

FORTY YEARS OF PREDICTION ERRORS

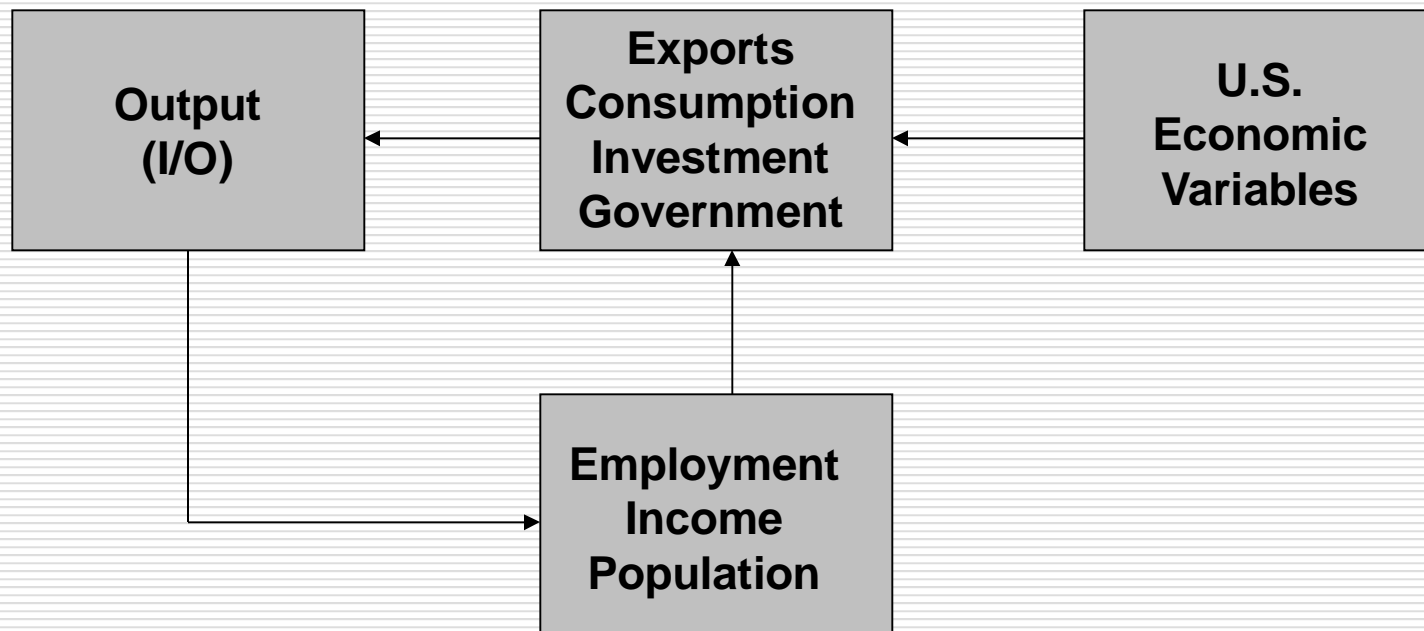
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ABOUT FORECASTING

- **Forecasts are bound to be wrong, at least to a degree (Tiebout).**
 - **Forecasting is a game; in the end there is a score.**
 - **There is a limit to forecasting accuracy (Klein).**
 - **New Mexico always wins.**
 - **I cannot promise an accurate forecast, only a reasonable one.**
 - **Economists cannot predict recessions.**
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WASHINGTON PROJECTION AND SIMULATION MODEL



WASHINGTON PROJECTION AND SIMULATION MODEL

Model size

- 151 endogenous variables**
- 123 behavioral equations**
- 28 accounting identities**
- 68 exogenous variables**

Industry detail

- 26 industries (output, employment, labor income)**
- 3 public sectors**

Other selected endogenous variables

- Gross State Product**
- Personal consumption expenditures**
- Residential and nonresidential investment**
- State and local government expenditures**
- Exports**
- Unemployment rate**
- Personal income**
- Population**
- Consumer price index**

PREDICTION ERRORS

	Actual 1972	Predicted 1985	Actual 1985	Percent Error
WASHINGTON				
GSP (bils. \$82)	43	71	67	5.6
Employment (thous.)	1,298	1,782	1,921	-7.2
Population (thous.)	3,447	4,414	4,409	0.1
UNITED STATES				
GSP (bils. \$82)	2,609	3,667	3,570	2.7
Employment (mils.)	82	100	107	-6.7
Population (mils.)	210	235	239	-1.9

ECONOMIC MULTIPLIERS, 1982

	Output Multiplier (\$82's/\$82)	Employment Multiplier (jobs/job)	Income Multiplier (\$82's/\$82)
WPSM			
Agriculture	2.55	2.80	3.14
Wood products	3.31	5.20	4.44
Aerospace	1.82	3.88	2.41
INPUT-OUTPUT MODEL			
Agriculture	1.97	1.84	2.07
Wood products	2.65	3.92	2.91
Aerospace	1.47	2.42	1.60
ECONOMIC BASE MODEL			
Agriculture	2.23	3.11	2.74
Wood products	2.23	3.11	2.74
Aerospace	2.23	3.11	2.74

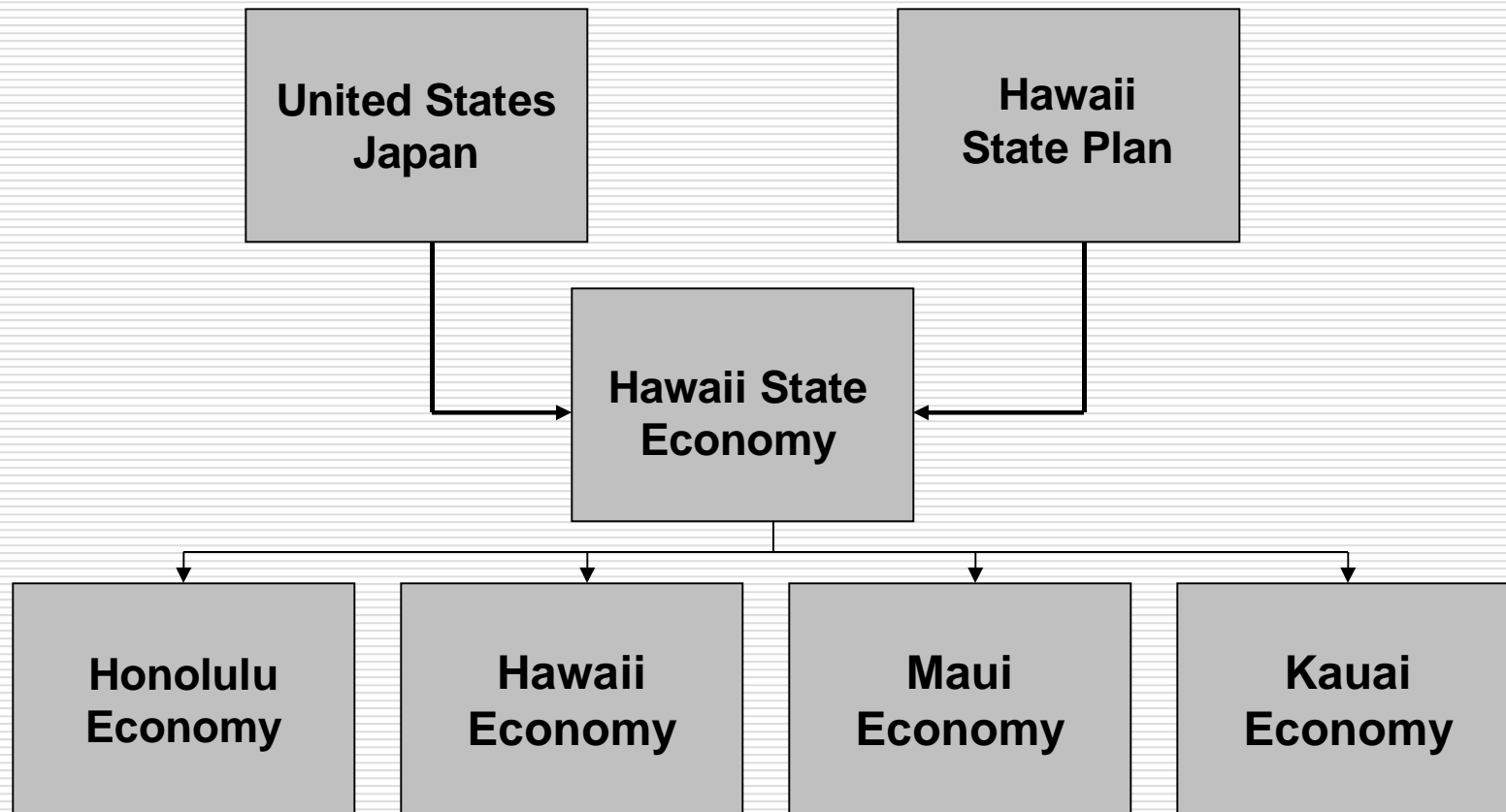
AEROSPACE SIMULATION

	1979	1980	1981	1982	1983
Direct aerospace change					
Output (mils. \$82)	500	500	500	500	500
Employment (thous.)	4.5	4.4	4.3	4.2	4.1
Income (mils. \$82)	155	153	150	151	145
Total change in economy					
Output (mils. \$82)	668	956	1,040	1,021	967
Employment (thous.)	9.4	16.7	19.4	19.5	18.5
Income (mils. \$82)	245	370	408	412	387
Multipliers					
Output (\$82's/\$82)	1.34	1.62	1.78	1.84	1.86
Employment (jobs/job)	2.07	2.91	3.42	3.71	3.85
Income (\$82's/\$82)	1.58	2.00	2.23	2.36	2.41

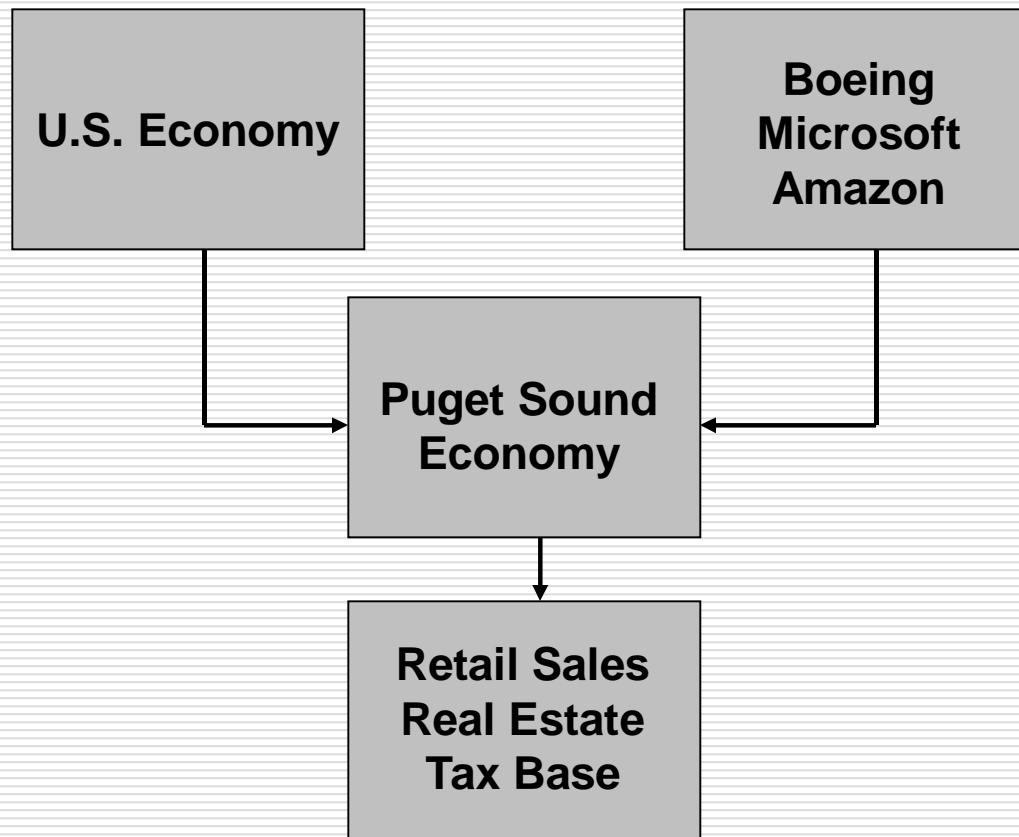
HAWAII



HAWAII PROJECTION AND SIMULATION MODEL



PUGET SOUND FORECASTING MODEL



PUGET SOUND FORECASTING MODEL

Estimation period

1970.1-2016.4

Model size

54 endogenous variables

42 behavioral equations

12 accounting identities

18 exogenous variables

Selected endogenous variables

Employment

Unemployment rate

Personal income

Population

Taxable retail sales

Home sales

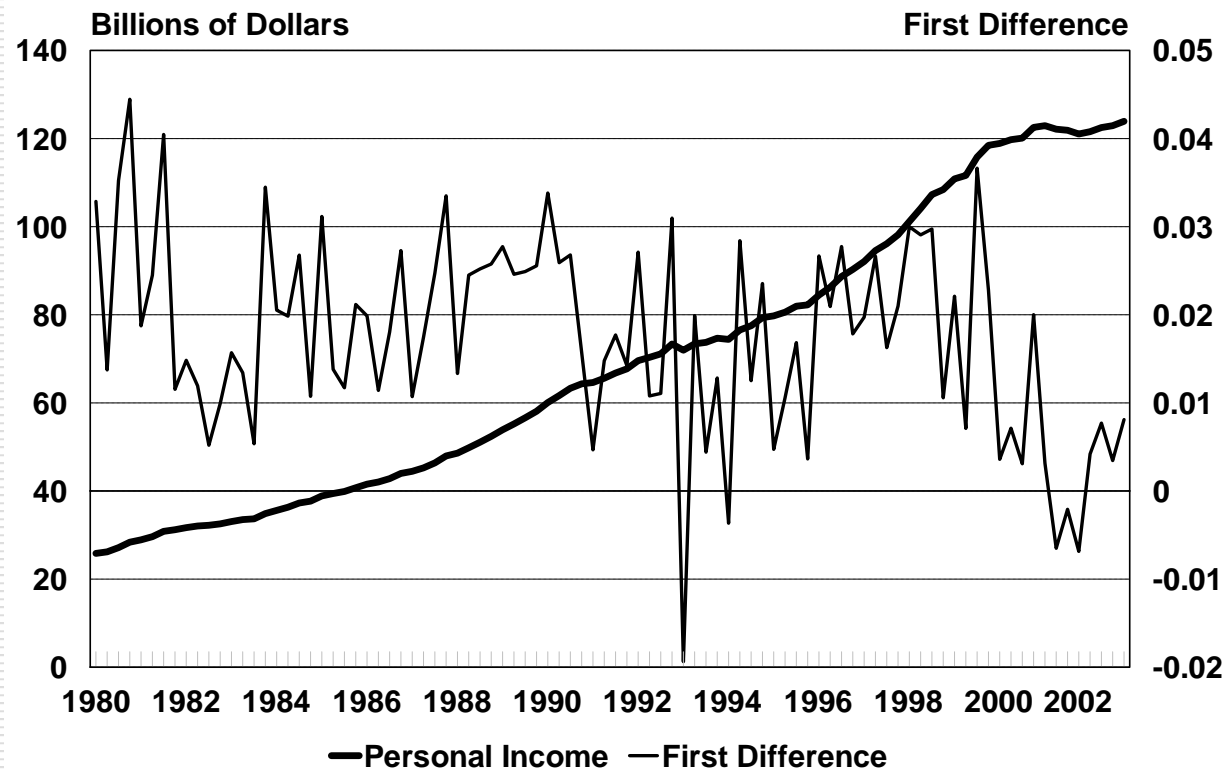
Selected exogenous variables

U.S. Gross Domestic Product

U.S. consumer price index

Boeing employment

PUGET SOUND PERSONAL INCOME



PERSONAL INCOME

Variable	Coefficient	T-Statistic
DLPYP		
DLYP	1.0168	57.8
DLPNR	0.5874	15.9
DLPPOPR	0.5170	2.5
pdl(DLSCPIR)	0.0666	2.2
MA	0.8892	25.1

$DLPYP = \log(PYP) - \log(PYP(-1))$

$DLYP = \log(USYP) - \log(USYP(-1))$

$DLPNR = \log(PN/USN) - \log(PN(-1)/USN(-1))$

etc.

$R^2 = 0.917$

SEE=0.004

DW=1.713

TAXABLE RETAIL SALES

Variable	Coefficient	T-Statistic
DLWSALES		
DLWYPW	0.8017	14.6
DLWUNRT	-0.1189	-5.5
DLWHS	0.0264	3.1

DLWSALES=log(WSALES)-log(WSALES(-1))

DLWYPW=log(WYPW)-log(WYPW(-1))

DLWHS=log(WHS)-log(WHS(-1))

WYPW=(WYP-WYSTK)+0.4WYSTK

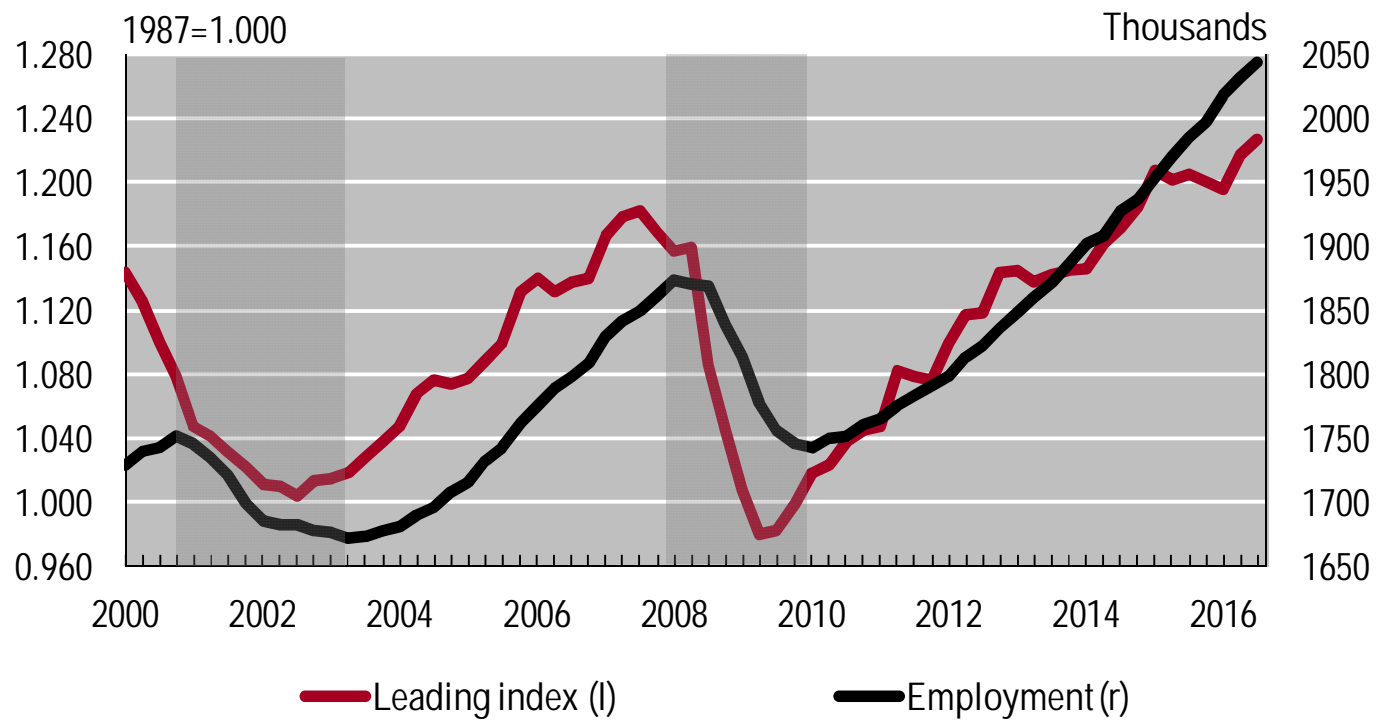
R²=0.583 SEE=0.015 DW=2.108

PREDICTION ERRORS, 1994-2016

Average Absolute Percent Error

	One Year Ahead	Bias
Employment (-4.8-5.4)	0.8	0.1
Personal income (-4.7-11.5)	2.3	-0.1
Consumer price index (1.1-4.3)	0.8	-0.2
Housing permits (-49.7-53.0)	10.5	-2.3
Population (0.5-2.1)	0.2	0.0
U.S. GDP (-2.8-4.7)	1.0	0.0

PUGET SOUND LEADING INDEX AND EMPLOYMENT



The shaded areas designate recessions.

PUGET SOUND FORECASTING MODEL

Strengths and Weaknesses

- **Strengths**
 - Small area model**
 - Good predictive capabilities**
 - Low cost**
 - **Weaknesses**
 - Limited set of variables**
 - Some data crafting**
 - Weak simulation properties**
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FINAL THOUGHTS

- **No ideal model**
 - **Need for a “kit bag” of forecasting tools**
 - **Model choice affects results**
 - **Should test models rigorously**
 - **Institutionalized research**
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