COMMODITIES

Innovation and Investment Pop Commodity Price Bubble

Expanded Supply of Commodities Has Moderated Prices Pushed Up by Chinese Demand

By PATRICK BARTA and JOHN W. MILLER

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The Tsingshan Holding Group produces nickel pig iron at this plant near Ningde. Chinese companies learned more efficient ways to make stainless steel from this cheaper substitute. *Patrick Barta/The Wall Street Journal*

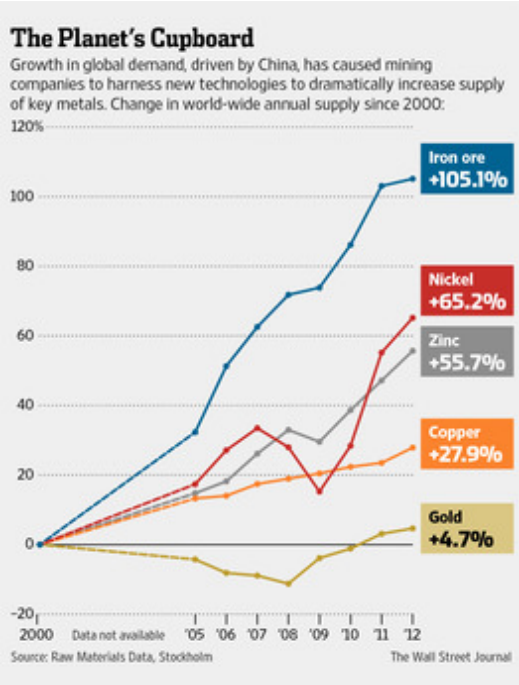
NINGDE, China—The price of nickel, a metal used to make stainless steel for everything from sauce pans to guitar strings, spiked past $50,000 a metric ton in 2007 from less than $10,000 just a few years earlier.

With nickel largely controlled by Western companies, China's swelling economy was especially vulnerable—until some of its steel producers figured out how to substitute a lower-grade "nickel pig iron," unlocking a mother lode of cheap supply.

The innovation has sent nickel prices tumbling to less than $14,000 a metric ton, and turned China into a leading nickel producer. The country now turns out more than 400,000 metric tons of nickel pig iron a year,

equal to a fifth of world-wide demand.

Economists for years warned that rising demand for natural resources by China and other emerging markets would outstrip supply, leaving the world short of everything from nickel to coal, copper and corn.



But a remarkable period of innovation and investment has produced a far different picture. Expanded supply has helped moderate commodity prices over the past year after a decade of demand from China helped push many prices into the stratosphere.

The International Monetary Fund's index of all commodity prices is down about 12% from recent peaks; it had roughly tripled between 2000 and 2011. Copper is down 28% from its record high in 2011, while thermal coal has fallen by more than half since a 2008 peak.

Of course, price declines are also driven by weaker demand, especially in China, where economic growth has slowed. And prices for many commodities, including oil, remain far above their average from 10 or 15 years ago.

But the global supply picture is the best in years. "It's kind of basic econ 101: Scarcity induces some sort of innovation," said David Jacks, an associate professor at Simon Fraser University in Canada, who has studied commodity cycles over the past century.

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The most widely known innovation is the oil-field technique known as hydraulic fracturing, or fracking, which fueled the shale boom by injecting water and other materials into the earth to unlock oil and natural gas.

But in agriculture, farmers are tapping new patches of arable land, and turning to higher-yielding hybrid seeds.

In the mining industry, drilling companies are using diamond-coated drill bits to reach miles farther beneath the earth's surface. They also employ aircraft radar to map the geology of remote areas. Firms that mix chemicals into minerals to make desired metals rise to the top or sink to the bottom now extract more product than ever from lower-grade deposits.

On top of all that, many projects that were funded years ago—including new or expanded copper, silver and nickel mines—have started producing.

As as result, mine production has nearly doubled or tripled for every major metal over the past two decades, according to the U.S. Geological Survey and other organizations.

Between 2000 and 2012, aluminum output increased to 45.7 million metric tons from 24.7 million, according to the Raw Materials Group Stockholm, a consultancy. Production of iron ore, used in steelmaking, hit two billion metric tons from just 975 million over the same period.

Global production of corn, meanwhile, rose by about 270 million metric tons over the past decade, according

to the Food and Agriculture Organization of the United Nations. That growth was the biggest 10-year increase on record and more than triple the gains of the previous decade.

Output of palm oil, used in cookies and instant noodles, has more than doubled since the start of the last decade, and so has the harvest of walnuts and almonds.

All this expanded production has often come with environmental costs, which in various places include air pollution, clear-cut forests and water tainted by chemicals.

And it remains unclear how the world can sustain the commodity-production gains still needed to meet future demand. Per capita consumption of energy and other resources in China remains lower than in the West, which means more production increases will be needed in the future as the Chinese economy grows. Many easy-to-reach minerals have been exhausted, likely raising future production costs.

But innovations of the past decade show how market signals help unlock new supply. The period compares with advances in copper production during the 1920s, Mr. Jacks said. And demand during World War II led to the expansion of synthetic rubber production.

Minerals companies, for example, have improved the chemical process to extract raw materials from waste rock. Rio Tinto in Utah extracts silver, gold and molybdenum from the muddy sludge that is a byproduct of mining copper. In Minnesota, a company called Magnetation Inc. has developed machines that use magnets to extract iron ore from mining waste.

China's nickel production is one of the most dramatic examples of fresh thinking. In the early 2000s, prices were below $10,000 per metric ton. Then China's economy took off, along with new demand for stainless steel, which requires nickel and iron. Nickel prices surpassed $51,000 per ton in mid-2007.

Chinese stainless steel producers were furious, especially since much of the world's nickel supplies were dominated by such foreign companies as BHP Billiton Ltd. , Vale SA of Brazil, and Russia's MMC Norilsk Nickel.

Most nickel production at the time came from so-called sulfide deposits in places like Canada and Russia, where mines were being depleted.

There were plenty of lower-grade laterite deposits in Indonesia and elsewhere. It could be refined into nickel pig iron, which contains a relatively small portion of nickel—usually less than 15%—mixed with iron. But processing the laterite ore required lots of energy and created lots of pollution.

Analysts figured it cost $20,000 or more per metric ton to make nickel pig iron, more than double the market price for nickel in the early 2000s. Mining companies often tossed laterite nickel aside.

But when nickel prices climbed, China saw a competitive advantage: it still had scores of old, inefficient blast furnaces. Beijing had been pressing steelmakers to shut them down. But with some fine-tuning, the blast furnaces could refine laterite ore into nickel pig iron, which can be used to make some steel alloys, including stainless steel.

Early Chinese producers burned coal, oil, wood chips and other materials to refine the laterite, which came mostly from Indonesia. The final product had only a small amount of nickel, but also iron, both needed ingredients.

As prices continued to climb, nickel pig iron became economical, and furnaces along China's eastern coast were put to work.

The Tsingshan Holding Group was among the leaders. As one of China's major producers of stainless steel, it needed lots of nickel.

The company was encouraged by early trials with nickel pig iron, but the refining process was still crude and dirty. So Tsingshan began experiments, including at a plant near Ningde, a coastal town in Fujian province surrounded by low green mountains and grape farms.

The company tried rotary kiln electric furnaces, which use less energy than blast furnaces and can extract more nickel from the ore.

Many people were skeptical, said John Li, a Tsingshan-subsidiary vice president in Ningde. One day, he said, a furnace started leaking iron slag everywhere.

But the process eventually succeeded, trimming electricity needs by as much as 40%, said Jiang Xinfang, president-director of another Tsingshan subsidiary in Shanghai. Tsingshan now pumps out nickel pig iron with 11% nickel, the company said, compared with 2% or less using older techniques.

"At its core, this is a sort of revolution in the way nickel units are made," said Andrew Shaw, a commodities analyst at Credit Suisse in Singapore.

Tsingshan now gets about half the nickel it needs from its own nickel pig iron, Mr. Li said. At its Ningde-area operations, a port unloads ships of Indonesian ore, which is piled in tall dark-brown mounds that cover an area roughly the size of a football field.

Later, the ore is transferred to a smelting plant where it is fed into a tangle of rust-colored pipes, smokestacks and rotating kilns for conversion into liquid nickel pig iron.

A blanket of foul-smelling smog envelops areas near Tsingshan's operation, though there are many other factories nearby, making it hard to know where all the pollution comes from. Some residents blame the pig iron plant.

Analysts say mining of Indonesian ore involves destructive stripping of the land in that country, as well.

But the rotary-kiln process has made refining significantly cleaner, according to analysts. Mr. Jiang at Tsingshan said his company's newest-generation operations include antidust equipment and low-sulfur coal.

Tsingshan's breakthroughs have been replicated across China. As nickel pig iron technology has improved, analysts say, the cost of processing it has fallen to as low as $12,500 per metric ton.

"There's been this huge deflationary effect on the nickel industry as nickel pig iron has developed," said Gayle Berry, an analyst at Barclays in London. "It certainly has destroyed the world" for traditional nickel, added Jim Lennon, a nickel expert and consultant to Australia's Macquarie Bank, though supplies could tighten again in the future.

One concern for producers is that Indonesia may restrict exports of nickel ore next year to entice mining companies to build refining operations there. Tsingshan is one of several companies taking steps to do so.

Meanwhile, Western miners are scrambling to deal with the new supply. Analysts estimated that as much as

40% of the nickel mining industry is losing money these days. Some predict China will keep finding ways to supply its own needs.

Ivan Glasenberg, chief executive of Glencore-Xstrata, the world's fourth-largest nickel miner, said earlier this year he was pessimistic about the metal's future price. In October, his company announced it would mothball its Falcondo mine in the Dominican Republic because of falling nickel prices, eliminating as many as 1,000 jobs. The company mines nickel ore in five countries, including Indonesia and sells much of it to China to make nickel pig iron.

"China is becoming self-sufficient" in nickel, said Vladimir Potanin, chief executive of Norilsk, the world's top nickel producer. "They are producing steel, which they need for their industrial development. They need this nickel pig iron close to where the steel is made. I think they're smart enough, and powerful enough to keep doing both forever."

Mr. Li, of the Tsingshan subsidiary, was pleased with his country's revamping of nickel production, with benefits extending around the world. "If we didn't have this nickel process in China," he said. "I think prices would be $80,000."

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