Examining the CRB index as a leading indicator for US inflation

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This article analyses historical movements in the commodity futures market and its relationship to inflation. Specifically, the relationship between the Commodity Research Bureau (CRB) index and US inflation is investigated. The results show that the CRB index continues to be an effective early indicator of inflation. However, as the composition of the US economy changes, the CRB should continue to realign the index to maintain its long-term viability.

I. Introduction

This study examines the efficacy of a commodity price index as an early indicator for inflation. The Commodity Research Bureau (CRB) has been maintaining an overall commodity price index since 1956. Since its inception, the index has been revised 10 times to maintain its empirical relevancy. The most recent amendment implemented in 2005 has 19 commodities and gives some commodities a greater weight than others. For instance, to reflect the recent changes in its market structure, a relatively higher weight has been assigned to the unleaded gas (RJCRB, 2008). The CRB index is generally considered as a comprehensive measure that tracks the movements in all sectors of the economy and serves as an early indicator for inflation (Rogers, 2007).

However, some of the recent studies have raised the question on the efficacy of the index in predicting inflation (Adams and Ichino, 1995; Furlong and Ingenito, 1996). Most of the previous studies are based on monthly price series that are prone to short-term idiosyncratic movements (Furlong, 1989). Therefore, it is important to re-evaluate the empirical relationship between these two macro variables using annual data (Gentle *et al.*, 2005, 2008; Chang and Cheng, 2002). In addition, the CRB has realigned its price index to reflect the recent changes in the US economy. In this light, this study estimates a Vector Autoregressive (VAR) model using annual time series data and re-evaluates the empirical relationship between the CRB index and inflation. A series of empirical tests were conducted to determine the order of the VAR system, stability of the selected model and the direction of causality between the CRB index and inflation. Moreover, the empirical results based on lower frequency data (i.e. annual series rather than monthly) used in this study are expected to provide a better measure of commodity price–inflation relationship than the results based on higher frequencies.

II. Effectiveness of the CRB Index as a Leading Inflation Indicator

Many economists and publications have in general accepted the CRB index as a bell weather indicator

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of future inflation (Angell, 1992; Nusbaum, 1993; Rogers, 2007). Economists place a great deal of importance to lag time because there can be an effect felt in one part of the economy that is not felt in the other parts of the economy immediately. Because the CRB index is updated continuously throughout the business day as commodity futures prices fluctuate and measurements of consumer price inflation adjust more slowly, the CRB index is monitored widely by financial market participants (Garner, 1995).

The price change signalling role for commodities rests on the fact that commodity prices are set in auction or flexi-price markets. Because of this, these commodity prices can dash ahead quickly in *response* to actual or expected changes in supply or demand. By contrast, prices of most final goods and services are restrained by contractual arrangements and other market frictions. So they respond gradually and steadily to supply and demand pressures, slowly gaining ground on commodity prices (Blomberg and Harris, 1995). Furthermore, Blomberg and Harris (1995) point at the classic exchange rate model developed in Dornbusch (1976). According to this model, prices on goods may be 'sticky' in the short run. However, in the short run, the financial markets may adjust to disturbances very quickly. The initial overreaction and then settling back down is often referred as an overshooting model (Dornbush, 1976; Rogoff, 2001; Romer, 2003).

The empirical literature on commodities expands on this simple theoretical framework and presents three different accounts of the linkages between commodity prices and broad inflation (Blomberg and Harris, 1995). First, as illustrated by the tortoise-and-hare fable, commodity prices may give forewarning signals of an inflationary swell in aggregate demand. Higher demand for final goods increases the demand for commodity inputs. Even though the inflation momentum may start in final goods markets, the first visible increase in prices may be in the flexi-price commodity markets. Because commodities are widely traded internationally, this aggregate demand signal would most likely occur when strong domestic demand is not counterbalanced by weak foreign demand. Certainly, in empirical models, commodity prices are often modelled as a function of global economic activity. These demand-induced commodity price run-ups most probably will be concentrated in industrial materials (Blomberg and Harris, 1995). Second, commodity prices and broad inflation may be directly connected because commodities are an important input to production, representing about one-tenth of the value of output in the United States. Thus, all else being equal, an increase in commodity prices should sooner or later be passed through to final goods prices. Historically,

large direct input price effects have tended to be concentrated in food and energy commodities (Blomberg and Harris, 1995). The third connection between commodity prices and future inflation stems from the first two. Because commodity prices respond quickly to wide-ranging inflation pressures, investors may see them as a useful inflation hedge. This view tends to be self-fulfilling. The more the commodities are seen as an effective hedge, the more likely the investors are to turn to them in anticipation of inflation. Usually, precious metals have been signalled out as the most convenient commodities for hedging inflation (Blomberg and Harris, 1995).

One such principle is the notion that rising commodity prices signal acceleration in the rate of inflation. A popular application of this idea is to sell government securities to price in possible monetary contraction by the Federal Reserve Board because the CRB index is in an uptrend. There is a link between the level of commodity prices and the rate of consumer price inflation (Blomberg and Harris, 1995).

A number of empirical studies have examined the effectiveness of CRB index as a leading indicator for inflation (Adams and Ichino, 1995; Tutterow, 1995; Furlong and Ingenito, 1996; Mahdavi and Zhou, 1997; Moosa, 1998; Bloch *et al.*, 2004, 2006). Although its strength has been weaker at times than others (Adams and Ichino, 1995; Furlong and Ingenito, 1996), most of these studies observe that the CRB index can still be used as a leading indicator for inflation (Mahdavi and Zhou, 1997; Moosa, 1998).

III. Method

Based on the literature reviewed in Section II, we developed the following *pth* order VAR system to describe the relationship between commodity prices and inflation:

$$CRB_t = a_{01} + \sum_{i=1}^{P} b_{1i}CRB_{t-i} + \sum_{i=1}^{P} c_{1i}Inf_{t-i}$$
$$+ d_{1i}Trend + \varepsilon_{1,t}$$
$$Inf_t = a_{02} + \sum_{i=1}^{P} b_{2i}CRB_{t-i}$$
$$+ \sum_{i=1}^{P} c_{2i}Inf_{t-i} + d_{2i}Trend + \varepsilon_{2,t} \qquad (1)$$

Here CRB_t is Reuters/Jefferies CRB index (CCI), Inf_t is US inflation rate and *Trend* is a trend variable expected to measure production capacity/technological innovation. A number of empirical and statistical

procedures are involved in deriving the final estimating equation from the *pth* order VAR system in Equation 2. First, a number of statistical tests such as final prediction error criteria, Hannan–Quinn criterion, Akaike information criteria and Schwarz criteria are used to determine the order of the VAR system. Second, unit root tests are conducted to determine the stability of the selected equation system. Third, a VAR Granger causality test is conducted to determine the direction of causality. In this study, we are interested to know whether there is one-way causality from commodity prices to inflation. Finally, variable exogeneity tests are conducted to determine whether the variables included in the model are exogenous to the system. To test our hypothesis, we used yearly inflation and CRB index data for the USA from 1957 to 2005.

IV. Results

We adopt an empirical approach in determining the order of the VAR system, stability of the selected model, the direction of causality between commodity prices and inflation and the exogeneity of other variables used in the VAR system. All five lag order selection tests indicate that the relationship between commodity price index and inflation rate can be closely approximated by a second-order VAR system (Table 1). Given these results, a second-order VAR system is used in all subsequent estimations.

The unit root test results indicate that all four roots of characteristic polynomials lie inside the unit circle, implying that the selected VAR system satisfies the stability condition. Moreover, the Granger causality test results show that movements in commodity prices indeed induce changes in inflation rate but not the other way around (Table 2). This implies that changes in commodity price index precede changes in inflation. The variable exogeneity tests indicate that money supply and gross domestic product growth rates are exogenous to the VAR system under consideration.

Table 2. Granger causality/block exogeneity Wald test results

Excluded variable	Chi-square (χ^2)	Degree of freedom	Prob.
Dependent variable: CRB index			
Inflation	1.602	2	0.449
All	1.602	2	0.449
Dependent variable: inflation			
CRB index	15.826	2	0.000
All	15.826	2	0.000

As a second test to examine whether there is a two-way relationship between commodity price index and inflation, a second order VAR system with trend and intercept as exogenous variable was estimated (Table 3). As expected, both of the coefficients associated with the lagged inflation variables in CRB index equation (column 1) are not significant. On the other hand, the coefficients associated with the lagged CRB index in inflation equation (column 2) are highly significant, implying that commodity prices affect inflation but inflation does not affect commodity prices.

Table 3. Estimated parameters for the second-order VAR system

Variable	CRB index	Inflation
Constant	20.3404	1.7432*
	(1.46)	(2.48)
CRB index (−1)	1.1513**	0.0337**
	−(6.58)	(3.81)
CRB index (−2)	−0.3906*	−0.0330**
	−(2.08)	−(3.47)
Inflation (−1)	−2.0028	0.9246**
	−(0.73)	(6.66)
Inflation (−2)	3.3434	−0.2060
	(1.25)	−(1.53)
Trend	1.0936	−0.0330
	−(1.68)	−(1.01)
R^2	0.87	0.82

Note: * and ** denote significance at 5 and 1% levels, respectively.

Table 1. VAR Lag order selection test results

Lag	Log L	LR	FPE	AIC	SC	HQ
0	−308.100	NA	9762.447	14.862	15.027	14.923
1	−271.668	65.925	2085.834	13.318	13.649	13.439
2	−258.633	22.345*	1360.312*	12.887*	13.384*	13.069*
3	−255.850	4.505	1449.420	12.945	13.607	13.188
4	−250.691	7.862	1384.269	12.890	13.718	13.193

Notes: The model used in testing VAR order includes CRB index and inflation as the endogenous variables and a constant and time trend as exogenous variables. The column headings are defined as Log L, log likelihood function value; LR, sequential modified likelihood ratio test statistic (each test at 5% level); FPE, final prediction error; AIC, Akaike information criterion; SC, Schwarz information criterion and HQ, Hannan–Quinn information criterion.
*Indicates lag order selected by the criterion.

V. Conclusions

Using VAR model, we found that the relationship between commodity price and inflation is still significant. In particular, the model results show that there is one-way relationship between commodity price index and inflation. Moreover, the results from the impulse response function show that an increase in commodity price index by 1 SD would increase inflation nearly by one unit in the second year. This implies that the CRB index can still be used as an early indicator of inflation.

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