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AN OIL PIPELINE EMPLOYMENT MULTIPLIER AND POST CONSTRUCTION RESIDUALS IN EMPLOYMENT

By

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INTRODUCTION AND INTENT

An area of increasing importance to Alaska decision makers is how to assess the impact of potentially large scale construction projects in the state. Alaska traditionally has been host to many such projects and for the near future, a gas pipeline, petrochemical complex, and capital move are in the planning stages.

Alaska legislators and other decision makers should feel less anxiety when making decisions concerning future large scale construction projects now that the state economy has experienced the largest private construction project in the world. Actual employment numbers are now available for 1978, quarter one, and various econometric forecasts of future growth are coming in line with each other.

The intent of this paper is to look objectively at the pipeline and post construction periods for the purpose of developing a proxy for a reasonable Alaska employment multiplier and formula for determining a post-construction residual in employment.

ESTABLISHING AN OIL PIPELINE EMPLOYMENT MULTIPLIER

An attempt has been made to establish a high and low employment impact multiplier for the recent trans-Alaska oil pipeline project. The first part of this analysis, which results in a "lower limit" employment multiplier, assumes that the project was 100 percent exogenous to the growth of the Alaska economy. The second part of this analysis assumes the project is another event in the development of the economy. This in effect establishes an "upper limit" to the oil pipeline employment multiplier. The components used in this analysis are: actual total nonagricultural wage and salary employment which is among the most consistent data series in the state, an average of the Alaska Department of Commerce and Economic Development (ACED) and the Alaska Department of Labor (ADOL) econometric forecasts of total nonagricultural wage and salary employment to 1980, and direct pipeline employment for 1975 and 1976 adjusted for a point in month estimate.1/

1/ Direct pipeline employment includes the Alyeska Service Company and all contractors.

A "LOWER LIMIT" OIL PIPELINE EMPLOYMENT MULTIPLIER

From 1966 to 1973, the period before pipeline construction, total nonagricultural employment grew at an annual rate of 5.98 percent. Under the "lower limit" scenario we can assume that if there was no oil pipeline project, this growth rate would continue to 1980, implying that the oil project was actually an extra impetus to the already fast growing economy. Figure 1 illustrates this situation.

We can now determine the difference between the extended pre-pipeline growth rate of total nonagricultural employment and the actual-forecasted growth in this series. This could be viewed as representing the surplus in jobs as a consequence of the oil pipeline project. Furthermore, if we divide these extra jobs by total direct pipeline employment, we have what could be considered a "lower limit" oil pipeline employment multiplier.

See Table 1

The mean of the "lower limit" oil pipeline multipliers for the eight quarters in 1975 and 1976 gives us 2.21 with a standard deviation of .30.

In summary, assuming the pre-pipeline growth trend would have continued without the intervention of the trans-Alaska oil pipeline project, pipeline workers created on the average 1.21 additional jobs per worker in the economy during the project.

AN "UPPER LIMIT" OIL PIPELINE EMOLOYMENT MULTIPLIER

In this scenario we assume that the oil pipeline project is one of many events in the developing economy of Alaska. If we remove the influence of the project, the pre-pipeline growth rate of nearly six percent will slow to something less. Although this "something less" is ambiguous, given the large government component of the economy and considering the many other events which contribute to normal growth, the Alaska economy would have, at a minimum, grown along a trended pre-pipeline growth rate. Trending the pre-pipeline growth rate and extending it to 1980 has the effect of dropping growth to a slower annual rate of 3.45 percent. This by Alaska standards is very conservative. Figure 2 illustrates this situation.

Once again we can subtract the difference between the trended pre-pipeline growth rate and the actual growth in total nonagricultural employment. Dividing this series by pipeline employment we have what could be considered a high or "upper limit" oil pipeline employment multiplier.

See Table 2

The multipliers for the 8 quarters in 1975 and 1976 have a mean of 2.47 and a standard deviation of .33. This analysis, then, tells us that pipeline workers during the oil pipeline project created, at most, an additional 1.47 jobs per worker.

FIGURE 1

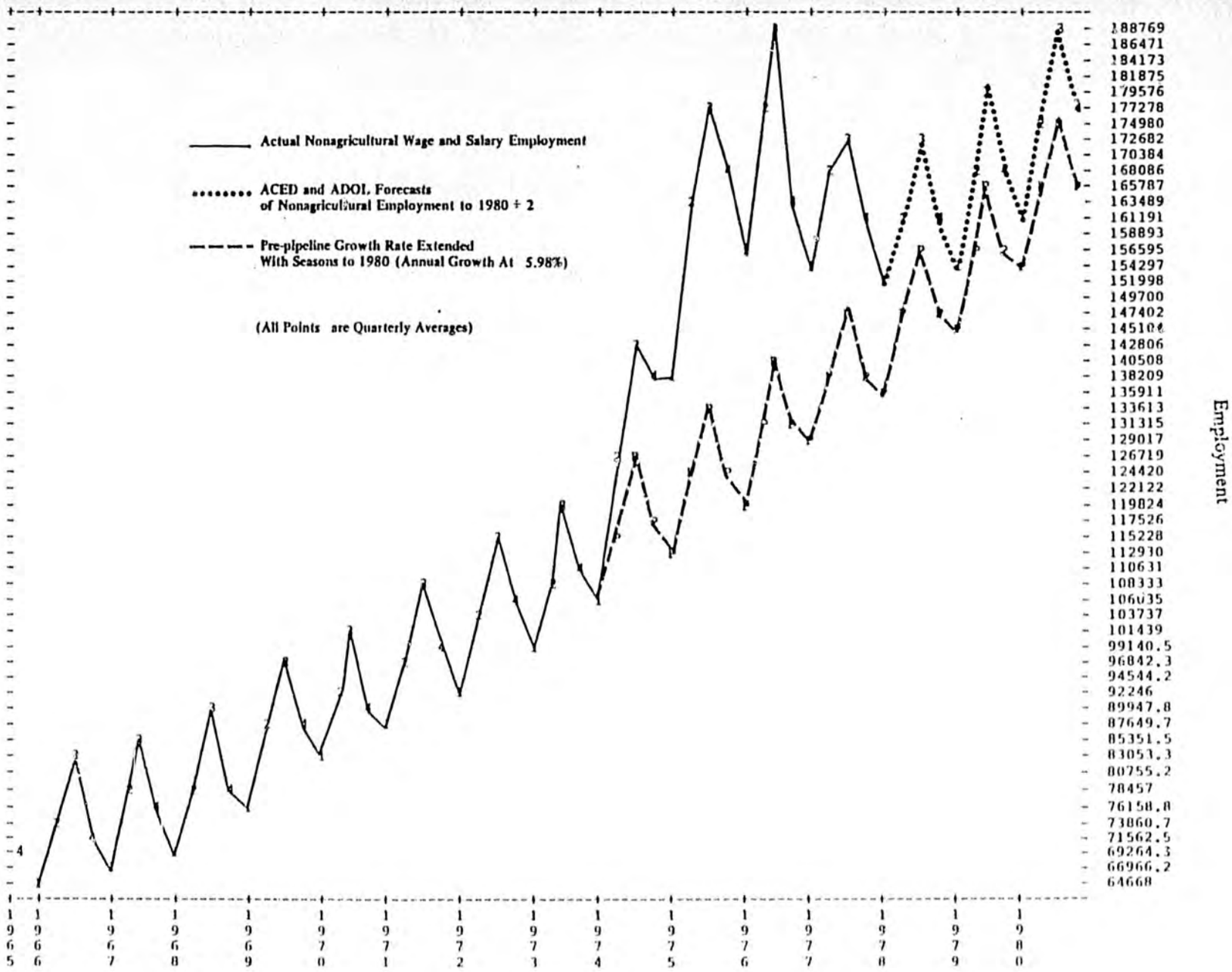
Actual Nonagricultural Wage and Salary Employment
ACED and ADOL Forecasts of Nonagricultural Employment to 1980 ÷ 2
Pre-pipeline Growth Rate Extended With Seasons to 1980 (Annual Growth At 5.98%)
(All Points are Quarterly Averages)
Employment
188769
186471
184173
181875
179576
177278
174980
172682
170384
168086
165787
163489
161191
158893
156595
154297
151998
149700
147402
145104
142806
140508
138209
135911
133613
131315
129017
126719
124420
122122
119824
117526
115228
112930
110631
108333
106035
103737
101439
99140.5
96842.3
94544.2
92246
89947.8
87649.7
85351.5
83053.3
80755.2
78457
76158.8
73860.7
71562.5
69264.3
66966.2
64668
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980

TABLE 1

	(1) Actual Non-Ag. Employment	(2) ACED + ADOL Forecasts of Non-Ag. ÷ 2	(3) Extended Pre-Pipeline Growth (5.98%) In Non-Ag. Employment	(4) Pipeline & Induced Employment (1) or (2) – (3)	(5) Total Direct Pipeline Employment	(6) Lower Limit On Pipeline Employment Multiplier (4) ÷ (5)
1975 1	137,238		113,325	23,913	13,282	1.80
2	162,574		123,279	39,295	17,559	2.24
3	178,019		133,354	44,665	23,316	1.92
4	168,925		123,393	45,532	16,387	2.78
(A)	161,689		123,338	38,351	17,636	2.17
1976 1	156,768		120,701	36,067	15,089	2.39
2	177,115		130,655	46,460	21,778	2.13
3	188,769		140,730	48,039	22,928	2.10
4	164,203		130,769	33,434	14,358	2.33
(A)	171,714		130,714	41,000	18,538	2.21
1977 1	155,406		128,518	26,888		
2	168,381		138,472	29,909		
3	173,478		148,547	24,931		
4	161,044		138,585	22,459		
(A)	164,577		138,530	26,047		
1978 1	153,000*		136,802	16,198		
2		161,908	146,756	15,152		
3		172,304	156,831	15,473		
4		160,906	146,870	14,036		
(A)		162,030	146,815	15,215		
1979 1		154,047	145,581	8,466		
2		167,115	155,535	11,580		
3		179,394	165,610	13,784		
4		167,893	155,649	12,244		
(A)		167,112	155,594	11,518		
1980 1		160,504	154,886	5,618		
2		174,732	164,840	9,982		
3		187,956	174,915	13,041		
4		176,683	164,954	11,729		
(A)		174,969	164,899	10,070		

* Preliminary estimate

FIGURE 2

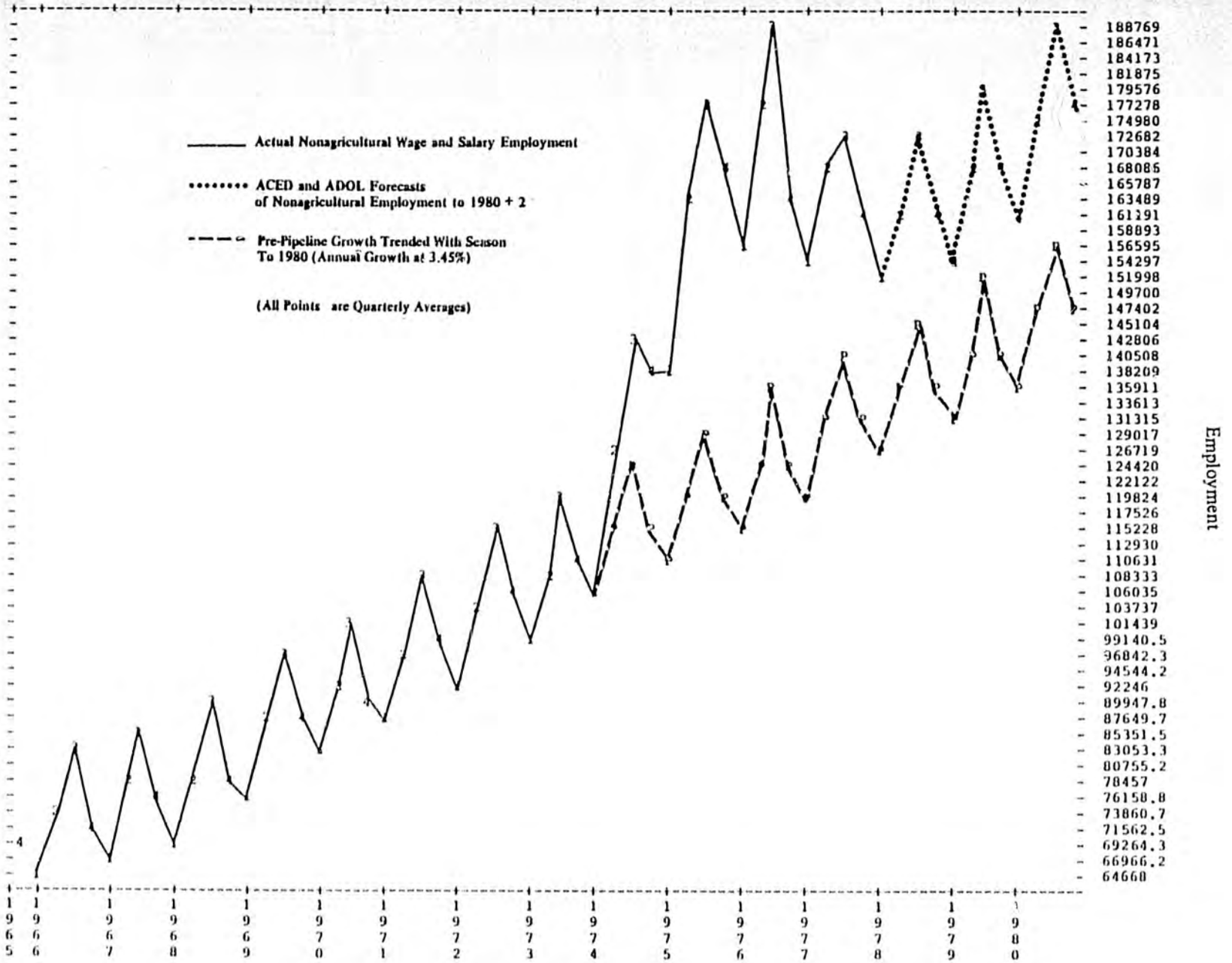
Actual Nonagricultural Wage and Salary Employment
ACED and ADOL Forecasts of Nonagricultural Employment to 1980 + 2
Pre-Pipeline Growth Trended With Season To 1980 (Annual Growth at 3.45%)
(All Points are Quarterly Averages)
Employment
188769
186471
184173
181875
179576
177278
174980
172682
170384
168086
165787
163489
161191
158893
156595
154297
151998
149700
147402
145104
142806
140508
138209
135911
133613
131315
129017
126719
124420
122122
119824
117526
115228
112930
110631
108333
106035
103737
101439
99140.5
96842.3
94544.2
92246
89947.8
87649.7
85351.5
83053.3
80755.2
78457
76158.8
73860.7
71562.5
69264.3
66966.2
64668
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980

TABLE 2

	(1) Actual Non-Ag. Employment	(2) ACED + ADOL Forecasts of Non-Ag. ÷ 2	(3) Trended Pre-Pipeline Growth (3.45%) in Non-Ag. Employment	(4) Pipeline and Induced Employment (1) or (2) −(3)	(5) Total Direct Pipeline Employment	(6) Upper Limit Oil Pipeline Employment Multiplier (4) ÷ (5)
1975 1	137,238		109,725	27,513	13,282	2.07
2	162,574		119,679	42,895	17,559	2.44
3	178,019		129,754	48,265	23,316	2.07
4	168,925		119,792	49,133	16,387	3.00
(A)	161,689		119,737	41,952	17,636	2.38
1976 1	156,768		115,124	41,644	15,089	2.76
2	177,115		125,078	52,037	21,778	2.39
3	188,769		135,152	53,617	22,928	2.34
4	164,203		125,191	39,012	14,358	2.72
(A)	171,714		125,136	46,578	18,538	2.51
1977 1	155,406		120,522	34,884		
2	168,381		130,476	37,905		
3	173,478		140,551	32,927		
4	161,044		130,590	30,454		
(A)	164,577		130,535	34,042		
1978 1	153,000*		125,921	27,079		
2		161,908	135,875	26,033		
3		172,304	145,950	26,354		
4		160,906	135,989	24,917		
(A)		162,030	135,934	26,096		
1979 1		154,047	131,320	22,727		
2		167,115	141,274	25,841		
3		179,394	151,349	28,045		
4		167,893	141,388	26,505		
(A)		167,112	141,333	25,779		
1980 1		160,504	136,719	23,785		
2		174,732	146,673	28,059		
3		187,956	156,748	31,208		
4		176,683	146,786	29,897		
(A)		174,969	146,731	28,238		

* Preliminary Estimate

A POST-PIPELINE RESIDUAL OF JOBS

The above discussion has focused on establishing a low and high oil pipeline employment multiplier for the two peak construction years of the project. Feeling comfortable with a construction phase multiplier ranging between 2.21 and 2.47, we can now take a look at the post-pipeline residual in jobs for our two scenarios.

Back to Table 1, the average post-pipeline (1978–1980) increase in jobs over the pre-pipeline extended growth trend is 12,268. This was computed by substracting the extended pre-pipeline growth trend (column 3) from the forecast series (column 2). We can do the same calculation for our slower growth scenario (Table 2). This produces a higher residual in jobs – 26,704.

At this point, we can say that the pipeline project has created somewhere between 12,300 and 26,700 post-pipeline jobs in the economy which otherwise would not have materialized.

AN EASY FORMULA FOR ESTIMATING POST-CONSTRUCTION EMPLOYMENT IMPACTS

Taking this analysis one step further, we have nearly all the information we need to construct a formula for estimating the employment impact of future projects with a character similar to the oil pipeline project. Two other pieces of information which will be needed are oil-pipeline operations and maintenance employment which is expected to stabilize at approximately 1800[2/] and an assumed employment multiplier for these occupations. An average of the "lower/upper limit" oil pipeline employment multipliers may be appropriate for this purpose, (2.34), although, using a higher or lower multiplier can be justified.

We can now create a low and high constant to be applied to historical peak construction employment for estimating the increase in jobs not related to post-construction operations:

Low Constant:

$$\frac{\text{post construction employment residual (low)} - (\text{operations} \times 2.34)}{\text{Peak oil pipeline employment}} = \frac{12268 - (1800 \times 2.34)}{23316} = .35$$

High Constant:

$$\frac{\text{post construction employment residual (high)} - (\text{operations} \times 2.34)}{\text{Peak oil pipeline employment}} = \frac{26704 - (1800 \times 2.34)}{23316} = .96$$

2/ Source: Alyeska

Using these constants, we can then construct a formula for estimating a post-construction employment residual range:

Low extimate of additional jobs:

(Peak employment X .35) + (operations X 2.34)

High estimate of additional jobs:

(Peak employment X .96) + (operations X 2.34)

IMPACT ANALYSIS

Using the lower and upper limit employment multiplier established for the construction phase of the oil-pipeline project and using our established formula for determining low and high post construction employment residuals, we can, for example, do a quick employment impact analysis of the proposed ALPETCO petrochemical complex and the gas pipeline project.

ALPETCO[3/]

Peak Employment = 3500
Operations = 1925

Gas Pipeline[4/]

Peak Employment = 9000
Operations = 400

Total Additional Jobs During Construction:

ALPECTO

Low Estimate
3500 X 2.21 = 7735

High Estimate
3500 X 2.47 = 8645

Gas Pipeline

Low Estimate
9000 X 2.21 = 19890

High Estimate
9000 X 2.47 = 22230

Total Additional Jobs After Construction:

ALPETCO

Low Estimate
(3500 X .35) + (1925 X 2.34)= 5729

High Estimate
(3500 X .96) + (1925 X 2.34) = 7864

Gas Pipeline

Low Estimate
(9000 X .35) + (400 X 2.34) = 4085

High Estimate
(9000 X .96) + (400 X 2.34) = 9576

3/ The ALPETCO petrochemical proposal: An Economic Analysis, by Scott Goldsmith and Lee Huskey, April, 1978.

4/ Author's estimate.

This quick analysis tells us a couple of important things. Assuming peak and operations employment estimates for the two projects are accurate, the ALPETCO petrochemical complex will have a relatively high post construction increase in employment compared to the construction phase of the project. The gas pipeline project on the other hand, will have a relatively small post construction influence on total employment when compared to the construction period.

DISCUSSION AND LIMITATIONS

As with all economic analysis there are always a myriad of variables and limitations which should be considered. The intent of this analysis was not to provide an answer for evaluating the impact of future economic events, but to provide a range of outcomes based on our valuable experience with the oil pipeline project. Hopefully, the employment multipliers and formulas for estimating construction and post construction employment residuals presented above will be used as a base for building and applying alternative assumptions as they come to light. The following areas should be given consideration:

The Changing Infrastructure

As the Alaska economy develops, the increase in goods producing and service industries will do much to reduce money leakages. This will result in an increasing employment multiplier. To keep things in perspective, however, multipliers of over 3.0 are uncommon in well developed economies such as Rhode Island, Wisconsin, and Illinois.5/

Also related to infrastructure is the project location. A project conducted in a dense, urban area of the state will undoubtedly circulate money in the local economy more times than a similar project in the bush.

Project Contingencies

It is often the case that large projects create enough political and national interest to spark other events which otherwise would have happened in due course. For example, the fast resolution of the Native Claims Settlement Act was sparked by the desire to build the trans-Alaska oil pipeline. The burgeoning of the Native Regional Corporations coupled with stepped-up oil exploration and development at Prudhoe Bay certainly added to employment during and after the oil pipeline project. These project contingencies suggest that the "upper limit" oil-pipeline multiplier developed in proceeding pages may be too high.

Local Hire and Operational Occupations

The local hire issue should be given some consideration in determining employment multipliers. Employing unemployed Alaskans rather than residents of other states will assure that a greater portion of wages circulate in the economy.

5/ David Reaume – Employment multiplier for increases in durable manufacturing jobs.

Another consideration is the occupations created by the new complex. Occupations demanding higher wage rates generally will create more jobs.

Project Size, Duration, and Intensity

The multipliers and formulas established in preceding pages are characteristic of a large specialized project crammed into a short time frame. A project of this character demands a very responsive support sector of which Alaskan industries are not totally able to supply. On the other hand, smaller projects of longer duration may give Alaskan industries ample time to adjust to new and increased demand for their services. This situation, needless to say, will result in higher employment multipliers.

SUMMARY

This paper has examined total employment fluctuations during the oil pipeline construction period for the purpose of establishing an acceptable and reasonable range for an employment multiplier. A formula has also been presented for calculating a high and low post construction residual in employment for future projects of similar character as the oil pipeline. Limitations of applying the oil pipeline experience to future projects have been discussed briefly. It is in the author's opinion that these considerations will have only slight changes on the coefficients expressed and for the near future these limitations will be well within the range specified by the "lower and upper limit" parameters.