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Kitov, Ivan and Kitov, Oleg

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Ivan O. Kitov, Oleg I. Kitov

Abstract

In the United States, there exist robust linear trends in the differences between headline (or core) CPI and price indices for individual subcategories of goods and services such as energy, food, housing, etc. Chiefly these differences can be represented by a piece-wise straight line. The periods of the transition from one trend to another are characterized by an elevated volatility. The difference between the core CPI and the price index for motor fuel can be also accurately approximated by several straight lines. In 2008, the negative trend was replaced with a positive one, and thus, a very high volatility in motor fuel price was observed, with an extension into 2009. The change in the trend was accompanied by an "overshoot" in the price for motor oil, which dropped much lower than that expected from the new trend. Therefore, the difference has to return to the new positive trend in 2009. During the recovery period, the index for motor fuel will grow by 90 units or 50%. The price for motor fuel in the US will also grow by 50% by the end of 2009. Oil price is expected to rise by ~50% as well, from its current value of ~$50 per barrel.

Therefore, the fair price is not a fixed value but a linear function of time.

Key words: CPI, motor fuel price, prediction, US

JEL Classification: E31, E37

Introduction

The change in consumer prices is an eternal concern of any economy. In developed countries, the overall level of prices is the responsibility of central banks. Both high price inflation and deflation are considered by the mainstream economics as malicious phenomena which must be avoided by any means. This is not a correct presumption, however, because inflation in advanced economies is driven only by the change in labor force [1-8]. There exists a linear lagged relationship between inflation and the rate of labor force change, which allows prediction of inflation at various time horizons from current estimates of workforce and its projections. Therefore, the overall price inflation can be accurately estimated, but any artificial restriction of inflation using monetary tools may result in the (possibly lagged) increase in unemployment [4].

Having a reliable forecast of the overall consumer price index (CPI) one can design a sound monetary policy, what is the primary objective for monetary and economic authorities. On the other hand, the overall CPI depends on the evolution of individual goods and services. Initially we found the presence of long-term linear trends in the difference between headline CPI and core (i.e. the headline one less food and energy) CPI [9]. Then we revealed that the differences between the headline (core) CPI and indices for individual expenditure categories such as energy, food, housing, and transportation is similar to that between the core CPI and headline CPI. Using the presence of piece-wise linear trends in corresponding differences we predicted [9] that "the index for energy will reach the level of the core CPI in 2008. Then, one should not expect further increase in energy price beyond that dictated by the headline CPI. It is likely that oil price will be falling in absolute terms." Now we can state that this prediction is correct: crude oil price reached ~$150 and then dropped to ~$40. Correspondingly the price index for energy lost around 80 units during very short period. A relevant finding was the presence of high volatility during the transition between adjacent linear trends, as was observed with the oil price in 2008 and 2009.

Analysis of the difference between the headline CPI and such small individual subcategories as apples and oranges also revealed the presence of linear trends [10]. One of the studied subcategories was fuel oil for housing purposes, which was shown to be dependent primarily on oil price. All in all, the evolution of the price indices for even tiny subcategories relative to the CPI is not a stochastic process. This finding allows predicting prices of practically all goods and services. Such predictions include timing of the changes in linear trends.

1. The model

As derived in [9,10], the difference between the core (or headline) CPI, *cCPI*, and individual indices, *iCPI*, can be described by a simplest time function :

$$cCPI(t) - iCPI(t) = A + Bt \tag{1}$$

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where *A* and *B* are empirical constants, and *t* is the elapsed time. Therefore, the "distance" between the core CPI and some individual index is a linear function of time, with a positive or negative slope *B*.

The difference between the core CPI and (headline) CPI provides the best demonstration of the presence of linear trends. Left panel of Figure 1 displays the difference between 1960 and 2009. There are three distinct periods of linear dependence on time: from 1960 to 1980, from 1980 to 2000, and from 2001 to 2008. There are also two turning points in 1980 and 2001, where the trends undergo changes. Both turning points are characterized by an elevated volatility. Currently, the difference is passing third turning point with very high volatility caused by the uncertainty in the characteristics of the following trend.

Right panel of Figure 1 presents quantitative parameters of the linear trends. Between 1980 and 2000, the difference was growing at a rate of 0.67 units per year. Between 2001 and 2008, the difference underwent a rapid fall at a rate of 1.6 units per year. Both trends are reliable ones with high goodness-of-fit. A fundamental feature of the difference consists in the fact that all deviations from the trends were only short-term ones. This implies that current or future deviations from the new trend, which has been under development since July 2008, should be rapidly compensated. This feature will be used to predict the price for motor fuel in the next Section.
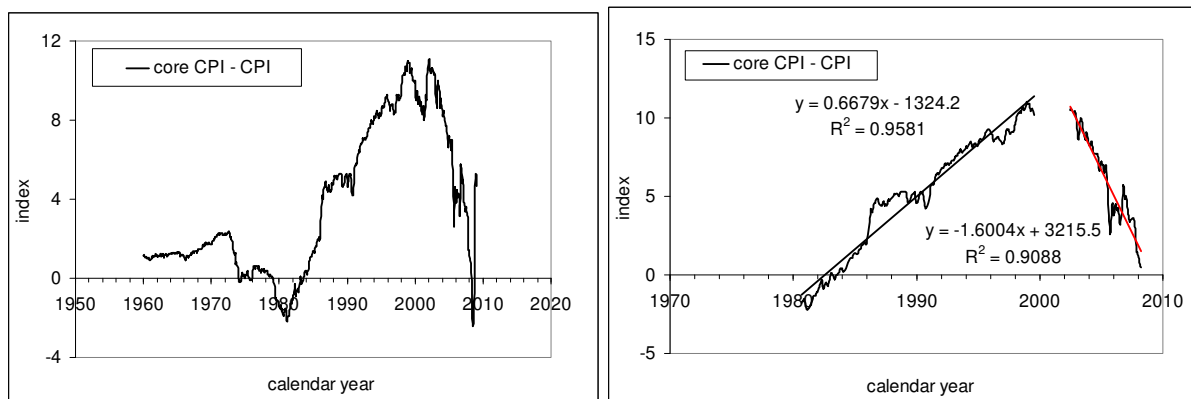

Figure 1. Illustration of linear trends in the difference between core and headline CPI in the U.S. *Left panel* demonstrates the full history of the difference between January1960 and March 2009. There are three quasi-linear segments with two turning points near 1980 and 2000. Currently, the difference passes third turning point. *Right panel* displays two linear trends with relevant linear regression lines.

2. Prediction

Having relationship (1) describing the evolution of the difference between the core CPI and individual indices one can easily predict its short- and long-term evolution. Figure 2 depicts time history of the differences for the index for energy and motor fuel. In general, both time curves

are similar to that in Figure 1 with an exception of amplitude. The index for motor fuel has suffered larger deviations from the core CPI and is characterized by higher volatility than the index for energy. Otherwise, both differences evolve in sync.

The period between 2008 and 2010 is characterized by an extraordinary high volatility in both differences. The new linear trend is under development and it is difficult to accurately estimate the rate of future growth. A naive assumption is that the following period will be a "mirror reflection" of the previous one. Therefore, the new slope should be the same as the old one but with opposite sign. Figure 3 shows the new trend by solid red line – the difference will grow from -60 in 2008 to +80 in 2015.
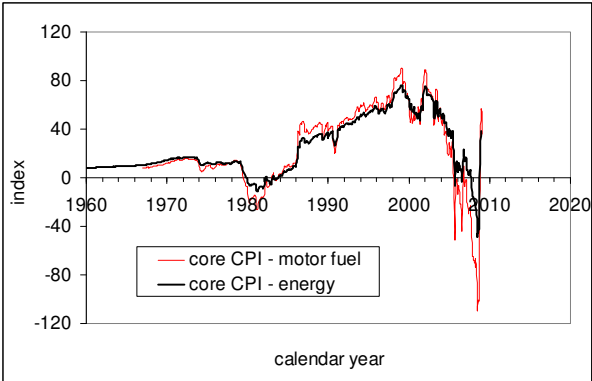

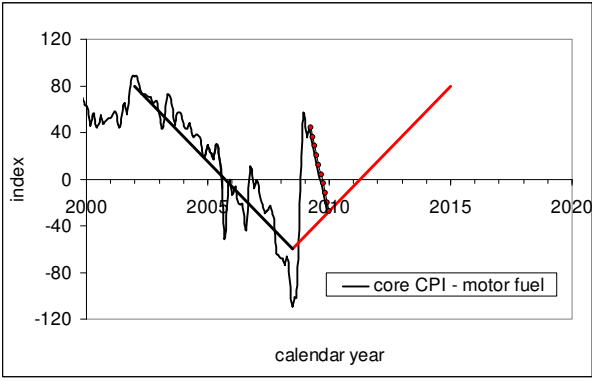Figure 2. Evolution of the price indices for energy and motor fuel relative to core CPI.

Figure 3. The difference between the core CPI and the index for motor fuel. Red filled circles predict the evolution of the difference between March and December 2009. Total increase in the difference is +90 units of index or +50%: from 173 in March to 263 in December. Solid red line represents the "mirror" trend for that between 2002 and 2008, which is shown by solid black line.

In March 2009, the difference was at the level of +45, i.e. much higher than the level predicted by the new trend. As happened in the past with numerous individual price indices [9,10], such a strong deviation (one might call it "dynamic overshoot") should be compensated in the near future. Without loss of generality, we have restricted the recovery to the trend by the end of 2009. As a result the index for motor fuel should growth by 90 units during the next 9

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months, or by 10 units per month. Red filled circles represent the evolution of the difference from April to December 2009. In 2010, the difference may undergo an overshoot in the opposite direction with additional rise in the index for motor fuel.

Translating indices into prices, the rise in the difference by 90 units (from 173 in March to 263 in December) means an increase in price by 50%. Therefore, it is very likely that the price for motor fuel in the beginning of 2010 will be 60% to 70% larger than in March 2009 due to the overshoot.

Correspondingly, the price index for energy, and thus, oil will also be growing in 2009 and likely in the first half of 2010. Sitting in May 2009, we observe a robust growth in oil price and futures. In any case, the difference should return to the new linear trend shortly.

Conclusion

The price index for motor fuel in the USA should grow by ~50% in 2009 – from 173 to 263 in order to intersect the long-term trend line. Accordingly, the price for motor fuel should grow by 50% from its March level. The rise in the price will be following up the growth in energy (including oil) price. Therefore, the headline CPI, which includes energy and food, will be growing faster that the core CPI in 2009 and the consumer price inflation will be positive.

The title of this paper refers to some fair price for motor fuel. Unlike many researches, policy makers, and businessmen we treat no fixed price as a fair one. The price index for motor fuel (and for other subcategories of goods and services) evolves relative to the core CPI as a linear function of time. Such evolution must be caused by a huge number of mainly uncontrolled interactions between economic agents. Therefore, the straight line representing the observed trend consist of "gravity centers" to which the difference must converge over time. This line defines the fair price of motor fuel at any time. Because the evolution of the headline and core CPI in the United States is predetermined by the change in labor force, the problem of the fair price is completely resolved. Observed deviations from the fair price line are related to market sentiments caused by the uncertainty in the estimates of the future inflation and real economic growth. This uncertainty can be substantially reduced when the market will understand the inevitable character of linear trends and the dependence of the overall inflation on the change in labor force.

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