

1985: The Strategic Reserve Problem

Cobalt, which is not produced in the U.S., is essential to a number of industries. (Defense accounted for 17% of the cobalt production in 1979.) Most cobalt comes from central Africa, a politically unstable region. The Strategic and Critical Materials Stockpiling Act of 1946 requires a cobalt reserve that will carry the U.S. through a three-year war. The government built up a cobalt stockpile in the 1950s, sold most of it in the early 1970s, and then decided to build it up again in the late 1970s, with a stockpile goal of 85.4 million pounds. About half of this stockpile been acquired by 1982.

Build a mathematical model for managing a stockpile of the strategic metal cobalt. You will need to consider such questions as:

- How big should the stockpile be?
- At what rate should it be acquired?
- What is a reasonable price to pay for the metal?

You will also want to consider such questions as:

- At what point would the stockpile be drawn down?
- At what rate should it be drawn down?
- What is a reasonable price at which to sell the metal?
- How should sold metal be allocated?

Below we give more information on the sources, cost, demand, and recycling aspects of cobalt.

Useful Information on Cobalt

The government has projected a need of 25 million pounds of cobalt in 1985.

The U.S. has about 100 million pounds of proven cobalt deposits. Production becomes economically feasible when the price reaches \$22/lb (as occurred in 1981). It takes four years to get operations rolling, and then six million pounds per year can be produced.

In 1980, 1.2 million pounds of cobalt were recycled, 7% of total consumption.

Please see **Figures 1–3**, whose source is *Mineral Facts and Problems*, U.S. Bureau of Mines (Washington, DC: Government Printing Office, 1980).

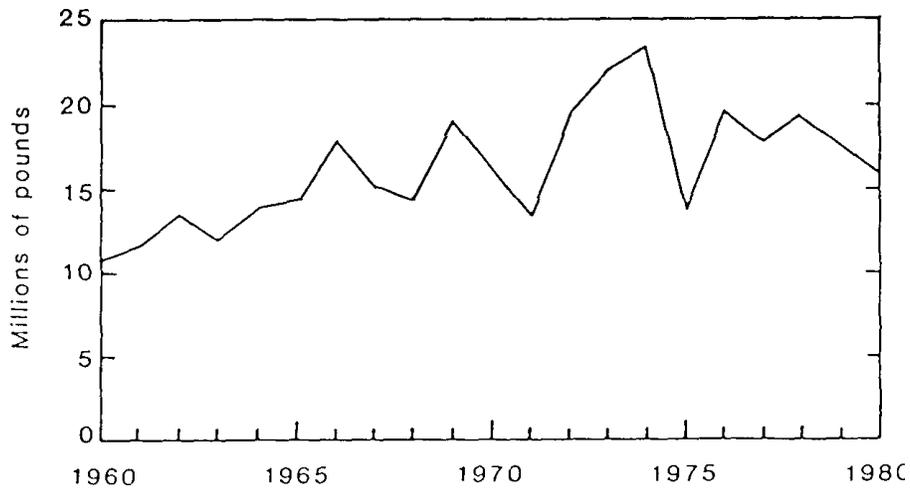


Figure 1. U.S. primary demand for cobalt, 1960–1980.

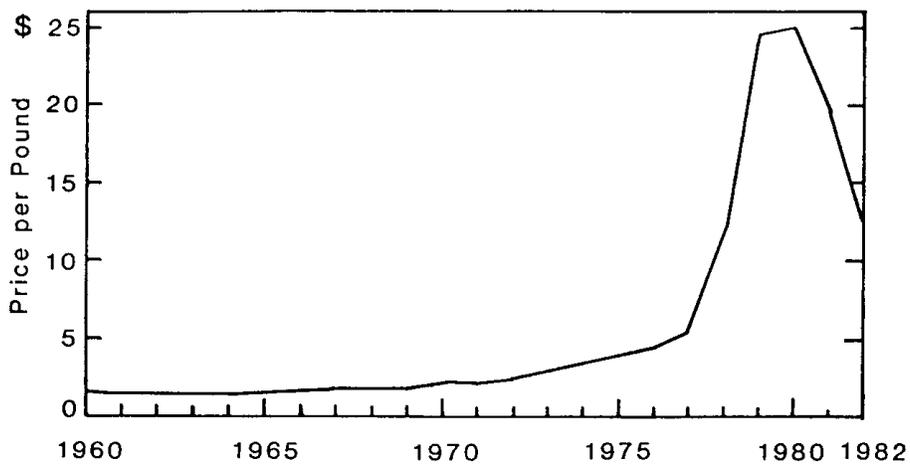
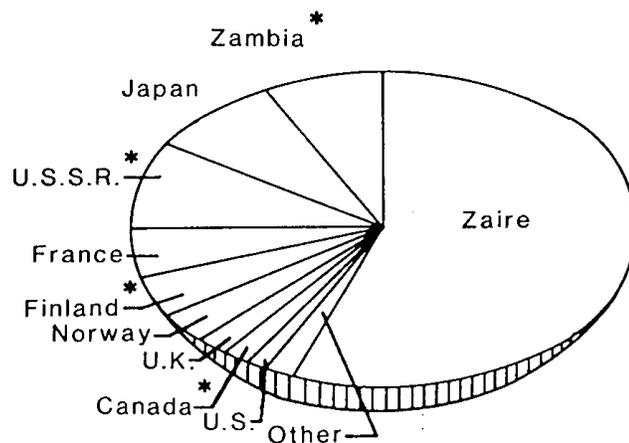


Figure 2. Cobalt prices in the U.S. market, 1960–1982.



Source: U.S. Bureau of Mines, Mineral Facts and Problems (1980)

Figure 3. Producers of refined metal and/or oxide, 1979. An asterisk denotes a country with domestic production.

Comments by the Contest Director

The problem was contributed by Fred Roberts (Dept. of Mathematics, Rutgers University, New Brunswick, NJ).