the LEI composite index, the question arises as to independence of variables. Heathcotte and Apilado (1974) also showed that the LEI does not consistently lead its own stock price component. CXO Advisors (2009b) felt that the Conference Board's LEI for the U.S. does not predict or forecast short-term or intermediate-term behavior of the U.S. stock market. Reilly and Brown (2000, at 491) believe that only with "perfect foresight" could changes in the LEI or the related diffusion index improve upon a buy and hold policy.

However, Granger and Newbold (1986) felt that the LEI is often misinterpreted. Leading indicator indexes are only designed to identify the turning points of economic activity, not the size of the subsequent change in the economy. A researcher at ECRI, Banerji (1999) indicated that tests of statistical significance on the indices themselves are fraught with problems. Regression analysis which attempt to explain the significance of co-movements of entire data series may be inappropriate for the identification of specific turning points of a business cycle. Banerji proposed the Granger-causality test and several other methods to use in the evaluation of whether leading indexes successfully identify turning points in the economy.

<u>ECRI Business Cycle Indexes.</u> The Economic Cycle Research Institute (ECRI) maintains a series of weekly and monthly economic indicator series. These indices provide a current indication of economic activity. Leading, coincident, lagging indexes are maintained on several countries, as well as long-leading series and leading indices on inflation. Diffusion indices on many of the series are also available. A smoothed six month growth rate of the weekly leading index exists, as well. Numerous international indexes have been developed over the years, too. Long-leading indexes project up to one year out, the Weekly Leading Index up ten months ahead, and short-leading at up to six months ahead.

Being proprietary in nature, the composition of ECRI indexes is less transparent than the Conference Board's indexes. Some information is available from historical sources of earlier research on predecessor indices. Moore & Cullity (1994) re-examined variables identified as far back as 1950 as leading in nature. Fundamental factors included:

- sensitive commodity prices
- average work (mfg)
- commercial and industrial building contracts
- new incorporations
- new orders
- housing starts
- stock price index
- business failure liabilities

Reilly and Brown (2000) indicate that a predecessor index to ECRI, the long-leading index developed at a unit of the Columbia Business School (CIBCR) provided signals farther out than leading indexes. Component series included: Dow Jones band prices; ratio of price to unit labor cost in manufacturing; M2, deflated; and new housing permits. The long-leading index predicted recessions at a minimum of 7 months in advance, and on average by 14 months. CIBCR also had leading employment indexes and leading inflation indexes. ECRI currently has employment indexes and a future inflation gauge index (FIG). The future inflation index is being used in coordination with the Weekly Leading Index (WLI).

Members of ECRI, Achuthan and Banerji (2004) provide a good review of current procedures of the indices. They note that employment, income, production, sales decline together in recessions. Co-movement of all four is the key to a recession. Once all four occur together, a downturn will spread from industry to industry and from region to region. In recovery, all four of these factors rise in unison. Sales rise, production then rise, employment increases, incomes rise, and that produces more sales. Business cycles are fluctuations in aggregate economic activity; a cycle has simultaneous expansions in different economic activities, followed by general recessions; the sequence is recurrent but not periodic; the cycle can be divided into shorter cycles of smaller magnitude and character. These four factors are more relevant for the start and end of a recession than the two quarters down in GDP rule of thumb of a recession.

Coincident indicators will turn in step with the economy. Output, employment, income, sales all turn together, and so are coincident. When these four factors turn together, the cycle has peaked or bottomed. The key to know when the coincident indicators turn is to look at the leading indicators that turn before the coincident indicators. For example, mortgage applications and corporate profits turn ahead of the economy.

New orders data is a good indicator that production may change, and would be classified as a leading indicator. Number of hours worked may be a leading indicator of future employment. The yield curve is another leading indicator whose inversion is one of the best predictors of recessions. But, the yield curve did not invert ahead of the 1990-1991 recession. On occasion, some of the indicators will not lead. The stock market itself may be out of sync at times, as are other individual leading indicators. Lagging indicators provide confirmation of what already has occurred.

Most of the leading indicators do not fail at the same time. Using an aggregate index is therefore important. Looking at indicators in terms of the relative sensitivity to the cycle provides the common link to being combined into one index. Typically, the indexes will turn in sequence from long-leading, leading, short-leading, and concurrent. There will be recognizable turning points that are pronounced (sufficient magnitude), pervasive (extent to which economy as a whole is affected), and persistent (cyclical up or downswing has to last for 5 months).

The Weekly Leading Index (WLI) contains initial jobs claims information that is an indication of unemployment, an Industrial Materials Sales Index which is designed to measure inflation in raw materials, and S&P 500 stock prices. Seven indicators form the composite, although exact identification of the remaining four data series was not provided in Achuthan and Banerji (2004).

Moeller (2004) states that there has been a 70% correlation between the year over year percent change in the ECRI and LEI of the Conference Board two series over the last ten years. Moeller believes the components of the ECRI weekly leading index are:

- money supply plus stock & bond mutual funds,
- the JOC-ECRI industrial materials price index,
- mortgage applications,
- bond quality spreads,
- stock prices,
- bond yields,
- and initial jobless insurance claims.

CXO Advisors (2009a) felt that the ECRI WLI movements probably coincided with or slightly trailed stock market behavior, offering no significant trading intelligence over the short or intermediate terms.

<u>Academic Papers.</u> Several articles have attempted to develop macro-economic indices to estimate the business cycle. Bai (2008) used “adaptive” indices that evolved over time, and Vliet and Blitz (2009) developed an index based on the credit spread, earnings yield, ISM manufacturing index, and the seasonally adjusted unemployment rate.

An interesting paper was that of Stock and Watson (1992), who developed a probabilistic model of recessions. Using an experimental leading and coincident index series developed for the model, probabilities of recessions occurring were generated. The effort was analogous to meteorological efforts used to forecast the probabilities of inclement weather.

Specific Variables

Multiple Variables Related

In an important and often-cited study, Chen, Roll, and Ross (1986) found statistical significance in explaining past stock returns from the spread between long and short-term interest rates, changes in the yield curve, expected and unexpected inflation, industrial production growth, and the spread between high and low-grade bonds. It was theorized that industrial production is a proxy for real cash flows, inflation affects nominal cash flows, and the yield spread affects the discount rate.

Shanken and Weinstein (1990) revised Chen, Roll, and Ross’s standard error of estimates for errors-in-variables, and found that the statistical importance of macro factors for equity returns was reduced.

Several others studies, including Fama and Schwert (1977), Keim and Stambaugh (1986), Campbell and Shiller (1988), and Fama and French (1988) found that short-term interest rates, expected inflation, dividend yields, term spread, default spread, and lagged stock returns can predict the expected returns of bonds and stocks.

Bulmash and Trivoli (1991) found that the stock prices are positively correlated with the previous month's stock price, money supply, recent federal debt, recent tax-exempt government debt, long-term unemployment, the broad money supply and the federal funds rate. There was a negative relationship between stock prices and the Treasury bill rate, the intermediate lagged Treasury bond rate, the longer lagged federal debt, and the recent monetary base.

Chen (1991) found forecasting ability in several macro variables, including lagged production growth rate, the term structure, the T-bill rate, the default spread and the dividend yield. The market excess on returns was found to be negatively correlated to economic growth variables, including the T-bill rate, lagged production growth rate, the default spread and term structure, and positively related to forward looking growth factors, including market dividend price ratio and unexpected future GNP growth.

Lamont (2001) demonstrated that portfolios developed to track the growth rates of industrial production, consumption, and labor income earned abnormal positive returns, while a portfolio tracking inflation did not.

The Chen, Roll, and Ross (1986) study has been examined in the international context. Hamoa (1988) looked at the Japanese market and generally had consistent findings as the Chen, et al study (aside from industrial production).

UK data did not support Chen, eta al, however. Poon and Taylor (1991) found that macroeconomic variables do not appear to affect share returns in the United Kingdom as they do in the U.S. They concluded that either different macroeconomic factors have affected UK capital markets or methodology used by Chen, et al may be an example of a spurious regression.

Gan, Lee, Yong, Zhang (2006) found that New Zealand's was consistently determined by the interest rate, money supply and real GDP. Inflation has a negative impact on stock prices, with a peak by the fourth month. A long run relationship existed between the equity market and the macroeconomic variables tested, specifically, the exchange rate index, inflation, long-term interest rates, GDP. Short-term interest rates, M1 also possessed explanatory power. The New Zealand market is not a leading indicator, however, possibly because the market is relatively small compared to other mature markets.

Vliet and Blitz (2009) constructed an index to measure the phases of the business cycle using the credit spread, earnings yield, ISM manufacturing index and the seasonally adjusted unemployment rate. The indicator was found to be close to the NBER economic cycle.

Vliet and Blitz then compared several allocation strategies across the economic cycle. A constant weight allocation produced a time-varying risk profile, with risk increased in bad times. A tactical allocation increased portfolio risk systematically, especially in bad time, in order to maximize return. A tactical allocation that was constrained to the same volatility as the static allocation still resulted in time-varying risk since the portfolio was linked to the static allocation's risk profile across the economic cycle. A varying allocation (described by the authors as "dynamic") which maintained constant risk levels across the business cycle produced higher returns than the static allocation in all periods of the economic cycle. Interestingly, risk was lower than the static allocation in all but the expansion phase of the cycle.

Goyal and Welch (2008) modeled as the control predictors, including price-dividend ratios, price-earnings ratios, dividend payout, book-to-market ratios, long term government bond returns, Consumer Price Index (all urban consumers), net issuing activity, term spread, default spread and default payout. Most of the variables did not perform well out of sample. The paper also found that many predictor variables lose forecasting ability after the oil embargo and shock to the economy in the 1970's.

Following Stock and Watson's (2005) test of 132 variables, Bai (2008) looked at 100 different economic variables. Price indices, interest rates, housing, employment, inventory and orders, real output wages, consumption, consumer confidence, exchange rates, money and credit, and unemployment all had some predictive power. The dividend price ratio, EP, book-to-market, term spread, default spread, default return, long-term bond return were found to be not have large R2 values. Four categories of variables, interest rates, price indices, housing, and employment were especially useful in predicting the equity premium.

Fama and French (1989) showed that dividend-price ratios, term spreads (long bond yield less short bond yield), and default spreads forecast stock and bond returns. Brandt (1999) developed optimal allocations from the dividend yield, default premium, term premium, and lagged excess returns, with the investment horizon and rebalancing frequency also affecting results.

In reviewing the literature, Cochrane (1999a) noted that a number of macroeconomic variables forecast stock returns, including the investment / capital ratio, the dividend-earnings ratio, investment plans, the ratio of labor income to total income, the ratio of housing to total consumption, an "output gap" formed from the Federal Reserve capacity index, and the ratio of consumption to wealth.

Liew and Vassalou (2000) show that Fama and French's size and book-to-market factors forecast output growth, and thus should be considered as "business cycle" variables.

Ferreira and Santa-Clara (2008) decomposed stock and found positive out-of-sample forecasting abilities from many of the following factors: stock variance, default return spread, long term bond yield, long term bond return, inflation, term spread, t-bill rate, default yield spread, net equity expansion, ROE, dividend payout, earnings price, smooth earnings price dividend price, dividend yield, book-to-market.

Money Supply

The money supply of an economy is an important variable to consider. Reilly and Brown, (2000) felt that changes in MS may initially impact the financial markets which eventually would impact that aggregate economy. Early studies indicated a strong leading relationship between MS changes and stock prices. While several subsequent studies still showed a relationship, the timing of the linkages suggested that MS was lagging stock markets by one to three months. Additional papers showed that stock prices adjust very quickly to unexpected changes in MS growth. This implies that analysts must successfully forecast unanticipated changes in MS growth.

An early study, Friedman and Schwartz (1963) found that declines in the rate of growth in the money supply have preceded business contractions by 30 months, while an increase in the growth rate has preceded economic expansion by eight months. Jensen, Johnson, and Mercer (1996) found many years later that monetary policy can dramatically affect the relationship between equity pricing and some financial variables (term spreads, dividend yield, default spreads). Size and price to book ratios may correlate to equity pricing only during expansionary MS policy regimes. Currently, it is felt that monetary policy variables are significant predictors of future equity returns, although other factors (dividend yield) are also involved (from Reilly and Brown).

MZM (M2 + savings deposits, small time deposits including money market deposit accounts), and retail money market mutual funds) may be a stable relationship with nominal GDP, over periods of up to 20 years (Jones, 2003). The relationship may be more stable than M2.

Inflation, Interest rates, and Asset Pricing

Reilly and Brown (2000) laid out general concepts. Changes in inflation may generate changes in the required rate of return of interest rates to maintain the same real rate of return. Due to the discount rate changing in response to inflation, there is an inverse relationship between interest rates and bond pricing. This also implies a negative relationship between inflation and bond prices, since as inflation increases, nominal interest rates will increase to maintain the real rate of return.

If interest rates would increase ceteris paribus, stock pricing would decline because the required rate of return, k, would increase. However, as interest rates increase, growth in earnings, g, and dividends may also increase, thus keeping stock prices the same. If earnings cannot rise due to product pricing pressure, then k-g would increase, thus decreasing equity pricing. If earnings declines in an environment of increasing interest rates (circa 1981-1982), then stock pricing could plunge, since k increases and g decreases. Thus, the relationship between interest rates and equity pricing is indeterminate at the outset, and is subject to fact specific circumstances that change over time. There may be a generally negative relationship between inflation, interest rates, and equity pricing since many firms cannot fully pass on higher production costs, and earnings decreases in a rising interest rate environment. This is sometimes not the case however, and in some isolated industries or settings, there may even be a positive relationship between inflation and stock pricing.

The spread between inflation and the Aaa corporate bond yield shows a definite correlation, but varies in its lag. Further, the spread between inflation and the corporate bond yield changes somewhat over time. Both the timing of the correlation and the changing spread suggests that investors may react to expected inflation.

French, Schwert, and Stambaugh, et al. (1987) theoretically determined that stock returns should be negatively correlated to both the long term and short term interest rates. Allen and Jagtianti (1997) indicated that interest rate sensitivity to stock returns has decreased dramatically since the late 1980's because of the invention of interest rate derivative contracts used for hedging purposes. Several papers, including Bodie (1976), Fama (1981), Geske and Roll (1983), show a negative impact of inflation and money growth on equity values.

From Jones (2003). While not constituting a statistical test, Warren Buffett has commented that interest rates and expected corporate earnings cause long-term movements in stock prices (Fortune interview, 12-10-01, at 82). This may be because interest rates and PE ratios of equities are inversely related. When interest rates are low, fixed income bonds will pay less, and investors will switch into equities. Thus, there is an inverse relationship generally between interest rates and inflation vs equity pricing. Additionally, stocks rise strongly when earnings rise and interest rates stay the same. Corporate earnings increases may be the base motivation behind share pricing and dividend increases, since with a constant PE, equity pricing should correspond with earnings changes. Jones feels that the relationship between earnings, interest rates, and stock prices is not perfect, and that may be a large reason why investors have great difficulty timing the market. General trends may be better discernable through the analysis.

CPI, unemployment rates, GDP and Treasury bill/bond yields from the FRED II database of the Federal Reserve Bank of St. Louis.

Yield Curve

Jones (2003) summarized the research. The shape of the yield curve has long been thought to be related to the business cycle. Yields are low and upward sloping at the start of a cycle. Yields are higher at the peak of business activity. As the curve steepens, the economy is accelerating in monetary policy acting as a stimulus. When the curve flattens, economic activity is slowing. An inverted curve has an expectation of a slowdown, with a recession normally being preceded by an inverted curve. Inverted yield curves may precede recessions by a year.

Ang and Bekaert (2007) developed a regime switching model to measure the term structure of the yield curve. They found that expected inflation drives about 80% of the variation of nominal yields at both short and long maturities, but during normal times, all of the variation of nominal term spreads is due to expected inflation and inflation risk. T

Consumption-Wealth

Guo (2001) found that stock market variance forecasts are greatly enhanced if the consumption to wealth ratio was included. The ratio was negatively correlated with equity variance and positively correlated with equity excess returns. Guo believed that the consumption-wealth ratio was closely related to the hedging component of excess returns as per Merton's (1973) ICAPM. With consumption used as an inter-temporal hedging component, the risk-return relationship was found to be stable and positive. Thus, the consumption-wealth ratio can be viewed as an important function of expected future asset returns and consumption growth.

Guo also believed there was a close link between consumption-wealth and the dividend yield. Consumption-wealth is considered to be the equivalent of the dividend yield in an exchange economy studied by Lucas (1978) and others. Consumption-wealth has stronger predictive ability for excess returns than does the dividend yield in post WWII data. Cochrane (1999b) believed that the dividend yield was statistically insignificant in many tests, while consumption-wealth was strongly significant. This suggests that the consumption-wealth ratio may be a better measure of forward consumption / investment opportunities than the dividend yield. Overall, results were thought to be closely related to the credit channel of business cycle.

Lettau and Ludvigson (2001, 2003) find that the consumption-wealth ratio predicts the mean and volatility of returns. Sarkar and Zhang (2006) find that consumption-wealth is negatively related to the return variance.

Credit Spreads and Bond Yields

The term spread (measured as 10 year treasury note – the 30 day T bill) as well as the default spread (AAA corporate bond yields – Baa corporate bond yields) were shown to be predictive in Fama and French (1989). Estrella and Mishkin (1997) found that the yield spreads were useful in predicting US recessions.

Bond returns may be predictable to a time varying risk premium related to the overall business cycle (Cochrane and Piazzesi (2005)), although bonds returns were not directly tied to specific macro or monetary variables. Ludvigson and Ng (2006) found little evidence connecting specific macro variables to bond risk premia. However, the yield curve had a strong countercyclical component. Considering the findings of Cooper and Priestly (2008) that bond returns where correlated to the output gap as well as stock returns, the authors felt that analyzing just the term structure of bonds or the yield curve would be insufficient to completely anticipate bond pricing changes.

The Risk Free Rate of Return

The risk free rate was shown to be predictive of returns in Campbell (1991) and Ang and Bekaert (2007). The change in the risk free rate (d rfrr) is also likely to be highly correlated with default risk.

Real Variables

Many papers group macro variables into two broad groupings, those involving financial factors (many such variables are summarized above) and real factors (new orders, production, output, etc). Real variables are often used with a national income accounting type of perspective, with various items in the production chain being tracked from early stages of manufacturing through the final product.

<u>Output-Related Variables.</u> One of the most important real variable is industrial production. In a recent and important paper, Cooper and Priestly (2008) showed that the output gap is predictive of stock and bond returns. Federal Reserve industrial production index data is used. The gap is generally measured as the deviations of the log of industrial production. CRSP data, S&P 500. Excess returns are derived from the return on the 30 day T-Bill minus the actual stock return. Both actual and excess returns are analyzed. Results are statistically significant both in and out of sample, and for equities and bonds. The output gap, based on a quadratic trend, falls before and throughout every recession, with the largest declines occurring in the recession periods. At business cycle frequencies, the output gap was found to be predictive of both actual and excess stock returns, with expected returns rising as economic conditions worsen and fall when conditions improve.

Cutler, Poterba, and Summers (1989) found that industrial production growth was correlated with real stock returns over the period 1926-1986, but not in some sub-periods. The Conference Board uses industrial production in its indices. Chen, Roll, and Ross (1986) considered industrial production growth. Chen (1991) looked into including lagged production growth rate. Lamont (2001) reviewed growth rates of industrial production. Vliet and Blitz (2009) used ISM manufacturing data.

Several other factors are indicative of output-related activity in the national economy. Cochrane (2007) commented on the output gap and housing to total consumption. Gan, Lee, Yong, Zhang (2006) reflected upon New Zealand's and real GDP. Bai (2008) used housing, inventory and orders in an index. Bulmash (2003) found that correlations between the stock market and GDP increased form no relation in current time frames to statistically significant in 12, 18, 24, and 36 month intervals. A wealth effect among investors is also noted, with a gradual increase in spending occurring as investors become more confident in the permanency of their stock market gains.

Conference Board and ECRI indices include manufacturers' new orders, consumer goods and materials, Index of supplier deliveries, Manufacturers' new orders (nondefense capital goods), building permits (new private housing units), inventories to sales ratios, commercial and industrial building contracts, housing starts

Liew and Vassalou (2000) even show that Fama and French's size and book-to-market factors forecast output growth. Thus, pricing indicators may be a proxy for output, at some basic level.

Employment. Economists see temporary jobs as a leading indicator, as employers are likely to hire temp workers before permanent ones. As component parts of various indicators, the Conference Board and ECRI uses the following labor related items: Average weekly hours, manufacturing; Average weekly initial claims for unemployment insurance; Employees on nonagricultural; payrolls; Personal income less transfer payments; Average duration of unemployment; Labor cost per unit of output, manufacturing; average work (mfg).

Bulmash and Trivoli (1991) uses long-term unemployment. Lamont (2001) analyzes labor income. Vliet and Blitz consider seasonally adjusted unemployment. Bai (2008) uses employment and unemployment.

Pricing Indicators

Numerous papers have focused on valuation shifts between asset classes, rather than looking at fundamental economic variables. These methods imply shifting in and out of asset classes in response to changing excess returns of asset classes. The following items comprise a wide-ranging field of strategies designed to take advantage of changing relative valuations between asset classes.

Relative Value Indicators. Perhaps the oldest and best known variables that involve asset valuation are price-to-value indicators. Graham and Dodd (1934) and a litany of other value-oriented writers have argued that high valuation ratios are an indication of an undervalued stock market that should predict high subsequent returns. Beginning in the early 1960's and lasting well into the 1980's, most academics either ignored or staunchly critiqued value studies, believing instead in market efficiency. Many authors finally took notice of the value studies by the late 1980's, when valuation ratios were mathematically documented by Fama and French (1988), Campbell and Shiller (1988), and others as being positively correlated with subsequent returns. These findings implied predictability of returns at longer horizons. The reasons for return predictability were still hotly debated, but there came to be a gradual recognition in asset return predictability.

Many observers believe that high PE ratios precede market declines. Campbell and Shiller (1998) showed that the inverse of price to earnings, E/P ratio, was negatively correlated with stock returns. Pesaran and Timmermann (1995) included both interest rates and E/P ratios as possible explanatory variables of stock market movements. The EP ratio was used as one component of a business cycle index in Vliet and Blitz (2009). Sheng (2002) determined that simple timing strategies based on the spread between the E/P ratio and interest rates outperformed a "buy-and-hold" strategy, and with a lower variance. The E/P ratio alone did note result in positive conclusions, however, but using interest rates alone performed better than the market index. Fisher and Statman (2000) believed that PE ratios may be useless for market timing purposes.

Many other relative price indicators (including the dividend yield, noted below) have been found in a wide variety of studies to generate value-oriented excess returns. For instance, Fama and French (1992) determined that book-to-market had higher excess returns than with a single factor asset pricing model. See, generally, Kaufhold (2005:3), for an extensive discussion of value indicators.

Dividend Yield. The dividend yield is an important price to value indicator that also has many items in common with discussions on the term structure, inflation, and interest rates (above). So, particular discussion of this relative value indicator is warranted.

The dividend yield was found to not predict returns better than the historical mean in Booaerts and Hillion (1999) and Goyal and Welch (2003). Jones (2003, at 362) observes that the dividend yield has generally been in a downtrend for years, due to corporate dividend policy shifts. Relying on the dividend yield to predict future market activity must therefore assume that no changes in the general trend of dividend payout policies will occur at the corporate level.

Dividend yield, as measured as the difference between the log of the 12 month moving sum of dividends and the log of lagged price was considered predictive of stock prices in Campbell and Shiller (1988) and Fama and French (1989). In particular, Campbell and Shiller (1988) found that the log dividend yield equals the discounted sum of future expected returns minus the discounted sum of future expected dividend growth rates. Robertson and Wright (2006) showed that payout ratios derived from dividends, repurchases and issuances (versus simple dividend yield) are robust indicators of excess returns. Fama and French (1988) noted that aggregate stock market returns were higher when the dividend yield was high. Campbell and Shiller (1988) felt that the yield could actually predict forward returns.

Fama and French (1988) showed that dividend / price ratios forecast stock market returns, especially at long horizons. Lettau and Ludvigson (2004) demonstrated that the consumption to wealth ratio also forecasts dividend growth, as well as returns. More recently, Goyal and Welch (2003, 2005) show that return forecasts based on dividend yields and numerous other variables do not work out of sample. Cochrane (2006) shows that return forecasting is still highly significant, and that long horizon return forecasts are closely related to dividend growth forecasts.

Fed Model. Jones (2003, at 364) reviews the Fed valuation model. This is a simple model that is based upon equilibrium between stock and bond yields. Stocks are relative attractive when the forward 12 months earnings yield on the S&P 500 is greater than the 10 year Treasury yield. Stocks are unattractive when E/P < 10 year T note yield. An implied "fair value" of the S&P 500 can be established by 12 month forward E/P / 10 yr T note yield. This establishes relative over or under valuation of the S&P compared with current levels. Also, the reciprocal of the 10 year yield is an estimate of the equilibrium PE of the S&P, with equilibrium PE = 1 / 10 year yield.

The model has worked remarkably well over very long time periods, but may not be overly predictive in shorter periods. Also, when interest rates are very low, it produces very high implied S&P levels. The model works better when no expansionary monetary policy is in place and interest rates are in a more typical range. Further, since forward earnings estimates are used, the model has subjective analysts projections built into it, which is fraught with difficulties let alone with constant revisions on forward estimates. The 10 year T note yield is impliedly the required rate of return in the model, and this has often not been the case, either.

TAA. Reilly and Brown (2000) summarize Tactical Asset Allocation (TAA) methods. A portion of a portfolio will be shifted into a different asset class, sector, or industry that is judged to more attractive.. In many instances, the analysis can be done via a "top-down" perspective of identifying national economic trends, then reviewing sectors and industries, and finally looking at individual assets. The process can also be driven by an evaluation of equity and bond risk premiums, with an overweighting given to the class having a higher return to risk ratio. The goal is to find and concentrate on areas of the economy (and specific investments) possessing positive expected excess risky asset returns. TAA is basically a market timing approach that increases asset class proportions in response to increasing expected excess returns.

SAA. Campbell and Viceira (2002) used Zin-Epstein utility functions and a VaR-like analysis. They found that equity allocations should increase as the expected excess returns in stocks increased and as risk tolerances rises. If inflation risk or reinvestment risk is present, then inflation-indexed long bonds would represent the risk-free choice, not the 90-day T-bill.

Both SAA and TAA generate a more variable allocation than with a buy and hold philosophy. If the expected excess stock return is low, then both SAA and TAA would generate a lower equity allocation than what is chosen through buy and hold. Once expected returns rise however, both allocation methods would generate much higher equity allocations than with a buy and hold that periodically rebalances. This occurs to the point where leverage would even be recommended for very positive excess stock returns. If leverage is not possible, then risk tolerant investors would just hold a 100% equity position with strongly positive excess returns. Cochrane (1999b) noted however that parameter uncertainty would eliminate any advantage of varying allocations.

Cochrane specifically analyzed the Campbell and Viceira analysis, but claimed advantages of TAA would conceivably suffer from the same argument.

Utility Factors

Gollier (2001) mathematically showed that lifetime consumption could be maximized by using expected utility constructs. By deliberately adjusting short-term allocations in a manner that takes advantage of return predictability, investors could gain a significant advantage over those who did not use a time horizon approach to investing. Backward induction used with dynamic programming could be used to determine optimal allocations.

Bai (2008) felt that considerations of utility would produces a strong cyclical pattern: reduced investment in risky stocks at the beginning of recession and increased investment at the end of recession. Allocations based on relative risk aversion showed a time-varying pattern across the business cycle.

Brandt (1999) uses a lifetime consumption model and the Euler equation to develop optimal allocations. Brandt found that investment horizon, rebalancing frequency, dividend yield, default premium, term premium, and lagged excess returns affected multi-period investment choices. Instead of fixing consumption and estimating preferences, Brandt fixes the preference parameters and then estimates optimal consumption. This avoids the necessity of a statistical model for the estimation of stock returns.

Conclusions and Further Research

Macro-economic conditions can obviously affect short-term asset pricing. As noted in Kaufhold (2009:1), the theoretical solution typically involves an equivalency discount rate linking micro asset pricing equations with macro general equilibrium models. Macro variables can also be seen as affecting the forward cash flow and dividend stream, which in turns affects asset pricing in a Dividend Discount Model format.

Return predictability and time-varying risk and return parameters across the business cycle and changing macro conditions leads to a more serious consideration of varying allocations. This is especially the case in light of studies which demonstrate time-varying risk with a fixed-allocation portfolio. The real question then becomes one of timing: can macro economic indicators provide relevant signals or markers for the deliberate shifting of allocations? The evidence is problematic at best. Many macro variables may have explanatory power in asset returns. But practitioners and theoreticians engaging in timing efforts have often found themselves severely embarrassed by an economy that refuses to behave as statistically predicted.

In terms of further research, statistical identification of individual variables which may be relevant to the investing process would be in order. An economic analysis explaining the underlying fundamentals of the variables being tested would also assist in avoiding data mining (although virtually all macro indicators can be explained in some way as being relevant to firm-level fundamentals). Time-series regressions can identify promising macro-economic financial and real variables. Once that is completed, the development of an index per Vliet and Blitz (2009) has the potential of providing the economic signals. Probabilistic models, such as Stock and Watson (1992) also may be of interest. Time-varying allocation policies can then be attempted.

Appendices

More detail on specific variables and index composition can be found in separate files that should be considered as supplements or appendices to this document. These separate documents can be found at http://www.kaufholdco.com/Econdata.html and comprise:

- Economic Indices
- Employment
- Production and Output
- Monetary Variables
- Capital Asset Pricing Variables
- Income and Consumption
- Relative Value Indicators
- Macro Indices Designed for Asset Allocation Policies

The asset allocation supplement will likely develop into a separate working paper as statistical testing commences on specific macro variables. The appendices contain descriptive and quantitative information more current and in-depth than this document.

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