Exhibit No.:	
Issue:	Noranda Rate
Witness:	Colin Pratt
Type of Exhibit:	Direct Testimony
Sponsoring Party:	Noranda Aluminum
Case No.:	ER-2014-0258
Date Testimony Prepared:	December 19, 2014

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariff to Increase its Revenues for Electric Service	)	**Case No. ER-2014-0258**

Direct Testimony of Colin Pratt

On behalf of

Noranda Aluminum, Inc.

December 19, 2014

BEFORE THE PUBLIC SERVICE COMMISSION
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In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariff to Increase its Revenues for Electric Service	))))))	**Case No. ER-2014-0258**

Affidavit of Colin Pratt

Colin Pratt, being first duly sworn, on his oath states:

1. My name is Colin Pratt. I am Managing Consultant of CRU having its principa place of Chancery House, 53-64 Chancery Lane, London WC2A 1QS, United Kingdom.

2. Attached hereto, and made a part hereof for all purposes, is my direct testimony which was prepared in written form for introduction into evidence in Missouri Public Service Commission Case No. ER-2014-0258.

3. I hereby swear and affirm that the testimony is true and correct.

Colin Pratt

Subscribed and sworn to before me this 19th day of December, 2014.

Notary Public or Commissioner for Oaths

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MY COMMISSION IS FOR LIFE

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Direct Testimony of Colin Pratt

Q PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A Colin Pratt. My business address is Chancery House, 53-64 Chancery Lane, London WC2A 1QS, United Kingdom.

Q WHAT IS YOUR OCCUPATION?

A I am Managing Consultant of CRU, Director of CRU's Valuation Practice Area.

Q PLEASE BRIEFLY DESCRIBE YOUR BUSINESS AND EDUCATIONAL BACKGROUND.

A I have spent the past 37 years working in commodity market analysis, most of them with CRU, where I headed the aluminum business unit from 1987 to 2002. During this period, I helped to build up CRU's aluminum research into the industry leading position it enjoys today. I joined CRU Consulting in 2003 and now work on consulting assignments across the spectrum of metals. Although still a specialist in aluminum from bauxite to can stock, I have also worked in the areas of industrial power markets, copper and gold, nickel, lead and zinc, magnesium, pulp and paper, non-metallurgical bauxite and alumina.

My research interests have included commodity market cyclicality, industrial power prices and contracts, alumina costs and contracts, aluminum smelting costs, vertical integration, company strategy, competitor analysis and project evaluations, public policy and taxation. I have managed consulting assignments in all of these areas. Prior to joining CRU I was Assistant Secretary for Policy and Planning with the Government of Papua New Guinea Mines Department, where I was responsible for advising on minerals policy, including the negotiation of major mining and petroleum license agreements.

I received my BA (Economics) from Manchester University and my MSc (Economics) from School of Oriental and African Studies, London University.

Q PLEASE DESCRIBE CRU'S BUSINESS.

A CRU provides business intelligence on the global metals, mining and fertilizer industries. The channels we deliver it through are market analysis, management consultancy and events using cost curves, pricing models, forecast algorithms, benchmarking checklists.

Q WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A The purpose of my testimony is to provide information regarding aluminum prices, aluminum price volatility and aluminum price forecasts. My testimony will show that aluminum prices are highly volatile. Consequently, although aluminum price forecasts and forward curves provide a reasonable starting point for evaluating the future, they are not sufficient to evaluate future risks and, therefore, do not provide a reliable basis to assess the sustainability of an aluminum smelter.

Q WHAT IS THE BASIS FOR YOUR CONCLUSION THAT THE PRICE OF ALUMINUM IS HIGHLY VOLATILE?

A The basis for my conclusion is simply an examination and analysis of historical aluminum prices. There is no reason to believe the future will be markedly different from the past in this respect. To examine historical prices, I have taken annual data for US Midwest P1020 (ingot) prices between 1982 and 2014. It would be possible to take the history back further, but the London Metal Exchange (LME) only began trading an aluminum contract in 1979, and pricing before 1979 was somewhat less transparent. By 1982, the LME had gained sufficient liquidity to become the main global benchmark price for aluminum. The US Midwest price is the LME 3 month price plus the Midwest ingot premium. The data is presented in a series of charts.

The first chart simply shows the annual average US Midwest prices – in nominal terms. As will be seen, the apparent upward trend can all be explained by general inflation. The cyclical pattern, with sharp peaks and troughs, is clear.

The sharp change in prices from year to year is illustrated by the second chart. This is based on the same data as chart 1, but shows the percentage changes from year to year. The annual percentage changes range from plus 44% to minus 33%. The chart also shows that large positive changes can be quickly followed by large negatives, for example in the years 1988 to 1990, or 2008 to 2010. Over the whole period, the average absolute change in price per year is 15.9%.

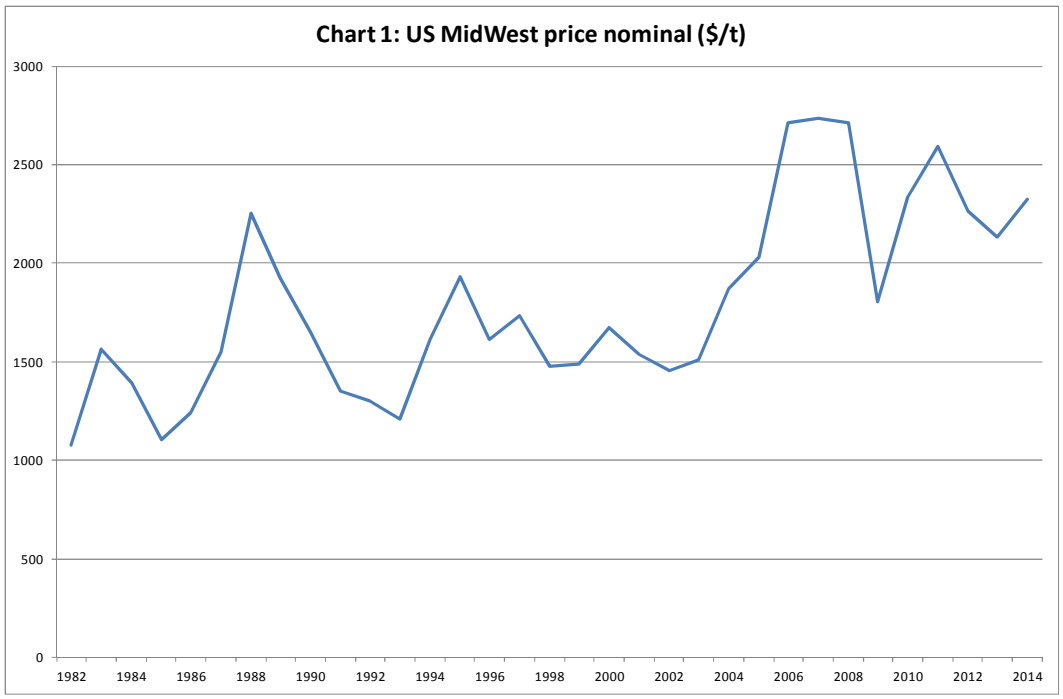


Chart 1: US MidWest price nominal ($/t)
3000
2500
2000
1500
1000
500
0
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

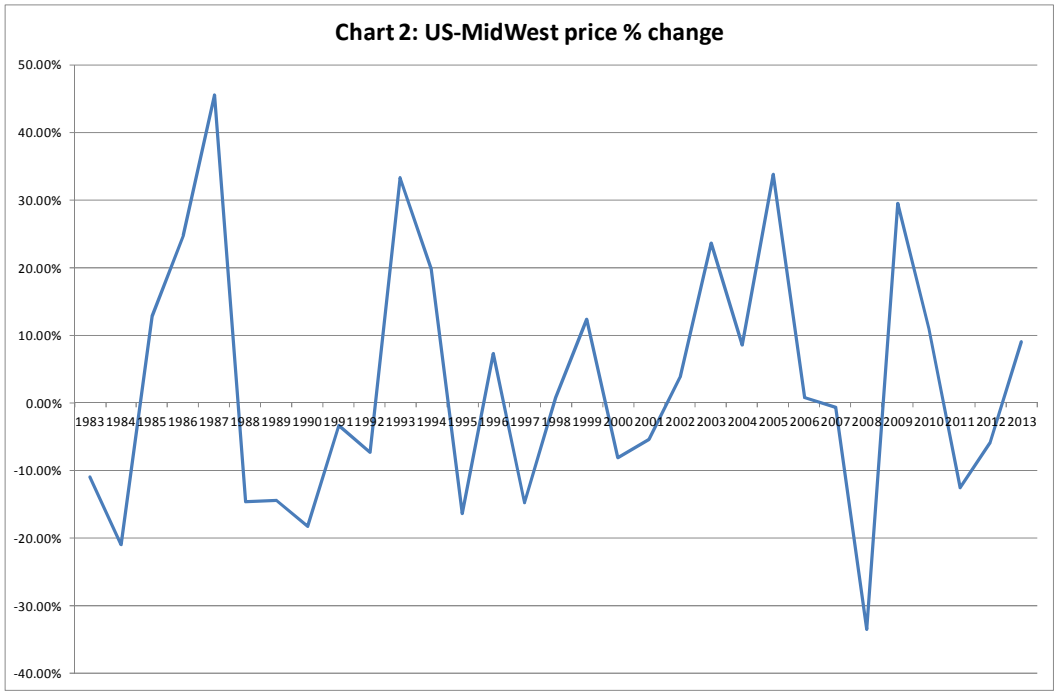
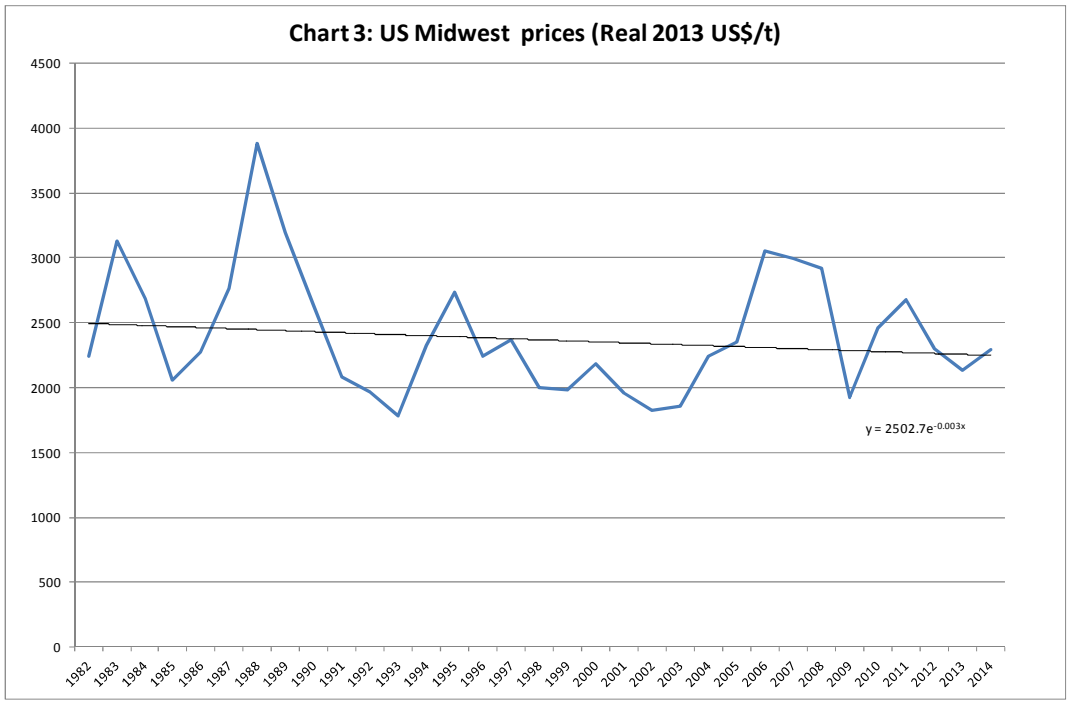


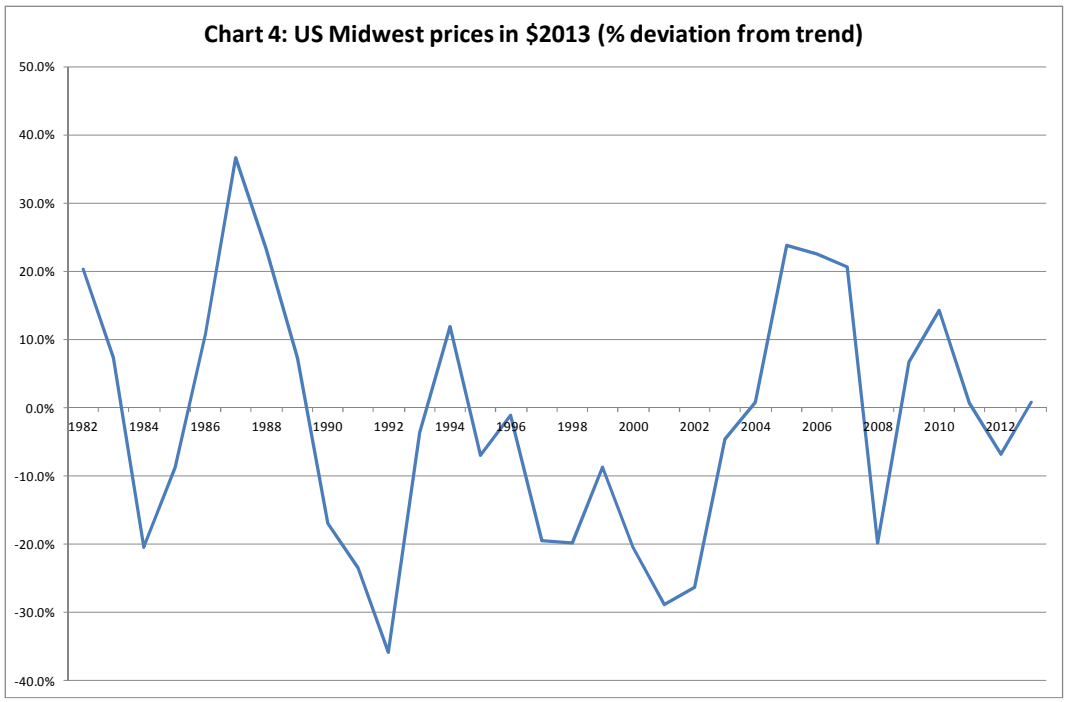
Chart 2: US-MidWest price % change
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
-10.00%
-20.00%
-30.00%
-40.00%
1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

The third chart below takes out the impact of inflation, by expressing all prices in dollars of 2013, using a US GDP deflator to inflate historical prices to money of 2013.



When we take out the impact of general inflation, we see that the trend in real prices has shown a slight decline of 0.3% a year. The terminal value of this trend line in 2013 is $2280.4/tonne, or $1.034 c/lb.

The final chart illustrates the annual percentage deviation from trend of the real prices shown in chart 3. This shows that prices have regularly fallen over 20% below trend, and, on two occasions (1993 and 2002) 36% and 29% respectively below trend. This information is useful in predicting the likely future pattern of prices.



Q WHAT ARE THE FACTORS THAT CAN CAUSE THE VOLATILITY?

A The answer to this question consists of three parts. Firstly, there are fundamental factors of demand and supply causing volatility. Secondly, since the 1990s, non-fundamental (mainly financial) factors have come into play. Finally, there are occasional economic "shocks", which have caused the most violent episodes of volatility.

It is important to note that the aluminum price is set by the interaction of buyers and sellers on the LME. The LME price is transparent, and so the LME acts as a **price discovery mechanism**. The LME is used as a reference price globally for the pricing of aluminum.

When we refer to fundamental factors we refer to the demand and supply of aluminum and their interaction in forming prices. The **demand for aluminum** is

cyclical, and there are three basic reasons for this. Firstly, demand follows the general macro-economic or business cycle. Fluctuations in the general level of consumption and investment impact the production of goods, and hence the demand for aluminum. Secondly, the consumption of aluminum is concentrated in industrial sectors that display above average cyclicality, in particular automotive production, house building and construction and consumer durables. These “big ticket” items suffer large swings in demand in response to economic fluctuations. Thirdly, and finally the fluctuations in demand are amplified by an **inventory cycle**. For example, in the event of an economic slowdown, agents throughout the supply chain tend to reduce inventory in response to lower demand and also in the expectation of lower prices. When this inventory correction reaches the end of the supply chain (in this case the aluminum smelter), the original reduction in demand will have been greatly amplified.

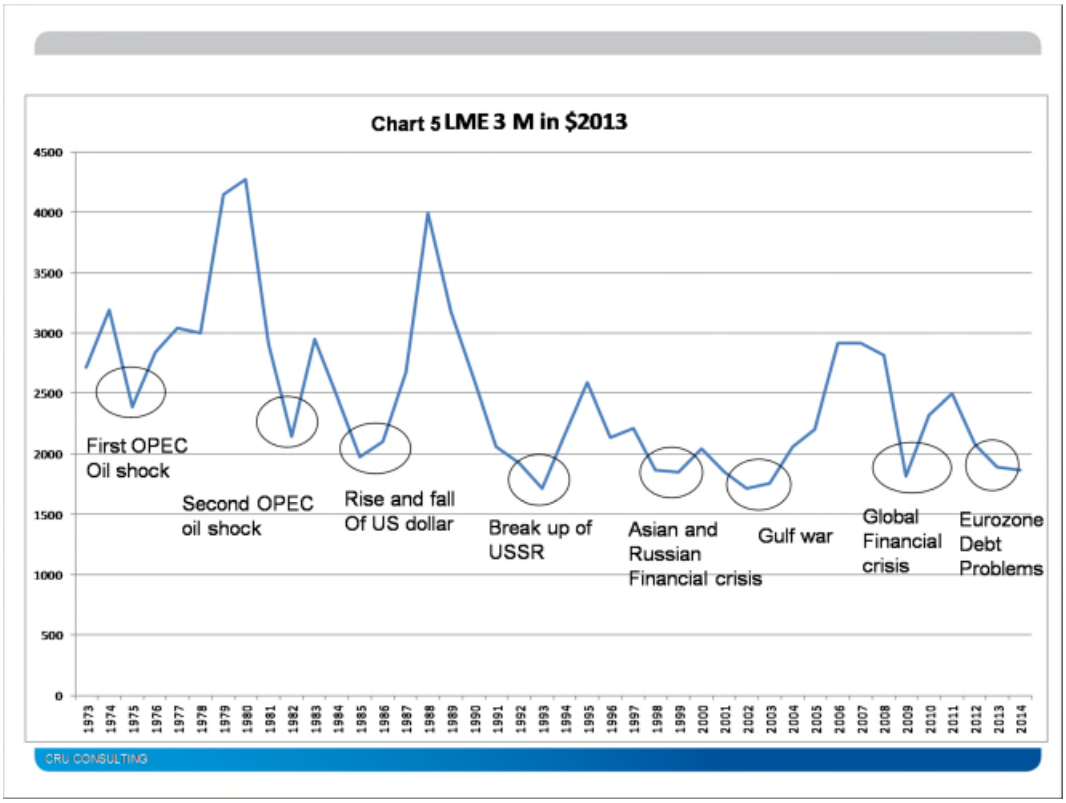
In the face of this cyclicality in demand, the **supply of aluminum** is comparatively unresponsive, or in economic terms, inelastic. Firstly, supply is inelastic as production reaches a capacity constraint. Capacity cannot be increased in the short term. This lack of supply response as production approaches capacity causes occasional large upward spikes in price (as in 1979 and 1988). However, more common is an unresponsive supply response on the downside. In other words, as demand falls, supply is unresponsive, or responds only after a long time lag. The reason for this lack of responsiveness is that aluminum production is a continuous process, and smelters are designed to work 24 hours a day, 365 days a year. Working at full capacity minimizes costs. Small adjustments in production are not generally practical, so curtailing production is a major decision involving the shutdown of a whole potline.

Smelters generally are therefore reluctant to curtail production in response to low prices. The result is that surplus inventories grow, and prices fall, to the point where high cost smelters are forced to curtail production in order to minimize losses. This process can take months and sometimes years.

The combination of cyclical demand and unresponsive ("sticky") production causes imbalances of supply and demand leading to surpluses and deficits in the market. These surpluses and deficits are manifested in reported industry inventories. Prices tend to move inversely with inventories – so as inventories increase, prices fall, and vice versa.

It is possible to explain the volatility of aluminum prices simply with reference to these fundamentals of supply and demand. However, since the 1990s non-fundamental factors have also played a role. I refer to the activities of short term investors (Commodity Trading Advisors or CTAs), medium term investors such as Hedge Funds, and longer term investors (index funds). The activity of financial investors has led to the so-called "financialisation" of commodity markets. Academic opinion is divided on the issue of how much these financial actors influence commodity prices. However, our own research suggests that they tend to anticipate as well as amplify the price movements based on fundamentals. By anticipating the fundamentals they tend to bring forward price movements in time. As in the stock market, financial actors react quickly to economic news, such as the dollar exchange rate, oil prices, prices of other metals and general economic indicators. This contributes to short term volatility.

The single biggest factor driving the cycle in aluminum prices is the demand cycle. Occasionally the demand cycle is hit by a major shock, and it is these shocks that historically have led to the biggest swings in aluminum prices. This is illustrated in the following chart. This shows the major events or shocks that have affected the market since 1973. Note that in place of the LME price before the introduction of the aluminum contract in 1979 a free market price quoted in the trade press is used as a proxy. The main impact of these negative shocks has been to amplify the downturn in the economic cycle, and hence in the price of aluminum.



Although these shocks may be regarded as unusual events, there have been eight in the past 40 years – every five years on average. So they are not so unusual. They are however, unpredictable. Looking forward, we may conclude

that there is a high likelihood of one or more of these shocks occurring in the next 10 years, but that it is very difficult to predict the nature or timing of the event.

Q PLEASE DESCRIBE THE CRU FORECAST METHODOLOGY AND HOW PRICE VOLATILITY IS REFLECTED.

A In the long term CRU forecasts are based on the idea of mean reversion towards a value that is based on the long run costs of production (long run marginal cost or LRMC). For these long run (greater than 5 years) forecasts we do not attempt to predict a price cycle. Partly this is because long run forecasts are generally used for investment decisions, and so the trend in prices is more important than the timing of the cycle. And partly it is because we do not have enough information to be able to make sensible predictions of the cycle so far ahead. For long run decisions we do however analyze the likely amplitude of the price cycle, particularly on the downside, even if we cannot predict the timing. This is because lenders to new projects need to know if cash generation will cover debt obligations under the worst conditions that might be expected.

For the short to medium term (up to 5 years) we use a market model of demand and supply to forecast inventory and price movements. Demand is driven by a macro-economic forecast for the major world economies. For supply, we have a degree of visibility going forward based on capacity under construction, as well as announced decisions regarding production. Future production decisions will depend on future prices, so the model is iterative. For any short to medium term forecast the starting conditions are very important – for example, are we above or below the long run trend price? Are inventories above or below normal? Has economic growth been accelerating, or slowing down? In December 2014 we

may characterize the starting conditions as follows: The industry still has a very large overhang of excess inventories. These inventories will eventually be made available to the market as interest rates rise, and will dampen any price recovery. In addition, the industry has a large amount of smelter capacity temporarily idled due to market conditions. Again, the potential reactivation of this idled capacity will, at the very least, dampen any price recovery. Finally, we enter 2015 with growth slowing in China and Europe, and with Russia and other oil producing countries facing major readjustments which will lead to slower growth. An implication of these starting conditions is that it is unlikely that the aluminum market will experience tight market conditions in the next two years. One of the problems with the starting conditions is that important economic data becomes available only after a lag, and is frequently revised. So, it is often said that an economic forecaster is driving a car with only a rear view mirror, and with a substantial blind spot.

Even the short to medium term forecasts of CRU and other forecasters rarely display the same degree of volatility that is evident in the price history. There are three main reasons for this. Firstly, macro-economic forecasts themselves usually contain much milder fluctuations than are evident from past experience. Secondly, the economic “shocks” that cause the most violent price fluctuations are not predictable, and so most forecasts do not attempt to predict them. Finally, in choosing a relatively smooth forecast most forecasters are choosing the lesser of two evils. While we may know that the future is likely to be more volatile than is forecast, we cannot accurately predict the timing, and to do so could be very misleading.

Q PLEASE EXPLAIN THE MIDWEST PREMIUM AND THE FACTORS WHICH INFLUENCE THE MIDWEST PREMIUM.

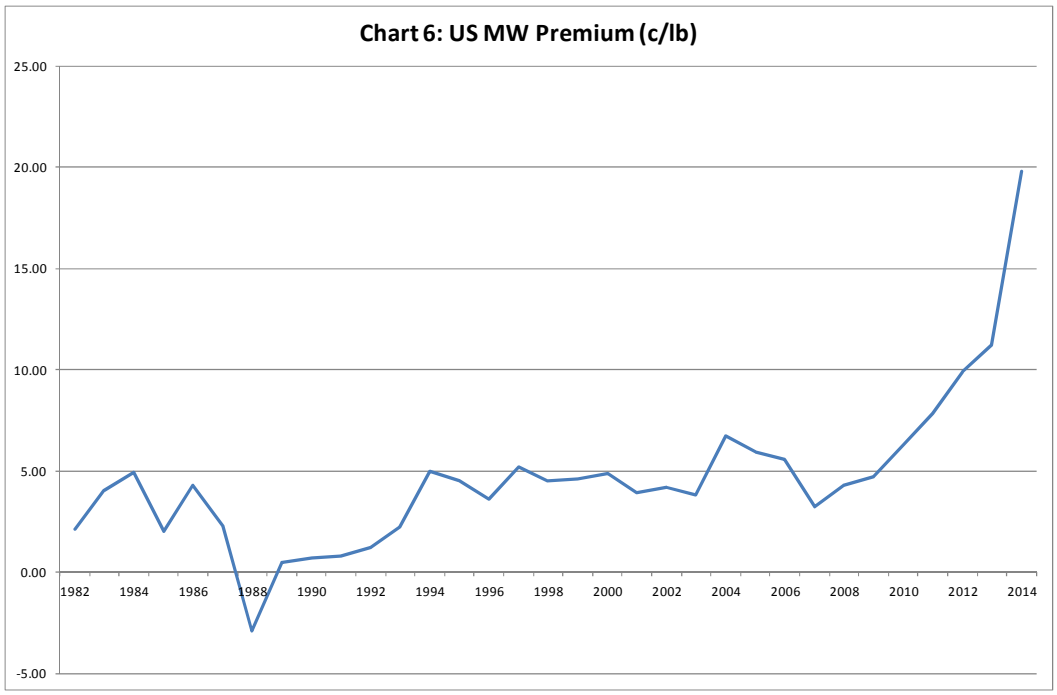
A The Midwest premium is an additional price added to the LME price paid by consumers for metal from a producer or merchant delivered to a customer's plant in the Midwest. There are several reasons why the premium exists. The premium is set in relation to the benchmark LME price, and the LME is the market of last resort for a consumer. However, if a consumer buys metal from the LME there are several disadvantages compared to buying from a producer or merchant. Firstly, there is the delivery basis. The delivery basis for US Midwest is delivered to customer's works. For the LME delivery is "in warehouse". To obtain the metal from the LME warehouse the consumer has to pay a "free on truck" (fot) or load out charge, and then pay transport costs to its works. In addition, when buying from the LME, the location of the warehouse is at seller's option, which may be very inconvenient for the consumer. The consumer may have to pay extra to obtain a warrant for metal in a more convenient location. Secondly, if a consumer buys from the LME they must settle in cash. Buying from a producer will usually involve 30 days credit. Thirdly, buying from a producer will involve metal of a known origin. LME metal could be of any origin that is a registered brand on the exchange. Finally, if a consumer buys LME metal they have to pay a warehouse rent on the metal until it can be loaded out of the warehouse. This last factor has become very important, as will be explained.

The value of all these differences between LME purchase and producer purchase can be calculated to give an approximation to a fundamentally justified value of the premium.

The factors that influence the Midwest premium follow from the above analysis. They include interest rates (which affects the value of credit), the warehouse fot charge, LME warehouse rents and the length of warehouse queues, and the cost of swapping LME warrants to obtain metal in a good warehouse location. In addition we should mention two other factors. Firstly, the USA is a deficit market for primary aluminum, and so imports constitute the marginal source of supply. Thus the Midwest premium must be adequate to attract metal to the USA, in competition with other destinations such as Europe or Japan, which are also deficit markets. The size of the US deficit, and hence location of the marginal supplier has an impact on the premium. For example if the marginal supplier to the USA is Canada, we would expect the premium to be lower than if the marginal supplier is Russia. The size of the US market deficit has widened in recent years, leading to upward pressure on the premium.

Q WHAT IS YOUR VIEW OF THE IMPACT OF AND OUTLOOK FOR THE MIDWEST PREMIUM?

A In the past few years, since 2010, the Midwest premium has broken out of its historical range. Between 1994 and 2009 the premium had fluctuated in a narrow range around the 5c/lb level. It has risen strongly since then, and will reach an average of almost 20c/lb in 2014. This is counter-intuitive, since in a market with a large surplus of inventory, the premium would normally be expected to weaken.



There are two reasons for this steep climb in premiums. Firstly, despite the existence of high industry inventories (in LME warehouses and elsewhere), much of this metal has not been available to the physical market, since it is tied up in long term financing deals. These financing deals have been facilitated by cheap money, low warehouse rents for long term deals, and the existence of a wide contango on the LME (the difference between cash and three month prices). Banks and other actors have therefore been able to borrow at very low cost, and earn the LME contango by continuously buying metal for cash and selling forward (called the "carry" trade). The second factor behind the steep rise in premiums is the development of long queues to obtain metal from certain LME warehouses – namely Detroit in the USA and Vlissingen in the Netherlands. As mentioned before, rent is payable on an LME warrant between cancellation of the warrant, and loading out from the warehouse. In addition, when obtaining LME metal the location is at sellers' option. Thus, the seller may choose a location with a long queue. The explanation of the development of these long queues is

complicated, and has been the subject of investigations by the LME as well as regulatory authorities. Suffice it to say that the development of long queues at selected warehouses greatly increased the notional rent element of the Midwest premium.

One of the impacts of the increased Midwest premium is that greater attention has to be paid to the "all-in" price (the LME price plus premium), since the premium element of the price has risen from being a relatively small and stable element of the price, to being almost 20% of the all-in price. Another impact has been to cause difficulties in risk management throughout the supply chain, because the premium element of the price cannot (or at least could not till recently) be hedged, as could the LME price.

The outlook for the Midwest premium depends heavily on two factors. The first is interest rates. A rise in interest rates will decrease the attractiveness of the carry trade. The second factor is the progress of LME reforms designed to limit the length of warehouse queues. These new rules (the load in – load out rules) are designed to gradually bring warehouse queues down to a maximum of 50 days. The rules were to have come into effect in April 2014, but were stayed by a legal challenge, which has since been overturned. Our view is that the new rules will be implemented in 2015, and will gradually result in a reduction in warehouse queues. This, coupled with a rise in interest rates, also currently expected in 2015, will bring the Midwest premium down towards more normal levels. However, the "new normal" is likely to be higher than the historical 5c/lb, due both to inflation, as well as to the structural increase in the US market deficit.

Q WHAT IS THE PROBABILITY THAT LME FORECASTS BY CRU OR OTHER MAJOR FORECASTERS WILL BE WRONG?

A The probability that any commodity price forecast covering several periods of time will be exactly right is virtually zero. It is therefore a question of whether the forecast is within an acceptable margin of error. During periods of relative stable forecasts can show low and acceptable margins of error. However, turning points are difficult to forecast (especially when caused by shocks), and so forecasts around the time of these turning points can display a wide margin of error. A very current example is the oil price. While the oil price was moving in a narrow range of $100-115/bbl, forecasters had a good chance of having a low error in their forecasts. In the past few months, oil prices have fallen by over 40% - a development that few had predicted. Thus oil price forecasts made earlier in 2014 will show a large error margin. Now that the fall has occurred, forecasters will adjust their forecasts accordingly. Thus the large errors occur around the time of the turning point.

Example 1: Aluminum forecast before and after the collapse of Lehman Bros in Sept 2008

CRU Forecasts of LME 3 Month price in 2008-09 (US$/t)

	2008 Q3	2008 Q4	2009 Q1	2009 Q2	2009 Q3	2009 Q4
CRU Forecast in July 2008	3,075	2,935	3,150	3,090	2,850	2,950
CRU Forecast in January 2009	----	-----	1,380	1,475	1,665	1,870
Actual outturn	2,845	1,882	1,396	1,523	1,836	2,034

Data: CRU

The example in the table above illustrates the same point with respect to the aluminum market in 2008, before and after the major shock of the collapse of

Lehman Brothers in September 2008. It shows that firstly, the major shock and subsequent downturn in demand and prices was not expected in July 2008. The July 2008 forecast anticipated a continuation of very high prices that were evident in the first half of the year. In this it reflected the macro-economic consensus of the time, which did not begin to predict a recession until at least September 2008. Secondly, once the turning point had occurred, the January 2009 forecasts were adjusted quickly to deal with the new reality. Finally, that once the price fall had occurred between September 2008 and January 2009, the subsequent recovery was reasonably well predicted.

Example 2: Aluminum price forecasts made in Q1 of 2011.

In early 2011 the aluminum price was riding high after a strong recovery from the 2008-09 financial crisis in 2010 and early 2011. The LME 3 month average reached $2527/t in Q1 and $2618/t in Q2. However, subsequently the eurozone debt problems and other factors led to a declining price trend which lasted through to Q1 of 2014. A survey of 30 forecasts made in Q1 2011, showed that every single forecast over-predicted the price for the years 2012 and 2013. Again, this illustrates the forecast errors that occur around major turning points, and shows that such errors are almost universal.

Example 3: Oil price forecasts

Such forecast errors are not confined to the aluminum market. During the period 2003 to 2008 there was a strong increase in oil prices, partly due to the boom in the Chinese economy. However, successive annual oil price forecasts by the IMF in its World Economic Outlook during those years showed the oil price leveling off at close to its level at the time of the forecast. Instead, they continued

to rise. Similarly, during the period of falling oil prices in the 1980s, successive forecasts by the US Department of Energy showed a familiar "hockey stick" pattern, with prices turning upward shortly into the forecast period. Instead, prices continued to fall.

Example 4: Macro Economic forecasts

Oil price forecasts are important because they feed into forecasts of other economic variables. Even more important in forecasting commodity market prices are general macro-economic forecasts of, for example GDP growth and industrial production. These macro-economic forecasts are also subject to a considerable error margin. In January 2013 the Congressional Budget Office (CBO) of the US Congress published a report on its Economic Forecasting Record – and it is worth stating here some of the main conclusions

- The accuracy of the CBO forecasts was similar to that of the Administration, and the *Blue Chip Consensus.*
- Among two year forecasts by CBO since the early 1980s, forecast values deviated from actual outcomes by 1.4 percentage points per year for real (inflation adjusted) output growth.
- Among five-year forecasts by CBO since the early 1980s, forecast values deviated from actual outcomes by 1.2 percentage points per year for real output growth.
- Sources of forecasting errors included the difficulty of predicting:
    - Turning points in the business cycle – the beginning and end of recessions
    - Changes in trends in productivity; and

- Changes in crude oil prices

- In addition, the report noted that revisions to the historical data (on output and income for example) that forecasters use for economic projections can complicate the task of interpreting forecasting errors.

More recently, the OECD published a paper in February 2014 on its forecasting record in the period 2007 to 2012. (OECD (2014), "OECD forecasts during and after the financial crisis: A Post Mortem", *OECD Economics Department Policy Notes,* No. 23 February 2014).

The study found that for the period 2007-2012 the average error for GDP forecasts for OECD countries made in May for the following year was -1.4 percentage points, and for the sub period 2007-2009 it was -2.6 percentage points.

For the sake of clarity, it should be pointed out that these percentage point errors are very large in relation to the average level of GDP growth over the period in question.

Note that I am not singling out CBO or the OECD for particular criticism, simply that these organizations have gone public with an analysis of their forecasting records.

Q WHAT ARE THE REASONS THAT LME FORECASTS ARE WRONG?

A Firstly, any forecast of the future can only be based on the state of knowledge at a particular time. The future will be subject to unforeseen events that nobody can predict.

Secondly, commodity price forecasts are usually based on market models of supply, demand and other factors. They will thus depend on forecasts of variables such as economic growth, industrial production, exchange rates, oil prices, and so on. These variables are themselves subject to forecast error, as seen in the previous example, which will transmit to the commodity price forecast.

Thirdly, as already mentioned, the main driver of a commodity price forecast is the macro-economic outlook, and these tend to show much smoother forecast fluctuations than have occurred historically.

Finally, the biggest price fluctuations have been caused by unexpected shocks that are difficult to predict. Refer to the previous diagram to see the eight shocks that have affected the market since 1973.

Q WHAT IS THE DIFFERENCE BETWEEN THE CRU FORECAST AND THE FORWARD CURVE?

A The forward curve is simply the prices (on a particular day) at which you may contract to buy or sell aluminum for future delivery. Whether you can actually do so (for a large quantity) depends on liquidity. The curve results from the interaction of buyers and sellers in the market. The forward curve is usually a

smooth progression, but history shows actual prices do not behave like that. The forward curve changes on a daily, and even hourly basis.

A CRU forecast is usually based on a model of market behavior, which uses various assumptions about the key drivers (macro growth, oil prices, exchange rates) to derive a commodity price forecast.

Both the forward curve and a model based forecast try to incorporate all current market information, but suffer from an inability to predict future events.

Q WHY DO YOU CONCLUDE THAT NEITHER THE CRU FORECAST OR THE FORWARD CURVE ARE SUFFICIENT TO TEST THE SUSTAINABILITY OF AN ALUMINUM SMELTER?

A Neither will sufficiently represent the potential price volatility in the forecast. The average price over a period of time does not give sufficient information. We need to understand potential variance. Forecasts rarely predict unexpected shocks (by definition). Although we cannot predict the precise timing of future price cycles, we can assume that the future will contain pronounced price cycles, as in the past.

Q HAVE YOU REVIEWED THE ANALYSES PREPARED BY NORANDA IN THIS PROCEEDING?

A Yes.

Q DO YOU AGREE THAT THE RANGE AND PATTERN OF ALUMINUM PRICES REFLECTED IN THOSE ANALYSES ARE REASONABLE?

A Yes. The forecasts prepared by Noranda simulate cyclical variations around a long run mean price. The mean price used in these calculations, of $1.064/lb in US $ of 2013 is the same average price used by CRU in its latest (December 2014) long term forecast for the period 2014-2025. The cyclical variations are based on overlaying a ten year cyclical pattern based on historical variation in prices over a sample of ten year time periods. The method chosen has the advantage that it reflects the potential volatility in the aluminum price using real data from previous periods. The patterns chosen are a reasonable sample of the potential cyclical patterns that may be faced in the coming 10 years.

Q DO YOU AGREE THAT THE RANGE AND PATTERN OF ALUMINUM PRICES REFLECTED IN THOSE ANALYSES ARE THE APPROPRIATE SET OF CASES TO EVALUATE THE SUSTAINABILITY AND RISK PROFILE OF THE NEW MADRID SMELTER?

A Yes.

Q DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A Yes, it does.