Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 113 (2017) 484–489

Procedia Computer Science

www.elsevier.com/locate/procedia

The 2nd International Workshop on Data Mining in IoT Systems (DaMIS 2017)

S&P500 Forecasting and trading using convolution analysis of major asset classes

Panagiotis Papaioannou[a], Thomas Dionysopoulos[b], Lucia Russo[c], Francesco Giannino[d], Dietmar Janetzko[e], Constantinos Siettos[a]*

[a]*School of Applied Mathematics and Physical Sciences, National Technical University of Athens, Athens GR 5780, Greece*
[b]*AXIANTA RESEARCH, Nicosia, Cyprus - Avenir Finance Investment Managers, Paris, France*
[c]*Consiglio della Ricerca, Naples, Italy*
[d]*Dept. of Agricultural Sciences, Univerisity of Naples Federico II, Naples, Italy*
[e]*Cologne Business School, Cologne, Germany*

Abstract

By monitoring the time evolution of the most liquid Futures contracts traded globally as acquired using the Bloomberg API from 03 January 2000 until 15 December 2014 we were able to forecast the S&P 500 index beating the "Buy and Hold" trading strategy. The proposed approach is a trend following trading strategy based on convolution computations of 42 of the most liquid Futures contracts of four basic financial asset classes, namely, equities, bonds, commodities and foreign exchange. Simulations provide empirical evidence of directional predictability of the S&P500 Index, thus enhancing the financial assets' forecasting toolkit of quantitative trading academics and professionals.

Peer-review under responsibility of the Conference Program Chairs.

Keywords: Financial Assets; Forecasting; Quantitative Trading Strategies; Financial Time Series

1. Introduction

Corporate finance theorists, macroeconomists, behavioral psychologists, quantitative finance mathematicians have teamed up to find the "holy grail" of the financial markets: that of consistently beating the market. Towards this aim,

* Corresponding author. Tel.: +30-0-7723950.
E-mail address: ksiet@mail.ntua.gr

1877-0509
Peer-review under responsibility of the Conference Program Chairs.
10.1016/j.procs.2017.08.307

methods can be categorized into (a) fundamentals, and (b) financial engineering. On the one hand, fundamentals include models most of which try to approximate the dynamics of macroeconomic observables such as the aggregate demand and supply, investment volume and consumption, risk premia etc. On the other hand, financial engineering and quantitative finance models try to forecast the price action of several financial instruments such as the S&P 500 Index[1] on a data driven basis.

Both approaches focus basically on several sub-targets such as the forecasting of a single asset as well as asset allocation methods among the four basic asset classes, namely, Equities, Commodities, Bonds, and Foreign Exchange Markets[2]. Several models have been proposed to forecast their future dynamics based on historical data and information acquired from almost all possible sources: price action, fundamentals as well as behavioral sentiment analysis and e-social platforms[3,4,5,6]. Even though success stories have been reported, these models are still prone to failure in situations undergoing structural changes and market crashes[7,8,9,10,11].

Here we propose an approach to forecast the E-mini S&P500 Futures contract exploiting convolution analysis of 42 of the most liquid Futures contracts of four basic financial asset classes: (1) equities, (2) bonds, (3) commodities, and, (4) foreign exchange. Our choice is motivated by the fact that we want to use a "non-memory" approach, one that does not need training datasets (e.g. ANNs etc.) and which would provide a point wise, time dependent and out-of-sample trading strategy even from the first few observations of the historical dataset. Based on the proposed approach, we managed to successfully forecast the S&P500 Futures Contract beating the "Buy and Hold" benchmark trading strategy.

2. Methodology

The question of how financial uncertainty gets incorporated in the risk premia offered by several financial assets and how it formulates the investors' preferences and their corresponding portfolios allocation is fundamental in contemporary financial research. Previous studies have shown that allocation decisions made by fund managers on behalf of the investors are shaped by several bounds regarding the portfolios weights of each asset class in order to ensure portfolio robustness, lower transaction costs (turnovers), longer investment horizon, smaller concentrations etc.[12,13,14].

Building up on these studies, our main hypothesis is that the shifts between the combinations of asset classes must be smooth and relatively slow, in order to achieve solid, safe and robust allocation of capital across economies and markets. An argument that supports this hypothesis is that the investors rebalance their portfolios via trading orders at global financial exchanges. Another argument towards the belief that the global trading microstructure affects the market dynamics is that responsible execution venues that govern the majority of financial transactions worldwide have to fulfill restrictions imposed by state financial authorities. Under normal market conditions, the shifts in the investments between asset classes that are influenced predominantly by supervised institutions must be relatively slow and smooth, as well as interconnected under some invariant internal properties of the entire market itself. The strong structural limitations imposed by the state authorities to the most influential market participants suggests that there must be a pattern that depicts the effects of several invariant properties of the biggest asset classes dynamics. In addition, market participants follow the rationale of the risk diversification benefits among the several asset classes. This basic investing rationale supports the hypothesis that the intercorrelation dynamics of asset classes are themselves smooth. Within this framework, we used convolution analysis to find patterns among the representatives of the four biggest financial asset classes that would provide "good" forecasters for indices such as the S&P500.

For our analysis we used Bloomberg tickers downloaded via the Bloomberg API from 03 January 2000 until 15 December 2014. We considered the most liquid futures contracts of 42 financial assets traded globally. The assets were selected on the basis of the global GDP ranking across countries worldwide according to the lists published by the International Monetary Fund (IMF). These lists traditionally include the following countries: EU, USA, China, Japan, Germany, UK, France, Brazil, Italy, India, Russia, Canada, Australia, South Korea, Spain and Mexico. Additional asset selection criteria were gleaned from the monthly reports of the World Federation of Exchanges depicting the volume ranking of the global stock exchanges by market capitalization, as well as the volume ranking of the global total value of bonds trading. Following common practices for a representative aggregation of data worldwide, we selected the basic assets for the USA aggregating the America region, the same basic assets for the EU aggregating the European region and the basic assets for China, Japan, Australia and New Zealand for the Asia region.