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Forecasting inflation using commodity price aggregates

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ABSTRACT

This paper shows that for five small commodity-exporting countries that have adopted inflation targeting monetary policies, world commodity price aggregates have predictive power for their CPI and PPI inflation, particularly once possible structural breaks are taken into account. This conclusion is robust to using either disaggregated or aggregated commodity price indexes (although the former perform better), the currency denomination of the commodity prices, and to using mixed-frequency data. In pseudo out-of-sample forecasting, commodity indexes outperform the random walk and AR(1) processes, although the improvements over the latter are sometimes modest.

1. Introduction

The increase in inflation targeting as part of an objective of monetary policy, together with the volatility of asset prices and periodic stock market bubbles, has raised the issue of the proper response of monetary policy to asset market signals. Early simulations by Fuhrer and Moore (1992) argued against responding to asset market prices, suggesting that it can lead to a loss in inflation control. Bernanke and Gertler (1999, 2001) also argued that monetary policy should not respond to changes in asset prices, except insofar as they reflect inflationary expectations. They emphasize in particular the difficulty of determining whether a change in an asset price is reflecting fundamentals or is a speculative bubble. In contrast, Cecchetti et al. (2002) argue that targeting monetary policy to misalignments in asset prices may improve macroeconomic performance.[1]

More recently, attention has been focused on, the more specific role of commodity prices as a significant determinant of current and future inflation. This view is articulated by Federal Reserve Chairman, Ben Bernanke, who has suggested that rising prices for globally traded commodities have been a principal contributor to the inflationary experience of the 2000s, prior to the financial crisis.[2] The theoretical basis for this connection and the empirical evidence are not so clear-cut, however. Simultaneity confounds identification and makes establishing causality difficult, and the empirical evidence linking commodity prices to inflation forecasts has also been elusive or episodic.[3] Recently, Gospodinov and Ng (2013) obtain some success in using the principal components of convenience yields in predicting inflation; however, they also find that using the IMF aggregate commodity index has little power in predicting inflation.

Most of the evidence in the literature employs US, and to some extent, UK data. In this paper we re-examine the usefulness of commodity prices in forecasting inflation from the viewpoint of small commodity-exporting countries. The motivation for doing so is three-fold. First, due to the high commodity production dependency in these countries, world commodity prices have a direct link to their real economy, affecting production revenues and export earnings, and therefore output, real wages, and other aspects of the macroeconomy. That is, for these countries, commodity price *is* a fundamental, and its linkage to the economy is not merely a financial asset. Second, previous literature such as Amano and van Norden (1993) and Chen and Rogoff (2003) demonstrated the presence of the "commodity currency" phenomenon: that global commodity prices play a key role in driving the currency value of several major commodity-exporting countries. While the currency responses tend to be very fast and even contemporaneous, to the

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[1] Much of the debate is summarized by Bean (2003), who in discussing the position of the Bank of England, suggests that the bottom line depends upon assumptions one is making about the underlying stochastic structure of asset prices and the information available to the policymaker.

[2] This view was expressed in a Speech entitled "Outstanding Issues in the Analysis of Inflation" presented at the Federal Reserve Bank of Boston's 53rd Annual Economic Conference, Chatham, MA, June 9, 2008.

[3] See e.g. Blomberg and Harris (1995), Hooker (2002), Stock and Watson (2003).

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extent that exchange rates pass through to consumer prices over time, world commodity price movements would have predictive power for CPI inflation. The possible presence of nominal rigidities such as menu costs would also imply a delayed producer currency index (PPI) response to commodity price shocks. Finally, by focusing on small economies with little market power to influence world markets, we eliminate the simultaneity issues identified by Gospodinov and Ng (2013).

We consider five countries: Australia, Canada, Chile, New Zealand, and South Africa. These five small economies all have a relatively long history of operating under well-functioning open markets, flexible exchange rates, and transparent monetary policies. They produce a wide spectrum of primary commodity products and rely heavily on them for exports. Previous studies have documented the strong connection between their currency values with world commodity prices, providing us with the motivation to examine further whether the linkage may help with inflation forecast.[4] As all these countries have inflation-targeting policies, forecasting inflation is also especially relevant for gauging future policy directions.[5]

To predict inflation in these countries, we use price indexes for the following seven broad categories of products: Metals, Textiles, Raw Industrials, Foodstuffs, Fats & Oils, Livestock, and Energy. Our choice in using these sub-indexes deviates from some of the earlier work that treats each country's exports as one aggregate basket.[6] By using disaggregated indexes, we explicitly recognize the distinct trends and cycles the prices of different broad commodity categories follow (see e.g. Cashin et al., 1999). We note that in general these sub-indexes are highly correlated, confirming the significant co-movement obtained in previous studies.[7] However, to the extent that agricultural markets and energy markets are driven by different shocks, allowing each component to have a differential impact may improve the quality of the predictions. Another advantage of the predictor indexes we use is that they are market information readily available to the public.[8] Alternatives such as the country-specific indexes published by the central banks or other major organizations are typically available with a long delay, and to construct them using market data would require specific knowledge of the production structure of the economies (and how they change over time).[9] Our indexes are observable on a daily basis and can be used in real time, which enables us to examine the effectiveness of using mixed data frequency forecasts.

We model the CPI, PPI and commodity prices as I(1) variables and allow for the possibility of cointegration. Due in part to explicit inflation targeting policies in the commodity exporting countries, we find clear evidence for structural breaks in the mean of the CPI and PPI inflation rates but no corresponding breaks in the commodity inflation series. These breaks are taken into account in our estimation of the forecasting relationships. We find that incorporating structural breaks substantially improves the forecasting performance.

We first consider in-sample predictive regressions using an error correction framework that incorporates structural breaks in the CPI and PPI inflation series. We see strong in-sample Granger causality from commodity price changes to both CPI and PPI inflation. For all five countries, some sub-indexes contain predictive content, with energy being almost the most uniformly significant predictor. Lagged inflation is often, but not always, an important predictor as well.

As part of a robustness check, we first explore the effect of home currency-denomination. Since commodity prices and therefore our indexes are denominated in US dollars, we translate them to domestic currency to see if the signal strengthens or diminishes. Overall, the results remain generally unchanged. Second, we replace the seven sub-indexes with an aggregate commodity price index and evaluate the predictive content of aggregate commodity prices for CPI and PPI inflation. Using two alternative measures for aggregate prices, we find that for all countries except Canada neither aggregate index does as well as the disaggregated series in predicting CPI and PPI inflation. We interpret these findings as first confirming that there are indeed signals from the commodity markets for gauging future inflation, and that the gains from disaggregation are greater in predicting CPI inflation than they are in predicting PPI inflation.

In light of the high correlation among the commodity price sub-indexes, which makes interpreting individual coefficient estimates difficult, we reduce the dimensionality by entering the regressors into the Least Angle Regressions (LARS) procedure, pioneered by Efron et al. (2004). This is a computationally efficient stagewise regression procedure that selects the appropriate regressors so as to optimize a prediction error-based criterion. This approach yields results that are generally consistent with the full error-correction regressions, confirming the general importance of sub-indexes.

After observing the robust in-sample predictive ability of commodity prices for inflation, we examine their out-of-sample forecasting performance. In doing so, we compare the predictions using the sub-indexes to those obtained using two benchmark univariate predicting schemes, namely (i) a random walk process and (ii) an AR(1) process.[10] We employ a variety of commodity-index-based forecasting specifications that fall under two classes. The first is the conventional out-of-sample equation parallel to the in-sample regressions where we use quarterly commodity prices to predict quarterly inflation. We then take advantage of the availability of daily commodity indexes and employ a mixed-sampling data forecasting strategy, motivated by the "MIDAS" literature (see, e.g. Ghysels et al., 2002). Specifically, we adopt the generalized autoregressive distributed lag (GADL) estimation methodology developed in Chen and Tsay (2011), which allows high-frequency daily information to have a differential impact on delivering forecasts for quarterly inflation.

For Australia, Canada, and New Zealand, we obtain reasonable forecasts using a rolling window procedure without incorporating structural change. While for Chile and South Africa, commodity indexes become useful only when we explicitly incorporate the

4 See Chen et al. (2010)

5 They do not necessarily target the same price index. For example, the Bank of Canada targets the headline inflation rate, using the core inflation rate as a measure of its trend, while the rest tend to focus on CPI inflation.

6 Chen and Rogoff (2003) use data published by the Reserve Bank of Australia and Bank of Canada. Cashin et al. (2004) constructed a panel of country-specific commodity price indexes using country-level export-share data and price series published by the IMF and the World Bank.

7 See e.g. Pindyck and Rotemberg (1990), Deb et al. (1996), and Ai et al. (2006), and other studies that investigate the issue of "excess co-movement" among commodity prices. This observed co-movement is often assumed to reflect some common underlying trend, possibly due to reaction to the same global demand conditions, and/or that substitutions across products tend help transmit shocks across product groups (e.g. oil and bio-fuels).

8 Our interest in the forecasting properties of commodity prices is not only from the perspective of policy maker, but also from the standpoint of the public for better gauging future policy actions.

9 Bank of Canada, for example, publishes a weekly commodity price series and the Reserve Bank of Australia a monthly one, based on their respective country's production structure. The IMF and World Bank also release various global indexes on a monthly basis.

10 We note that we do not include the Phillips Curve specification in our inflation forecasting comparisons. This is in part due to evidence by Atkeson and Ohanian (2001), and more recently by Stock and Watson (2007), suggests that it is not particularly successful in forecasting inflation, being out-performed by standard autoregressive models. While this may not be true for the commodity economics, the focus of this paper is to establish predictive content within the commodity price series; we leave explorations to more elaborate predictive equations for future research.