



LITERATURE REVIEW AND COMPETITOR ANALYSIS

MScFE Capstone Project

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Literature Review

We aim to revisit and then, capture the performance of a financial instrument (SP 500), a randomly chosen ETF, with extensive data analysis through some distinguished and efficient statistical and hyper-technical tools (where needful) and reveal the insights due to any interventions to its performance. We are considering a decade of data ending the last quarter of 2022 since we are expecting to capture some interventions in the form of regime shifts during this period. We are planning to compare this performance to that of other instruments (randomly chosen) of the similar class through some statistical and econometric tests, data visualization process.

There are two spheres of the researchers who are interested in this kind of work and those are in relation to academic and industry aspect. In particular, the academic researchers include faculties, students, and research associates who are basically indirect market people. Sometimes, researchers conduct research in the academic domain for the purpose of utilizing research results to industry usage in the form of projects. There is some other form where academicians work for professional landscape in the form of projects. To some extent regulators like Federal, Exchange Commissions or particular industry-wise regulators (to take measures in the form of regulation or deregulation if looks required), Policymakers and legislators are market people as well. On the other side, at the industry level financial engineers, quants, traders (actively participate in trading, setting strategies and playing role in trading itself), financial analysts, fund managers, portfolio managers, and other relevant investment professionals (like Chartered CFA and Chartered Investment Actuary who work on the behalf of institutional side, and do manage huge funds like pension funds, mutual funds, and similar funds and invest in the markets) do research in the same field being the direct players. These direct players act role as individual and institutional on the behalf of their clients through managing the portfolio with buy-sell actions, investment, disinvestment, and reinvestment decisions.

History:

If we look back in relation to SP500 and some macroeconomic indicators we need to cover two aspects: macroeconomic and financial. We now indicate the macroeconomic

aspects. Mitchell and Burns (1937) published literature in the research topic of business cycle statistical indicators. This is one of the pioneering works in analyzing business cycle indicators. Since that time, a lot of work has been done in the primary research area of business cycle analysis. Numerous studies have found that a wide range of economic and financial characteristics can provide insight into potential future economic recessions. For the purpose of analyzing recessions, Kaval and Moore (1991) constructed leading economic indicators. According to Estrella and Mishkin (1998), the term structure of Treasury yields and the stock market's slope have proven to have predictive potential for U.S. recessions. Camacho and Perez-Quiros (2002) suggested an ideal filter to convert the Conference Board Composite Leading Index (CLI) into the likelihood of a U.S. economic recession. They also examined how well the CLI predicts U.S. output growth. Additionally, they indicated that the best method for forecasting the business cycle schedule and GDP growth is a combination of switching regimes and non-parametric forecasts. One of the risk factors of the financial markets is geopolitical unpredictability. Because political uncertainties can produce an unfavorable economic environment, this may restrict the stock market's ability to perform well. Financial markets are impacted by geopolitical instability in a variety of complex and varied ways. Firstly, macroeconomic dynamics may be impacted by geopolitical uncertainty. Secondly, geopolitical instability may have an impact on future returns along with an investors' risk aversion. However, despite all the risk factors, financial markets still offer vital services for growth. Hao and Ng (2011) investigated how well different financial and macroeconomic indicators in predicting Canadian recessions. Several advanced dynamics, autoregressive, dynamic autoregressive, and static probit models were all evaluated together with the traditional static probit model. Recent research conducted by Huang et al. (2018) illustrated the predictive potential of news sentiment analysis on the U.S. economy. They built a metric that functions as a leading indicator in recession analyzing models through topic modeling algorithms and sentiment scoring techniques.

Thereafter, the blessing of computational capacity started with the theoretical developments in statistical mechanics (especially, the nonequilibrium statistical mechanics that works on a moving object (here price) will never go to saturation in the long-run). Also, some statistical tools (especially, Copula) were invented. The complex network theory (previous graph theory), fractal and multi-fractal, scaling theory, power monomial issues and more alike in the statistical domain (in fact, the researches on this topics were old but somewhat stopped some decades ago and restarted in the last decade of 20th century again

after a long gap). These topics are mostly related to capture any phenomena that are under non-equilibrium statistical dynamics for long terms (like stock price movements). Then, it was time to frame it in the form of computational application (especially with a programming language) and both the speed in research and application gone faster due to advancement in the computational language world (that is python, though many decades ago many researchers work on it and then stopped surprisingly; maybe it is due to absence of computer support in those days).

Latest picture:

A lot of work is there in relation to SP500 and just a few of recent are addressed hereunder. Some latest research works are related to proposing appropriate modeling for predictions, some related to comparative analysis amongst the models under external conditions and fitting. One of the relevant research works is performance metrics of stock are exposed to external factors including macroeconomic variables, policies or regulations and hence the market phase shifts abruptly. This needs to be brought under study with regime shift identification for traders so that they can fix their trading strategy having clear ideas on various asset classes and market sections in identified regimes. In the research the instrument is SP 500 index from 2000-2017 and the model is Markov Autoregressive model in the paper of Sonam Srivastava, Mentor – Ritabrata Bhattacharyya. Other kinds of work include doing analysis with newly invented approaches and comparing to the old approaches and cashing the benefits. In recent years, the analytical approaches and toolkits have been changed to model the index of ETFs based on economic indicators. All underlying visualizations and tests have been carried out with Machine Learning approaches and appropriate indicators are tracked by Ligita Gaspreniene, Rita Remeikene, Aleksejus Sodidko, and Vigita Vebrate (2021). As a result the accuracy of the work increased to a remarkable level and therefore the prediction of the performances of ETFs by Ligita Gaspreniene, Rita Remeikene, Aleksejus Sodidko, and Vigita Vebrate. In addition, there are some works by Sonam Srivastava, Mentor – Ritabrata Bhattacharyya in relation to identification of regime shift for the appropriate time selection for investment of funds from a class of assets by the investors with the suitable timing of buy and sell of investments. In addition to above, some works are relevant to extracting the systematic trading strategy for the traders; some others are in relation to searching for alternative risk measures tools for the portfolio managers. Different risk measure methods like VaR, Expected Shortfall are tested with the blessings of modern

computational algorithms and language (specifically, python). Again the instrument is the most reliable SP 500. There are some portfolio managers who invest in the same SP500 in different markets in the different countries or territories over the world. Gabjin Oh and Seunghwan Kim, Cheol-Jun Um (2006) addressed the statistical properties daily index performances data of SP 500 with another ETF (KOSDAQ) of seven different countries have been investigated using Detrended Fluctuation and Surrogate test and found the returns of international stock market indices of those countries follow universal power law with an exponent of approximately 3 while for Korean market it is 0.3. In addition, the non-linearity of returns were traced from the magnitude time series that reveals emerging market ETFs (KOSDAQ) incur higher volatility than that of mature market (SP 500). Furthermore, Mark Babayev, Folakemi Lotun, Googwill Tatenda Mumvenge, Ritabrata Bhattacharyya did a distinct work emphasizing the black swan events and identifying black swans that might be important for broad scale especially for the traders. That is a short-term Mean-Reversion system is helpful to get a risk-return profile picture. Based on which risk mitigation techniques can be applied having a clear understanding of trading performances. Hence, an outperforming Mean-Reversion strategy can be possibly constructed.

Trends and Cutting Edge:

The last year of the first decade of the 21st century was a very crucial time for the quantitative researchers in the financial and macroeconomics world. Before 2020 and near-time we had been confined in some traditional mathematical and statistical analysis and that desired time arrived to work with big data (financial and econometric data) and mining them all in a reasonably short span of time. And, there was a real boom and thereafter a great transition was in place and such unprecedented transition worked like a magic that made us address all the technical and quantitative analysis from a new perspective. It was a transition of technique, framework, and approaches. A change of a world had occurred in the quantitative finance and econometric world after computational advancement and then, we got Machine Learning algorithms. In recent years, researchers could incorporate Deep Learning algorithm toolkits to unveil the further secrets with greater accuracy. Today, analysis is not a human brain; rather it is in computers' skull but the working methods in that skull look exactly the same as human neurons' data analysis process.

Competitor Analysis

So, neither we are the only research group working with SP500 nor on its versatile researching scopes nor we are the forefront researchers of SP500. Many researchers did extensive work with SP500 in various scopes: tracking SP 500 Index Funds, modeling SP 500, regime switching identification and allocation of assets in different market regimes, risk measuring tools proposals, cross-border (international) behaviors, external factors' impact, and trading strategy for SP500. In fact, it's an open secret competition in terms of proposing latest devise and risk mitigation, capturing regime shift and cash the benefit from it in the form of investment (different investment at different regimes) and setting trading strategies, modeling performance with cutting edge technology and algorithms, achieving accuracy with the help of ultra-modern technologies and intelligences (AI) and Deep Learning (DL) through robusing and mining big datasets.

We use the Standard and Poor's 500 (shortly S&P 500 or SP500, with ticker SPY) as our benchmark instrument (stock market index tracker of 500 large companies listed in US) in this research which is categorically an ETF of USD 33.8 trillion as at the last day of 2022 in US market. Hence, it might not be an exaggeration to say that SP500 represents the phase of US economy to a significant degree and therefore we assume the market players play roles as such SP500 grasps around 80% of the US Stock market capital. We, therefore, reasonably have considered this ETF as a benchmark as it is accepted as a set element of the most influential market reflecting indicators based on the most of the academicians' and researchers' interest that the direct key market players' activity can be tracked. Our interest is to do work from October 2012 to September 2022. We also considered other 3 ETFs in our research; those are Energy sector SPDR - XLE, Finance Sector SPDR - XLF, Vanguard Real Estate Index Fund ETF - VNQ. We are interested in the return (more specifically, weekly returns) extracted from price. Here, we are interested in adjusted closing prices (though we would make a check opening prices) as our key data field. To be noted that, price reveals every action done by every market player. To handle the regime shift we have planned to utilize relevant macroeconomic factors: Unemployment rates, Fed Fund rates, and Bank loan rates for the same time frame.

Some researchers did the nearly same type of work with SP 500 but with different matrices, different financial instruments along with SP 500, different macroeconomic indicators, and different time frames. Usually, their work is a bit latest though this kind of study falls under regular and continuous work category.

This work fits into a larger field in the sense it covers the temporal continuation of the performances of SP500 which is expected to become a part of continuous assessment and review and therefore add values through becoming the latest updates of SP500 performance.

In the nut-shell, our work is latest, flexible to any other ETFs and various macroeconomic indicators, different datasets, other data fields, and alternative matrices. Therefore, this creates opportunities for prospective researchers to work with different datasets, data fields, financial instruments, matrices, macroeconomic indicators, and hence it can be said to be versatile.

To justify our choice of doing such research in this field with SP 500 to a reasonable degree, we give our SWOT analysis below to figure out some insights of our work in SWOT lens.

SWOT

Strength - The goal of our project is to research publicly available data and information (to detect any problem at preliminary stage) to help define problem(s) from 2012 to 2022. Through this research any interested party will have access to look back in the recent past and to know what has been happening and how the trend is now. Any interested party and its competitors might get an extended recent past in relation to SP500 and other ETFs' footprints from adjusted closing prices with besides the macroeconomic indicators - interest rate and unemployment rates matrices for the recent decade. We are doing the latest.

Our research on the available data has been uploaded to the Jupyter notebook. Here is the link: https://github.com/krishxx/wqumscfin/blob/main/src/MScFE_Capstone.ipynb

Weakness – It requires more effort to do comprehensive research to reach a focal point. Besides, we have considered only 3 other ETFs (energy - XLE, real estate - VNQ, finance - XLF) with SP500 out of many ETFs in the US market. We have not even considered SP500 traded in the overseas market. Therefore, our research might not be proved as universal as a whole. We have considered bank loan rates and unemployment rates as two types of macroeconomic indicators. If we could consider more ETFs (assessing on the basis of their individual weights enforced) and SP500 prices from overseas markets and consider the respective exchange rates in our research and consider more macroeconomic indicators (assessing on the basis of their individual weights enforced) then we might generate a more representative and universal work. It would be more insightful if we could perform with alternative prices and with other ETFs as associate to SP500 and with other macroeconomic indicators.

Opportunity - As our research is limited in only SP500 (benchmark instrument) and other 3 ETFs in USA territory and some two types of macroeconomic indicators including bank loan rates and unemployment rates due to limited time study hence sophisticated works remain opened for the future researchers to study the recent past with other stock market movement reflecting influential ETFs and influential macroeconomic indicators like consumer financial behavior (household), commodity market, monetary supply and etc. This work can be extended with other prices as well and prospective researchers have the opportunity to work in future. To be noted that the opening price measures short-term trading activity on that day/week the traders use that as a good marker while the closing price indicates the market sentiment of that day/week the valuers use that for their valuation.

Threat - It is difficult to do comprehensive research due to time constraints. We have maintained a process in our study that fits for short term research since limited time to study is the common challenge of this kind of research. As a category this type of research has fallen under formulative research. Since, our work is based on the data of SP 500 in the US market, we considered only 3 additional ETFs and 2 types of macroeconomic indicators as a result we could hardly declare that our work does represent an universal picture. In addition, we couldn't justify whether any of the prices is addressed as an ideal and appropriate consideration for the study and that creates a threat in using results. Therefore, decisions taking or not taking based on the reliance on the figures of our research and interpretations may create threat.

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