ECO 610
Problem Set #4
Fall 2020

1. (8 pts.) See the attached article from the WSJ 11/24/17. Describe the pertinent market structure characteristics of the paint industry, and explain what type of market structure you think it is. Then take the information on sales by each of the major paint producers and calculate the industry HHI. Explain how you get your answer and show your work. There are a number of smaller producers not listed in the chart, but you can ignore them for purposes of answering this question.

2. (12 pts.) Read the attached article on the global cobalt market from the WSJ 11/30/17. Cobalt is mined by a number of companies in different places around the globe. Since the beginning of the year, cobalt prices have increased from around $10/lb to $30/lb. As you can see in the attached chart, cobalt prices had been in the $10 to $15 range for a number of years. Since you work for a major battery manufacturer supplying automobile manufacturers in North America, your bosses have asked you to explain what is going on. The CEO and most of the board members have MBA's, so they understand commodity market models. Now for the framework of your report:
   a) What does long-run equilibrium look like in the global cobalt market? Is long-run equilibrium price closer to $10 per pound or $30 per pound? What does that suggest to you about minimum LRAC for producing cobalt? Draw diagrams for the market and for a typical cobalt mining company that are consistent with your description of long-run market equilibrium.
   b) What does the future hold? Do you anticipate that prices will stay at $30 per pound, or do you see them returning to a lower level? If so, what level? And how long do you think the adjustment process will take? Draw diagrams for the market and for a typical cobalt mining company consistent with your explanation of 2016 prices being $10/lb, 2017 prices being $30/lb, and 20?? prices being whatever you are predicting.

Section 201/203 Teams:
1. M. Appleton, K. Wiard, J. Franks
2. N. Burr, C. Workman, T. Murphy
3. R. Flickinger, K. Suzuki, L. Gray
4. T. Greene, R. Syed, M. Hurst
5. M. Lattin, M. Oertal, D. McQuaid
6. C. Shepherd, K. Stenzel, C. Dobson
7. L. Smart, J. Lenoir, T. Bradford
8. B. Stevens, J. MacLeod, L. Fowler
9. M. Ticar, K. Midelfort, B. Sturgill
10. Y. Xia, L. Adedokun, R. Tandon
11. K. Bradford, K. Silver

Section 202/204 Teams:
1. K. Rowe, E. Hammons, C. Swartout
2. B. Billiter, M. Koutourousiou, J. Thomas
3. T. Williamson, E. LaFavers, JD Heck
4. J. Rolf, K. Moore, A. Kilgore
5. J. Donahue, C. Smith, R. Mahan

6. T. Gatewood, I. Almagdub, K. Obeng
7. K. Fugate, M. Anderson, M. Paranzino
8. K. Meyer, R. Saunders
9. S. Patel, S. Reiner, T. Stapleton
10. P. Almeter, H. Ganesh, J. Wells
11. M. Mastalerz, A. Smith, J. White
12. J. St. James, T. Thompson, K. Stafford
13. A. Terry, M. Alonso, K. Starns

WSJ 11/24/17

Paint Industry Draws Excitement

The otherwise quotidian world of paint is turning into a feeding frenzy of merger activity. Money is to be made betting on the prime targets.

The latest news: Japan's **Nippon Paint** is interested in **Axalta Coating Systems**, pushing aside a bid by Dutch rival **Akzo Nobel**, which itself has been a target for industry leader **PPG Industries**. It is unclear what price Nippon has offered for Axalta, though it will need to be more than its current enterprise value of $11.7 billion including debt.

Akzo's retreat before a smaller rival isn't as odd as it sounds. This year, the Dutch company refused to negotiate over three separate bids from Pittsburgh-based PPG, which vies with Cleveland-based **Sherwin-Williams** for the top spot in the global paints industry. Investors, noisily led by New York activist **Elliott Management**, wanted Akzo to negotiate.

Chairman Antony Burgmans blocked PPG by invoking arcane clauses of Dutch law, leaving him little credit with investors to draw on in support of a punchy takeover. The Axalta deal, billed as a "merger of equals," always looked like a poison pill to keep PPG away, but investors were happy to swallow it as long as Akzo could promise merger synergies without a hefty takeover premium. Nippon's all-cash offer has made that impossible.

Nippon Paint is making a huge bet. With an enterprise value equivalent to $10.6 billion, it is slightly smaller than Axalta. The offer looks serious, though. The Japanese company has no net debt and a clear ambition to be a global player.

Crucially, Nippon Paint's key shareholder implicitly stands behind its management. Almost two-fifths of the company's shares belong to **Wuthelam Holdings**, the investment vehicle of Singaporean billionaire Goh Cheng Liang. Mr. Goh distributed Nippon paint for decades before his son, now director of the board, spearheaded a 2014 merger.

Akzo's inability to compete with Nippon Paint leaves it vulnerable. PPG has done its best to temper expectations of another round of bidding, but this could just be a negotiating ploy. The numbers should still work: The dollar has weakened against the euro this year, but PPG's share price has outperformed Akzo's, which is still 18% below the level of PPG's final bid. PPG's "put-up-or-shut-up" quiet period expires next month.

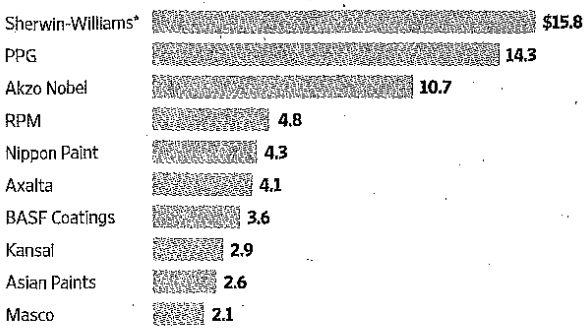
There is an outside chance **Sherwin-Williams** could also be interested in Akzo. In the spring it had its hands full with the acquisition of smaller rival Valspar, but this was completed in June.

In a consolidating market it makes sense to own the takeover targets. It is clearer than ever that these include Akzo Nobel as well as Axalta.

—Stephen Wilmot

Color Palette

Global coatings sales 2016, in billions



*Pro-forma including Valspar.
Sherwin-Williams's acquisition of Valspar completed in June 2017.
Sources: Coatings World, Sherwin-Williams

THE WALL STREET JOURNAL.

WSJ 11/30/17

Will a Shortage of Cobalt Kill Electric-Vehicle Makers?

Wedged between iron and nickel on the periodic table, cobalt has suddenly emerged as the electric-car killer.

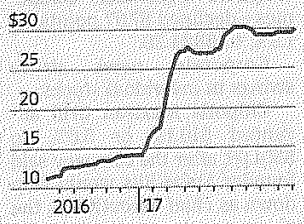
The once-obscure metal, a critical part of batteries, has nearly tripled in price since last summer as concerns grow about whether there will be enough cobalt to meet demand.

The ingredients for a shortage are there: Output is concentrated in the politically unstable Democratic Republic of Congo and refining is dominated by China. Demand is set to soar as companies from Tesla to Volkswagen ramp up production of electric vehicles.

With the price of cobalt hitting $30 a pound, investors have poured into shares of companies that mine or own rights to the metal. Canada's **Cobalt27 Capital**, which believes there is already a deficit in supply that will worsen, is up 162% this year.

Pedal to the Metal

Price of cobalt US 99.8% a pound as tracked by CRU International



"I don't think automobile manufacturers are as concerned about price as availability," says George Heppel, a consultant at materials research firm CRU International who says the shortage could peak in 2021.

But the dreaded shortage of cobalt is a bit more complicated than industry projections would suggest. As anyone who remembers the fears around rare earth metals will agree, high prices have a way of boosting supply and reducing demand. With the cost of cobalt alone having risen to over $800 for some leading electric models—about as much as that of aluminum or plastic per vehicle—mother necessity is calling.

Like cobalt, rare earths aren't so rare. China's move to restrict exports in 2010 exacerbated the perceived shortage, sending the prices of some varieties up 10-fold. Companies such as **Molycorp**, Rare Element Resources and **Quest Rare Mineral**, which all had some connection to reserves, saw their shares surge based on supposedly rosy prospects. Since then, all have lost nearly all of their value.

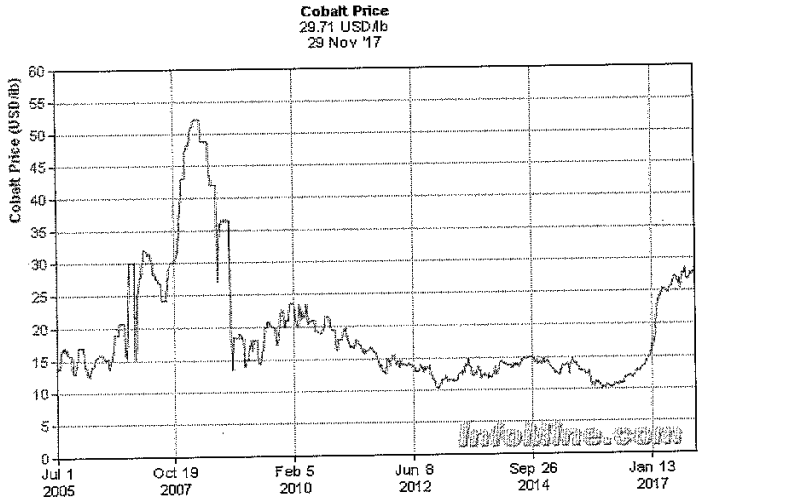
Already, Mr. Heppel explains, other users of the metal, for example in the pigments industry, are searching for alternatives. Meanwhile, some batteries, such as a design by Tesla, use less of the metal. Lower-performing batteries use none at all, and those batteries' capabilities may improve with technological tweaks.

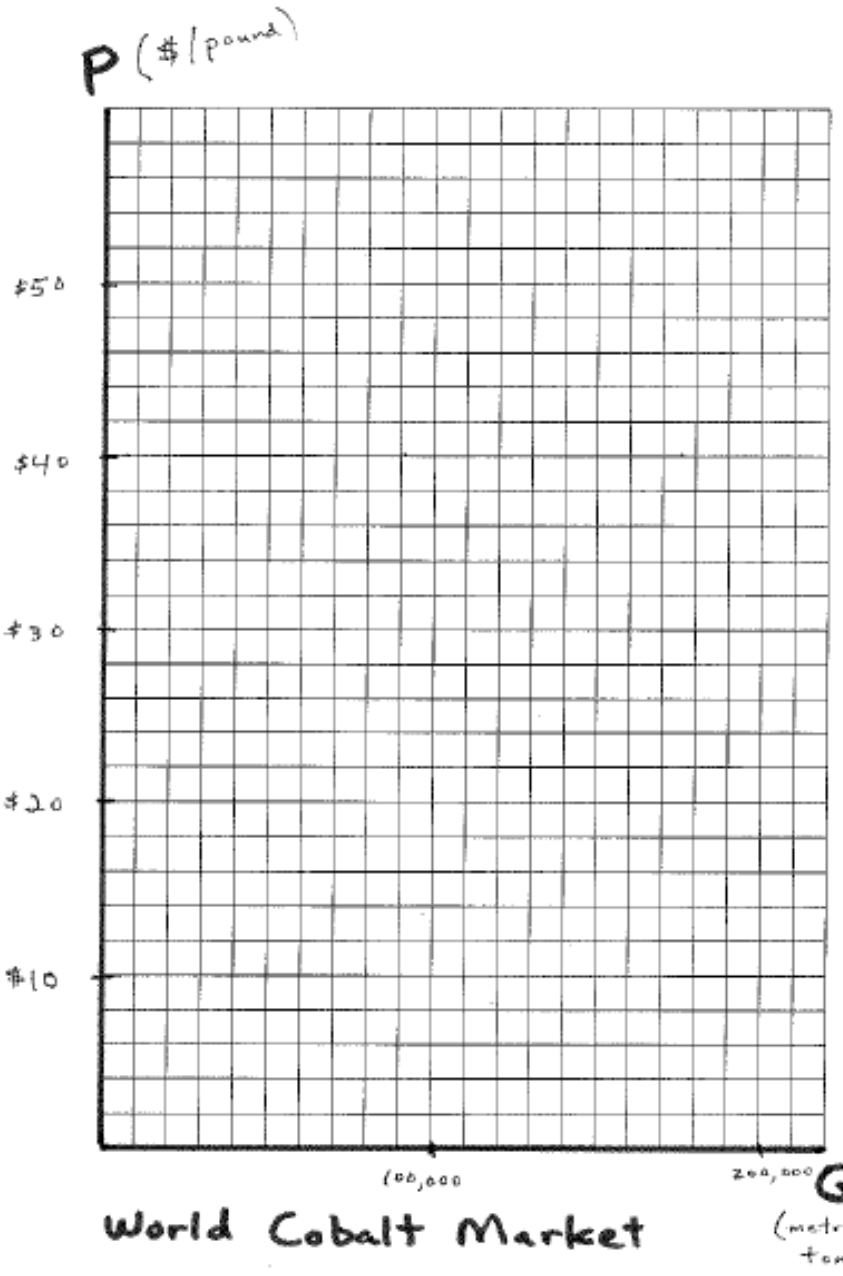
Supply will react, too. Companies that operate copper and nickel mines, where cobalt is co-produced, are targeting expansion, and there are some pure-play cobalt mines being planned that could start producing shortly after the projected shortage hits. For electric vehicles, this looks more like a speed bump than a cliff.

—Spencer Jakab

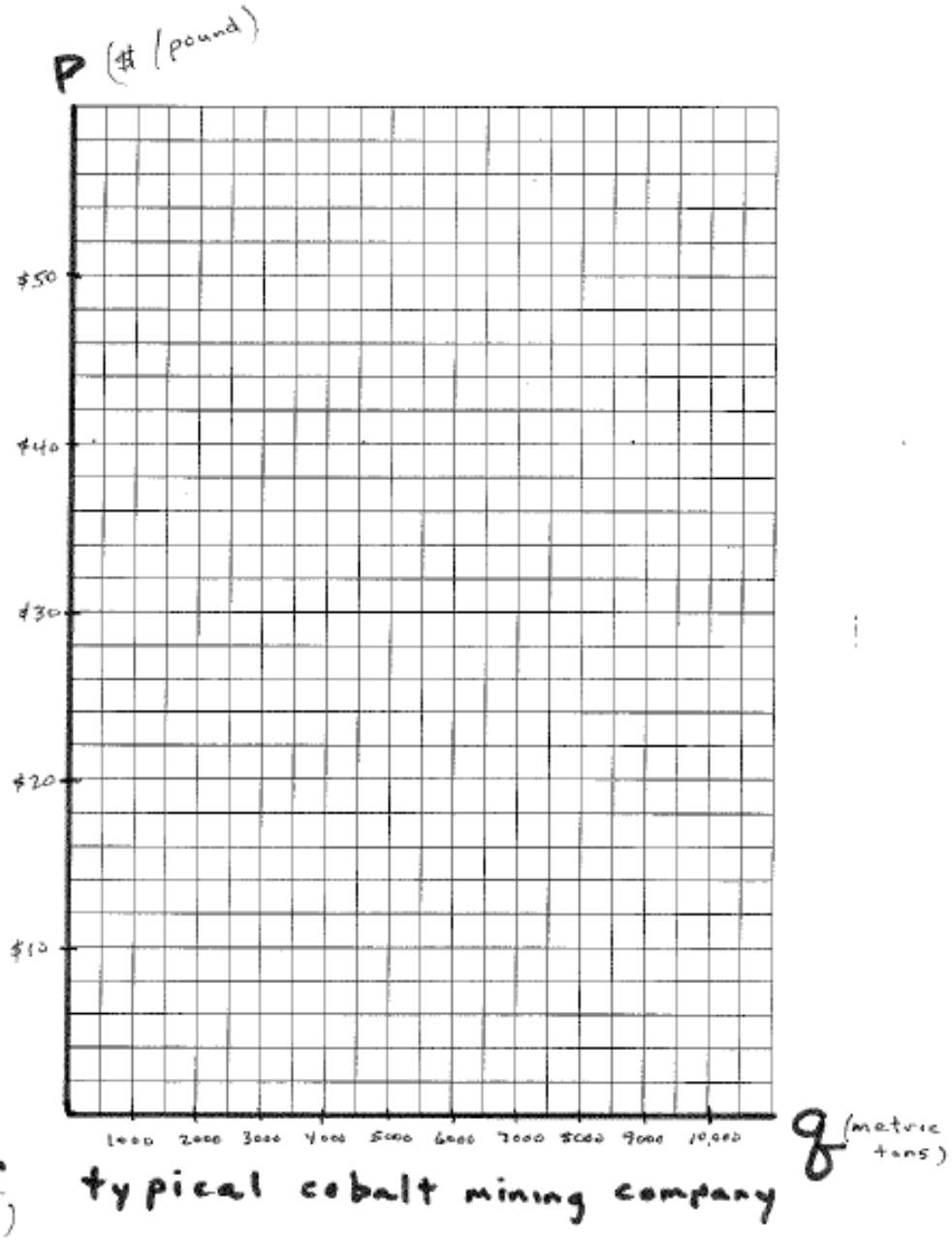
Historical Cobalt Prices and Price Chart

Cobalt Price 29.71 USD/lb (65,500.00 USD/t | 55,054.72 EUR/t) 29 Nov 2017 - 52 Week Low 13.61 USD/lb 52 Week High 3





World Cobalt Market



typical cobalt mining company