

PRELIMINARY PUGET SOUND ECONOMIC AND TAX BASE FORECASTS

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1. INTRODUCTION

Under contract to King County, Conway Pedersen Economics, Inc., has prepared thirty-year economic and tax base forecasts for the Puget Sound region and each of its three counties (King, Snohomish, and Pierce) in support of work by the Regional Transportation Investment District.

This report discusses the forecasting methodology and summarizes the projections. Following a review of the forecasts by the technical committee and other interested parties, a final set of forecasts and a more detailed report will be prepared.

2. FORECASTING METHODOLOGY

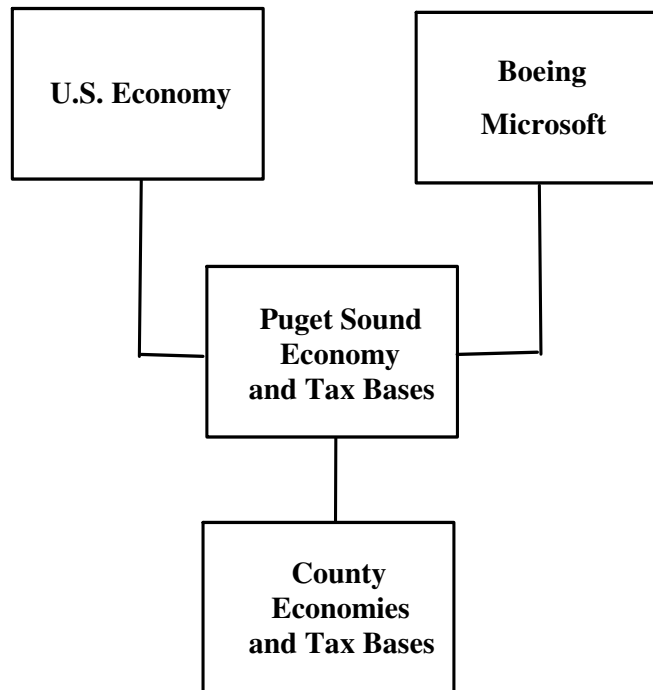
The forecasts have been developed with a regional econometric model that in various forms has been around since 1987. For the past ten years the model has produced predictions for *The Puget Sound Economic Forecaster*, a quarterly forecast and commentary on the regional economy published by Conway Pedersen Economics, Inc.

The Puget Sound Forecasting Model depicts the economic behavior of the three-county region within the context of its national economic environment (Figure 1). The model is a system of simultaneous equations specified to predict 91 endogenous variables (e.g., Puget Sound employment, King County population, and Snohomish County taxable retail sales) on a quarterly basis over a thirty-year period (Table 1). The model is composed of 70 behavioral equations and 21 accounting identities. The parameters of the behavioral equations are estimated by regression analysis using quarterly data from 1970.1 to 2003.4. The model employs 17 exogenous variables (e.g., U.S. Gross Domestic Product, U.S. consumer price index, and Boeing employment), most of which portray conditions in the national economy.

The Puget Sound Forecasting Model follows the conceptual framework of the economic base theory of regional growth. This theory distinguishes between the export (basic) and local (nonbasic) demands placed upon the regional economy. The theory postulates that the economic growth of the three-county region, whether measured in terms of output, employment, or income, is related to the growth of its basic sector. Thus, for example, an expansion of exports is expected to trigger a responding (multiplier) process in the regional economy that leads to increased employment and income in the nonbasic sector.

While the Puget Sound Forecasting Model has much in common with other types of regional econometric models, it has several noteworthy features:

Figure 1
PUGET SOUND FORECASTING MODEL



1. Model specification. Each of the 70 behavioral equations is a fully integrated structural time-series model. Not only does each equation contain both explanatory variables and an ARMA model, but each dependent variable, in accordance with the Box-Jenkins approach to time-series modeling, is made stationary by taking the first difference of the natural logarithm of the variable. Thus, the model predicts, in effect, the growth rate of each variable rather than its level. Moreover, the regression coefficients in an equation are the estimated elasticities of the dependent variable with respect to the independent variables. For example, the estimated regression coefficient for personal income in the Puget Sound taxable retail sales equation is 0.93. This implies that a one percent change in personal income, all else being equal, is expected to lead to a 0.93 percent change in taxable retail sales. In other words, according to the forecasting equation, taxable retail sales will not grow quite as fast as personal income in the long run. In general, combining structural equations with Box-Jenkins components is a strategy to improve both the short-term and long-term forecasting capabilities of the regional model.

Table 1**PUGET SOUND FORECASTING MODEL***

Forecast period

2004-2033 (quarterly)

Estimation period

1970-2003 (quarterly)

Model size

91 endogenous variables

70 behavioral equations

21 accounting identities

17 exogenous variables

Selected endogenous variables

Employment

Personal income

Consumer price index

Housing permits

Population

Taxable retail sales

Registered motor vehicles

Motor vehicle excise tax base

Assessed property value

Selected exogenous variables

U.S. Gross Domestic Product

U.S. employment

U.S. personal income

U.S. consumer price index

U.S. housing starts

U.S. population

U.S. mortgage rate

Boeing employment

Microsoft employment

Stock option income

*The Puget Sound Forecasting Model is composed of regional, county, and tax base sub-models.

Table 2
CLASSIFICATION OF INDUSTRIES

Industry	NAICS Code
Goods	11,21,23,31-33
Natural resources and mining	11,21
Construction	23
Manufacturing	31-33
Aerospace	3364
Other durable goods	321,327, other 33
Nondurable goods	31,322-326
Services	22,42-81
Wholesale and retail trade	42,44-45
Transportation, warehousing, and utilities	22,48-49
Information	51
Financial activities	52-53
Professional and business services	54-56
Other services	61-62,71,72,81

2. Estimation. A rule of thumb in economic modeling is that the estimation period should be at least as long as the forecast period. Thus, the Puget Sound Forecasting Model, which projects the regional and county economies to 2033, is estimated with thirty-four years of quarterly data. From a practical standpoint, it is especially important in this instance to have a long history of data because of the boom and bust nature of the Puget Sound economy. A smaller data set would make it more difficult to discern the short-term cyclical movements in the economy from the long-term trends. Since economic cycles tend to last about ten years, the historical data currently cover three complete cycles and the beginnings of a fourth.

The data required to estimate the model come from various government agencies: Federal Reserve Board, U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, U.S. Bureau of the Census, Washington Department of Licensing, Washington Department of Revenue, Washington Employment Security Department, and Washington Office of Financial Management.

The regional model includes eighteen categories of employment, which are reported in accordance with the recently adopted North American Industrial Classification Scheme (NAICS). NAICS, which replaces the Standard Industrial Classification (SIC) system, was designed to better reflect the structure of our modern economy. For example, there is now an information industry, which includes software publishers (Table 2). A significant amount

of time on this project was spent converting historical employment estimates to the new scheme.

3. Exogenous variables. The United States is the largest market for Puget Sound exports and the principal driving force for the regional economy. To ensure that the regional and county forecasts are consistent with economic developments at the national level, the model makes use of long-range projections of the U.S. economy developed by the Blue Chip panel of economic forecasters. Since the Blue Chip consensus forecasts encompass only a ten-year period, it is necessary to extend the Blue Chip forecasts beyond that time using projections from other sources, such as Global Insight.

The Puget Sound economy is particularly dependent upon Boeing and Microsoft, the region's two largest private employers. Thus, special consideration is given to Boeing aircraft production and employment and Microsoft employment and stock option income. While these forecasts are ultimately made on a judgmental basis, they are backed by considerable analysis (e.g., the Boeing and Microsoft impact studies).

4. Add factors. Add factors are employed to control unreasonable projections made by one or more equations in an economic forecasting model. The goal of building a model that requires no add factors is rarely achieved, since models are imperfect representations of reality. Apart from one minor exception, the Puget Sound Forecasting Model uses no add factors through 2014. In other words, operating free of add factors, the model generates reasonable economic forecasts for the first ten years of the forecast period. Beyond 2014 the only problematic forecasting equation is professional and business services employment, which yields unreasonably high forecasts. Lowering these projections with the use of an add factor brings the entire set of regional and county forecasts into line. Other add factors are used for "window dressing" but do not substantially change the long-term outlook for regional employment, personal income, and population. As a gauge of the importance of the role of add factors, note that the model with add factors and the model without add factors forecast 2,366,200 and 2,540,500 regional jobs in 2033, respectively. This amounts to a 6.9 percent difference, which is not large for thirty-year projections.

3. FORECASTS

In effect, the economic outlooks for the nation, Boeing, and Microsoft represent the three major forecasting assumptions underlying the Puget Sound and county projections:

1. U.S. economy. According to the Blue Chip panel, the U.S. economy, which showed considerable life at the end of 2003, will grow strongly for another two years. After expanding at a 4 percent annual rate in 2004 and 2005, real Gross Domestic Product (GDP) will grow at a 3 percent average annual rate over the next ten years, close to the historical trend. Since the labor force will be increasing at a relatively slow rate, just above one percent per year, this forecast of real GDP growth presumes that the large gains in labor productivity achieved in recent years will continue indefinitely. In addition to a healthy growth rate, the long-term national forecast calls for relatively low

inflation (significantly below 3 percent per year) and low unemployment, dropping to about 5 percent by 2015.

2. Boeing. The commercial aircraft division of Boeing has had a difficult time since 1998, slashing production and laying off tens of thousands of workers. Nevertheless, there are signs, such as a recent upswing in air travel, that the aerospace slump is about to end. Boeing's long-term market outlook calls for 20,000 new airplanes over the next two decades. If Boeing divides the market 50-50 with Airbus, this implies that Boeing will produce 500 airplanes in an average year and more than 600 in a good year. Since Boeing is planning to deliver only 275 airplanes this year, it is hard to imagine that the company could more than double production without calling back thousands of workers. Specifically, after bottoming out around 60,000 this year, Puget Sound aerospace employment is projected to peak at about 80,000 in 2008 and 2009.
3. Microsoft. Few companies have weathered the recent economic storm as well as Microsoft. Between 2000 and 2003, fiscal-year revenue climbed 40 percent, while profits rose 6 percent. The \$32-billion enterprise currently employs 27,000 people in King County, an increase of 7,000 in the last three years. Third-quarter 2003 financial results surprised even Microsoft, as year-over-year profits jumped 28 percent due to a big upswing in personal computer sales. In the long run, however, the company must reduce its reliance on the maturing market for pc software. Microsoft's strategy to deal with this challenge calls for heavy investment in research and development and more personnel. As a hint of what this might mean for the regional economy, Microsoft just purchased another parcel of land for an Issaquah campus, giving it the capacity to hire up to 15,000 additional employees. Our forecast calls for about 10,000 new workers over the next ten years.

Considering the healthy growth of the national economy, the likelihood of a Boeing upturn later this decade, and the continuing expansion of Microsoft employment, the Puget Sound economy can expect better days ahead (Tables 3-6):

1. Short-term economic outlook. Economic conditions in the Puget Sound region have been dismal for three years. The reasons are many: a national recession, the high-tech bust, and back-to-back Boeing downturns. Employment in the three-county area has plunged from 1,656,700 in the fourth quarter of 2000 to 1,570,100 in the fourth quarter of 2003. If we had a measure of Gross Regional Product, we would probably conclude that the recession ended in the middle of last year. Yet, with employment about 87,000 jobs below the peak, it is clear that the region is still waiting for a meaningful recovery.

But things are looking up. Not only has the national economy shifted into high gear, but the worst of the Boeing job cuts appears to be over. Moreover, as indicated by big jumps in the U.S. and Puget Sound leading indexes since last summer, the national and regional economies can both look forward to

Table 3**PUGET SOUND AND U.S. ECONOMIC FORECASTS**

	1990	2000	2010	2020	2030
Puget Sound					
Employment (thous.)	1,301.5	1,646.7	1,800.3	2,041.2	2,284.8
Personal income (mils. \$)	58,685.9	115,891.1	174,825.3	307,242.3	554,007.0
Consumer price index (82-84=1)	1.268	1.792	2.222	2.903	3.972
Population (thous.)	2,578.8	3,052.4	3,364.5	3,699.6	4,080.5
United States					
Employment (mils.)	109.5	131.8	144.3	160.0	173.8
Personal income (bils. \$)	4,878.6	8,429.7	13,357.4	23,230.6	40,940.0
Consumer price index (82-84=1)	1.307	1.722	2.151	2.807	3.810
Population (mils.)	250.6	282.9	309.3	334.7	361.1

Table 4**PUGET SOUND AND U.S. ECONOMIC GROWTH RATE FORECASTS**

Average Annual Percent Change

	1980-90	1990-00	2000-10	2010-20	2020-30
Puget Sound					
Employment (thous.)	3.5	2.4	0.9	1.3	1.1
Personal income (mils. \$)	8.7	7.0	4.2	5.8	6.1
Consumer price index (82-84=1)	4.4	3.5	2.2	2.7	3.2
Population (thous.)	2.0	1.7	1.0	1.0	1.0
United States					
Employment (mils.)	1.9	1.9	0.9	1.0	0.8
Personal income (bils. \$)	7.8	5.6	4.7	5.7	5.8
Consumer price index (82-84=1)	4.7	2.8	2.2	2.7	3.1
Population (mils.)	1.0	1.2	0.9	0.8	0.8

Table 5
PUGET SOUND AND COUNTY ECONOMIC FORECASTS

	1990	2000	2010	2020	2030
Puget Sound					
Employment (thous.)	1,301.5	1,646.7	1,800.3	2,041.2	2,284.8
Population (thous.)	2,578.8	3,052.4	3,364.5	3,699.6	4,080.5
King County					
Employment (thous.)	937.4	1,187.2	1,256.1	1,405.4	1,553.0
Population (thous.)	1,517.2	1,739.1	1,848.4	1,994.3	2,155.9
Snohomish County					
Employment (thous.)	169.4	215.1	253.8	294.2	335.5
Population (thous.)	471.1	609.3	708.5	808.6	925.2
Pierce County					
Employment (thous.)	194.7	244.4	290.3	341.6	396.3
Population (thous.)	590.5	704.0	807.6	896.7	999.4

Table 6
PUGET SOUND AND COUNTY ECONOMIC GROWTH RATE FORECASTS
Average Annual Percent Change

	1980-90	1990-00	2000-10	2010-20	2020-30
Puget Sound					
Employment (thous.)	3.5	2.4	0.9	1.3	1.1
Population (thous.)	2.0	1.7	1.0	1.0	1.0
King County					
Employment (thous.)	3.3	2.4	0.6	1.1	1.0
Population (thous.)	1.7	1.4	0.6	0.8	0.8
Snohomish County					
Employment (thous.)	5.0	2.4	1.7	1.5	1.3
Population (thous.)	3.3	2.6	1.5	1.3	1.4
Pierce County					
Employment (thous.)	3.2	2.3	1.7	1.6	1.5
Population (thous.)	1.9	1.8	1.4	1.1	1.1

substantial growth in 2004. The third-quarter 2003 reading of the Puget Sound leading index was particularly impressive, as all seven of the components advanced, the first time this has happened since the boom years of the 1980s. There was good follow-through in the fourth quarter when six of the seven components increased.

Following a 0.7 percent loss in 2003, Puget Sound employment is expected to increase 0.8 percent in 2004 and 1.8 percent in 2005. Over the two-year period (2003.4-2005.4), this amounts to 55,000 new jobs. Current-dollar personal income growth will accelerate from 2.7 percent in 2003 to 4.4 percent in 2004 and 4.7 percent in 2005. Income growth will be hampered by the continuing decline in stock option income, which currently is running about \$3 billion per year. As measured by the Seattle consumer price index, the annual inflation rate will stay below 2 percent.

2. Long-term economic outlook. If Boeing and its aerospace subcontractors do in fact add 20,000 jobs locally during the next aircraft rebound, regional employment growth will continue to accelerate, reaching almost 3 percent in 2008, according to the long-term outlook. Three percent is not as high as past peak employment growth rates. Last decade, for example, the employment growth rate hit 5.3 percent in 1997. Slower long-term employment growth, the consequence of our aging population, coupled with a smaller than usual rebound in Boeing employment, the result of increased productivity and outsourcing, will moderate the next regional upturn. Nevertheless, the Boeing recovery is expected to provide a respectable ending to an otherwise dreary decade. After losing 33,000 jobs during the first half of the decade, the Puget Sound economy is expected to create 186,000 jobs during the second half of the decade.

Looking across the next three decades, the Puget Sound economy will continue to follow a long-term trend of slowing growth. For example, the 1.1 employment growth rate projected between 2000 and 2030 is just one-third of the 3.3 percent rate achieved between 1970 and 2000. The slowdown notwithstanding, the expected absolute growth of employment (about 638,000 jobs), personal income (\$438 billion), and population (1,028,000 people) is still substantial. As a consequence, by 2030, local employment will hit 2,285,000, income will climb to \$554 billion, and population will reach 4,081,000.

As the region expands economically, it will continue to spread out geographically. As a consequence, Snohomish and Pierce Counties are expected to grow faster than King County. For example, between 2000 and 2030, the projected population growth rates for Snohomish and Pierce Counties are 1.4 percent and 1.2 percent, respectively, well above the projected 0.7 percent rate for King County. In spite of a lower growth rate, King County is expected to capture two-fifths of the new population over the next thirty years.

Table 7

PUGET SOUND TAX BASE FORECASTS

	1990	2000	2010	2020	2030
Tax base					
Taxable retail sales (mils. \$)	30,044.2	53,520.6	77,324.3	131,320.2	228,027.3
Registered motor vehicles (thous.)	2,506.2	2,980.5	3,319.5	3,619.6	3,874.0
Motor vehicle excise tax base (mils. \$)	10,415.5	25,738.2	40,683.6	65,569.0	110,884.5
Related variables					
Personal income (mils. \$)	58,685.9	115,891.1	174,825.3	307,242.3	554,007.0
Population, 20-64 years (thous.)	1,599.3	1,912.0	2,129.7	2,243.6	2,319.7

Table 8

PUGET SOUND FORECAST TAX BASE GROWTH RATES

Average Annual Percent Change

	1980-90	1990-00	2000-10	2010-20	2020-30
Tax base					
Taxable retail sales (mils. \$)	8.9	5.9	3.7	5.4	5.7
Registered motor vehicles (thous.)	2.8	1.7	1.1	0.9	0.7
Motor vehicle excise tax base (mils. \$)	11.3	9.5	4.7	4.9	5.4
Related variables					
Personal income (mils. \$)	8.7	7.0	4.2	5.8	6.1
Population, 20-64 years (thous.)	2.3	1.8	1.1	0.5	0.3

Table 9**COUNTY FORECAST TAX BASE GROWTH RATES**

Average Annual Percent Change

	1980-90	1990-00	2000-10	2010-20	2020-30
Taxable retail sales (mils. \$)					
King County	8.7	6.0	3.0	5.2	5.5
Snohomish County	10.3	6.0	4.7	5.9	6.1
Pierce County	8.4	5.8	5.8	5.7	6.0
Registered motor vehicles (thous.)					
King County	2.2	1.5	0.5	0.6	0.4
Snohomish County	4.7	2.4	1.9	1.3	1.1
Pierce County	2.9	2.0	1.8	1.0	0.9
Motor vehicle excise tax base (mils. \$)					
King County	11.2	8.7	3.9	4.7	5.2
Snohomish County	12.8	10.7	5.8	5.2	5.7
Pierce County	10.5	11.1	5.9	5.0	5.6

3. **Tax base forecasts.** While taxable retail sales are highly volatile, they tend to follow personal income in the long run, though at a somewhat slower pace (Tables 7-9). Following a prolonged period of stagnation, taxable retail sales resumed growth at the end of 2003. They are expected to expand on average about 5 percent in 2004 and 2005. Between 2003 and 2033, taxable retail sales are projected to grow at a 5.6 percent annual rate, slightly less than the 5.9 percent annual rate for personal income. Taxable retail sales will increase from \$53 billion in 2003 to \$270 billion in 2033.

Registered motor vehicles will grow from 3,004,000 in 2003 to 4,015,000 in 2033, according to the long-run outlook. In this case, the annual growth rate will average 1.0 percent. Like our labor force, motor vehicle ownership will be affected by changing demographics. Our aging population will tend to slow the growth of the number of people working as well as the number of vehicles owned. As a consequence, the future growth rate for registered vehicles (1.1 percent) will be much lower than the historical rate (2.8 percent).

In line with the county employment and population projections, the tax bases of Snohomish and Pierce Counties are projected to expand at higher rates than the tax bases of King County.

4. FORECAST UNCERTAINTY

Forecasts are bound to be wrong, at least to a degree. Thus, a forecaster cannot guarantee accurate predictions. On the other hand, a forecaster can promise reasonable predictions.

Reasonable forecasts are predictions that are consistent with all of the available information regarding regional trends, industry developments, and the national outlook at the time of the forecast. Analysts employ economic models in order to produce reasonable forecasts under the presumption that reasonable forecasts stand the greatest chance of being accurate.

This still leaves unanswered the question of forecasting accuracy. It is difficult to assess the uncertainty associated with economic and tax base forecasts, particularly with projections that extend thirty years into the future. However, in May 1994, the authors did prepare long-range economic and tax base forecasts for the Puget Sound Regional Council using the same methodology. This provides some insight into the nature and magnitude of prediction error.

Table 10

**MAY 1994 PUGET SOUND ECONOMIC AND
TAX BASE FORECASTS, 1993-2003***
Average Annual Percent Change

	May 1994 Forecast 1993-03	Actual 1993-03
Puget Sound		
Employment (thous.)	2.0	1.6
Personal income (mils. \$)	5.7	5.7
Consumer price index (82-84=1)	3.3	3.0
Population (thous.)	1.2	1.4
Population, 20-64 years (thous.)	1.4	1.6
Tax bases		
Taxable retail sales (mils. \$)	6.2	4.7
Registered motor vehicles (thous.)	1.9	1.9
Motor vehicle excise tax base (mils. \$)	6.2	7.2

*In this forecast the Puget Sound region includes Kitsap County.

As shown in Table 10, the predicted ten-year growth rates for the four-county Puget Sound economy were fairly accurate, considering the length of the forecasting period. The largest error was associated with regional employment. By 2003, the projection was about four percentage points too low. This was largely due to the recession, which cost the region nearly five percent of its employment. Although the projection of personal income in current dollars was on the mark, the accuracy was the result of compensating errors. The employment downturn's adverse impact on labor income was offset by the unforeseen growth of stock option income.

Registered motor vehicles were also projected accurately due to a good population forecast. This in turn led to an acceptable projection of the motor vehicle excise tax base. But there was a large error associated with the prediction of taxable retail sales. Taxable retail sales are extremely sensitive to economic cycles. They virtually stopped growing during the three-year recession, which was an unprecedented event. Thus, by 2003, actual taxable retail sales were about 14

percent below the prediction made ten years earlier. The forecast tracked well until the verge of the recession, which began in 2001. As a consequence, the prediction of total taxable sales over the ten-year period was off by only 4.7 percent.

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