Mining employment trends of 2007–09: a question of prices

Employment trends in mining during the 2007–09 recession can be better understood through analysis of commodity indices and other major economic indicators

Brian Davidson

Employment within the mining industry[1] followed a different pattern than that of most other industries during the 2007–09 recession.[2] (See table 1.) Indicators such as commodity prices, global demand for mining output, and industrial production help tell the story of how job growth within mining continued through the first 10 months of the recession while total nonfarm employment was falling.

Increasing energy and commodity prices and industrial production fueled job growth in mining, leading to an employment peak of 728,000 in the sector in September 2008, the highest level since June 1986. Employment then fell over the next 13 months before reaching a trough in October 2009, 4 months after the recession had ended. In the decade or so leading up to the recession, employment among the subsectors within mining followed similar long-term growth trends, while support activities for mining was the primary source of employment gains in the sector.

At the most recent peak of mining employment, in September 2008, 69 percent of the employment was in oil and gas extraction and in support activities for mining. Both of these subsectors are associated primarily with oil. Support activities involve the maintenance and drilling of wells, whereas oil and gas extraction, as its name implies, focuses on the extraction of petroleum resources.

Similarly to oil and gas extraction and to support activities, coal mining saw substantial job growth before the peak in the business cycle in December 2007. Coal mining represented 11 percent of mining sector employment in September 2008. Employment in metal ore mining rose during the first few months of the recession and then dropped, whereas employment in nonmetallic mineral mining began falling before the recession along with construction activity and continued to do so throughout the recession.

Effects of global energy demand

Global energy production and global energy demand increased together before the recession and during the first few months of it. During 2007, China and India, two of the world's largest economies, saw their petroleum consumption increase by 3.7 percent and 4.1 percent, respectively, while worldwide consumption increased by only 0.7 percent.[3] Given the difficulty of increasing crude oil supplies on a timely basis and the low absolute value of the price elasticity of demand for oil, the price of oil rose sharply. The spot price for West Texas Intermediate crude oil reached a high of $133.93 per barrel in June of 2008. As prices rose, businesses and consumers were spending a disproportionate share of their earnings on oil products. Because of the worldwide decline in industrial production, demand for crude

Brian Davidson is an economist in the Division of Current Employment Statistics in the Office of Employment and Unemployment Statistics at the Bureau of Labor Statistics. Email: davidson.brian@bls.gov.

oil dropped near the end of summer 2008.[4] From 2007 to 2009, global consumption of petroleum declined by over 1.6 million barrels of petroleum per day.[5]

Before the peak in oil prices, as demand for energy increased, more exploratory and development wells were drilled.[6] In 2008, 355 million feet were drilled, nearly twice as many feet as were drilled during 2001 and 46 million more feet than in 2007.[7] Drilling activity led to increased demand for support activities. An employment peak in support activities for mining occurred 10 months into the recession. Employment in support activities for mining accounted for 67 percent of job gains in mining from the start of the recession to the September 2008 peak in total mining employment and in production in the industry of drilling of oil and gas wells.[8] Oil and gas extraction contributed 23 percent of job gains in mining during this period. Employment in oil and gas extraction reached a high 3 months later than employment in support activities. As nonenergy industrial production lessened, demand for energy resources, and thus employment in mining, fell with it.

From September 2008 through June 2009, mining employment fell by 92,000. Support activities for mining accounted for 74 percent of total employment losses in mining. Oil and gas extraction accounted for 4 percent of employment losses in the sector during the same period.

Oil and gas employment by State

Four States—Texas, Louisiana, Alaska, and California—accounted for more than three-fourths of oil production in the United States in 2008, a peak year for production. Furthermore, these States accounted for over half of all jobs related to oil and gas extraction and support activities for mining at that time. (See table 2.) Of the States that produce natural gas, Louisiana and Texas produced about

Table 1. Employment in mining during the 2007–09 recession, seasonally adjusted

[in thousands]

Industry	Dec. 2007	Sept. 2008	June 2009	Change, Dec. 2007–Sept. 2008	Change, Sept. 2008–June 2009	Change, Dec. 2007–June 2009
Total nonfarm	137,983	136,313	130,493	-1670	-5820	-7490
Mining	681	728	637	48	-92	-44
Oil and gas extraction	154	164	160	11	-4	7
Mining, except oil and gas	223	228	208	5	-20	-15
Coal mining	77	84	81	7	-2	4
Metal ore mining	39	41	34	2	-6	-4
Nonmetallic mineral mining	107	103	92	-4	-11	-15
Support activities for mining	305	336	269	32	-68	-36
Support activities for oil and gas	202	227	193	25	-34	-9

SOURCE: Bureau of Labor Statistics, Current Employment Statistics survey.

Table 2. Production of natural gas and oil, and employment in oil and gas extraction and support activities for mining, for selected States and the U.S. as a whole, 2008

State	Natural gas, annual production		Oil, annual production		Employment, Sept. 2008 (not seasonally adjusted)	
	Cubic feet, in millions	Percent of U.S. total	Barrels, in thousands	Percent of U.S. total	Thousands of jobs	Percent of U.S. total
Alaska	398,442	1.9	249,874	13.8	13	3
Texas	7,403,720	34.9	447,076	24.7	220	44
California	296,469	1.4	238,691	13.2	21	4
Louisiana	3,082,492	14.5	445,606	24.6	51	10
Colorado	1,389,399	6.5	24,054	1.3	[1]2	5
New Mexico	1,446,204	6.8	59,403	3.3	[1]17	3
Oklahoma	1,913,029	9.0	64,065	3.5	[1]51	10
Wyoming	2,274,850	10.7	52,943	2.9	20	4
United States	21,239,516	100.0	1,811,819	100.0	503	100

[1] Datum is from the BLS Quarterly Census of Employment and Wages.

SOURCE: Unless otherwise noted, employment data are from the BLS CES survey. Production data are from the U.S. Energy Information Administration.

half of all output in 2008, and only four other States produced more than one trillion cubic feet of natural gas—Colorado, New Mexico, Oklahoma, and Wyoming.

Louisiana held only a 10.1-percent share of oil-and-gas-related employment but produced nearly as much oil as Texas, which employed nearly half of all workers in these industries. This paradox stems from the fact that a substantial share of offshore oil production takes place in Louisiana waters but that a majority of the workers in those waters are employed by firms located in Texas.

After September 2008, the boom in oil and gas employment ended. Nearly half of the 84,000 jobs lost during the remainder of the recession were in Texas; most of the rest of these losses occurred in the other major oil-and-gas-producing States. (See table 3.)

Other mining resources

Coal mining saw substantial job growth before the peak in energy prices. The energy market played a role in bolstering coal mining employment because high oil prices created a substitution effect[9] in some markets by which coal was purchased in lieu of oil. For instance, China started to demand more coal over oil in order to increase the production of electricity.[10] The number of U.S. carloads of coal—that is, the amount of coal traveling on domestic rail—spiked one month after the 2008 peak of West Texas Intermediate oil prices.[11] From January 2008 until well after the recession ended, employment in coal mining declined; however, the number of carloads of coal began to rise in June 2009 as the recession ended.

Metal ore mining has a relatively small workforce, but it did see employment rise with a boom in commodity prices that started in 2003 and lasted until around June 2008. After that point, both nonferrous metals prices and metal ore mining employment began to decline. (See chart 1.) This employment trend was similar to the trends that occurred during and after the recessions of the 1960s, 1970s, and 1980s. During all of those periods, the employment peak in metal ore mining lagged the onset of the recession, and the industry group continued to shed jobs for some time after the end of each economic contraction.[12] Price change proves to be the dominant force in determining employment trends within metal ore mining.

Nonmetallic mineral mining relies mostly on the construction industry to utilize its products, which include sand, stone, and clay. During the 2007–09 recession, employment in nonmetallic mineral mining declined by 14 percent. In fact, employment had begun to decline before the start of the recession, reflecting a reduction in public infrastructure spending and the sharp decline in residential construction in the United States.[13] From 2007 to 2008, production of sand and gravel for construction and that of crushed stone, both for consumption, each fell by roughly 200 million metric tons,[14] bringing the production of each of the commodities to its lowest level since 1997.

Stepping back

The rise and fall of oil prices in 2008 is similar to the price shock that occurred during the early-to-mid 1970s. The difference is that oil prices in the early-to-mid 1970s rose sharply as a result of an OPEC embargo that constrained the world supply of oil, whereas in 2008, worldwide demand for oil outpaced the growth in supply. Both shocks resulted in rapid increases of employment in the mining industry. However, employment in mining continued to grow through the 1973–75 recession until peaking in October 1981. (See chart 2.)

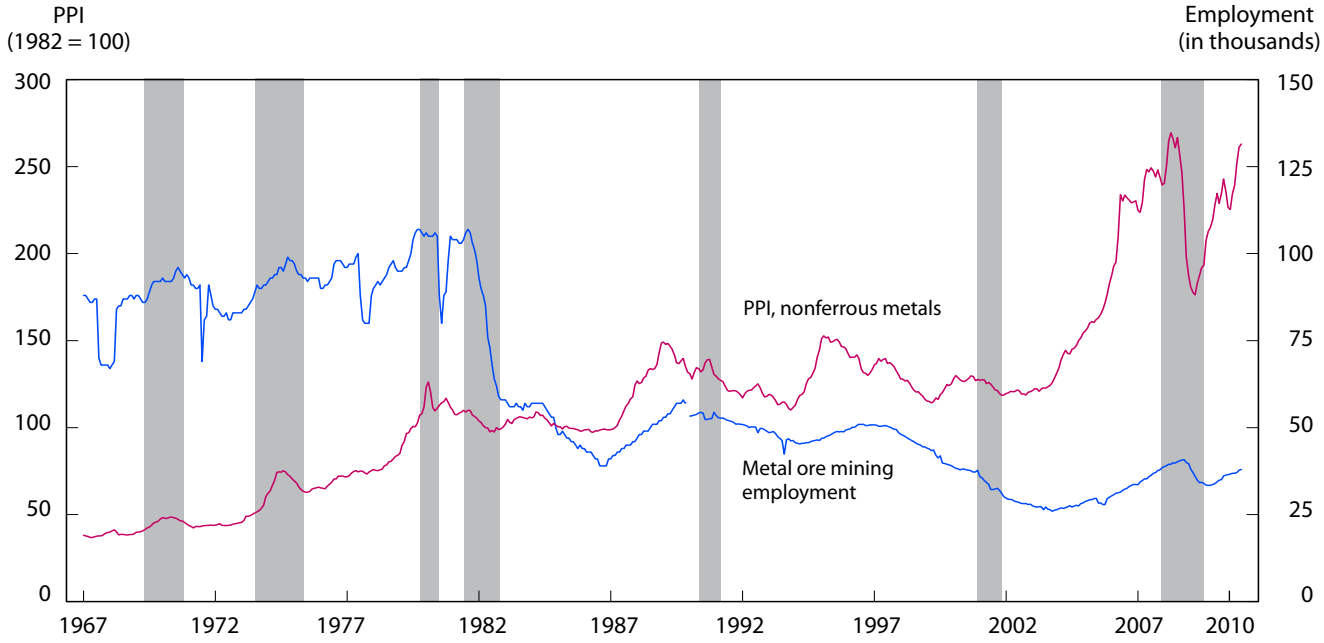
Table 3. Employment in mining and logging in selected States during the 2007–09 recession, seasonally adjusted

[in thousands]

State	Dec. 2007	Sept. 2008	June 2009	Change, Dec. 2007–Sept. 2008	Change, Sept. 2008–June 2009	Change, Dec. 2007–June 2009
Alaska	15	16	15	1	0	1
California	28	29	26	1	-3	-2
Colorado	26	29	24	3	-6	-3
Louisiana	53	55	51	2	-4	-2
New Mexico	20	22	17	2	-5	-2
Oklahoma	49	53	43	4	-11	-6
Texas	216	236	198	20	-38	-18
Wyoming	28	30	25	3	-5	-3

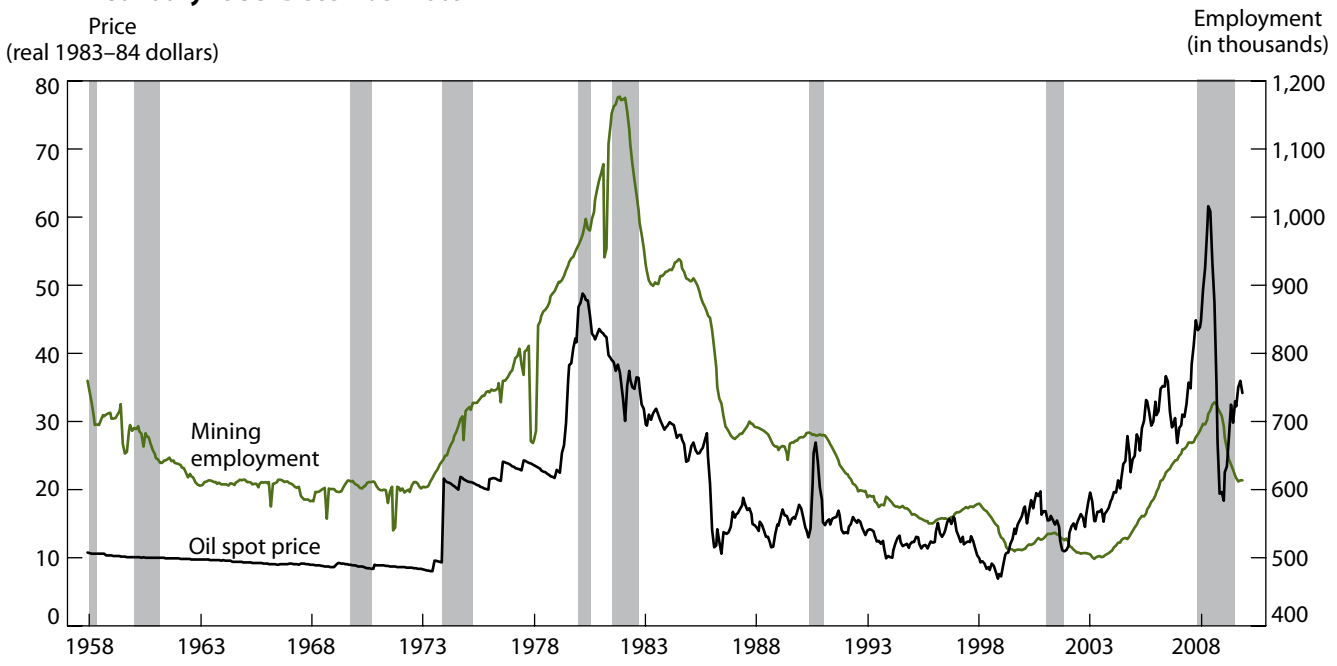
SOURCE: Bureau of Labor Statistics, Current Employment Statistics survey.

Chart 1. **Metal ore mining employment and the PPI of nonferrous metals, monthly data, seasonally adjusted, January 1967–December 2010**



NOTE: Shaded areas represent recessions as determined by the National Bureau of Economic Research. The PPI is seasonally adjusted except for the 1990–2003 period, when seasonal adjustment was not applicable. There is a break in the metal ore mining employment series because of the transition from the Standard Industrial Classification system to the North American Industry Classification System.
SOURCE: Bureau of Labor Statistics.

Chart 2. **Mining employment (seasonally adjusted) and the real spot price for West Texas Intermediate crude oil, January 1958–December 2009**



NOTE: Shaded areas represent recessions as determined by the National Bureau of Economic Research.
SOURCES: Bureau of Labor Statistics and Dow Jones & Company.

During the 1990–91, 2001, and 2007–09 recessions, the trend in mining employment lagged that of total nonfarm employment. Although there was a moderate oil shock in the 1990–91 recession, the oil price peak in October 1990 did not coincide with the beginning of the decrease in mining employment as the oil price peak in 2008 did.

The timing of swings in oil prices during the 1990–91 recession was similar to that during the 2007–09 recession, although the swings differed in amplitude. The decline in mining employment during the 1990s was not solely a result of a decrease in mining activity, but also of a shift towards greater productivity. Following the most recent recession, mining companies have made efforts to increase productivity.[15]

Historically, the mining industry has faced diminishing returns to production as the least costly sources of output are exhausted. Consequently, mining producers increasingly have relied upon sustained and significant price increases as signals for justifying increased investment through added employment. As this article has shown, mining employment grew even during the first half of the 2007–09 recession in response to notably higher prices and then fell when energy prices decreased substantially. □

Notes

[1] In this article, the term "mining industry" is used to denote the industry known as the "mining division" under the Standard Industrial Classification (SIC) system or the "mining, quarrying, and oil and gas extraction sector" in the North American Industry Classification System (NAICS).

[2] Recessions are identified by the National Bureau of Economic Research (NBER). According to the NBER, the most recent recession began in December 2007 and ended in June 2009. The previous two recessions were from March 2001 to November 2001 and from July 1990 to March 1991. For a complete list of business cycle dates, consult the NBER webpage at **http://www.nber.org/cycles/cyclesmain.html** (visited Nov. 2, 2010). The data on employment used in this article are from the Current Employment Statistics (CES) survey, which is a monthly survey of approximately 140,000 nonfarm businesses and government agencies representing approximately 440,000 individual worksites. For more information on the CES program's methods, see "Technical Notes to Establishment Survey Data Published in Employment and Earnings" at **http://www.bls.gov/web/cestn2.htm** (visited Apr. 13, 2011). CES data are available at **http://www.bls.gov/ces** (visited Apr. 13, 2011). The CES data used in this article are seasonally adjusted unless otherwise noted.

[3] *International Energy Statistics* (U.S. Energy Information Administration), **http://tonto.eia.doe.gov/cfapps/ipdbproject/iedindex3.cfm?tid=5&pid=5&aid=2&cid=ww,CH,IN,&syid=2006&eyid=2007&unit=TBPD** (visited Apr. 13, 2011).

[4] James D. Hamilton, *Causes and Consequences of the Oil Shock of 2007–08*,(Cambridge, Mass., National Bureau of Economic Research, NBER working paper series, no. 15002, May 2009); and Yanan He, Shouyang Wang, and Kin Keung Lai, "Global economic activity and crude oil prices: A cointegration analysis," *Energy Economics*, July 2010, pp. 868–76.

[5] *International Energy Statistics.*

[6] Guro Bornes Ringuld, Knut Einar Rosendahl, and Terje Skjerpen, "Does oilrig activity react to oil price changes? An empirical investigation," *Energy Economics*, March 2008, pp. 371–96.

[7] Table 4.5, "Crude Oil and Natural Gas Exploratory and Development Wells, Selected Years, 1949–2009," *Annual Energy Review,* 2009 (U.S. Energy Information Administration), **http://www.eia.doe.gov/aer/pdf/pages/sec4_11.pdf** (visited Apr. 14, 2011).

[8] See *G. 17, Industrial Production and Capacity Utilization* (Federal Reserve Board, Federal Reserve Statistical Release), **http://www.federalreserve.gov/datadownload/Download.aspx?rel=G17&series=b194d5644bbe8dee772666612041a553&filetype=spreadsheetml&label=include&layout=seriescolumn&from=01/01/2000&to=11/30/2010** (visited Apr. 14, 2011).

[9] Robert Halvorsen, "Energy Substitution in U.S. Manufacturing," *The Review of Economics and Statistics*, November 1977, pp. 381–88.

[10] Andy Xie, "Asian Oil Demand Declining," *Global Economic Forum*, July 14, 2005, **http://www.morganstanley.com/views/gef/archive/2005/20050714-Thu.html#anchor2** (visited Apr. 15, 2011).

[11] The relevant data come from the data extract titled "Rail Time Indicators 2006–2010" from the *Weekly Railroad Traffic Report* of the Association of American Railroads (Washington, DC, 2010).

[12] Historical data for metal ore mining are based on two industry classification structures. Employment data from before 1990 are based on the Standard Industrial Classification (SIC) system, and later data are based on the North American Industry Classification System (NAICS). As of the first quarter 2001, employment in the SIC-based series accounted for 93.1 percent of employment in the NAICS-based series. Given this high level of overlap, a comparison can be made.

[13] Adam Hadi, "Construction employment peaks before the recession and falls sharply during it," *Monthly Labor Review*, this issue, pp. 24–27.

[14] Thomas D. Kelly and Grecia R. Matos, "Historical Statistics for Mineral and Material Commodities in the United States" (U.S. Geological Survey, data series 140, 2010), **http://minerals.usgs.gov/ds/2005/140/** (visited Apr. 15, 2011); see the documents for "stone (crushed)" and "sand and gravel (construction)."

[15] Russell Andersson, Sudhir Chawla, and Zafar Khan, "Effects of Cutbacks in the United States Oil and Gas Industry on Employee Attitudes: An Empirical Study," *International Journal of Management*, December 2009, pp. 400–10.