[*COMMODITY PRICING: EVIDENCE FROM RATIONAL AND BEHAVIOURAL MODELS*]

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Overview

With the extent of the debate on likely drivers of commodity prices during the commodity super cycle, what is surprising is the relatively limited attention to formal tests of rational based models. The seminal work by Pindyck (1993) describes a market that is generally consistent with the rational asset pricing model (RAPM). With a much larger sample of data and range of commodities, we re-assess the evidence of the RAPM. Our sample is subject to a considerable commodity super cycle and the potentially related role of commodity financialization. We formally implement a consistent set of efficiency based tests, as those carried out by Pindyck (1993). Our results are consistent for all commodities examined and for a range of different specifications. In all cases we reject the restrictions associated with the long-run RAPM model. The formal long-run model assumes no role for agents with a short-term perspective. When we assume heterogenous expectations and investment horizons, we find that a much greater role is played by speculators, rational speculators in particular. The overall fit of the model improves considerably when we simultaneously take account of agents with a long-run focus (fundamentals) and a short-run focus (short-run fundamentals and short-run contrarians). Taking the case of crude oil, there is a consistent, but far from dominant role played by long-term fundamental based agents. There is a much greater role played by speculators and rational speculators in particular.

Methods

Formal tests of the hypothesis of rational pricing in commodities is carried out drawing on Campbell and Shiller (1989) and Pindyck (1993). A VAR model is used to test the restrictions implied by the present value model. We start with the simple case, where we assume constant returns and extend to the case where discount rates vary with the risk-free rate and a constant risk premium. We also examine cases when the ex-ante discount rate is not observed directly, but we assume it is a function of a related but observable variable. This is the case for two common asset pricing models, namely the standard CAPM where the discount rate is proportional to the squared ex-post stock return, and the consumption CAPM (CCAPM) where the discount rate is proportional to consumption growth. Rather than evaluating each of the agents separately, we also examine the case where all agents can be present. We expect commodity prices to reflect fundamentals either in the long-run or the short-run. However, if the popular view is correct, there is likely to be a more dominant role for trend chasers during the commodity super cycle in particular. To generate the expectations of these short-run agents, we augment the VAR models with the observed proportional change in the price of the commodity.

Results

In all cases we reject the restrictions associated with the RAPM. Our results are in contrast to the conclusions set out in Pindyck (1993). The formal long-run model assumes no role for agents with a short-term perspective. When we assume heterogenous investment horizons in particular, we find that a much greater role is played by rational speculators. The overall fit of the model improves considerably when we simultaneously take account of agents with a long-run focus (fundamentals) and a short-run focus (short-run fundamentals and short-run contrarians). The long-term fundamental based agents, which are the primary focus of the study by Pindyck (1993), certainly play a role, but not a dominant role relative to speculators and rational speculators in particular.

Conclusions

Our study incorporates a number of important innovations, both in terms of the tests to which we subject the classical rational valuation model of commodities pricing and in terms of its extension in a behavioral direction, to a multi-

horizon and multi-agent setting. While a number of studies conceptually rely on the rational valuation model, with the exception of Pindyck (1993) no study has examined a rigorous set of restrictions implied by this model for the estimated reduced form model. The first part of our study, drawing very much on Pindyck (1993), implements a considerable range of tests of such restrictions. While we find evidence of long-run relationships between prices and fundamentals (the convenience yield) of the commodities in our sample, consistent with fundamentals-based rational pricing and thus in line with the conclusions of recent empirical studies (e.g. Brooks et al. (2015)), formal and more stringent cross-equation restriction tests overwhelmingly reject the RAPM. Though our conclusions using the classical model are in stark contrast to Pindyck (1993), a number of considerations are required. Compared to the Pindyck (1993) study, we examine a much larger number of commodities, a different sample-period and in particular a sample that combines a significant increase in global commodity demand and a simultaneous process of financialization of commodities. Also, while the long-run relationships estimated by Pindyck (1993) offer evidence in favour of the RAPM, the results of his own tests of formal cross-equation restrictions imposed on such relationships (the reduced form model) by the RAPM (the structural model) are considerably less supportive of rational fundamental-based commodity pricing. Our results are very much consistent with Pindyck (1993) in this respect.

The second innovation is that we present an asset pricing extension in a behavioral direction. This is the first known evaluation of commodity price dynamics using a formal behavioral perspective. Rather than focusing solely on the long-run perspective of a representative agent endowed with rational expectations, with this extension we also examine the case of alternative investment horizons and alternative agents. Our emphasis is on similar considerations as in the work of Singleton (2014), who draws attention to informational frictions in commodity futures markets and the possibility that heterogeneous expectations among financial investors affect the expected returns of commodity futures. In fact, our behavioral model is directly motivated by the potential for informational frictions in commodity markets highlighted by Singleton (2014). Singleton (2014) argued that heterogeneous beliefs may lead to speculation in commodity markets and so prices deviating from fundamentals. Our behavioral model takes account of potential heterogeneous investment horizons and also heterogeneous expectations in relation to short-term commodity price changes.

References

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