

Estimating Base Wages and Wage Growth Rates for Workers in the Oil and Natural Gas Industries

Introduction

1. The markets for oil and natural gas are volatile, and supplier characteristics such as output, employment, and wages respond substantially to volatility in oil and gas prices. When estimating base wages and wage growth rates for oil and natural gas extraction workers, failure to account for this volatility can lead to unreasonable projections of future earnings.

2. The techniques described in this memorandum apply to workers in the North American Industry Classification System (NAICS) code group 211-Oil and Gas Extraction, and workers in the NAICS industries 213111-Drilling Oil and Gas Wells and 213112-Support Activities for Oil and Gas Operations. According to the NAICS:

- Industries in the Oil and Gas Extraction subsector operate and/or develop oil and gas field properties. Such activities may include exploration for crude petroleum and natural gas; drilling, completing, and equipping wells; operating separators, emulsion breakers, desilting equipment, and field gathering lines for crude petroleum and natural gas; and all other activities before the product leaves the producing property. This subsector includes the production of crude petroleum, the mining and extraction of oil from oil shale and oil sands, and the production of natural gas, sulfur recovery from natural gas, and recovery of hydrocarbon liquids. Establishments in this subsector include those that operate oil and gas wells on their own account or for others on a contract or fee basis. Establishments primarily engaged in providing support services, on a fee or contract basis, required for the drilling or operation of oil and gas wells (except geophysical surveying and

mapping, mine site preparation, and construction of oil/gas pipelines) are classified in Subsector 213, Support Activities for Mining.¹

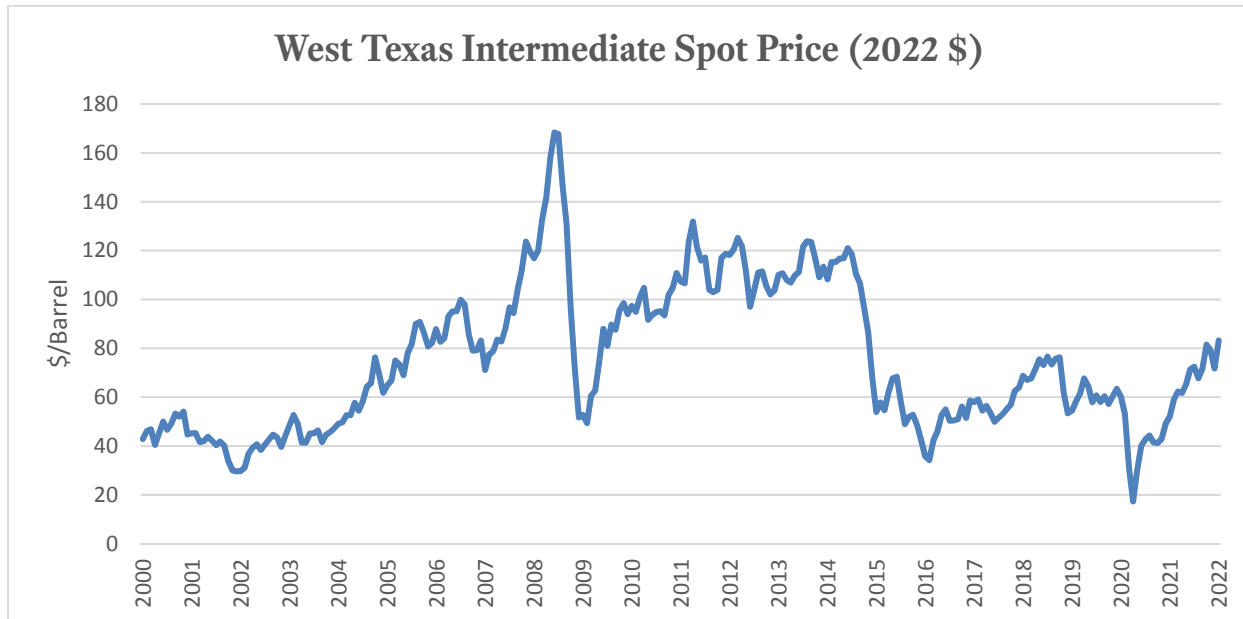
- The Drilling Oil and Gas Wells industry comprises establishments primarily engaged in drilling oil and gas wells for others on a contract or fee basis. This industry includes contractors that specialize in spudding in, drilling in, re-drilling, and directional drilling.²
- The Support Activities for Oil and Gas Operations industry comprises establishments primarily engaged in performing support activities on a contract or fee basis for oil and gas operations (except site preparation and related construction activities). Services included are exploration (except geophysical surveying and mapping); excavating slush pits and cellars, well surveying; running, cutting, and pulling casings, tubes, and rods; cementing wells, shooting wells; perforating well casings; acidizing and chemically treating wells; and cleaning out, bailing, and swabbing wells.³

3. The figures below show spot prices for oil and natural gas, US oil and gas rig counts, number employed in oil and natural gas production since 2000, and median annual worker earnings in 2022 dollars.

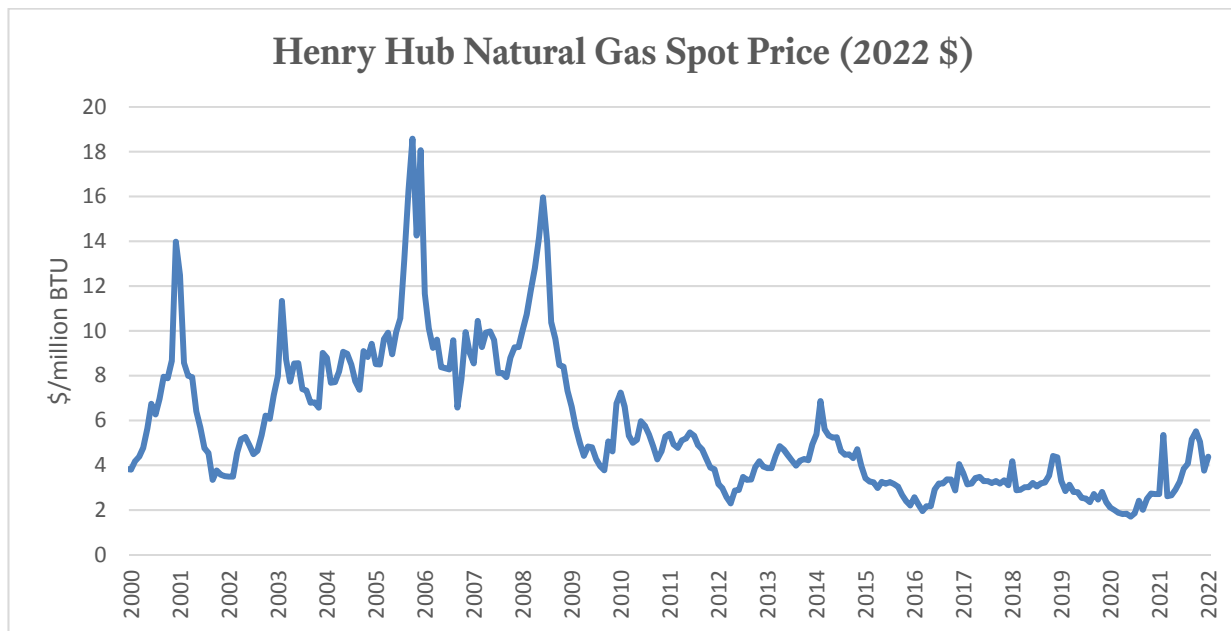
¹ Description of NAICS Code 211-Oil and Gas Extraction. Available from <https://siccode.com/en/naicscodes/211/oil-and-gas-extraction-1>.

² Description of NAICS Code 213111-Drilling Oil and Gas Wells. Available from <https://siccode.com/en/naicscodes/213111/drilling-oil-and-gas-wells>.

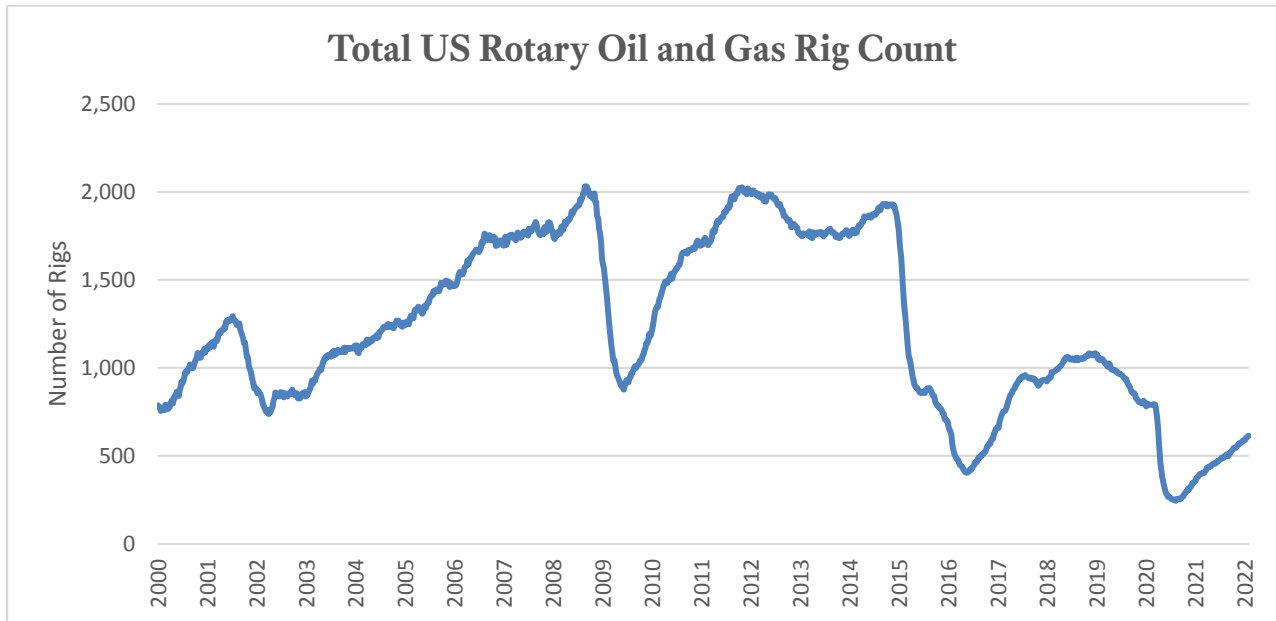
³ Description of NAICS Code 213112-Support Activities for Oil and Gas Operations. Available from <https://siccode.com/en/naicscodes/213112/support-activities-for-oil-and-gas-operations>.



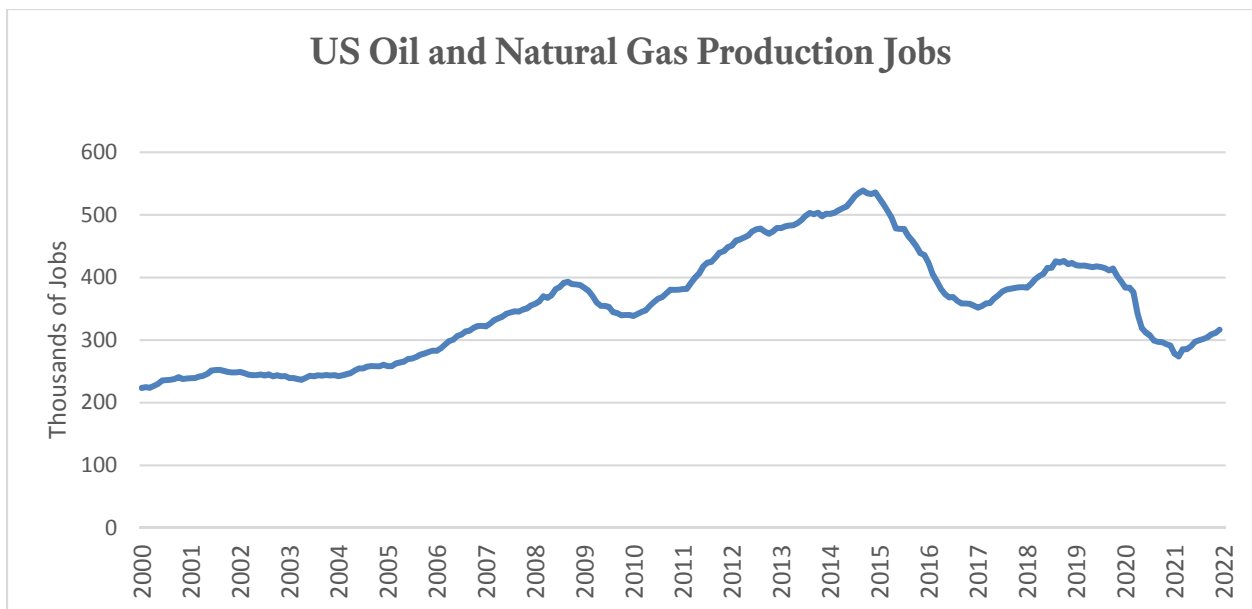
Source: US Energy Information Administration. Available from <https://www.eia.gov/dnav/pet/hist/rwtcd.htm>.



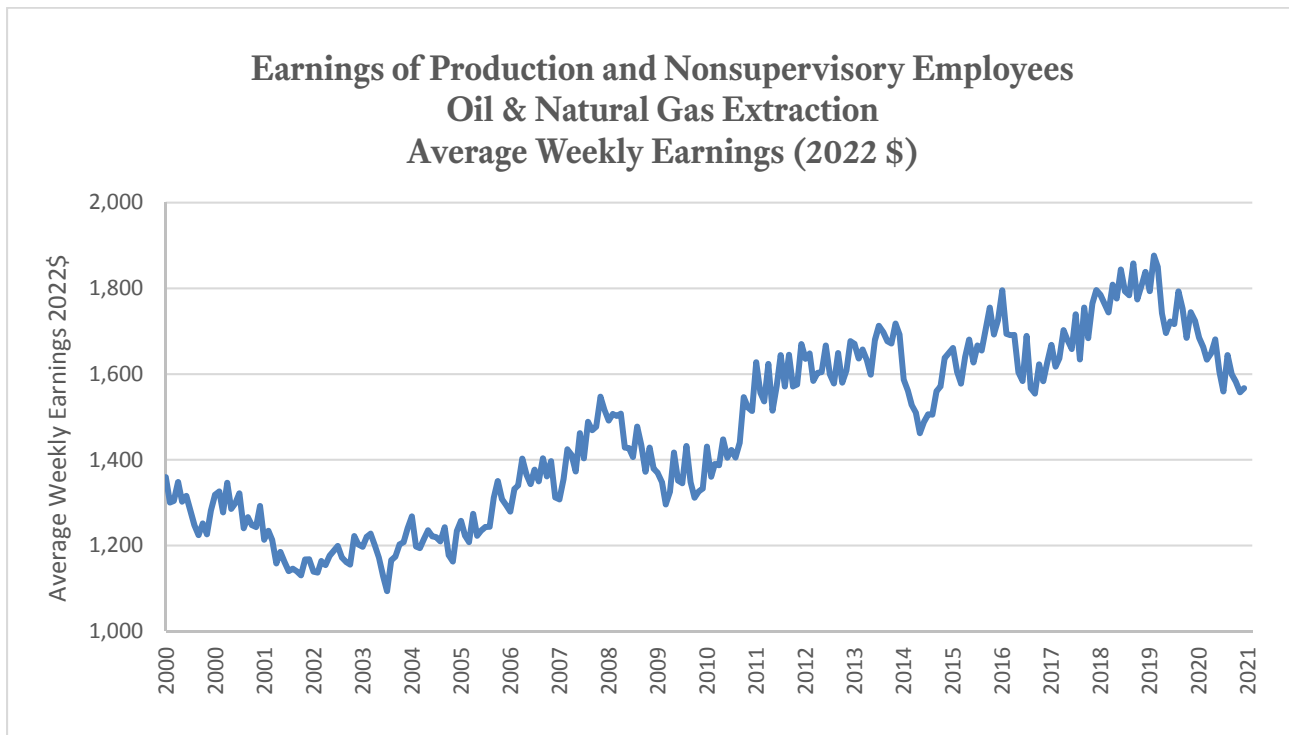
Source: US Energy Information Administration. Available from <https://www.eia.gov/dnav/ng/hist/rngwhhdm.htm>.



Source: Baker Hughes. Available from <http://phx.corporate-ir.net/phoenix.zhtml?c=79687&p=irol-reportsother>.



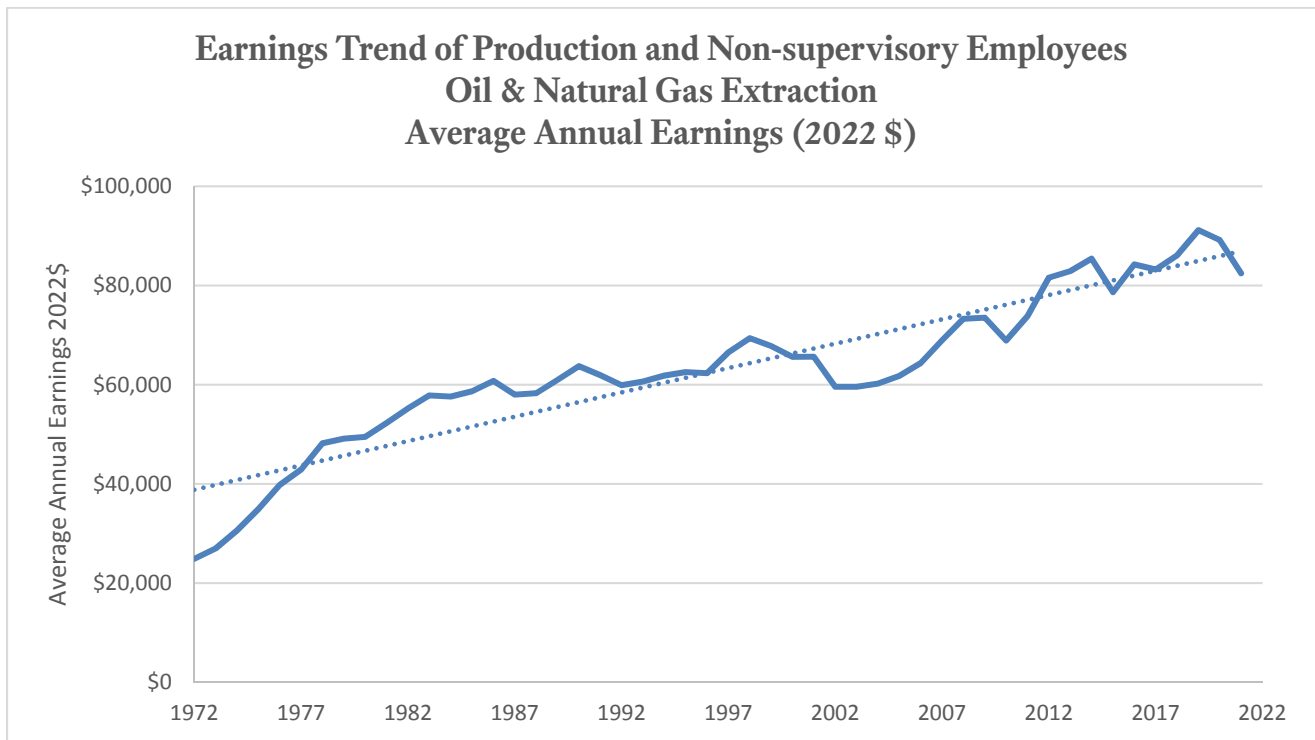
Source: Bureau of Labor Statistics. Total workers in “support activities for oil and gas operations” and “oil and gas extraction.” Available from <https://www.bls.gov>.



Source: Bureau of Labor Statistics. Average weekly earnings of production and non-supervisory employees, oil and gas extraction. Available from <https://www.bls.gov>.

Wage Growth

4. Long-run growth rates of a cyclical time series should be calculated in a way that smooths out short-run volatility. This can be done by estimating a long-run trend of a series and then calculating the growth based on the trend rather than short-run movements around the trend. The figure below shows average nominal earnings of production and non-supervisory employees in oil and gas extraction and estimates a long-run trend line from a linear regression model.



Source: Bureau of Labor Statistics. Annualized average weekly earnings of production and non-supervisory employees, oil and gas extraction. Available from <https://www.bls.gov>.

5. Since 1972, trended real wages of oil and gas extraction employees have grown 1.64% annually.

Base Wages

6. Rather than using earnings from a short period (e.g., one to five years) to determine earning capacity for a worker in the oil/natural gas industries, an economist or vocational consultant should usually average earnings over a longer period (ten or more years) to smooth out the effects of industry volatility. Before averaging, earnings for each year (whether individual or industry) should be converted to current dollars. If a worker had earnings from the oil/natural gas industry for ten or more years, the analyst can average that worker's earnings. When a worker has over ten years of earnings, the analyst should average the most recent ten years of earnings.

7. If the worker worked fewer than ten years in the industry, the analyst can compare the worker’s earnings with average national earnings for the same years. The formula below compares a worker’s earnings to average earnings for the industry over more years, smoothing out volatility. The years considered are from 2000 through 2021.

$$\text{Earning Capacity} = \frac{\text{Worker historical avg. earnings}}{\text{Avg. earnings for same years}} (\text{Avg. earnings for full period})$$

Examples

8. Worker A had twelve years of earnings from the oil industry. The most recent ten years are converted to current dollars and used to create a volatility-smoothed, long-run average in the figure below.

Calculation of Base Earnings for Worker A

	(A)	(B)	(C)	(D)
Year	Earnings	CPI Inflation	Adjustment Factor	Earnings in 2022 \$
2010	\$39,000	1.6%	124.3%	\$48,459
2011	\$47,000	3.2%	120.4%	\$56,588
2012	\$42,000	2.1%	117.9%	\$49,528
2013	\$54,000	1.5%	116.2%	\$62,738
2014	\$49,000	1.6%	114.4%	\$56,033
2015	\$50,000	0.1%	114.2%	\$57,119
2016	\$60,000	1.3%	112.8%	\$67,663
2017	\$65,000	2.1%	110.5%	\$71,794
2018	\$73,000	2.4%	107.9%	\$78,740
2019	\$72,000	1.8%	106.0%	\$76,289
2020	\$65,000	1.2%	104.7%	\$68,055
2021	\$60,000	4.7%	100.0%	\$60,000
2022		0.0%	100.0%	-
			Average Earnings	\$62,751

Source: (A) Historical Earnings for Worker A
 (B) Annual CPI inflation rates from <https://www.bls.gov>
 (C) RPC Calculation, Current Adjustment Factor = Future Adjustment Factor x (1+ (B))
 (D) RPC Calculation, (A) x (C)

9. Worker B had four years of earnings from the oil industry. The figure below converts Worker B's historical earnings to a volatility-smoothed, long-run average. This worker's average earnings from 2017 to 2020 were \$95,366 in 2022 dollars. This average was 9.2% higher than average earnings for workers in the comparison industries for the same years. Therefore, this worker's volatility-smoothed, long-run average earnings are calculated as 9.2% higher than average industry earnings over the longer period.

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Calculation of Base Earnings for Worker B

	(A)	(B)	(C)	(D)	(E)	(F)
Year	Earnings	Average Earnings for Oilfield Workers	CPI Inflation	Adjustment Factor	Historical Earnings in 2022 \$	Average Earnings in 2022 \$
2000		\$41,706	3.4%	157.1%	-	\$65,521
2001		\$42,913	2.8%	152.8%	-	\$65,582
2002		\$39,556	1.6%	150.4%	-	\$59,499
2003		\$40,467	2.3%	147.0%	-	\$59,502
2004		\$41,990	2.7%	143.2%	-	\$60,117
2005		\$44,530	3.4%	138.5%	-	\$61,657
2006		\$47,878	3.2%	134.2%	-	\$64,238
2007		\$52,778	2.8%	130.5%	-	\$68,884
2008		\$58,244	3.8%	125.7%	-	\$73,234
2009		\$58,207	-0.4%	126.2%	-	\$73,481
2010		\$55,455	1.6%	124.3%	-	\$68,905
2011		\$61,306	3.2%	120.4%	-	\$73,813
2012		\$69,131	2.1%	117.9%	-	\$81,522
2013		\$71,272	1.5%	116.2%	-	\$82,805
2014		\$74,616	1.6%	114.4%	-	\$85,325
2015		\$68,794	0.1%	114.2%	-	\$78,589
2016		\$74,647	1.3%	112.8%	-	\$84,180
2017	\$85,000	\$75,300	2.1%	110.5%	\$93,884	\$83,170
2018	\$120,000	\$79,752	2.4%	107.9%	\$129,436	\$86,023
2019	\$87,000	\$86,012	1.8%	106.0%	\$92,182	\$91,135
2020	\$63,000	\$85,153	1.2%	104.7%	\$65,961	\$89,155
2021		\$82,443	4.7%	100.0%		\$82,443
			Period Average (G)		\$95,366	\$87,371
			Worker /Average Ratio (H)		1.092	
			Long-run Average (2000–2021) (I)			\$74,490
			Ratio-Adjusted Worker B Earnings (J)		\$81,307	

Source:

(A) Historical Earnings for Worker B.

(B) Average weekly earnings of production and non-supervisory employees in oil and gas extraction. Available from <https://www.bls.gov>.

(C) Annual CPI inflation rates from <https://www.bls.gov>.

(D) RPC Calculation, Current Adjustment Factor = Future Adjustment Factor x (1+ (B))

(E) RPC Calculation, (A) x (D)

(F) RPC Calculation, (B) x (D)

(G) Averages of (E) and (F) in years where both have available data

(H) First value in (G) / second value in (G)

(I) Average of (F) from 2000 to 2018

(J) RPC calculation, (I) x (H)