

PUGET SOUND ECONOMIC AND TAX BASE FORECASTS

Prepared for

Regional Transportation Investment District

By

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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. Following the worst recession in thirty years, the regional economy is expected to return to a healthy long-term growth rate, according to the projections. Between 2003 and 2033, regional employment will grow at a 1.4 percent annual rate, while current-dollar personal income will expand at a 5.9 percent rate. This in turn will lead to a 5.6 percent growth rate for taxable retail sales and a 5.3 percent growth rate for the motor vehicle excise tax base. As a consequence, taxable retail sales will increase from \$53 billion in 2003 to \$271 billion in 2033, while the motor vehicle excise tax base will increase from \$28 billion to \$135 billion.

These forecasts have been prepared with the Puget Sound Forecasting Model, a regional econometric model built specifically for this study. The main body of this report is divided into two sections. The first section discusses the major forecasting assumptions, summarizes the short-term and long-term regional economic predictions, and presents the tax base forecasts. The second section discusses forecast uncertainty, offering high and low alternatives to the baseline forecast based on optimistic and pessimistic projections for the U.S. economy, Boeing, and Microsoft. Appendix A contains technical notes on the forecasting methodology. Appendix B shows the detailed baseline forecasts for the region and the counties.

2. FORECAST

Forecast Assumptions

The Puget Sound region, the largest manufacturing and commercial center in the Pacific Northwest, has strong links to the national economy. Between one-third and one-half of the goods and services produced in the region are sold to customers outside of it. Such sales create jobs not only in the local exporting industries but also in supporting industries through the so-called multiplier process. Thus, much of the business activity in the Puget Sound region is affected in one way or another by the performance of the national economy and the region's major exporters, most notably Boeing and Microsoft.

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 of national economic forecasters, the U.S. economy, which has shown considerable life lately, 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 rise 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 strong growth rate, the long-term national forecast calls for a low inflation rate, significantly below 3 percent per year, and a low unemployment rate, which is expected to drop to about 5 percent in 2015 before it levels off.

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 and the decision to build the 7e7 in Everett, 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 280 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.

Regional Forecast

Considering the strong 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 1-4):

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 2002. Yet, with current 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,

Table 1

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 (bils. \$)	58.7	115.9	174.8	307.2	554.0
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 2**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 (bils. \$)	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 3**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 4**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

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 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.

Because of the depth of the recent recession, the long-term growth rates are somewhat stronger between 2003 and 2033, which is the forecast period for this study. Regional employment will expand at a 1.4 percent annual rate, while current-dollar personal income will grow at a 5.9 percent rate.

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.

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 5-7). 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.

Table 5**PUGET SOUND TAX BASE FORECASTS**

	1990	2000	2010	2020	2030
Tax base					
Taxable retail sales (bils. \$)	30.0	53.5	77.3	131.3	228.0
Registered motor vehicles (thous.)	2,506.2	2,980.5	3,319.5	3,619.6	3,874.0
Motor vehicle excise tax base (bils. \$)	10.4	25.7	40.7	65.6	110.9
Assessed property value (bils. \$)	106.8	244.3	472.7	923.4	1,853.7
Related variables					
Personal income (bils. \$)	58.7	115.9	174.8	307.2	554.0
Population, 20-64 years (thous.)	1,599.3	1,912.0	2,129.7	2,243.6	2,319.7

Table 6**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 (bils. \$)	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 (bils. \$)	11.3	9.5	4.7	4.9	5.4
Assessed property value (bils. \$)	11.1	8.6	6.8	6.9	7.2
Related variables					
Personal income (bils. \$)	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

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).

Despite the significant slowdown in the growth of motor vehicles, the motor vehicle excise tax base will increase at a 5.3 percent annual rate over the next thirty years. Thus, the motor vehicle excise tax base will increase from \$28 billion in 2003 to \$135 billion in 2033.

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.

Table 7

COUNTY FORECAST TAX BASE GROWTH RATES

Average Annual Percent Change

	1980-90	1990-00	2000-10	2010-20	2020-30
Taxable retail sales (bils. \$)					
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	4.6	2.4	1.9	1.3	1.1
Pierce County	2.9	2.0	1.8	1.0	0.8
Motor vehicle excise tax base (bils. \$)					
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
Assessed property value (bils. \$)					
King County	11.5	8.5	6.7	6.6	7.0
Snohomish County	9.7	9.2	7.3	7.6	7.8
Pierce County	10.7	8.4	7.1	7.3	7.5

3. FORECAST UNCERTAINTY

Alternative Forecasts

The baseline projections represent the “best guess” regarding the long-run course of the Puget Sound regional economy. Because of the inherent uncertainty of the future, especially with regard to the national economic outlook, as well as the inability of the Puget Sound Forecasting Model to predict the cyclical position of the economy beyond the first few years, the baseline forecasts are bound to be wrong, at least to a degree.

As one indication of the overall uncertainty in forecasting the future, high and low alternatives to the baseline projections have been developed. These two alternatives constitute reasonable bounds within which the future growth of the regional economy is expected to lie.

Each set of projections, including the baseline forecasts, is based on particular outlooks for the national economy as well as specific prospects for local industry. The high forecast assumes a generally optimistic outlook, whereas the low forecast assumes a pessimistic one:

1. Optimistic outlook. Based on long-range projections developed by the Blue Chip panel of economic forecasters and Global Insight, the optimistic outlook calls for real Gross Domestic Product (GDP) to grow at a 3.3 percent growth rate between 2000 and 2030. Two important assumptions underlie this scenario. First, compared to the baseline projections, there will be larger increases in the labor supply (because of less restrictive immigration policies), capital stock, and labor productivity. Second, in spite of rapid economic growth, the inflation rate will remain low, averaging only 2.3 percent per year, as measured by the consumer price index. Interest rates will also remain low, with the three-month Treasury bill rate rising to just 4 percent in 2030. This combination of high growth and low inflation will contribute to strong demands for consumer durables, housing, and equipment, including commercial aircraft.

Boeing and Microsoft will flourish in this environment. Puget Sound aerospace employment will climb to about 99,000 in 2009 and remain above 90,000 for the rest of forecast period, while Microsoft employment will rise steadily, reaching close to 50,000 in 2030, about double its current count.

2. Pessimistic outlook. According to the pessimistic scenario for the national economy, future growth of real GDP will be hampered by lower growth rates for both labor and capital stock, the latter contributing to smaller gains in labor productivity. As a result, real GDP will increase at an average annual rate of 2.4 percent between 2000 and 2030. The relatively sluggish pace will be accompanied by a higher inflation rate and higher interest rates. The pessimistic outlook foresees large federal and trade deficits.

High interest rates and weak long-term demand for air travel will hurt airline profits, inflicting further damage to the commercial aircraft market. The

impact on the Puget Sound economy will amount to 25,000 fewer aerospace jobs by 2030. In addition, Microsoft will struggle to maintain its place as the world's leading producer of software. As a consequence, compared to the baseline projection, Microsoft will employ 10,000 fewer people in 2030. Finally, attempts to correct the federal deficit will lead to military base closures and a loss of federal civilian jobs.

Table 8 compares the high and low alternatives with the baseline forecasts for selected regional economic variables. There are two noteworthy characteristics of these alternative scenarios. First, they are fairly symmetrical with respect to the baseline scenario. For example, in 2030, the employment forecast difference is 14.4 percent in the high case and -10.1 percent in the low case. The somewhat greater uncertainty on the high side is due to the fact that the regional economy is currently near the bottom of a recession. Second, the uncertainty bands are wider for the region than the nation. For example, the band for national employment in 2030 is 8.0 percent on the upside and -4.0 percent on the downside, respectively. The higher degree of uncertainty associated with Puget Sound's future economic growth is not an unreasonable expectation, considering the fact that the regional economy is only a small part of the national economy. The

Table 8**HIGH AND LOW PUGET SOUND ECONOMIC FORECASTS, 2000-2030**

	2000	2010	2020	2030
Employment (thous.)				
Baseline	1,646.7	1,800.3	2,041.2	2,284.8
High	1,646.7	1,891.0	2,255.8	2,614.9
Percent difference	0.0	5.0	10.5	14.4
Low	1,646.7	1,727.7	1,885.8	2,053.1
Percent difference	0.0	-4.0	-7.6	-10.1
Personal income (bils. \$)				
Baseline	115.9	174.8	307.2	554.0
High	115.9	182.2	331.0	605.5
Percent difference	0.0	4.2	7.7	9.3
Low	115.9	170.6	297.4	537.0
Percent difference	0.0	-2.4	-3.2	-3.1
Consumer price index (82-84=1.000)				
Baseline	1.792	2.222	2.903	3.972
High	1.792	2.168	2.724	3.567
Percent difference	0.0	-2.4	-6.2	-10.2
Low	1.792	2.292	3.136	4.491
Percent difference	0.0	3.2	8.0	13.1
Population (thous.)				
Baseline	3,052.4	3,364.5	3,699.6	4,080.5
High	3,052.4	3,473.0	3,984.2	4,552.3
Percent difference	0.0	3.2	7.7	11.6
Low	3,052.4	3,272.6	3,471.6	3,712.3
Percent difference	0.0	-2.7	-6.2	-9.0

Puget Sound economy is also subject to the vagaries of its major employers, namely Boeing and Microsoft. Indeed, the wide range in the Boeing and Microsoft employment forecasts accounts for much of the difference between the regional and national scenarios with regard to their respective deviations among the alternative projections.

The alternative projections for the regional tax bases are shown in Table 9. The distinguishing characteristic of these forecasts is the relatively narrow bands associated with the current-dollar projections. For example, reflecting the alternative projections of personal income in Table 8, the uncertainty band for current-dollar taxable retail sales in 2030 is 9.9 percent in the high case and

-4.0 percent in the low case. The narrower bands for the current-dollar projections stem from the

offsetting effect of the scenarios' basic assumptions. The optimistic case, for example, assumes a high real growth rate, which raises the taxable retail sales forecast, and a low inflation rate, which lowers the forecast.

Table 9

HIGH AND LOW PUGET SOUND TAX BASE FORECASTS, 2000-2030

	2000	2010	2020	2030
Taxable retail sales (bils. \$)				
Baseline	53.5	77.3	131.3	228.0
High	53.5	81.0	142.2	250.6
Percent difference	0.0	4.8	8.3	9.9
Low	53.5	75.1	126.0	218.8
Percent difference	0.0	-2.8	-4.0	-4.0
Motor vehicles (thous.)				
Baseline	2,980.5	3,319.5	3,619.6	3,874.0
High	2,980.5	3,437.0	3,919.5	4,348.7
Percent difference	0.0	3.5	8.3	12.3
Low	2,980.5	3,218.2	3,376.5	3,499.7
Percent difference	0.0	-3.1	-6.7	-9.7
Motor vehicle excise tax base (bils. \$)				
Baseline	25.7	40.7	65.6	110.9
High	25.7	41.8	67.7	113.2
Percent difference	0.0	2.7	3.2	2.1
Low	25.7	40.0	65.4	112.9
Percent difference	0.0	-1.7	-0.3	1.8
Assessed property value (bils. \$)				
Baseline	244.3	472.7	923.4	1,853.7
High	244.3	490.9	1,005.7	2,056.5
Percent difference	0.0	3.9	8.9	10.9
Low	244.3	461.0	888.3	1,785.3
Percent difference	0.0	-2.5	-3.8	-3.7

May 1994 Forecast

Since projections, especially going out thirty years, are seldom on the mark, a forecaster cannot guarantee accurate predictions. On the other hand, one 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 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: specifically, how accurate are the Puget Sound economic and tax base forecasts? As noted earlier, it is difficult to assess the uncertainty associated with long-range forecasts. The high and low forecasts presented earlier give one indication. Another perspective comes from long-range forecasts produced in the past. In May 1994, this author prepared long-range economic and tax base forecasts for the Puget Sound Regional Council using the same methodology. An analysis of the forecasts ten years later 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 (bils. \$)	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 (bils. \$)	6.2	4.7
Registered motor vehicles (thous.)	1.9	1.9
Motor vehicle excise tax base (bils. \$)	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 and 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 a decade 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.

APPENDIX A
TECHNICAL NOTES

TECHNICAL NOTES

A-1. DEFINITIONS

Region

King, Snohomish, and Pierce counties constitute the Regional Transportation Investment District (RTID). For purposes of this study, the three counties are called the Puget Sound region.

Employment

Employment is the annual average number of full and part-time wage and salary employees working in King, Snohomish, and Pierce counties. This employment series is commonly called non-agricultural wage and salary employment, since it excludes workers in agriculture, fishing, and forestry. Employment is measured by place of work. Washington Employment Security Department (ESD) publishes monthly estimates of county employment by industry (see Section A-3 for more detailed information on data sources). The Puget Sound Forecasting Model predicts employment for 18 industrial and government groups. Table A-1 shows their definitions according to the North American Industrial Classification System (NAICS). The monthly employment series are converted into quarterly series and seasonally adjusted for use in the forecasting model.

Unemployment Rate

ESD also reports the monthly unemployment rate for the Puget Sound region and each of its counties, which is the percent of the civilian labor force without a job. The unemployment rate is measured by place of residence. The monthly unemployment estimates are converted into a quarterly series and seasonally adjusted.

Personal Income

Personal income is income earned by people: wage and salary disbursements; proprietors' income; other labor income (e.g., medical benefits); property income (e.g., dividend payments); transfer payments (e.g., welfare payments); and personal contributions to social insurance (e.g., payments to Social Security), which are deducted from the other components of personal income. Since personal income is measured by place of residence while labor income is measured by place of work, there is also a residence adjustment. In the case of Snohomish County, for example, the residence adjustment is positive and large since many Snohomish County residents work in King County. The residence adjustment for the region as a whole is comparatively small. Personal income is valued in both current and 2000 dollars. The 2000-dollar series, also called the constant-dollar series, is a measure of personal income's real purchasing power over time. Following standard conventions, estimates of real income are obtained by deflating current-dollar personal income by the U.S. implicit price deflator for consumption expenditures. The U.S. Bureau of Economic Analysis publishes annual estimates of personal income for each county. The annual series are converted into a quarterly series using

a multi-step interpolation procedure. There is no need to seasonally adjust the personal income series.

Table A-1

CLASSIFICATION OF INDUSTRIES AND GOVERNMENT

<u>Industry</u>	<u>NAICS Code</u>
Goods producing	11,21,23,31-33
Natural resources and mining	11,21
Construction	23
Manufacturing	31-33
Durable goods	321,327,33
Aerospace	3364
Other durable goods	321,327, other 33
Nondurable goods	31,322-326
Service producing	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
Government	
State and local	
Federal	

Consumer Price Index

The Seattle consumer price index, which has an average value of one for 1982-84, is a measure of the local prices of consumer goods and services purchased by households in the greater Seattle metropolitan area. Changes in the index are a gauge of the local inflation rate. The index is published every other month by the U.S. Bureau of Labor Statistics. The series is not seasonally adjusted.

Housing Permits

Housing permits are the annualized number of building permits issued for new residential construction. There are two types of housing units: single-family buildings (single units) and multi-family buildings (two or more units). Housing permits are a good but inexact measure of housing construction, since permits are issued in advance of actual building and not every permit leads to construction. The U.S. Bureau of the Census publishes monthly estimates of residential

building permits for each county. The monthly series are converted into quarterly series and seasonally adjusted.

Population

Resident population is defined as the number of people living in the Puget Sound region on the first day of July. The source of population estimates is the U.S. Bureau of the Census. The U.S. Bureau of Economic Analysis also reports the annual population estimates in its county personal income tables. The estimates for the years 1970, 1980, and 1990 differ slightly from the ten-year census figures, since the latter are measured on April 1. The population series also differ somewhat from those reported by the Washington Office of Financial Management (OFM), which makes its own population estimates for counties between census years. A simple interpolation procedure is used to convert the annual population series into quarterly series.

Taxable Retail Sales

Taxable retail sales include all sales subject to the retail sales tax. Taxable retail sales include goods and certain services sold to consumers, construction (including maintenance and repair), lodging, and telephone services. Excluded from taxable retail sales are purchases of food for consumption at home. The Washington Department of Revenue reports quarterly taxable retail sales by county. The series are seasonally adjusted for use in the forecasting model.

Registered Motor Vehicles

All vehicles designed primarily for highway use must be registered with the Washington Department of Licensing. For purposes of this study, registered motor vehicles are classified into four groups: passenger cars, gas trucks, diesel trucks, and other vehicles (e.g., motor cycles and trailers). The annual series reported by the Department of Licensing are converted into quarterly series. The quarterly estimates do not require seasonal adjustment.

Motor Vehicle Excise Tax Base

The motor vehicle excise tax is a tax “in lieu of the property tax.” The tax base is the value of all registered motor vehicles. The value of a vehicle in a given year is the depreciated value of the manufacturer’s suggested retail price. The schedule of depreciation rates, which is established by statute, is the same for all vehicles. The Washington Department of Licensing reported the motor vehicle excise tax base for all counties until I-695 eliminated the tax at the end of 1999. Sound Transit, however, continued to collect the tax. Since Sound Transit’s taxing district is a large part of the Regional Transportation Investment District, it is possible to make reasonable estimates of RTID’s motor vehicle excise tax base by county for the years between 2000 and 2003. The annual estimates are converted into quarterly estimates.

Assessed Property Value

Unless specifically exempted, all real and personal property is subject to the property tax. Real property includes land and structures. Personal property includes machinery, supplies, and certain utility property. In general, property is assessed at fair market value based on its “highest and best use.” Property appraisers use three methods: comparable sales in the same area; cost of

replacement; and the present value of the property's income potential. Annual estimates of assessed property value have been obtained from the county assessors' offices. The annual series are subsequently converted into quarterly series.

A-2. PUGET SOUND FORECASTING MODEL

General Specification

The economic and tax base 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 A-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 A-2). 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.

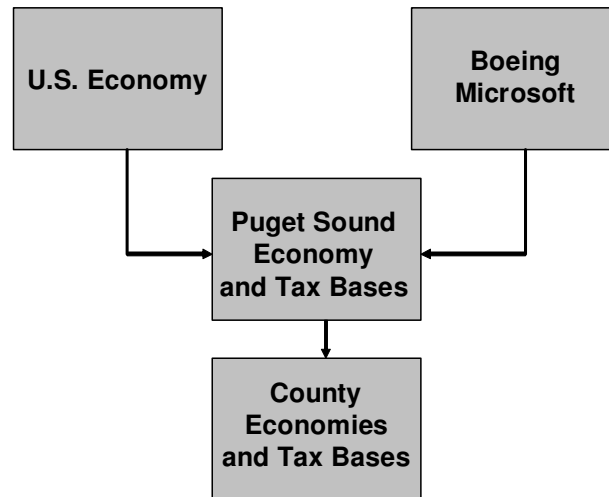
While the Puget Sound Forecasting Model has much in common with other types of regional econometric models, it has several noteworthy features:

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, each equation's regression coefficients 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 model.

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.

Figure A-1
PUGET SOUND FORECASTING MODEL



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.

As previously noted, 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. 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 cover 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.

Table A-2

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
Unemployment rate
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. unemployment rate
U.S. personal income
U.S. personal consumption deflator
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.

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 modify 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.

Representative Equations

The Puget Sound Forecasting Model is organized into three submodels: (1) the regional economy; (2) the county economies; and (3) tax bases. Following are eight representative equations from the forecasting model. Along with explanatory variables, the equations include time-series models, specifically autoregressive moving-average (ARMA) models. The regression equations are estimated in change-of-log form using Ordinary Least Squares (OLS) method. Shown with the regression coefficient estimates are their respective t-values. Also given are the corrected coefficient of determination (adjusted R²), the standard error of the estimate, and the Durbin-Watson statistic. Dummy variables, which depict one-time disturbances, are not shown.

Puget Sound Personal Income

Variable	Coefficient	T-Value
DLPYPE		
C	-0.0000	-0.1
DLYP	0.9987	46.2
DLPNR	0.7034	21.8
PDL(DLSCPIR)	0.0821	3.5
MA(1)	0.6787	9.9

R²=0.947, SEE=0.003, DW=1.452

DLPYPE=log(PYP-PYSTK)-log(PYP(-1)-PYSTK(-1))

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

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

DLSCPIR=log(SCPI/USCPI)-log(SCPI(-1)/USCPI(-1))

PYP	Puget Sound personal income
PYSTK	Puget Sound stock option income
PN	Puget Sound employment
SCPI	Seattle consumer price index
USYP	U.S. personal income
USN	U.S. employment
USCPI	U.S. consumer price index

Personal income is the single most important equation in the Puget Sound Forecasting Model, since it influences many other variables (e.g., wholesale and retail trade employment). Although the forecast of income is not based on the same causal framework as found in other regional econometric models, it has its own logic. Reflecting the region's dependency upon national markets, Puget Sound income is expected to follow national income, all else being equal. Regional income, however, will tend to grow faster than national income when regional employment outpaces U.S. employment, as indicated by the relative employment growth rate term. Regional income is also affected by local inflation. During periods of high inflation, which are typically associated with rapid expansions, regional wage rates will rise to offset the

impact of higher living costs. Note that the relative inflation rate term enters the equation with a lag, as indicated by the PDL notation, which stands for polynomial distributed lag. In this case, personal income is being affected by the relative inflation rate in the current quarter as well as the three prior quarters, according to the estimated equation.

The estimated elasticities in the personal income equation are reasonable in size. If the regional economy is diversified and open to national markets, we would expect the income elasticity to display a value close to one. Given that wages and salaries constitute 65 percent of personal income, we would expect the employment elasticity to be around 0.65.

Puget Sound Other Durable Manufacturing Employment

Variable	Coefficient	T-Value
DLPNODUR		
C	-0.0085	-4.1
DLPYPW00	0.6823	4.4
DLPUNRT	-0.0614	-2.7
PDL(DLX)	0.0965	3.7

$R^2=0.421$, $SEE=0.015$, $DW=1.888$

$DLPNODUR = \log(PNODUR) - \log(PNODUR(-1))$

$DLPYPW00 = \log(PYPW00) - \log(PYPW00(-1))$

$DLPUNRT = \log(PUNRT) - \log(PUNRT(-1))$

$DLX = \log(USX) - \log(USX(-1))$

$PYPW00 = ((PYP - PYSTK) + 0.4PYSTK) / USPC$

PNODUR Puget Sound other durable manufacturing employment

PYPW00 Puget Sound weighted average income (\$00)

PUNRT Puget Sound unemployment rate

USX U.S. industrial production index

USPC U.S. personal consumption deflator

Goods produced in other durable manufacturing (wood products, metals, machinery, and transportation equipment) are sold both inside and outside the region. Thus, the predictors in the other durable manufacturing employment equation include Puget Sound personal income and the unemployment rate, which represent the local or nonbasic demand, and the U.S. industrial production index, which represents the national or basic demand. Note that personal income in this equation is expressed on 2000 dollars. Income is also weighted to take into account the special effect of stock option income. With regard to its impact on spending, stock option income is discounted, since it is earned in large chunks and so much of it is taxed and saved. Specifically, a dollar of stock option income is considered to be the equivalent of only 40 cents of other personal income.

Puget Sound Construction Employment

Variable	Coefficient	T-Value
DLPNCON		
C	-0.0023	-0.5
PDL(DLPYPW00)	0.1921	2.8
PDL(DLPHS)	0.0359	5.6
AR(1)	0.2730	3.2

$R^2=0.391$, $SEE=0.021$, $DW=2.045$

$DLPNCON=\log(PNCON)-\log(PNCON(-1))$
 $DLPYPW00=\log(PYPW00)-\log(PYPW00(-1))$
 $DLPHS=\log(PHS)-\log(PHS(-1))$

PNCON Puget Sound construction employment
PHS Puget Sound housing permits

Construction is a nonbasic industry, primarily serving local demand. The key independent variables are real income and housing permits. Housing permits capture the variation in construction employment related to residential building cycles. Both the income and housing permit variables have four-quarter lags. The lag on housing permits stems from the fact that the housing permits are issued in advance of actual construction.

Puget Sound Unemployment Rate

Variable	Coefficient	T-Value
DLPUNRT		
C	-0.0015	-0.2
DLUNRT	0.6202	6.2
DLPNR	-2.1392	-3.6
MA(1)	0.4720	5.9

$R^2=0.578$, $SEE=0.048$, $DW=1.975$

$DLPUNRT=\log(PUNRT)-\log(PUNRT(-1))$
 $DLUNRT=\log(USUNRT)-\log(USUNRT(-1))$
 $DLPNR=\log(PN/USN)-\log(PN(-1)/USN(-1))$

USUNRT U.S. unemployment rate

The formulation of the unemployment rate equation is based on labor market equilibrium principles. The first explanatory variable of the equation implies that the supply of labor expands (contracts) in response to increases (decreases) in the number of persons employed such

that the region's unemployment rate follows, but does not necessarily equal, the national unemployment rate in the long run. As indicated by the second explanatory variable, the regional unemployment rate in the short run will tend to be low (high) relative to the national unemployment rate when regional employment is growing faster (slower) than national employment.

King County Employment

Variable	Coefficient	T-Value
DLKN		
C	-0.0003	-1.6
DLPN	1.0398	67.5
DLKNAERR	0.0850	6.4

$R^2=0.972$, $SEE=0.002$, $DW=1.920$

$DLKN=\log(KN)-\log(KN(-1))$

$DLPN=\log(PN)-\log(PN(-1))$

$DLKNAERR=\log(KNAER/PNAER)-\log(KNAER(-1)/PNAER(-1))$

KN	King County employment
KNAER	King County aerospace employment
PNAER	Puget Sound aerospace employment

Given the regional forecasts of employment, personal income, the unemployment rate, housing permits, and population, the county submodel in effect predicts each county's share of regional economic activity. The null hypothesis for the King County employment equation is that, because the county economy is an integral part of the regional economy, the county grows along with the region. This is borne out in the estimated equation, as the elasticity of King County's employment growth rate with respect to the Puget Sound employment growth rate is close to one. However, as evident by the aerospace employment term, King County tends to expand faster than the region during Boeing upturns and slower than the region during Boeing downturns. Moreover, the negative constant term indicates that in the long run King County is growing somewhat slower than the rest of the region. In other words, King County's share of regional employment is slowly falling over time. Note that, as a final step in forecasting county employment, the individual county predictions are adjusted such that they sum to the regional total. In general, these adjustments are relatively small in size even as far out as 2033.

Puget Sound Taxable Retail Sales

Variable	Coefficient	T-Value
DLPSALES		
C	0.0000	0.0

DLPPYPW	0.9301	17.1
DLPHS	0.0311	3.3
DLPUNRT	-0.0454	-2.4
AR(1)	-0.2766	-3.4

$R^2=0.585$, $SEE=0.016$, $DW=2.005$

$$DLPSALES=\log(PSALES)-\log(PSALES(-1))$$

One-half of taxable retail sales is sales from retail establishments. Thus, as one would expect from the theory of consumer behavior, the key explanatory variable in the Puget Sound taxable retail sales equation is regional personal income. The forecasting equation also includes the regional unemployment rate to depict the cyclical nature of taxable retail sales. The negative sign on the unemployment rate term indicates that taxable retail sales decline when the unemployment rate rises, all else being equal. Since taxable retail sales also include construction, regional housing permits are also an important explanatory variable.

Puget Sound Registered Passenger Cars

Variable	Coefficient	T-Value
DLPMVCARP		
C	0.0009	1.1
PDL(DLPUNRT)	-0.0103	-3.8
MA(1)	0.9825	77.7

$R^2=0.864$, $SEE=0.005$, $DW=1.473$

$$DLPMVCARP=\log(PMVCAR/PPOP20)-\log(PMVCAR(-1)/PPOP20(-1))$$

$$DLPUNRT=\log(PUNRT)-\log(PUNRT(-1))$$

PMVCAR Puget Sound registered passenger cars
PPOP20 Puget Sound population, 20-64 years of age

In 2003, there were 2,013,100 registered passenger cars in the region. The number of passenger cars amounted to 1.015 per person in the primary driving-age population, people between 20 and 64 years of age. Since 1975 this ratio has risen from a value of 0.864. As there has been a roughly one-to-one correspondence between the growth in passenger cars and population in the 20-64 year age cohort, the dependent variable in the passenger car forecasting equation is defined as the number of cars per person in that age group. The constant in the forecasting equation shows that this ratio is rising slowly over time, while the unemployment rate indicates that it is sensitive to economic cycles. Specifically, an increase in the unemployment rate tends to reduce passenger car ownership.

Puget Sound Motor Vehicle Excise Tax Base

Variable	Coefficient	T-Value
DLPMVET		
C	-0.0037	-0.7
DLPMVETE	1.4742	28.2
AR(1)	0.9044	21.8
MA(1)	0.3362	3.1

$R^2=0.960$, $SEE=0.004$, $DW=1.922$

$DLPMVET=\log(PMVET)-\log(PMVET(-1))$

$DLPMVETE=\log(PMVETE)-\log(PMVETE(-1))$

$PMVETE=PMVET03(USPCAR03WT)$

$PMVET03=10.7PMVCAR+7.9PMVTRKG+9.9PMVTRKD+6.0PMVOH$

$USPCAR03=USPCAR/23485$

$USPCAR03WT=(USPCAR03+\dots+USPCAR03(-20))/21$

PMVET	Puget Sound motor vehicle excise tax base
PMVTRKG	Puget Sound registered gas trucks
PMVTRKD	Puget Sound registered diesel trucks
PMVOH	Puget Sound other registered vehicles
USPCAR	U.S. average car price

The econometric equation used to predict the motor vehicle excise tax base represents a two-step forecasting process. The first step develops an initial estimate of the tax base (PMVETE) by taking into account the number of motor vehicles by type (e.g., PMVCAR), the average value of each vehicle in 2003 (e.g., \$10.7 thousand for passenger cars), and a weighted price index for motor vehicles (USPCAR03WT). The second step compares the actual tax base over the 1975-03 historical period with the initial estimate of the tax base. This is accomplished by regressing the change in the actual estimate of the tax base against the change in initial estimate of the tax base. As the high t-value in the forecasting equation indicates, there is a strong and predictable relationship between the two variables.

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APPENDIX B
BASELINE FORECAST