

The Proposed Virginia Coal Slurry Pipeline And Its Employment Effects on The Railroad Industry

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Abstract

This study uses estimated price elasticity of coal to compute the potential employment effects of a coal slurry pipeline. Our conclusion is that a \$5 per ton decrease in coal price due to a slurry pipeline will cause an approximately 6.74 million tons of reduction of shipment from railroads. This will cost the railroad industry approximately 440 jobs. The feasibility study of coal slurry is desirable because it produces new jobs and reduces prices for consumers.

Introduction

The Slurry pipeline controversy has been around for several years. During the early 1980's several studies were conducted to determine the physical, economic and legal feasibility of a slurry pipeline. The first major feasibility study which examined the potential slurry locations in the U.S. as well as regional markets was published in 1980.(1) Although the study did not examine the Virginia coal slurry, it did make some points concerning the employment effects, using the potential plausibility of a pipeline from East Kentucky to North and South Carolina. According to this study, the pipelines share of the coal transportation would range from 5 to 10.5 percent, depending upon the pipeline cost and rail rates in the specific region.(2)

Another study by the Virginia Society of Professional Engineers (1983) provides pertinent data as well as potential employment effects. According to a study by BDM Corporation (1983) the demand for Virginia coal with construction of a pipeline or any other cost reducing technological alternative, will remain relatively elastic during the next couple of decades. Any increase in demand for coal will come from shipments from Hampton Roads to electric utilities along the east coast. BDM estimates that Norfolk Southern (3) would lose five million tons a year. However, there is an agreement between BDM and our study that the employment generated by the pipeline would offset any loss of railroad jobs.

Some other studies such as Yucel (1982) concentrate

primarily on the technological aspects of a pipeline, such as the types of pumps that would move the slurry mixture along most efficiently. This and other similar types of studies provide a good reference point for engineers.

What the above mentioned studies lack is a solid economic analysis concerning the employment effects of a proposed slurry pipeline. Our study uses annual data from 1970 through 1980 from the State of Virginia to measure the price elasticity, income elasticity, cross price elasticity as well as employment effects. Our first attempt will be to estimate the own price elasticity of demand for coal slurry. A price elasticity shows a responsiveness (or sensitivity) of quantity demanded with respect to changes in the price of the product in question. In Mathematical sense, an elasticity shows a percentage change in the quantity demanded of a product due to a one percent change in the price of the product.(4)

Before the estimated coefficient for various elasticities are shown, we discuss some of the economic assumptions made for our analysis.

1. The prices are charged according to the principle of marginal cost pricing, i.e. the unit price charged from the consumer will be equal to the marginal cost of supplying coal to the consumer. It should be noted that before the slurry pipeline, the railroads were able to exercise their monopoly power by charging a price

higher than its marginal cost. With virtually no price competition in the coal industry, a higher price would not result in a significant decrease in sales because consumers may find it relatively less expensive to pay the higher price than to convert to other sources of electricity.(5) With construction of a coal slurry pipeline and its efforts to reduce coal transportation costs, the railroads would not be able to afford to maintain their relatively higher prices. The pipeline would literally break up a monopoly leading to decreased prices for the consumer would normally be a result. We must assume, therefore, that prices are at the minimum level in order for both transporters to have the highest market share possible. This leads to our second assumption.

2. Railroads will not be able to under-price the pipeline. It is believed that state legislators would approve the construction of a pipeline only if it would with some certainty lead to cost reduction in coal transportation.(6)

The third assumption is that no factors (other than price reduction from increased competition) affecting coal consumption will change. That is, income, energy technology, prices of substitute fuels, etc. will remain reasonably stable. It is also anticipated that one hundred percent of the cost reductions resulting from the pipeline will be passed along to the consumer in the form of lower electric bills. For example \$5 million reduction in transportation cost will result in a \$5 million decrease in Virginia's electric bills. Since the pipeline does not currently exist, we can only guess the expected amount of utility bills decrease.

3. The fourth assumption implicitly uses a continuously differentiable production function with somewhat elastic capital/labor ratios. Although one might argue that in certain cases the railroads use only one combination of capital and labor to produce a given output. This type of fixed proportion production function may be assumed in some specialized cases. However, most tasks in railroad shipment may use flexible capital/labor ratios. One example of this would be using different shifts with flexible crews. Therefore, an adaptable capital/labor ratios are assumed.

4. Our final assumption is that the slurry pipeline will transport 15 million tons of coal per year.(7)

Based on annualized data mentioned earlier, a logarithmic transformation of all variables is used to run an Ordinary Least Squares regression. The results are

further corrected for first order autocorrelation of the error term. The results are presented in Table 1.

The estimated coefficients of the right hand side variables reflect elasticities since the data are transformed into natural logs. The estimated coefficient for own-price variable shows a somewhat "elastic" elasticity. The negative sign is consistent with economic theory and the t-statistic indicate the estimate is statistically significant at (at least) 95 Level of confidence.

The estimated coefficient for per capita income shows positive but insignificant elasticity. As far as the remaining variables are concerned, the estimated coefficient for oil prices is larger than gas prices and statistically significant. The elasticity of .62 shows some substitutability of oil for coal when the price of coal rises. As indicated by economic theory, the positive sign shows that the goods are substitutes. This implies that the consumers are much more apt to convert energy sources between coal and oil.

The regression results produced in Table 1 are corrected for first order serial correlation. The adjusted R² of .97 shows that a significant percentage of variability in quantity demanded of coal is being explained by the right hand side variables. Although due to the data limitations the sample size is quite small, it still produces statistically plausible results.(8)

Based on the elasticity estimates produced in Table 1, one can measure the employment effects by using the following 4 step process.

Step 1: Suppose the price of coal per ton is \$34.58 (for the most current year available.) Let's reduce the price by \$5.00 per ton, this gives us the new price of \$29.58, which represents a 14.5% decrease.(9)

Step 2: Now lets determine the percentage change in quantity demanded. Price elasticity equals the percentage change in quantity demanded divided by the percentage change in price.

Therefore: Elasticity * % Change in Price = % Change in Quantity Demand. That is (14.5) * (1.134) = 16.44

Thus, with a \$5 per ton decrease in the price of coal, the quantity demanded will go up by 16.44 percent, which means a change from 9.5 million tons (see BDM study) to 11.06 million tons. A net increase of 1.56 million tons. Because a substantial quantity of Vir-

ginia's coal production goes into exports, it would not be unreasonable to assume that only a fraction of 25 million tons is consumed in the state. Because the focus of this project is exclusively on Virginia, we must assume that the coal consumed in Virginia as a percentage of coal produced in Virginia equals the amount of pipeline coal consumed in Virginia as a percentage of total pipeline volume.

Step 3: In 1980, Virginia produced 41 million tons of coal.(10) The same year the domestic consumption of coal in Virginia was about 9.5 million tons or only 23.2 percent of total coal produced. Since the slurry pipeline will transport about 15 million tons, it is plausible to estimate the total tonnage of coal (whether it's used in Virginia or abroad) taken away from the railroads. This can be calculated in the following way:

$$\begin{aligned} &\text{Millions of tons expected to be shipped by Slurry} \\ &\text{pipeline} - (\text{percentage change in price} * \text{price elasticity} \\ &\text{of demand} * \text{total quantity of coal produced in Virginia}) \\ &= 15 \text{ million tons} - [(14.6\% * (1.134)] * (41 \text{ million}) \\ &= 6.74 \text{ million tons.} \end{aligned}$$

Our next step is to compute an approximate employment loss due to the building of the coal slurry pipeline. Before explaining Step 4, lets have a look at the following table of employment.(11) This indicates that for every one million tons of coal railroad loses due to the coal slurry pipeline, 65.3 railroad jobs will be lost. Since the total expected railroad tonnage loss is 6.74 million, the potential job loss (6.74 * 65.30) equals 440.(12) This means that if a coal slurry which hauls 15 million tons of coal is constructed, the job decrease will be about 125.

Tables 2 and 3 give a general breakdown of employees in the railroad industry. The specific information concerning different categories of employees in the state

of Virginia is not available. However, a report published in 1986(13) provides some information concerning the employment categories in the railroad industry nationwide. This data summary is produced in Table 2. The percentages of workers employed in different categories nationwide are used to generate an approximation for the state of Virginia. Those numbers are presented in Table 3. The potential displacement of workers due to the slurry pipeline is expected to be largest in categories 3, 4, 5 and 6.

However, it is expected that the construction of the pipeline would take three years and will employ approximately 2573 people yearly. Once the construction is completed, the pipeline maintenance employment level will be approximately 935 employees annually. It is evident that a gain in employment due to the construction of coal slurry pipeline clearly outweighs the potential loss in railroad employment. It is plausible to assume that displaced workers may be able to find employment in pipeline or elsewhere. However, nobody denies the temporary hardship which the families of displaced workers may endure.

Concluding Remarks

This study uses estimated price elasticity of coal to compute the potential employment effect of a coal slurry pipeline. Our conclusion is that a \$5 per ton decrease in coal price (due to an alternative, namely slurry pipeline, method of transportation) will cause an approximately 6.74 million tons reduction of shipment from railroads. The railroads may lose about 440 jobs. It is desirable to study the economic plausibility of the coal slurry because it has potential to produce new jobs and transport coal at reduced prices. This will ultimately benefit the Virginia consumers.

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1	Virginia Class I Railroad Employment.....=	13,004
2	Total Virginia freight (million of tons).....=	199
3	Total Virginia coal freight (million of tons).=	138.3
4	Coal as a percentage of total freight.....=	69.5
5	Assume that 69.5 percent of the railroad employee hours are spent on handling coal. The number of all railroad employees that handle coal (69.5% of 13,0004).....=	9,038
6	Number of employees per million tons of coal (9038/138.3).....=	65.3

Table 1

Estimated Coefficients of Regression
Equation by using OLSQ*
Dependent Variable = LCONS

R H S Variables	Estimated Coefficients	Standard Errors	t-Stats.
Constant	3.380	6.759	0.500
LOWNP**	-1.134	0.251	-4.414
LINCOM	0.227	0.751	0.303
LINGP	0.018	0.173	0.104
LOLP**	0.624	0.267	2.344

Standard Error of the Regression = 0.076

R-Squared = 0.98

Adjusted R-Squared = 0.97

Durbin-Watson Statistics = 1.39

F -Stat. (4, 6) = 47.83

* = The regression is run with correction for first order serial correlation of the error term. All data are in natural logs.

** = The estimated coefficients are significant at least 95% confidence level.

Key LOWNP = Our Price of Coal
 LINCOM = Income Per Capita
 LINGP = Price of Natural Gas
 LOLP = Price of Oil

Table 2: National Data

Employment and Annual Wages by Class - 1986

<u>Employee Group</u>	<u>Avg. # of Employees (throughout the course of the year)</u>	<u>% of Total Employees</u>	<u>Avg. Yearly Earnings</u>
1. Executive, officials and staff assistants	13,230	4.8	\$ 53,488
2. Professional and Administrative	50,769	18.4	32,872
3. Maintenance of way and structures	57,097	20.7	30,829
4. Maintenance of equipment and stores	51,441	18.7	31,018
5. Transportation, other than train, engine	18,082	6.6	34,053
6. Transportation, train and engine	85,198	30.9	41,691
TOTAL	<u>275,817</u>		

Table 3

National Data Applied to Virginia

<u>Employee Group</u>	<u>Avg.# Employees</u>	<u>% of Total Employees</u>
1. Executive, officials and staff assistants	624.192	4.8
2. Professional and Administrative	2,392.736	18.4
3. Maintenance of way and structures	2,691.828	20.7
4. Maintenance of equipment and stores	2,431.748	18.7
5. Transportation other than train, engine	858.264	6.6
6. Transportation, train and engine	4,018.236	30.9
	<u>13,017.004</u>	

The above data is obtained by using national averages on total Virginia Class I railroad employees. This is only an approximation. The actual employment numbers may differ somewhat.

FOOTNOTES

- 1 ICF Incorporated. *The Potential Energy and Economic Impacts of Coal Slurry Pipelines*. 1-2
2 Virginia Society of Professional Engineers, *Virginia Coal Transportation Study* (Richmond, VA, July 1983) 29.
3 *ibid.*
4 Cross-price elasticity provides a measure of the responsiveness of demand of the product X with respect to the change in price of some
other good Y. Mathematically speaking Cross-Price of Elasticity of X, $Y = \% \text{ change in quantity demanded of X} / \% \text{ change in Price}$
of Y. If this elasticity is positive, the goods X and Y are substitutes.
5 See Solberg.
6 This assumption is made to facilitate the analysis. The building of coal slurry will induce competition. However, it is not clear at
this point whether it is at all possible for the railroads to underprice the slurry due to their (railroads) higher cost of transportation.
7 The BDM Corporation, *Virginia Coal Slurry Pipeline Study* (McLean, VA: BDM, 1983) VII-2.
8 *ibid.* The authors have considered the possibility of multicollinearity among one or more R.H.S. variables. It is likely that price and
income may be collinear over time. One of the techniques used to reduce multicollinearity is to take a first difference of all variables.
However, the estimated coefficients produced by logarithmic first difference specifications will not show elasticities. They only show
relative growth rates. It is more useful to only use logarithmic transformation, so one generates elasticities. The regression results
for logarithmic first difference specifications are available upon request.
(See Gujarati for more detailed analysis.)
9 \$5. Reduction is assumed to facilitate the numerical calculation.
10 United States Department of Energy *Bureau of Minerals Yearbook*. Telephone interview.
11 Virginia Society of Professional Engineers, *opt.cit.*
12 It is important to point out that any public sector project has obvious negative employment effect of taxation. That is, spending of
\$X on pipeline must reduce private spending by \$X. However, the method of financing the slurry pipeline is not clear at this time,
therefore, the employment estimate is not adjusted for taxation effect. Some critics may argue that private sector can do the same or
even better job of constructing the slurry pipeline. The criticism is well taken and may be worth exploring in a more detailed study.
13 The data used in Tables 2 and 3 comes from a publication entitled *Railroad Facts*, published by the Association of American Railroads
Information and Public Affairs Department (1986, p.57). The data applies to the Class I Railroad Freight Systems in the United States.
In 1987 there were 16 railroad systems that made up Class I. One of these systems is Norfolk Southern Corporation. Because the
data applies to many companies, the "percentage of total employees" category might be a better indication of Virginia railroad
employment figures. In addition to the Class I systems, there are approximately 500 local, regional and switching and terminal
railroads in the country.

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