Resources Policy 45 (2015) 92–97

Contents lists available at ScienceDirect

Resources Policy

journal homepage: www.elsevier.com/locate/resourpol

Transparent and opaque pricing: The interesting case of lithium ☆

Philip Maxwell

Curtin University, GPO Box U1987, Perth, WA 6845, Australia

ARTICLE INFO

Article history:
Received 1 October 2014
Received in revised form
10 March 2015
Accepted 11 March 2015
Available online 18 April 2015

JEL classifications:
L11
L13
Q31

Keywords:
Lithium
Transparent prices
Opaque prices
Oligopoly
Bilateral contracts
Commodity exchanges

ABSTRACT

Appreciating the pricing arrangements for a mineral and its compounds provides useful insight into the nature of its market and the industrial structure of its production. This paper focuses on the case of lithium, which has emerged from being a minor metal with limited profitable applications in 1950 to its glamour metal status some 65 years later. During this period bilateral contracts based on producer prices have been the major way in which prices have been negotiated. The entry of a major new producer (SQM) in the late 1990s led to a situation where price information was difficult to obtain, even though competition in the sector was growing. This is consistent with a movement from cooperative oligopoly to non-cooperative oligopoly. Growing price transparency since 2010 has been associated with the actual and projected entry of several new producers. With its continuing growth it seems inevitable that lithium will be formally traded on one of major metal exchanges within the next decade. In addition to this, the practice of transfer pricing between branches of established multinational producers also applies to the lithium industry.

Introduction

First identified in 1817, lithium is the lightest metal. It is electrochemically reactive, has a low thermal expansion coefficient and the highest specific heat of the solid elements. Some lithium compounds also possess flat viscosity/temperature ratios. This range of attributes has made lithium metal, lithium carbonate, lithium hydroxide and other lithium compounds attractive inputs in a variety of applications. In the past decade primary and secondary (rechargeable) batteries have become its major area of use. An emerging associated use is in large battery grid storage of electricity to assist in the management of peak loads. Other important applications are in glass and ceramics manufacturing, specialist lubricants, air conditioning and dehumidification, pharmaceuticals, polymers, continuous casting, alloys, industrial bleaching and sanitation.[1] With these applications lithium has rapidly become a much more important and valuable mineral in the world economy.

Consumption of lithium metal and contained lithium in its various compounds increased from less than 25 tonnes per year in the early 1900s, to around 1000 tonnes in 1950, to 13,000 tonnes by 2000 and then to more than 28,000 tonnes in 2010.[2] By 2014, annual production had reached about 36,000 tonnes. Lithium consumption and new mine production have been at similar levels, with recycling technology still mainly in the pilot plant phase, and lithium stockpiles not presently significant. Industry commentators expect its strong growth to continue in the coming decades.

The large producers published list prices for lithium metal and its key compounds such as lithium carbonate, lithium chloride, lithium bromide and lithium hydroxide from the late 1940s until the late 1990s. Annual summaries of these data appear in various issues of the *Minerals Yearbook*, published by the U.S. Bureau of Mines until 1993 and by the U.S. Geological Survey between 1994 and 2000.

A few companies have traditionally dominated the lithium extraction industry. By the mid-1990s, for example, three

☆The author wishes to thank Marian Radetzki and John Tilton, for their helpful comments of on an earlier draft of this paper.

E-mail address: p.maxwell@curtin.edu.au

[1] An earlier important application of lowering the melting point of the cryolite bath in aluminum production has been in decline because of the application of alternative technology and materials.

[2] An alternative way of expressing lithium consumption is in terms of lithium carbonate equivalent. Approximately 5.32 units of lithium carbonate (Li_2CO_3) converts to one unit of lithium metal.

http://dx.doi.org/10.1016/j.resourpol.2015.03.007
0301-4207/

companies (Cypress Foote Mineral Company,[3] FMC Corporation and Sons of Gwalia[4]) controlled early stage supply. The Chilean-based company, SQM, began producing in 1998 from its low cost brine deposits, adjacent to those of Cypress Foote (operating as Sociedad Chilena de Litio Ltda (SCL)) in the Salar de Atacama in northern Chile. SQM offered lithium compounds at significant discounts from previous prices, in an apparent strategy to generate profits and gain market share.[5] After 2000, it was problematic for the next decade to obtain reliable current price information from producing companies or trade publications.

In her chapter on lithium in the USGS *Minerals Yearbook* (United States Geological Survey, 2007), Ober noted that:

> Lithium pricing became very competitive when SQM entered the market in 1998, and it has been difficult to obtain reliable price information since that time. Companies may announce price hikes, but they are reported relative only to previous prices. Producers negotiate with consumers on an individual basis; price information is not usually reported.

In this changed market situation, the United States Geological Survey estimated lithium carbonate prices based on observations from US customs data relating to imports of lithium compounds from South America.[6] As Ebensperger et al. (2005) noted, these data almost certainly reflected long-term contract prices.

As the demand for lithium has continued rising since 2000, markets have broadened and several large manufacturing firms have become more significant buyers. In this more competitive environment price levels have been reported again in the business and specialist mineral industry press since about 2012. For example, in 2013 recent prices in the US and Chinese market were available from the *Industrial Minerals* website (www.indmin.com) for lithium carbonate, lithium hydroxide and glass grade spodumene, while several lithium compounds are also now quoted at the *Asian Metal* web site (www.asianmetal.com). Some price data are also available from the Shanghai Metals Market website (www.metal.com).

The graphs in Fig. 1 give one historical view of nominal and real lithium carbonate prices between 1960 and 2013. They are based on data available in Ober (1999), as well as information reported by Yaksic and Tilton (2009) and United States Geological Survey (2012, 2013). The price deflator used is the United States Consumer Price Index. These estimates are consistent with the general observations of authors such as Barnett and Morse (1963) and Sullivan et al. (2000) about falling long-run trends in mineral prices in the 20th century.

But they also highlight the major dip between 1998 and 2005 associated with the entry of SQM. As with many other minerals, there was a reversal of this trend after 2006, with real prices for lithium returning to their levels of the mid-1990s by 2010, before mildly declining until 2013.

Over the past six decades, those companies producing lithium and its compounds have priced them in a variety of ways, ranging from rather secretive contracts to relatively transparent ones. By

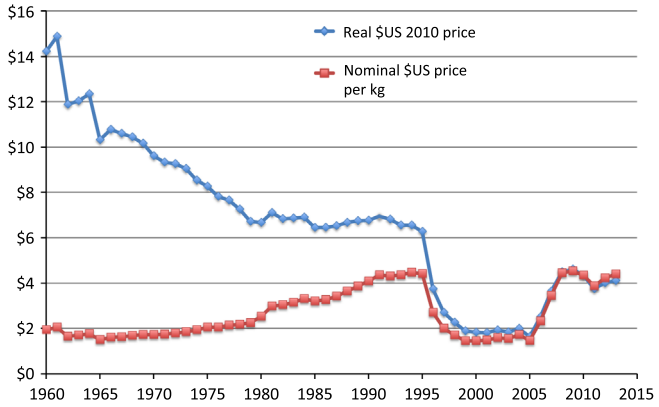

Fig. 1. Estimated annual lithium carbonate prices in real (2010) and nominal US dollars 1960–2013.

focusing on these changing pricing regimes the goal of this paper is to appreciate better the evolution of this rapidly growing industry. In undertaking this exercise, the paper provides an interesting case study of the mineral pricing frameworks discussed recently by authors such as Radetzki (2013). It also highlights the possibility that for minerals where a small number of firms traditionally dominate supply, a move to greater competition may lead to a situation for several years where current price information is difficult to obtain.

In setting the appropriate context, the second section offers further brief background about the recent emergence of the lithium industry from a small base. The third section then focuses on suggested taxonomies of mineral pricing. Discussion in the fourth section considers the way in which the lithium industry has related to this framework over the past six decades. Some concluding comments are then offered.

The growing importance of lithium

Analysts from the United States Geological Survey and the United States Energy Information Administration regularly assess the market status of at least 50 metals, 50 non-metals and seven or eight major energy minerals. These materials vary widely in economic value[7] with oil in 2010 being worth perhaps US$2 trillion and coal around US$400 billion. Iron ore used in steel production was worth perhaps US$200 billion in 2010. The major metals such as copper, aluminum and gold were each worth around US$100 billion. By contrast the annual output of some less prominent minerals was worth as little as US$10 million each year. Though sales of lithium metal and its key compounds have recently grown strongly, lithium has historically been one of the less prominent minerals.

Based on current prices, Jimenez (2004) estimated for example in 2003 that annual indicative sales of different lithium products was about $US 500 million. A decade later, this value is perhaps $US 1.5 billion per annum.

One recent estimate is that of Baylis (2013). He identifies four broad lithium product types,[8] which are

- **technical products** such as lithium carbonate, lithium chloride and lithium hydroxide that require only one or two process steps;

[3] In 1998 Chemetall GmbH, a subsidiary of Metallgesellschaft A.G. (MG), purchased Cyprus Foote Mineral Co. from Cyprus Amax Minerals Company. Cyprus Foote's operations in Chile, Sociedad Chilena de Litio Ltda., were also part of the agreement. In 2004, Rockwood Specialties Group Inc., a US-based specialty chemicals and advanced materials subsidiary company of Rockwood Holdings Inc., acquired Chemetall. Another large US-based company, Albemarle Corporation, bought Rockwood in July 2014.

[4] Talison Minerals acquired the lithium, tin and tantalum interests from Sons of Gwalia in 2005. Tianqi then acquired Talison in early 2013. Though it was an unsuccessful bidder for Talison at the time of the Tianqi transaction, Rockwood then purchased a 49 per cent share of Talison from Tianqi in December, 2013.

[5] Using estimates from Baylis (2013), SQM held market shares of more than a quarter of battery grade lithium and 30 per cent of technical grade lithium in 2011–2012.

[6] Other commentators have also used Chilean, Japanese and Chinese customs records to generate annual price estimates.

[7] This depends as well on the stage of processing reported.

[8] Useful taxonomies of lithium products also appear in relevant figures in Ebensperger et al. (2005, p. 221) and Yaksic and Tilton (2009, p. 189).