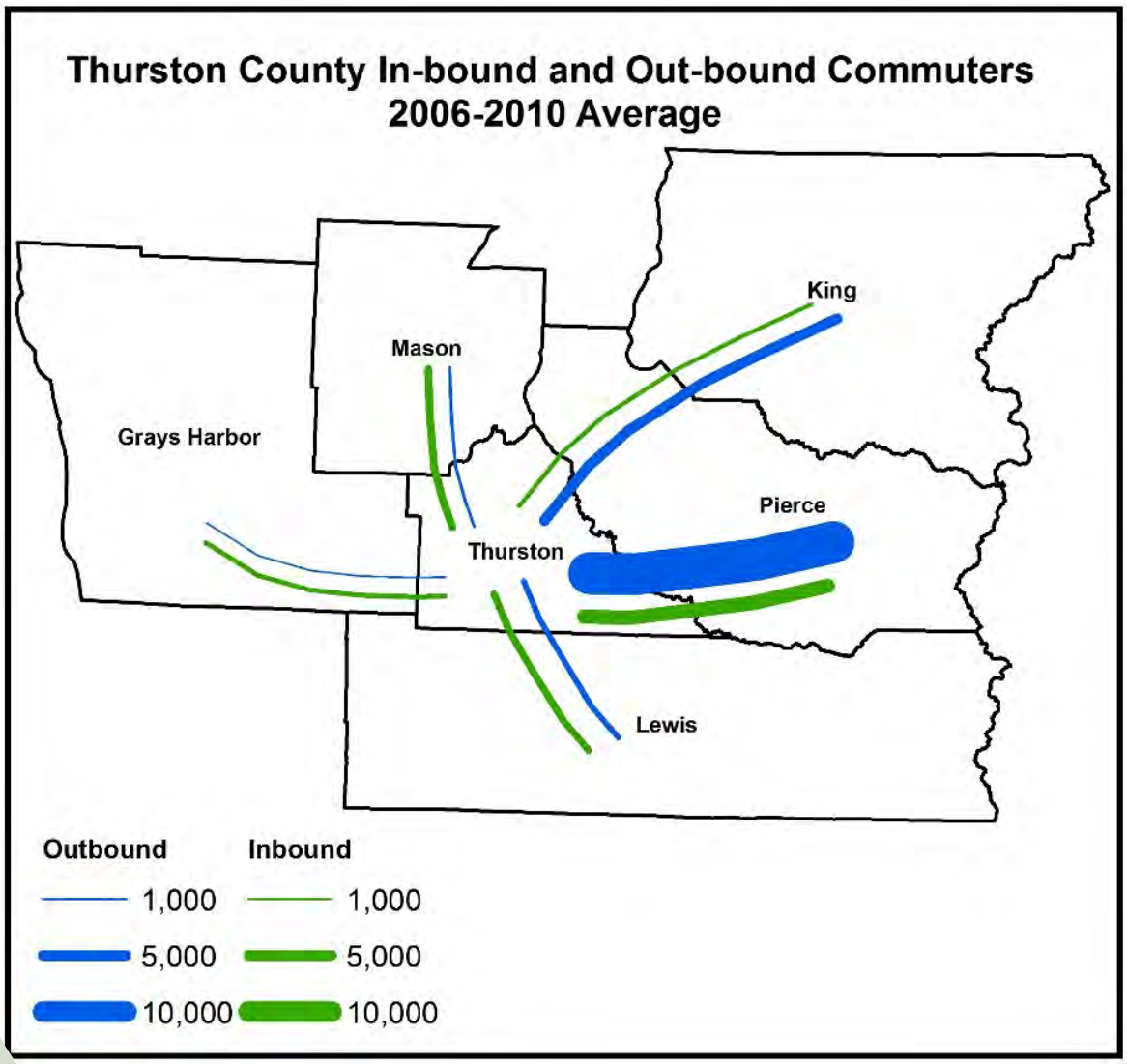
TRPC
Countywide Employment and Commute Forecast

Population and Employment Forecast for Thurston County



January 17, 2018

thurston regional planning council

THURSTON REGIONAL PLANNING COUNCIL (TRPC) is a 22-member intergovernmental board made up of local governmental jurisdictions within Thurston County, plus the Confederated Tribes of the Chehalis Reservation and the Nisqually Indian Tribe. The Council was established in 1967 under RCW 36.70.060, which authorized creation of regional planning councils.

TRPC's mission is to **"Provide Visionary Leadership on Regional Plans, Policies, and Issues."**

To Support this Mission:

A. Support **regional transportation** planning consistent with state and federal funding requirements.
B. Address **growth management, environmental quality, economic opportunity**, and other topics determined by the Council.
C. **Assemble** and **analyze data** that support local and regional decision making
D. Act as a **"convener"** to build regional **consensus** on issues through information and citizen involvement.
E. Build **intergovernmental consensus** on regional plans, policies, and issues, and advocate local implementation.

2017 MEMBERSHIP
THURSTON REGIONAL PLANNING COUNCIL

Governmental Jurisdiction	Name of Representative
City of Lacey	**Virgil Clarkson,** Councilmember
City of Olympia	**Nathaniel Jones,** Councilmember
City of Rainier	**George Johnson,** Councilmember
City of Tenino	**David Watterson,** Councilmember
City of Tumwater	**Tom Oliva,** Councilmember
City of Yelm	**JW Foster,** Mayor
Confederated Tribes of the Chehalis Reservation	**Amy Loudermilk,** Staff
Nisqually Indian Tribe	**Heidi Thomas,** Tribal Councilmember
Town of Bucoda	**Alan Vanell,** Councilmember
Thurston County	**John Hutchings,** County Commissioner
North Thurston Public Schools	**Chuck Namit,** School Board Member
Olympia School District	**Justin Montermini,** School Board Member
Tumwater School District	**Mel Murray**, Staff
Intercity Transit	**Karen Messmer,** Authority Member
LOTT Clean Water Alliance	**Cynthia Pratt,** Board Member
Port of Olympia	**Joe Downing,** Port Commissioner
PUD No. 1 of Thurston County	**Russell Olsen,** PUD Commissioner
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Economic Development Council of Thurston County	**Michael Cade,** Executive Director
Lacey Fire District #3	**Gene Dobry,** Commissioner
Puget Sound Regional Council	**vacant**
Timberland Regional Library	**Cheryl Heywood,** Library Director
The Evergreen State College	**Jeanne Rynne,** Director of Facilities Services

Chair	Vice Chair	Secretary
Tom Oliva	**Nathaniel Jones**	**JW Foster**
City of Tumwater	City of Olympia	City of Yelm

Marc Daily, Executive Director

Population and Employment Forecast

Advisory Committee

2017-2018

Representative	Organization/Jurisdiction
Allison Osterberg	Thurston County
Amy Loudermilk	Confederated Tribes of the Chehalis Reservation
Andy Ryder	City of Lacey, Transportation Policy Board
Angela White	Olympia Master Builders
Christy Osborne	City of Lacey
Clarita Mattox	Port of Olympia
Clark Gilman	City of Olympia, Transportation Policy Board
David Ginther	City of Tumwater
David Schaffert	Thurston County Chamber
Don Melnick	Intercity Transit, Transportation Policy Board
Grant Beck	City of Yelm
Heidi Thomas	Nisqually Indian Tribe
Jason Robertson	Citizen / Local Economist
Jeremy Davis	Thurston County
Joel Baxter	Olympia Master Builders
John O'Callahan	City of Tenino, Transportation Policy Board
Jonathan Stephenson	City of Rainier, Transportation Policy Board
Katrina Van Every	City of Tenino, City of Rainier
Kevin Pestinger	Citizen Representative, Transportation Policy Board
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Mark Kitabayashi	Thurston County Realtors
Michael Cade	Thurston Economic Development Council
Rob LaFontaine	Intercity Transit
Ryan Andrews	City of Lacey
Tim Smith	City of Olympia
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Walt Jorgensen	Citizen Representative
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Acknowledgments

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Thurston Regional Planning Council has been providing population and employment forecasts for Thurston County since the late 1960s.

For More Information

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Summary

The Thurston Regional Planning Council (TRPC) develops updated population and employment forecasts every three to five years. These forecasts are used for transportation, sewer, water, land use, school, and other local governmental planning purposes. They are also used by the private sector for market studies and business planning. Forecasts are developed for both the county level and the neighborhood level. TRPC has been preparing these forecasts since the late 1960s. This report documents the 2017 countywide employment forecast update.

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Introduction

Modeling History

Over the past four decades, Thurston County has experienced one of the highest growth rates in the nation. This growth has generated a need for new schools and hospitals, and prompted major investments in water, sewer, and transportation facilities. As these investments are expensive and must be planned many years in advance, forecasts of future population growth and its distribution are used to estimate where and when new facilities will be needed. For this reason, the Thurston Regional Planning Council (TRPC) has prepared population and employment forecasts periodically since 1969. Local jurisdictions, however, were not required to use the figures for the purposes of developing comprehensive planning documents and capital facilities plans prior to 1990.

This all changed with the passage of Senate Bill 2929 in 1990, known as the Growth Management Act, which required that certain fast-growing counties plan for the future in a very specific and prescribed manner.

The key provision in the Growth Management Act required that the state Office of Financial Management prepare a twenty-year population forecast for each county in the state. Counties required to plan are directed that:

> *"Based upon the population forecast made for the county by the Office of Financial Management, the urban growth areas in the county shall include areas and densities sufficient to permit the urban growth that is projected to occur in the county for the succeeding twenty-year period."*

In 1992 Thurston County, in consultation with the cities and towns, adopted the Countywide Planning Policies. One provision in these policies was that:

> *"The state Office of Financial Management growth management planning population projections for Thurston County will be used as the range of population to be accommodated for the coming 20 years.*
>
> *Within the overall framework of the OFM population projections for the County Thurston Regional Planning Council will develop countywide and smaller area population projections, pursuant to RCW 36.70A.110 and based on current adopted plans, zoning and environmental regulations and buildout trends."*

The 1992 forecast was the first to incorporate data from the 1990 Census, along with other new information. A round of military base closings elsewhere in the nation was leading to increased troop levels at Fort Lewis. The countywide model was updated to incorporate revised assumptions for off-base military personnel and their families living in Thurston County. Also in 1992, the population allocation model was used to evaluate the effects of land use policy alternatives. The major question was whether the community's 1988 urban growth areas would meet the requirements of the 1990 Growth Management Act. Would these areas provide adequate capacity for twenty years' growth? The analysis found that there was more than enough room.

In 1995-1996, the forecast was updated to incorporate several changing trends since the 1992 analysis. The adoption of Initiative 601 in 1993 had lowered the outlook for State government employment growth. Policymakers were hoping that aggressive efforts to attract industry would offset some of these effects. Hence the model assumptions for the future included both lower state government employment and higher manufacturing employment than in earlier forecasts. Finally, having recently adopted land use plans and zoning ordinances to meet the requirements of the Growth Management Act, these changes were modeled in the population allocation model.

In 1998-1999 TRPC focused its update primarily on technical improvements, though the model, as always, reflected changes due to evolving state and local trends. The employment model was revised to use the Bureau of Economic Analysis data on total employed persons – both wage and salary workers and proprietors – rather than wage and salary workers alone. Industry detail was increased from 24 industries to 33. Commuting trends into and out of Thurston County were extensively analyzed. Labor force participation rates for older workers (age 55 and up) were revised to account for the effect of increasing education levels on longer working careers. Birth rates and death rates in the demographic model were overhauled.

In 2004, the forecast update was focused again on technical improvements. The results of the 2000 Census were incorporated into the forecast, and both the future county-to-county commuting trends and unemployment rates were overhauled. The forecast allocations were finalized in 2004, and updated again in 2007 to fully incorporate the 2007 Buildable Lands land capacity analysis.

In February 2010, the county-wide forecast was updated. This forecast is the first to move away from the Standard Industrial Classification (SIC) classification of employment sectors, converting to the North American Industry Classification System (NAICS). The conversion required an extensive back casting of the data series.

In 2012 the countywide forecast was updated to reflect the continuing weakness in the economy, and adjustments to the statewide employment forecast, which has a large effect on the local economy in Thurston County.

In 2017 countywide economic forecast was updated without any major changes in methodology, however, all the regression-based formulas were recalculated to take into account the Great Recession. In addition, TRPC coordinated with the Washington State Office of Financial Management as they developed their county Growth Management Act population forecasts, in lieu of developing a separate countywide population forecast for Thurston County, as the data past models relied upon for migration and commuting were no longer available at the scale and accuracy needed for the population forecast. The 2017 update extends the forecast horizon to 2045.

Relationship to Growth Management Act

The Growth Management Act requires that counties and cities base their planning on population forecasts that are consistent with those prepared by the Population Studies Division of the Office of Financial Management (OFM). OFM prepares a high, medium, and low population forecast for each county. The consistency requirement means Thurston County must use a population forecast that falls between the high and low OFM forecasts. In the past TRPC prepared a local countywide population forecast. For this forecast update, TRPC coordinated with OFM as they updated their county forecasts, rather than develop a separate countywide population forecast. TRPC continues to develop countywide employment forecasts, and small area distributions of both the population and employment forecast.

Under the Growth Management Act, counties have the responsibility for what forecasts will be used locally. The Act requires consultation among the local jurisdictions before action. In their Countywide Planning Policies, Thurston County delegated the review and approval of the forecasts to the Thurston Regional Planning Council. This not only takes advantage of the technical expertise at TRPC, but also provides for the necessary consultation.

How the Forecasts and Forecast Models are Used

Local jurisdictions, utilities, transit providers, consultants, and nonprofits, use TRPC's forecasts and forecast models in a variety of ways for general planning purposes. The countywide employment forecast is used to develop small area employment allocations. Employment is distributed to a small geography so that it can be reported for a variety of geographies, including:

- Transportation analysis zones
- Transit planning areas
- Water utility planning areas
- Cities, urban growth areas, tribal reservations
- Planning areas
- Watershed boundaries
- School district boundaries
- Fire district boundaries

In order to maintain consistency between planning efforts, local jurisdictions in Thurston County have agreed to use the same forecast in their planning efforts, and a variety of stakeholders participate in the development and review of the regional models.

Both the transportation and small area population and employment forecast models can also be used to model alternatives, or scenarios. The official TRPC forecast is considered a Baseline model, or the model that shows future conditions absent any major changes in policy or external circumstances. Scenarios can be modeled by changing assumptions. Some assumptions that can be modified include the following:

Countywide Employment Forecast

- Commute forecast
- Explicit assumptions for each employment sector

Countywide Population Forecast

- The countywide population forecast could be raised or lowered to simulate the effects of a recession or influx of climate migrants, for example. The alternative forecast could then be run through the small area models.

Small Area Population and Employment Forecasts

- Zoning or critical areas. Changes in zoning or critical area regulations will change estimates of land supply, which in turn will impact the small area distribution of both population and employment.

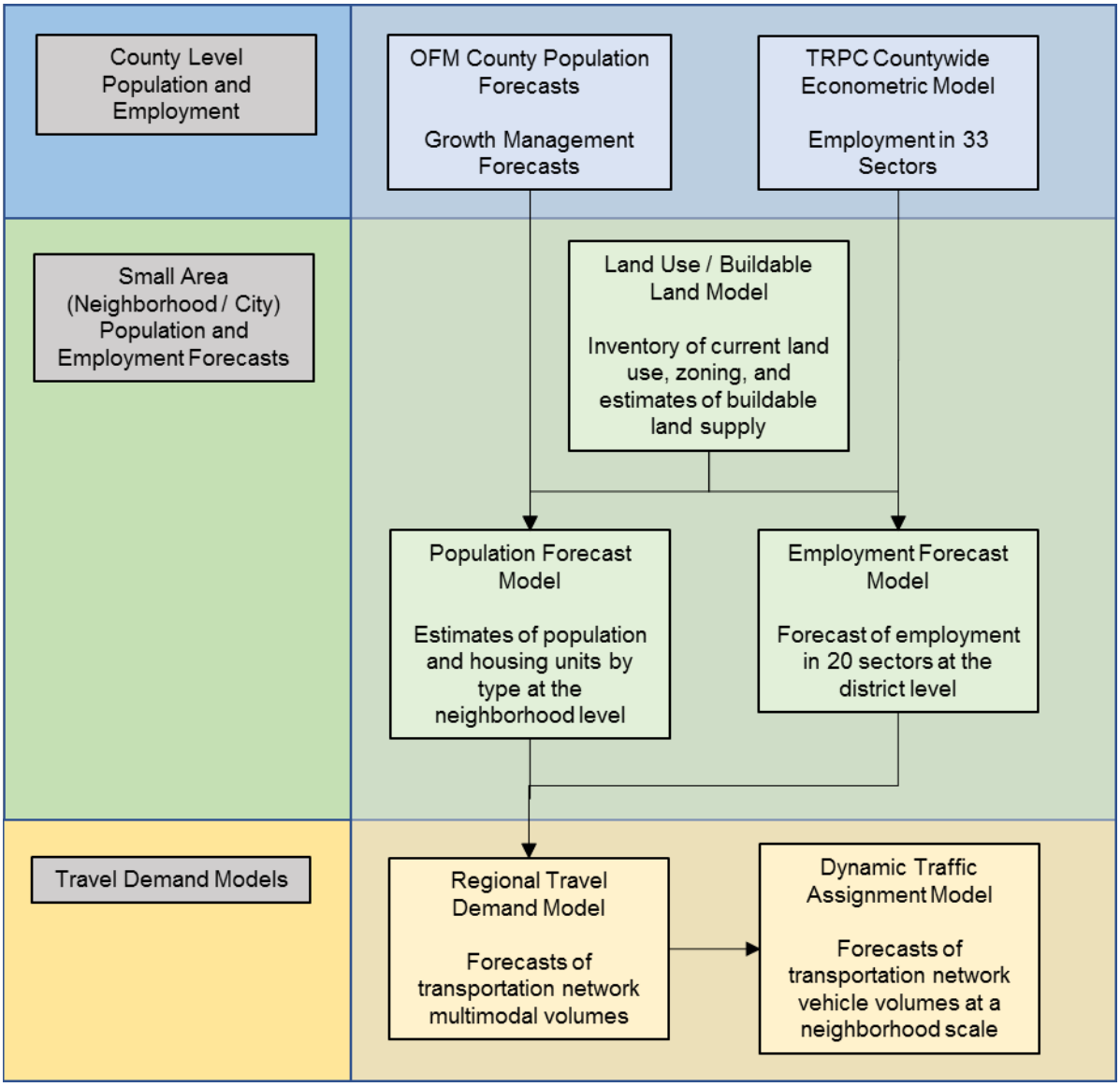
Travel Demand Models

- Travel lane or intersection alternatives. Changes in travel lanes or intersections affect travel demand distribution on the network.
- Transit frequency. Changes in transit availability will affect the amount of people using transit for travel.
- Parking costs. Changes in parking costs will affect where and how people travel.

Structure of the Forecast Model

The TRPC forecasting process involves multiple stages, and relies on both computer modeling and human judgment. The first stage is to forecast growth in employment at the county level using an econometric model, and coordinate with the state Office of Financial Management as they develop county population forecasts. The second stage is to break down those figures to the neighborhood level using a large database of developable lands, development trends, and zoning densities. Within each stage are many sub-tasks and detailed assumptions. The overall approach is to base the modeling on a great many small assumptions, rather than a few giant leaps of faith.

Structure of TRPC Forecast Models



Assumptions

Every forecast is a product of the assumptions it makes. Some assumptions are detailed and explicit. They are documented in each updated forecast. Others are more general and implicit, but also have major importance in determining the outcome. They are as follows:

1. There will be no major war, depression, or extensive natural disaster during the period covered by this forecast. In fact, the model is designed to look at "average" economic conditions; it does not attempt to predict the timing of business cycles, such as recessions or recoveries.
2. Thurston County will continue to be influenced by the patterns of growth or decline of Washington State and the Puget Sound Region. Future demographic and employment interrelationships will largely reflect the general trends of the last twenty to thirty years.
3. No major existing employers will close or move from the county during the forecast period, except as may be explicitly assumed for each forecast update. Likewise, no new major employers will move to Thurston County during the forecast period, except as may be explicitly assumed.
4. Infrastructure will be provided as needed, according to the currently adopted policies of the various jurisdictions. Significant changes in the relative availability or costs of needed infrastructure — either a) for Thurston County versus other counties, or b) for one subarea versus another within Thurston County — could affect the projections.

Assumptions

Some assumptions – such as availability of water, energy, fuel pricing, climate refugees – are of widespread concern but there is not a definitive direction on how to model them.

Historic Employment Trends

Overview

Thurston County employment showed steady growth over the last 35 years, somewhat comparable to overall employment growth in Washington State, but highly influenced by its position as the capital of Washington State. During the 1980s, county employment grew at a higher rate than overall state employment growth, likely due to an increase in state government employment. This ended with the passage of Initiative 601, which slowed growth in the state government sector. The county was more resilient during the 2001 recession, which saw a drop in dot.com industries, which are a large sector for the state, especially the Seattle area, but not a large sector in Thurston County. During the Great Recession in the late 2000s, the county was slightly more resilient than the state as the recession started, but was also much slower to recover, likely due in large part to the slow recovery in state government employment.

The county's economy has diversified over the years. State employment was more than one quarter of our work force in 1980 (26 percent), and accounts for 17 percent today. Conversely, with two regional hospitals, the education, health, social services, combined with arts, entertainment, and recreation comprised 9 percent of the jobs in 1980, but captures a 16 percent share today. Growth share in the professional and business services has almost tripled between 1980 (4 percent) and 2015 (11 percent), with actual number of employees increasing seven-fold.

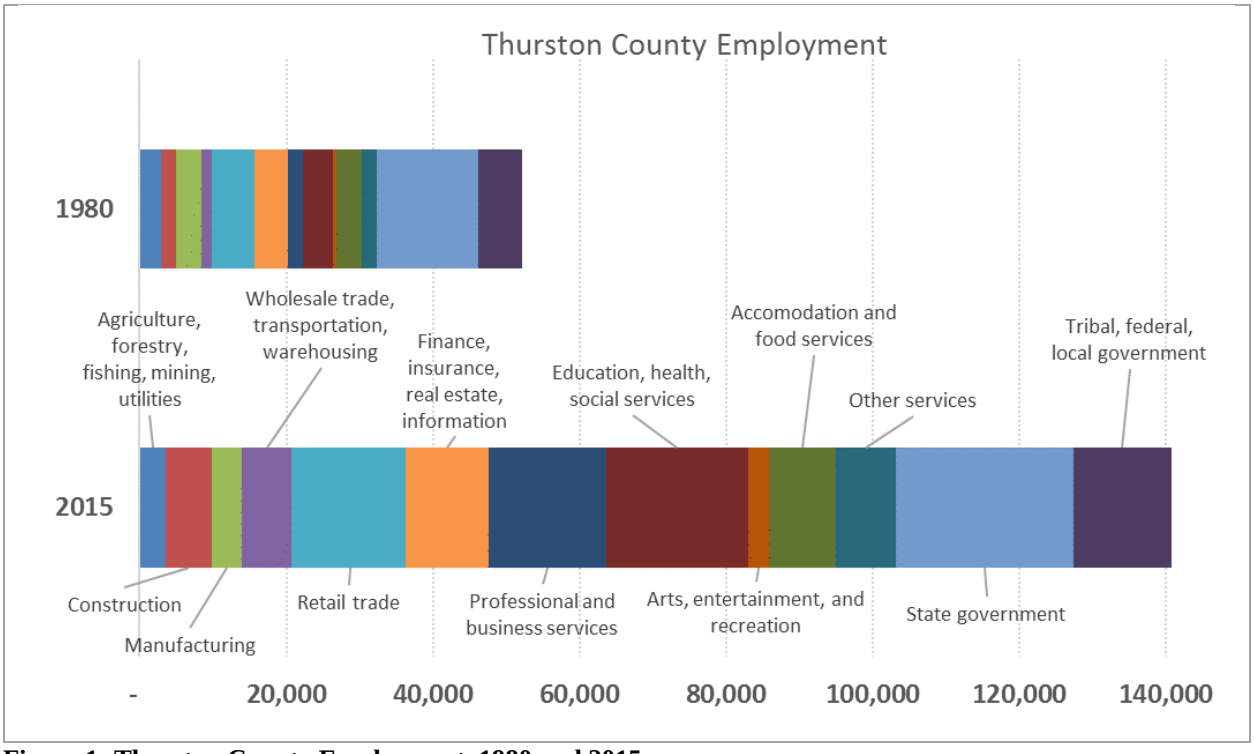


Figure 1: Thurston County Employment, 1980 and 2015.

The 1970s

Thurston County entered the 1970s with its economy in transition. The 1960s saw the gradual decline of the local forest products industry, culminating in the closure of two mills in 1967. At the same time, state government employment was on the rise, taking over the role of major employer in the community. During the 1970s, it continued to grow strongly, reflected in a large expansion of the State Capitol Campus to the east of Capitol Way. Other major events dramatically changed the community, reflecting a diversification of the local economy. The Evergreen State College opened in 1971, starting the growth spurt of the Olympia's Westside. St. Peters Hospital moved to Lilly Road in 1971, eventually taking most of the medical community with it.

Similarly, West Olympia saw the construction of a regional shopping center in 1978, which attracted commercial activity to the area. This development, in turn, resulted in a decrease in the “leakage” of retail sales to Pierce and King Counties.

In nearby Grays Harbor County, construction of the Satsop Nuclear Plant began in 1977. Roughly half of the peak employment of 4,000 lived in Thurston County. This added a considerable stimulus to the local economy.

While state and federal government employment grew by 52 percent during the 1970s, employment in trade and services grew by 87 percent and 145, percent respectively. Population grew by 62 percent during the 1970s, as housing starts doubled previous levels. To meet the needs, new schools were built all over the county. The downtown Olympia sewage treatment plant, which became operational in 1982, and many of the major trunk lines, were also completely rebuilt.

The 1980s

As quickly as the boom began, it ended. By 1980, Thurston County was in the start of a long slump that lasted until the middle decade. From 1980 through 1983, manufacturing employment declined. State and federal government employment dropped in both 1981 and 1982. In 1983 work on the Satsop Nuclear Plant was halted. Growth slowed to a trickle.

But fluctuations in business cycles are typically expected to occur. It is useful to remember that the late 1960s were also boom years, and the early 1970s were also a slow period. The late 1980s and early 1990s brought a resurgence of growth to our local economy.

As the county pulled out of the recession of the early 1980s, new construction began to boom once again. Major projects began to change the face of our several communities. Olympia built a new performing arts center, a community center, a farmer’s market, and several major expansions of the successful Percival Landing waterfront boardwalk. Private dollars flowed into many renovated historic downtown buildings. Other downtown sites saw major new office complexes.

Olympia’s Westside saw the construction of the community’s second hospital. Many new offices were built near the Capital Mall and near the county courthouse. Several large apartment complexes and a large new retirement center also came to the Westside. Lacey’s Core Area was the scene of major renovations and expansions to South Sound Shopping Center. A commercial center anchored by Fred Meyer opened across the street. Major new offices sprang up in Rowe Six and Woodland Square. Other commercial

development followed the strong residential growth to the south and east of Lacey. Major new community commercial development came to the Yelm Highway and Hawks Prairie areas. Responding to the growth, the North Thurston School District rebuilt the North Thurston High School and the South Bay Elementary School, and built new grade schools on Abernathy Road and in The Meadows subdivision.

Tumwater saw strong residential growth, especially on Tumwater Hill and along Yelm Highway. Industrial growth was also strong, particularly in the Mottman Industrial Park and the Thurston Airdustrial Center. Tumwater expanded its industrial land base with annexations to the west and to the south, taking in the airport and the Airdustrial Center. Strong growth to the west of Tumwater led the Tumwater School District to build a new grade school at Black Lake. A new Costco store opened on Littlerock Road, dramatically boosting retail sales in Tumwater.

The South County also saw strong growth, especially in the Yelm area. Although the South County remained rural in nature, many residents commuted to jobs in the North County, or at Fort Lewis, Tacoma, or Centralia.

Even though our growth rate rebounded from its low point in the early 1980s, it did not regain the extreme high of the late 1970s.

The 1990s

The rebound continued through the early 1990s. Population grew at a moderate rate, similar to that experienced in the 1980s. Growth was strongest in Yelm, Rainier, and Lacey, changing the distribution of the county's population. The Tumwater school district built the Black Hills High School. Employment growth continued to be strong in the retail sector, with several large retail chains, including Home Base and Home Depot, moving into the region. While Olympia continued to dominate the retail market, Yelm, Tumwater and Lacey carved out larger shares. The face of downtown Olympia changed during the 1990s. The Yardbirds department store closed down in the early part of the decade, to be replaced by senior housing. A new home for the Farmers Market was built at the north end of Capital Way, where it was joined by a restaurant, office complex, and coffee brewing facility several years later.

The manufacturing industry continued to be strong in the early part of the decade, but slowed down in the later part, as growth was offset by the relocation or downsizing of several manufacturers, including the Hardel Lumber plant in West Olympia. The construction of Northwest Landing, north of the Nisqually River in Pierce County, brought many high-tech workers to the region to work for Intel. Many of the Intel workers settled in Thurston County.

Across the country, the 1990s was a time of downsizing the military with numerous base closures occurring. An expected influx of displaced personnel to the Fort Lewis base had not yet materialized though, and was not anticipated in the TRPC forecast from that time. State government underwent several major changes during the 1990s. Beginning in 1992, there was a period of decentralization, with satellite campuses developed in Lacey and Tumwater for the Departments of Ecology and Labor and Industries respectively. A new Department of Natural Resources building was constructed on the Capitol Campus. In 1993, with the passage of Initiative 601, state spending was severely limited, resulting in a dramatic drop in the rate of new state job growth.

The 1990s overall was a time of stability and low unemployment. The first half was also a time of rapid growth in jobs and population, while the second half was a time of very slow growth rates.

The 2000s

At the end of the 1990s, many state offices were consolidated, and new agency headquarters relocated near and around Tumwater's emerging Town Center. In Lacey, the Hawks Prairie area was beginning to see rapid industrial and residential growth. By the mid-2000s the area of Hawks Prairie around Marvin Road was becoming a major retail center. A quick succession of large retail stores opened, culminating in a regional attractor – Cabela's sporting goods store – in 2007. In the south County, the Grand Mound area saw big changes with the location of the Great Wolf Lodge destination resort. This partnership of the Confederated Tribes of the Chehalis Reservation and business community led to new investment in this largely rural community located off the interstate between Tumwater and Chehalis.

The national economic downturn after 2001 had its impact in Thurston County. Growth in employment slowed, but overall population and employment continued to increase, albeit at a lower rate. The housing market began to pick up in 2003, and Thurston County saw a rapid increase in new homes permitted until 2006-2007. The mid-2000s saw fairly low unemployment rates in Thurston County, staying below five percent. This changed in 2008 with the national financial crisis. Unemployment rose to 9.6 percent nationwide, and 9.0 percent in Thurston County by 2010 – the highest level since the 1980s. Housing prices collapsed, home sales plummeted, and new home starts dropped to their lowest levels in decades. 2009 was the first year since the 1980s where employment decreased – rather than a slowdown in growth – and this decrease continued into 2011. Population continued to increase even as jobs declined, in part due to the collapse in the housing market causing people to stay in place and in part due to the expansion of Joint Base Lewis-McChord just to the north of the County.

The 2010s

As the county entered the 2010s, the region was still in the midst of the Great Recession. Thurston County experienced a steady decrease in employment from 2008-2011, but employment did not recover to 2008 levels until 2013-2014. Unemployment began to decrease in the early 2010s, and was back to average levels by 2016, leading to an increase in population in-migration. New home construction continued its recession-induced slump until midway through the decade. Residential building picked up in 2016, with multifamily construction at the highest levels the region has seen since data have been collected (1994). Retail sales followed the same pattern as total employment, with a slump starting in 2008 and continuing through 2014-2015. By 2016, retail sales were back to prerecession levels.

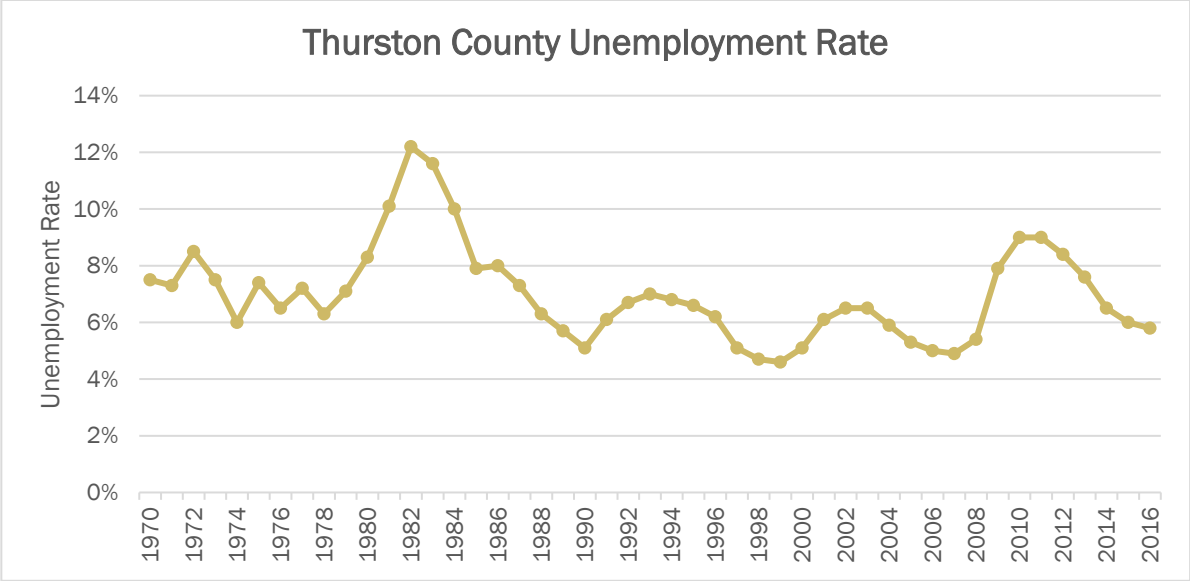


Figure 2: Thurston County unemployment rate. Thurston County's unemployment rate is cyclical, representing boom and bust periods. Unemployment is inversely related to migration; when unemployment is low, in-migration is high. Source: US Bureau of Labor Statistics.

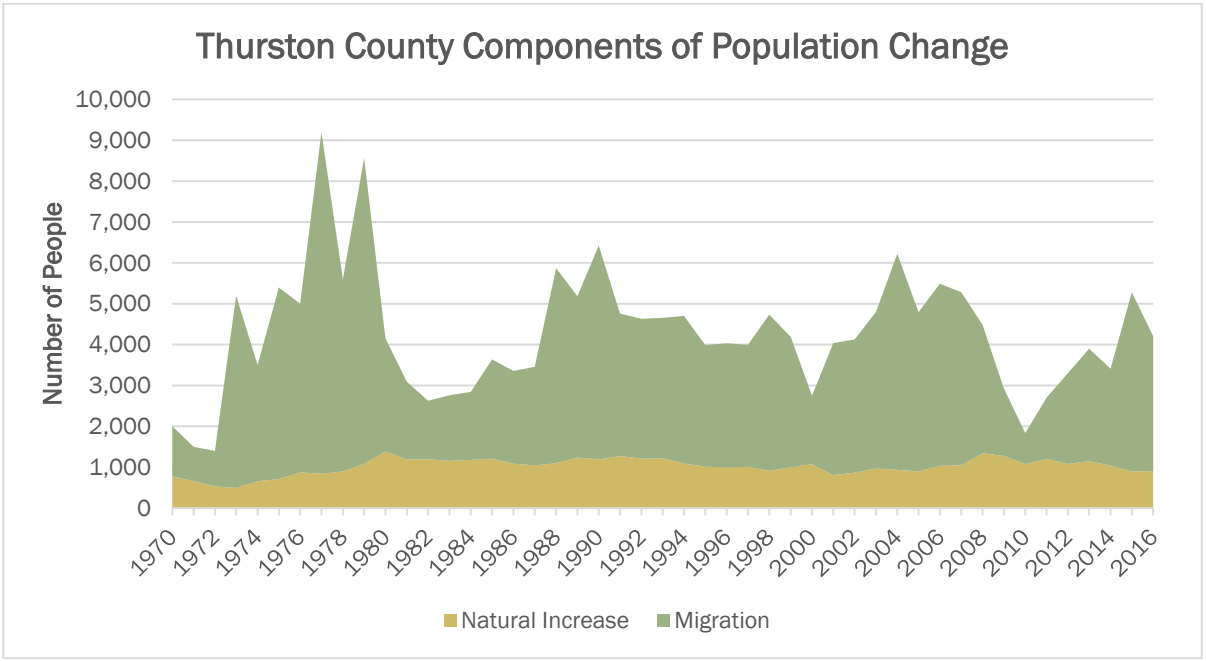


Figure 3: Components of population change. Natural increase is the difference between births and deaths, while migration is the difference between people moving to and from the region. The 1970s saw the greatest amount of net migration to our region. While natural increase remains fairly steady, net migration is strongly influenced by employment opportunities. Source: Washington State Office of Financial Management.

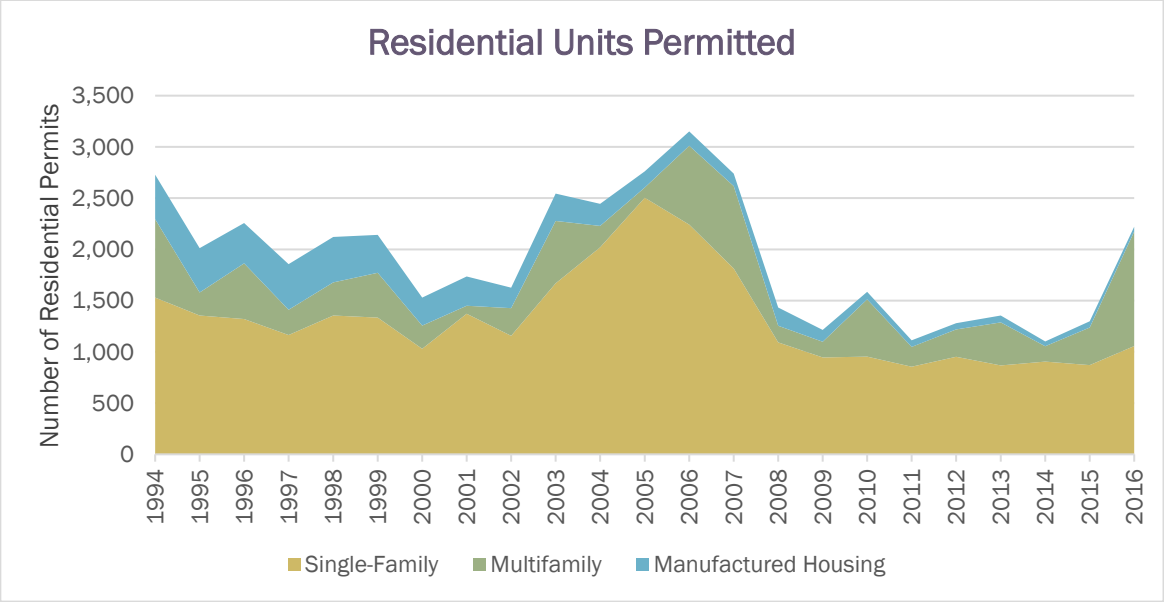


Figure 4: Residential building activity. Residential units permitted are new homes permitted in Thurston County. Building activity increases during economic boom cycles, such as the mid-2000s. Source: TRPC compilation of local jurisdiction building permits.

What will the future bring?

It is clear that the future will bring changes, but what changes, and how much change is difficult to predict. Although it is not possible to know the future, systematic and reasonable assumptions can be made about it. When forecasts are prepared, historical trends in the national, state, and local economy are interpreted, then used to provide a foundation to TRPC's computer model to project future employment and commute trends in Thurston County.

Countywide Employment Forecast

Employment in Thurston County is expected to grow by 42% in the next 30 years, or approximately 60,000 new jobs. Overall, the county's employment forecast closely mirrors the state's employment forecast.

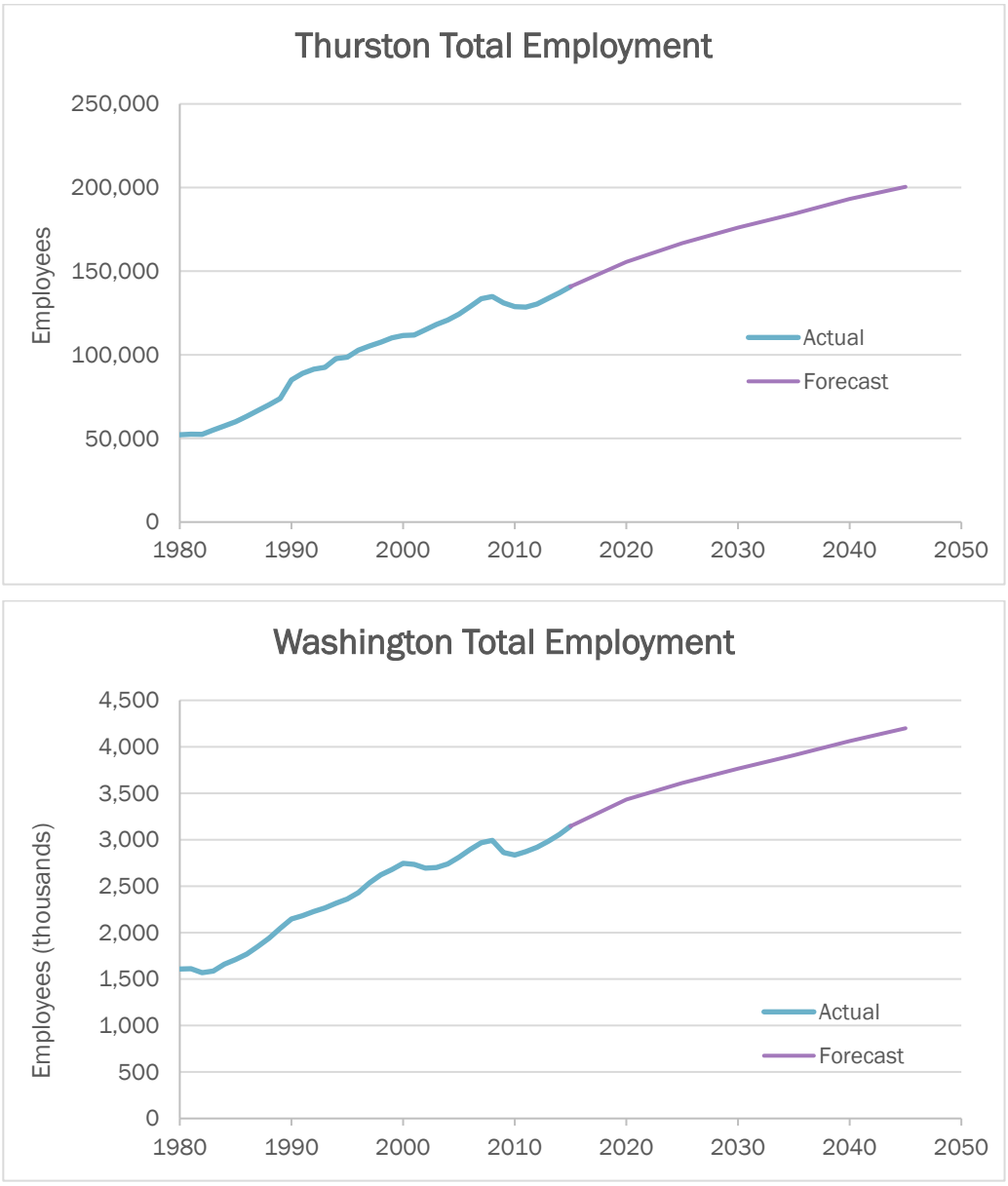


Figure 5: Comparison of Thurston County and Washington State employment forecasts. Source: Thurston Regional Planning Council; Washington State Forecast: Office of Financial Management, Long-Term Economic Forecast.

The four largest employment sectors in Thurston County account for 53 percent of the jobs today:

- State Government (17 percent)
- Education, Health, and Social Services (14 percent)
- Professional and Business Services (11 percent)
- Retail Trade (11 percent)

Education, health, and social services is the fastest growing sector of the larger employment sectors, and by 2040 is expected to pass State government as our largest employment sector. Professional and business services has been our fastest growing employment sector in the past, and recently became our third largest sector, growing larger than retail trade.

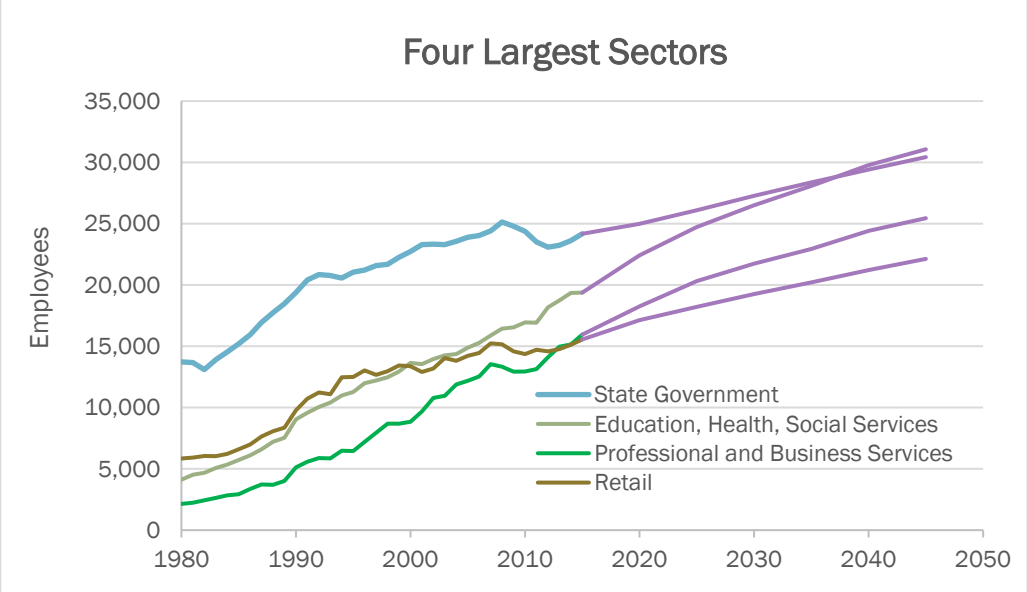


Figure 6: Comparison of Thurston County's four largest employment sectors.

Comparison with Previous Forecast

The 2017 Employment Forecast is 0.8 percent higher than the 2012 Forecast for the year 2025, but is 3.2 percent lower than the 2012 Forecast for the year 2040. The main reason for the adjustment is differences in the Office of Financial Management's forecast of statewide employment, and an update of the regression-based formulas used to forecast Thurston County employment.

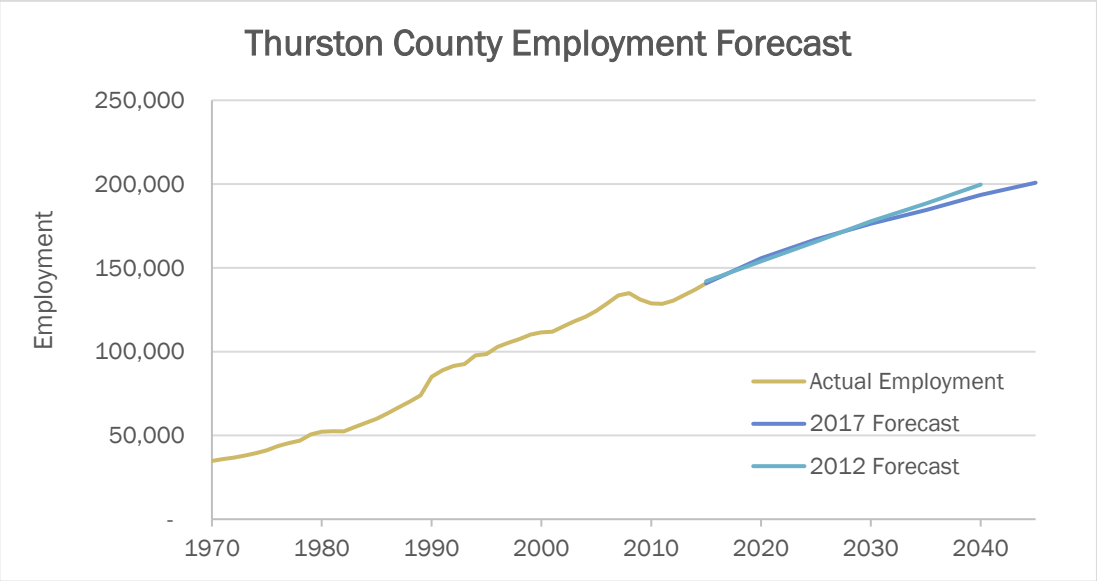


Figure 7: Comparison of Thurston County's current and previous employment forecasts.

Methodology

The **Econometric Model** forecasts future employment *demand* in about three dozen local economic sectors. In economic models these are called “industries” EMPFOR is an “economic base behavioral model.” The “economic base” part means that it assumes that overall employment trends are driven by the fortunes of our economic base — i.e., those industries that export goods or services outside Thurston County — thus bringing home jobs and dollars. These are referred to as our “basic industries” — for example, state government and manufacturing. The rest are called “non-basic industries” — for example, retail trade and local government. They mainly serve the local community, and their fortunes are dependent on those of the basic industries.

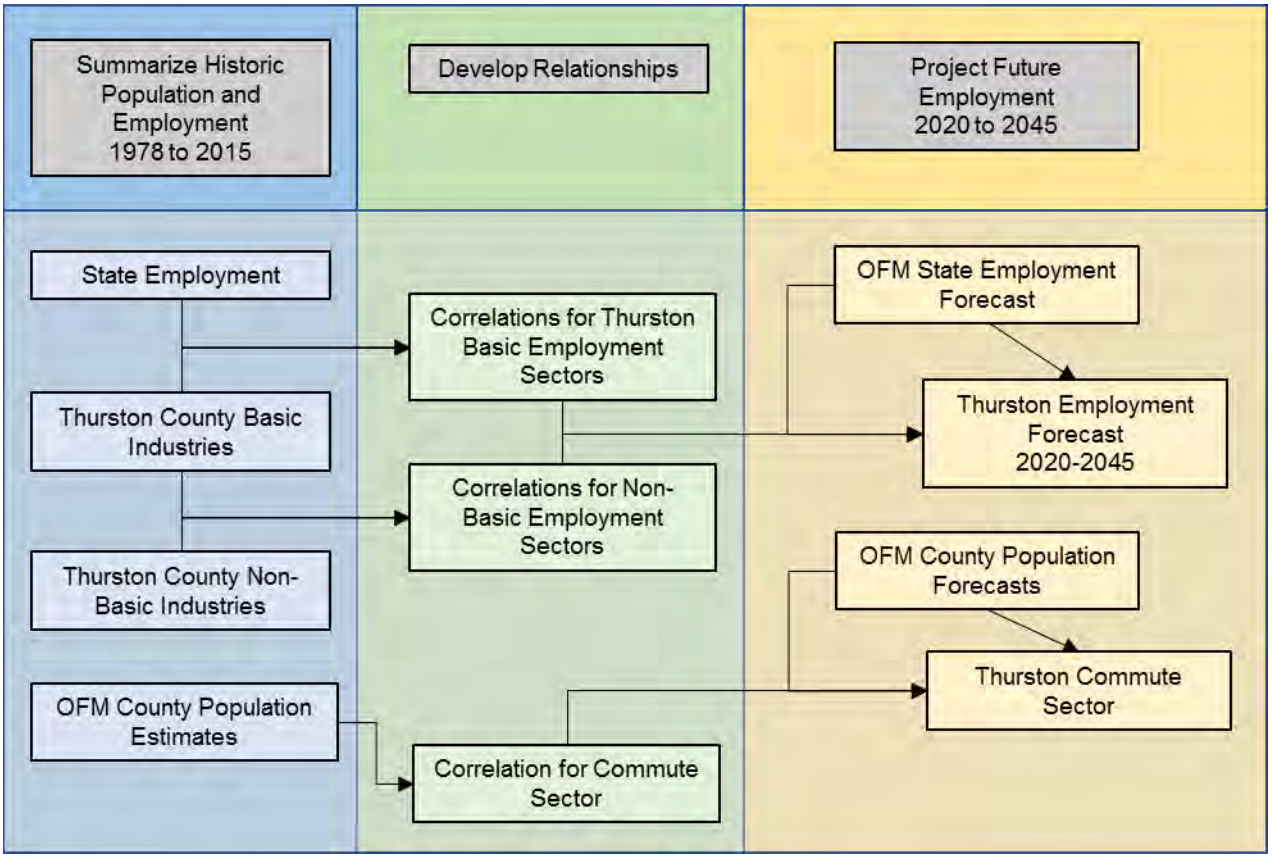
The “behavioral” part means that the model looks at how employment in one industry *behaves* when employment in another industry goes up or down. Of course, jobs in state government do not *directly* beget jobs in local retail trade. It actually takes place through the intermediary of dollar flows. More complicated models than ours — such as those used by state and national economic forecasters — factor in dollar flows based on salary levels, labor productivity rates, purchases of goods and services by industry, and so on.

We use multiple regression analysis to correlate employment trends in local basic industries to state-level trends in those industries — for example, in local versus state-level plastic products manufacturing. Then employment in local non-basic industries is correlated with local basic industries.

The analysis examines total employment by industry, which includes both business owners (“proprietors”) and wage-and-salary workers. The methodology starts with time-series data on total employment in 23 major industry divisions (such as “manufacturing,” “information,” or “retail trade”) from the period 1978-2015. These data are from the Regional Economic Information System (REIS) of the Bureau of Economic Analysis, US Department of Commerce. Using data on employment covered by unemployment insurance, the major industries are split into the 33 individual industries used in the model (such as “wood products manufacturing” versus “food products manufacturing,” or “publishing” versus “software”).

Shares of total employment by more detailed industry are estimated using data on those wage-and-salary workers that are covered by the unemployment insurance program, administered by the Department of Employment Security. This “ES-202” dataset covers about 77 percent of all local workers — more in some industries, less in others. Some industries have a large share of non-covered workers, such as real estate and many service industries.

Structure of TRPC Countywide Econometric Model



Reliability of the Econometric Model

The EMPFOR model was "back-cast" to test its ability to replicate the historic employment data (1980-2015) used to create it. In other words, how well does it predict the past? This test showed an adjusted R^2 of 0.998 for predicted total employment versus actual total employment. An R^2 of 1.0 represents a perfect fit.

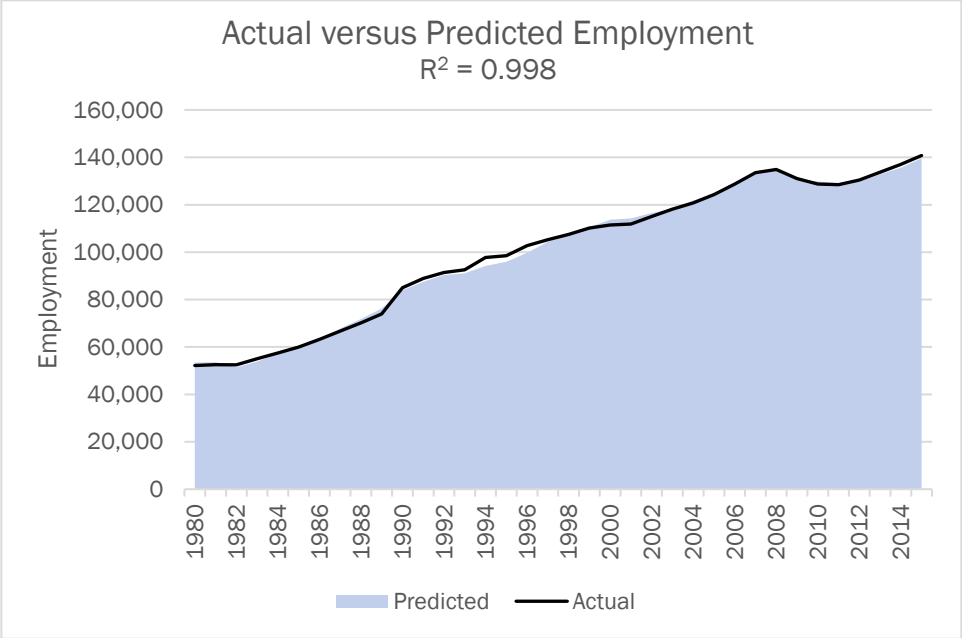


Figure 8: Comparison of Actual versus Predicted Employment.

Employment Forecasts by Sector

The countywide employment forecast is the sum of the forecasts for 33 employment sectors. This section details trends in those sectors and the assumptions used to forecast them.

Resources and Utilities

The share of employment in the resource sector (agriculture, forestry, and fishing and mining) has decreased from 5 percent in 1980 to 2 percent in 2015. The agriculture, forestry, and fishing sector grew until the mid-1990s, and then began a slow decline, stabilizing through the 2000s. The statewide forecast for this sector is slow but steady growth (10 percent between 2015 and 2045). The forecast assumption for Thurston County is that the resource sector will grow at the same rate as the statewide resource forecast.

The mining sector has experienced a slow but steady increase since 1980. This trend is expected to continue.

The utilities sector has remained fairly stable over the last few decades, and is not expected to change appreciably.

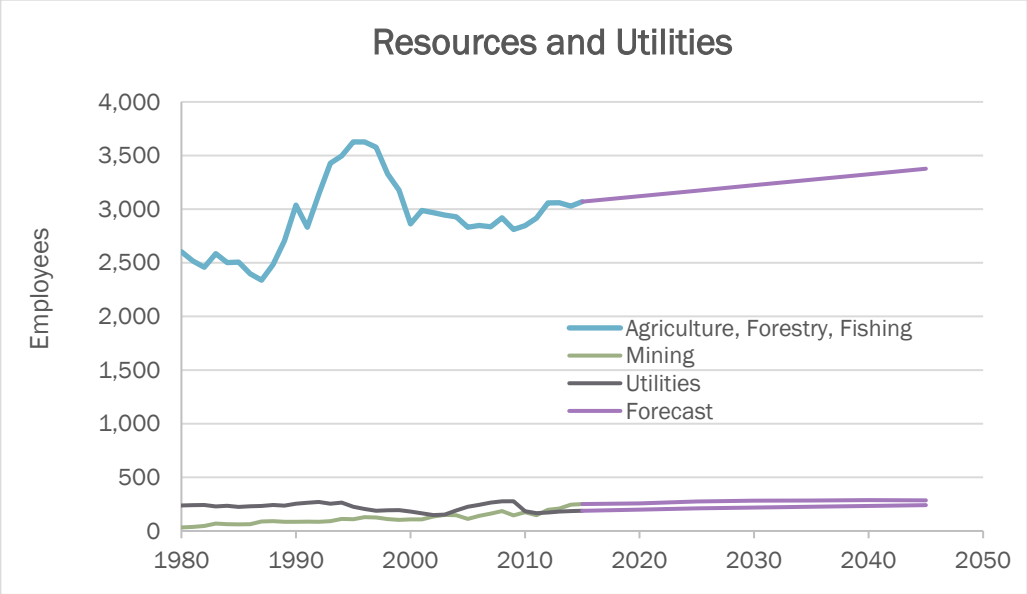


Figure 9: Resource and utilities sectors forecast.

Construction

The construction sector grew steadily over the decades, with new construction booming due to rapid population and employment growth in the county. The sector was hit especially hard during the Great Recession, as the housing industry stagnated. The recovery in this sector has been slower than other sectors, and has not yet reached pre-Great Recession levels.

The forecast for the construction sector was developed by relating the sector to a formula containing state construction, local manufacturing, and federal and state government employment growth. This resulted in a forecast of slow but steady growth, at a greatly reduced pace than the pre-Great Recession boom.

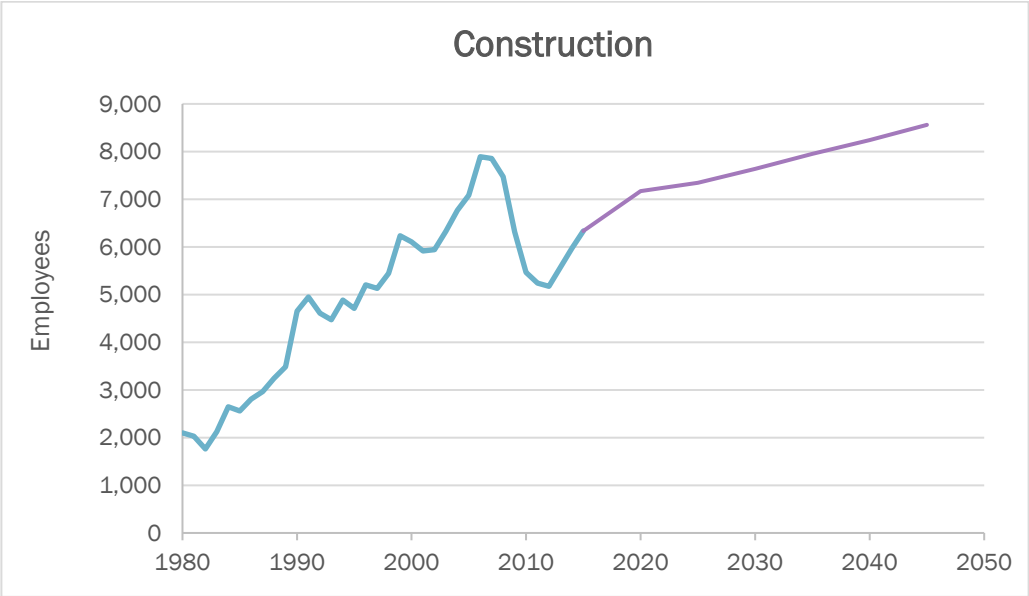


Figure 10: Construction sector forecast.

Manufacturing

In the long run, Washington State is expected to buck the national trend of declining employment in manufacturing. This is because many of the state's industries are newer, technology-oriented ones like computing equipment, rather than older, “structurally mature” ones, like steel. Thus, while employment in beverages and wood products may be declining, machinery and plastics will probably grow, though more slowly than industries such as services.

Thurston County’s manufacturing employment is likely to grow slowly too. While big employers are lost from time to time (e.g., Hardel plywood, Miller brewery), small ones are gained constantly. This has been an ongoing trend since early 1980s. As elsewhere, the local manufacturing sector is hard hit by recessions, when they occur.

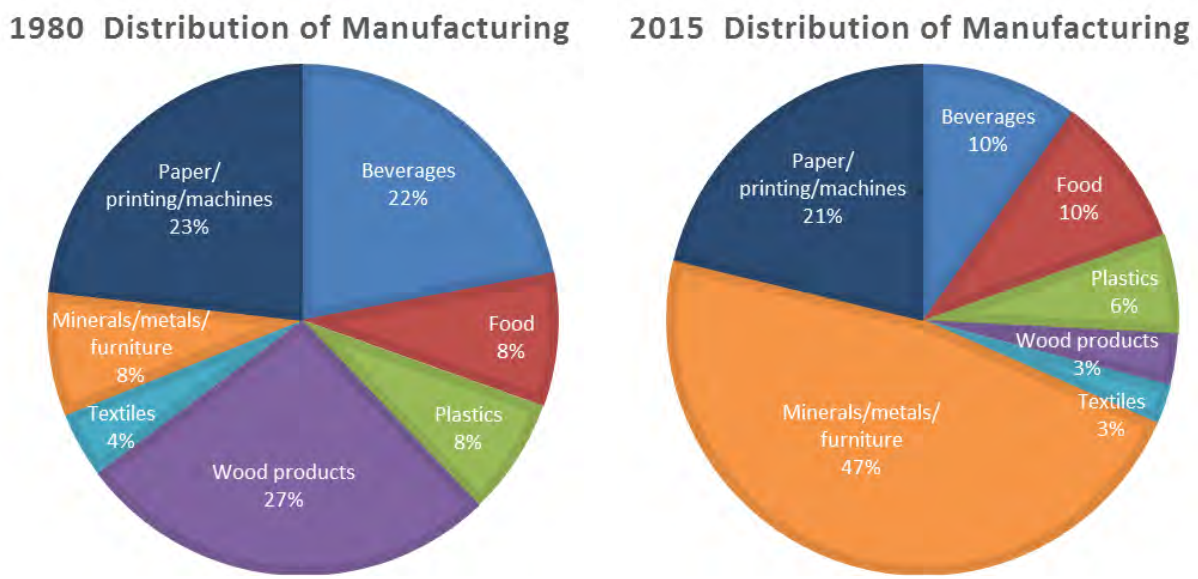


Figure 11: Changes in the manufacturing sector. Manufacturing in Thurston County has changed over the decades. Sectors such as wood products and beverages have reduced, while minerals, metals, and furniture (such as glass manufacturers) have grown.

The forecast model makes separate projections for seven manufacturing industries or groups of industries. Inevitably, some projections will be too high and others too low. Manufacturing is a highly volatile and uncertain sector, especially as the number of employees in each industry is fairly low compared to large sectors such as state government. It is assumed that manufacturing employment will track to statewide trends, dropping during recessions and rebounding thereafter. In the long run, the model projects slow growth.

Assumptions can be programmed into the model to accommodate new industries that may be poised to enter the community, or old ones about to shrink or relocate. The 2017 forecast does not insert any specific assumptions about new industries about to appear.

The forecast for manufacturing relies heavily on the state’s forecast for state manufacturing sectors. The forecast is for slow but steady growth in Thurston County’s manufacturing sector.

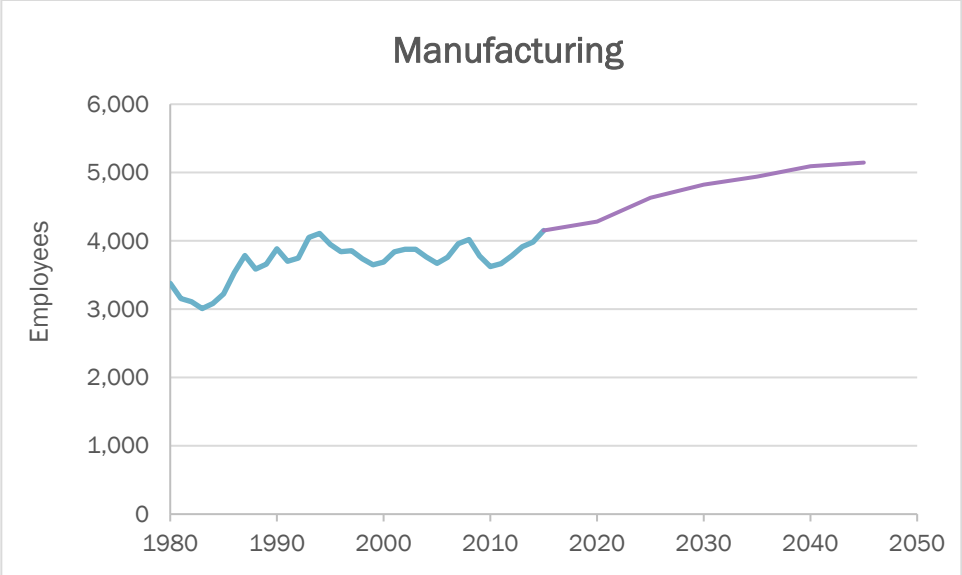


Figure 12: Manufacturing forecast.

Wholesale Trade, Transportation, and Warehousing

Employment in both the wholesale trade and the freight transportation sectors has grown steadily over the decades. Wholesale trade was fairly resilient to the Great Recession, and is projected to grow steadily in the future. The forecast was developed through relationships to state transportation, warehousing, and utilities forecasts, as well as basic industries such as manufacturing and state government.

A draft forecast for freight transportation was developed for review by the forecast advisory committee. The committee observed that freight is, and will likely continue to be, a fast-growing sector. Several factors play into this:

a. There are currently plans for a large employer to locate in Hawks Prairie – probably 100+ employees
b. Overall there is a shift from brick and mortar retail, and increase in online sales, which makes freight transportation a growing sector
c. Industrial sites in Thurston County have better freeway access, and relatively less congestion means there is less time navigating the local roads

There is, however, a question of land supply for future warehouses, especially as Hawks Prairie builds out. Based on the committee's input, the employment in this sector was increased by 100 additional employees between 2015 and 2020, and rounded up to reflect a growth rate of 10 percent. After 2020, growth was set at 5 percent for each five-year interval.

Passenger transportation, which includes taxis, airport transportation, and firms that are contracted for school bus services, remained fairly steady until recently, when a few new firms located in Thurston County, including a firm that provides transportation for railroad employees and a firm that employs personal shoppers. The forecast is for very slow growth in the future. School bus drivers employed by school districts are included in local employment, as are Intercity Transit employees.

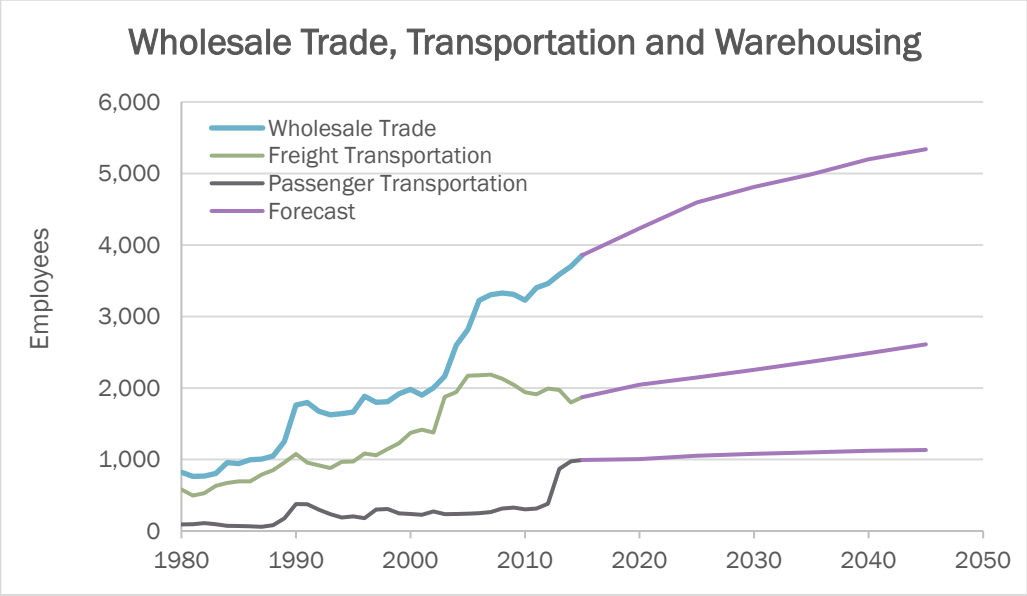


Figure 13: Wholesale trade and transportation and warehousing forecasts.

Retail Trade

Retail trade is broken into two projections: motor vehicles and parts, and other retail trade. Auto sales showed steady growth over the decades, but was hit hard by the Great Recession with employment dropping by 18 percent. Other retail saw rapid growth in the 1980s, as Thurston County became a major retail center with the opening of Capital Mall in the late 1970s. After that the sector saw steady growth. This sector was not heavily impacted by the Great Recession, with employment dropping by just 4 percent.

The forecasts for retail trade were calculated with a formula that included total Washington State employment, and Thurston County state government employment and manufacturing. The real question for these sectors is how well will the past predict the future. For auto sales, the infusion of autonomous vehicles into the marketplace, and potential for ride sharing, could mean less private vehicle ownership. With other retail sectors, the move to online retail sales could mean less brick and mortar retail stores, and therefore less retail employees, replaced by warehousing and freight transportation employees.

The advisory committee discussed the changes in retail services, especially as it pertains to brick and mortar buildings. There was general agreement that the need for new retail space may decrease, but vacancies could be absorbed by other businesses such as services. As there didn't seem to be any major concern about the draft retail trade forecast, it was not adjusted.

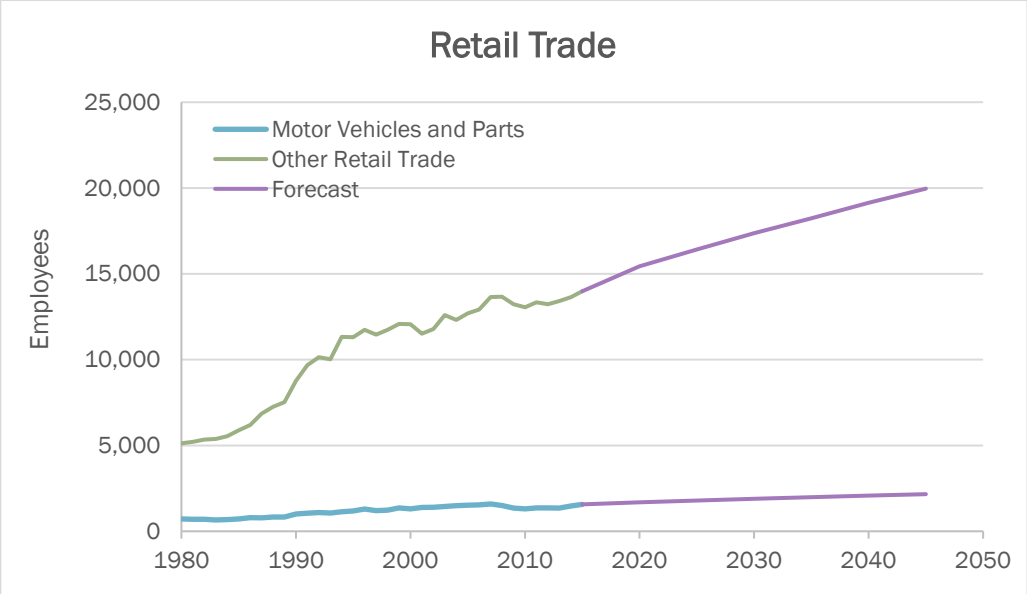


Figure 14: Retail trade forecast.

Finance, Insurance, Real Estate

The finance, insurance, and real estate sectors have experienced steady growth over the last few decades. These sectors are non-basic, meaning that they serve a local population and are not strongly influenced by state trends. The forecasts for these sectors were calculated by relating them to other large industries in Thurston County, which resulted in a forecast of steady growth.

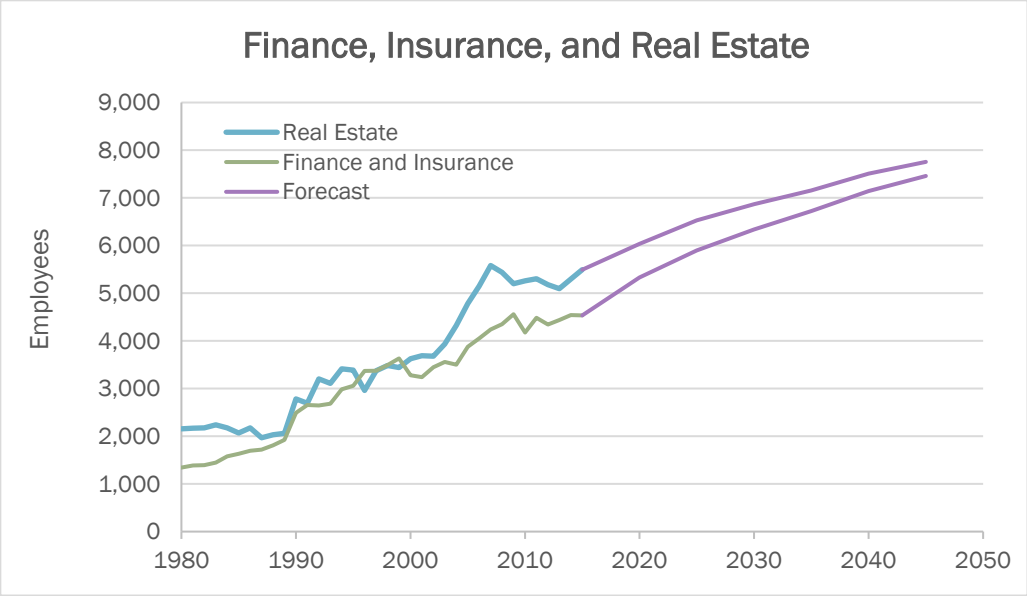


Figure 15: Finance, insurance, and real estate forecast.

Information

The forecast for the information sector is broken into three sectors:

- Publishing
- Software
- Other information

Publishing, which mainly includes newspapers and print publishing, has seen a steady decline as online media becomes more prevalent. This forecast for this sector was calculated based on state forecasts of publishing. Publishing is expected to decline to almost zero in the future.

On the other hand, there has been a steady increase in the software sector since the 1990s, and this sector is projected to continue to grow. The forecast is calculated with a formula relating Thurston County software growth to both the local manufacturing sector and state growth in the software sector.

The other information sector includes movie theaters, television providers like COMCAST, radio, and television stations. Growth in this sector has been erratic as firms come and go, but in general there has been a steady increase in employment. The forecast is calculated with a formula relating the Thurston County other information sector to state growth in the other information sector.

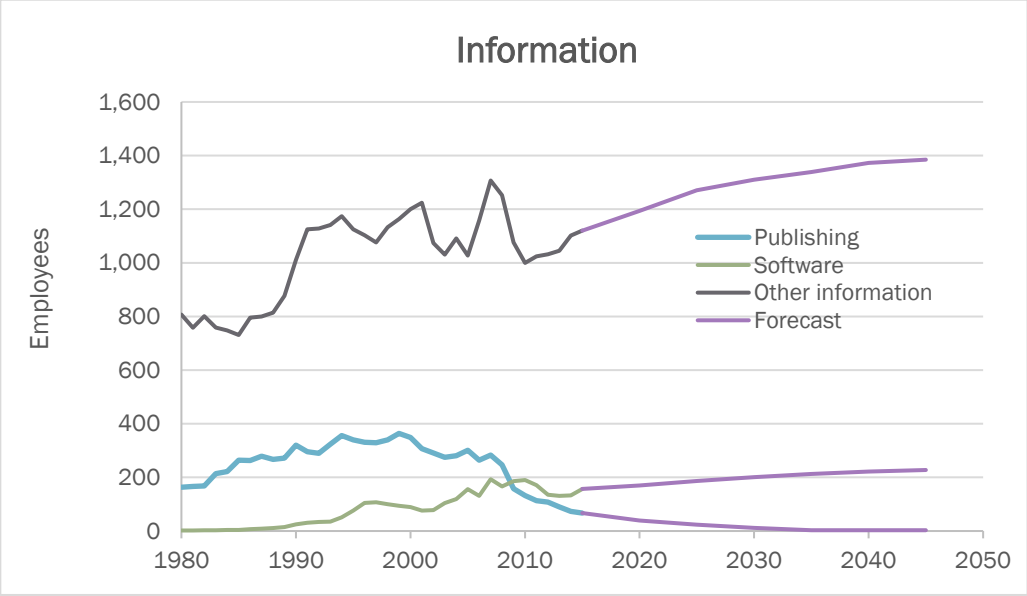


Figure 16: Information sector forecast.

Professional and Business Services

Professional and business services is the third largest sector of Thurston County employment, after state government and the education, health, and social services sector, surpassing retail trade in 2015. By far, this was the fastest growing sector of employment in Thurston County between 1980 and 2015, growing from just over 2,000 jobs in 1980 to almost 16,000 in 2015, and was fairly resilient to the effects of the Great Recession. In general, these are businesses and services that support other businesses and local and state government.

The forecast for professional and business services is calculated with a formula relating Thurston County growth in this sector to forecast growth in the state professional and business services and education, health, and social services sectors.

The forecast for this sector shows it remaining above the retail sector in coming years (see Figure 6).

This sector is broken down into four general categories:

1. Professional, scientific, and technical services. Industries in the professional, scientific, and technical services subsector group establishments engaged in processes where human capital is the major input. These establishments make available the knowledge and skills of their employees, often on an assignment basis, where an individual or team is responsible for the delivery of services to the client.
2. Management of companies and enterprises. This sector includes three main types of establishments:
    - Those that hold the securities of (or other equity interests in) companies and enterprises
    - Those (except government establishments) that administer, oversee, and manage other establishments of the company or enterprise but do not hold the securities of these establishments
    - Those that both administer, oversee, and manage other establishments of the company or enterprise and hold the securities of (or other equity interests in) these establishments
3. Administrative and Support Services. This sector includes establishments engaged in activities that support the day-to-day operations of other organizations. The processes employed in this sector (e.g., general management, personnel administration, clerical activities, cleaning activities) are often integral parts of the activities of establishments found in all sectors of the economy.
4. Waste Management and Remediation Services - establishments engaged in the collection, treatment, and disposal of waste materials.

During review of the draft forecast, the forecast committee observed that during the Great Recession state employment decreased, but the state still had to provide services to the public, therefore many of the services were spun off to the private industry. During that time period (2008-2015) there was a decrease in state employment, and a rapid increase in employment in the professional and business services sector.

After the committee meeting, TRPC staff looked at the relationship between the two sectors. Before the passage of Initiative 601, which capped growth in state government employment, a greater number of jobs were added to state government compared to the professional and business services sector. This

changed after the passage of Initiative 601. The difference was even more acute during the Great Recession.

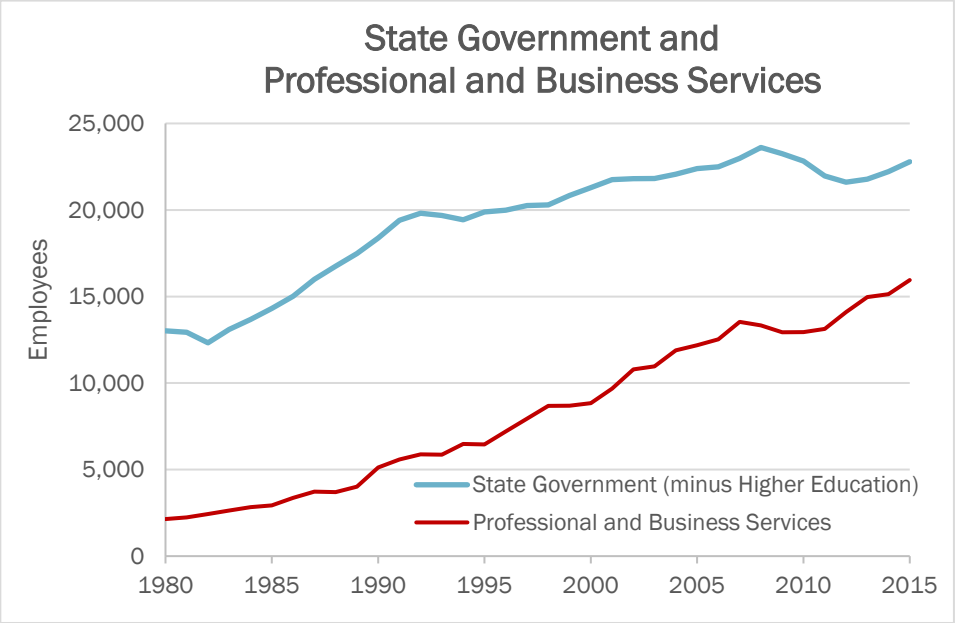


Figure 17: Comparison of growth in the state government and professional and business services sectors.

Table 1: Comparison of growth in the state government and professional and business services sectors.

		Growth in Number of Employees	
	Time Period	**State Government (minus Higher Education)**	**Professional and Business Services**
Before I-601	1980-1993	6,669	4,337
After I-601 to Great Recession	1993-2008	3,926	7,475
From start of Great Recession	2008-2015	-819	2,618

While there was a rise in the professional, scientific, and technical services subsector (19 percent; 650 jobs) between first quarter 2008 and first quarter 2016, which may have been caused by the state contracting out technical services, this was not the subsector that accounted for majority of growth in the professional and business services sector. By far, the fastest growing subsector was administrative and support services, which grew by 72 percent (compared to a growth rate between 16 and 20 percent for the other three subsectors). The main reason for this was a rise in employment in temporary help services (temp agencies) during the Great Recession.

The advisory committee also discussed the increased automation of manufacturing and warehousing that results in a decrease in jobs, with a corresponding increase in information technology (IT) jobs to run the computers.

Education, Health, and Social Services

Education, health, and social services is the second largest employment sector in Thurston County, surpassing retail trade in 2000. It is projected to become the largest sector in the future, and is anticipated to pass state government sometime between 2035 and 2040 (see Figure 6).

Thurston County is a regional hub for health services, which means it provides health services not only for local residents, but also residents from nearby counties. With two regional hospitals and many supporting health and social services, the employment sector has experienced rapid and steady growth since the 1980s. It was one of the few sectors that was fairly resilient to the effects of the Great Recession. In addition to health and social services, the sector includes education services, including private schools and daycares.

Demographics are likely to play a large role in the growth of jobs in this sector. The baby boom generation is the largest age cohort in Thurston County today. As the boomers age, there will be a greater need for both health and social services.

The forecast for the education, health, and social services sector is calculated with a formula relating Thurston County growth in this sector to forecast growth in the state education, health, and social services and the professional and business services sectors.

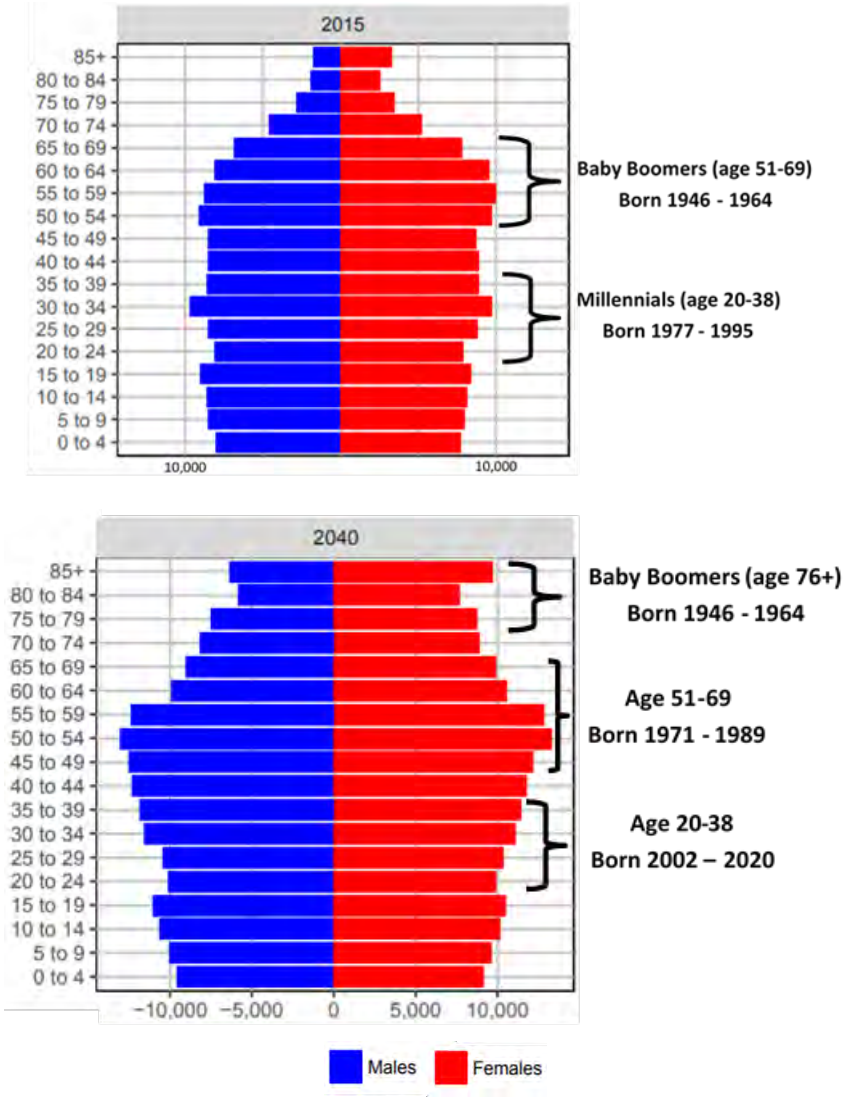


Figure 18: Age cohorts for Thurston County. The baby boom generation, those born roughly between 1946 and 1964, were approximately 51 to 69 years old in 2015. As this large age-cohort ages, there will be an increasing need for health and social services. Source: Office of Financial Management 2017 county forecasts.

Arts, Entertainment, and Recreation

The arts, entertainment, and recreation sector is one of Thurston County's smaller sectors, but has experienced the second largest growth rate of any sector in Thurston County, mirroring other service industries. Tribal Enterprises, which include tribal casinos, are included under local and tribal government.

Arts, entertainment, and recreation services are a mix of arts and entertainment, such as theaters and museums, and recreation such as fitness clubs, sports clubs, and facilities for other recreational centers, such as laser tag. Movie theaters are not in this category; they fall into the information sector. Since 1980, there has been rapid and steady growth in this sector.

The forecast for this sector is calculated with a formula relating it to growth in state education and health services, and the Thurston County professional and business services sector.

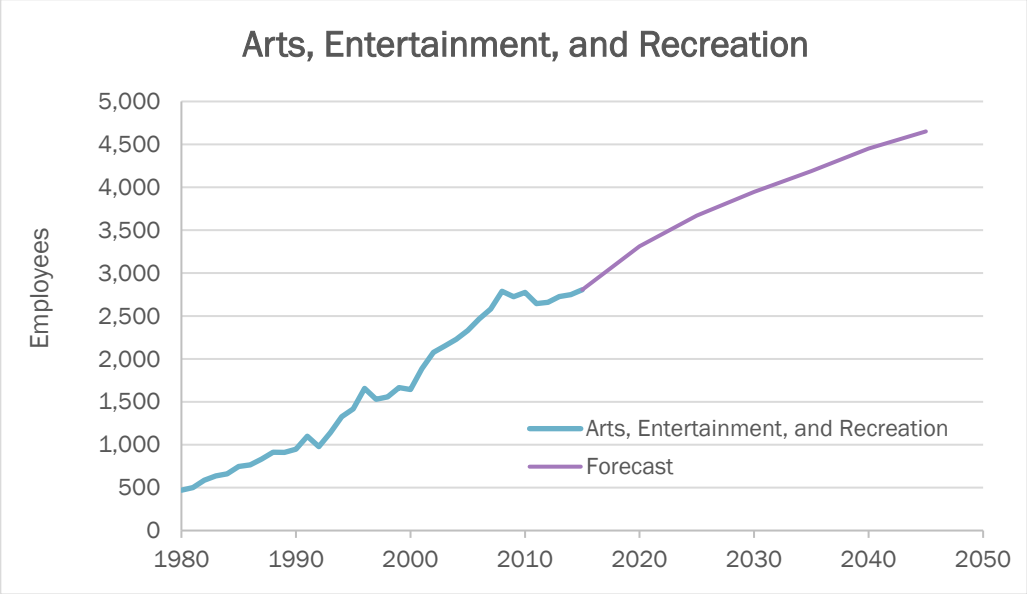


Figure 19: Arts, entertainment, and recreation forecast.

Accommodations and Food Services

The accommodations and food services sector has grown moderately since the 1980s. It represented about 6 percent of Thurston County jobs in 1980, and currently represents around 7 percent. It contains businesses such as hotels and restaurants.

The forecast for this sector is calculated with a formula relating it to growth in local business and health care sectors.

Other Services

The other services sector currently represents about 6 percent of the jobs in Thurston County. Other services are those services not covered in the preceding categories, such as equipment and machinery repairing, promoting or administering religious activities, grantmaking, advocacy, providing drycleaning and laundry services, personal care services, death care services, pet care services, photofinishing services, temporary parking services, and dating services. The growth in this sector has been sporadic in the past, with growth spurts as new businesses came to town, followed by periods of low growth. The Great Recession did not have as severe an effect on this sector as on other sectors.

The forecast for this sector is calculated with a formula relating it to growth in the state business sector and overall state employment growth.

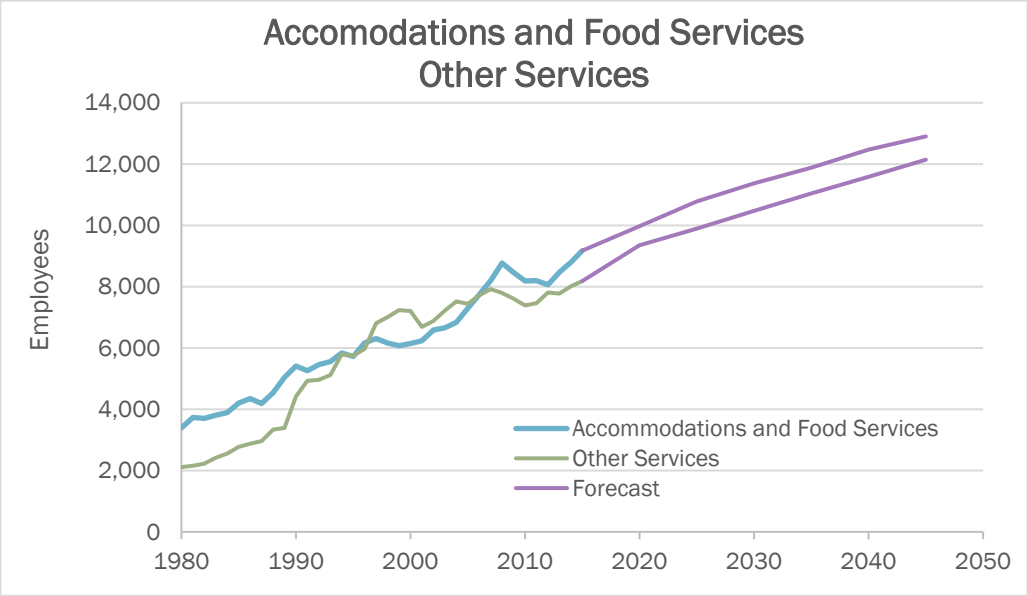


Figure 20: Accommodations and food services, and other services forecast.

State Government

State Government without Higher Education

The passage of Initiative 601 in 1993 ensured that trends in state government employment would change, probably permanently. Before the passage of Initiative 601 in 1993, state government employment in Thurston County tracked closely and concurrently with statewide total non-agricultural wage-and-salary employment. After its passage, even though it had not yet officially gone into effect, the governor and legislature took immediate actions. There were layoffs and the growth rate slowed. This all fits with the I-601 requirements which 1) limit the growth of state government spending to the growth of population (which is caused by growth in jobs) and inflation over the previous three years, and 2) limit the growth of revenue (which stagnates when jobs decline).

After 1996, although statewide employment boomed, state government employment continued to grow at a measured pace. Not all of this can be ascribed to the effects of I-601, since there were also changes in governorships and in party control of the legislature during this period.

During and after the recession of 2001, state government employment declined slightly. During the Great Recession, state government employment declined considerably, and didn't begin to rebound until 2010. In 2015, it still had not rebounded to pre-Great Recession levels, even though statewide employment had rebounded.

State government employment in Thurston County outpaced state population growth until the passage of Initiative 601. For the next nearly two decades, state government employment kept pace with population growth, until the Great Recession. Employment is rebounding at a slightly higher pace than state population growth.

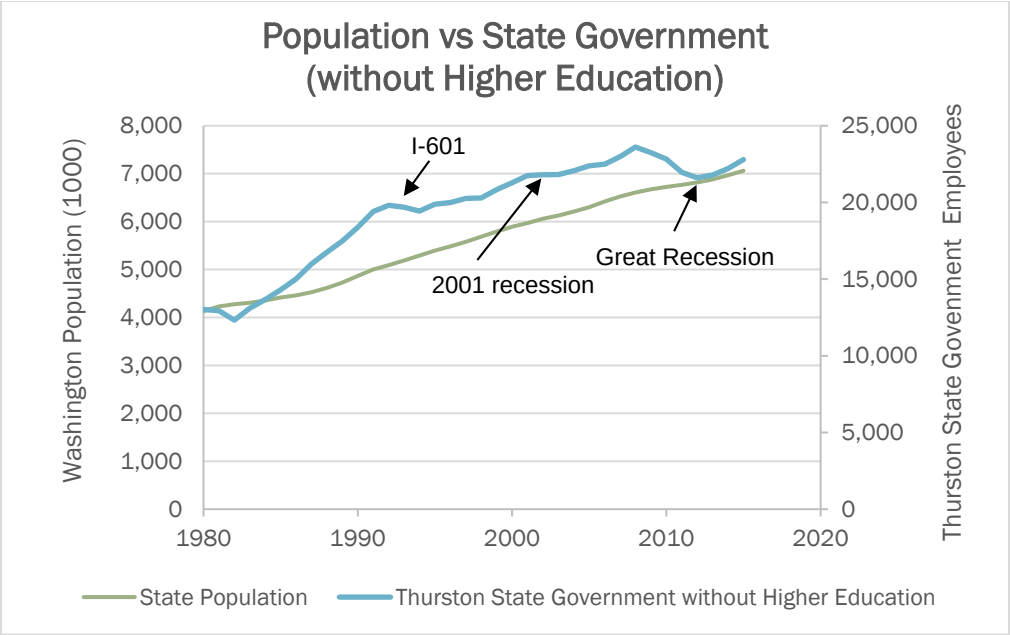


Figure 21: State government employment compared to population growth.

The forecast for state government employment without higher education was calculated with a formula that relates state government employment without higher education in Thurston County to statewide total non-agricultural wage-and-salary employment, and statewide state and local government. State government outpaced growth in Washington employment until the passage of Initiative 601.

State government was more resilient than overall employment during the 2001 recession, but was hit harder by the Great Recession than overall employment, with a relatively greater loss in jobs, and slower recovery. The forecast for the state government employment sector is influenced by the state's forecast of both state and local government employment, and total employment. It shows a slightly lower growth rate compared to the post-Great Recession recovery, followed by steady employment growth, comparable to the post I-601 period.

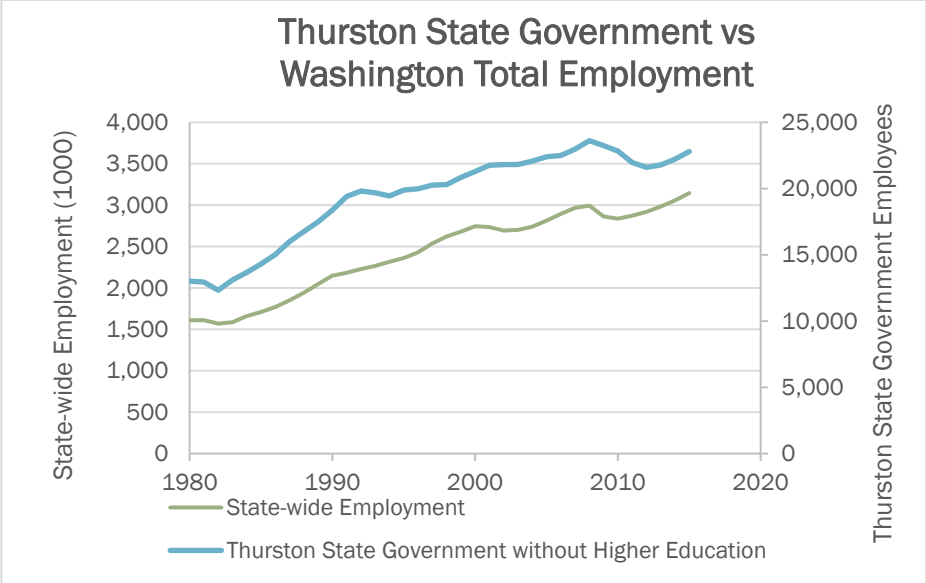


Figure 22: Thurston state government compared to Washington total employment.

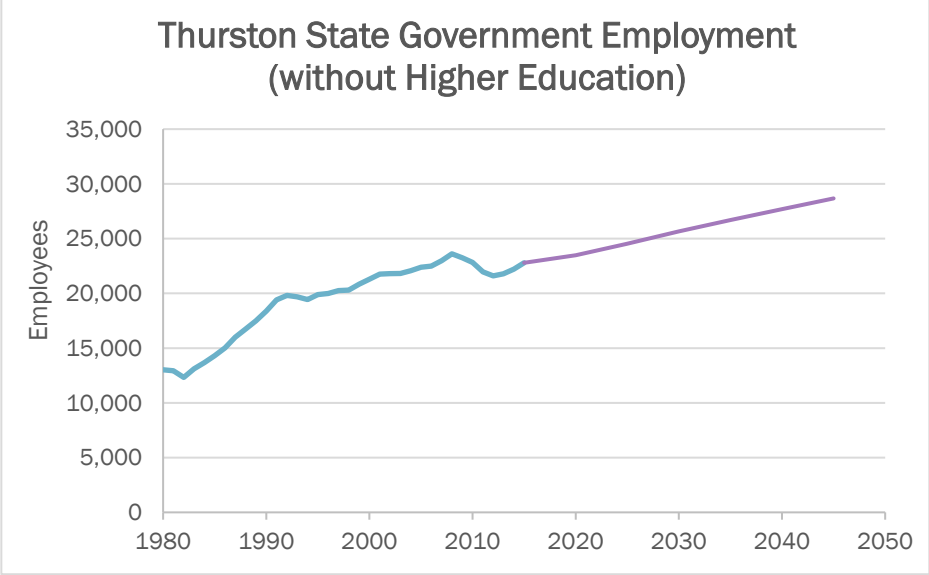


Figure 23: Thurston County state government employment, without higher education, forecast.

State Government Higher Education

There are two public higher education institutions in Thurston County, The Evergreen State College (Evergreen) and South Puget Sound Community College (SPSCC).

The forecast for Evergreen was based on an estimate of full-time (FTE) equivalent students provided by the college. This was converted to employees by looking at the average of the FTE equivalent students per job between 1976 and 2015.

The formula for SPSCC was based on relating growth at the college to growth at Evergreen and State employment growth.

The employment forecast for Evergreen shows very slow growth overall, with employment regaining to pre-Great Recession levels by the end of the forecast period.

The employment forecast for SPSCC, which was less impacted by the Great Recession, shows a higher rate of growth.

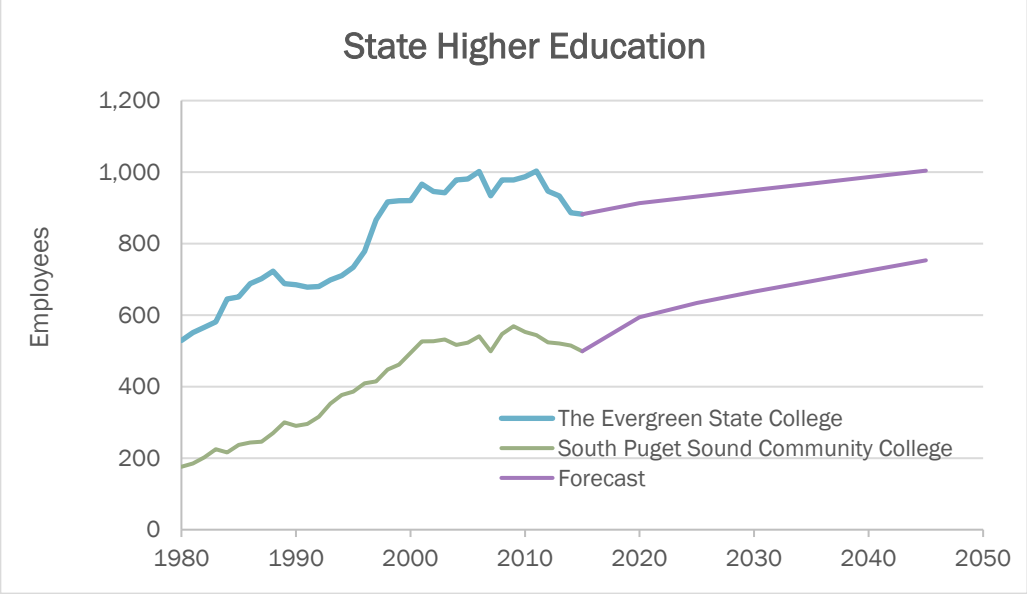


Figure 24: State higher education forecast.

Federal Government

Federal government employment is not a large sector of Thurston County employment. The forecast is broken out into three categories, post office, other federal civilian employment, and military.

The forecast for the post office is based on a formula relating post office employment to local government and other services. The forecast is for a fairly low growth rate.

Other civilian federal government includes some federal agencies, and every ten years, a little increase in employment due to the Federal Census. The forecast also reflects this bump due to the Census, meaning that the forecasts on "ten" years are higher than the forecasts for the mid-decade years.

Military employment is military personnel stationed in Thurston County, such as National Guard or recruitment centers. It excludes those people employed at Joint Base Lewis-McChord (JBLM), as those jobs are included in a forecast of Pierce County employment. Employment at JBLM is considered in our commuter forecast. The forecast for the Thurston County military sector was derived from taking the average employment in this sector from 2000 to 2015, and extending it into the future.

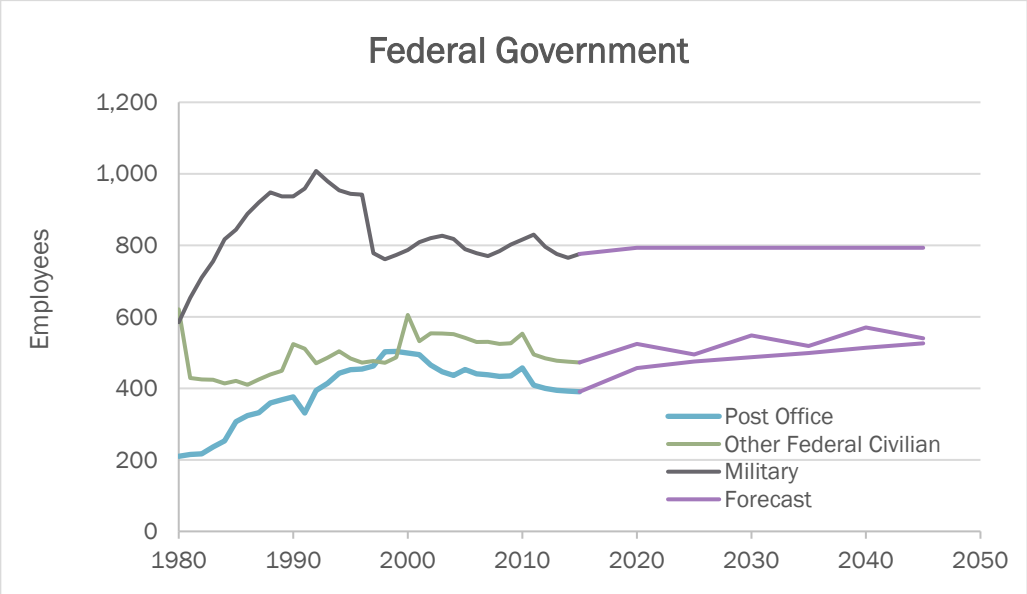


Figure 25: Federal Government forecast.

Local and Tribal Government

About two-thirds of the employment in local and tribal government is in the school districts, with the remainder representing county government, city government, tribal government, and the various special purpose districts like the Port of Olympia, Thurston Regional Planning Council, Timberland Regional Library, and so on.

The formula used to develop the forecast for this sector was based on growth in Washington State total employment, state and local government employment, and other services. It resulted in a forecast for slow and steady growth – more robust than the last 15 years which was dominated by a variety of revenue-limiting initiatives (e.g., I-747, which generally limits property tax revenue growth to 1 percent annually), but less robust than the 1990s.

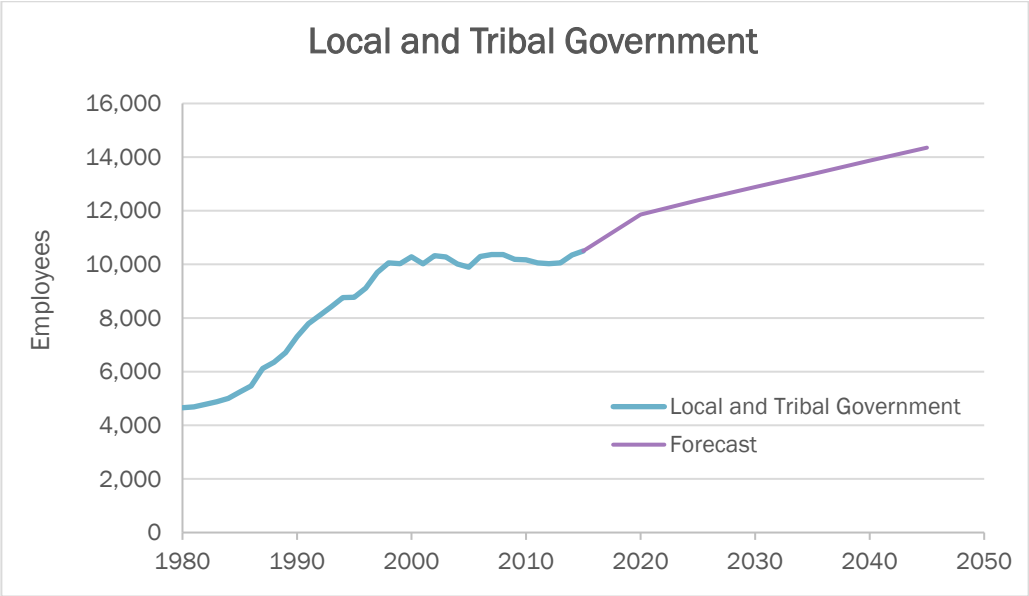


Figure 26: Forecast for Local and Tribal Government.

Tribal Enterprises

Tribal enterprises comprise mainly of tribal casinos and associated businesses. Thurston County currently has two tribal casinos and related enterprises that serve a mix of local and export (i.e., out-of-county) markets. In 1988 the federal Indian Gaming Regulatory Act (IGRA) was passed by Congress, and the first tribal casino in the state was opened in 1991. Locally, the Confederated Tribes of the Chehalis opened a casino in 1995, and the Nisqually Indian Tribe followed in 1997. Both have expanded over time, making major changes to the local economy. The Lucky Eagle Casino underwent an expansion between 2015 and 2017. At the time of this forecast, the expansion was complete, but the number of new employees, estimated at around 50 to 75, was not reflected in base data, and was therefore explicitly programmed into the forecast.

Representatives of the tribes advised that the growth of employment at the casinos has largely flattened out, since the maximum number of gaming machines allowed is set by a compact with the State. Based on the advice of the tribes, the forecast projects continued growth in tribal enterprise employment based on growth in both local and outside markets.

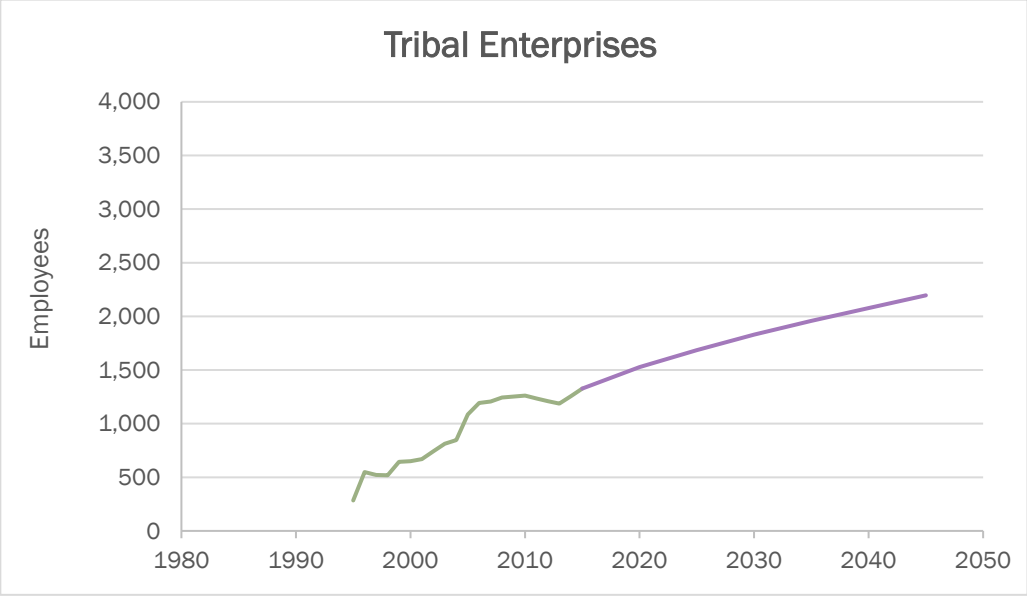


Figure 27: Forecast for tribal enterprises.

Commute Forecast

Commute Trends

For decades, various data have shown that people are commuting longer distances than before. These sources include the Decennial Censuses (1970-2000), the Census Bureau's annual American Community Survey (2005-15), and estimates for other years (e.g., intercensal years). The data are sparse, and subject to large margins of error. Note the irregularity of the estimate line for the decade 2000-15 in Figure 27, reflecting the influence of statistical sampling error.

Previous models developed forecasts of commute trends based on job projections developed by Puget Sound Regional Council for the counties to the north, and population estimates developed by the Office of Financial Management for the other counties. In the past, the commute forecast was used in the regression formulas for many non-basic industries, and therefore had a tremendous impact on the forecast. For the 2017 forecast update, the commute forecast was not used to forecast other sectors as it was considered too variable.

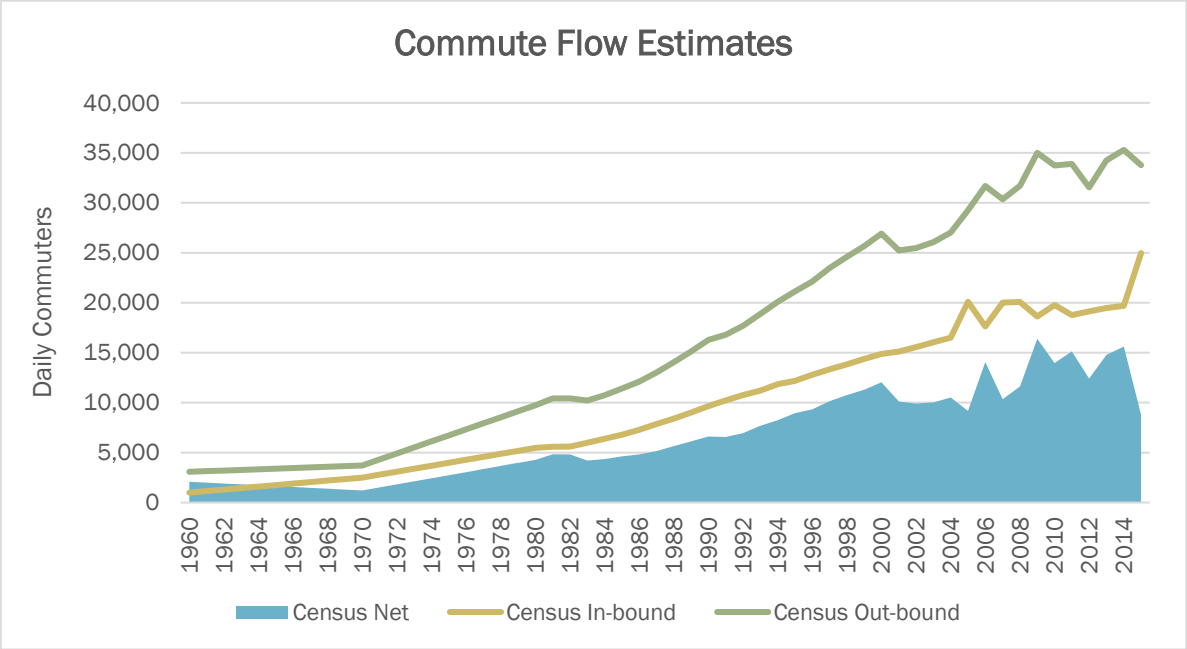


Figure 28: Annual estimates of commute flow. The number of Thurston County in-bound and out-bound commuters has grown steadily over the decades. Thurston County's out-bound commute has always been stronger than the in-bound commute. Data irregularities starting in 2000 with a change in Census sampling frequency has made this data set difficult to correlate with employment data. Source: US Census.

Since the 1970s, the ratio of out-bound to in-bound commuters has held steady, with around 1.7 out-bound to every in-bound commuter. This means that Thurston County has a fairly strong net out-bound commute, which has grown decade over decade.

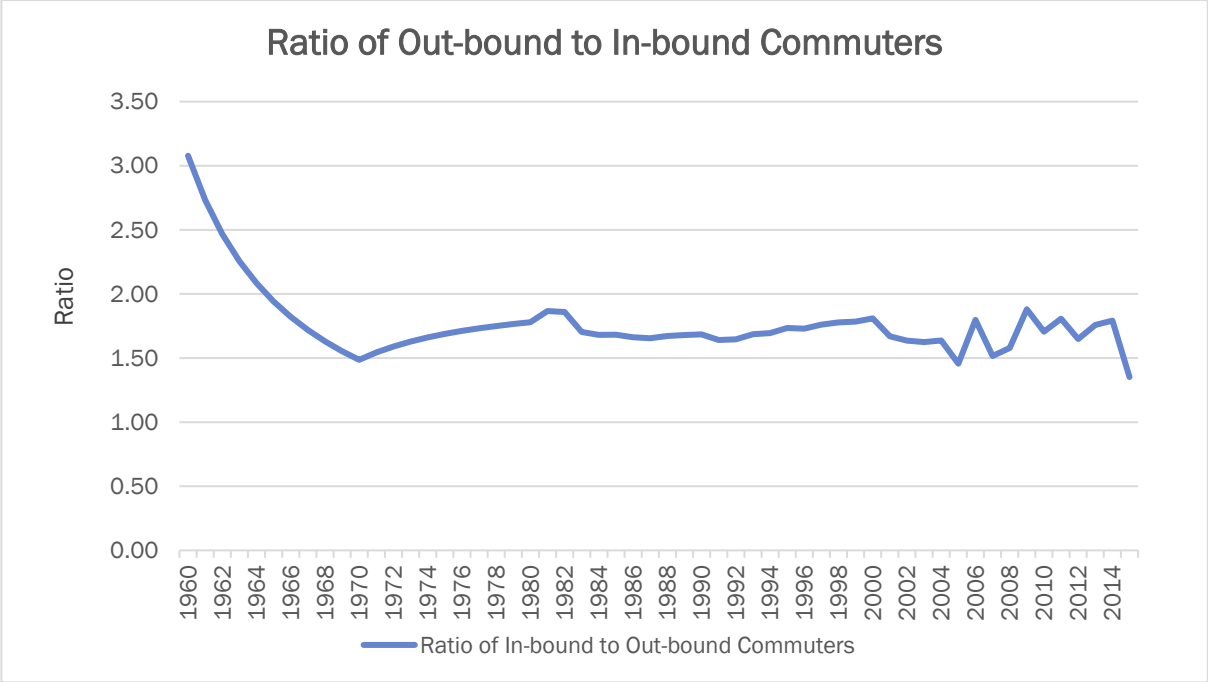


Figure 29: Ratio of out-bound to in-bound commuters. Thurston County has more residents traveling to other counties for work, than residents of other counties traveling to Thurston County for work. Since the 1970s, the ratio of out-bound to in-bound commuters has remained relatively steady. Source: US Census Bureau.

When the Interstate 5 was built in the 1950s and 1960s, it was envisioned as a means of travel for freight and people over long distances – such as state to state travel. In the 1960s and 70s, there were around 2,000 to 2,500 commuters traveling from Thurston County to Pierce or King counties. This number has increased to around 25,000 commuters today.

By far, the greatest number of out-bound commuters travel to Pierce County – no surprise given the large amount of jobs in Pierce County, many of them near the Thurston County border on Joint Base Lewis-McChord. King County also has a fairly strong net out-bound commute pattern, and Lewis County has a slight out-bound commute pattern. In contrast, the commute pattern to Grays Harbor and Mason counties show a fairly strong in-bound commute pattern.

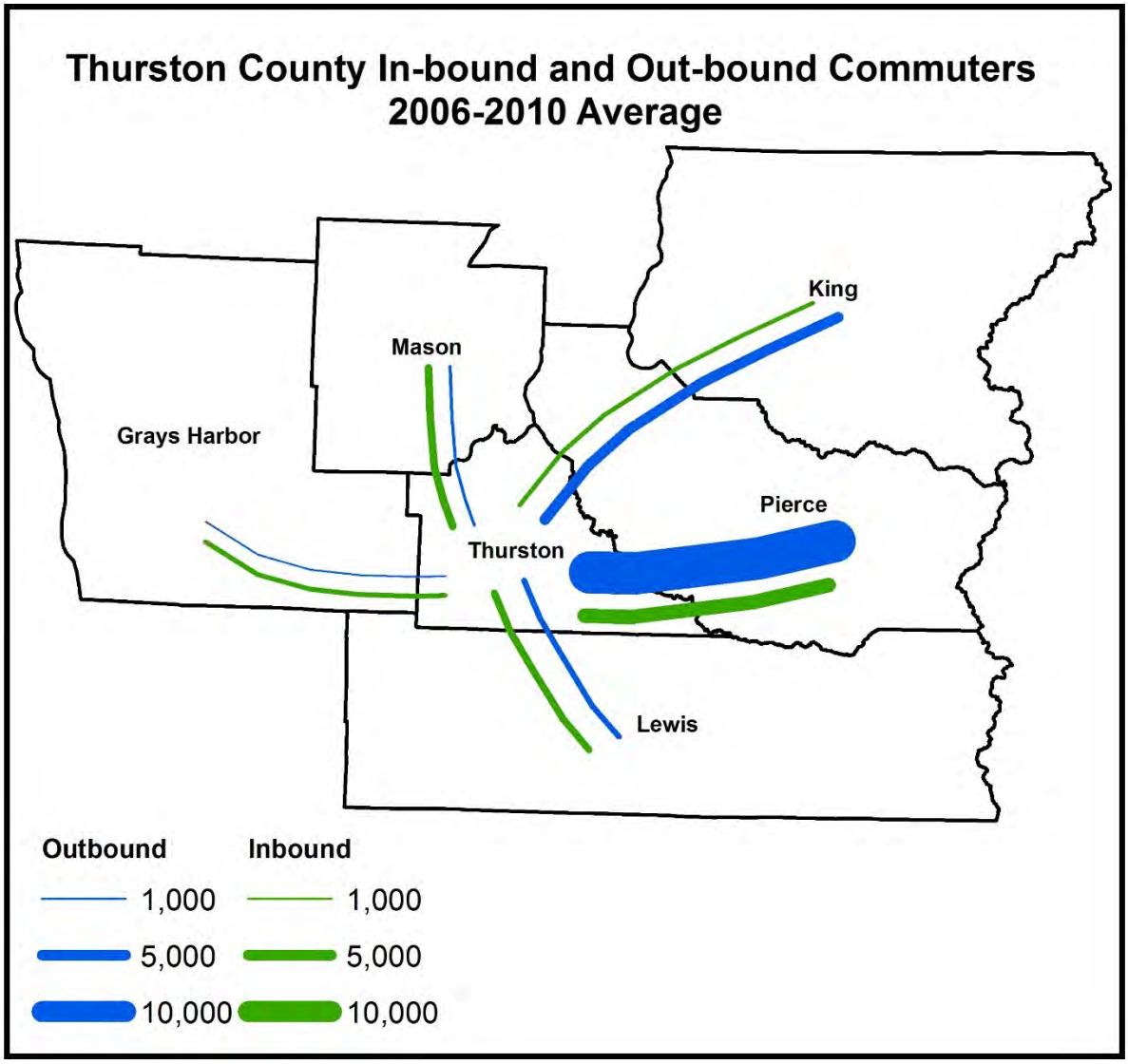
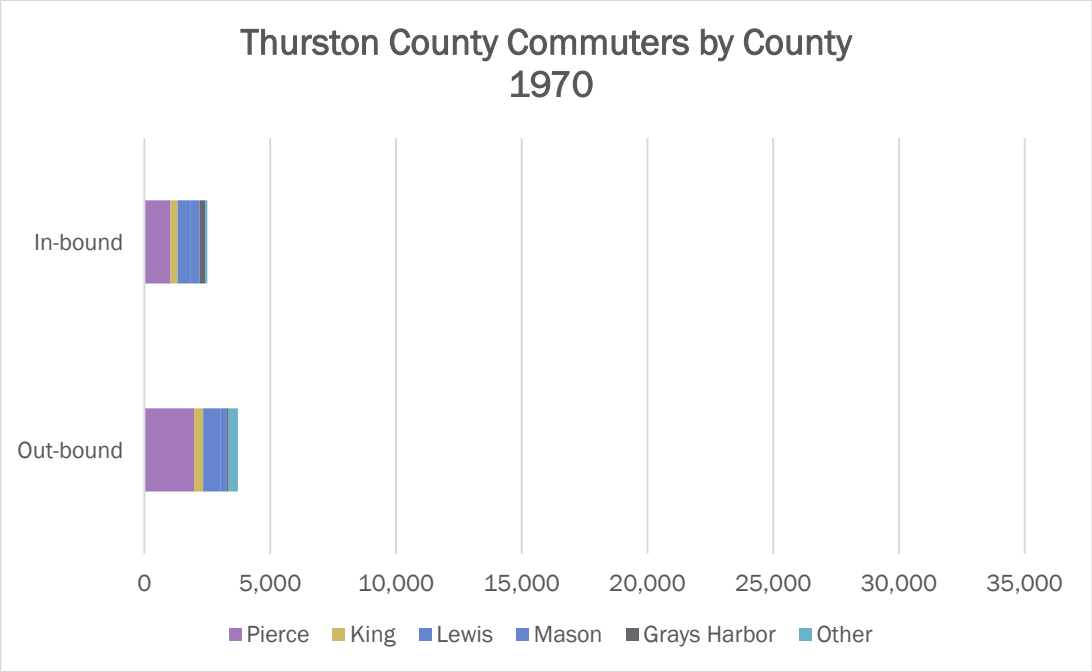


Figure 30: Map of in-bound and out-bound commute flows.



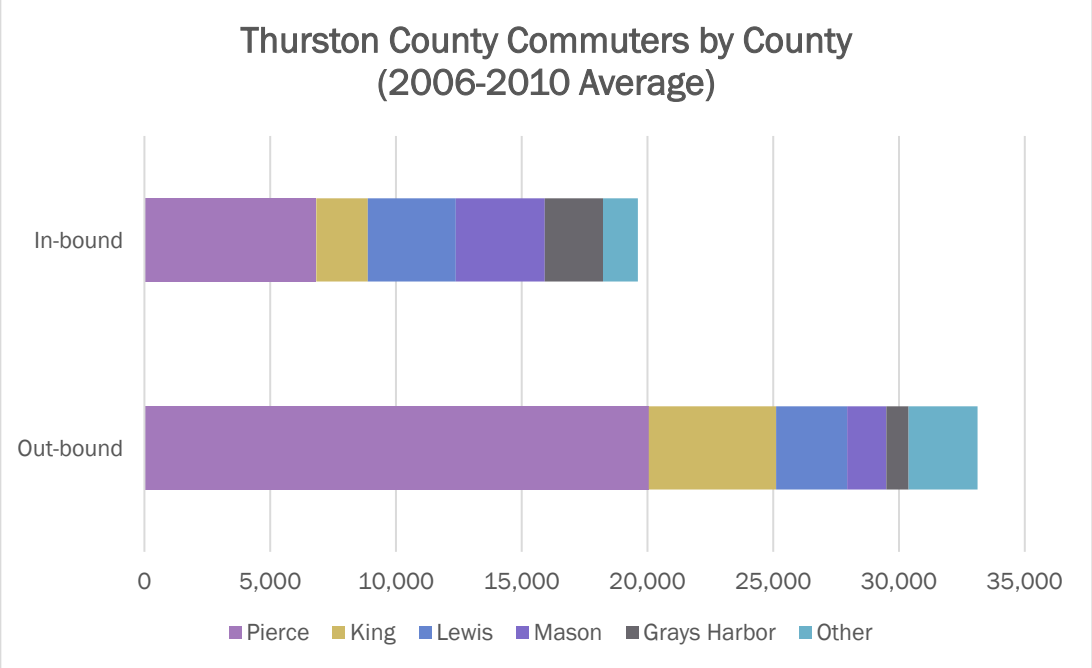


Figure 31: Comparison of Thurston County commuters by county in 1970 and today. In the 1970s, around 2,000 to 2,500 people per day traveled from Thurston to Pierce or King County for employment. Today, over 20,000 people per day travel from Thurston to Pierce County, and another five thousand travel to King County. That is a lot of commuters in buses, vanpools, carpools, and single-occupancy vehicles, most using Interstate 5. Source: US Census Bureau.

Table 2: Summary of in-bound and out-bound commuters by county.

County of Residence	County of Workplace	1960	1970	1980	1990	2000	2006-2010 Average
Out-bound Commuters - Total		**3,081**	**3,716**	**9,752**	**16,295**	**26,908**	**32,625**
Thurston	Pierce	1,937	1,975	3,768	8,526	14,352	20,050
Thurston	Lewis	331	702	1,950	2,610	2,843	2,825
Thurston	King	155	359	812	2,064	5,350	5,065
Thurston	Mason	127	243	717	1,086	1,597	1,555
Thurston	Grays Harbor	102	67	1,651	683	951	885
Thurston	Kitsap	12	23	40	180	267	295
Thurston	Snohomish	22	21	38	172	243	390
Thurston	Other	395	326	776	974	1,305	1,560
In-bound Commuters - Total		**1,001**	**2,500**	**5,397**	**9,681**	**14,871**	**19,615**
Pierce	Thurston	379	1,029	2,355	3,750	4,953	6,830
Lewis	Thurston	277	530	842	1,749	2,383	3,500
King	Thurston	171	288	864	1,304	1,792	2,050
Mason	Thurston	111	350	770	1,438	2,841	3,535
Grays Harbor	Thurston	39	216	329	953	1,595	2,315
Kitsap	Thurston	12	8	54	109	325	230
Snohomish	Thurston	0	0	13	108	263	380
Other	Thurston	12	79	170	270	719	775
Internal Commuters - Total		**16,245**	**23,391**	**42,659**	**59,069**	**74,078**	**82,375**
Thurston	Thurston						
Net Outbound Commuters		**2,080**	**1,216**	**4,355**	**6,614**	**12,037**	**13,010**
Out-bound / In-bound		**3.1**	**1.5**	**1.8**	**1.7**	**1.8**	**1.7**

Source: US Census Bureau.

Commute Assumptions

Commuting assumptions are always a challenge. Many of Thurston County's residents commute to JBLM, however it is difficult to predict future jobs on JBLM as decisions regarding military bases are made at the national level. Other questions must be considered. Will increasing congestion and gas prices over time reduce the incentive to commute to jobs in other counties? On the other hand, increasing congestion in King and Pierce Counties has made commuting difficult on arterials from outlying communities in those counties (e.g., commuting from Puyallup to Tacoma). How will housing costs factor in? Housing prices in King County are increasing rapidly, and for now, housing in Pierce County is slightly higher than Thurston County.

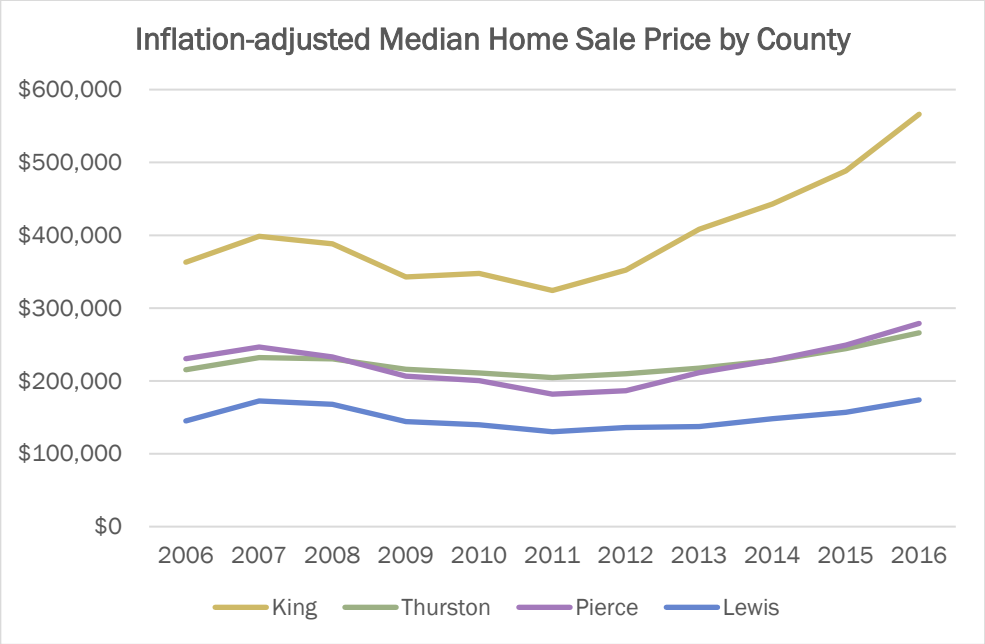


Figure 32: Median home sales by county. Home prices in King County are increasing more quickly than those in Pierce and Thurston Counties. This will likely mean that more people will commute from Pierce and Thurston to higher-wage jobs in King. Home prices in Pierce are slightly higher than those in Thurston. If this trend continues, it is likely that people will drive even further in order to have a slightly more affordable house, as people rarely factor in the price and time of commuting when making their home purchase. Source: Washington Center for Real Estate Research.

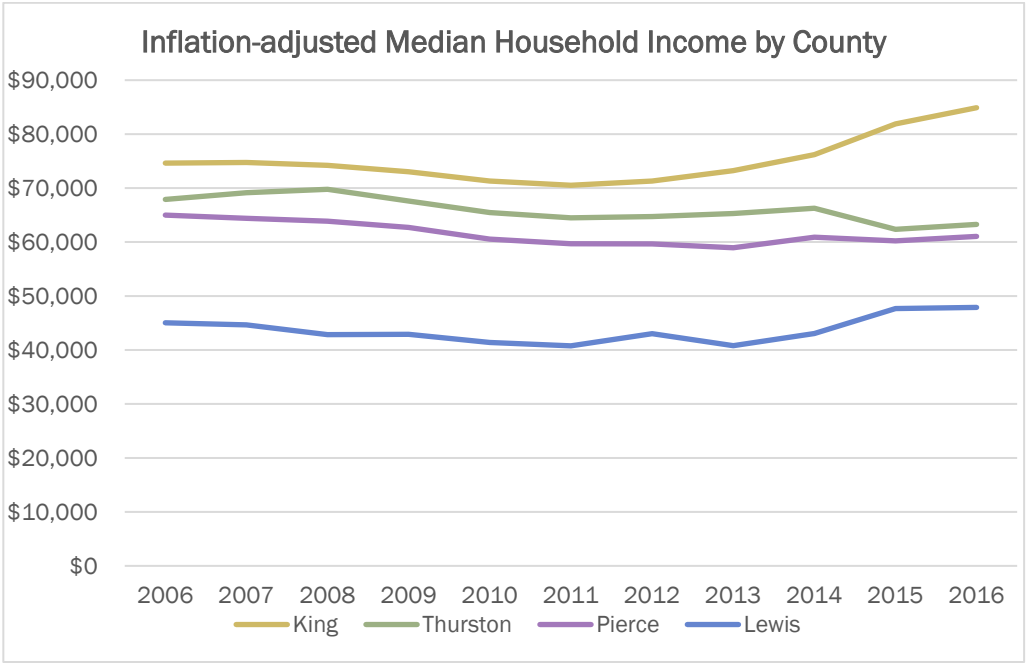


Figure 33: Median household income by county. People tend to commute further for higher-wage jobs. As the wage gap between King County and Thurston County grows, there will likely be an increase in commuters. Source: Washington State Office of Financial Management.

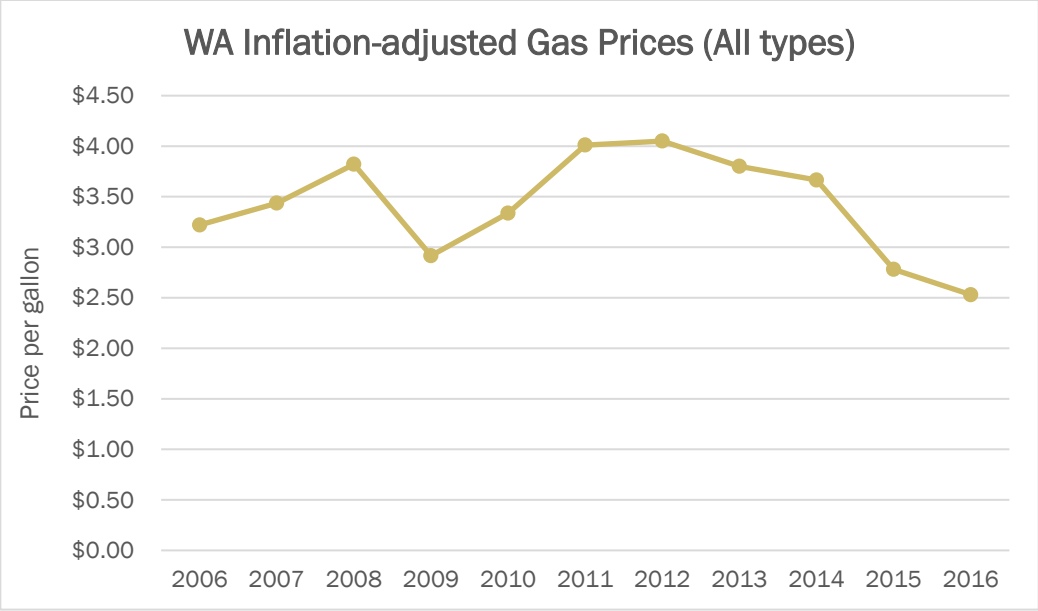


Figure 34: Washington gas prices. As gas prices go up, people tend to reduce their commute or take alternatives to drive-alone trips. Gas prices are the lowest they've been in a decade.

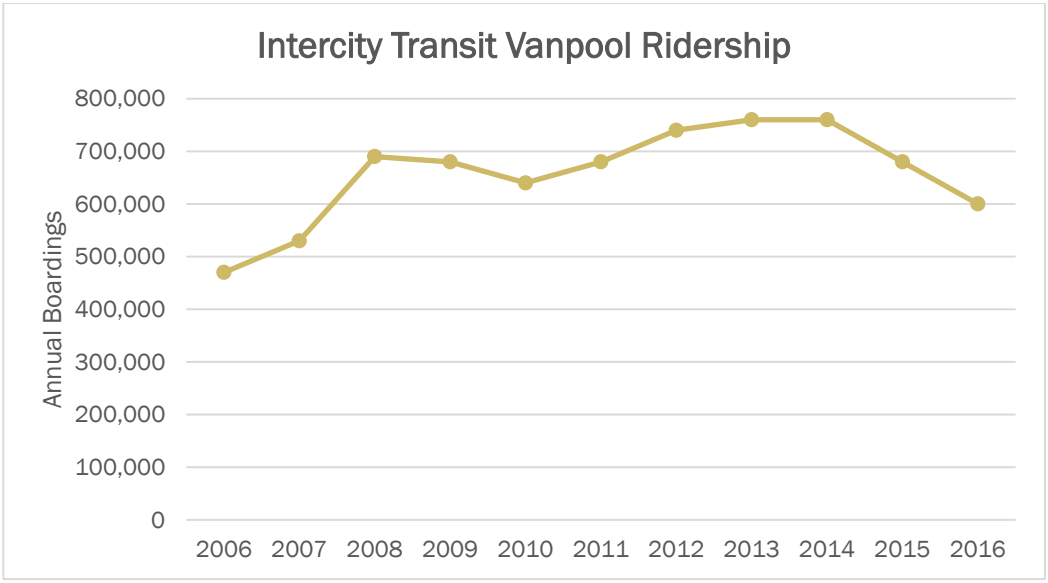


Figure 35: Intercity Transit vanpool ridership. Intercity Transit's vanpool ridership went up when gas prices went up, and decreased when gas prices went down. Vanpools are used by many commuters. Source: Intercity Transit.

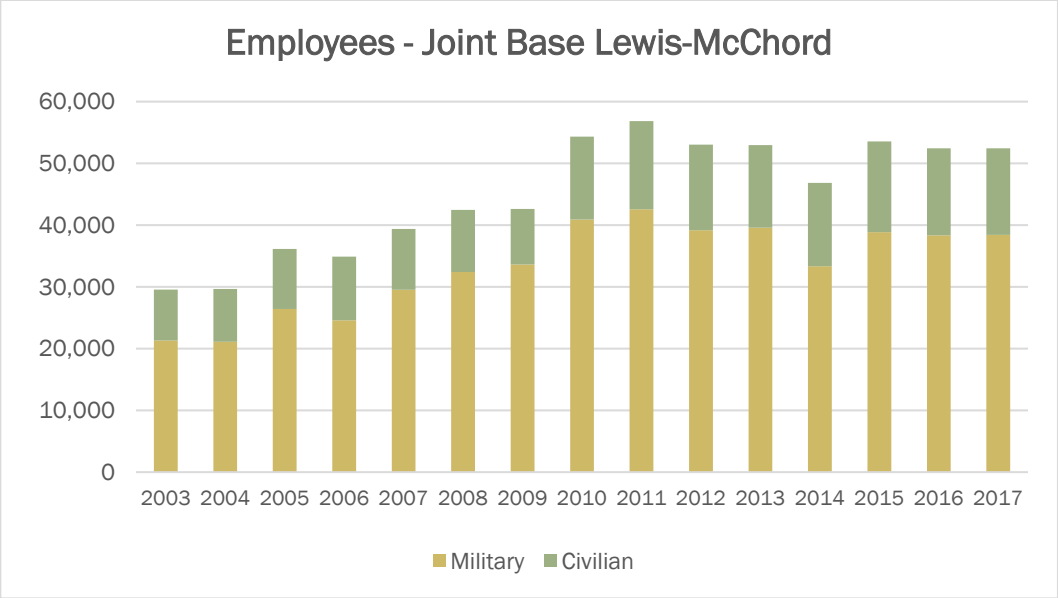


Figure 36: Employees – Joint Base Lewis-McChord. Employment at JBLM grew by almost 25,000 between 2003 and 2010. Around 29 percent of JBLM's workforce resides in Thurston County. Source: JBLM ASIP Historical Data.

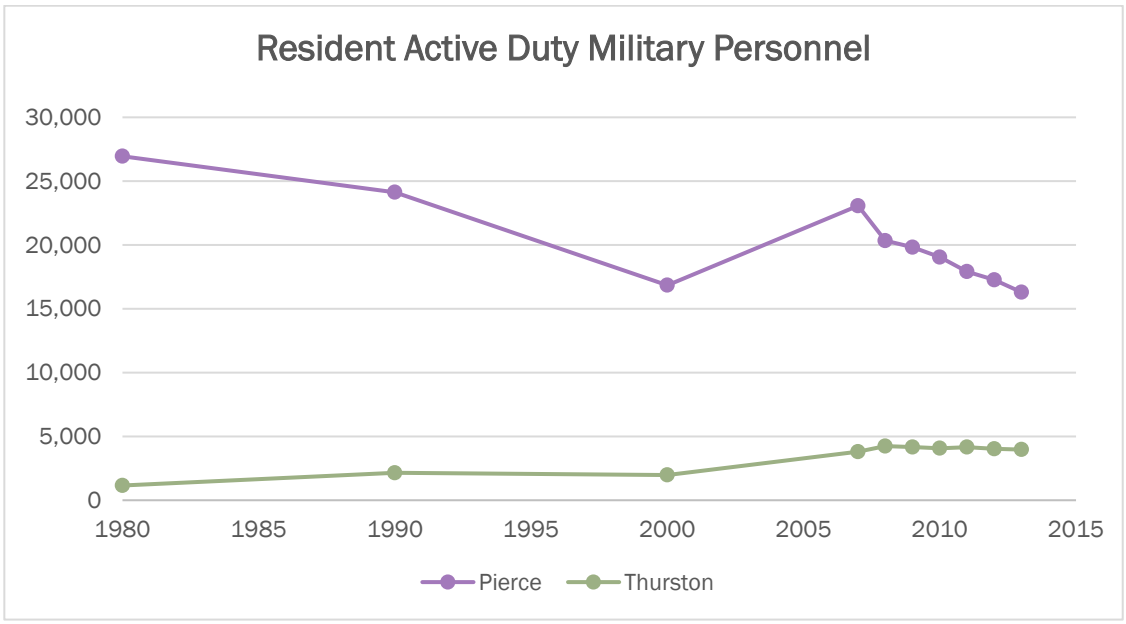


Figure 37: Resident Active Duty military personnel. Resident active duty personnel are a component of the service members shown in Figure 12, along with Guard and Reserve. The number of Active Duty personnel residing in Thurston County, but most likely commuting to JBLM, was fairly steady for decades, until the 2000s when JBLM experienced rapid growth. Source: U.S. Census.

Commute Forecast

In the past, the commute flow baseline forecast was the aggregate of forecasts of commute patterns between Thurston and adjacent counties. Those forecasts were based on employment forecasts for Snohomish, King, and Pierce counties, and population forecasts for Lewis, Mason, and Grays Harbor counties respectively. Due to the data irregularities in commute data from 2000 on, TRPC staff no longer had confidence in this method of forecasting commute patterns. In addition, the Puget Sound Regional Council is in the midst of updating employment forecasts for Snohomish, Pierce, and King counties. For the 2017 update, TRPC treated commuters like other industries, and forecasted growth in in-bound and out-bound commuting based on a multiple regression analysis taking into account the population of adjacent counties and Thurston County employment. This resulted in a baseline commute forecast, assuming past relationships could predict the future.

The 2017 commute forecast is lower than the 2012 forecast. At the time the 2012 forecast was developed, JBLM was experiencing rapid growth, and there was a corresponding rapid increase in commuters. Since then, growth on JBLM has stabilized, and commuting is hampered by the chronic congestion on I-5. This is balanced, somewhat, by the lower housing prices in Thurston County and the rapid increase in housing in Seattle.

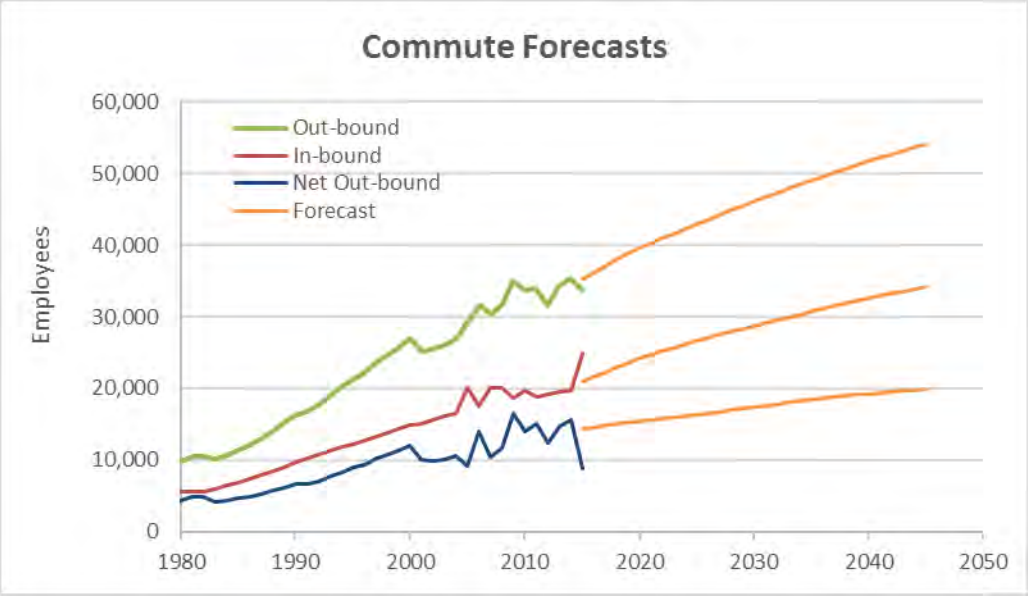


Figure 38: Commute forecast.

Appendix 1: Thurston County Employment and Commute Forecast

Thurston County
Detailed Employment Forecast
Commute Forecast and Population Forecast

	Actual		Projected					
Industry	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
Agriculture, forestry, fishing, and mining	3,022	3,321	3,400	3,400	3,500	3,600	3,600	3,700
Utilities	184	188	200	200	200	200	200	200
Construction	5,466	6,334	7,200	7,300	7,600	8,000	8,200	8,600
Manufacturing	3,625	4,152	4,300	4,600	4,800	4,900	5,100	5,100
Wholesale trade	3,227	3,857	4,200	4,600	4,800	5,000	5,200	5,300
Retail trade	14,358	15,555	17,100	18,200	19,300	20,200	21,200	22,100
Transportation and warehousing	2,243	2,865	3,100	3,200	3,300	3,500	3,600	3,800
Information	1,322	1,344	1,400	1,500	1,500	1,600	1,600	1,600
Finance and insurance	4,176	4,535	5,300	5,900	6,300	6,700	7,100	7,500
Real estate and rental and leasing	5,261	5,493	6,000	6,500	6,900	7,200	7,500	7,800
Professional and business services	12,946	15,951	18,300	20,300	21,700	22,900	24,400	25,400
Education, health, and social services	16,950	19,375	22,400	24,700	26,500	28,100	29,800	31,100
Arts, entertainment, and recreation	2,776	2,806	3,300	3,700	3,900	4,200	4,500	4,700
Accommodation and food services	8,188	9,176	10,000	10,800	11,400	11,900	12,500	12,900
Other services	7,389	8,183	9,400	9,900	10,500	11,000	11,600	12,100
Federal government	1,826	1,639	1,800	1,800	1,800	1,800	1,900	1,900
State government	24,367	24,174	25,000	26,100	27,300	28,400	29,400	30,400
State government, except education	22,827	22,793	23,500	24,500	25,700	26,700	27,700	28,700
State education	1,540	1,381	1,500	1,600	1,600	1,700	1,700	1,800
Local and Tribal government	11,432	11,827	13,500	14,200	14,800	15,500	16,100	16,700
Local & Tribal government, except tribal ent.	10,170	10,500	11,900	12,400	12,900	13,400	13,900	14,400
Tribal enterprises	1,262	1,327	1,600	1,800	1,900	2,100	2,200	2,400
Total Local Employment	128,758	140,775	155,700	167,000	176,300	184,500	193,500	200,900
Out-bound commuters	34,208	35,276	39,600	42,900	46,200	49,100	51,800	54,100
In-bound commuters	19,049	20,943	24,200	26,700	28,700	30,700	32,500	34,300
Net out-bound commuters	15,159	14,333	15,500	16,300	17,400	18,400	19,200	19,900
Population	252,264	267,410	294,300	316,500	336,000	354,400	370,700	383,500

Source: Employment and Commute Forecast: Thurston Regional Planning Council (TRPC), Forecast Work Program, 2018.

Population Forecast: 2010-2040: Washington Office of Financial Management (OFM) medium series forecast for Thurston County, 2017. 2045 - TRPC's extrapolation of OFM's forecast.

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Appendix II: Sources of Employment Data

The 1978-2015 employment data for the econometric module was developed from a variety of sources and techniques, since a single source for the data was unavailable. The organization of employment data by industry was changed from the Standard Industrial Classification (SIC) codes to the North American Industrial Classification System (NAICS) codes in 2001, as a result of the North American Free Trade Agreement (NAFTA) adopted in 1993. SIC codes were based on the product or service produced by the industry, while NAICS codes are based on the type of process used by the industry to produce its product or service. About one-third of the SIC codes have a direct counterpart in the NAICS classification. The rest are substantially changed, with some SIC industries split into new NAICS industries, some combined to make new NAICS industries, and some a mix of splitting and recombining. The historic data series based on SIC codes prior to 2001 needed to be converted to estimates based on NAICS codes.

The techniques used for the state-level data were somewhat different than those used for the county-level data. A general description of methodology is as follows:

Washington State Employment

The TRPC EMPFOR forecasts use state-level forecasts of employment by industry as predictor variables. These state-level forecasts are in the form of non-agricultural wage and salary workers. The Washington State Employment Security Department (ESD) had already converted the SIC series state-level data to NAICS codes for the period since 1990. It was necessary to convert the 1978-1989 data from SIC to NAICS codes.

Employment by NAICS codes at the six digit level of detail (highest) was available from ESD for the period 1990-2002, for employment covered by unemployment insurance ("ES202" data). Employment by SIC codes at the four digit level of detail (highest) was available from ESD for the period 1981-1996. Using iterative proportional fitting, an allocation table of the state-level data was created to estimate the shares of each SIC industry that was assigned to the various three-digit NAICS industry groups for the overlapping period 1990-1996. The initial population of the seed values in the iterative proportional fitting was drawn from the national allocation proportions reported for 1997, the first year of NAICS use. Numerous cycles of fitting were performed to allocate four-digit SIC detailed industries to the three-digit NAICS groups. Next the four-digit SIC industries were aggregated to (mostly) two-digit SIC industry groups and additional cycles of fitting were performed until the data mostly converged. This was done separately for each of the years 1990-1996.

Using the results from the 1990-96 period, the allocation proportions were then projected backwards to 1978, typically fitting logarithmic curves to the data. These allocation proportions developed from the ES202 data were then applied to the Non-Agricultural Wage and Salary data to derive an estimated NAICS major industry series.

Thurston County Employment

The TRPC EMPFOR forecasts are based on total employment as defined and reported by the Bureau of Economic Analysis (BEA). This includes both employees and proprietors (business owners and employees who work on commission rather than wages or salaries). The county-level BEA total employment data is reported at the two-digit major industry group level for NAICS 2001-most recent. Prior to 2001, the data was reported by SIC major industries. The methodology to develop a series based on NAICS for all years was as follows:

Years 2001-10: Total employment by industry was available for all major industry sectors (two-digit) for Thurston County directly from BEA. Covered employment by industry was available for detailed industries (six-digit level if needed) for Thurston County from ESD. The EMPFOR model uses mostly two-digit industry detail, plus a few three- or four-digit detailed industries, particularly in the manufacturing and information industries. For these more detailed industries it was necessary to disaggregate total employment by major industry sector into the more detailed categories. In particular, it was necessary to disaggregate the proprietors (business owners and workers paid by commission). State-level data on both ES202 workers and total workers by detailed industry were available from ESD and BEA respectively; this was used to determine the share of proprietors to assign to each detailed industry at the county level.

Years 1990-2000: At the state level, total employment by detailed industry (from BEA) and covered employment by detailed industry (from ESD) were available in both NAICS and SIC. At the county level, only covered employment was available (from ESD) by detailed industry, in both NAICS and SIC; and total employment by SIC (from BEA). The goal was to find a way to calculate the proprietors (non-covered employment) for the county-level employment by the NAICS industry sectors used by EMPFOR, so they could be added to the covered employment to derive total employment by EMPFOR sectors.

The adjustment was done in two stages. The first stage was to calculate three ratios for the period 2001-2007: 1) the Washington ratio of total employment to covered employment, 2) the Thurston County ratio of total employment to covered employment, and 3) the ratio of the two ratios. Since the Washington ratio was available for the period 1990-2000 as well, the third ratio was projected backward using logarithmic curves to construct an estimated Thurston county ratio for this period. This county ratio was then used to create preliminary estimates of total employment by industry.

The second stage was to calculate the shares of proprietors (non-covered employment) by industry implied by the difference between the estimated total employment and the ES202 covered employment. This was done for major industry groups (NAICS two-digit level).

The third stage was to adjust the proprietors by major industry so that the total proprietors would match the total reported by BEA.

The next several stages involved using the same strategy to disaggregate the proprietors by detailed industry (typically NAICS three-digit level), particularly in the manufacturing and information major sectors.

Years 1978-1989: Only SIC data were available at the county level, for both covered and total employment.

The first stage was to create a data series of estimated ES202 covered employment by NAICS from the SIC data. Using iterative proportional fitting, an allocation table of the county-level ES202 data were created to estimate the shares of each SIC industry that was assigned to the various three-digit NAICS industry groups for the period 1990-2001. The initial population of the seed values in the iterative proportional fitting was drawn from the national allocation proportions reported for 1997, the first year of NAICS use. Numerous cycles of fitting were performed to allocate four-digit SIC detailed industries to the three-digit NAICS groups. Next the four-digit SIC industries were aggregated to (mostly) two-digit SIC industry groups and additional cycles of fitting were performed until the data mostly converged. This was done separately for each of the years 1990-2001.

Next, the allocation shares for apportioning the SIC industry groups to the NAICS industry groups were projected backwards from the 1990-2001 period into the 1978-1989 period, generally using logarithmic curves. These allocation shares were applied to the SIC-based industry group data to develop the NAICS-based industry group covered employment estimates.

Once the ES202 covered estimates were set, iterative proportional fitting was used to create initial apportionments of the proprietors (uncovered employment) from the SIC total employment data series to the NAICS categories for each year during the period 1990-2000. Seed values were created by the apportioning the total employment by SIC group into the NAICS groups using the same shares as for covered employment, then subtracting covered employment from total employment. Iterative proportional fitting was then used to control alternately to total proprietors by SIC, then to total proprietors by NAICS, until the data mostly converged. Allocation shares were then projected backwards from the results of the 1990-2000 data to the period 1978-1989, generally using logarithmic curves. Estimated proprietors by NAICS industry group generated from this procedure were then added to estimated covered employment to obtain the initial estimates of total employment by industry group.

The next steps are the same as for the second stage calculations for the 1990-2000 data: calculate the shares of proprietors (non-covered employment) by industry implied by the difference between the estimated total employment and the ES202 covered employment. This was done for major industry groups (NAICS two-digit level).

Then proprietors by major industry were adjusted so that the total proprietors would match the total reported by BEA.

The next several stages involved using the same strategy to disaggregate the proprietors by detailed industry (typically NAICS three-digit level), particularly in the manufacturing and information major sectors.

Appendix III: Detailed Forecast

This section documents how the detailed forecast was developed.

Forecast Type:

Explicit: Forecast is made with explicit assumptions outlined in the main documentation.

Predicted: Forecast is developed based on relationships to other local or state employment sectors. Graphs outlining these the relationship of these sectors and the predicting variables between 1980 and 2015, and the resulting correlations, are included in this appendix following the tables.

Sum: Forecast is the sum of other sectors.

Table 3: List of Thurston County detailed sectors, abbreviations, and type of forecast.

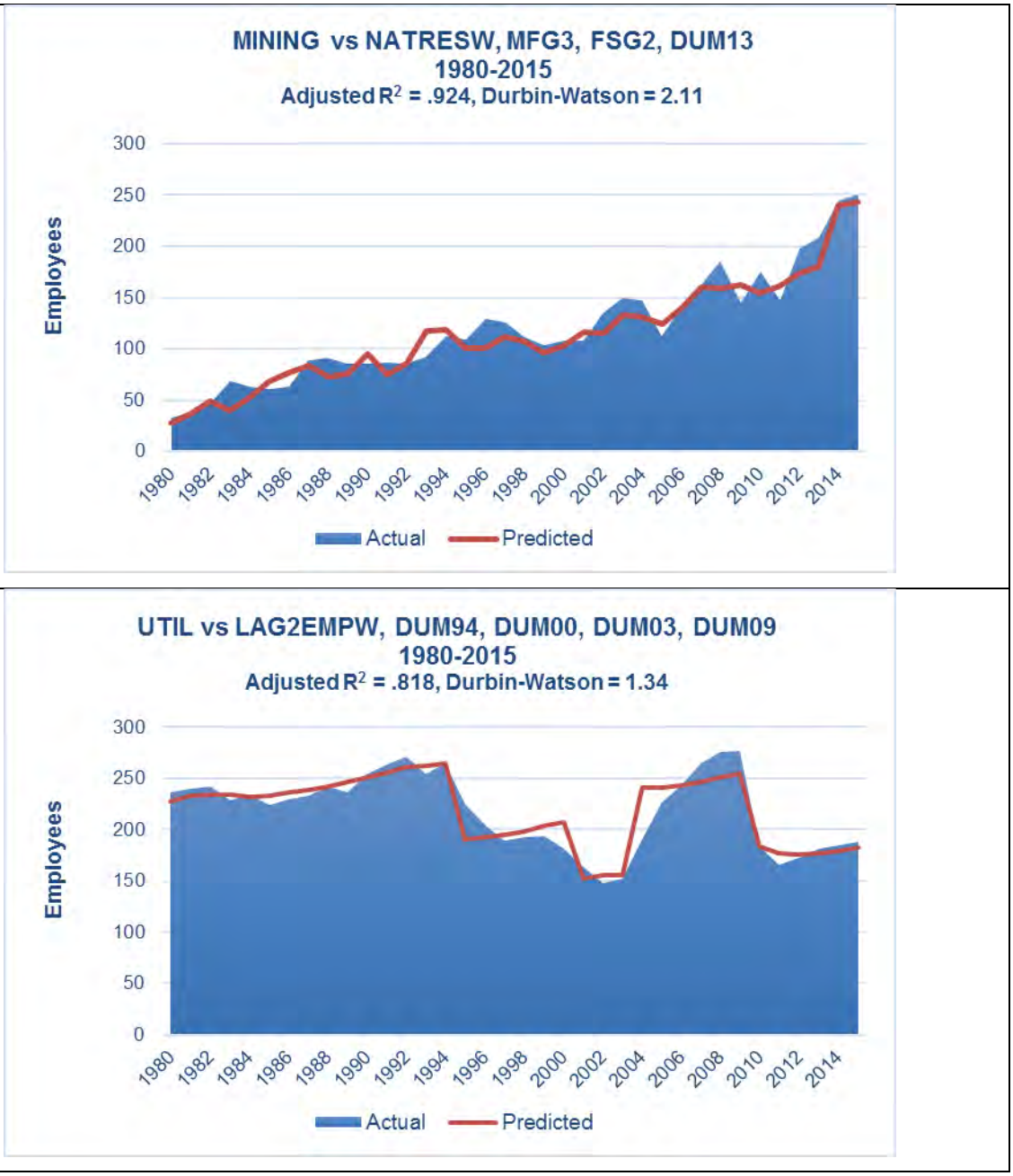
Thurston County Sector	Abbreviation	Forecast Type
Agriculture, forestry, fishing, & related	AGFOR	Explicit
Mining	MINING	Predicted
Utilities	UTIL	Predicted
Construction	CONST	Predicted
Manufacturing	MFG	Sum
Non-durable	NONDUR	Sum
Food prod mfg	FOOD	Predicted
Beverage & tobacco prod mfg	BEV	Predicted
Textile mills & prods, apparel, & chems	ONONDUR	Predicted
Durable	DUR	Sum
Wood prod mfg - 3-yr rolling average	WOODAVG	Predicted
Petroleum, coal, plastics, & rubber prod mfg	PLASTC	Predicted
Other durable	ODUR	Predicted
Paper, Printing, Fabricated Metals, Machinery, Computers	MANCOM2	Predicted
Wholesale trade	WT	Predicted
Retail trade	RT	Sum
Motor vehicle and parts dealers	AUTO	Predicted
All other retail	ORETL	Predicted
Transportation and warehousing	TRANS	Sum
Freight transportation	TRANSF	Predicted
Passenger transportation	TRANSP	Predicted
Information	INFO	Sum
Publishing	PUBL	Predicted
Software	SOFTWR	Predicted
Recording, broadcasting, telecom, etc.	OINFO	Predicted
Finance and insurance	FIN_INS	Predicted
Real estate and rental and leasing	RE_RENTS	Predicted
Professional and business services	BUSR	Predicted
Education, Health, & Social Services	EDU_HSR	Predicted
Arts, entertainment, and recreation	REC	Predicted
Accommodation and food services	ACCOM_FS	Predicted
Other services, except public administration	OSRV	Predicted

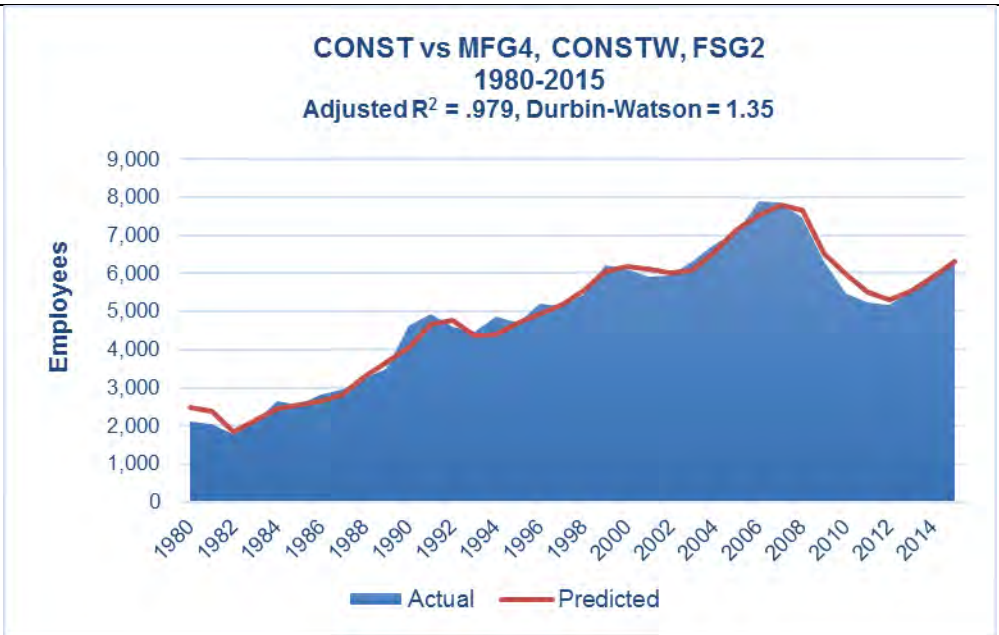
Thurston County Sector	Abbreviation	Forecast Type
Federal, civilian	FG	Sum
Post Office	USPS	Predicted
Federal government - other civilian	OFG	Predicted
State government	SG_TOT	Sum
State government, non-education	SG	Predicted
The Evergreen State College	TESC	Explicit
South Puget Sound Community College	SPSCC	Predicted
Local government (from BEA, includes tribal casinos)	LG_TOT	Sum
Local government minus tribal casinos	LG	Predicted
Tribal casinos	CASINOS	Predicted
Military (stationed in Thurston, e.g., National Guard)	MIL	Explicit
Total Thurston County Employment	THURTOTEMP	Sum
Net Outbound Commuters	COMMTR1	Sum
Outbound commuters (5 yr rolling avg after 2000)	COMOUTAVG	Predicted
Inbound commuters (5 yr rolling avg after 2000)	COMINAVG	Predicted

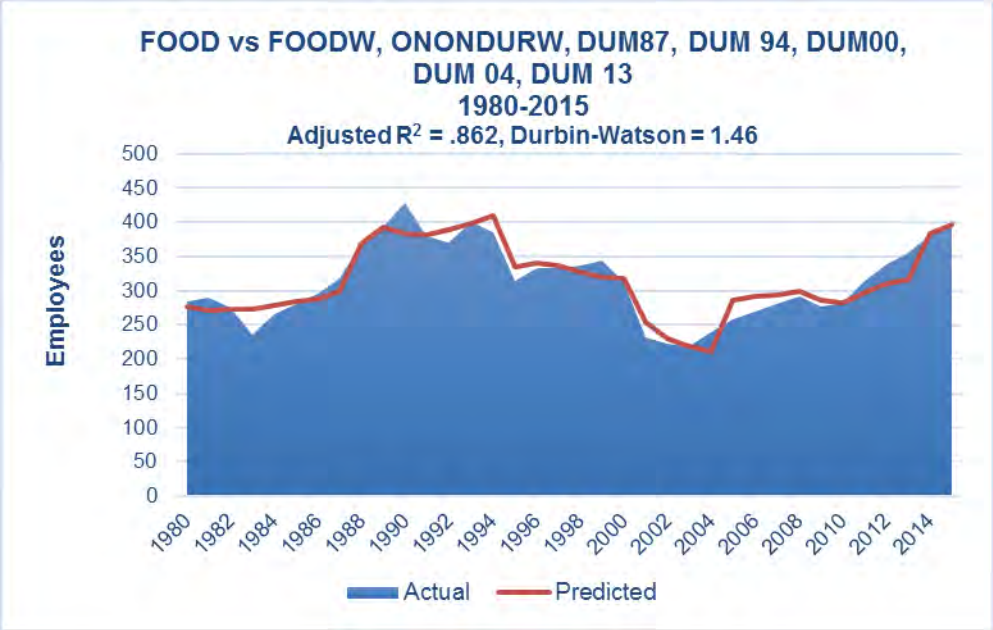
Table 4: List and source of state and regional sectors used as predicting variables in the forecast.

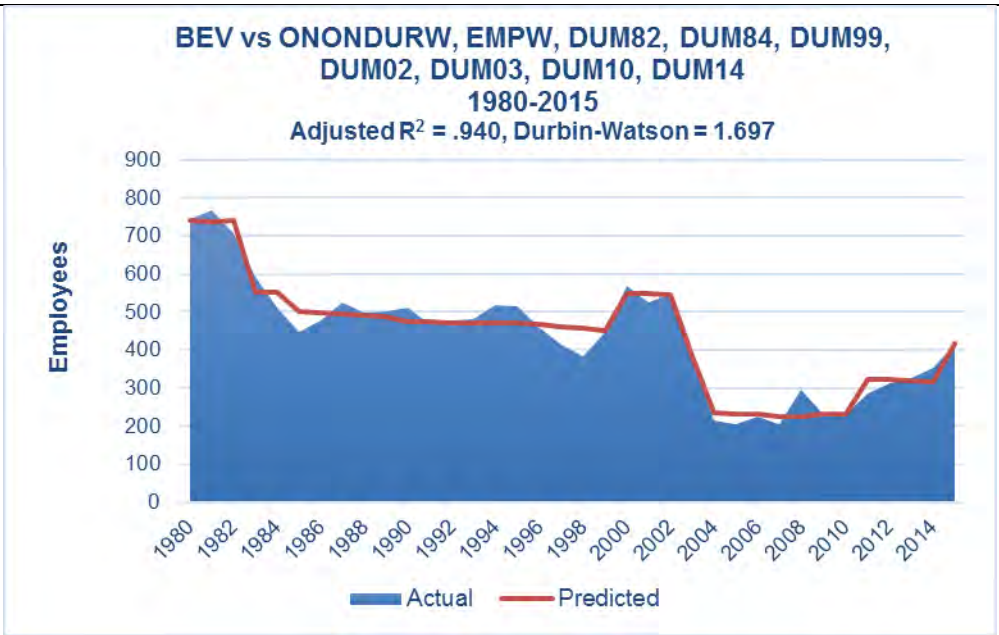
Variable	Abbreviation	Source for Forecast
Population Variables		
Population of King County (/100)	KPOP	OFM Medium Forecast
Population of Pierce County	PPOP	OFM Medium Forecast
Population of Snohomish County	SPOP	OFM Medium Forecast
Population of Mason, Lewis, & Grays Harbor	MLGHPOP	OFM Medium Forecast
Population of Thurston County	THURPOP	OFM Medium Forecast
Statewide Employment Sectors		
Natural Resources (logging + mining)--Wash	NATRESW	WA Forecast
Construction--Wash	CONSTW	WA Forecast
Food products--Wash	FOODW	WA Forecast
Beverages, textile mills & prods, apparel, & chems	ONONDURW	WA Forecast
Wood products--Wash	WOODW	WA Forecast
Petroleum, coal & plastic prod--Wash	PLASTCW	WA Forecast
Minerals, metals, elec, transp, furniture, & misc prod mfg less Aerospace--Wash	ODURW2	WA Forecast
Minerals, furniture, misc prod mfg--Wash	ODURW1	WA Forecast
Fabricated metal products--Wash	FMW	WA Forecast
Machinery, computers, electrical eqt, & appliance mfg--Wash	MACHNSW	WA Forecast
Transportation, warehousing, utilities--Wash	TRWUW	WA Forecast
Newspaper, Book & Directory Publishers--Wash	PUBLW	WA Forecast
Software Publishers--Wash	SOFTWRW	WA Forecast
Recording, broadcasting, telecom, ISPs, etc.--Wash	OINFOW	WA Forecast
Professional and business services--Wash	BUSRW	WA Forecast
Education & Health Services--Wash	EDU_HSRW	WA Forecast
State and Local Government -- Wash	SLGW	WA Forecast
Total Non-Ag Wage & Salary workers--Wash	EMPW	WA Forecast
EMPW, lagged one year	LAGEMPW	calc
EMPW, lagged two years	LAG2EMPW	calc
Thurston County Employment Combinations		
OFG+SG+TESC+SPSCC	FSG2	Sum
USPS+OFG+SG	FSG3	Sum
Manufacturing, except BEV & WOOD	MFG3	Sum
Manufacturing, except WOOD	MFG4	Sum
MFG3, lagged one year	LAGMFG3	calc
Dummy variables to account for a change in conditions such as a large firm moving into or leaving the region.	DUM(Year)	
US Census workers every 10 years	CENSUS(Year)	

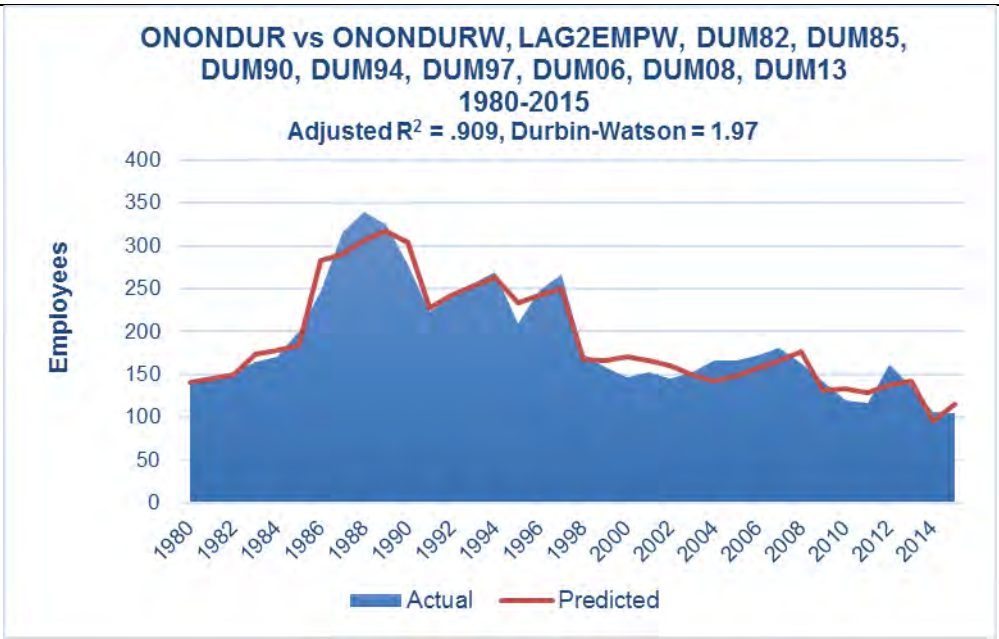
Figure 39: Detailed graphs showing predicted versus actual historic data for each sector.

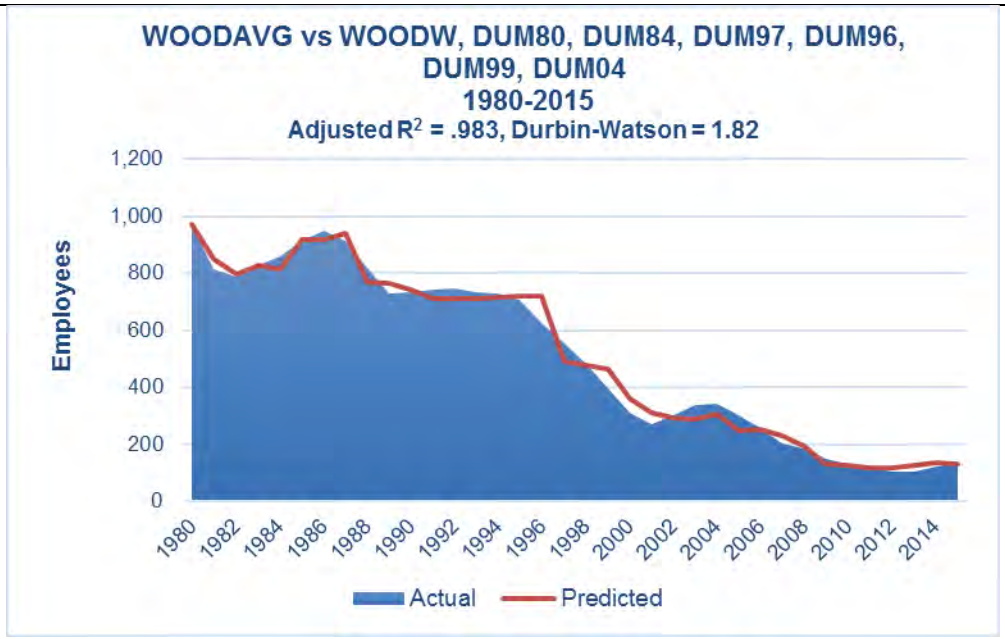


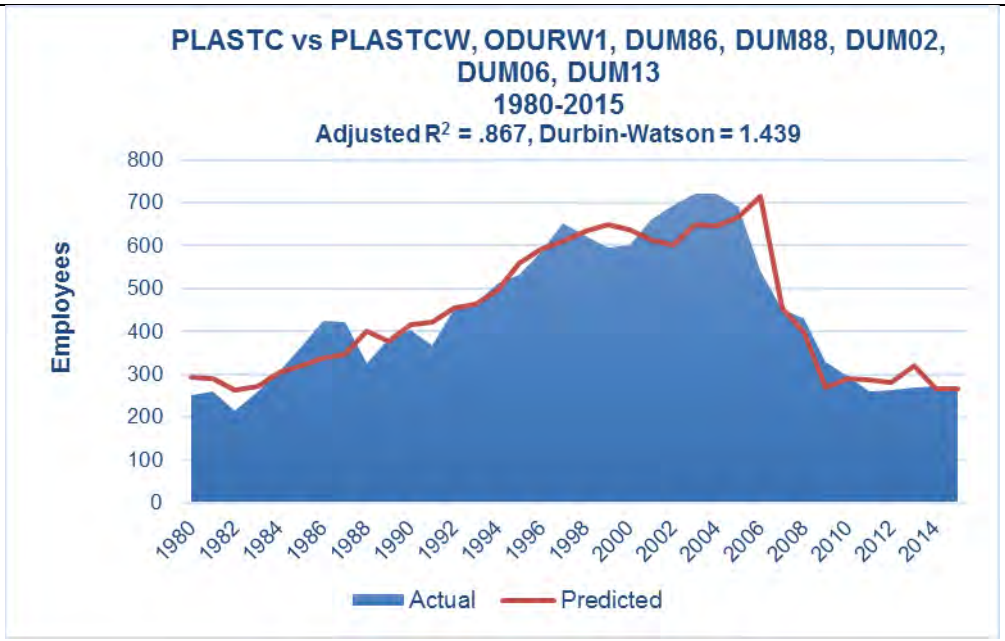

CONST vs MFG4, CONSTW, FSG2
1980-2015
Adjusted R2 = .979, Durbin-Watson = 1.35
Employees
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

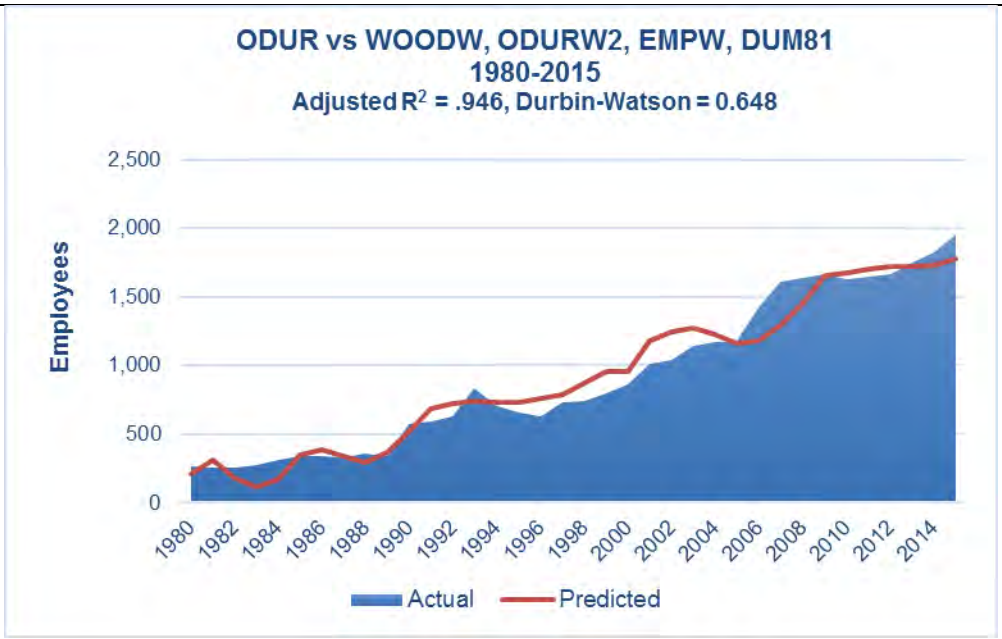

FOOD vs FOODW, ONONDURW, DUM87, DUM 94, DUM00, DUM 04, DUM 13
1980-2015
Adjusted R2 = .862, Durbin-Watson = 1.46
Employees
500
450
400
350
300
250
200
150
100
50
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

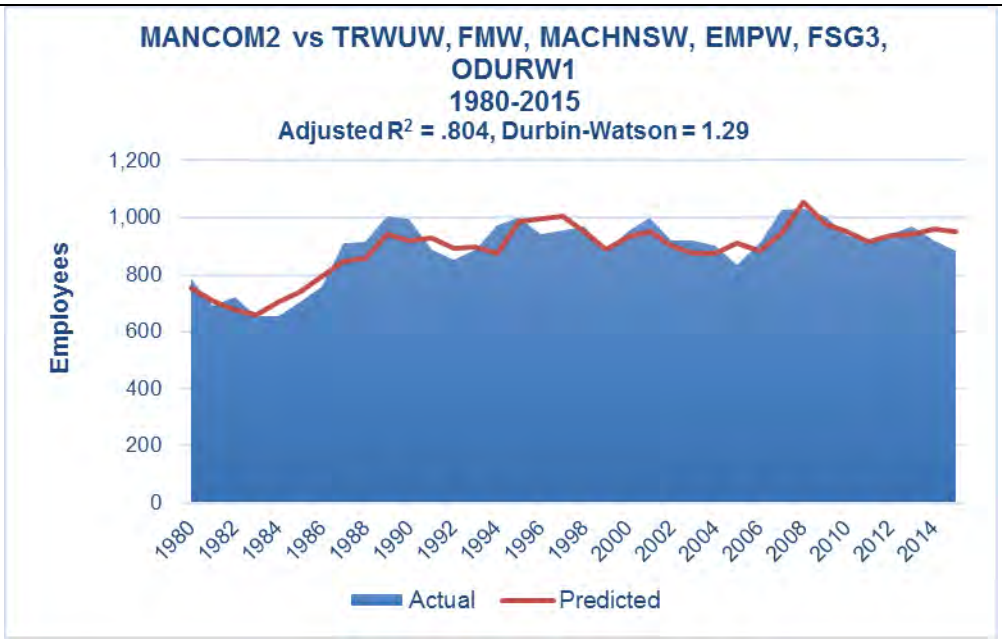

BEV vs ONONDURW, EMPW, DUM82, DUM84, DUM99, DUM02, DUM03, DUM10, DUM14
1980-2015
Adjusted R2 = .940, Durbin-Watson = 1.697
Employees
900
800
700
600
500
400
300
200
100
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

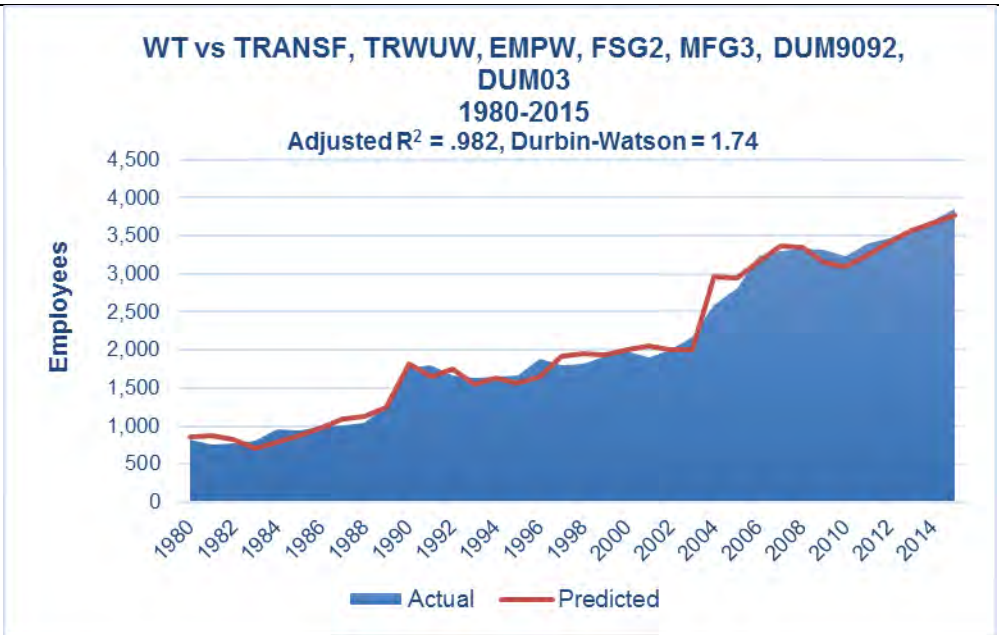

ONONDUR vs ONONDURW, LAG2EMPW, DUM82, DUM85, DUM90, DUM94, DUM97, DUM06, DUM08, DUM13
1980-2015
Adjusted R2 = .909, Durbin-Watson = 1.97
Employees
400
350
300
250
200
150
100
50
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

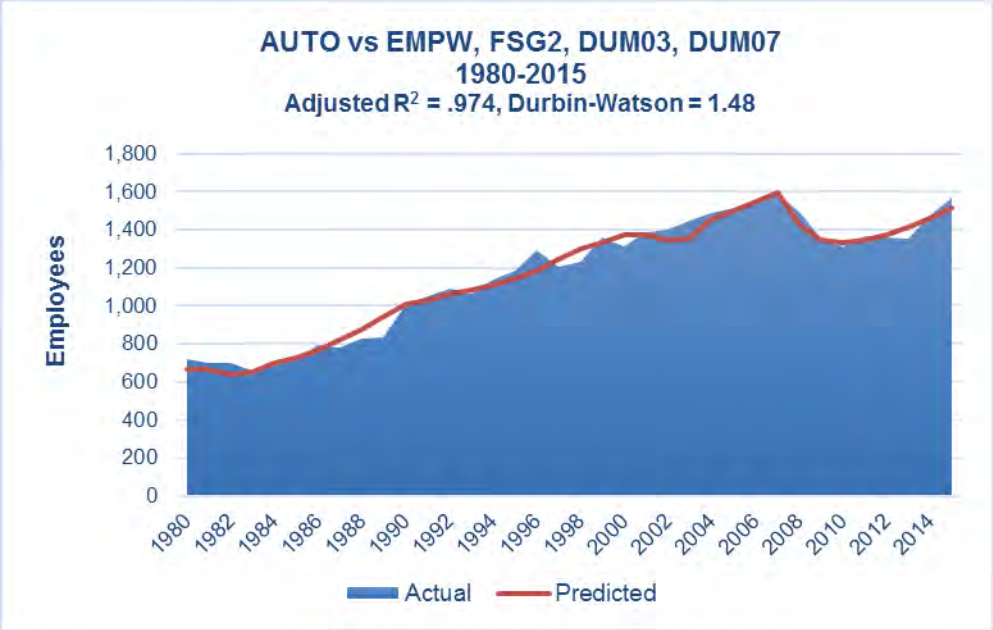

WOODAVG vs WOODW, DUM80, DUM84, DUM97, DUM96, DUM99, DUM04
1980-2015
Adjusted R2 = .983, Durbin-Watson = 1.82
Employees
1,200
1,000
800
600
400
200
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

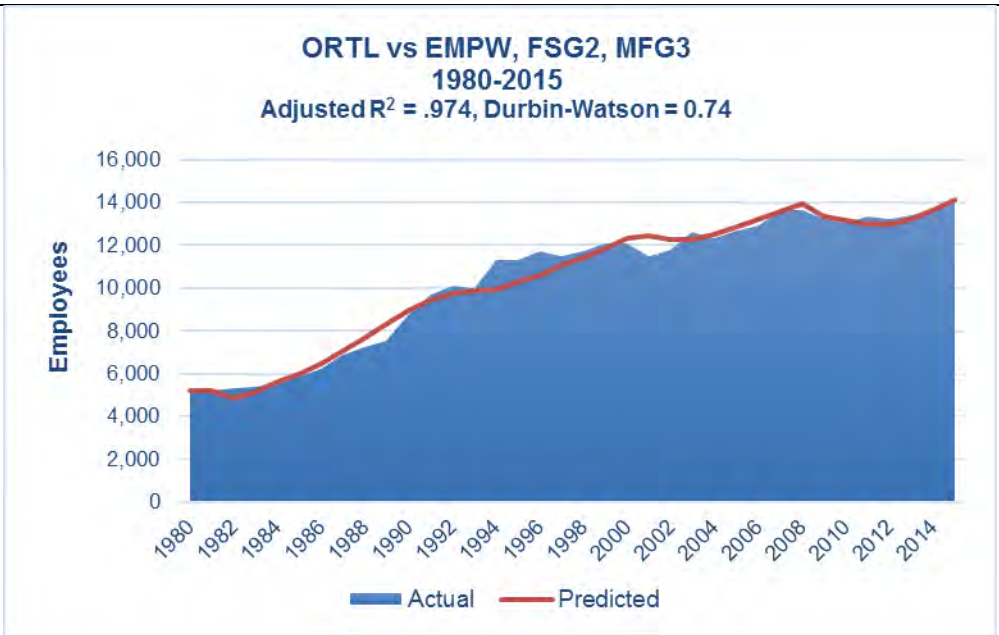

PLASTC vs PLASTCW, ODURW1, DUM86, DUM88, DUM02, DUM06, DUM13
1980-2015
Adjusted R2 = .867, Durbin-Watson = 1.439
Employees
800
700
600
500
400
300
200
100
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

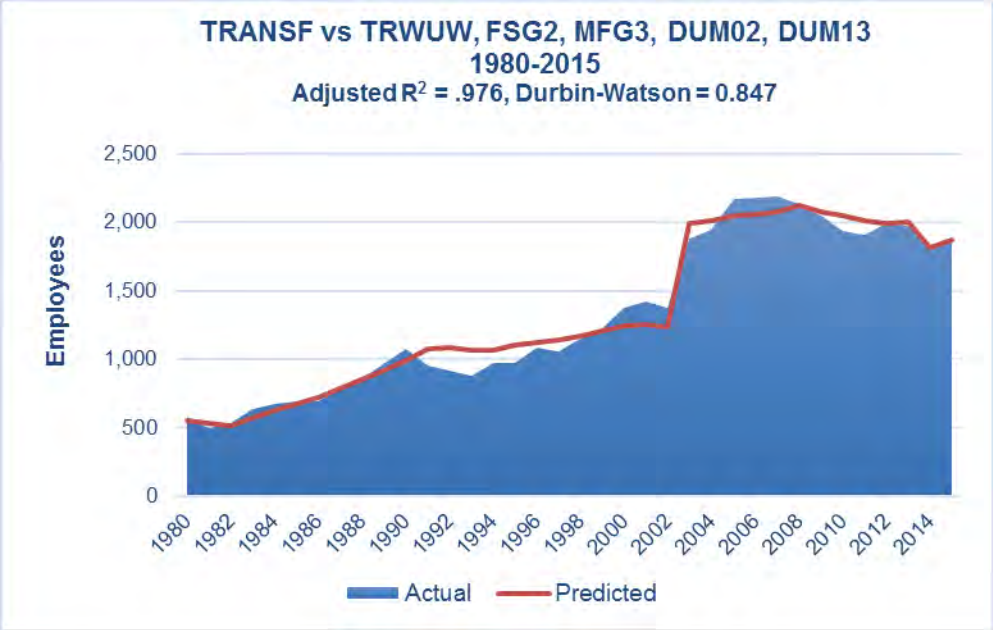

ODUR vs WOODW, ODURW2, EMPW, DUM81
1980-2015
Adjusted R2 = .946, Durbin-Watson = 0.648
Employees
2,500
2,000
1,500
1,000
500
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

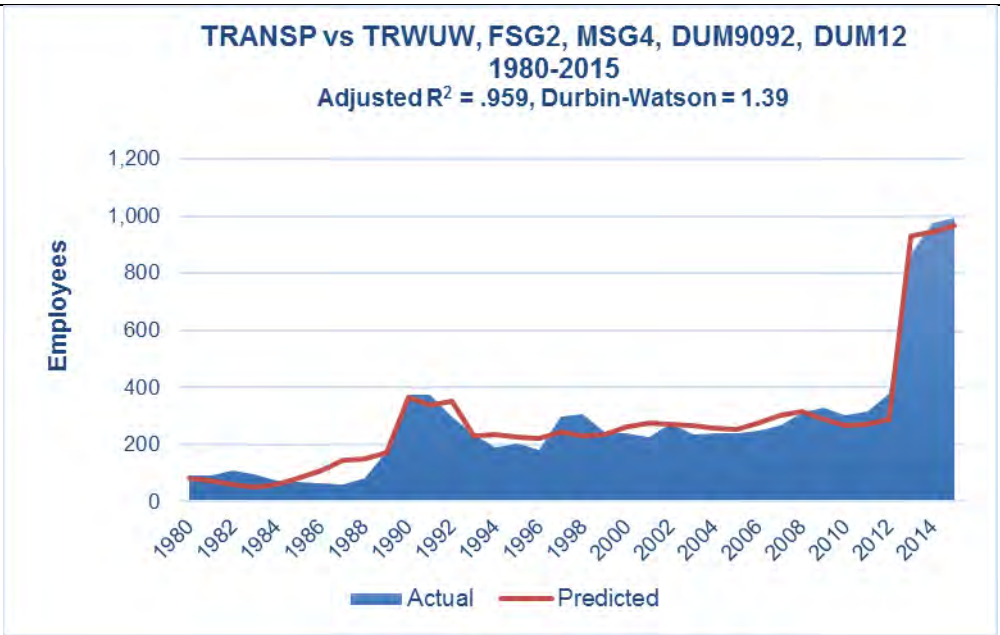

MANCOM2 vs TRWUW, FMW, MACHNSW, EMPW, FSG3, ODURW1
1980-2015
Adjusted R2 = .804, Durbin-Watson = 1.29
Employees
1,200
1,000
800
600
400
200
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

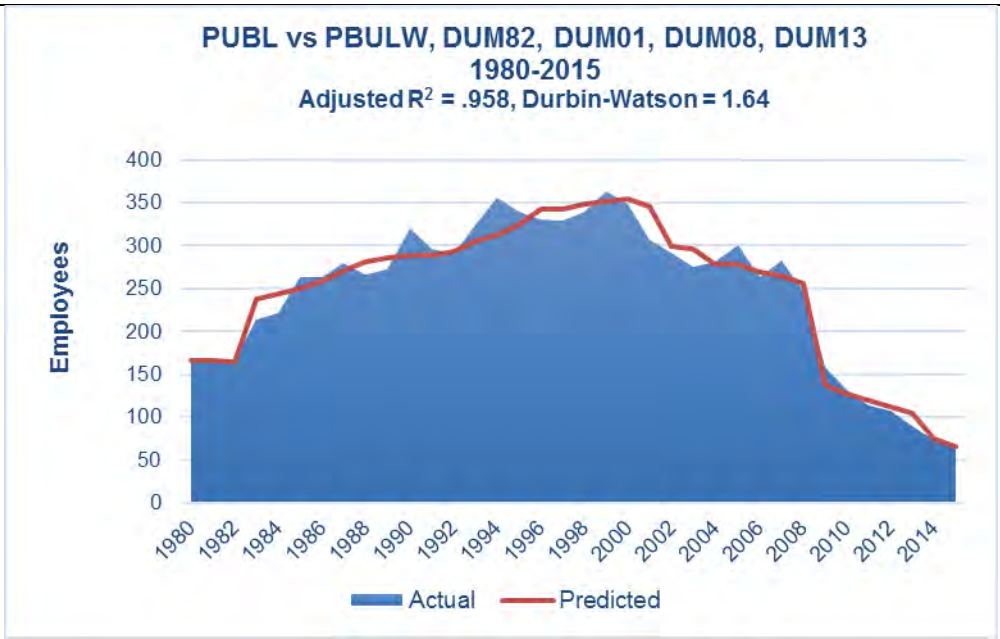

WT vs TRANSF, TRWUW, EMPW, FSG2, MFG3, DUM9092, DUM03
1980-2015
Adjusted R2 = .982, Durbin-Watson = 1.74
Employees
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

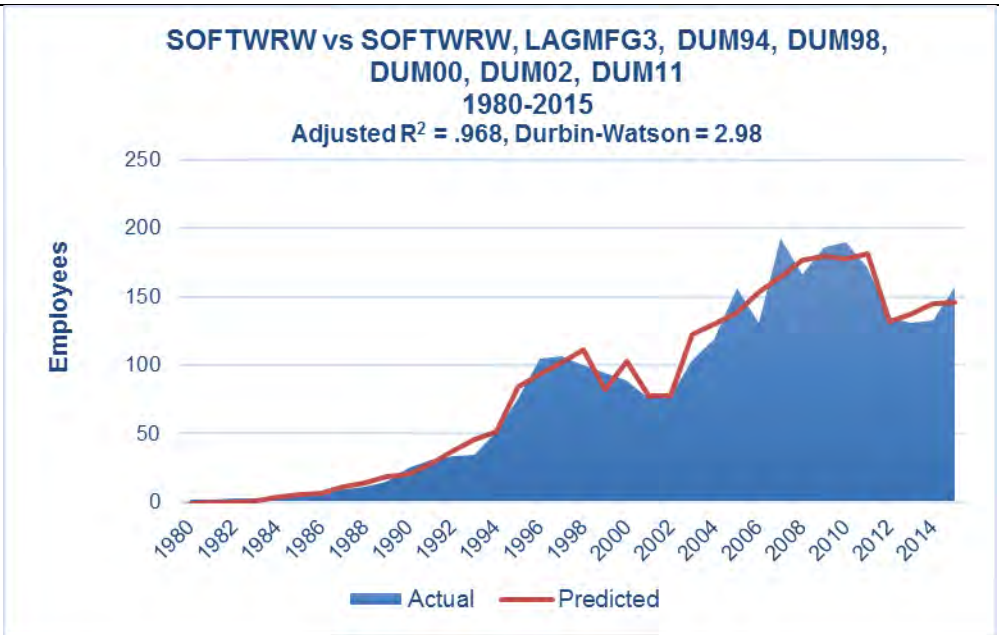

AUTO vs EMPW, FSG2, DUM03, DUM07
1980-2015
Adjusted R2 = .974, Durbin-Watson = 1.48
Employees
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

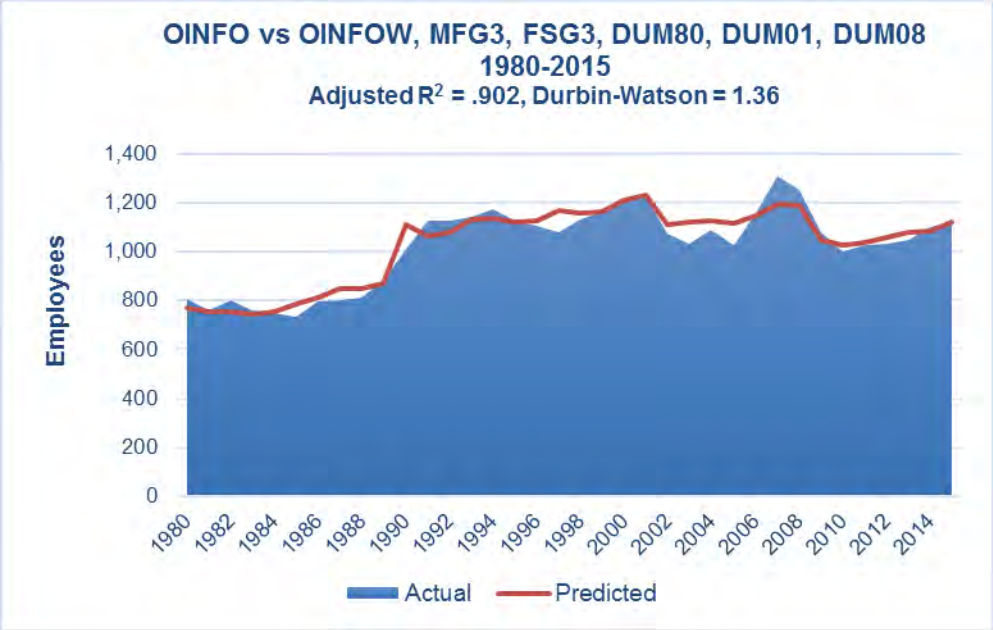

ORTL vs EMPW, FSG2, MFG3
1980-2015
Adjusted R2 = .974, Durbin-Watson = 0.74
Employees
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

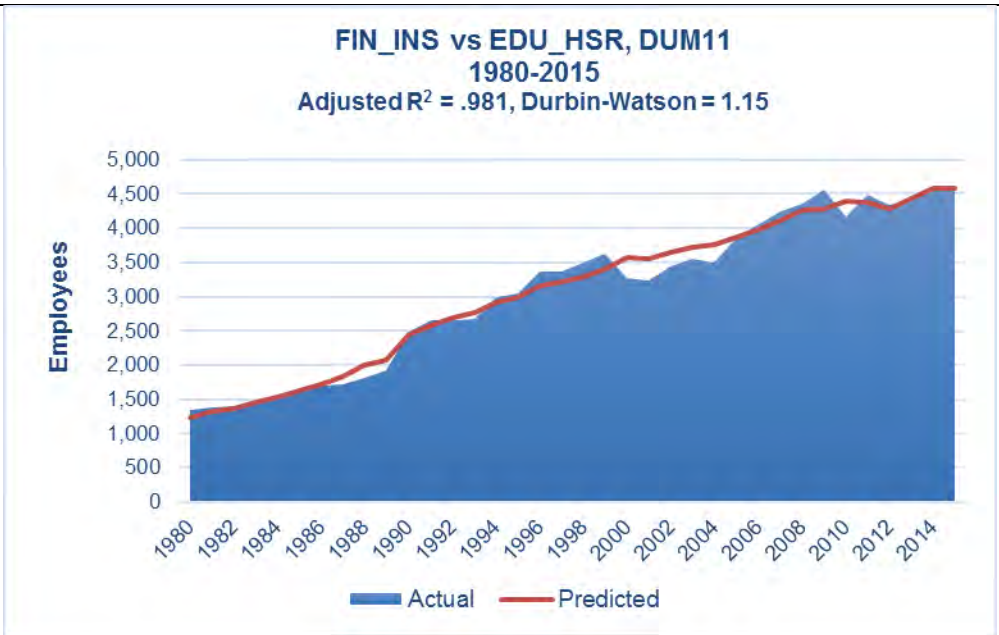

TRANSF vs TRWUW, FSG2, MFG3, DUM02, DUM13
1980-2015
Adjusted R2 = .976, Durbin-Watson = 0.847
Employees
2,500
2,000
1,500
1,000
500
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

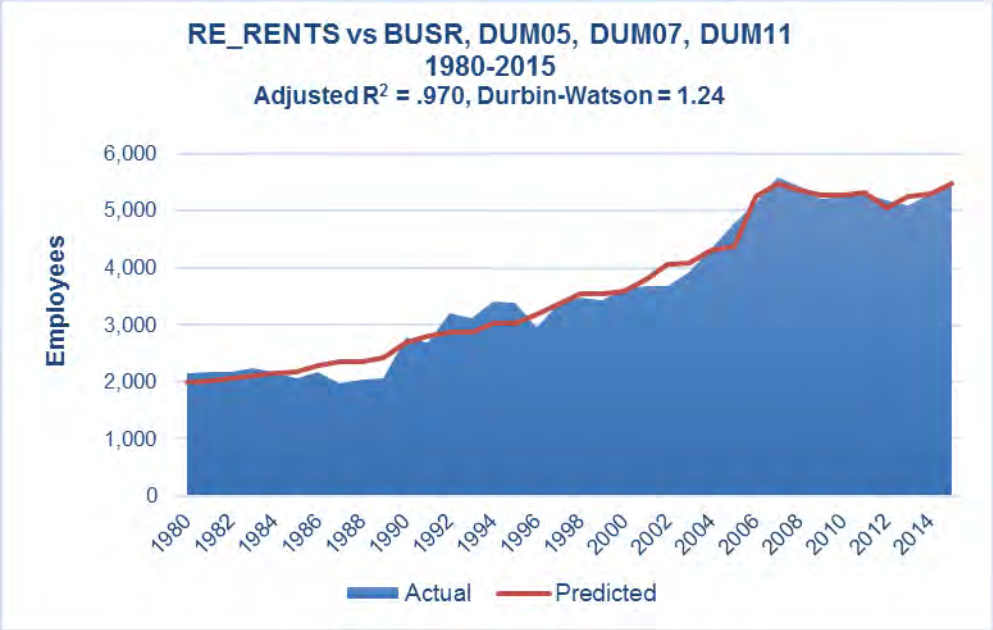

TRANSP vs TRWUW, FSG2, MSG4, DUM9092, DUM12
1980-2015
Adjusted R2 = .959, Durbin-Watson = 1.39
Employees
1,200
1,000
800
600
400
200
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

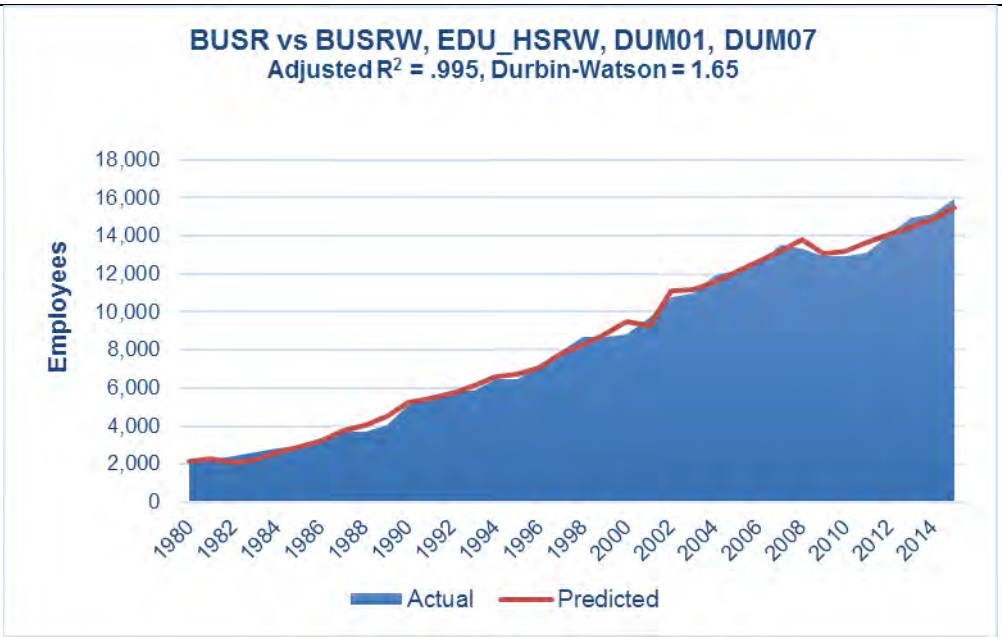

PUBL vs PBULW, DUM82, DUM01, DUM08, DUM13
1980-2015
Adjusted R2 = .958, Durbin-Watson = 1.64
Employees
400
350
300
250
200
150
100
50
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

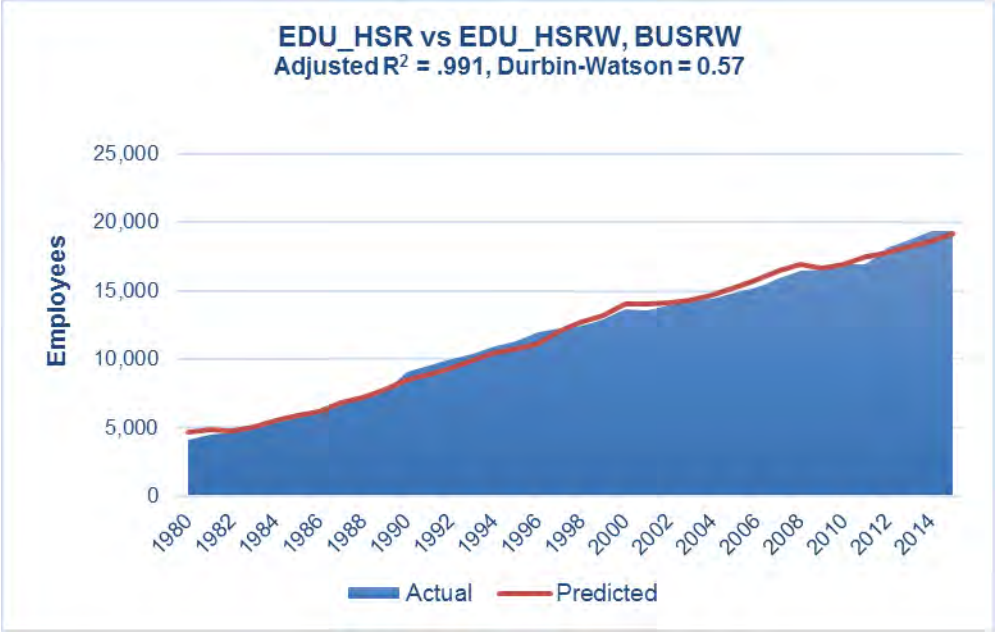

SOFTWRW vs SOFTWRW, LAGMFG3, DUM94, DUM98, DUM00, DUM02, DUM11
1980-2015
Adjusted R2 = .968, Durbin-Watson = 2.98
Employees
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted

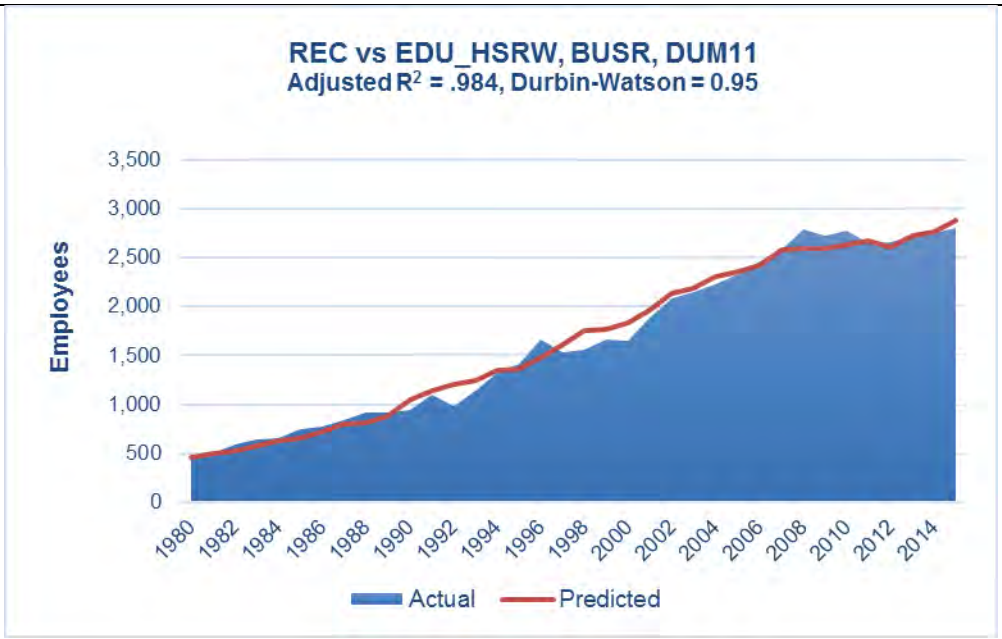

OINFO vs OINFOW, MFG3, FSG3, DUM80, DUM01, DUM08
1980-2015
Adjusted R2 = .902, Durbin-Watson = 1.36
Employees
1,400
1,200
1,000
800
600
400
200
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted

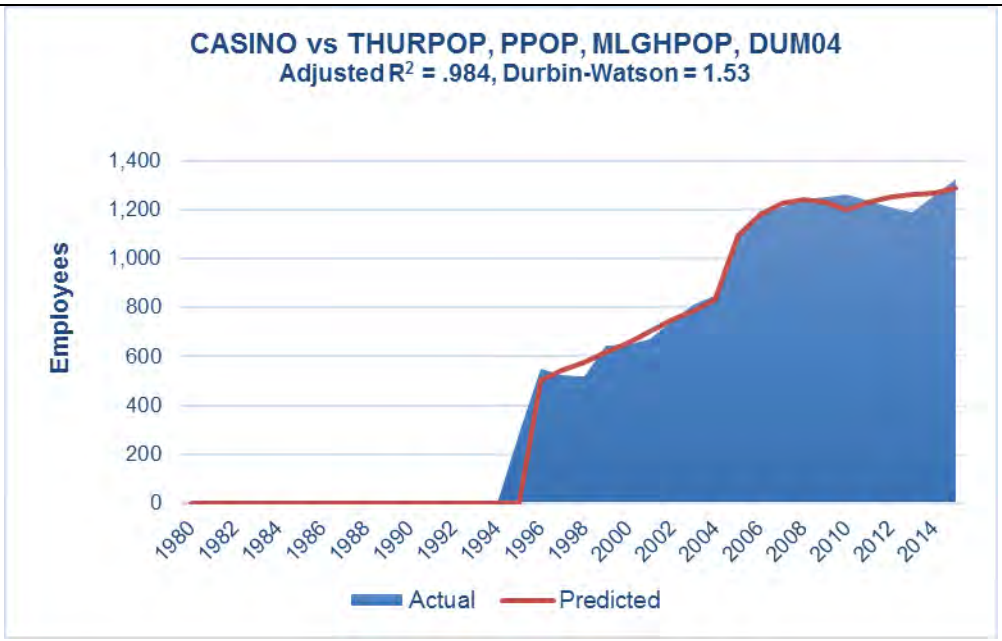

FIN_INS vs EDU_HSR, DUM11
1980-2015
Adjusted R2 = .981, Durbin-Watson = 1.15
Employees
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted

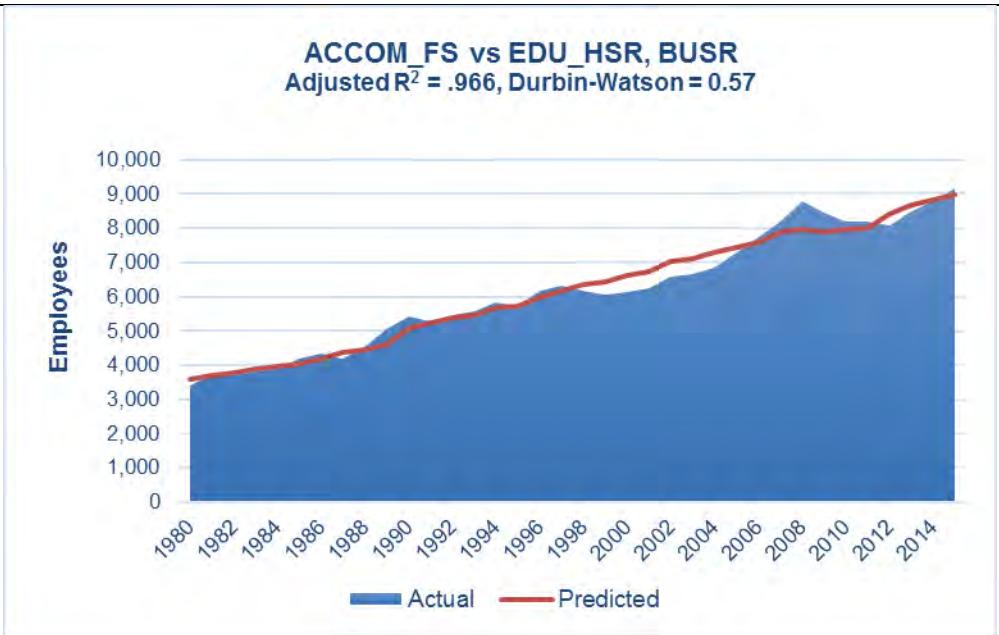

RE_RENTS vs BUSR, DUM05, DUM07, DUM11
1980-2015
Adjusted R2 = .970, Durbin-Watson = 1.24
Employees
6,000
5,000
4,000
3,000
2,000
1,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted

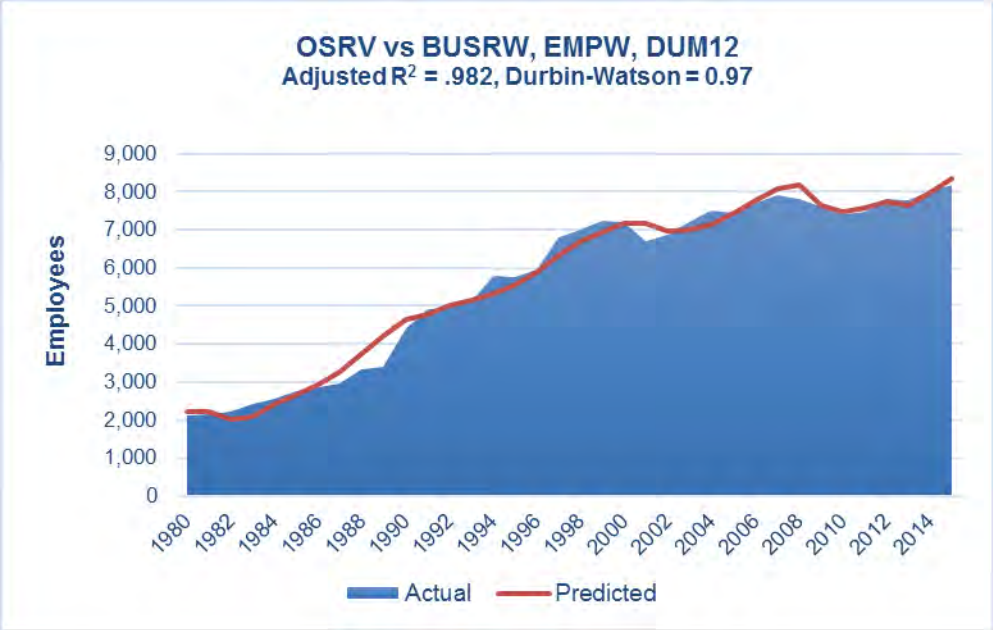

BUSR vs BUSRW, EDU_HSRW, DUM01, DUM07
Adjusted R2 = .995, Durbin-Watson = 1.65
Employees
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

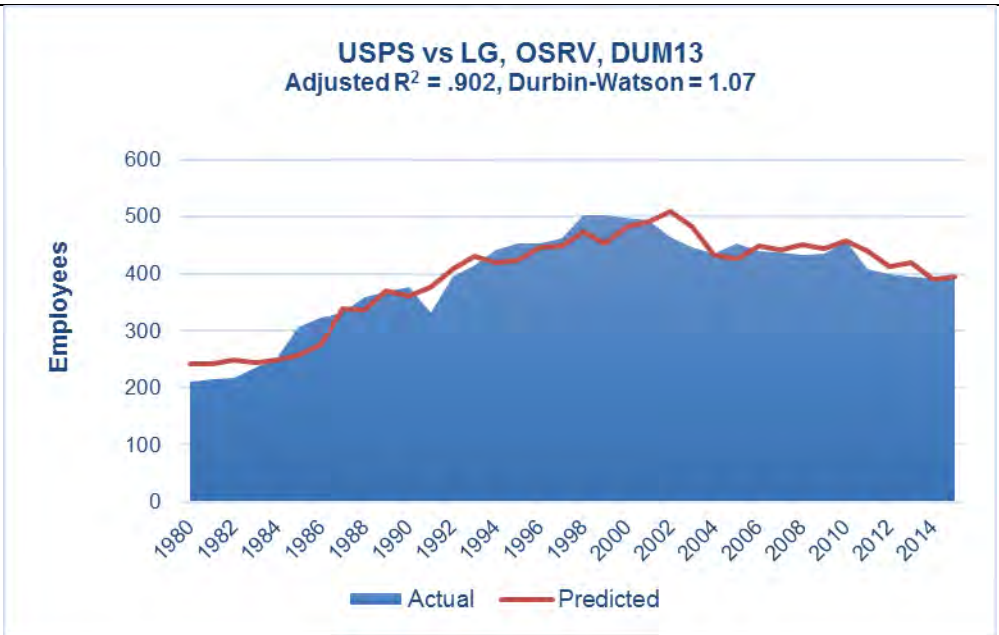

EDU_HSR vs EDU_HSRW, BUSRW
Adjusted R2 = .991, Durbin-Watson = 0.57
Employees
25,000
20,000
15,000
10,000
5,000
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

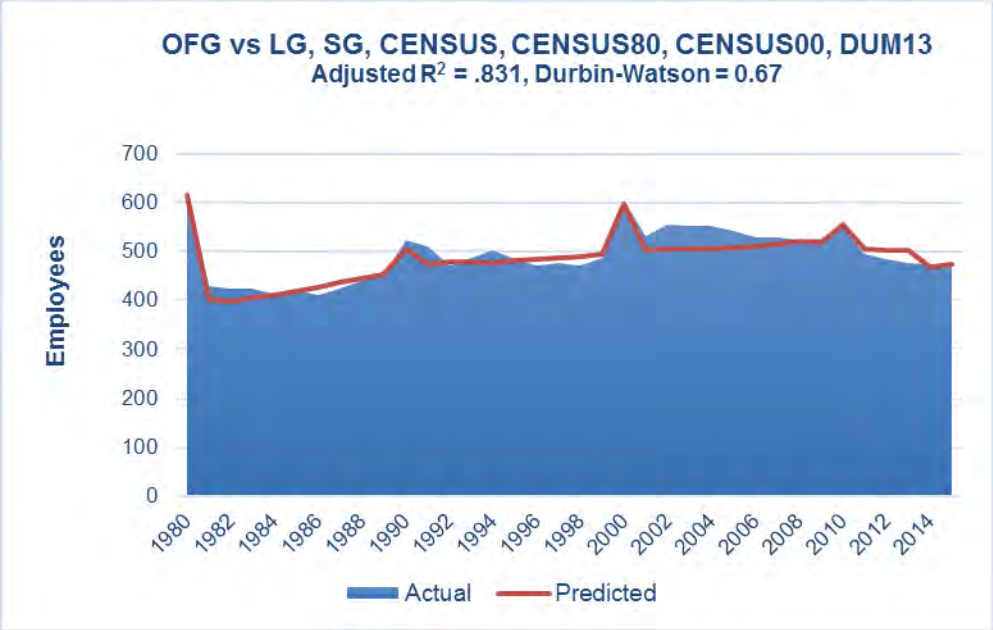

REC vs EDU_HSRW, BUSR, DUM11
Adjusted R2 = .984, Durbin-Watson = 0.95
Employees
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

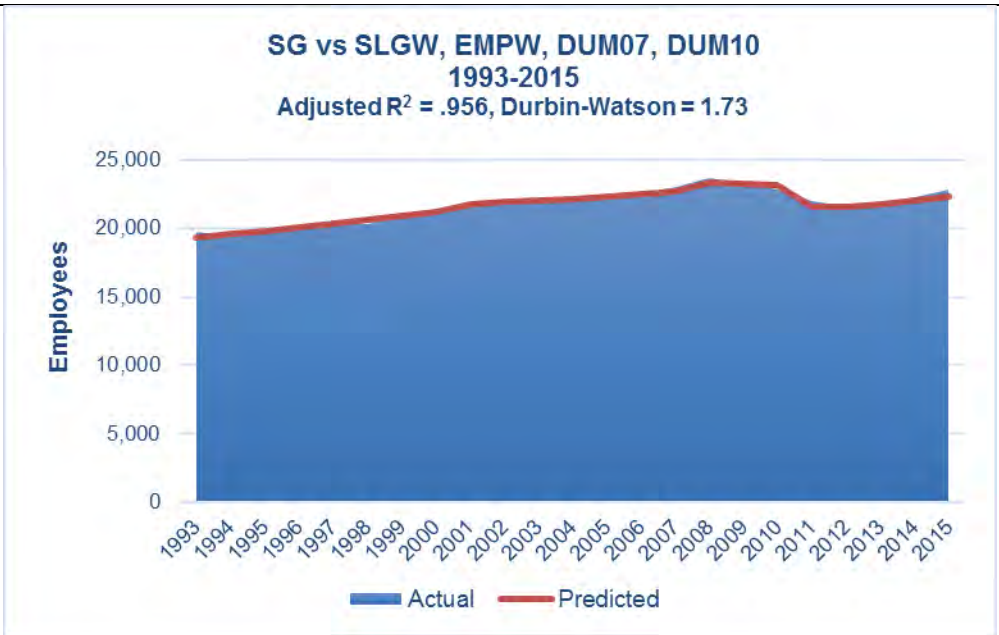

CASINO vs THURPOP, PPOP, MLGHPOP, DUM04
Adjusted R2 = .984, Durbin-Watson = 1.53
Employees
1,400
1,200
1,000
800
600
400
200
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted

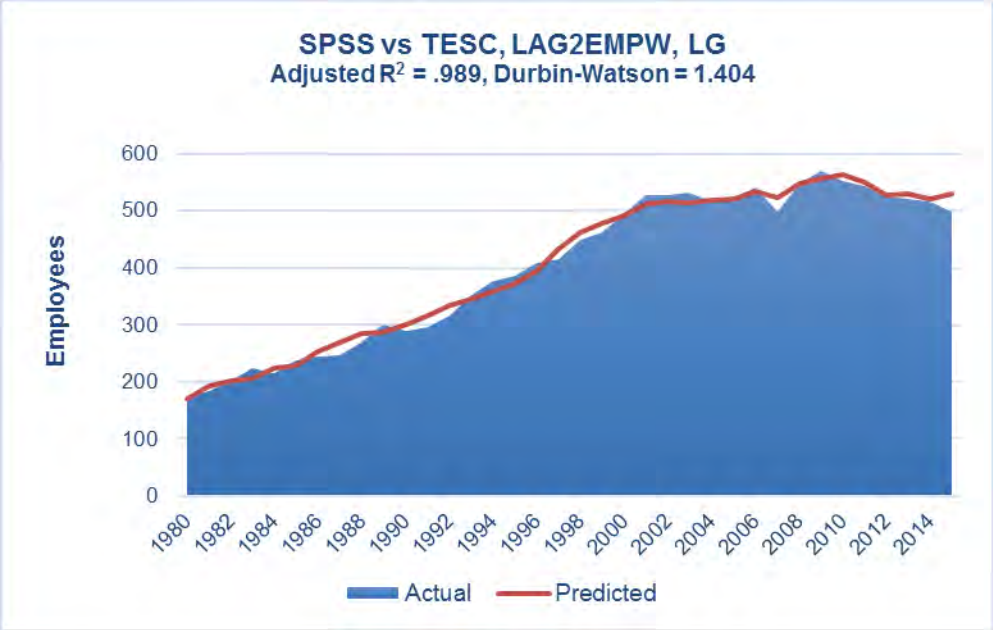

ACCOM_FS vs EDU_HSR, BUSR
Adjusted R2 = .966, Durbin-Watson = 0.57
Employees
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted

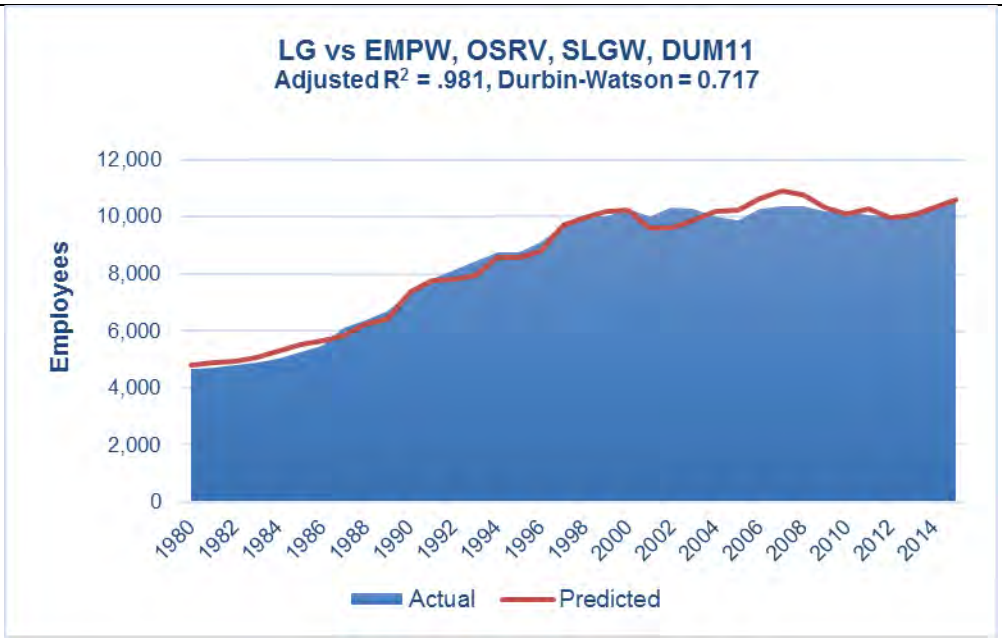

OSRV vs BUSRW, EMPW, DUM12
Adjusted R2 = .982, Durbin-Watson = 0.97
Employees
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted

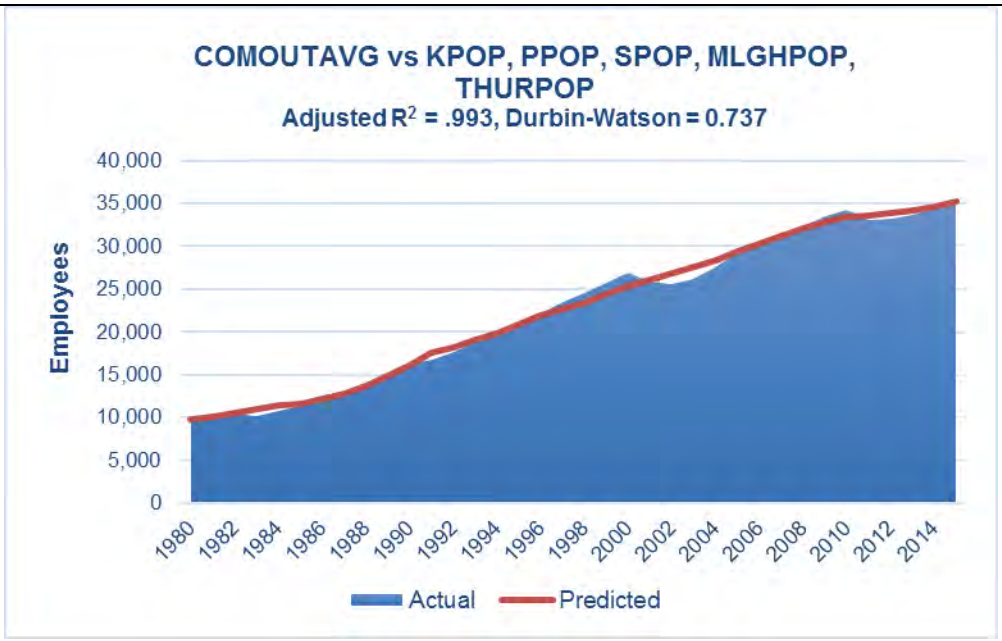

USPS vs LG, OSRV, DUM13
Adjusted R2 = .902, Durbin-Watson = 1.07
Employees
600
500
400
300
200
100
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted

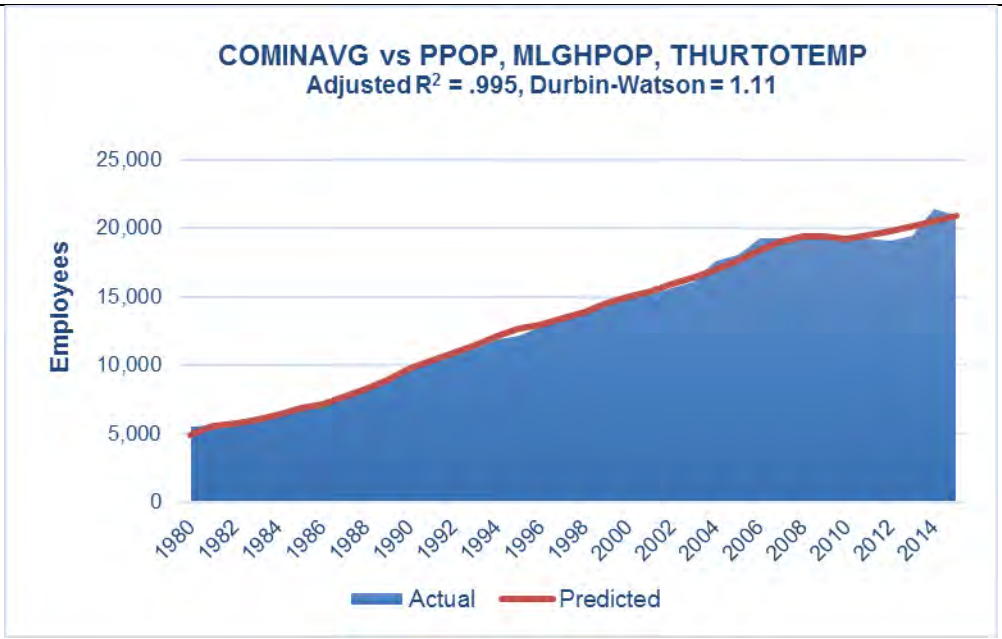

OFG vs LG, SG, CENSUS, CENSUS80, CENSUS00, DUM13
Adjusted R2 = .831, Durbin-Watson = 0.67
Employees
700
600
500
400
300
200
100
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted


SG vs SLGW, EMPW, DUM07, DUM10
1993-2015
Adjusted R2 = .956, Durbin-Watson = 1.73
Employees
25,000
20,000
15,000
10,000
5,000
0
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Actual
Predicted


SPSS vs TESC, LAG2EMPW, LG
Adjusted R2 = .989, Durbin-Watson = 1.404
Employees
600
500
400
300
200
100
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Actual
Predicted


LG vs EMPW, OSRV, SLGW, DUM11
Adjusted R2 = .981, Durbin-Watson = 0.717
Employees
12,000
10,000
8,000
6,000
4,000
2,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted


COMOUTAVG vs KPOP, PPOP, SPOP, MLGHPOP, THURPOP
Adjusted R2 = .993, Durbin-Watson = 0.737
Employees
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted


COMINAVG vs PPOP, MLGHPOP, THURTOTEMP
Adjusted R2 = .995, Durbin-Watson = 1.11
Employees
25,000
20,000
15,000
10,000
5,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Actual
Predicted