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Phosphate rock costs, prices and resources interaction

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HIGHLIGHTS

- There were two price spikes in the phosphate rock market, in 1975 and in 2008.
- Information on mining costs used to discuss how costs and prices interact.
- Industry cash production costs have been fairly stable.
- Future market price spikes likely with consequent impact on food prices.
- Higher mine production costs will eventually promote recycling.

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ABSTRACT

This article gives the author's views and opinions as someone who has spent his working life analyzing the international phosphate sector as an independent consultant. His career spanned two price hike events in the mid-1970's and in 2008, both of which sparked considerable popular and academic interest concerning adequacy of phosphate rock resources, the impact of rising mining costs and the ability of mankind to feed future populations. An analysis of phosphate rock production costs derived from two major industry studies performed in 1983 and 2013 shows that in nominal terms, global average cash production costs increased by 27% to $38 per tonne fob mine in the 30 year period. In real terms, the global average cost of production has fallen. Despite the lack of upward pressure from increasing costs, phosphate rock market prices have shown two major spikes in the 30 years to 2013, with periods of less volatility in between. These price spike events can be seen to be related to the escalating investment cost required by new mine capacity, and as such can be expected to be repeated in future. As such, phosphate rock price volatility is likely to have more impact on food prices than rising phosphate rock production costs. However, as mining costs rise, recycling of P will also become increasingly driven by economics rather than legislation.

1. Introduction

There has been much debate in recent years as to if and when mankind is likely to ever to face phosphorus (P) supply constraints as a result of phosphate rock (PR) resource limitations. The implications of a PR supply-driven constraint are immense, given the irreplaceable nature of P in biological processes. In particular, a supply-driven fall in production would imply hugely increased PR production costs and, as a result, vastly inflated price levels. This would undoubtedly increase sharply the number of farmers who can't afford nutrients to fertilize their soils. Even today, amidst it seems a plentiful supply of PR, farmer access to P nutrient with which to grow food varies widely across the globe. In some areas, farmers are currently able to afford to use more fertilizer through direct and indirect subsidies whilst others, just because they happen to live in landlocked countries with no local PR production, find transport and handling costs put fertilizer beyond their means. Just as we live in a world of hunger whilst producing enough food to feed everyone on the planet, we also live in a world where producers of PR can fulfill all demand requirements, yet many farmers continue to struggle to grow crops through inequitable access to fertilizer nutrients (Chart 1, Chart 2).

So as we debate the rate of use of PR resources and the degree of urgency to recycle and cut P losses, it is imperative that we do not lose sight of the need also to develop the means of improving access to P as a nutrient for all farmers globally.

2. Production costs relatively stable — market prices less so

In the foreseeable future, I believe that it is not PR production cost escalations we need to plan for, but significant market price fluctuations. There is an economic incentive for PR producers to minimize production costs. According to studies performed by industry experts, average PR

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cash production costs (excluding the cost of capital) have fallen in real terms in the last 30 years.

Calculations show that the average cost of mining PR globally has increased by less than general inflation in the last 3 decades. Production (mining and beneficiation) costs were derived for each PR mining operation worldwide in major industry studies for 1983 (SRI International et al, 1983) and for 2013 (CRU International, 2014a, 2014b). I have used data on the capacity of each mining/beneficiation operation in these studies to calculate a global weighted average production cost.

The results show that in 1983, the global average PR production cash cost (excluding financing costs) was $30 per tonne ex-mine, with a range of costs globally of $16–$55 per tonne. The same calculation based on capacity and cost data for the largely different set of mines active in 2013 results in a weighted average cost of $38 per tonne and a range of $13–$94 per tonne.

All the above values are in nominal, current dollar terms. If a general inflation factor is applied of around 2.5% p.a., the 1983 value would translate to over $60 in 2013 constant dollar terms. Thus I conclude that the PR industry, overall, has lowered its cost profile in real terms during the 30 years to 2013.

This seems to be contrary to the general belief that the 'best' PR resources (here expressed in terms of how much it costs to mine them) have been mined first. Of course, when a deposit is scheduled for mining, it makes economic sense to mine the lowest cost portion of that reserve first, whether it be the highest grade ore, the least amount of overburden or the closest part of the orebody to the beneficiation unit. Looking at individual operations that have been mined for a considerable period, for example in Florida, one can indeed see a progression to higher costs as ore grades deteriorate, as pumping distances from mine to plant increase and because of general inflation in wages, utilities and fuel. However, the influence of these Florida mines with rising costs is waning. Falling US PR capacity has been offset by increased output in China, where costs are generally lower than in the U.S.

So what implication does this small increase in cash production costs have for PR market prices? The answer is, very little. PR market price levels rise and fall as a result of changing market supply/demand dynamics. However, cash production costs do provide a floor for market pricing and this could become more important in the longer-term future. Despite the lack of growth in production costs, twice in the last 30 years we have seen PR market prices suddenly jump 6–8-fold after a long period of relative stability. In both cases the price spike initiated debates about the impact of P costs on food prices, the adequacy of PR resources and the ability of the global population to feed itself and future populations.

3. Production cost impact on market prices

Cash production costs (when added to logistic and other costs) provide a theoretical low-end price limit below which a producer will begin to lose money. In theory, this provides a progressive brake on PR supply volumes as PR prices fall, with the higher cost producers coming under pressure first. (History has shown us that this is by no means a perfect mechanism, however).

In contrast, there is no immediate upper limit to PR price levels when the market is short of product. Prices can escalate very quickly to multiples of the previous level under certain circumstances. Historically this has happened twice, in 1975 and in 2008. In both cases, prices followed the same path — what I call 'jump–slump-plateau' in which prices initially rise to a very high level in the space of 12–18 months; prices then fall back to lower levels before recovering to a plateau phase. The plateau phase after the 1975 jump–slump held PR prices at a level 3–4 times higher than before the jump. If this multiplier from the previous plateau phase is to be repeated, PR prices should now remain in the range $110–160 per tonne for some considerable time.

To understand this price behaviour, it is necessary to look at adjustments in the market that happen on both the demand and supply side when PR prices escalate.

On the demand side, high PR prices translate into high P fertilizer prices to the farmer. This effect is exacerbated by high levels of other input prices (other nutrients, other agrochemicals, fuel, freights, utilities etc.) and by low grain/produce prices. In the case where all input prices spike in rapid succession, a mechanism kicks in that is unique to P amongst the three major plant nutrients. The ability of some soils to absorb a significant proportion of the applied soluble P as low-solubility compounds creates a P bank or 'sink' in the soil that is released slowly over time as plant available P. This mechanism allows farmers in many of the major grain growing regions such as Europe, to lower, or remove all together, P applications for one or more seasons, without detriment to the crop yield. When farmers are pushed to do this by deteriorating economics, the demand for P fertilizer and hence PR can be substantially reduced. The impact is most felt in the level of purchases in the traded PR market since this is where PR prices have escalated the most (of course, integrated rock consumers continue to be based on their mining costs in such a situation, with cost escalations limited to higher energy costs etc.).

This cut-back in PR import demand is the main cause of the subsequent price slump. After the 1975 price hike, PR trade fell by 25% from the 1974 peak of 54.9 million tonnes (IFA, PIT Committee). OCP and the USA, the two main exporters at the time, both lost more than 20% of their respective markets, heightening competition and driving prices down. Following the spike in PR prices in 2008, PR trade fell by 36% from 30.5 million tonnes to just 19.5 in 2009 (IFA, PIT Committee). The largest market supplier, Morocco, saw its PR exports falling by almost 60% from 14.1 million tonnes in 2007 to just 5.8 million tonnes in 2009. The result was again for PR prices to fall back sharply as exporters looked to regain markets.

On the supply side of the PR market, when prices are high, new projects are initiated in the industry that eventually brings more capacity into production, thereby relieving the tight supply/demand position. The sharp run-up in prices in 2008 initiated such a surge in new projects. As of its August 2014 report (CRU International, 2014a, 2014b) CRU was following over 60 PR supply projects through its Project Gateway System, but only a small fraction of these are expected to come to fruition in the near to medium term. A similar proliferation of projects was apparent after the mid-1970s PR price hike.

Although PR mining companies can operate on a cash cost basis in order to compete in a weak market, over the medium to longer term it is, of course, necessary for companies to cover all their costs in order to be viable. The additional costs above cash costs include logistical and other sales costs as well as the cost of capital required to build and sustain mining.

The escalation in the cost of capital for PR mine development and construction has been steeper than the escalation in cash costs. It is the cost of developing and operating new mines, as required by increasing demand levels, that sets the level of market prices in the longer-term. Beyond the 5 year horizon, CRU uses its in-house Long Run Marginal Cost (LRMC) econometric model to calculate the level at which PR prices need to be in order to generate returns commensurate with building and profitably operating new greenfield PR mines that are required to meet expected demand levels. The output of this model is a rising curve that predicts where the PR price would theoretically be at any point in time in a balanced market.

However, what happens in practice is that new PR mine construction, resulting from a period of high prices, invariably creates an oversupplied market, which in turn forces prices to remain relatively low (the plateau phase of pricing described earlier) compared to the progressively rising Reinvestment Cost. As demand for PR increases over time, pressure gradually builds for new production capacity to be constructed, but prices do not warrant the commercial investment required. Eventually, once the pressure is high enough, an economic

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