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# Economic Impact of the Arizona Mining Industry

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**ARIZONA  
MINING ASSOCIATION**

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# Executive Summary: Economic Impact 2017

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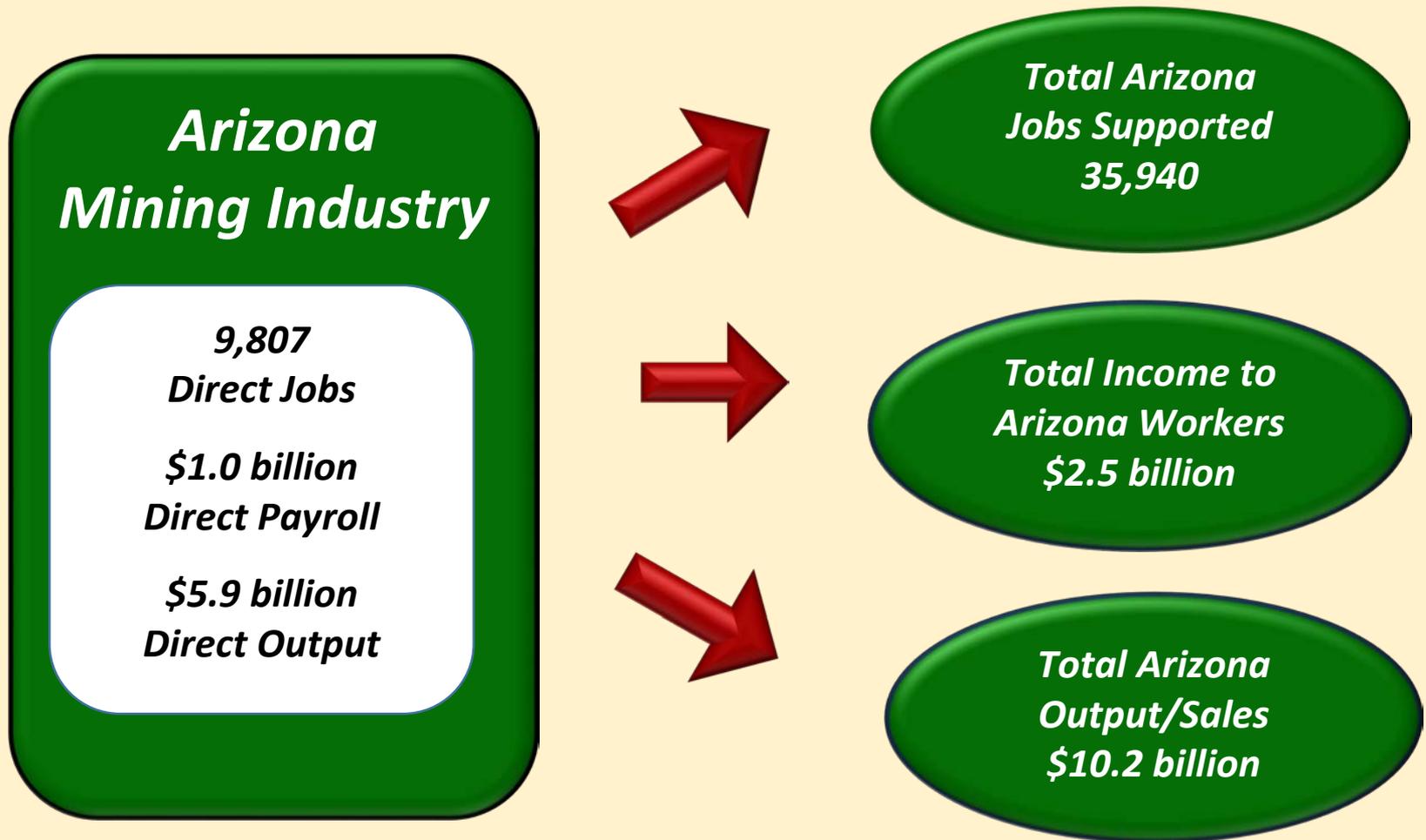
The Arizona mining industry includes copper and molybdenum, lead, zinc, gold, silver, uranium, and other metal ore producers, as well as coal. Arizona mineral mining firms in 2017 employed 9,807 Arizona workers with a payroll of \$1.0 billion, producing output (sales) valued at \$5.9 billion. The combined worker income and before-tax business income, known as value added, was \$1.2 billion for the mining industry. Value added is the contribution of the mining industry to Arizona's Gross State Product. These measures describe the direct impact of the Arizona mining industry.

Purchases of intermediate goods and services by the mining industry created revenues and supported jobs for many other Arizona businesses across the mining supply chain. Meanwhile, workers in mining and supplier industries made consumer purchases, creating additional jobs and revenues in Arizona. These indirect impacts supported an additional 26,133 jobs with personal income to workers of \$1.4 billion, value added of \$2.4 billion, and additional output produced by Arizona businesses of \$4.3 billion.

The total impact of the Arizona mining industry is the sum of direct and indirect impacts, resulting in total employment of 35,940 workers with personal income of \$2.5 billion, value added of \$3.6 billion and output valued at \$10.2 billion. The total tax revenue to Arizona state and local governments was \$395 million.

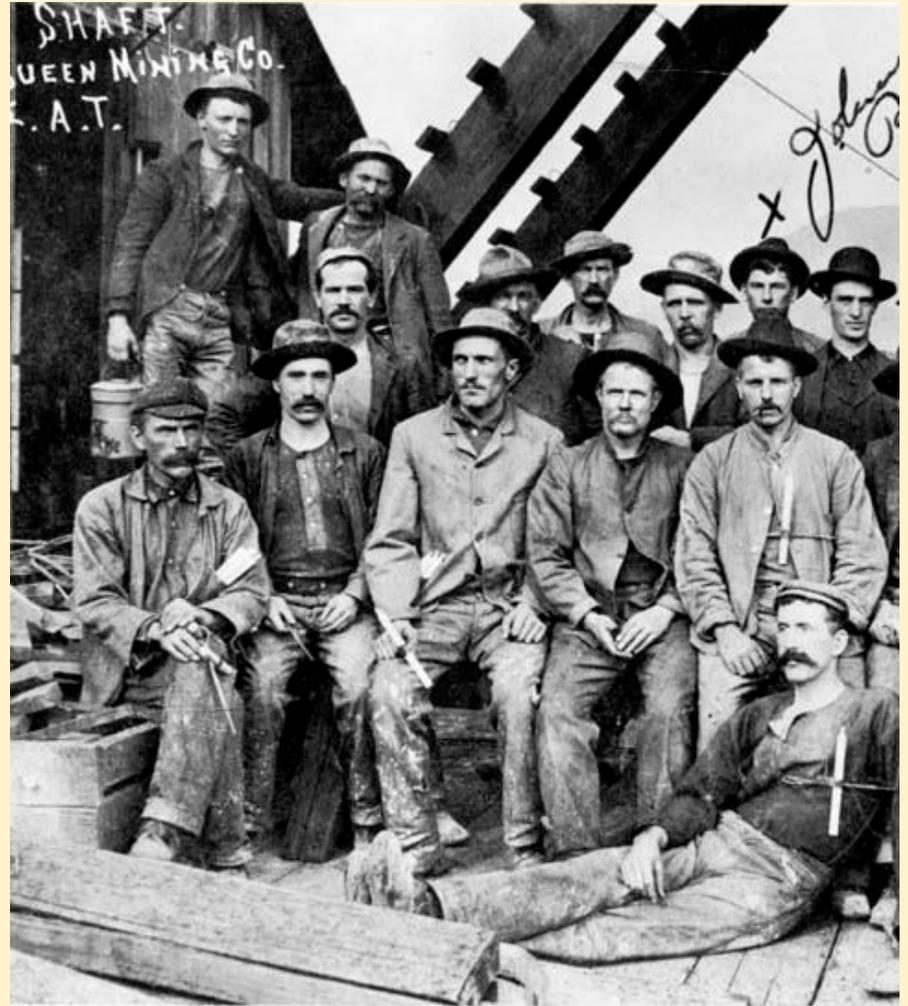
# The Mining Industry Supports Arizona Workers and Businesses

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# The Arizona Mining Industry

Mining has played a central role in the economy of Arizona since statehood. In 1910, one-quarter of wage earners in Arizona were employed in the mining industry. By 1970, after the state population had increased more than eightfold, copper mining was still touted as one of the Five Cs which formed the backbone of the Arizona economy. Over the past four decades, the Arizona population has more than tripled in size and the economy has continued to become more diverse, experiencing rapid growth in new high-technology industries such as semiconductors and aerospace. Because of the growth and diversification of the state's economy, the share of mining employment in total employment has declined in Arizona, as it has throughout the United States.



*Source: Arizona Historical Society*

# The Arizona Mining Industry



*Source: Freeport-McMoRan Copper & Gold*

Nevertheless, Arizona remains one of the top producers of copper in the world, and the mining industry continues to play a significant role in the state's economy and is one of its most important economic base industries. Arizona consistently ranks among the top five states for non-fuel mineral resource production - the state ranked 2<sup>nd</sup> in 2017.

Copper has been the predominant product of mining activity in Arizona for more than a century. This continues to be the case today. Other notable Arizona mining outputs include molybdenum, coal, gold, silver and uranium. The value of Arizona's mining output in 2017 was \$5.9 billion. Copper represented by far the largest component, at \$5.38 billion, followed by coal at \$321 million and other metal ore products at \$252 million.

# Arizona was the Second Leading State for Non-Fuel Mineral Resource Production in 2017

State	Rank	Value	Percent of U.S. Total
Nevada	1	\$8.7 billion	11.5%
Arizona	2	\$6.6 billion	8.8%
Texas	3	\$5.2 billion	6.9%
Alaska	4	\$3.5 billion	4.7%
California	5	\$3.5 billion	4.7%

According to the U. S. Geological Survey, Arizona ranked second in the nation in the value of non-fuel mineral production 2017. *Note: the table includes sand and gravel, cement, and crushed stone as well as copper and other metals and minerals.*

# **Economic Impact of The Mining Industry**

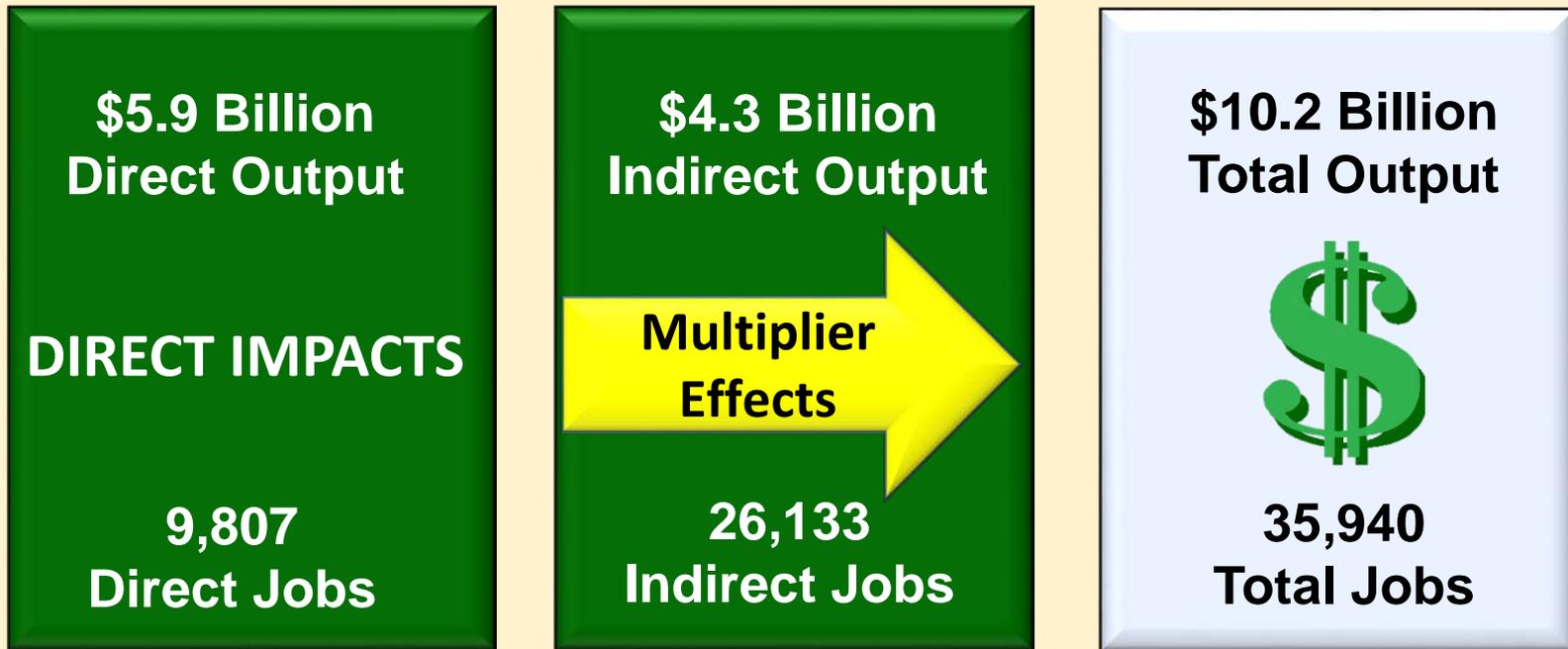
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**This study was conducted to analyze the economic impacts of mining on the state of Arizona for calendar year 2017. Four indicators were used to measure impacts: output, employment, personal income, and value added.**

**Output is the dollar value of annual production for the component sectors of the mining industry. Employment is the average annual number of jobs due to the presence of the mining industry. Personal income is wages and benefits paid to workers, plus self employed income. Value added, the contribution to Arizona Gross State Product, includes combined personal income and before-tax business income.**

**Economic impacts include both the direct and indirect effects of mining operations. The direct impact of an industry equals the value of its own output and employment, as well as personal and business income created, and taxes and fees paid to governments. Indirect impacts arise as firms purchase goods and services across the supply chain, and when employees spend their wages to make consumer purchases (known as the induced impact). An additional indirect impact comes from spending by state and local governments out of new tax revenues. The accompanying figure illustrates how direct and indirect impacts combined to create the total economic impact of the Arizona mining industry.**

# Total Impact is the Sum of Direct & Indirect Impacts



In 2017, the mining industry produced direct output valued at \$5.9 billion, and there were 9,807 direct mining jobs. As mining firms purchased intermediate goods and services and workers spent their incomes, an additional \$4.3 billion of indirect Arizona output was created, along with another 26,133 jobs. The total economic impact of the Arizona mining industry was \$10.2 billion of output and 35,940 total jobs. Each mining industry worker supported an additional 2.7 jobs in the overall economy in 2017.

# Direct Impact of The Mining Industry

<b>Direct Impact</b>	<b>Output (\$ millions)</b>	<b>Value Added (\$ millions)</b>	<b>Personal Income (\$ millions)</b>	<b>Employment</b>
<b>Copper</b>	<b>\$5,358</b>	<b>\$1,140</b>	<b>\$976</b>	<b>9,320</b>
<b>Coal</b>	<b>321</b>	<b>50</b>	<b>42</b>	<b>402</b>
<b>Other Metal Ore (gold, lead, zinc, uranium, all other)</b>	<b>252</b>	<b>10</b>	<b>9</b>	<b>85</b>
<b><i>All Direct Impacts</i></b>	<b><i>\$5,931</i></b>	<b><i>\$1,200</i></b>	<b><i>\$1,027</i></b>	<b><i>9,807</i></b>

The Arizona mining industry includes copper and molybdenum, lead, zinc, gold, silver, uranium, and other metal ore producers, as well as coal. The direct impact of the mining industry was \$5.9 billion of output produced and creation of 9,807 mining jobs with worker income of \$1.0 billion. The industry value added contributed \$1.2 billion to Arizona's Gross Domestic Product (GDP) in 2017. Value added is always smaller than output or sales because it is computed as output minus the cost of intermediate inputs, supplies and materials in production.

# Indirect Impacts of the Mining Industry

<b>Indirect impact</b>	<b>Output (\$ millions)</b>	<b>Value Added (\$ millions)</b>	<b>Personal Income (\$ millions)</b>	<b>Employment</b>
<b>Supplier Purchases</b>	<b>1,194</b>	<b>760</b>	<b>389</b>	<b>5,077</b>
<b>Worker Spending</b>	<b>1,817</b>	<b>1,023</b>	<b>587</b>	<b>12,503</b>
<b>Government Spending</b>	<b>1,243</b>	<b>606</b>	<b>463</b>	<b>8,533</b>
<b><i>All Indirect Impacts</i></b>	<b><i>\$4,255</i></b>	<b><i>\$2,389</i></b>	<b><i>\$1,439</i></b>	<b><i>26,133</i></b>

Indirect impacts occur as workers spend their incomes (induced effects), and as mining firms purchase materials and services from Arizona suppliers, who in turn purchase from their own suppliers and make payment to their employees. Taxes paid by firms and workers provide revenues for government spending, estimated as a separate impact in this study. These ripple effects of the multiplier process created indirect impacts of **26,133 additional** Arizona jobs and **additional** output of \$4.3 billion, with **additional** income to workers of \$1.4 billion and **additional** value added to Arizona Gross State Product of \$2.4 billion.

# Indirect Impacts Benefit Other Arizona Industries

<b>Arizona Industries</b>	<b>Output (\$ millions)</b>	<b>Personal Income (\$ millions)</b>	<b>Employment</b>
<b>Wholesale and Retail Trade</b>	<b>639</b>	<b>255</b>	<b>3,924</b>
<b>Banking, Insurance &amp; Real Estate</b>	<b>496</b>	<b>108</b>	<b>3,043</b>
<b>Environmental/Business Services</b>	<b>473</b>	<b>243</b>	<b>2,904</b>
<b>Health Care Services</b>	<b>363</b>	<b>214</b>	<b>2,230</b>
<b>Leisure Activity and Food Services</b>	<b>217</b>	<b>82</b>	<b>1,330</b>
<b>Transportation and Warehousing</b>	<b>169</b>	<b>60</b>	<b>1,038</b>
<b>Government (including Education)</b>	<b>163</b>	<b>62</b>	<b>1,003</b>
<b>All Other Industries</b>	<b>1,735</b>	<b>415</b>	<b>10,661</b>
<b><i>All Indirect Impacts</i></b>	<b><i>\$4,255</i></b>	<b><i>\$1,439</i></b>	<b><i>26,133</i></b>

As Arizona's mining industry spending recycled in the economy, indirect impacts benefited every other Arizona industry with additional sales, jobs and worker incomes. Wholesale and retail trade, followed by the financial sector, felt the greatest impact from mining activity. Over 2,000 jobs were also supported in business services and health care.

# Total Impact of The Arizona Mining Industry

<b>Total impact</b>	<b>Output (\$ millions)</b>	<b>Value Added (\$ millions)</b>	<b>Personal Income (\$ millions)</b>	<b>Employment</b>
<b>Direct Impact</b>	<b>5,931</b>	<b>1,200</b>	<b>1,027</b>	<b>9,807</b>
<b>Indirect Impacts</b>	<b>4,255</b>	<b>2,389</b>	<b>1,439</b>	<b>26,133</b>
<b><i>Total Impacts</i></b>	<b><i>\$10,186</i></b>	<b><i>\$3,589</i></b>	<b><i>\$2,466</i></b>	<b><i>35,940</i></b>

The total economic impact of the Arizona mining industry is the sum of direct and indirect impacts (\$10.2 billion as measured by output). Mining operations ultimately created 35,940 total jobs in the Arizona economy with total personal income to workers of \$2.5 billion. The total value added to Gross State Product was \$3.6 billion. Value added is made up of worker and business income associated with the production of industry output. Total output is greater than total value added by the cost of intermediate inputs (\$6.6 billion). The ratio of total impact to direct impact is a measure of the multiplier effect. For example, total output was 1.7 times greater than direct output. The employment multiplier for mining was fairly large, at 3.7.

# Tax Impact of The Mining Industry

<b>Taxes Paid By</b>	<b>State and Local (\$ millions)</b>	<b>Federal (\$ millions)</b>	<b>Total (\$ millions)</b>
<b>Mining Firms</b>	<b>152</b>	<b>214</b>	<b>366</b>
<b>Mining Workers</b>	<b>85</b>	<b>121</b>	<b>206</b>
<b>Supplier Firms</b>	<b>68</b>	<b>96</b>	<b>164</b>
<b>Supplier Workers</b>	<b>90</b>	<b>127</b>	<b>217</b>
<b><i>All Tax Impacts</i></b>	<b><i>\$395</i></b>	<b><i>\$558</i></b>	<b><i>\$953</i></b>

As businesses buy supplies and produce output they pay state, local and federal taxes. Workers pay taxes on their earnings and consumer purchases. Businesses and workers pay property taxes, motor vehicle taxes, and various fees. Mining operators pay additional taxes based on the value of output. Total state and local tax revenues associated with the Arizona mining industry's economic activity summed to \$395 million in 2017. Federal taxes paid by the mining industry were \$558 million.

# Mining Impacts in Arizona Counties

<b>County</b>	<b>Direct Output (\$ millions)</b>	<b>Direct Employment</b>	<b>Total Output (\$ millions)</b>	<b>Total Employment</b>
Apache	0.0	0	0.0	0
Cochise	17.8	30	31.0	111
Coconino	36.2	61	63.0	225
Gila	647.9	1,086	1,129.0	4,030
Graham	304.7	511	531.0	1,896
Greenlee	2,030.9	3,405	3,538.9	12,633
La Paz	2.3	4	4.0	14
Maricopa	285.2	478	497.0	1,774
Mohave	80.3	135	140.0	500
Navajo	321.0	402	409.7	1,042
Pima	1,047.3	1,756	1,825.0	6,515
Pinal	647.3	1,085	1,128.0	4,027
Santa Cruz	0.0	0	0.0	0
Yavapai	510.1	854	889.0	3,173
Yuma	0.0	0	0.0	0
<b>Total Impacts</b>	<b>\$5,931.0</b>	<b>9,807</b>	<b>\$10,186</b>	<b>35,940</b>

Direct output and employment in the accompanying table measure production and jobs within mining firms in each county. Total output and employment include all multiplier effects of indirect spending and employment supported by the presence of mining activity and sales in that county.

# Economic Impact Study Methodology

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The study was undertaken to analyze and measure the economic impact of the Arizona mining industry on the state's economy. The economic contribution of the mining industry includes direct and indirect impacts. The direct impact of an industry equals the value of its output and employment, personal and business income created, and taxes and fees paid to governments. Indirect impacts occur as workers spend their incomes (induced effects), and as mining firms purchase materials and services from Arizona suppliers, who in turn purchase from their own suppliers and make payment to their employees.

Indirect impacts were measured through application of an input-output model (IMPLAN) based on Arizona data. The IMPLAN model is regularly used in regional economic research for impact analysis. The model estimates multiplier effects from direct impacts and also has state-specific values for other useful variables such as output per worker, and the proportion of inputs each producer purchases locally.

Statistics on 2017 direct employment for each mining sector in Arizona counties and the state were obtained from the Quarterly Census of Employment and Wages, from the U.S. Bureau of Labor Statistics, supplemented with EMSI estimates for nondisclosed data. Jobs were checked against county figures from the Mine Safety and Health Administration.

# **Economic Impact Study Methodology *Continued***

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**Personal income consists of two components, worker compensation and proprietor (self employed) income. Compensation includes wages received by workers as well as employer paid social security, health insurance and other benefits as derived from the U.S. Bureau of Economic Analysis and incorporated in the data for the IMPLAN model.**

**Output is synonymous with the value of sales or shipments for each of the component sectors of the mining industry. Direct output for copper was based on U.S. Geological Survey reports for 2017. Output estimates for other producers (such as coal, gold, lead, zinc, and molybdenum) were derived through Arizona output coefficients in the IMPLAN model.**

**Value added is a measure of the change in value at each stage of production, calculated as the value of output from that production stage minus the cost of intermediate inputs from suppliers. The basic components of value added for an industry are compensation paid out to workers and retained business income before taxes. Conceptually, firms at each stage of production “add value” when they buy inputs and then process these inputs for sale to the next stage of production at a new higher price sufficient to cover the costs of the initial inputs plus compensation to workers plus a return to the business enterprise.**

# **Economic Impact Study Methodology *Continued***

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**The sale price of products to final users such as consumers incorporates the combined valued added at each previous stage of production. At the national level, Gross Domestic Product (GDP) is defined as the sum of value added by each industry, net of the cost of intermediate inputs. Similarly, the sum of the direct value added by the Arizona mining industry (\$1.2 billion) is the industry's addition to the Arizona Gross State Product.**

**Other state and local taxes were estimated by multiplying the income attributable to production by the statewide ratio of state and local taxes to income, a figure derived from the U. S. Census Bureau. This percentage was applied to personal income and income earned by producers of direct and indirect impacts to calculate revenue to state and local governments of \$395 million. Government spending effects were removed from the input-output analysis and re-introduced to the model as a separate source of impact, resulting in an addition to output of \$1.2 billion and 8,553 jobs created throughout the economy, due to government spending of tax revenues associated with economic activity of the Arizona mining industry.**

# Economic Impact Data Sources

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The following data sources were used in this study:

1. Arizona Department of Revenue, Phoenix, Arizona
2. EMSI <http://www.economicmodeling.com/>
3. IMPLAN Group and IMPLAN System, Huntersville, N.C.
4. U. S. Bureau of Labor Statistics, Washington, D. C.
5. U.S Census Bureau, Washington, D.C.
6. U. S. Geological Survey, Washington, D.C.
7. U.S. Mine Safety and Health Administration, Denver, CO

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# Economic Impact of the Arizona Mining Industry

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