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Abstract

Exxon Mobil and ConocoPhillips stock price has been predicted using the difference between core and headline CPI in the United States. Linear trends in the CPI difference allow accurate prediction of the prices at a five to ten-year horizon.

Key words: stock price, Exxon Mobil, ConocoPhillips, prediction, CPI

JEL classification: G1, E3

Introduction

The future of stock market is unpredictable. This is a well-known motto of market participants, who are definitely convinced that all available information is already priced in. Otherwise, one would be able to use such unaccounted information and outperform the market. It looks in line with common wisdom, but such logic is a faulty one. From the scientific point of view, we are always aware that there exists something real that we do not know yet. Accordingly, there exist market features and processes currently inaccessible, but fully objective and describing the evolution of prices far beyond contemporary paradigm.

There are several models and infinite number of tools related to stock pricing. For our purposes they are all inapplicable because limited by the convention of unpredictability. To the extent we know, the concept proposed in this paper has no link to the current understanding of stock market. Also, we borrow no ideas or techniques from available models and tools. Therefore, we omit usual review of the literature devoted to stock markets.

The main goal is to demonstrate that stock prices, at least for some companies, are governed by forces with predictable future. As an example, two large energy-related companies have been selected from the S&P 500 list: Exxon Mobil Corp. (XOM) and ConocoPhillips (COP). (Historical data were retrieved from http://finance.yahoo.com.) The former has the largest weight in the list – around 4.4%, and the latter has an input of 0.85% at the 27^{th} place. This choice is not random. First, we have studied the short- and long-terms behavior of the consumer and producer price index for energy, and thus oil-related subcategories, in tiny details [1-4]. Second, it is likely that stock prices of energy-related companies are driven by the deviation of the headline CPI (with energy included) from the core CPI. In other words, the change in XOM and COP stock price) are proportional to the change in the pricing power of energy relative to other goods and services. It is likely that the same relation is valid for similar companies as well.

The remainder of this paper is organized as follows. Section 1 presents linear trends in the difference between the core and headline CPI observed in the past and predicts the evolution at a several year horizon. In Section 2, COP and XOM price is predicted as a linear function of the above difference.

1. The model and data

There exist linear trends in consumer and producer price indices, as derived and validated in [1-4]. It was found that the difference between the core CPI, *cCPI*, and the headline CPI, *hCPI*, can be approximated by a simple time function:

$$dCPI(t) = cCPI(t) - hCPI(t) = A_1 + B_1 t \quad (1)$$

where $dCPI(t)$ is the difference, A_1 and B_1 are empirical constants, and t is the elapsed time. Therefore, the distance between the core CPI and the headline CPI is a linear function of time, with a positive or negative slope B_1.

This difference provides an appropriate demonstration of the presence of linear trends. (Both variables are seasonally adjusted ones and borrowed from web-site of the Bureau of Labor Statistics: http://www.bls.gov/data.) Figure 1 displays this difference from 1960 to 2009. There are three distinct periods of linear dependence on time: from 1960 to 1980, from 1980 to 1998, and from 2002 to 2008. The second period is characterized by a linear trend with slope B_1=+0.66, and the third one has a larger negative slope of B_1=-1.59. There are also two turning points or short time intervals - between 1980 and 1981, and from 1999 to 2002, where the trends undergo major changes. Since 2008, the difference has been passing third turning point accompanied by very high volatility. Similar effect was observed between 1999 and 2002. In the past, the trends were very strong attractors to all deviations. Therefore, it is likely that in the near future a new linear trend will emerge, which will repeat the previously observed duration and slope. In Figure 1, green solid line represents the trend between 2009 and 2015 predicted as a mirror reflection of the previous trend between 2002 and 2008. Basically, the difference will grow from 1 unit of index in 2009 to 11 units in 2015.

Our pricing model is trivial. We assume the presence of a linear link between stock price, *sp* (=*XOM* or *COP*), and the difference between the core and headline CPI,

$$sp(t) = A_2 + B_2 dCPI(t + t_2) \quad (2)$$

where A_2 and B_2 are empirical constants, t is the elapsed time, and $t_2 \geq 0$ is the time delay between the stock and the CPI changes, i.e. the CPI may lag behind the price. Constants in (2) are

determined for all linear trends. This implies the possibility of structural breaks in relationship (2) due to the turn to a new trend.

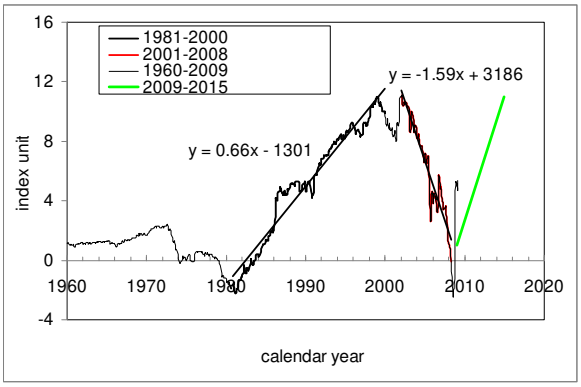

Figure 1. The difference between the core and headline CPI as a function of time. One can distinguish three periods of quasi-linear behavior with two distinct turning points. For second and third periods, linear regression lines are characterized by slopes B_1=+0.66 and B_1=-1.59, respectively. Green solid line represents the trend between 2009 and 2015 predicted as a mirror reflection of the previous trend.

2. COP and XOM price

To begin with, ConocoPhillips stock price is modelled as a linear function of the core and headline CPI difference. Trial-and-error method is applied to obtain the best visual fit between the COP (monthly close) price and the *dCPI(t)*. Left panel in Figure 2 illustrate the fit between the actual price and that predicted using the following coefficients throughout the whole period between 1982 and 2009: A_2=90, B_2=-4, t_2~2 months or 1/6 year. The time lag of approximately 2 months gives the best fit for the most recent segment of the actual price curve when the price has been undergoing a severe fall. This lag is the same for all predicted curves in this study. The slope of -4 implies that an increase by 4% in the COP price is followed by a 1% decrease in the *dCPI* in two months. The actual and predicted curves rapidly diverge back in the past since 1998.

The monthly close price demonstrates a spike near 2005. This sharp tooth was induced by a stock split, i.e. is of artificial character. So, it is better to model the close price adjusted for dividends and splits. Right panel in Figure 3 displays corresponding curves. The predicted curve is obtained using the following relationship:

$$COP(t) = (-6)*dCPI(t+1/6) + 80 \quad (3)$$

Therefore, the change in the adjusted price is about 50% larger than that in the regular close price.

In the right panel, there is no fit before 1999 as well. At first glance, one might suggest that the *dCPI* provides no information about the evolution of the COP price. Surprisingly, this is not a right assumption. Figure 1 shows that the linear trend before 1999 was positive and after 2002 – negative. In terms of econometrics, there was a structural break in the behavior of the *dCPI*. In other words, the set of long-term economic bounds between goods and services, comprising the CPI and defining the linear trend in the *dCPI* between 1982 and 1999, underwent a three-year-long transition to a new set. In turn, the new set defined the trend observed from 2002 to 2008. So, it is reasonable to assume that the sign of slope in (2) should change to an opposite one. Since the positive slope between 1981 and 1999 is only about a half of that between 2002 and 2008, one can expect that coefficient B_2 before 1999 should also be divided by a factor of 2. Free term in (2) is another issue – it must change in a way to retain the continuity of the predicted price function. After reversing the sign and calibrating relevant amplitude and level between 1982 and 1998 (we included the transition into the second segment) we have obtained a much better fit as depicted in Figure 3 using the following function:

$$COP(t) = (+3)*dCPI(t-2) - 10;\ 1980<t<2002 \quad (4)$$

Finally, a complete prediction of the COP price between 1982 and 2009 is obtained. Before 1987, the predicted curve in Figure 3 sinks below the zero line. There is no special need to describe the price in the early 1980s using the CPI difference. As shown in [1,2], all subcategories of the consumer price index, except the index for energy, are parallel before 1982. Therefore, the difference between any two indices, including the headline and core CPI, is constant, i.e. it contains no information on the changes in stock prices. In any case, accurate prediction of the past is of lower interest than prediction of the future.

Similar procedures have been applied to Exxon Mobile stock price adjusted for dividends and splits. Figure 4 summarizes most important findings. In general, the evolution of XOM price is very similar to that of COP. A minor deviation consists in a slightly bigger free term of 90. This might result from the usage of the trial-and-error method with visual fit. It is really crude

and does not provide accurate estimates of coefficients in (2). The similarity of the COP and XOM time series allows suggesting that other large oil companies in the S&P 500 list also obey relationship (2). We leave it to the reader to conduct comprehensive research.

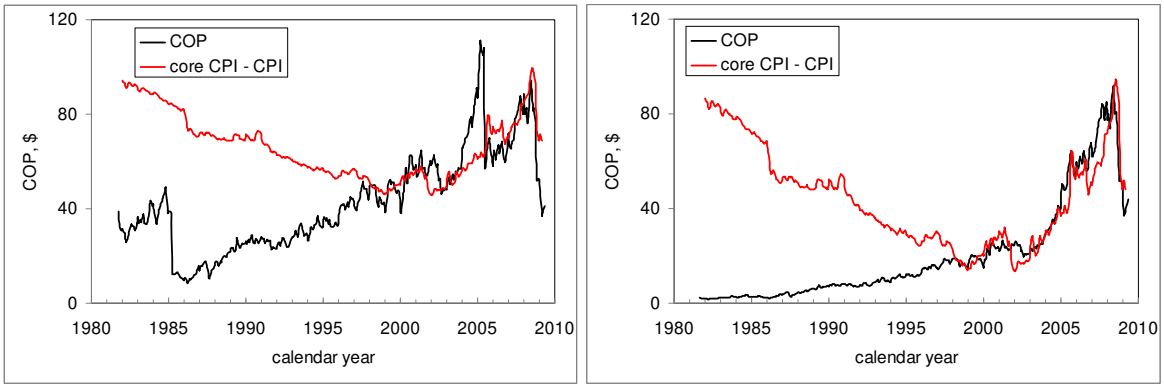

Figure 2. Historical (close) prices for COP (black line) and the scaled difference between the core CPI and the headline CPI (red line) from 1982 to 2009. *Left panel*: Close price. A_2=90, B_2=-4. Notice two splits in 1985 and 2005. *Right panel*: Close price adjusted for dividends and splits. A_2=80, B_2=-6.

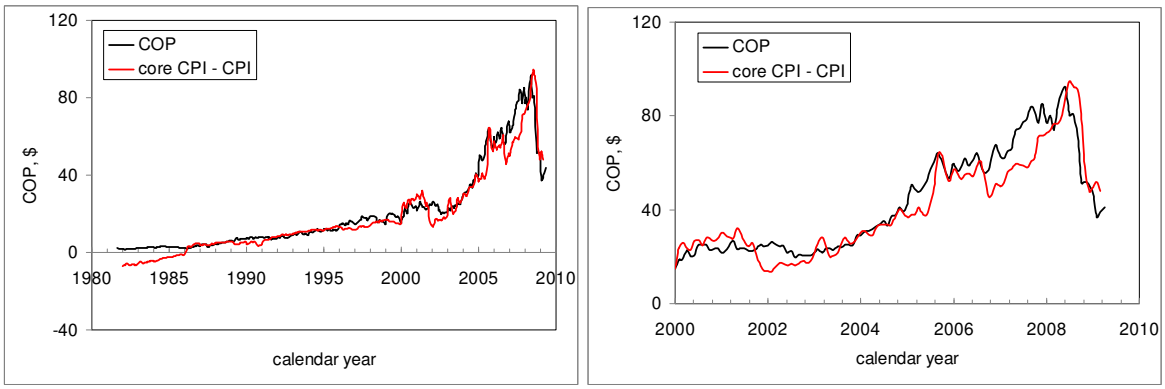

Figure 3. The observed and predicted COP price: A_2=-10, B_2=3 (1982-1998); A_2=80, B_2=-6 (1999-2009)

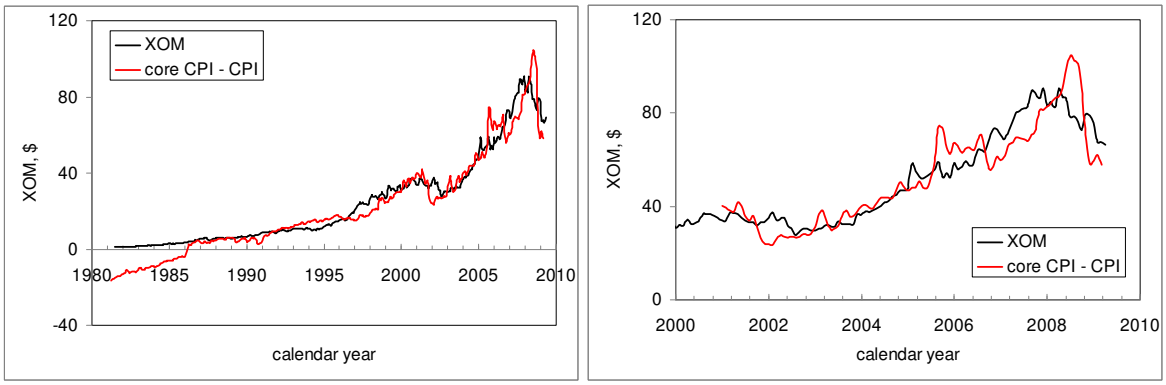

Figure 4. Same as in Figure 3 for XOM. A_2=-10, B_2=3 (1980-1998); A_2=90, B_2=-6 (1999-2009).

Now, if XOM and COP stock price will follow the new trend in the *dCPI* (green line) in Figure 1, as is did between 1985 and 2008, one will be able to predict the "trend price" at any given time before 2015. Large deviations from this trend price are likely in the future because they were observed in the past. Even when random, these deviations contain crucial information on the change in relevant stock prices. Any deviation from the trend must be compensated in the short run by an adequate deviation with an opposite sign to retain the price near the trend in the long run. Physically, it sounds like the action of restoring force returning a pendulum in the equilibrium position. Figure 5 displays absolute and relative difference between the observed and predicted time series for ConocoPhillips. Both differences demonstrate substantial amplitudes. A remarkable feature of the difference is that any deviation is compensated in the short-run. Hence, the larger is a given deviation from the zero line the higher is the return from the next compensating movement. It is a matter of time only, but the probability of such event was 100 per cent.

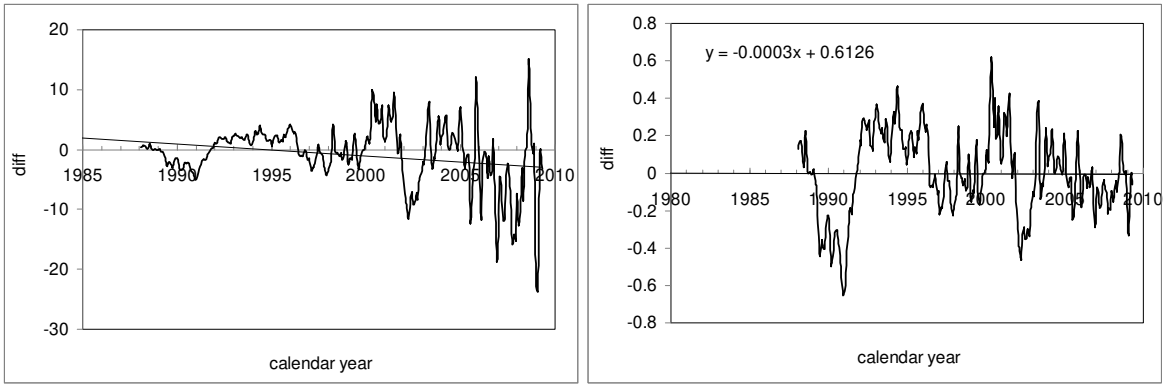

Figure 5. Absolute (left panel) and relative (right panel) difference between the observed and predicted time series. Both differences demonstrate substantial amplitudes. A remarkable feature of the difference is that any deviation is compensated in the short-run. Hence, the larger is a given deviation from the zero line the higher is the return from compensating movement.

Conclusion

This paper presents preliminary results of a feasibility study. By no means, this is a comprehensive investigation of the CPI and its components as a predictor of stock prices. All empirical constants were estimated by very crude visual fit. So, we do not recommend the usage of our quantitative results for actual evaluation of investment strategy.

At the same time, there is enough information for several basic conclusions. In general, the difference between the core and headline CPI provides a good approximation of the evolution of the price for energy-related stocks. However, there are short periods of rapid and deep fall in stock price associated with the change in linear trends. The fall is likely induced by higher volatility in the CPI during the transitions. Conditions of low confidence and high risk associated with elevated volatility might be easily transformed into mass panic.

Between 1999 and 2002, the functional dependence of XOM and COP price on the *dCPI* underwent a transformation from positive factor B_2=+3 to negative factor B_2=-6. Within the uncertainty of relevant estimates, the ratio of these factors (-6/3)=-2 is close to the ratio of the slopes in corresponding linear trends (-1.57/0.66)~-2.4. Hence, one can expect that B_2 for the new trend will be proportional to its slope. Inevitably, Exxon Mobil and ConocoPhillips stock price will be growing after the end of the current transition period. This will happen despite the fact that the price index for energy (and thus oil price) will be growing at a lower rate than the core CPI.

A new rally with known B_2 is likely to start in 2010, after the end of the current transition period. In five to ten years, the difference between the core and headline CPI will reach the next turning point. Then XOM and COP price will suffer a sudden drop again.

In a sense, company name is irrelevant under the framework developed in this paper. The evolution of stock price for any company can be modelled and thus the time when the price will go up or down can be predicted. However, it is possible that some companies from the S&P 500 list cannot be represented as a function of the *dCPI*. Then other difference between various subcategories of the CPI could be tested as a predictor. Figure 6 depicts preliminary results of the modelling of MSFT stock price using the difference between the headline CPI and the index for housing, *H(t)*: *hCPI(t)-H(t)*. The overall dependence is split into two segments with different coefficients: before and after 2003. This is the year when the difference turned to a constant line with high volatility. This is a preliminary model and much more work is needed to obtain a consistent model. Even a crude forecast of general trends in stock prices at a five-year horizon is a valuable piece of information.

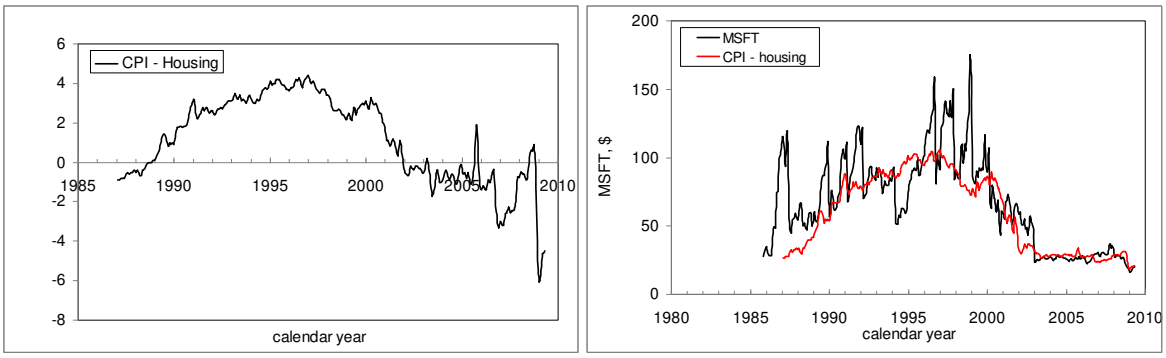

Figure 6. *Left panel*: the evolution of the difference between the headline CPI and the price index for housing. After 2003, the difference is practically parallel to the x-axis. *Right panel*: Monthly (unadjusted) close price of MSTF stock and the price predicted using the difference in the left panel with the following coefficients: A_2=40, B_2=15 (before 2003); A_2=30, B_2=2 (after 2003).

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