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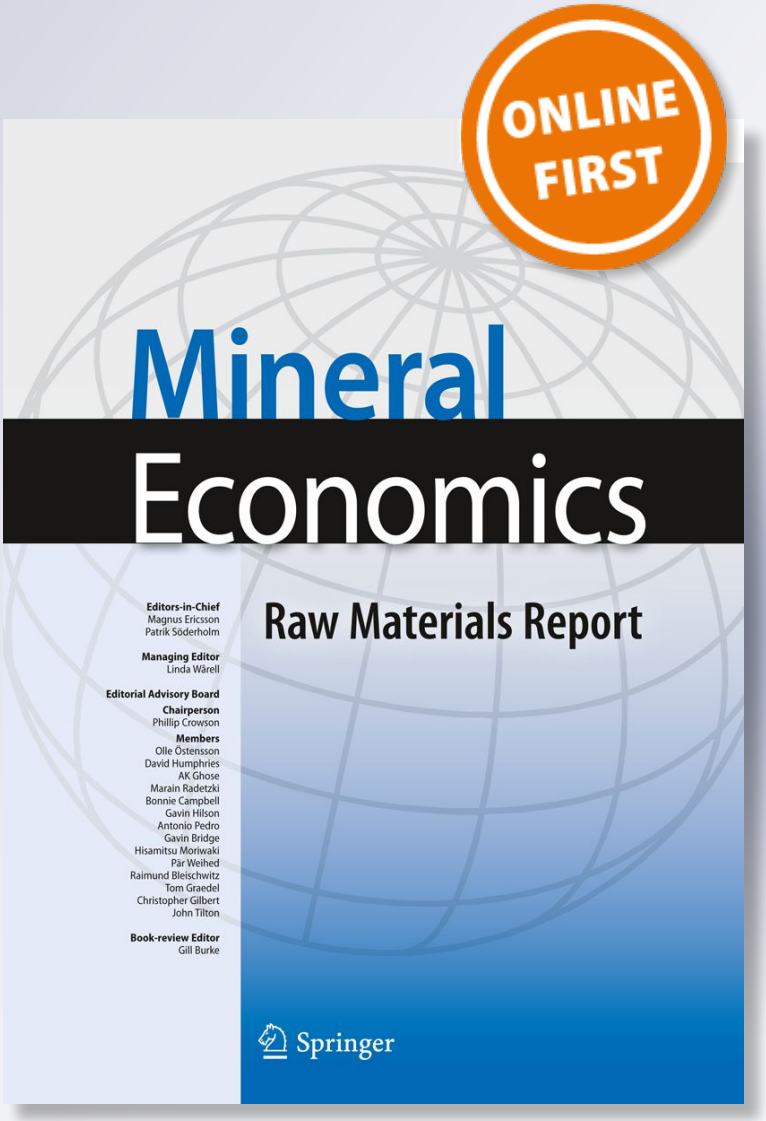

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ORIGINAL PAPER

The perseverance of the ongoing metal and mineral boom

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Abstract Commodity booms are typically of short duration. They are regularly triggered by a spurt in economic expansion and an ensuing upward jump in commodity consumption that, in turn, raises commodity prices. They commonly end when the spurt is followed by a recession resulting in price falls due to shrinking commodity demand. The commodity boom that started in 2004 and that perseveres in 2012 is unusual in its durability. The paper addresses two questions, focusing on metal and mineral commodities. First, how long is a boom likely to be in the absence of a recession that punctuates demand and prices. I conclude that the high price period will then persevere until the new capacity needed to satisfy the higher demand is in place. Given a variety of investment lags and constraints in the input supplying industries, this may take in excess of 10 years, much longer than the 5-year gestation period that is typical in greenfield mineral investments. The second question is why the deep recession of 2008–2009 did not punctuate the ongoing boom. I conclude that, while the world economy was severely hit by the recession, the major emerging economies continued to grow at fast rates. The world recession had little impact on commodity markets because the emerging economies have recently come to dominate global metal and mineral demand.

Keywords Metal booms · Investment cycle · The 2008–2009 recession

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Introduction

My "three booms" article from 2006 (Radetzki 2006), analyzing the three major commodity booms since the Second World War, beginning in 1950, 1973, and 2004, respectively, concluded that all three were triggered by fast macroeconomic expansion and an ensuing upward jump in commodities demand that, in turn, raised commodity prices. The first two booms were of short duration. After about 2 years, they were both punctuated by recessions that suppressed demand, leading to price falls. The third boom, however, which started in 2003–2004, was still riding high early in 2008, and at that time, there was no recession in sight.

A concern of considerable importance to mineral-dependent economies has always been to clarify how long an ongoing mineral boom will last and what forces other than a recession might conceivably end it. To help resolve this concern, I wrote a short note together with four colleagues, which was eventually published in *Resources Policy* (Radetzki et al. 2008). The note argues that, in the absence of a demand reducing recession, the boom could persevere for up to about 15 years, given the extended process needed to bring new production capacity in place and so restoring balance between supply and demand at prices around long-run equilibrium. The first part of the present paper reproduces the main arguments of that note.

A deep recession did, in fact, occur in 2008–2009, in the wake of the international financial crisis, and observers coined it as the deepest setback to the world economy since the 1930s depression. Yet, after a surprisingly short and not very deep decline, metal and mineral prices in real terms have continued to ride at historically very high levels. They still do in the spring of 2012, as this is being written. The second part of the paper explores the nature of the 2009 recession to understand why it did not kill the commodities boom. A concluding section summarizes and provides a forward outlook.

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The extended *investment cycle*

Following standard microeconomic theory, my analysis posits that an upward move in mineral and metal prices will ensue upon an unexpected surge in demand that cannot be satisfied by existing production capacity. In the absence of a demand-reducing recession (see "The short and mild price impact of the 2008–2009 recession"), the inadequate capacity and high price will prevail until sufficient new capacity has been put in place. The process of reestablishing market balance by additions to capacity will be helped by the high prices that will raise profits and so stimulate investment activities.

There is a common perception that it takes about 5 years on average to put new greenfield capacity in place in mineral and metal industries. It follows, so the argument goes, that 5 years should be enough to rectify any market imbalance caused by unexpected spurts in demand. On further reflection, this view appears erroneous. Investments are subject to a variety of perception and decision lags, the latter comprising the time to bring together the needed financial package, and to overcome various regulatory hurdles, comprising increasingly restrictive environmental legislation in recent times. In the present boom, there was also the time-consuming need to overcome the investors' unpreparedness to act, nurtured by decades of low prices and general uninterest in the industry. In the generic case, there are further delaying constraints of crucial importance in the form of limited capacity in the industries that provide physical and human inputs in mineral and metal investments. For all these reasons, a price boom, and especially the present one, may last much longer than the alleged 5 years.

How much longer will depend on the changes that initially led to the boom and on a number of circumstances in the investment process. These will not be treated in any detail. Instead, in what follows, a bare-bones generic numerical model is constructed, using some plausible assumptions about the initial changes that shifted prices upwards, to explore how long the boom with its elevated prices might persevere. The model's main assumptions comprise:

1. Growth of mineral demand is 2 %/year until year 1. In that year, it increases to 5 % and remains steady at the higher level;
2. Five percent of existing capacity must be replaced each year due to depletion and depreciation. Hence, prior to year 1, gross capacity addition must be 7 %/year; from year 1, gross addition must be 10 %/year to maintain equilibrium;
3. It normally takes an average of 5 years from investment decision until production startup;
4. The difference between actual and required capacity is the capacity deficit. A deficit raises prices and profits and so stimulates investment.

The model is then applied to four alternative cases relating to the lags and constraints likely to confront the investors, all in order to determine how long the boom will last. The *first case*, based on the above model, is not very realistic. It assumes perfect foresight, a complete absence of investment lags, and no restraints in the needed flows of investment inputs. The results are given in Table 1. Capacity deficits shown in italics (column f) grow through years 1–5, as the low investments of earlier years mature. In year 6, however, the entire capacity deficit is eliminated as the extreme upward jump in investments in year 1 (by more than 300 %) yields new production units. This case is the only one where balance is restored within a 5-year period. It is unrealistic in its assumption that producers react promptly and fully to the new trend, whose permanence in year 1 cannot be known, and that investments can be raised more than fourfold in year 1 without any restraint imposed by the input producers.

The *second case*, presented in Table 2, takes it either that already in year 1; producers sense the beginning of a new and faster trend in the growth of demand, but that they act somewhat cautiously because they are uncertain of its permanence. Alternatively, producers would like to invest more but are prevented from doing so by capacity constraints among investment input producers. Irrespective of which of the two limitations applies, it is assumed that investments expand by 20 % per year from year 1 onwards. It will be seen (column j) that, despite this impressive rate of investment expansion, it will take until year 13 for the capacity deficit to be eliminated.

Cases 3 and 4 work on somewhat more complex rules for investment decisions to bring about the elimination of the capacity deficit. In *case 3*, it takes the producers 3 years of slow investment growth (1) to become fully aware that a new permanent trend is in force and (2) to implement the accelerated investment process by overcoming the many existing lags. From year 4, however, investments are taken to expand by 30 %/year, unrestrained by any capacity limitations among input producers.

It will be seen from Table 3 that the characteristics of delayed initial adjustments, followed by very fast subsequent investment expansion, will yield quite a long period of capacity deficits (column n), with market balance restored only in year 14.

Case 4, presented in Table 4 below, contains perhaps the most realistic suppositions about the behavioral investor response to the assumed changes in demand trend. The perception and reaction lags are seen to have a duration of 1 year only, so in year 2, investments push ahead by 30 %, a rate that is not sustainable for the input producers. In years 3, 4, and 5, therefore, investment growth declines, optimistically perhaps, to 10 %, while the input industries consolidate. By year 6, this consolidation process is completed; the input supply becomes more relaxed, and investments can grow from that year onwards by 20 % per year. The capacity

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Table 1 Investments with perfect foresight and prompt elimination of capacity deficit

Year	Required capacity	Capacity initiated	Gross new capacity	Available capacity	Capacity deficit
(a)	(b)	(c)	(d)	(e)	(f)
0	100.00	7.73	7.00	100.00	
1	105.00	31.68	7.14	101.78	*3.22*
2	110.25	14.10	7.28	103.61	*6.64*
3	115.76	14.82	7.43	105.49	*10.27*
4	121.55	15.55	7.58	107.41	*14.14*
5	127.63	16.33	7.73	109.38	*18.24*
6	134.01	17.14	31.68	134.01	0.00
7	140.71	18.01	14.10	140.71	0.00
8	147.75	18.90	14.82	147.75	0.00
9	155.13	19.85	15.55	155.13	0.00
10	162.89		16.33	162.89	0.00
11	171.03		17.14	171.03	0.00
12	179.59		18.01	179.59	0.00
13	188.56		18.90	188.56	0.00
14	197.99		9.85	197.99	0.00

deficit (column r) in this case is overcome only by year 15 (not shown in the table).

To summarize, cases 2, 3, and 4, taking account of perception and reaction lags among investors and of likely capacity constraints in the input industries, yield capacity deficits and high prices in the metal and mineral industries, which endure for between 12 and 15 years with the assumptions used. One can, of course, come to other results by varying the strength of the demand acceleration and composing alternative patterns of lags and investment constraints, and readers are encouraged to construct their own cases. But on most reasonable counts, the capacity deficit is unlikely to be shorter than 10 years or, to much, exceed a 15-year period. In conclusion, the investment cycle and the ensuing price boom are much more extended than the 5-year gestation period of greenfield investments in the industries under review.

The simplicity of the model must be underlined. It does abstract from many real-world complications in order to reflect its conclusions starkly. It would certainly become less transparent if such complications were built into the model's structure, but I judge that the main conclusions about the boom's perseverance would, nevertheless, stand.

Table 2 Investments grow by 20 % per year

Year	Required capacity	Capacity initiated	Gross new capacity	Available capacity	Capacity deficit
(a)	(b)	(g)	(h)	(i)	(j)
0	100.00	7.73	7.00	100.00	0.00
1	105.00	9.28	7.14	101.78	*3.22*
2	110.25	11.13	7.28	103.61	*6.64*
3	115.76	13.36	7.43	105.49	*10.27*
4	121.55	16.03	7.58	107.41	*14.14*
5	127.63	19.23	7.73	109.38	*18.24*
6	134.01	23.08	9.28	112.73	*21.28*
7	140.71	27.70	11.13	117.67	*23.04*
8	147.75	33.24	13.36	124.47	*23.27*
9	155.13	39.89	16.03	133.48	*21.66*
10	162.89		19.23	145.07	*17.81*
11	171.03		23.08	159.75	*11.29*
12	179.59		27.70	178.07	*1.51*
13	188.56		33.24	200.75	−12.18
14	197.99		39.89	228.60	−30.61

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Table 3 Investments grow by 2 % in years 1, 2, and 3 and by 30 % in subsequent years

Year	Required capacity	Capacity initiated	Gross new capacity	Available capacity	Capacity deficit
(a)	(b)	(k)	(l)	(m)	(n)
0	100.00	7.73	7.00	100.00	0.00
1	105.00	7.88	7.14	101.78	*3.22*
2	110.25	8.04	7.28	103.61	*6.64*
3	115.76	8.20	7.43	105.49	*10.27*
4	121.55	10.66	7.58	107.41	*14.14*
5	127.63	13.86	7.73	109.38	*18.24*
6	134.01	18.02	7.88	111.41	*22.60*
7	140.71	23.43	8.04	113.48	*27.23*
8	147.75	30.46	8.20	115.59	*32.15*
9	155.13	39.59	10.66	119.95	*35.19*
10	62.89		13.86	127.12	*35.77*
11	171.03		18.02	137.88	*33.15*
12	179.59		23.43	153.25	*26.34*
13	188.56		30.46	174.52	*14.05*
14	197.99		39.59	203.41	−5.42

It is important to distinguish the investment cycle identified above from the *super cycle* (Heap 2005; Cuddington and Jerrett 2008) that also arises, following an unanticipated acceleration in demand growth, but that perseveres as long as the faster demand growth is maintained, which the authors claim on historical evidence from earlier instances may last for some 30 years or even longer. I doubt the super cycle thesis, primarily because its adherents neglect to explain why high profits can be earned for such extended periods without attracting the investment and capacity needed to restore market balance. Furthermore, high growth rates of demand that remain stable are not, by themselves, a reason for maintained high prices. The aluminum industry, whose demand rose 40-fold in the 30-year period 1939–1969, experienced at the same time persistently falling real prices (Schmitz 1979).

The short and mild price impact of the 2008–2009 recession

The recession of 2008–2009, triggered by the 2008 International Financial Crisis, has been widely seen as the deepest

Table 4 Investments grow by 2 % in year 1; by 30 % in year 2; by 10 % in years 3, 4, and 5; and then by 20 % per year

Year	Required capacity	Capacity initiated	Gross new capacity	Available capacity	Capacity deficit
(a)	(b)	(o)	(p)	(q)	(r)
0	100.00	7.73	7.00	100.00	0.00
1	105.00	7.88	7.14	101.78	*3.22*
2	110.25	10.25	7.28	103.61	*6.64*
3	115.76	11.28	7.43	105.49	*10.27*
4	121.55	12.40	7.58	107.41	*14.14*
5	127.63	13.64	7.73	109.38	*18.24*
6	134.01	16.37	7.88	111.40	*22.61*
7	140.71	19.64	10.25	115.57	*25.14*
8	147.75	23.57	11.28	120.51	*27.24*
9	155.13	28.28	12.40	126.26	*28.87*
10	162.89		13.64	132.91	*29.98*
11	171.03		16.37	141.81	*29.22*
12	179.59		19.64	153.38	*26.21*
13	188.56		23.57	168.10	*20.46*
14	197.99		28.28	186.57	*11.43*

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setback to the world economy since the 1930s depression. Yet, as is clear from Fig. 1, the metal and mineral price index was not severely disturbed. It dipped from a peak of 330 in 2008 to a low of 230 in 2009, even that booming price level in historical terms, then rose quickly, to attain an even higher peak in 2011.

A closer scrutiny of the recession (Fig. 2) throws some light on this weak and brief price impact. First, on a global scale, the recession was short and not very deep, so the above characterization is clearly misleading. Only in 2009 did global output shrink (by 0.6 %); already in 2010 that it was back at 5 %. Second, only advanced economies (52.1 % of world economy in PPP terms) were seriously afflicted, with two consecutive years of growth substantially below trend. Third, the recession was barely noted in developing Asia (accounting for 24.1 % of the world economy, up from 14 % in 2000) or in Africa (7.4 %), while Latin America (8.6 %) recorded only a 1 year dip (2009) from its high growth trend.

The importance of the three developing regions for metal and mineral consumption and especially for consumption growth is much higher than their share of the world economy. Table 5 reveals that they together accounted for 40 % of the world economy, but the stage of their economic development is highly metal–mineral intensive, so they absorbed around 60 % of world metal and mineral output. The contrast between the shares of GDP and metal consumption would be even sharper with the use of exchange rate that determined GDP numbers. Furthermore, the three developing regions represent the virtual totality of metal and mineral demand growth, given that consumption in advanced economies is in decline since at least a decade. The impact of a world recession on world commodity consumption will be strongly exaggerated, if, as was the case, the recession is a phenomenon by and large isolated to the rich world.

Table 6 reemphasizes the point made in the preceding paragraph. It focuses on Asia ex-Japan, the dominant developing region, and records its progress of metal consumption in the years around the 2009 recession. Violent fluctuations between the years appear to have taken place. Consumption growth in 2009, when metal prices fell, was not at all that

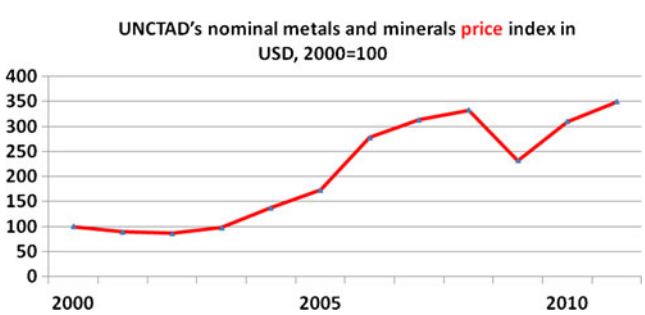

Fig. 1 UNCTAD's nominal metals and minerals price index in USD, 2,000=100

Fig. 2 Annual growth of GDP (in percent)

weak. In fact, all the metals listed show positive growth figures, and the unweighted average growth is higher than for any other of the years shown. One may wonder about the reliability of the statistics.

A summary of findings

Price booms in metal and mineral markets are commonly triggered by an accelerated growth of demand for whose satisfaction existing production capacity is wanting. Price booms are usually of short duration, and their common end is an economic recession that curtails demand. These characteristic held for the booms of 1950 and 1973, each if which lasted for only about 2 years.

The boom that started in 2004, however, is different, and prices continue to ride high in early 2012, 8 years later. The paper first explores the durability of a boom that is not punctuated by economic recession. By analyzing the investment cycle triggered by the elevated profitability yielded by high price levels, it concludes on the basis of plausible assumptions about a variety of investment lags and investment constraints that the restoration of balance between capacity and demand may take anything between 12 and 15 years. This, then, is the maximum length of a price boom that has not been ended by recession.

The analysis then goes on to explore why the recession of 2009 did not put an end to the metal and mineral price

Table 5 Developing countries share of world GDP and world metal consumption in 2010 (in percent)

GDP	40
Aluminum	56
Copper	62
Lead	66
Nickel	54

Developing countries include Asia, Latin America, Africa, and the Middle East [sources, IMF and World Bureau of Metal Statistics (WBMS)]

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Table 6 Asia ex-Japan, percentage growth of metal consumption

	2007	2008	2009	2010
Aluminum	28.4	0.5	11.3	−9.8
Copper	20.5	2.7	23.6	1.7
Lead	11.2	21.3	8.4	5.5
Nickel	8.8	−3.9	51.5	5.6
Zinc	7.2	9.6	10.2	10.2
Unweighted average	15.2	6.0	21.0	2.6

Source, WBMS 2011

boom. It is demonstrated that the recession was by and large limited to the advanced nations whose economic weight grossly exaggerates their more limited role as consumers of minerals and metals and, in particular, in generating metal consumption growth. The dominant consuming areas in the emerging world have not suffered from a serious recession in recent years. A limited and temporary dip has been followed by speedy growth of the emerging world's GDP and of its consumption of all raw materials. A recession that is to make a serious dent in metal and mineral demand trends and seriously suppress price levels must afflict China and India and the other important emerging economies. Unless such a recession occurs, the ongoing boom may persevere for the full duration of the investment cycle of 12–15 years, with high prices remaining until 2016 and beyond.

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