Energy Economics 65 (2017) 424–433

Contents lists available at ScienceDirect

Energy Economics

journal homepage: www.elsevier.com/locate/eneco

Noncausality and the commodity currency hypothesis ☆

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ARTICLE INFO

Article history:
Received 15 October 2015
Received in revised form 11 January 2017
Accepted 31 May 2017
Available online 8 June 2017

JEL classification:
C53
F37
Q02

Keywords:
Commodity prices
Exchange rates
Noncausal autoregression
Nonlinearity

ABSTRACT

This paper provides new evidence on the role of exchange rates in forecasting commodity prices. Consistent with previous studies, we find that commodity currencies hold out-of-sample predictive power for commodity prices when using standard linear predictive regressions. After we reconsider the evidence using noncausal autoregressions, which provide a better fit to the data and are able to accommodate the effects of nonlinearities and omitted variables, the predictive power of exchange rates disappears.

1. Introduction

Understanding the dynamics of commodity prices is of interest not only to commodity traders, but also to policy makers in both commodity exporting and importing countries. Unfortunately, prices of commodities are notoriously hard to forecast. As for many other assets traded on competitive financial markets, commodity prices display near-random walk behavior with changes being virtually unpredictable by past prices or other observable factors[1].

Against this background, Chen et al. (2010 - hereafter CRR) find a surprising novel channel of commodity price predictability. 'Commodity currencies', the exchange rates of commodity exporters, appear relevant predictors for commodity prices at quarterly horizons. Using linear predictive regressions, CRR document predictive power both in and out of sample. In an update of the original article, Chen et al., (2014b) show this predictability to hold as well for an extended sample period including the recent financial crisis.

Following Engel and West (2005), CRR arrive at the hypothesis that exchange rates predict commodity prices from a standard

☆ We thank Richard Tol (the Editor), two anonymous referees, Helinä Laakkonen, Markku Lanne, Mikko Niemenmaa, Andrew Patton, Barbara Rossi and conference and seminar participants at Aalto University, the Financial Econometrics and Empirical Asset Pricing Conference (Lancaster, 2016), CREST Paris (2015), the 9th and 10th International Conference on Computational and Financial Econometrics (London, 2015; Seville, 2016), the 10th Energy and Finance Conference (London, 2015), the Society for Nonlinear Dynamics and Econometrics (Oslo, 2015), the Nordic Econometric Meeting (Helsinki, 2015) and the Finnish Economic Society (Helsinki, 2015) for useful discussions. The second author is grateful for financial support from the Academy of Finland and the Research Funds of the University of Helsinki.

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[1] Various predictors for commodity prices have been proposed in the literature, such as commodity forward prices (e.g., Fama and French, 1987; Gorton et al., 2013; Chinn and Coibion, 2014). Out-of-sample results remain however mixed, as remarked by Bernanke (2008), who emphasizes that the unpredictability of commodity prices poses a major challenge to monetary policy.

http://dx.doi.org/10.1016/j.eneco.2017.05.024
0140-9883/

present value model for exchange rates in which exchange rates (s_t) represent discounted expected fundamentals (f_t):

$$s_t = \gamma \sum_{i=0}^{\infty} \delta^i E_t \left(f_{t+i} \right). \quad (1)$$

Campbell and Shiller (1987) show that this present value relation implies that future fundamentals are predictable by the exchange rate. CRR argue that commodity prices can be thought of as the 'fundamentals' for the exchange rates of commodity exporters, implying that commodity prices should be predictable by commodity currencies. CRR test this 'commodity currency hypothesis' using currencies and country-specific commodity-price indices for five commodity exporters (Australia, New Zealand, Canada, Chile and South Africa) and demonstrate that the currencies indeed hold predictive power for the commodity indices.

The commodity currency hypothesis does not necessarily imply that the predictive relation between exchange rates and commodity prices is linear. Moreover, additional variables may play a role. Chen et al., (2010) therefore conclude their article by suggesting to study the robustness of their results to alternative nonlinear model specifications and omitted variables as a direction for future research. This is not a straightforward exercise because of the degrees of freedom involved. Nonlinear econometric models come in many forms, not to mention the sheer amount of other potential predictors. In predicting commodity prices, these nonlinearities may include, among others, regime switches (Mamatzakis and Remoundos, 2011; Beckmann and Czudaj, 2014; Chevallier et al., 2014), periods of booms and busts (Cashin et al., 2002) and changes in the persistency (even local trends and explosive behavior) of commodity price levels (Kellard and Wohar, 2006; Gronwald, 2016). The relation between commodity prices and various other macroeconomic variables has also been studied extensively. Besides exchange rates, these variables include for example interest rates, industrial production (real activity), money and inflation (consumer prices) (e.g., Browne and Cronin, 2010; Akram, 2010), and oil prices (e.g., Wang et al., 2014; Ahmadi et al., 2016).[2] However, Pindyck and Rotemberg (1990), among others, argue that such fundamental variables do not fully explain the observed dynamics of commodity prices. Commodities are often treated as an investment class, rather than a production input. As with the prices of other financial assets, unobservable factors (e.g., investor psychology and heterogeneous expectations) play a role in driving commodity prices, leading to bubble-type patterns and excess volatility, thereby weakening the relation between commodity prices and its fundamentals (see, e.g., Arezki et al. (2014) for a recent survey on the 'financialization' of commodity markets).

In addition to the choice of the correct nonlinear and/or multivariate model specification being ambiguous, commonly used nonlinear and multivariate regression models contain more parameters than the simple linear predictive regressions used by CRR. These additional parameters are costly to estimate in small samples, leading possibly to inferior forecasting ability of the nonlinear and multivariate model. In this study, we aim to tackle these issues by reconsidering the out-of-sample predictability documented by CRR in the context of so-called noncausal (vector) autoregressions, which are autoregressive models that parsimoniously allow for dependence on both future and past observations (see Brockwell and Davis, 1987; Breidt et al., 1991; Lanne and Saikkonen, 2011, 2013). Noncausal autoregressions can accommodate various nonlinearities and omitted variables, missed by conventional predictive models, without explicit specification, while containing the same number of parameters as simple linear causal autoregressions. The ambiguity regarding the correct nonlinear function form of commodity pricing models motivates the application of noncausal models in this context. For example, Deaton and Laroque (1992) propose a rational expectations competitive storage model with a central feature that the market as a whole cannot carry negative inventories, introducing non-linearity to the predicted commodity price series. However, they also acknowledge that their model does not yield a fully satisfactory explanation for nonlinearities and autocorrelation structure of actual commodity prices leaving out some unmodeled dynamics.

As we further discuss in Section 2, noncausal autoregressions have been recently applied successfully in modeling and forecasting various financial and macroeconomic variables. In particular in the presence of omitted variables or nonlinearities, noncausal models are found to fit the data better than their causal counterparts (see, e.g., Lanne and Saikkonen, 2011; Lanne et al., 2012b; Lof, 2013; Hencic and Gouriéroux, 2015). Gouriéroux and Zakoian (2017) show that noncausal models have an observationally equivalent nonlinear causal representation. We illustrate this relation between nonlinearity and noncausality with a small-scale simulation study in the Appendix. Based on these theoretical and empirical results, we believe that noncausal autoregressions are appropriate tools for investigating the robustness of the commodity currency hypothesis to nonlinearities and omitted variables.

Using the same data as Chen et al., (2014b), we start by considering the predictability of commodity prices using conventional univariate and bivariate causal linear autoregressions. Our results confirm the main findings of CRR: Including exchange rates in the information set leads, for a number of countries, to more accurate out-of-sample forecasts of commodity price indices. After we expand the exercise to include noncausal models, we find that noncausal models in general do a better job at predicting commodity prices than their causal counterparts. Nevertheless, within the class of noncausal models we find less evidence that conditioning on exchange rates improves the out-of-sample predictability of commodity prices. Finally, we pool the forecasts across countries and concentrate on the qualitative differences between forecasts to increase the number of observations and gain statistical power. The results of this pooling exercise confirm that the increased forecasting accuracy from allowing for noncausality is statistically significant, while the incremental ability of exchange rates to predict commodity prices is insignificant.

We have also explored the predictability in the reverse direction, from commodity prices to exchange rates. Both causal and noncausal autoregressive models turn out to perform poorly at forecasting exchange rates. This should not come as a surprise as it is well known from the literature (including CRR) that it is hard to beat a random walk when it comes to forecasting exchange rates. In this paper, we therefore only report results on forecasting commodity prices.

Our results are consistent with those of Bork et al. (2014), who cast doubt on the commodity currency hypothesis by arguing that the predictive relations implied by the present value model (Eq. (1)) do not hold when the fundamentals f_t are themselves set by forward-looking financial markets. Market efficiency implies that tradeable assets should not be predictable by lagged information. As commodity prices and exchange rates simultaneously absorb all available and relevant information at the time of release, there can be no intertemporal predictability from one to another. Consistent with this view, Bork et al. (2014) provide evidence that the relation between commodity prices and exchange rates is mainly contemporaneous, while the evidence for predictability is rather minor and not robust.

Although our paper also studies the robustness of the currency-commodity predictability, we look at the issue from a different angle than Bork et al. (2014). They attribute the discrepancies between their results and those of CRR mainly to data choices. The predictability is weakest when disaggregated individual commodity prices and

[2] See also, e.g., Gospodinov and Ng (2013), Chen et al. (2014a) and West and Wong (2014) for recent applications of factor models for commodity prices.