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Script to accompany the BME slideshow

Copper: BME's proposal on how to understand and model global consumption, production, stocks and prices in a market where investors dominate price

Slide 1. Bloomsbury Minerals Economics Ltd. (BME) has a well recognised track record for price forecasting in industrial raw materials markets. We were the first to recognise and accurately model a world that had changed from 2002, when exchange rate shifts began to dominate copper price movements and again from 2005, when the impact of fund investments in metals futures first began materially to be felt.

The next phase is already upon us, where an investment-dominated price itself has begun to work as a driver of what used to be regarded as the fundamentals, i.e. supply, demand and stocks. Also looming on the horizon are much larger base metals ETFs, which will further change price behaviour.

We are well on the way to developing a model to define the relationships in this emerging world and thus define future trends, opportunities and risks in price and in the physical market in this emerging environment. Sponsorship of our model programme would allow you to get in at the start of this exciting new stage in metals market forecasting.

Slide 2. This presentation will allow you to understand the new programme and the advantages that it will offer you. It is set out in five parts.

The first part sets out the background, showing how investment drivers of price have achieved supremacy over physical market price drivers in copper.

The second part demonstrates the challenges that this will bring in terms of a resulting copper price that initially at least seems likely to exceed physical market equilibrium. We explore the potential impact of assumed investment-driven excess prices on consumption, production, market balance and cumulative stock build. We conclude that prices above around \$5,000 per tonne may prove dramatically unstable in the long term.

The third part of the presentation goes on to look at those forces which might prolong the inferred phase of investment-driven excess prices and those which might curtail it.

The fourth part of the presentation explores dynamic (rather than assumed steady-state) systems in which investment / disinvestment drives price which drives the so-called fundamentals.

The final part of the presentation explains the benefits offered by the new model and model to mining majors, governments of copper export dependent countries, financial institutions and merchants, and how to gain access to BME's price and whole-industry models.

Slide 3. Part 1 of the presentation: investment drivers of price have achieved supremacy over physical drivers of price in copper.

Slide 4. For copper, the price super-cycle that is clearly in place is partly driven by Chinese demand, partly by poor supply from ageing mines, but in part is investment driven bubble.

Over 2000 – 2005, commodity market enthusiasts promoted one super-cycle theory for commodities: that China would dramatically boost global commodities consumption growth, that production would not be able to keep up, and that prices would soar.

Combined with academic research which showed that historical yields from commodity investments were negatively correlated with yields from other asset classes, from around 2004, vast amounts of pension fund (and other) money flowed into relatively small commodities markets, including copper.

In fact, while consumption growth rates accelerated sharply for many commodities, the effect was modest in copper. In the early years of the century, the red metal was just emerging from a decade of over-investment in telecommunications infrastructure during the dot-com bubble. Copper consumption had been unsustainably high in the 1990s. In the present century, slowing demand growth outside China offset much of the 'China effect'. Copper production growth did in fact still disappoint, but that is a different story.

Copper was indeed in a super-cycle, but one that was not just a China story, more a China story over-lain with investment in futures and a considerable element of "bubble".

Slide 5. Investment in copper has, and is continuing to, raise prices above physical market equilibrium, and is suppressing consumption growth, boosting production, and setting and keeping stocks on an upwards track.

Until 2004, copper was a simple and relatively well-behaved industrial raw materials market, with a price cycle that was readily understood in terms of an inverse relationship to both stocks (r squared = 0.62) and US dollar strength (r squared = 0.59) and a direct relationship to year-on-year growth in global industrial production (r squared = 0.11).

Slide 6. This slide is important as it sets out the starting point, from which we can measure how much things have changed since 2004, once investment drivers got added to the mix.

Just to deal with it in passing, the 'non-modeller's' approach on the left of the slide yielded poorish results for copper (and much worse results for aluminium and nickel), and which had to be labelled "the fundamentals" to discourage people from pointing out how inadequate this approach was.

The benchmark that we are going to use to establish changes in price behaviour is the simple model on the right hand side of the slide, showing currency effects, average production costs, the rate of economic growth and stock ratios as the four main price drivers for an industrial raw material market. The r squared for this industrial raw material market model was 0.82 over the period through 2004.

Slide 7. In this slide, we use the old industrial raw material style price model – estimated using data through 2004 – to show how much copper price behaviour changed from mid-2005. The difference between where prices would previously have been expected and the actual out-turn averaged around \$2,500 per tonne, though ranged up to a difference of \$4,000 per tonne briefly. It was BME's inference that the difference was net long investment in futures: i.e. long only index funds +/- the net long or net short positions of hedge funds.

Slide 8. In this slide the results of a difference calculation (industrial raw material model output versus actual price) have been divided as best we can between the relatively smooth contribution of index funds and the highly volatile contribution of hedge funds. There are no truly rigorous time series for either and the split is judgemental, but we reckon it to be right to within around \$500.

Slide 9. This slide illustrates the mechanism by which relatively price-insensitive investment longs have changed the balancing mechanism in the futures market. Before investment longs entered the market, the futures balance was essentially between consumer hedge longs and speculative longs on the one hand versus producer hedge shorts, exchange stock owners contango-earning hedge shorts and speculative shorts. Then, the entry into the balance of a new item, investment longs, required short counter-parties. In the short term, these were speculative shorts and they could only be tempted into the market by higher prices. Thus investment longs raised futures prices. But this mechanism raised prices above physical market equilibrium and created structural surpluses (most enduringly in aluminium, but also very visible in other base metals by late 2009). A proportion of these surpluses showed up as exchange stocks and in turn brought in additional shorts: contango-earning hedge shorts on the additional exchange stocks. Thus in the first instance, investor longs were offset by speculative shorts, but later by a mix of speculative shorts and exchange stock holders' hedge shorts.

Index fund buying has buoyed nearby future prices and has dragged up cash prices part way in their wake, so that nearby contangos have become the norm, even at high price levels.

The impact of long-only investors has thus been to create not only surpluses but also a mechanism by which these surpluses could be financed in contango-earning hedges.

Slide 10. In this slide, we contrast the old world of commodity market analysis, which was dominated by individual, single-commodity-market experts working within specialist commodity research companies, and the new world, in which no-one will be able to understand a single commodity market in isolation from broader financial influences on investment / disinvestment flows. The latter field includes investor sector rotation between equities, bonds and commodities (and other assets), nominal and real interest rates and last but not least, the regulatory environment.

Slides 11 & 12. Here we are moving on into the second part of our presentation. We begin to examine a world in which (what BME believes to be) investment-driven excess prices drive what we used to think of as the basic forces in the market: consumption, production, market balance and stocks. In Part 2, we take a first look at this new world by making a simplifying assumption – studying what various levels of steady-state investment-driven prices might do to the physical market. [Later in this presentation we shall move on to look at dynamic systems]

Slide 13. In this, we estimate how different assumed investment / disinvestment driven price levels might affect demand trends. This can in fact be measured with some reasonable degree of assurance from changes that took place during the middle part of the last decade. A price level of around \$3,000 gave a consumption growth trend of around 3.5%. At prices around \$8,000, this had fallen to around 1.5%. While our simple interpolation on the chart may not be perfect, we think it is close enough.

[As an aside, one might think carefully about this slide and its implications for some of the arguments that one hears bandied about. Some of these run something like this: “Of course the price will continue around \$7,500 – how else will 3.5% consumption growth be satisfied?” To which the response is that at \$7,500 the consumption growth trend won’t be 3.5% but half that rate – or at least, so BME reckons.]

Slide 14. This shows our first approximation to the refined production growth rates that might be expected to correspond to different steady-state price levels. These are much less easy to assess than consumption growth rates, because the recent history has been doubly distorted – once by the industry’s and analysts’ failure to understand how severely copper production from some old mines would deteriorate, the second time by under-estimation of expropriation and other political risks in D.R. Congo, Mongolia, Pakistan etc, where many of the new projects are located.

We have opted for \$5,000 yielding an equilibrium 2.5% p.a. production growth trend. Much below that price and we think that you will get very little moving forward in the D.R. Congo. And much above that level and almost every project in the world outside the D.R. Congo

would become viable. Many other analysts opt for figures between \$3,500 and \$4,000 for copper price equilibrium in the physical market, but we think that recent developments on the political risk front make such figures too low.

Slide 15. Despite the uncertainties about the sensitivity of production to price in the short term, we think this chart is good enough to highlight the sort of medium-term results that one would see if prices around say \$7,500 were to persist, when around \$5,000 is the equilibrium. By 2015, we believe the *trend* surplus of production over consumption would be over one and a half million tonnes per year.

Slide 16. This takes the computation one stage further and shows the cumulative surplus that could be expected between now and 2015, if prices of \$7,500 were to continue. The figure is not far short of ten million tonnes. While cross reference to the aluminium market does show us that large stocks can be financed, still we are sceptical that so high a figure could be managed in the copper market by conventional routes, even with the additional outlet of ETFs taken into account.

As an aside, conversely however, one should remember the precedents for huge cumulative stock builds resulting from prolonged excess prices. The 'wine lake' and the 'butter mountain' resulting from the EU's Common Agricultural Policy were good examples.

Slide 17. From the above, we think (or should that be "we hope"?) that investment-driven excess prices around today's levels cannot last even five years. We need to consider carefully the forces which might perpetuate for a while these excess prices, then the forces which might curtail them.

Slide 18. There are three main factors which might prolong excess prices.

The first is that base metals ETFs are planned which seem likely for a while to absorb some or all of the trend surpluses that are now (BME believes) becoming established in the base metals. The most important implication in the short term is that ETFs may mop up much of the excess aluminium stock. But excess stocks of copper might for a while go the same way.

The second factor is that as mining majors become more alert to the risks of rising stocks (whether housed in ETFs or not), some of them may begin to ignore what they may see as anomalous price signals and simply match their project pipelines to an assumed low (i.e. price suppressed) demand growth rate instead. In copper one has seen similar thinking before, such as voluntary low-grading at Escondida in 2002-2003, and more recently the reluctance of FMI to re-open idled US capacity when the company very clearly sees that there is no industrial growth or physical demand to absorb extra US production.

The third factor is that opportunities to invest directly in commodities might divert hot money that would otherwise have gone into equity investments in mining juniors. This

diversion of funds would limit the juniors' ability to finance new mines. Reportedly, gold ETFs have already had this effect on gold mining companies' ability to raise equity finance.

Slides 19 & 20. We list eight forces which might curtail investment-driven excess prices in copper.

The first of these is that investment in commodities is being fuelled by very low nominal and real interest rates. Anticipation of rising interest rates as 2010 progresses may cause disinvestment in commodities.

Second, commodity investments have served as a good hedge against dollar weakness. If the dollar were to begin a firm upward trend, investment in commodities might reverse.

Third, negative correlation with other asset classes aroused pension fund interest in the first place. Positive correlation has been seen more recently and may eventually reduce interest.

Persistent contangos will give negative roll yield for commodity index funds and will maximise the tendency for stock holders to hedge sell forward and earn the contango.

If very large scale producer hedging were to emerge at very high prices, it might offset investment longs more fully.

Extraordinarily high stock levels and a crisis in confidence in another base metal (most likely aluminium) might spread to become general disinvestment in base metals.

Financial vehicles which make investment in short-only commodity positions straightforward (short-only index funds and short ETFs) might proliferate at high prices.

Finally, if investment-driven distortions occur in oil as well as copper, driving the oil price to say \$150 or \$200 / bbl, that might cause global recession and spark regulatory response.

Slide 21. Part four of our presentation explores dynamic (rather than steady-state) systems in which investment / disinvestment drives price which drives so-called fundamentals.

Slide 22. This describes how BME will model demand growth trends and cycles in a world of largely investment driven copper prices.

BME's demand forecasting will begin with a time series for future global industrial production (or GDP) growth forecasts.

Superimposed on this in the new BME whole-industry model will be price-driven changes in intensity of use per unit of economic activity.

Time lags will be added to the model to accommodate the delays which take place in the real world while substitution or re-engineering of products takes place.

BME will eventually add a supply chain inventory cycle and interaction with the direct melt scrap cycle for further refinement of the dynamic model.

Slide 23. This describes BME's planned modelling of production growth trend and cycles in a world of largely investment-driven copper prices.

For the short term, a directly known capacity growth forecast will be used, but further ahead we would pass into a partly modelled then wholly modelled (based on lagged prices) series.

In the new whole-industry model, price would then affect capacity utilisation rates (%) and thus be used to forecast mine production.

Price would also both concurrently and after a time lag affect secondary refined production.

As a later refinement, we would add a price and growth driven stock change along the process chain (i.e. concentrates, blister, anode and the big tonnage item - nascent cathode).

Slide 24. This describes the modelling of price to stock relationships in a largely investment-driven copper market.

Until large-scale *investment* in copper futures began, price to exchange stock relationships had been stable for decades.

Prices are driven by the balance in the futures market, which traditionally was a balance between producer hedge shorts, exchange stock holders' contango-earning hedge shorts, speculative shorts, *on the one hand*, versus consumer hedge longs and speculative longs *on the other hand*.

From around 2005, a previously insignificant part of the balance – investment longs – began to offset more and more exchange stock holders' hedge shorts, requiring more and more speculative shorts to be drawn into the market at any given stock level. These changes are already being modelled by BME, to allow us to get a dynamic picture of the evolving price to stock relationship.

Slide 25. Part five of the presentation explains the benefits for different players of gaining access to BME's price models and the coming generation of whole-industry models.

Slide 26. This slide describes what the new whole-industry model of an investment driven copper industry will have to offer the mining majors.

The most fundamental benefit would be in quantifying better the effect that different investment patterns would have in raising the price and thus slowing demand growth trends, in turn affecting optimum project pipeline timings.

Very nearly equally important would be providing the basis for scenario analysis regarding different rates of project development, such as the implications for investor / industry interaction if China were for instance to buy a less politically contentious mining major and rapidly accelerate its project development programme

Issues of diversification could be addressed in a much more informed way: perhaps diversification into areas where product prices have not (or not yet) been boosted by incorporation in index funds and where ETFs have not yet become established; or indeed diversification outside the industry.

Slide 27. This slide explains what the new BME whole-industry model has to offer governments of commodity dependent countries.

First, the new model will allow governments to anticipate a succession of price eras, phases first of investment-driven excess prices, then very likely abnormally low prices, during disinvestment and the elimination of excess stocks, then a new era of conventional market equilibrium.

Anticipation of that likely sequence will allow appropriate inflation and exchange rate strategies to be formulated, to mitigate the likely damaging effects on other industries in the country.

Anticipating the same sequence of pricing eras would assist in the optimisation of taxation and royalty structures and price stabilisation of buffer stock schemes.

Slide 28. This slide describes what the new BME models will have to offer the major financial institutions that are heavily involved in metals.

These financial institutions will have to deal with their own potentially conflicting interests, for instance, mine financing, where higher prices are desirable; proprietary trading, where volatility is desirable; exchange stock financing, where as full a contango as is possible is desired; selling commodity index funds, where a backwardation is helpful. But with the commodity index funds come increased prices and with that come an increasing stock trend. The setting up of ETFs to accommodate those surpluses is beginning.

The new model will allow those financial institutions which have advance knowledge of the investment pipeline to understand and anticipate interactions between physical markets, index funds, ETFs and the exchange financing of stocks.

Slide 29. This slide describes what the new BME whole-industry models have to offer merchants.

The models will help merchants to understand a world which has become much more complex, with subtle interactions between physical markets, index funds and – now – a looming ETF industry.

The new models will stimulate new thinking on the sources of knowledge advantage in this market. Such advantage is no longer derived from the physical order books of the largest producers and traders. Ultimately, crucial advantage now derives from precise knowledge of the current buying pressure derived from investment in copper futures and knowledge of the pipeline of planned pension and other investments some eighteen months ahead.

The models will assist traders in a changing world in which advantage is passing *from* traders which own producing assets (mines, smelters and refineries) and sell physical copper *towards* those in close alliance with the managers of commodity index funds and ETFs.

Slide 30. This slide emphasises that understanding commodities prices is a moving target.

BME was the 'thought leader' over 2002 - 2005, broadening analytical focus of industrial raw materials market participants from (typically) just stock ratios to the interaction of stock ratios, rate of demand growth and currency factors.

From late 2005, it was BME that first assessed the shift towards hybrid raw material / investment markets, incorporating the effects of commodity index fund longs and net long / short positions of hedge funds.

In 2010, BME will again be providing 'thought leadership', by exploring a commodities world in which investment in futures has gained ascendancy over physical market factors. In our price models, we shall be looking at investment flows more closely, including sector rotation between equities, bonds and commodities. And moving on from price models to whole-industry models, we shall be modelling the feedback loop in which investment drives prices which suppress consumption, boost production and drive the rate of stock increase. We shall go on to assess how ETFs may begin to change the market dynamics yet again.

Slide 31. This shows how you can gain access to BME's two types of model: price models and whole-industry models.

BME's current standard multi-user models run with monthly data through 2010. They model prices, not entire industries. They are currently being extended to 2030.

These standard multi-user models are available for copper, aluminium, nickel, zinc and lead. Annual licenses cost £10,000 for one metal, £16,000 for two metals, £20,000 for three metals, £23,000 for four metals and £25,000 for five metals.

Similar models could be set up for other commodities.

BME is now moving on, to add whole-industry models, as described in this presentation. Companies wishing to take this opportunity to discuss either exclusive single-user sponsorship, or multi-client licensing, are invited to contact BME to discuss.

Peter Hollands, 1st February 2010

