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ALASKA ECONOMIC FORECAST:

1978

(including review of 1977)

Institute of Social and Economic Research
707 "A" Street, Suite 206
Anchorage, Alaska 99501

University of Alaska
Fairbanks Anchorage Juneau

Presented at Captain Cook Hotel, January 20, 1978

1977 Review

The Alaska economy "settled back" in 1977, following superheated economic growth in the previous three years. The year was certainly not a "bust," but declining employment and rising unemployment contrasted sharply with the pipeline-boom period. In the paragraphs below, we review the aggregate performance of the state economy, and also disaggregated regional and industrial activity in 1977.* We include in this review an evaluation of our 1977 forecasts.

INFLATION

Inflation in Alaska subsided in 1977, with the Anchorage Consumer Price Index (CPI) rising 6.3 percent for the year, and the October index 5.8 percent above the October 1976 level. These rates are far below the double digit levels of 1975, and very close to the U.S. inflation rate. The actual rate of inflation was almost exactly equal to our forecasted rate.**

UNEMPLOYMENT

Unemployment in Alaska rose sharply in 1977 to the highest levels ever recorded. Based on preliminary data, the average unemployment rate

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for the year was about 14.5 percent of the labor force, on a "non-CPS" basis.* Much of the increase over 1976's 10.5 percent unemployment rate directly reflects the massive pipeline layoffs. At the same time, however, there has no doubt been a general easing of the state's previously tight labor markets. Although unemployment rose throughout the state, it was exceptionally high in Fairbanks, as a direct result of pipeline completion. I.S.E.R. forecasted record unemployment in 1977, and in fact our forecasted level of 12 percent for the year was substantially exceeded.

EMPLOYMENT

The post-pipeline employment contraction has been distributed unevenly across the state's major regions, and across industries. The Fairbanks region was relatively hard-hit, with substantial declines in construction and distributive industries, while the Anchorage region seems to have suffered quite minor employment declines in sectors such as construction, with gains in other sectors, such as services and government. The remainder of the employment declines have occurred in Alaska's North, as a direct result of pipeline completion. Although

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our model has no regional detail, we suggested in our 1977 forecast that Fairbanks would be particularly hard-hit, having been the most directly impacted during pipeline construction, but forecasted employment declines in Anchorage may not have occurred.

Several sectors of the Alaska economy were very strong in 1977, in spite of less expansive economic conditions: state and local government employment grew rapidly,* as we forecast last year. Employment in finance, insurance, and real estate also increased. This sector was much stronger than we forecast, apparently continuing to respond to effects of the pipeline boom.

The construction sector contracted sharply in 1977, as forecast, as pipeline completion more than offset a strong construction performance in Anchorage. The transportation, services, and trade sectors all experienced declines in employment of varying magnitudes, although in general these declines will be smaller than forecast, based on preliminary data.

Those sectors of the Alaska economy which are not responsive to local conditions did well in 1977. Manufacturing employment was strong, in particular, as a result of an improving salmon catch, and the mining sector expanded as exploration activity increased in the Northern Gulf

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of Alaska and permanent operations personnel took over pipeline operations. Employment in the Federal government sector was steady at the 1976 level. We forecasted strength in the "exogenous" sectors in 1977, except for Federal government, but, as we pointed out last year, the forecasts of these sectors are not based on results from our econometric model.

In summary, 1977 was a year of transition for the Alaska economy. As the "post-pipeline" era began, those sectors and regions of the state economy most affected by the pipeline boom were also the most affected by pipeline completion. In terms of our overall forecasts, unemployment did reach record levels, prices rose as fast as we had predicted, but employment declined less than we forecast.* In particular, the Anchorage economy was stronger than forecast.

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*Two reasons employment declined less than anticipated are: first, the Alyeska consortium employed many more pipeline workers in 1977 than we had anticipated; and second, state and local government employment was revised sharply upward in 1977 after our forecast.

1978 Forecast

The Alaska economy will again "mark time" in 1978. With the oil pipeline completed and with no major gas pipeline construction scheduled in 1978, the economy will settle back a little more this year.

UNEMPLOYMENT

Unemployment will remain high in 1978 at the record levels of 1977, with the unemployment rate in the first quarter of 1978 exceeding 17 percent* of the labor force (see highlights box and Table 1). The annual average for the year will be almost identical to 1977, as the last half of 1978 should witness lower unemployment rates than the last half of 1977.

INFLATION

Prices will rise more slowly in 1978 than in 1977, as measured by the Anchorage CPI.** By the end of 1977, inflation had slowed to under 6 percent; and in 1978, it will further decelerate to about 4.5 percent. This will be the best inflation performance since 1973 and reflects further slackening in the economy.

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*Non-CPS adjusted method.

**New index to be issued in mid-1978.

HIGHLIGHTS BOX

1978 FORECAST HIGHLIGHTS

• EMPLOYMENT: (Civilian Wage and Salary)	Down 4% compared to 1977
• PRICES: (Anchorage C.P.I.)	4.5% higher in 1978 4.7% for fourth quarter of 1978
• UNEMPLOYMENT	14.4% for 1978 17.5% for first quarter of 1978

Table 1. ALASKA ECONOMIC FORECAST FOR 1978

Year: Quarter	Unemployment Rate**	Anchorage C.P.I.	Civilian Wage and Salary Employment	Trade Employment	Services Employment	Construction Employment	Transportation, Communication, and Utilities Employment	Finance, Insurance and Real Estate Employment	State and Local Government Employment
1977: 1	15.7%*	169.4†	155,406*	26,271*	26,740*	18,953*	14,695*	7,281*	31,096*
2	15.2%*	172.6†	166,941	27,263	26,853	23,476	15,014	7,176	32,094
3	12.7%*	177.4†	168,543	27,030	24,779	20,800	14,443	6,803	33,560
4	15.2%	177.3†	146,803	24,666	21,829	13,706	13,085	6,419	34,370
1977 Average	14.7%	174.2†	159,423	26,307	25,050	19,234	14,309	6,920	32,780
1978: 1	17.5%	179.0	139,973	22,827	21,094	11,180	13,014	6,137	34,085
2	14.5%	180.5	154,094	24,873	22,754	14,228	13,865	5,971	35,731
3	12.0%	182.8	164,357	25,534	22,709	16,838	14,492	5,985	35,493
4	13.7%	185.6	150,531	24,803	21,977	14,457	13,708	6,088	35,625
1978 Average	14.4%	182.0	152,239	24,509	22,134	14,176	13,770	6,045	35,234
Change from 1977	--	+ 4.5%	- 4.5%	- 6.8%	- 11.6%	- 26.3%	- 3.8%	- 12.6%	+ 7.5%

*Preliminary data supplied to I.S.E.R. by Research and Analysis Division, Department of Labor, State of Alaska, and Department of Labor, Statistical Quarterly.

**Old reporting method (non-CPS).

†Actual.

EMPLOYMENT

Employment will also fall in 1978, although by a smaller percentage than in 1977. The forecasted 4 percent decline will again be spread unevenly across industries. However, by the fourth quarter of 1978, employment should be higher than 1977, even with no gasline construction.

Employment will fall most sharply in the construction sector, since 1977 construction employment included a substantial number of pipeline workers, prolonged by the reconstruction of Pump Station 8, and there will be very little of this employment in 1978. The residential construction sector will also probably be weaker in 1978. The employment decline is forecast at 26 percent. Excluding Alyeska employment, however, the construction sector employment will fall by 14 percent.

Employment in support sectors will generally show small declines from 1977. Communications, public utilities, and transportation employment will decline only slightly in 1978 (4 percent), while employment in trade (7 percent) and services (12 percent) will fall somewhat more sharply. The larger decline in services reflects the fact that a substantial number of Alyeska employees are included in the services sector. The model also projects a decline in employment in the finance, insurance, and real estate sector (12 percent); but this sector will probably remain flat in 1978.

The state and local government sector will again grow in 1978, mainly as a result of a growing state budget. Employment in state and local government is forecast to rise about 7 percent over 1977.

Employment in Alaska's "export" sectors is forecast separately from the model (see Appendix). We are forecasting higher employment in mining (mainly oil and gas) and in agriculture, forestry, and fisheries. Employment in manufacturing should also rise with a better salmon harvest. Employment in Federal government should again be steady at 1977 levels.

Overall, the 1978 picture is one of modest declines in employment, continued high unemployment, and a slowing of inflation. By the end of 1978, however, the economy will have completed its "post-pipeline transition" and will be growing again.

APPENDIX A

DESCRIPTION AND BACKGROUND OF I.S.E.R.'s QUARTERLY ECONOMETRIC MODEL

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APPENDIX A

Description and Background of I.S.E.R.'s Quarterly Econometric Model[1]

The state of Alaska is receiving hundreds of millions of dollars per year in royalties and taxes from Prudhoe Bay oil production. The long-term consequences of this massive flow of "petrodollars" have been studied by the Institute of Social and Economic Research at the University of Alaska for the past four years. Several long-run, policy-oriented econometric models of the state have been constructed. These models are driven by resource development scenarios, which project the employment and revenue impacts of further development of Alaska's petroleum resources, and by state expenditures, a key policy variable which, given the massive "petrodollar" flows, can be manipulated by policymakers with major effects on the economy.[2]

Long-term models of Alaska's economy tend to show relatively smooth and steady growth. Yet quite recent experience is demonstrating once again the "boom-bust" elements in the Alaska economy. In order to capture the short-run characteristics of the Alaska economy, a quarterly

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[1] A more detailed and technical discussion of model construction, estimation, and testing is contained in Daniel A. Seiver, "A Quarterly Model of the Alaska Economy," February 1977. This model was created using the TROLL system of the National Bureau of Economic Research, Inc.

[2] David T. Kresge et al, Issues in Alaska Development, forthcoming, 1978, University of Washington Press.

econometric model has been constructed and has been tested against historical data and used for the forecast discussed above.

The structure of the model is diagrammed in Figure A.1. The symbolic notation can be decoded by referring to the symbol dictionary on page A-4. All "Q" suffixes have been deleted from Figure A.1 to simplify the diagram.

Employment in Alaska's support sectors is a function of local demand, which is measured by real disposable personal income (DPIRQS). Almost all the demand-employment relations contain seasonal dummies, reflecting the highly seasonal nature of the Alaska economy. Those variables which do not exhibit seasonal variation are marked with an asterisk.[3] Several support sector employment equations have slightly differing specifications. During the historical period, much of the communications network was turned over to private industry by the Federal government, and a special dummy has been added to the communications employment equation to account for this transfer. The transport sector, particularly trucking and air transport, has been exogenously affected by oil development and pipeline construction: a special dummy has been added to the transport employment equation to capture this effect. During a major project construction boom, construction employment has a large exogenous component (ECONXQ)

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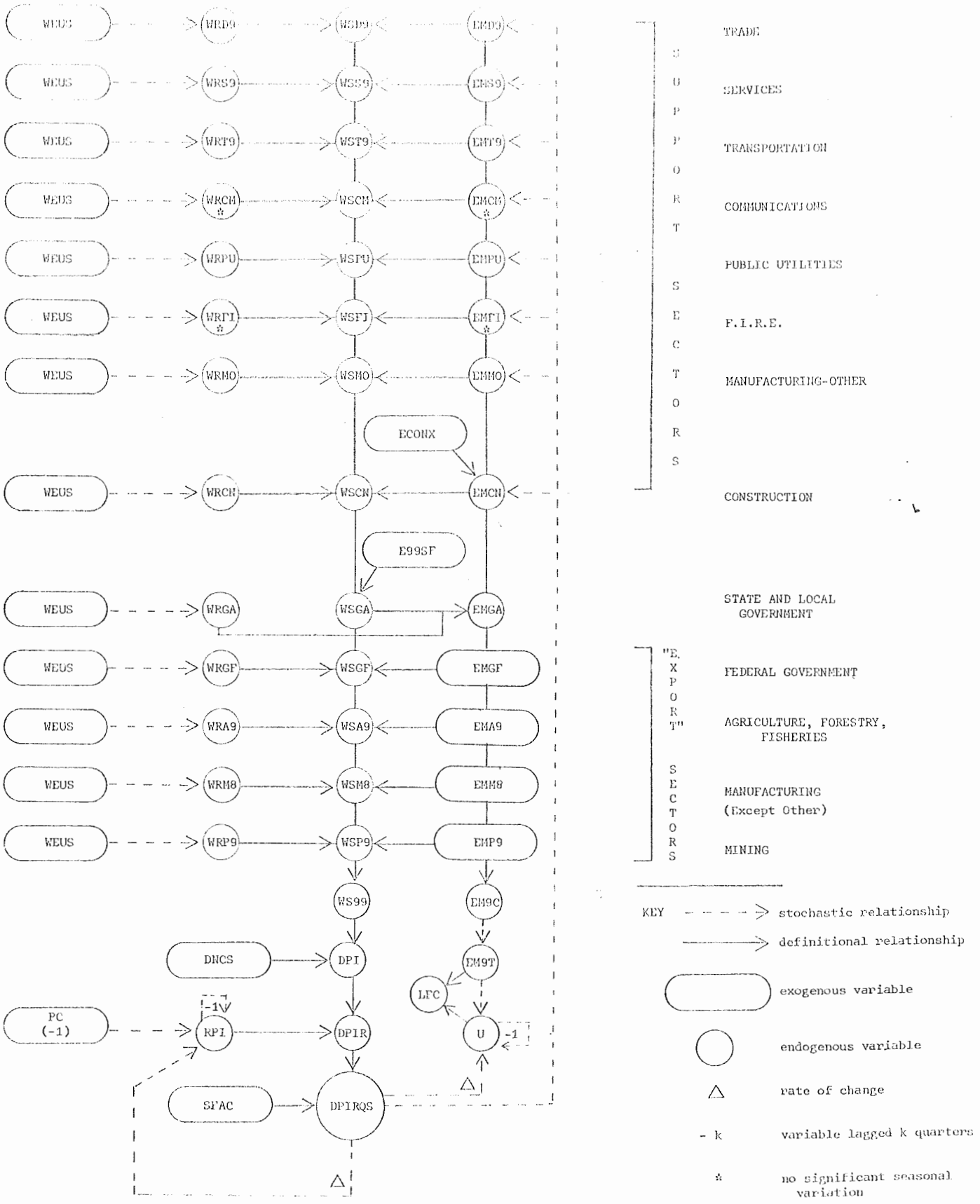
[3] Appendix B, listing all the equations in the model and containing regression results for all stochastic equations, is available from I.S.E.R. In some cases, lagged values of right-hand side variables have been included in the equations.

Figure A.1


WEUS
WRD9
WSD9
EMD9
WRS9
WSS9
EMS9
WRT9
WST9
EMT9
WRCM
WSCM
EMCM
WRPU
WSPU
EMPU
WRFI
WSFI
EMFI
WRMO
WSMO
EMMO
ECONX
WRCN
WSCN
EMCN
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WRGA
WSGA
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WRA9
WSA9
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WSP9
EMP9
WS99
EM9C
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RPI
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SFAC
DPIRQS
TRADE
SERVICES
TRANSPORTATION
COMMUNICATIONS
PUBLIC UTILITIES
F.I.R.E.
MANUFACTURING-OTHER
CONSTRUCTION
STATE AND LOCAL GOVERNMENT
"EXPORT" SECTORS
FEDERAL GOVERNMENT
AGRICULTURE, FORESTRY, FISHERIES
MANUFACTURING (Except Other)
MINING
KEY
stochastic relationship
definitional relationship
exogenous variable
endogenous variable
rate of change
- k
variable lagged k quarters
*
no significant seasonal variation

SYMBOL DICTIONARY

Sector	Symbol	Sector	Symbol
Ag., For., Fish.	A9	Manufacturing (except other)	M8
Communications	CM	Mining	P9
Construction	CN	Public Utilities	PU
Federal Government	GF	Services	S9
Federal Military	GM	State and Local Government	SL
F.I.R.E.	FI	Trade	D9
Manufacturing (Other)	MO	Transport	T9

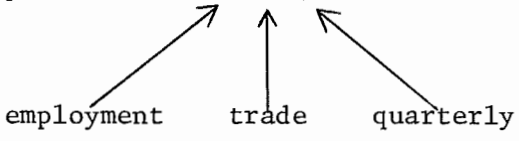
OTHER VARIABLES

Symbol	Name	Symbol	Name
DNCSQ	Federal Payment for Alaska Native Claims Settlement Act	PC	U.S.C.P.I.
DPIQ	Disposable Personal Income	RPIQ	Alaska Relative Price Index
DPIRQ	Real Disposable Personal Income	S(i)	Seasonal Dummy for ith Quarter (i-1,2,3)
DPIRQS	DPIRQ Seasonally Adjusted	SFAC	Seasonal Adjustment Factors
E99SFQ	State Government Non-Capital Expenditures	UQ	Unemployment
ECONXQ	Exogenous Construction Employment	URATE	Unemployment Rate
EM9CQ	Civilian Employment	WEUSQ	U.S. Average Weekly Earnings
LFCQ	Civilian Labor Force	WS99Q	Total Wages and Salaries
		XCN	ECONXQ/EMCNQ

VARIABLE PREFIXES

Coefficient - C
Employment - EM
Wage Rate - WR
Wages and Salaries - WS
Rate of Change - DEL (Δ)

Example: EMD9Q



which is forecast separately, based on periodic employment and employment projection reports obtained from the construction companies. The endogenous component of construction is estimated using the standard support sector specification, and exogenous construction employment is added to determine total construction employment.

Wage rates (average earnings per quarter) in the support sectors are functions of U.S. quarterly average weekly earnings (WEUSQ). Most of the historical variation in support sector wage rates can be explained with this variable and seasonal dummy variables. However, the pipeline construction boom has had a major impact on all wage rates in Alaska. To capture this effect, a dummy variable, ECONXQ/EMCNQ, has been added to most wage rate equations.

The "export" sectors of the model have exogenously determined employment levels, but endogenously determined wage rates. Federal government employment has changed relatively little over the historical period. Most of the manufacturing employment in Alaska consists of food (fish) processing (45 percent of 1975 manufacturing employment) and lumber and paper manufacturing (35 percent of 1975 manufacturing employment). Most lumber and paper output is exported to Japan, and food processing employment depends crucially on the sizes of the relevant harvests of fish. It is thus not feasible to tie what manufacturing employment Alaska does have to the national economy. The remainder of manufacturing employment is responsive to local demand and is treated as a support sector.

Agriculture, forestry, and fisheries is a heterogenous sector for which employment is also determined outside the model. Alaska has almost no agriculture. Forestry employment is heavily dependent on supply management considerations, and fisheries employment depends on supply considerations also. Total employment in agriculture, forestry, and fisheries comprises less than one percent of total civilian employment.

Mining employment in Alaska is essentially petroleum employment, which is not sensitive to either local or national aggregate demand conditions. Independent projections of mining employment are contained in the resource development scenarios of I.S.E.R.'s long-run models.

The state and local government sector is the policy sector of this model. Most of the variation in state and in local government wages and salaries can be explained by fiscal year state non-capital expenditures. Thus, altering the level of the state budget has a direct impact on wages and salaries in the government sector, and thus has an indirect impact on support sector employment. Employment in the state and local government sector is defined as the ratio of wages and salaries to the wage rate, which is determined by U.S. earnings and local prices. I.S.E.R. has estimated state non-capital expenditures for fiscal year 1977 at $740 million and fiscal 1978, $900 million, which reflects the first receipts of "petrodollars."

An estimate of Federal military employment is subtracted from the sum of sector employment totals to determine total civilian wage and

salary employment. Total wages and salaries is similarly the sum of all sectors' wages and salaries. Disposable personal income is determined by the relationship between wages and salaries and disposable personal income estimated on an annual basis. Disposable personal income is then deflated by an Alaska relative price index (RPIQ) to determine real disposable personal income, and this quantity is then seasonally adjusted, based on historical seasonal adjustment factors. The use of seasonally adjusted disposable personal income in the support sector employment equations provides an unambiguous interpretation of the seasonal dummy variables in those equations.

The Alaska relative price index is a regionally weighted function of the Anchorage, Alaska, consumer price index, with an adjustment made to reflect the difference in the level of prices between Alaska and the rest of the United States. Since Alaska produces almost no consumer or producer goods, much of the variation in Alaska prices can be explained by U.S. prices. Since 1961, Alaska prices have risen more slowly than U.S. prices, reflecting reductions in transport costs and scale economies. The recent boom in Alaska has shown, however, that local demand conditions can affect prices, and during the 1975-76 period, prices rose faster in Alaska than in the U.S. Thus, the price level equation contains a proxy for the rate of growth of local demand. In addition, in a quarterly model, it is appropriate to specify a lagged response of Alaska prices to U.S. prices. The assumed geometric lag structure gives the familiar lagged

dependent variable on the right-hand side; in addition, the regression was improved by lagging the U.S.C.P.I. by one quarter.

The modeling of the state's labor market has been a difficult task. No estimates of quarterly state population are available,[4] and interpolations are misleading since there is an important seasonal component in net interstate migration to Alaska. Population is, therefore, not an input in the determination of the labor force. Labor force is defined as the sum of total employment and unemployment. Total employment is essentially civilian wage and salary employment adjusted for self-employed and multiple job holders and is thus a function of EM9CQ. Unemployment is a function of employment, seasonal dummies, the rate of growth of employment, a special dummy to account for a (1970) change in data collection methodology, and the level of unemployment in the previous quarter.

The quarterly model has been estimated by ordinary least squares regression. The historical period begins with 1965:1 and ends with 1977:1.

Historical simulations have been run for the 1966:1 to 1977:1 period, years of rapid but uneven growth in the Alaska economy. Figures A.2 to A.5 graph the simulated results for the historical period against the actual data, for four key variables in the model. Table A.1 lists the measures of "goodness of fit" for each variable determined within the model. These measures can show how well the model "tracks" the historical period.

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[4] The annual Census Bureau estimates of the state's population may be radically revised in the near future. Our unemployment numbers are, therefore, based on the "non-CPS-adjusted" series.

Figure A.2

NON-AGRICULTURAL WAGE
AND SALARY EMPLOYMENT

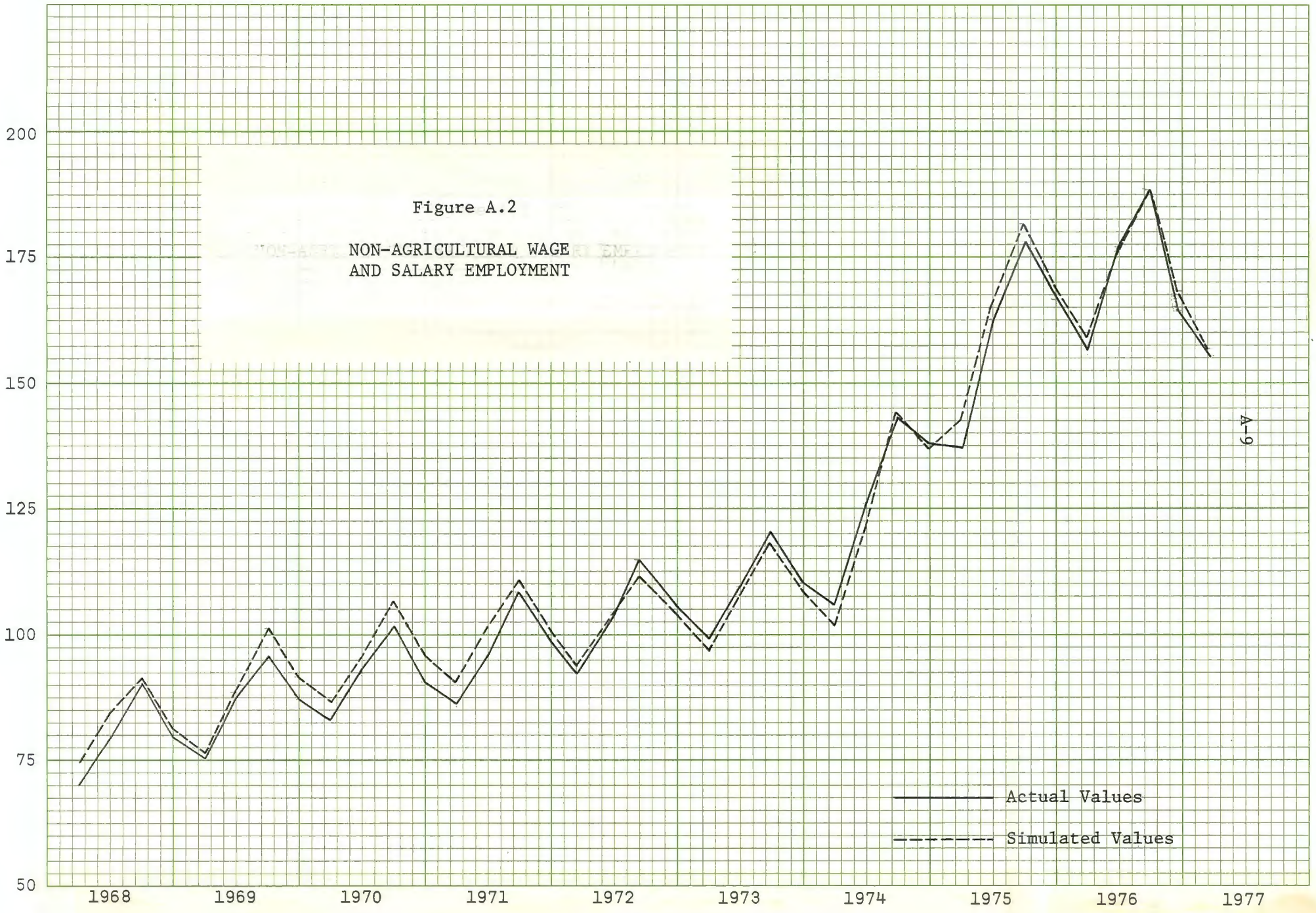

Figure A.3

TOTAL WAGES AND SALARIES

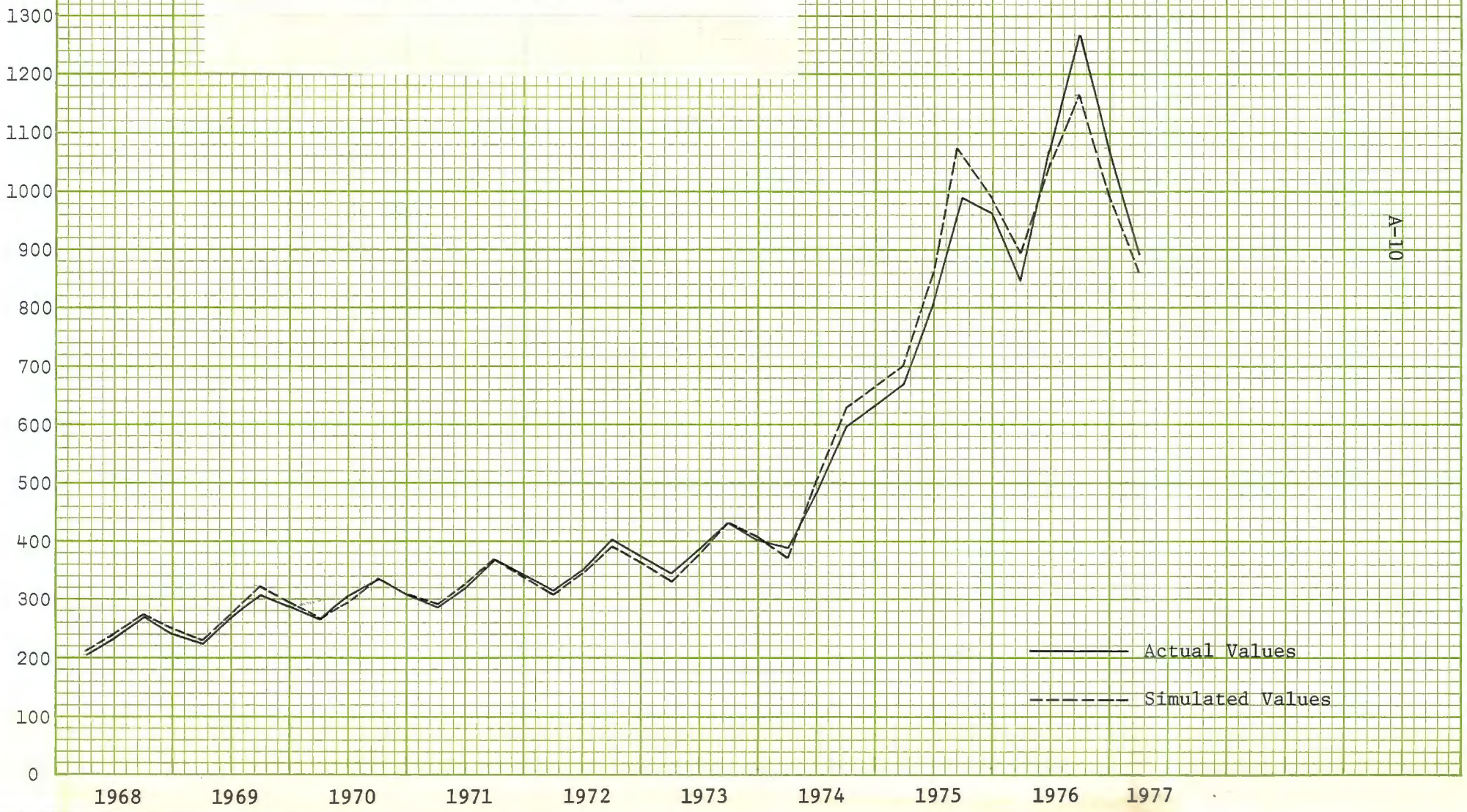

Figure A.4

UNEMPLOYMENT RATE

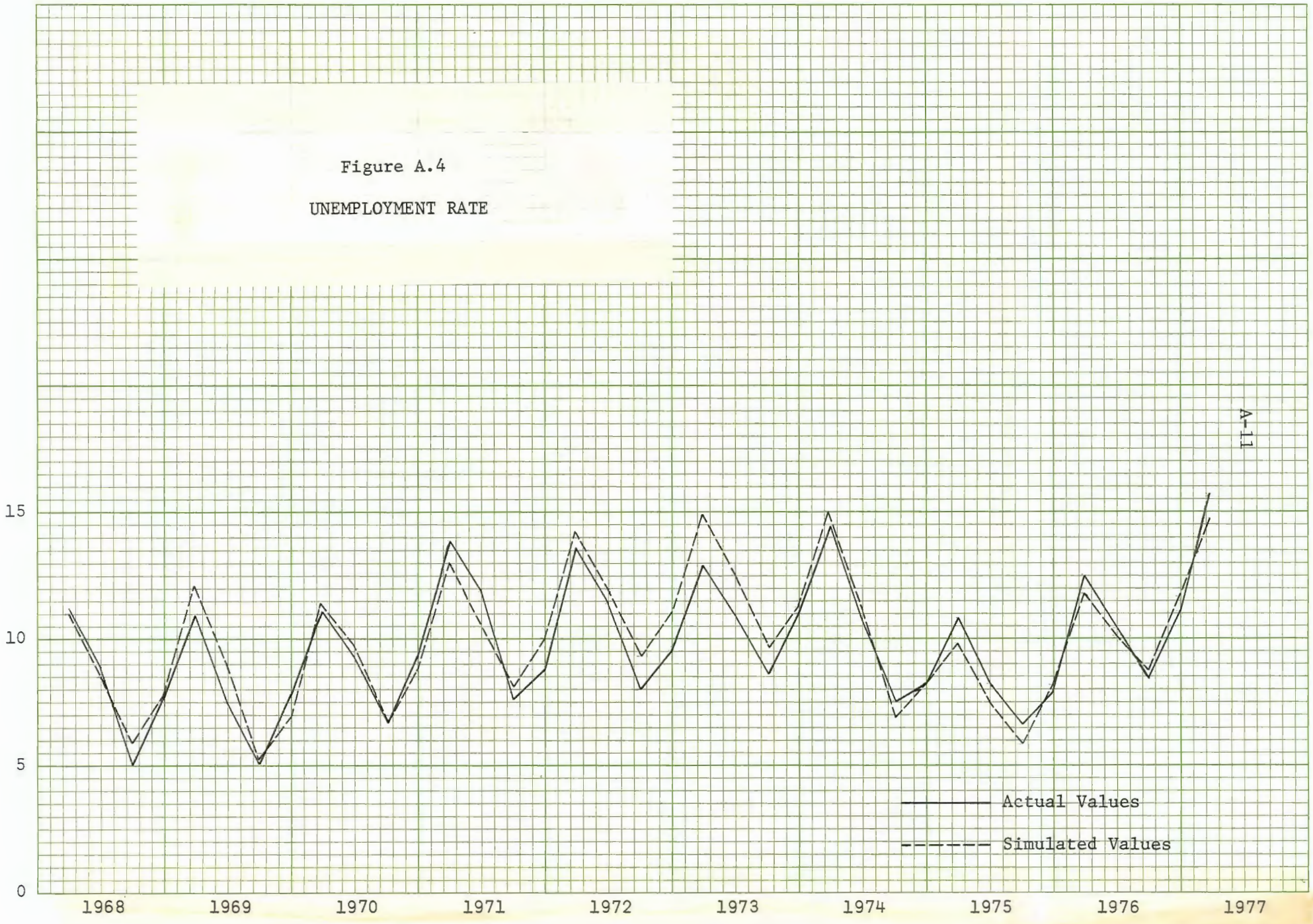

Figure A.5

RELATIVE PRICE INDEX

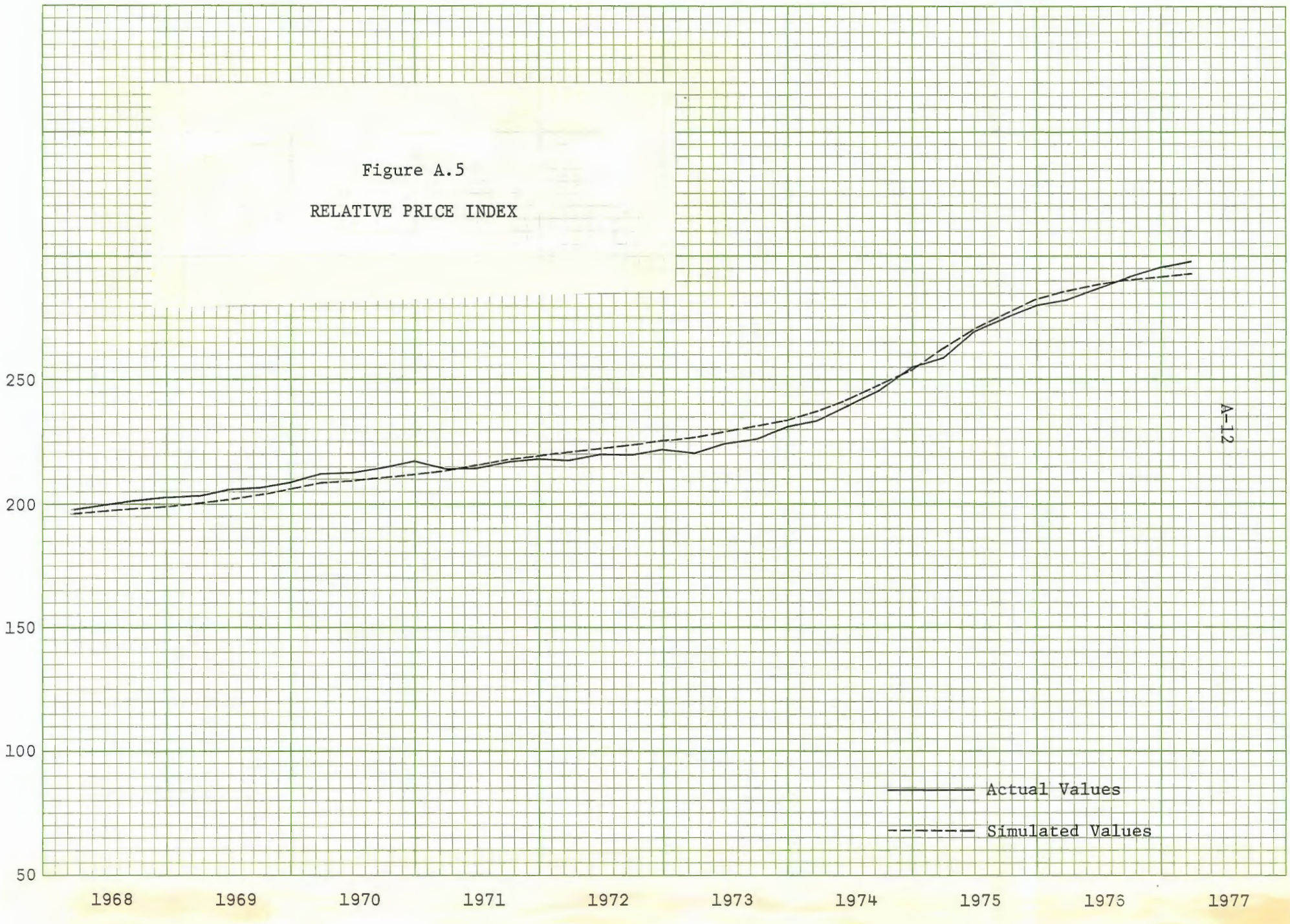

Table A.1

HISTORICAL SIMULATION STATISTICS

Variable	R.M.S.P.E.[a]	M.A.P.E.[b]	Variable	R.M.S.P.E.[a]	M.A.P.E.[b]
EMS9Q	6.52	5.30	WSSLQ	6.61	5.37
EMCNQ	10.55	7.75	WRS9Q	5.98	4.67
EMFIQ	9.44	8.10	WRCNQ	7.47	5.94
EMPUQ	7.33	6.58	WRFIQ	3.09	2.64
EMCMQ	5.97	4.85	WRPUQ	4.93	3.71
EMMOQ	5.88	4.82	WRCMQ	6.92	5.81
EMT9Q	5.01	3.80	WRA9Q	17.50	13.57
EMD9Q	4.40	3.42	WRP9Q	4.96	4.05
DPIRQS	3.93	3.38	WRGFQ	4.49	3.73
RPIQ	1.71	1.43	WRT9Q	5.07	3.83
WS99Q	3.62	2.93	WRD9Q	1.96	1.46
LFCQ	2.83	2.30	WRMOQ	4.69	3.84
EM9CQ	3.28	2.70	WRM8Q	5.03	4.14
URATE	10.38	8.36	WRSLQ	4.36	3.46

[a] $$R.M.S.P.E. = \left[\frac{\sum_i \left[\frac{(A_i - P_i)}{A_i} \right]^2}{N} \right]^{\frac{1}{2}} \cdot 100$$

[b] $$M.A.P.E. = \frac{\sum_i \left[\frac{|A_i - P_i|}{A_i} \right]}{N} \cdot 100$$

A_i = actual value in quarter i

P_i = predicted value in quarter i

N = number of observations

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Prices will rise more slowly in 1978 than in 1977, as measured by the Anchorage CPI.** By the end of 1977, inflation had slowed to under 6 percent; and in 1978, it will further decelerate to about 4.5 percent. This will be the best inflation performance since 1973 and reflects further slackening in the economy.

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*Non-CPS adjusted method.

**New index to be issued in mid-1978.

HIGHLIGHTS BOX

1978 FORECAST HIGHLIGHTS

• EMPLOYMENT: (Civilian Wage and Salary)	Down 4% compared to 1977
• PRICES: (Anchorage C.P.I.)	4.5% higher in 1978 4.7% for fourth quarter of 1978
• UNEMPLOYMENT	14.4% for 1978 17.5% for first quarter of 1978

Table 1. ALASKA ECONOMIC FORECAST FOR 1978

Year: Quarter	Unemployment Rate**	Anchorage C.P.I.	Civilian Wage and Salary Employment	Trade Employment	Services Employment	Construction Employment	Transportation, Communication, and Utilities Employment	Finance, Insurance and Real Estate Employment	State and Local Government Employment
1977: 1	15.7%*	169.4†	155,406*	26,271*	26,740*	18,953*	14,695*	7,281*	31,096*
2	15.2%*	172.6†	166,941	27,263	26,853	23,476	15,014	7,176	32,094
3	12.7%*	177.4†	168,543	27,030	24,779	20,800	14,443	6,803	33,560
4	15.2%	177.3†	146,803	24,666	21,829	13,706	13,085	6,419	34,370
1977 Average	14.7%	174.2†	159,423	26,307	25,050	19,234	14,309	6,920	32,780
1978: 1	17.5%	179.0	139,973	22,827	21,094	11,180	13,014	6,137	34,085
2	14.5%	180.5	154,094	24,873	22,754	14,228	13,865	5,971	35,731
3	12.0%	182.8	164,357	25,534	22,709	16,838	14,492	5,985	35,493
4	13.7%	185.6	150,531	24,803	21,977	14,457	13,708	6,088	35,625
1978 Average	14.4%	182.0	152,239	24,509	22,134	14,176	13,770	6,045	35,234
Change from 1977	--	+ 4.5%	- 4.5%	- 6.8%	- 11.6%	- 26.3%	- 3.8%	- 12.6%	+ 7.5%

*Preliminary data supplied to I.S.E.R. by Research and Analysis Division, Department of Labor, State of Alaska, and Department of Labor, Statistical Quarterly.

**Old reporting method (non-CPS).

†Actual.

EMPLOYMENT

Employment will also fall in 1978, although by a smaller percentage than in 1977. The forecasted 4 percent decline will again be spread unevenly across industries. However, by the fourth quarter of 1978, employment should be higher than 1977, even with no gasline construction.

Employment will fall most sharply in the construction sector, since 1977 construction employment included a substantial number of pipeline workers, prolonged by the reconstruction of Pump Station 8, and there will be very little of this employment in 1978. The residential construction sector will also probably be weaker in 1978. The employment decline is forecast at 26 percent. Excluding Alyeska employment, however, the construction sector employment will fall by 14 percent.

Employment in support sectors will generally show small declines from 1977. Communications, public utilities, and transportation employment will decline only slightly in 1978 (4 percent), while employment in trade (7 percent) and services (12 percent) will fall somewhat more sharply. The larger decline in services reflects the fact that a substantial number of Alyeska employees are included in the services sector. The model also projects a decline in employment in the finance, insurance, and real estate sector (12 percent); but this sector will probably remain flat in 1978.

The state and local government sector will again grow in 1978, mainly as a result of a growing state budget. Employment in state and local government is forecast to rise about 7 percent over 1977.

Employment in Alaska's "export" sectors is forecast separately from the model (see Appendix). We are forecasting higher employment in mining (mainly oil and gas) and in agriculture, forestry, and fisheries. Employment in manufacturing should also rise with a better salmon harvest. Employment in Federal government should again be steady at 1977 levels.

Overall, the 1978 picture is one of modest declines in employment, continued high unemployment, and a slowing of inflation. By the end of 1978, however, the economy will have completed its "post-pipeline transition" and will be growing again.

APPENDIX A

DESCRIPTION AND BACKGROUND OF I.S.E.R.'s QUARTERLY ECONOMETRIC MODEL

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Fairbanks Anchorage Juneau

APPENDIX A

Description and Background of I.S.E.R.'s Quarterly Econometric Model[1]

The state of Alaska is receiving hundreds of millions of dollars per year in royalties and taxes from Prudhoe Bay oil production. The long-term consequences of this massive flow of "petrodollars" have been studied by the Institute of Social and Economic Research at the University of Alaska for the past four years. Several long-run, policy-oriented econometric models of the state have been constructed. These models are driven by resource development scenarios, which project the employment and revenue impacts of further development of Alaska's petroleum resources, and by state expenditures, a key policy variable which, given the massive "petrodollar" flows, can be manipulated by policymakers with major effects on the economy.[2]

Long-term models of Alaska's economy tend to show relatively smooth and steady growth. Yet quite recent experience is demonstrating once again the "boom-bust" elements in the Alaska economy. In order to capture the short-run characteristics of the Alaska economy, a quarterly

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[1] A more detailed and technical discussion of model construction, estimation, and testing is contained in Daniel A. Seiver, "A Quarterly Model of the Alaska Economy," February 1977. This model was created using the TROLL system of the National Bureau of Economic Research, Inc.

[2] David T. Kresge et al, Issues in Alaska Development, forthcoming, 1978, University of Washington Press.

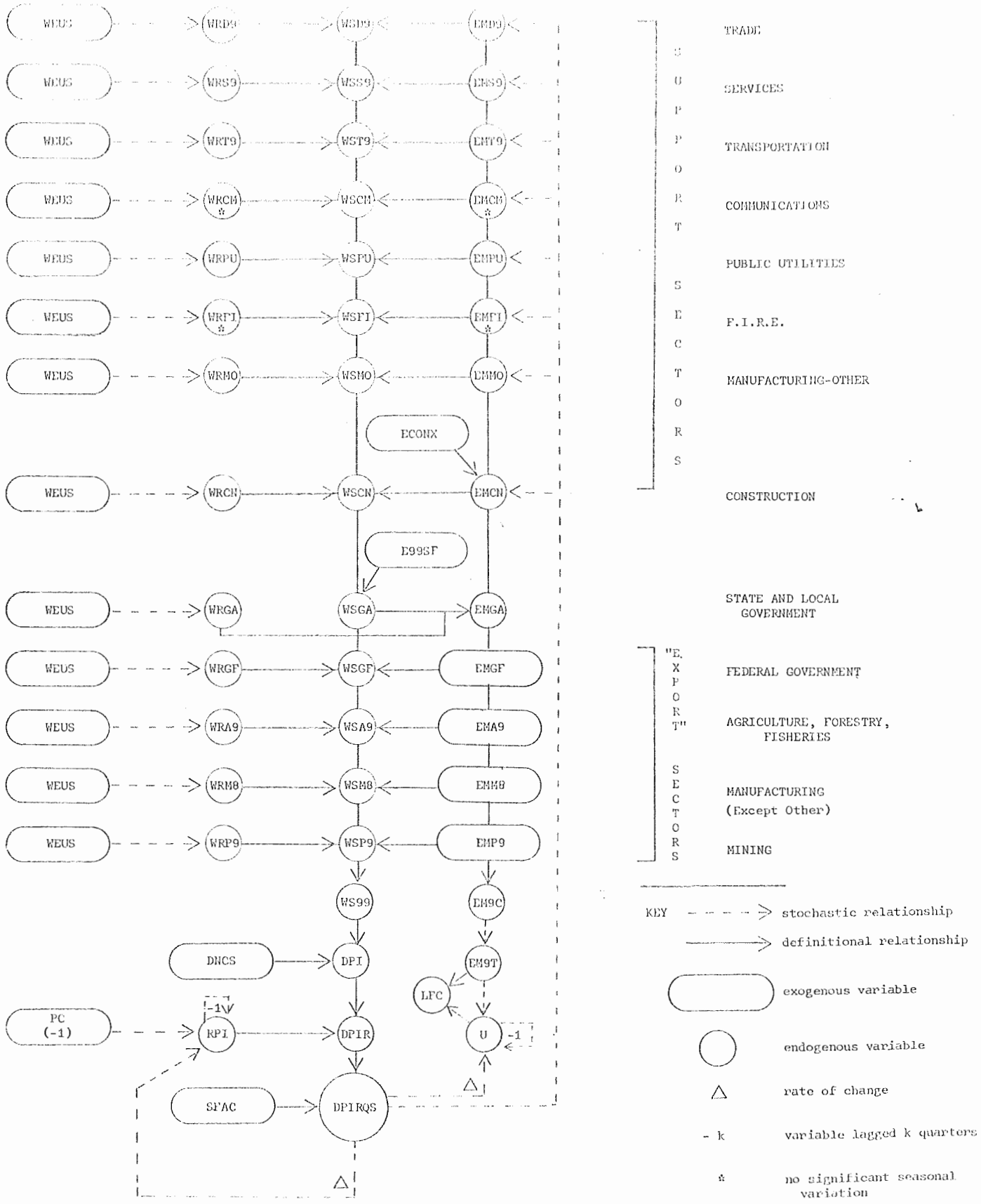
econometric model has been constructed and has been tested against historical data and used for the forecast discussed above.

The structure of the model is diagrammed in Figure A.1. The symbolic notation can be decoded by referring to the symbol dictionary on page A-4. All "Q" suffixes have been deleted from Figure A.1 to simplify the diagram.

Employment in Alaska's support sectors is a function of local demand, which is measured by real disposable personal income (DPIRQS). Almost all the demand-employment relations contain seasonal dummies, reflecting the highly seasonal nature of the Alaska economy. Those variables which do not exhibit seasonal variation are marked with an asterisk.[3] Several support sector employment equations have slightly differing specifications. During the historical period, much of the communications network was turned over to private industry by the Federal government, and a special dummy has been added to the communications employment equation to account for this transfer. The transport sector, particularly trucking and air transport, has been exogenously affected by oil development and pipeline construction: a special dummy has been added to the transport employment equation to capture this effect. During a major project construction boom, construction employment has a large exogenous component (ECONXQ)

[3] Appendix B, listing all the equations in the model and containing regression results for all stochastic equations, is available from I.S.E.R. In some cases, lagged values of right-hand side variables have been included in the equations.

Figure A.1


WEUS
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WSD9
EMD9
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WSCM
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WSPU
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WRFI
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WRMO
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ECONX
WRCN
WSCN
EMCN
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WRGA
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EMM8
WRP9
WSP9
EMP9
WS99
EM9C
DNCS
DPI
EM9T
LFC
PC
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-1
SFAC
DPIRQS
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△
SUPPORT SECTORS
TRADE
SERVICES
TRANSPORTATION
COMMUNICATIONS
PUBLIC UTILITIES
F.I.R.E.
MANUFACTURING-OTHER
CONSTRUCTION
STATE AND LOCAL GOVERNMENT
"EXPORT" SECTORS
FEDERAL GOVERNMENT
AGRICULTURE, FORESTRY, FISHERIES
MANUFACTURING (Except Other)
MINING
KEY
stochastic relationship
definitional relationship
exogenous variable
endogenous variable
△ rate of change
- k variable lagged k quarters
* no significant seasonal variation

SYMBOL DICTIONARY

Sector	Symbol	Sector	Symbol
Ag., For., Fish.	A9	Manufacturing (except other)	M8
Communications	CM	Mining	P9
Construction	CN	Public Utilities	PU
Federal Government	GF	Services	S9
Federal Military	GM	State and Local Government	SL
F.I.R.E.	FI	Trade	D9
Manufacturing (Other)	MO	Transport	T9

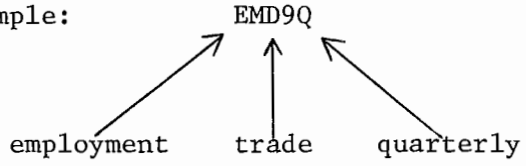
OTHER VARIABLES

Symbol	Name	Symbol	Name
DNCSQ	Federal Payment for Alaska Native Claims Settlement Act	PC	U.S.C.P.I.
DPIQ	Disposable Personal Income	RPIQ	Alaska Relative Price Index
DPIRQ	Real Disposable Personal Income	S(i)	Seasonal Dummy for ith Quarter (i-1,2,3)
DPIRQS	DPIRQ Seasonally Adjusted	SFAC	Seasonal Adjustment Factors
E99SFQ	State Government Non-Capital Expenditures	UQ	Unemployment
ECONXQ	Exogenous Construction Employment	URATE	Unemployment Rate
EM9CQ	Civilian Employment	WEUSQ	U.S. Average Weekly Earnings
LFCQ	Civilian Labor Force	WS99Q	Total Wages and Salaries
		XCN	ECONXQ/EMCNQ

VARIABLE PREFIXES

Coefficient - C
Employment - EM
Wage Rate - WR
Wages and Salaries - WS
Rate of Change - DEL (Δ)

Example: EMD9Q



which is forecast separately, based on periodic employment and employment projection reports obtained from the construction companies. The endogenous component of construction is estimated using the standard support sector specification, and exogenous construction employment is added to determine total construction employment.

Wage rates (average earnings per quarter) in the support sectors are functions of U.S. quarterly average weekly earnings (WEUSQ). Most of the historical variation in support sector wage rates can be explained with this variable and seasonal dummy variables. However, the pipeline construction boom has had a major impact on all wage rates in Alaska. To capture this effect, a dummy variable, ECONXQ/EMCNQ, has been added to most wage rate equations.

The "export" sectors of the model have exogenously determined employment levels, but endogenously determined wage rates. Federal government employment has changed relatively little over the historical period. Most of the manufacturing employment in Alaska consists of food (fish) processing (45 percent of 1975 manufacturing employment) and lumber and paper manufacturing (35 percent of 1975 manufacturing employment). Most lumber and paper output is exported to Japan, and food processing employment depends crucially on the sizes of the relevant harvests of fish. It is thus not feasible to tie what manufacturing employment Alaska does have to the national economy. The remainder of manufacturing employment is responsive to local demand and is treated as a support sector.

Agriculture, forestry, and fisheries is a heterogenous sector for which employment is also determined outside the model. Alaska has almost no agriculture. Forestry employment is heavily dependent on supply management considerations, and fisheries employment depends on supply considerations also. Total employment in agriculture, forestry, and fisheries comprises less than one percent of total civilian employment.

Mining employment in Alaska is essentially petroleum employment, which is not sensitive to either local or national aggregate demand conditions. Independent projections of mining employment are contained in the resource development scenarios of I.S.E.R.'s long-run models.

The state and local government sector is the policy sector of this model. Most of the variation in state and in local government wages and salaries can be explained by fiscal year state non-capital expenditures. Thus, altering the level of the state budget has a direct impact on wages and salaries in the government sector, and thus has an indirect impact on support sector employment. Employment in the state and local government sector is defined as the ratio of wages and salaries to the wage rate, which is determined by U.S. earnings and local prices. I.S.E.R. has estimated state non-capital expenditures for fiscal year 1977 at $740 million and fiscal 1978, $900 million, which reflects the first receipts of "petrodollars."

An estimate of Federal military employment is subtracted from the sum of sector employment totals to determine total civilian wage and

salary employment. Total wages and salaries is similarly the sum of all sectors' wages and salaries. Disposable personal income is determined by the relationship between wages and salaries and disposable personal income estimated on an annual basis. Disposable personal income is then deflated by an Alaska relative price index (RPIQ) to determine real disposable personal income, and this quantity is then seasonally adjusted, based on historical seasonal adjustment factors. The use of seasonally adjusted disposable personal income in the support sector employment equations provides an unambiguous interpretation of the seasonal dummy variables in those equations.

The Alaska relative price index is a regionally weighted function of the Anchorage, Alaska, consumer price index, with an adjustment made to reflect the difference in the level of prices between Alaska and the rest of the United States. Since Alaska produces almost no consumer or producer goods, much of the variation in Alaska prices can be explained by U.S. prices. Since 1961, Alaska prices have risen more slowly than U.S. prices, reflecting reductions in transport costs and scale economies. The recent boom in Alaska has shown, however, that local demand conditions can affect prices, and during the 1975-76 period, prices rose faster in Alaska than in the U.S. Thus, the price level equation contains a proxy for the rate of growth of local demand. In addition, in a quarterly model, it is appropriate to specify a lagged response of Alaska prices to U.S. prices. The assumed geometric lag structure gives the familiar lagged

dependent variable on the right-hand side; in addition, the regression was improved by lagging the U.S.C.P.I. by one quarter.

The modeling of the state's labor market has been a difficult task. No estimates of quarterly state population are available,[4] and interpolations are misleading since there is an important seasonal component in net interstate migration to Alaska. Population is, therefore, not an input in the determination of the labor force. Labor force is defined as the sum of total employment and unemployment. Total employment is essentially civilian wage and salary employment adjusted for self-employed and multiple job holders and is thus a function of EM9CQ. Unemployment is a function of employment, seasonal dummies, the rate of growth of employment, a special dummy to account for a (1970) change in data collection methodology, and the level of unemployment in the previous quarter.

The quarterly model has been estimated by ordinary least squares regression. The historical period begins with 1965:1 and ends with 1977:1.

Historical simulations have been run for the 1966:1 to 1977:1 period, years of rapid but uneven growth in the Alaska economy. Figures A.2 to A.5 graph the simulated results for the historical period against the actual data, for four key variables in the model. Table A.1 lists the measures of "goodness of fit" for each variable determined within the model. These measures can show how well the model "tracks" the historical period.

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[4] The annual Census Bureau estimates of the state's population may be radically revised in the near future. Our unemployment numbers are, therefore, based on the "non-CPS-adjusted" series.

Figure A.2

NON-AGRICULTURAL WAGE
AND SALARY EMPLOYMENT

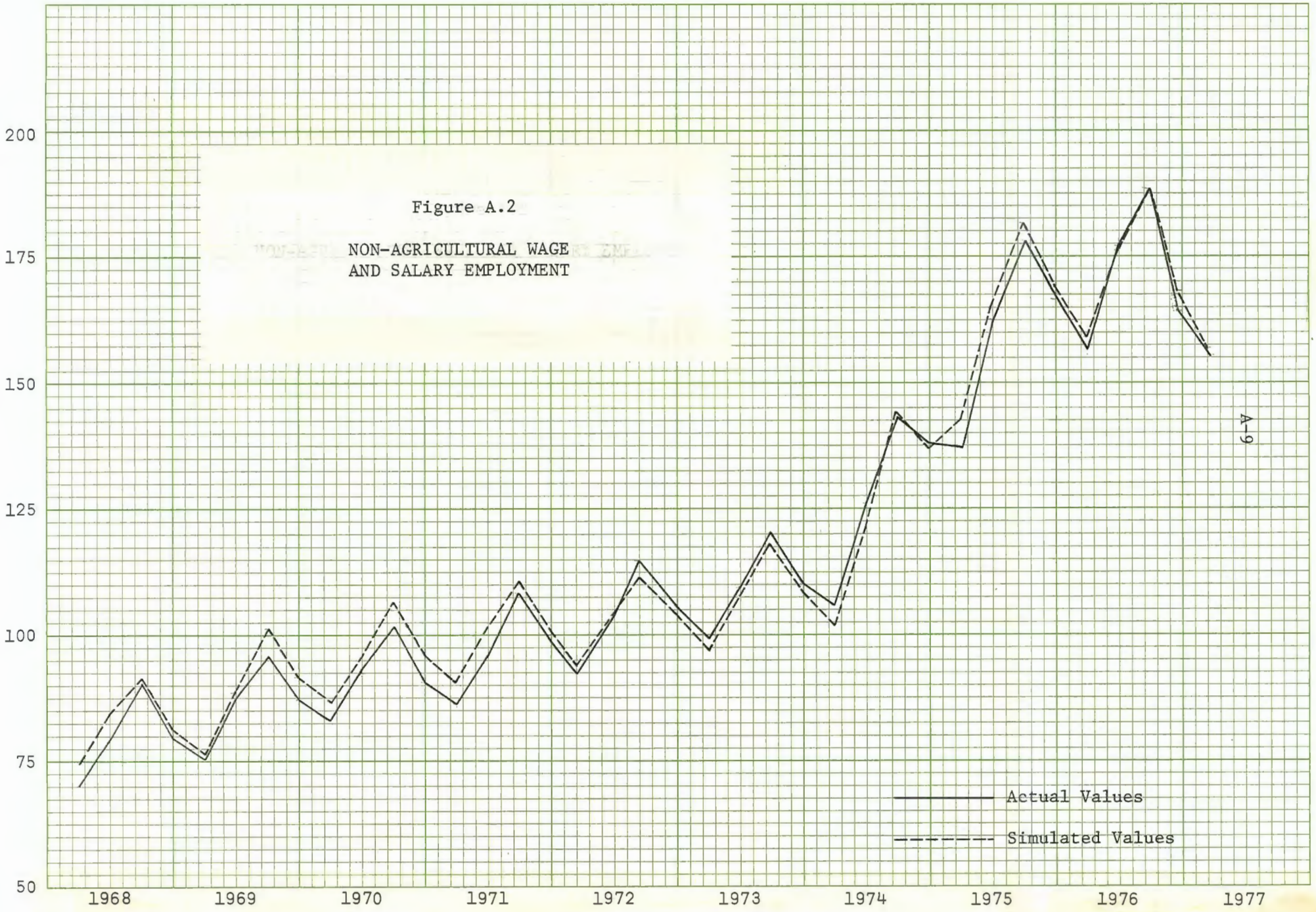

Figure A.3

TOTAL WAGES AND SALARIES

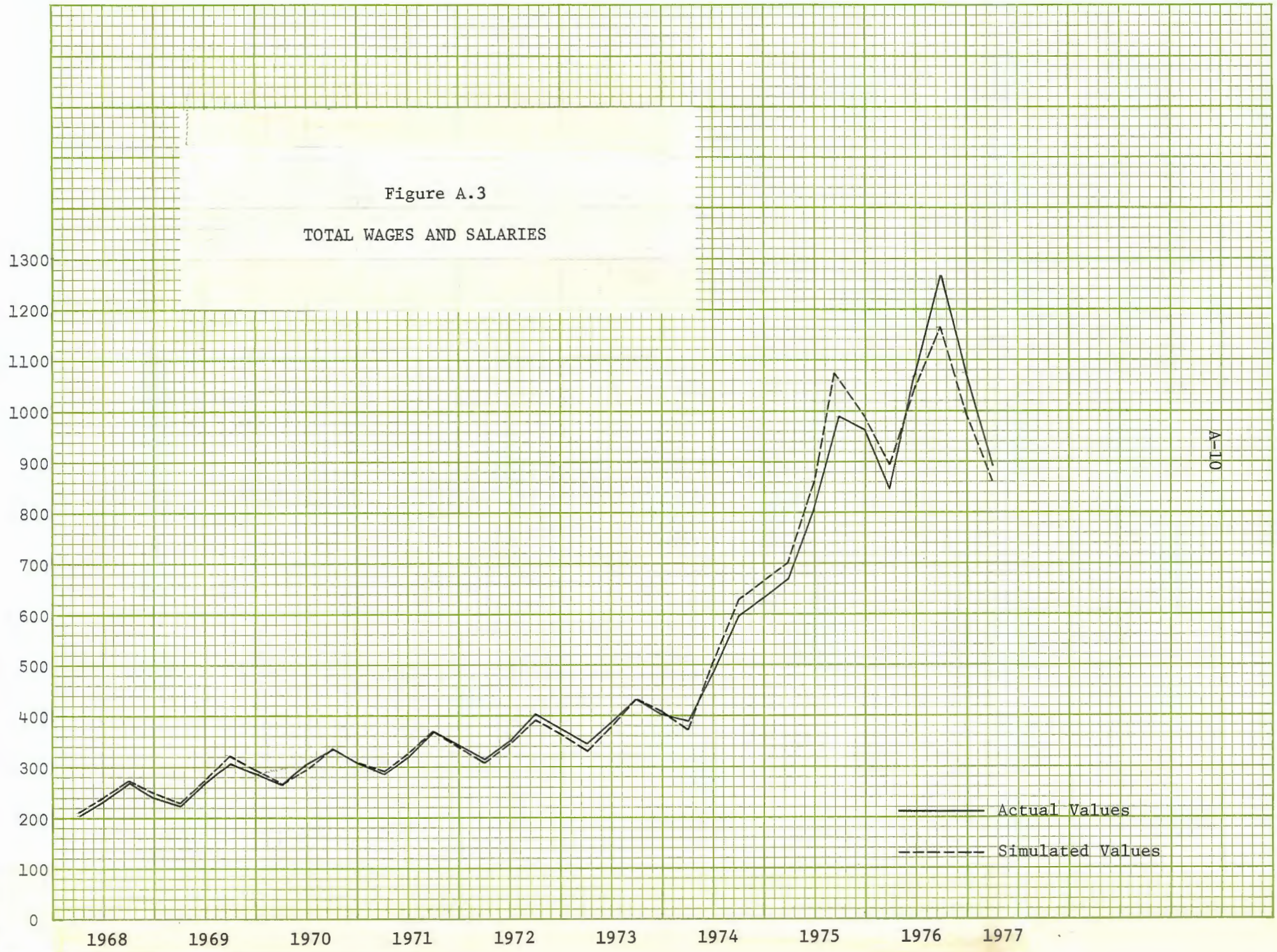

Figure A.4

UNEMPLOYMENT RATE

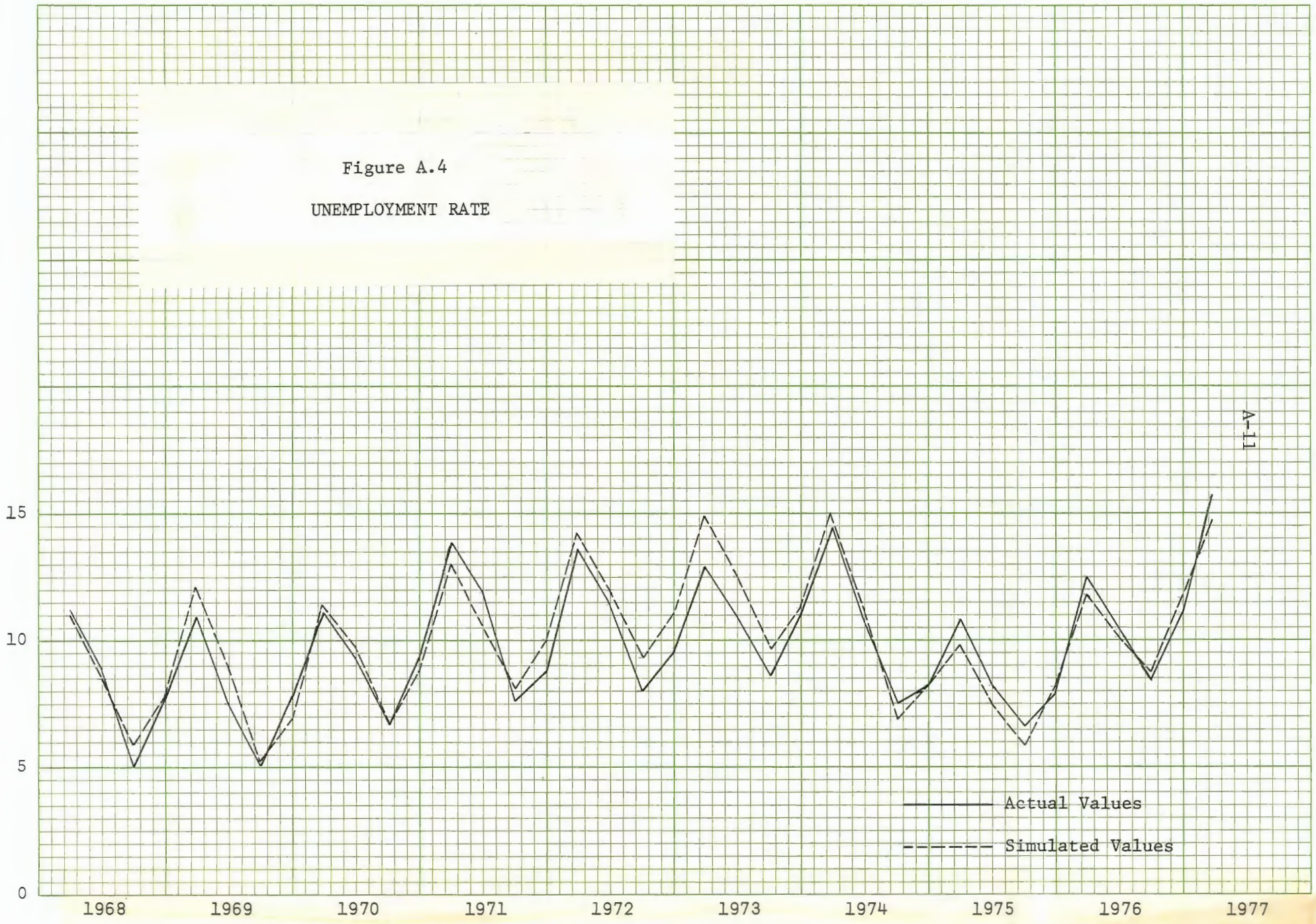

Figure A.5

RELATIVE PRICE INDEX

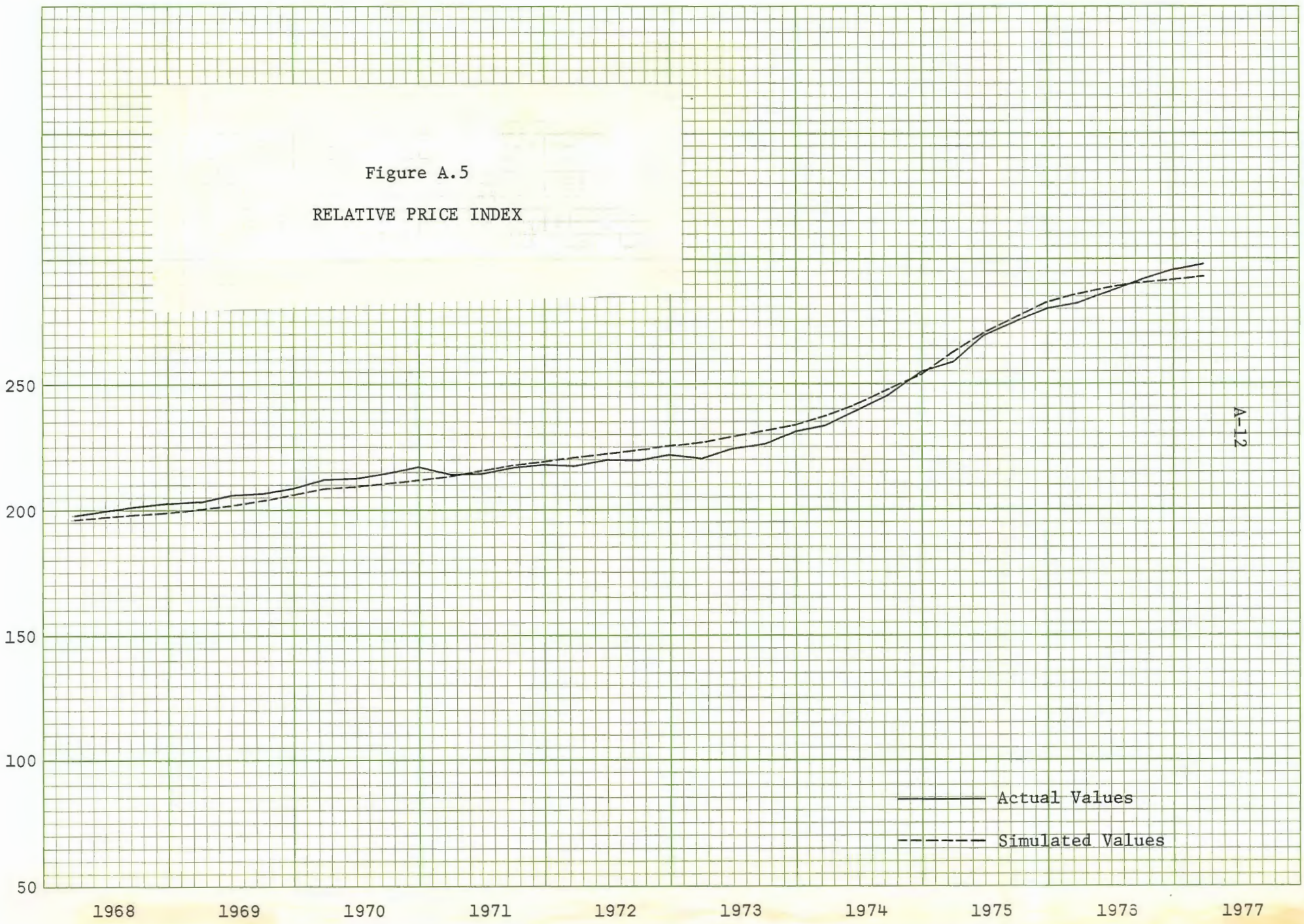

Table A.1

HISTORICAL SIMULATION STATISTICS

Variable	R.M.S.P.E.[a]	M.A.P.E.[b]	Variable	R.M.S.P.E.[a]	M.A.P.E.[b]
EMS9Q	6.52	5.30	WSSLQ	6.61	5.37
EMCNQ	10.55	7.75	WRS9Q	5.98	4.67
EMFIQ	9.44	8.10	WRCNQ	7.47	5.94
EMPUQ	7.33	6.58	WRFIQ	3.09	2.64
EMCMQ	5.97	4.85	WRPUQ	4.93	3.71
EMMOQ	5.88	4.82	WRCMQ	6.92	5.81
EMT9Q	5.01	3.80	WRA9Q	17.50	13.57
EMD9Q	4.40	3.42	WRP9Q	4.96	4.05
DPIRQS	3.93	3.38	WRGFQ	4.49	3.73
RPIQ	1.71	1.43	WRT9Q	5.07	3.83
WS99Q	3.62	2.93	WRD9Q	1.96	1.46
LFCQ	2.83	2.30	WRMOQ	4.69	3.84
EM9CQ	3.28	2.70	WRM8Q	5.03	4.14
URATE	10.38	8.36	WRSLQ	4.36	3.46

[a] $$\text{R.M.S.P.E.} = \left[\frac{\sum_i \left[\frac{(A_i - P_i)}{A_i} \right]^2}{N} \right]^{\frac{1}{2}} \cdot 100$$

[b] $$\text{M.A.P.E.} = \frac{\sum_i \left[\frac{|A_i - P_i|}{A_i} \right]}{N} \cdot 100$$

A_i = actual value in quarter i

P_i = predicted value in quarter i

N = number of observations