# THE IMPACT OF FINANCIALISATION ON COMMODITY PRICES IN THE POST-2003 COMMODITY "SUPER-CYCLE"

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*Abstract*
Commodity prices have risen sharply since 2002. This period of rising prices has been labelled a "super-cycle". While rapid resource-intensive growth in India and China clearly contributed to rising prices, some authors have argued that the extent of price increases was greater than could be explained by "fundamental" determinants of commodity supply and demand. These authors point to the growing "financialisation" of commodity markets – the purchase of commodities as a financial asset by mainly pension funds - and the role this has played in increasing prices.

This paper examines the extent to which this "financialisation" of commodity markets impacted on commodity prices since 2002. The question is important because it is possible that "financialisation" resulted in commodity prices rising much more than would otherwise be the case. Secondly, it increases the vulnerability of commodity prices to a sharp downward correction if investment buying of commodities reverses.

It is found that there has been a significant increase in the correlation of futures prices for exchange traded commodities, but no change in the correlation between exchange-traded commodities and non-exchange-traded commodities such as iron ore. This supports the view that the growth of investment funds has impacted significantly on prices in the futures markets in which they trade. It is found, too, that there is also a significant increase in the correlations of spot commodity prices, suggesting that "financialisation" of the futures markets contributed to recent record-high spot prices.

*JEL Classification: G10, G13*
*Key words: Super Cycle, Commodity price boom, Financialisation*

## 1. INTRODUCTION

Commodity prices have risen dramatically since 2002. A number of factors have contributed to this increase, including rapid commodity-intensive economic growth in China and India. The period since 2002 also saw the rapid growth of financial investments in commodity markets, mainly through the use of financial futures. A vigorous debate (Irwin & Sanders, 2011) has developed regarding the extent to which these financial investments have influenced the level of both future and spot commodity prices. Irwin & Sanders (2011:1) highlight the importance of this debate, stating that it: "has important ramifications from a policy and regulatory perspective, as well as practical implications for the efficient pricing of commodity products."

The discourse around the subject can be divided into two opposing camps. The first propounds that there is a direct link between the "financialisation" of commodity markets and the rising prices and price volatility of commodities since 2002. This group (Masters, 2008, Wray, 2008, Phillips & Yu, 2010 and Tang & Xiong, 2011) is in favour of increased regulation to prevent commodity markets being distorted by what they see as excessive speculation.

The second camp (Dwyer, Gardner & Williams, 2011, Smith, 2009, Ross, 2011 and Irwin and Sanders, 2011)) dispute these claims and highlight fundamental price determinants as the main cause of the continued commodity price boom. They oppose any further regulation of the sector and extol the positives that "financialisation" has brought about, such as greater market efficiency and deeper commodity markets.

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## 2. THEORY OF COMMODITY PRICE DETERMINANTS

*Cyclical nature of commodity prices*
Mackey (1989: 497) states that "Trade cycles, business cycles, and fluctuations in the price and supply of commodities have attracted the attention of economists for well over 100 years." In the classical supply

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and demand model, the price of a commodity is set when the quantity supplied is equal to the quantity demanded. Quantity supplied is determined by the marginal cost of production, as profit maximising firms produce until marginal cost equals marginal revenue (the product price). Any variation in supply (marginal cost) or the quantity demanded upsets this equilibrium and triggers supply/demand responses which equilibrate the two and move the price to its new equilibrium level. If an increase in demand causes the price to rise above marginal cost then, in perfect competition, this will trigger new entrants into the market. These new entrants shift the supply curve outwards, which forces the price back to equilibrium where it equals marginal cost and there is a return to 'normal' profits in the industry (Parkin, Powell & Mathews, 2005: 65-68).

In the case of commodities there are a number of factors which cause price changes to move in cycles (Meadows, 1969). Firstly, for most commodities there is a considerable time lag for bringing new production capacity online. This can lead to sustained supply shortages when demand suddenly rises, fuelling prolonged periods of high prices. Secondly, "commodity production processes often have high ratios of fixed to marginal costs, and there may be heavy penalties associated with the suspension of production" (Meadows 1969: 18). This exacerbates situations of oversupply as the penalties of shutting down production even when firms are making a loss outweigh the decreasing returns from low prices so long as prices exceed fixed costs. State support in the sector is common, especially in developing economies where production of a single commodity often plays a crucial role in the economy. As a result, in a downward price trend, governments often support loss-making domestic champions, even when they are running at a considerable loss. The nationalised Zambian copper mines were a prime example of this phenomenon (Bomsel, 1992 in Tilton, 1992:68-70).

These factors combine to make the supply of commodities "lumpy". The long time lag to bring new supply on stream lengthens the upward pressure on prices from lack of supply. When the new supply does come online, it is often of a large scale and might even exceed the previous growth in demand, which forces prices downward. When prices fall supply is slow to contract. This "lumpy" nature of the sector lengthens and strengthens rising and falling price cycles.

Elasticities of supply and demand for commodities also play a role. Demand for commodities is often inelastic in the short/medium term and this is combined with similar inelasticity in the supply side. This is mitigated partly by supply stocks, but storage costs as well as deterioration/space determinants minimize the effects of inventories on prices (Meadows, 1969: 19).

These factors combine to make the commodity sector especially prone to cyclical pressures. They are highlighted by supporters of the view that financialisation is not responsible for increased commodity prices over the past decade.

*Super cycles*

The main difference between a super cycle and the normal commodity price cycle discussed in the previous section is the time frame, scale and scope. A super cycle is defined as an "extended period (decades) of trend rise in real prices of a commodity" (Heap, 2005: 1). Super cycles in commodities are driven mainly by the impact on demand of commodity-intensive economic growth when large economies industrialize and urbanise (Heap, 2005: 5). Inn a super cycle commodity intensive growth combines with a lagged supply response which takes time to catch up to meet the rapidly growing demand. These conditions result in dramatic increases in prices for an extended period of time. Lyons (2010:1) expands on this definition as follows:

> "A period of historically high global growth, lasting a generation or more, driven by increasing trade, high rates of investment, urbanisation and technological innovation, characterised by the emergence of large, new economies, first seen in high catch-up growth rates across the emerging world."

Radetzki (2006:63) highlights the role that the supply factors play in a super cycle, stating that "Not all periods of sharply accelerating macroeconomic performance give rise to booming prices in commodity markets". Other conditions must also exist, such as "tight production capacity situation and relatively small inventories" (Radetzki, 2006:63).

The 2003-2011 commodities boom was an exceptional event. Humphreys (2009:1) describes it as "the most powerful and sustained such boom since the Second World War". The factors that resulted in such a boom can be split between the "fundamental" drivers of price, supply and demand, and "non-fundamental" factors, more specifically the role of financialisation.

*"Fundamental" drivers*

The most common explanation of the commodities price boom is the large demand shock for commodities, driven by rapidly growing emerging markets, including China. Global real GDP growth averaged 4% over the period 2004-2007, with emerging markets achieving even higher growth rates than this (Radetzki *et al.,* 2008:126).

The fact that the major driver of this rapid global growth was taking place in emerging economies meant the growth was especially commodity intensive (Humphreys (2009:5). This is a result of industrialisation and urbanisation occurring concurrently. Heap (2005:12) highlights that approximately 10 million people are moving from rural to urban areas every year in China alone. This results in a rapid increase in infrastructural requirements for urban dwelling, raising the demand for basic commodities like steel and copper. This combination of rapid urbanization and industrialization produced a demand side shock in commodity markets.

Rapidly rising demand and a delayed supply response are presented by Humphreys (2008), Goldman Sachs (2008) as the fundamental determinant of surging commodity prices since 2003. But an increase in demand is sufficient to trigger sustained price increases only if supply does not rise in response. One must therefore also look to the supply side to ascertain why such a substantial increase in demand did not immediately trigger a supply response which would bring prices back to equilibrium and neutralize the upward spiral of prices.

Humphreys (2009:1) and der Mensbrugghe *et al.* (2009) highlight the importance of the relative dis-investment in the mining sector in favour of the "weightless economy" during the "dot-com" boom of the late 1990s as a factor that prevented the needed supply response in commodity markets. Humphreys (2009:1) notes: "Metal prices remained severely depressed through 1998–2002 and few companies in the sector were making attractive returns for their shareholders." Radetzki *et al.* (2008:125) note that as a consequence the establishment of new capacity in mineral production was slower than previously thought.

Heap (2005:17) cites increasing production costs as another factor reducing the supply side response. He notes that while the majority of this production cost increase is cyclical, it will also continue to rise on a structural basis. He therefore concludes that "The additional supply required to meet higher trend demand growth will be at higher cost" (Heap 2005: 17).

*Non-'Fundamental' drivers*

Frenk (2010:2) argues that the financialisation of commodity markets came about because the 2000 Commodity Futures Modernization Act in the US "deregulated commodities markets, weakening speculative position limits and providing loopholes for speculation through completely unregulated shadow markets". He argues that "From the moment the act passed, non-commercial participants began to increase their share of the commodities futures market" (Frenk, 2010:2. As a consequence, the futures option trading volume rose over five times, from approximately 630 million contracts in 1998 to 3.2 billion contracts in 2007 (CFTC, 2008:8).

During this period, new investment vehicles such as commodity index funds were also created and billions of dollars were invested in them. Baffes & Haniotis (2010) note that the source of these funds came from four places: the diversification of investment vehicles, where investment managers are looking for 'uncorrelated'[2] assets to broaden their portfolio; a rebalancing of investment portfolios; a switch from dollar denominated holding to commodities; and excess liquidity in the global capital markets.

These commodity index funds differ from the usual shorter term investment and speculation in commodity futures in that they can only take a long position.[3] They are therefore betting on prices to continually rise (Wray, 2008:22). Stoll & Whaley (2010:18) describe commodity index trading as a

[2] Masters (2008:3) gives emphasis to this point: "Commodities looked attractive because they have historically been "uncorrelated," meaning they trade inversely to fixed income and equity portfolios."

[3] Masters & White (2008:6) note that "Commodities futures contracts do not pay interest, rents, dividends, or entitle the holder to a share of a company's future cash flow. Therefore, the only return someone can hope to achieve is a favorable change in the price of the contract." The difference between normal speculators and index speculators is that normal speculators take both long and short positions, which acts to cancel out each others impact on market prices and thus normalizes prices in the long run. Index Speculators, as mentioned, only lean in one direction, long, and they "lean with all their weight." The result being that they "push prices in only one direction." (Masters & White: 2008:11)

"mechanical trading strategy based on a set of well-defined and well-known rules" which are often being unrelated to the conditions of the specific commodities that make up the "basket" in the traded commodities index.

Masters (2008:5) also notes that index speculator demand is different from traditional speculator demand. He states that the demand arises predominantly from portfolio allocation decisions, as highlighted by the following example:

> "When an Institutional Investor decides to allocate 2% to commodities futures they come to the market with a set amount of money. They are not concerned with the price per unit; they will buy as many futures contracts as they need, at whatever price is necessary, until all of their money has been "put to work." Their insensitivity to price multiplies their impact on commodity markets." (Masters, 2008:5).

Masters (2008:6) notes also that index speculator demand increases the more prices increase. An increase in prices results in an increase in an institution's allocation to the sector. As a result, their "profit-motivated demand for futures is the inverse of what you would expect from price-sensitive consumer behavior."[4]

The scale of investment in these index funds increased dramatically, from only $8 billion in 2002 to $200 billion by mid 2008 (Humphreys, 2009:7). Of this $200 billion, Heap (2007) estimates that about a quarter was invested in metals, this being a very substantial amount considering the small size of the overall metals markets.[5] Dwyer, Gardner & Williams (2011:52) estimate that commodity assets under management approached $410 billion in the first quarter of 2011, with the majority coming in the form of index fund investment.[6]

Humphreys (2009) notes that there is still considerable debate about the impact of these funds on prices. Some analysts describe them as playing a catalytic role in speeding up and pushing prices to new heights. Others attribute their role as a normal, market determined response to basic underlying dynamics. The detractors of the financialisation of the commodity markets acknowledge that economic fundamentals of demand and supply have played a part in increasing prices, but emphasise that they alone cannot account for the dramatic increase in volatility and extended price increases experienced in recent years. Masters (2008) claims that index speculators are the prime culprit in the abnormal price and volatility increase in the commodity sector over the past decade.

## 3. REVIEW OF EMPIRICAL STUDIES

*Empirical work in support of financialisation*

Stoll & Whaley (2010) attempted to determine whether commodity index investment (financialisation) plays a statistically significant role in determining futures returns. They chose a basket of twelve consumable commodities and utilized Granger-causality[7] tests to investigate possible relationships. Their investigation found only one statistically significant result amongst the twelve commodities they investigate. They therefore concluded that investment flows do not affect commodity futures prices. Buyuksahin & Harris (2009) also made use of Granger causality tests to investigate whether crude oil futures prices and the positions of traders are related. They found no statistical evidence that changes in

[4] Masters (2008:6) goes on by stating that "Index Speculators buy futures and then roll their positions by buying calendar spreads. *They never sell.* Therefore, they consume liquidity and provide zero benefit to the futures markets. As a result, Index Speculators' trading strategies amount to virtual hoarding via the commodities futures markets. Institutional Investors are buying up essential items that exist in limited quantities for the sole purpose of reaping speculative profits."

[5] As an example of this disparity in size, in 2002 the worlds total commodity production was worth and estimated at $1.6 trillion, this is dwarfed however by the size of the financial futures markets which weigh in at $28 trillion in 2008. (Masters & White: 2008:12)

[6] The sheer size and rapid increase in flows forms the basis of the 'gut instinct' argument. This argument stems from the apparent logic that such a massive inflow simply has to have some effect on prices. In essence, Petzel (2009) argues that: "The bottom line is that the size of index fund investment is "too big" for the size of commodity futures markets and that in the short-run, prices and price volatility can increase sharply."

[7] The appropriateness of the Granger causality as a suitable test is a refuted one. Frenk (2010:6) discusses the suitability of this test and states that it is not appropriate or a worthwhile test to undertake in isolation. Rossi(2011:17) on the other hand, highlights the test wide spread usage and appropriateness.

traders' positions systematically precede price changes[8] and therefore also concluded that financialisation did not impact on prices.

Irwin & Sanders (2010) utilized cross-sectional regressions to test the influence of index positions on nineteen commodity futures' market returns and volatility. They used a cross-sectional approach to improve their statistical validity compared to time-series Granger-type tests. In their investigation they found "very little evidence that index positions influence the cross-section of 19 commodity futures market returns or volatility" (Irwin & Sanders (2010:28).

*Empirical work detracting from financialisation*

Tang and Xiong (2011) focused on the increasing correlation between individual commodity returns and price co-movements during the past decade. They concluded (Tang & Xiong, 2011:27) that an increase in index investment in commodities markets increased the correlation of prices between non-energy commodities and oil. This effect was significantly more pronounced for commodities that were the SP-GSCI and DJUBS indices.[9] They conclude that "As a result of the financialisation process, the price of an individual commodity is no longer simply determined by its supply and demand. Instead, prices are also determined by the aggregate risk appetite for financial assets and investment behavior of diversified commodity index investors" (Tang & Xiong, 2011:27).

Gilbert (2009) concluded that there was a significant relationship between index fund trading activity and returns in crude oil, aluminum, and copper. Gilbert (2009) estimated the maximum price impact of index funds on these markets to be an increase of 15%.

Büyükşahin & Robe (2011) made use of dynamic conditional correlation (DCC) methodology of Engle (2002) to obtain "dynamically correct estimates of the intensity of commodity-equity co-movements" (Büyükşahin & Robe, 2011:9). They obtain this from analyzing the returns on equity and commodity index investments. They concluded (Büyükşahin & Robe, 2011:9) that during the 2008-2009 financial crisis, commodity and equity correlations rose to new levels, unseen in the previous two decades and that, after controlling for economic fundamentals, it is speculative activity in commodity futures markets that helps explain the fluctuations in the commodity-equity DCC estimates over time.

Singleton (2011) looked at the role of financialisation in the oil markets and "found that the correlations between changes in oil futures prices and both index and managed-money flows are positive. He concludes that "growth in positions of index investors and managed-money accounts had significant positive effects on returns in oil futures markets around the time of the 2008 boom/bust in oil price" (Singleton, 2011: 27).

Conceição & Marone (2008:23) highlight that during the recent boom, prices of commodities deviated significantly from their marginal costs (a clear sign of moving away from fundamentals). They note that copper's ratio of price to marginal cost was 2.8 times in 2006.

*Conclusions from the empirical findings*

The results of the empirical findings are thus mixed, with some studies suggesting that the financialisation of commodity prices did not impact on commodity prices, while other studies suggest that it did.

The remainder of this paper seeks to add to the body of existing evidence. More specifically, it seeks to extend the findings beyond the period of the 2008 global financial crisis and the period of resumed commodity price increases which followed it; as well as into the more recent period of generally declining prices.

## 4. EMPIRICAL INVESTIGATION

The empirical section of this paper broadens Tang & Xiong's (2011) investigation by extending their analysis into the relationship between the prices of copper, zinc, nickel, tin and aluminium. An analysis of the relationship between these metal prices and the oil prices as well as to non-traded metals will also be conducted. The same hypothesis as in Tang and Xiong (2011) applies: namely, if index financialisation

[8] Once again the appropriateness of the Granger causality is a factor.

[9] The Standard & Poors - Goldman Sachs Commodity Index and the Dow Jones - UBS Commodity Index are the two most popular commodity indices.

plays a significant part in recent commodity price increases and volatility, then the prices of various unrelated metals will be increasingly correlated and will become increasingly correlated with the price of oil.

The empirical analysis will utilize the same techniques employed by Tang & Xiong (2011), namely the calculation of rolling correlations of futures returns.[10] Firstly, between exchange-traded metals; secondly, between exchange-traded metals and oil; and thirdly, between exchange traded commodities and bulk commodities not traded on exchanges. The study utilizes 3 month future contracts of the metals and Brent oil taken from Thompson Datastream. Metal and oil price correlations are calculated using daily 3 month futures prices. The monthly bulk commodity price index of the Reserve Bank of Australia is used to test the relationship between metals and oil futures prices and bulk commodity prices.

*Increase in return correlation between traded metals futures and metals and oil futures*

Tang & Xiong's (2011) hypothesis that the financialisation of the commodity sector has increased the return correlation between unrelated commodities as a result of index speculation was broadened to include 3-month futures prices for zinc, nickel and tin. The time period analysed was from 1993-2003 and daily data were used.

Utilizing the same methodology as Tang & Xiong of analysing the one year rolling correlation of daily returns on futures it was found that there was a significant increase in the return correlation between futures prices of copper, zinc, nickel, tin and aluminium in the period from 2001-2013 compared to the previous period of 1994-2001. Table 1 summarises these results and the results for the individual metals are shown graphically in Appendix A.

Table 1: Average return correlation of 3-month traded metal futures prices

| Average return correlation of traded metals | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Zinc v Copper** | **Zinc v Nickel** | **Zinc v Tin** | **Copper v Nickel** | **Copper v Tin** | **Nickel v Tin** | **Aluminium v Zinc** | **Aluminium v Copper** | **Aluminium v Nickel** | **Aluminium v Tin** |
| **1994-2001** | 0.4157 | 0.3867 | 0.3077 | 0.4898 | 0.3331 | 0.3719 | 0.4116 | 0.5655 | 0.4418 | 0.3412 |
| **2002-2013** | 0.7403 | 0.5667 | 0.4617 | 0.6086 | 0.5180 | 0.4560 | 0.6716 | 0.7440 | 0.5373 | 0.4494 |
| **Ave 1994-2013** | 0.6129 | 0.4961 | 0.4013 | 0.5620 | 0.4455 | 0.4230 | 0.5706 | 0.6746 | 0.5002 | 0.4073 |
| **Increase in Correlation:** | 0.3245 | 0.1799 | 0.1540 | 0.1188 | 0.1850 | 0.0841 | 0.2600 | 0.1784 | 0.0955 | 0.1082 |
| **Increase in Correlation: %** | 78.1% | 46.5% | 50.0% | 24.2% | 55.5% | 22.6% | 63.2% | 31.5% | 21.6% | 31.7% |

All five metals experienced increases in correlation, with the return correlation between copper and zinc showing the most marked increase of 0.32. Table 2 shows even larger increases in percentage terms in the correlation between oil and metals futures.

[10] Masters & White (2008:8) give an explanation for using future prices: "Futures prices have become the benchmark for spot prices, both indices are based on commodities futures prices and not on underlying spot prices. The S&P-GSCI and the DJ-AIG are both based predominantly upon the prices of the nearest-to-expiration futures contracts for their respective set of commodities."

Table 2: Average return correlation of 3-month oil futures versus 3-month traded metal future prices

| Average return correlation: Oil vs traded metals | | | | | |
|---|---|---|---|---|---|
| | **Oil v Zinc** | **Oil v Copper** | **Oil v Nickel** | **Oil v Tin** | **Oil v Aluminium** |
| **1994-2001** | 0.0442 | 0.0473 | 0.0709 | 0.0432 | 0.0227 |
| **2002-2013** | 0.2489 | 0.3033 | 0.2390 | 0.2220 | 0.2720 |
| **Ave 1994-2013** | 0.1694 | 0.2039 | 0.1737 | 0.1526 | 0.1752 |
| **Increase in Correlation:** | 0.2048 | 0.2560 | 0.1680 | 0.1788 | 0.2493 |
| **Increase in Correlation: %** | 463.4% | 540.8% | 236.8% | 413.3% | 1096.5% |

Table 3: Average return correlation of 3-month traded metal futures prices

| Average return correlation of traded metals | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Zinc v Copper** | **Zinc v Nickel** | **Zinc v Tin** | **Copper v Nickel** | **Copper v Tin** | **Nickel v Tin** | **Aluminium v Zinc** | **Aluminium v Copper** | **Aluminium v Nickel** | **Aluminium v Tin** |
| **2004-2011** | 0.7666 | 0.5902 | 0.4903 | 0.6184 | 0.5271 | 0.4677 | 0.6963 | 0.7356 | 0.5498 | 0.4656 |
| **2006-2011** | 0.7746 | 0.6065 | 0.5194 | 0.6373 | 0.5589 | 0.5002 | 0.7060 | 0.7290 | 0.5582 | 0.4973 |
| **2008-2011** | 0.7793 | 0.6277 | 0.5560 | 0.6695 | 0.6010 | 0.5378 | 0.7023 | 0.7282 | 0.5895 | 0.5278 |
| **2011-2013** | 0.7896 | 0.6243 | 0.5981 | 0.6782 | 0.6402 | 0.5822 | 0.7226 | 0.7458 | 0.6063 | 0.5733 |

Table 4: Average return correlation of 3-month oil futures versus 3-month traded metal future prices

| Average return correlation: Oil vs traded metals | | | | | |
|---|---|---|---|---|---|
| | **Oil v Zinc** | **Oil v Copper** | **Oil v Nickel** | **Oil v Tin** | **Oil v Aluminium** |
| **2004-2011** | 0.2955 | 0.3506 | 0.2841 | 0.2592 | 0.3154 |
| **2006-2011** | 0.3600 | 0.4242 | 0.3462 | 0.3248 | 0.3884 |
| **2008-2011** | 0.4120 | 0.4924 | 0.4135 | 0.3933 | 0.4498 |
| **2011-2013** | 0.3960 | 0.4814 | 0.4139 | 0.4091 | 0.4414 |

These results are confirmed by the increasing correlations between metals as well as between oil and metals for the time periods since 2004 shown in Tables 3 and 4. Table 3 shows increased correlations for most metals in the period 2011-13 when commodity prices were falling. The correlation between oil and metals futures falls in the period 2011-2013 but remains very much higher than in the period before 2004, which is before financialisation began on any significant scale.

These results confirm those of Tang & Xiong (2011) and provide evidence to confirm the claim that financialisation impacted significantly on the prices of metals and oil futures.

*No increase in return correlation between traded and non-traded metals*

The next step, also utilized by Tang & Xiong (2011) is to check if these increases in return correlations are present for commodities that are not traded on exchanges (and are therefore not subject to financialisation). This test looked at the return correlations between the same metals utilized in the previous sections and the bulk commodities price index of the Reserve Bank of Australia. The logic behind this test is that bulk commodities such as coal and iron ore are not traded on exchanges (because

grades differ greatly) and therefore could not form part of the commodity futures purchases of financial investors.[11]

Table 5: Average return correlations of 3-month traded metal futures prices versus bulk commodities prices

| Average return correlation of traded metals | | | | | | |
|---|---|---|---|---|---|---|
| | **RBA v Zinc** | **RBA v Copper** | **RBA v Nickel** | **RBA v Tin** | **RBA v Aluminium** | **RBA v Oil** |
| **1994-2001** | -0.2597 | -0.2787 | 0.0353 | -0.1014 | -0.1496 | |
| **2002-2013** | -0.2993 | -0.1364 | -0.0706 | -0.0216 | -0.1027 | |
| **1994-2013** | -0.2820 | -0.1985 | -0.0243 | -0.0564 | -0.1232 | |
| **Increase in Correlation:** | -0.0396 | 0.1423 | -0.1059 | 0.0798 | 0.0469 | |
| **Increase in Correlation: %** | 15.2% | -51.0% | -299.9% | -78.7% | -31.3% | |

Table 6: Average return correlations of 3-month traded metal futures prices versus bulk commodities prices

| Average return correlation of traded metals | | | | | | |
|---|---|---|---|---|---|---|
| | **RBA v Zinc** | **RBA v Copper** | **RBA v Nickel** | **RBA v Tin** | **RBA v Aluminium** | **RBA v Oil** |
| **2004-2013** | -0.2844 | -0.1746 | -0.0932 | -0.0482 | -0.1188 | |
| **2006-2013** | -0.1786 | -0.1161 | -0.0271 | 0.0029 | -0.0247 | |
| **2008-2013** | -0.1135 | -0.0910 | 0.0278 | -0.0119 | 0.0304 | |
| **2011-2013** | -0.0814 | -0.1439 | -0.0554 | -0.0249 | 0.0059 | |

The results of these tests were conclusive in that the average return correlations did not increase[12]. The results are in accordance with Tang & Xiong's (2011) findings and further emphasize the conclusion that financialisation was the cause of the increased correlations for traded metals futures.

*Increase in return correlation between spot prices of traded metals*

The fact that financialisation caused increased correlation between metals futures prices does not mean that this automatically translated into an effect on spot market prices. For every buyer of a future there must be a seller. These are not necessarily the same operators as in the spot markets, unless the sellers of futures hedge their position in the spot market.

Table 7 shows changes in the correlation between the spot prices of metals and Table 8 shows changes in the correlation between oil and metal spot prices.

[11] These two commodities are vital in any industrialisation/development and if the supply and demand arguments are to hold up, they should also echo the increases in price and returns of the traded metals.

[12] Tests were also done for coal and iron ore prices and traded metals future and similar results were obtained.

Table 7: Average return correlations of traded metal spot prices

| Average return correlation of traded metals | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Zinc v Copper** | **Zinc v Nickel** | **Zinc v Tin** | **Copper v Nickel** | **Copper v Tin** | **Nickel v Tin** | **Aluminium v Zinc** | **Aluminium v Copper** | **Aluminium v Nickel** | **Aluminium v Tin** |
| **1994-2001** | 0.4502 | 0.4343 | 0.3006 | 0.4811 | 0.2924 | 0.3250 | 0.4368 | 0.5364 | 0.4377 | 0.3101 |
| **2002-2013** | 0.7326 | 0.5590 | 0.4578 | 0.5982 | 0.5118 | 0.4505 | 0.6597 | 0.7307 | 0.5293 | 0.4447 |
| **1994-2013** | 0.6229 | 0.5106 | 0.3967 | 0.5527 | 0.4265 | 0.4018 | 0.5731 | 0.6552 | 0.4937 | 0.3924 |
| **Increase in Correlation:** | 0.2823 | 0.1247 | 0.1573 | 0.1170 | 0.2194 | 0.1255 | 0.2229 | 0.1943 | 0.0916 | 0.1346 |
| **Increase in Correlation: %** | 62.7% | 28.7% | 52.3% | 24.3% | 75.1% | 38.6% | 51.0% | 36.2% | 20.9% | 43.4% |
| **2004-2011** | 0.7579 | 0.5816 | 0.4853 | 0.6080 | 0.5193 | 0.4602 | 0.6845 | 0.7239 | 0.5431 | 0.4583 |
| **2006-2011** | 0.7672 | 0.5962 | 0.5162 | 0.6258 | 0.5588 | 0.4944 | 0.6947 | 0.7210 | 0.5516 | 0.4924 |
| **2008-2011** | 0.7740 | 0.6217 | 0.5528 | 0.6664 | 0.6002 | 0.5359 | 0.6937 | 0.7233 | 0.5855 | 0.5242 |
| **2011-2013** | 0.7808 | 0.6156 | 0.5912 | 0.6766 | 0.6363 | 0.5807 | 0.7106 | 0.7390 | 0.5976 | 0.5655 |

Table 8: Average return correlations of oil spot price and traded metal spot prices

| Average return correlation: Oil vs metals | | | | | |
|---|---|---|---|---|---|
| | **Oil v Zinc** | **Oil v Copper** | **Oil v Nickel** | **Oil v Tin** | **Oil v Aluminium** |
| **1994-2001** | 0.0299 | 0.0175 | 0.0539 | 0.0156 | 0.0190 |
| **2002-2013** | 0.2638 | 0.3032 | 0.2395 | 0.2317 | 0.2591 |
| **1994-2013** | 0.1729 | 0.1922 | 0.1674 | 0.1477 | 0.1658 |
| **Increase in correlation:** | 0.2339 | 0.2856 | 0.1857 | 0.2161 | 0.2402 |
| **Increase in correlation: %** | 782.9% | 1628.0% | 344.7% | 1385.4% | 1267.5% |
| **2004-2011** | 0.3098 | 0.3592 | 0.2888 | 0.2745 | 0.3182 |
| **2006-2011** | 0.3614 | 0.4215 | 0.3444 | 0.3310 | 0.3827 |
| **2008-2011** | 0.4089 | 0.4900 | 0.4099 | 0.3937 | 0.4439 |
| **2011-2013** | 0.4033 | 0.4921 | 0.4275 | 0.4303 | 0.4413 |

Table 7 shows significant increases in the correlations of metals spot prices and Table 8 shows significant increases in the correlation between oil spot prices and metals prices also. These results are shown graphically in Appendix B. These results suggest that financialisation impacted on the spot markets of traded commodities as well as on their future markets.

## 5. CONCLUSION

The evidence presented in this paper extends the work of Tang & Xiong (2011) and supports the argument that the financialisation of the commodity sector played a significant role in the increasing commodity prices and price volatility during the post-2003 commodity 'super-cycle'. Correlations between prices increased during the period of rising prices from 2003-2011 and during the period of falling prices from 2011-13. The influence of financialisation was not limited to the futures market; it appears to have impacted on the spot markets also. Thus higher commodity prices over the period were the result of increased financialisation as well as the fundamental determinants of commodity demand and supply.

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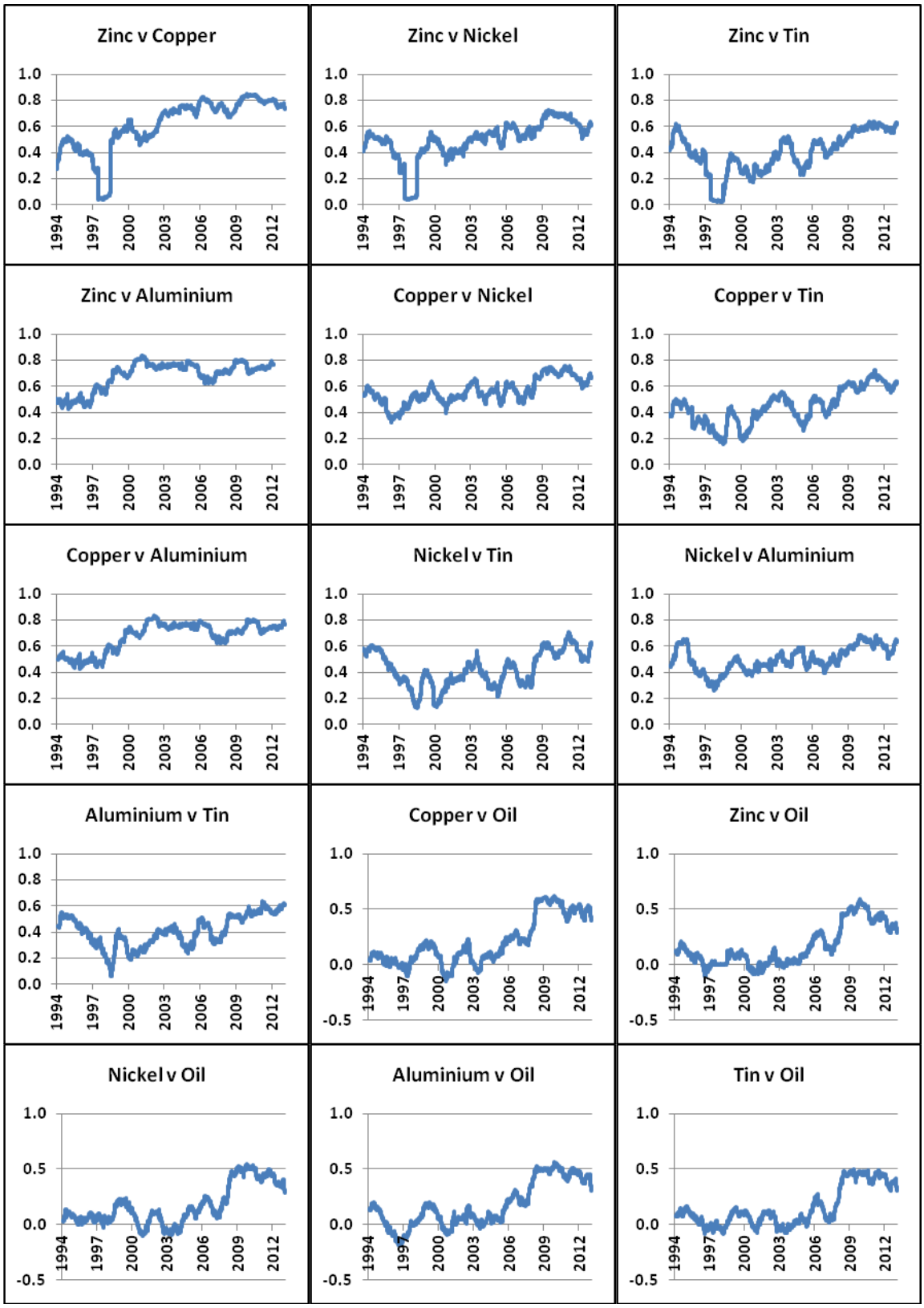
Appendix A: 3 month Futures prices - 12 month rolling correlations



Appendix B: Spot prices - 12 month rolling correlations