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Behavioral influences in non-ferrous metals prices

Mark Cummins [a,*], Michael Dowling [b], Brian M. Lucey [c,d]

[a] DCU Business School, Dublin City University, Glasnevin, Dublin 9, Ireland
[b] ESC Rennes School of Business, 2 Rue Robert d'Arbrissel, 35065 Rennes, France
[c] School of Business, Trinity College Dublin, Dublin 2, Ireland
[d] Faculty of Economics, University of Ljubljana, Ljubljana, Slovenia

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ABSTRACT

Recent research has identified the presence of behavioral influences on traders in predominantly professionally traded markets such as oil, gold, and foreign exchange. Previous research had largely confined behavioral-based investigations to equity markets due to an assumption that noise traders would drive any influence and these traders were mainly absent from the professionally traded markets. This paper extends this research to the non-ferrous metals markets and demonstrates similar influences on prices. It is shown that psychological price barriers, where there is predictable trading patterns around psychologically important price points, are important. Specifically, lead, zinc, and aluminium alloy show anomalous price reactions in the days particularly following a breach of a $1000 price point. There is also evidence presented of negative price clustering before key price barriers. Subperiod tests further indicate that the relevant psychological price point is dependent on average prices. Recognizing the multiple hypothesis testing nature of the study, Generalized Bonferroni corrections are implemented to provide a robust control for the possibility of data mining. This represents a first investigation of behavioral influences in non-ferrous metals prices, and suggests that these markets are not immune to trader biases influencing the setting of prices.

Introduction

> Copper looks set to test the $10,000 a ton mark again, supported by strong import figures from China Commerzbank, 13th April 2011
>
> Aluminum futures have settled below the symbolic $2000-per-tonne mark on the London Metal Exchange for a full week of trading, suggesting that weak fundamentals might finally be catching up with the speculation-driven market. Metal Bulletin, 25th August 2009

The idea that certain price points in the non-ferrous metals markets (and indeed most financial markets) are symbolic or psychologically important is taken as given in media coverage and market analysis. Yet this behavioral aspect of prices for these markets has never been investigated. In fact, no behavioral analysis has previously been applied to develop a deeper understanding of how non-ferrous metals are priced. This is despite behavioral finance principles having been successfully applied in a number of other similarly professionally-traded markets, such as oil, gold, and foreign exchange, and showing a strong ability to improve knowledge of trader decision-making and price setting in these markets.

Researchers in equity pricing have repeatedly shown that some price points are more psychologically important than others to market participants and that this influences prices (e.g. Donaldson and Kim, 1993). To illustrate this research: the Dow Jones Industrial Average breaking through 10,000 points is argued to be a more prominent and salient event than the price reaching 9500. Apple's share price approaching $1000 is considered to be more noteworthy to investors than the shares approaching $1050. Aggregating market price events like these, equity researchers have shown that for psychologically important price points, prices tend to show abnormal clustering (often interpreted as a reluctance of prices to cross through a price point), and also that pricing in the days immediately following a breach of a price barrier tends to be predictable. These findings in equity markets were initially attributed to the actions of poorly informed small traders, but recent research has extended the area to markets that are predominantly professionally traded. Thus, Mitchell and Izan (2006) find psychological barriers to be evident in foreign exchange markets; Aggarwal and Lucey (2007) find clustering and barriers in gold prices; and most recently Dowling et al. (2015) show these effects in oil futures prices. For example, in oil futures it is found that whole $10 price points are psychologically important in these markets, with prices showing retrenchment subsequent to breaching a $10 barrier through rising prices.

* Corresponding author.
E-mail addresses: Mark.Cummins@dcu.ie (M. Cummins), michael.m.dowling@tcd.ie (M. Dowling), blucey@tcd.ie (B.M. Lucey).

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We extend this research to the non-ferrous metals markets. The testing approach is adapted from Dowling et al. (2015) and Aggarwal and Lucey (2007) and focuses on detecting the presence of price clustering and psychological barriers in the prices of non-ferrous metals traded on the London Metal Exchange (LME). The seven non-ferrous metals selected are aluminium, aluminium alloy, copper, lead, nickel, tin, and zinc; and consist of daily cash contract prices from 03 December 1993 to 05 December 2013. Key findings include that price clustering is present for the majority of metals around whole $1000 price points. The most common form of clustering is negative clustering, where there is a lower frequency of prices in psychologically important price regions. Further there is evidence of directional price movements for a number of metals in the days immediately after prices pass through a $1000 barrier level. Subperiod tests indicate that these findings are still a feature in today's markets, but that a $100 price barrier was the most relevant in the early period when metals traded at significantly lower average prices compared to the most recent period.

Given the amount of tests undertaken in the study there is a risk of spurious findings (a common criticism of behavioral finance studies; see e.g. Sullivan et al., 2001; and more recently for general finance research by Harvey et al., 2014). With 1134 coefficients tested across the study, some coefficients would, by chance alone, appear to be significant even if all null hypotheses were true. We control for this possibility through implementing a Generalized Bonferroni correction (Romano et al., 2010); the practical implication of which is that only coefficients with a p-value less than 0.00503 are considered to be significant. This adds a strong element of reassurance as to the robustness of the findings.

The implications of these findings relate, firstly, to the efficiency of the markets. A price passing through a $100 or a $1000 level should not cause predictability of subsequent price movements, nor should prices cluster around price levels. Yet, we show this effect in these markets. This suggests that (at least for this particular price feature) a number of the non-ferrous metals markets are not even weak-form efficient. There is, secondly, a trading implication. For example, one of the most notable findings is that aluminium alloy prices retrench by 1.2% in the day immediately after rising through a $1000 barrier. Other metals also show significant predictability of price movements after passing through a psychological price level. The final benefit of the study is of a more general nature; the demonstration that the behavioral biases shown to be present in equity markets, and more recently in other professionally-traded markets such as oil, gold, and foreign exchange are also a feature of the non-ferrous metals markets. This provides a justification for further investigation of behavioral biases in these markets.

The remainder of the paper is structured as follows. In the section “Non-ferrous metals prices”, the prior research on non-ferrous metals pricing is reviewed. The section “Clustering and psychological barriers” provides an overview of the price clustering and psychological barriers literature and relates this to the non-ferrous metals markets. The data and methodology is discussed in the section “Data and methodology”, while the empirical findings are presented and analyzed in the section “Empirical results”. The section “Conclusion” concludes and provides some potential direction for further research.

Non-ferrous metals prices

Watkins and McAleer (2004) provide a comprehensive meta-analysis of research on non-ferrous metals prices published between 1980 and 2002. One of the striking notes from their analysis is how limited the study of non-ferrous metals prices is, with just 45 papers identified over the entire period. Key topics for the extant research focused on market efficiency, risk premia, and volatility, with explanatory models generally using either macro-economic, industrial, or financial variables to understand price dynamics. The London Metals Exchange (LME) is the primary data source utilized in prior research and studies are commonly restricted to the seven main industrially-used non-ferrous metals (the ‘base metals’), namely aluminium, aluminium alloy, copper, lead, nickel, tin, and zinc. While silver is sometimes included, it is primarily classified as a precious metals despite also having significant industrial uses. Copper is the most widely studied, being generally regarded as the most competitive market due to low industry concentration of suppliers and consumers.

Todorova et al. (2014) analyze volatility spillovers between aluminium, copper, lead, zinc, and nickel LME futures for 2006–2012 and find strong evidence of such spillovers, especially post the financial crisis period, thus providing a rationale for analyzing the metals together. One explanation offered for these spillover effects is the industrial interrelationships between the metals, for example between aluminium and nickel for the automobile industry, and copper and lead for the electronics and electrical sector.

Long-term pricing studies of metals also show an increased interrelationship between metals prices and other financial markets over time. Cochran et al. (2012) find stronger evidence of a relationship between copper and equity market volatility post the 2008 financial crisis. Buncic and Moretto (2014) provide comprehensive additional support for this increased inter-relationship between copper and equity market volatility, and attribute this, in part, to a general increase in financialization across all financial markets. The financialization hypothesis, where the increased presence of financial market actors (as opposed to industrial actors) leads to increased speculation in markets, has also been noted in other professionally traded markets such as oil (e.g. Tokic, 2011). One example of this in non-ferrous metals is their increased use as collateral in the Chinese shadow banking sector (Tang and Zhu, 2014).

Despite the preponderance of studies applying theories based on investor psychology to understanding equity market pricing (e.g. see the comprehensive reviews contained in Hirshleifer, 2001, 2014), there is no investigation of this area in metal markets. The aforementioned Watkins and McAleer (2004) meta-analysis could find no behavioral-based investigations of metals prices. A long-standing argument against the application of investor psychology in professionally traded markets is due to the absence of small investors who are presumed to drive noise trading in equity markets.[1] However studies have increasingly noted that professional traders can also be affected by similar behavioral biases. For example, Coval and Shumway (2005) find Chicago Board of Trade traders to be influenced by loss aversion in their trading, while O'Connell and Teo (2009) find professional currency traders to be affected by overconfidence.

Pierdzioch et al. (2013) do find that market analysts for a number of non-ferrous metals show the same behaviorally-driven forecasting errors as seen in other financial markets, but no study of the impact on market prices is attempted. No other study could be located that investigates a psychology-based explanation for trading in these markets. The closest research in the area is Coakley et al. (2011) who find evidence of long-term memory in copper pricing, which they argue could be consistent with noise trader risk being priced in copper, although they do not elaborate on this. Also, an attempt by Heaney (2006) to explain copper, lead

[1] The London Metal Exchange describes their markets as almost exclusively professionally-traded, in part due to the large minimum lot sizes. (London Metal Exchange (2008) ‘Response to CESR-CEBS Consultation on Commodities’ available at http://www.esma.europa.eu/system/files/8-LME.pdf).