Characterizing Oregon's Economy:

Key Determinants of Oregon Tax Revenue 2001-2009

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Table of Contents

I. Introduction

This paper addresses Oregon's state tax revenue and its variability due to macroeconomic conditions. Specifically, we examine the effect of changes in employment and wage levels on state-level tax revenue since 2001. We begin with general information concerning Oregon's tax revenue throughout the past decade and then describe the motivation for further exploration of this topic. We go on to develop a tax revenue model that utilizes employment and wage data. By comparing our model to specific tax revenue data, we can illustrate several important characteristics of Oregon's economy. These include the interactions between wage and employment levels and state tax revenue as well as the general trend of employment changes in Oregon over the past decade. We also consider the impact of individuals belonging to different portions of the income distribution on tax revenue during and between recessions.

Our results are relevant to people interested in Oregon's economy and state tax revenue. We find that the largest component of Oregon's tax revenue is occupational earnings. Within occupational earnings there are two key variables, wages and employment. We find that employment shifts, rather than wage shifts, have been most responsible for the trend of Oregon state tax revenue over the past decade. The most volatile component of Oregon state tax revenue has been individual capital gains income. The volatility of capital gains income allows it to impact the overall movement of Oregon state tax revenue. We find that the tax liability generated by capital gains income, the majority of which is earned by the top 1% of earners, suffers most during recessions and rises most during periods of expansion. Therefore, we observe the following. Occupational income is the greatest driver of Oregon state tax revenue. This has been most affected by employment shifts rather than wage shifts. Additionally, a smaller but more volatile component of state tax revenue, capital gains income, also impacts the movement of revenue and is not directly motivated by wage or employment levels. Our analysis of these issues also allows us to consider the evolution of Oregon's economy over the past decade in terms of the types of employment shifts that have taken place.

II. Abstract

This paper explores the variation in Oregon tax revenue between 2001 and 2009 by modeling income tax revenue, the largest component of Oregon state tax revenue. We identify occupational income and capital gains income as key factors of change in taxable income. The wealthiest tax payers are responsible for the large majority of capital gains revenue, a component with high variation due to business cycle effects. Thus, the wealthiest tax payers experience a decrease in tax burden during recessions. A model of occupational income tax revenue created from BLS occupational data leads to a

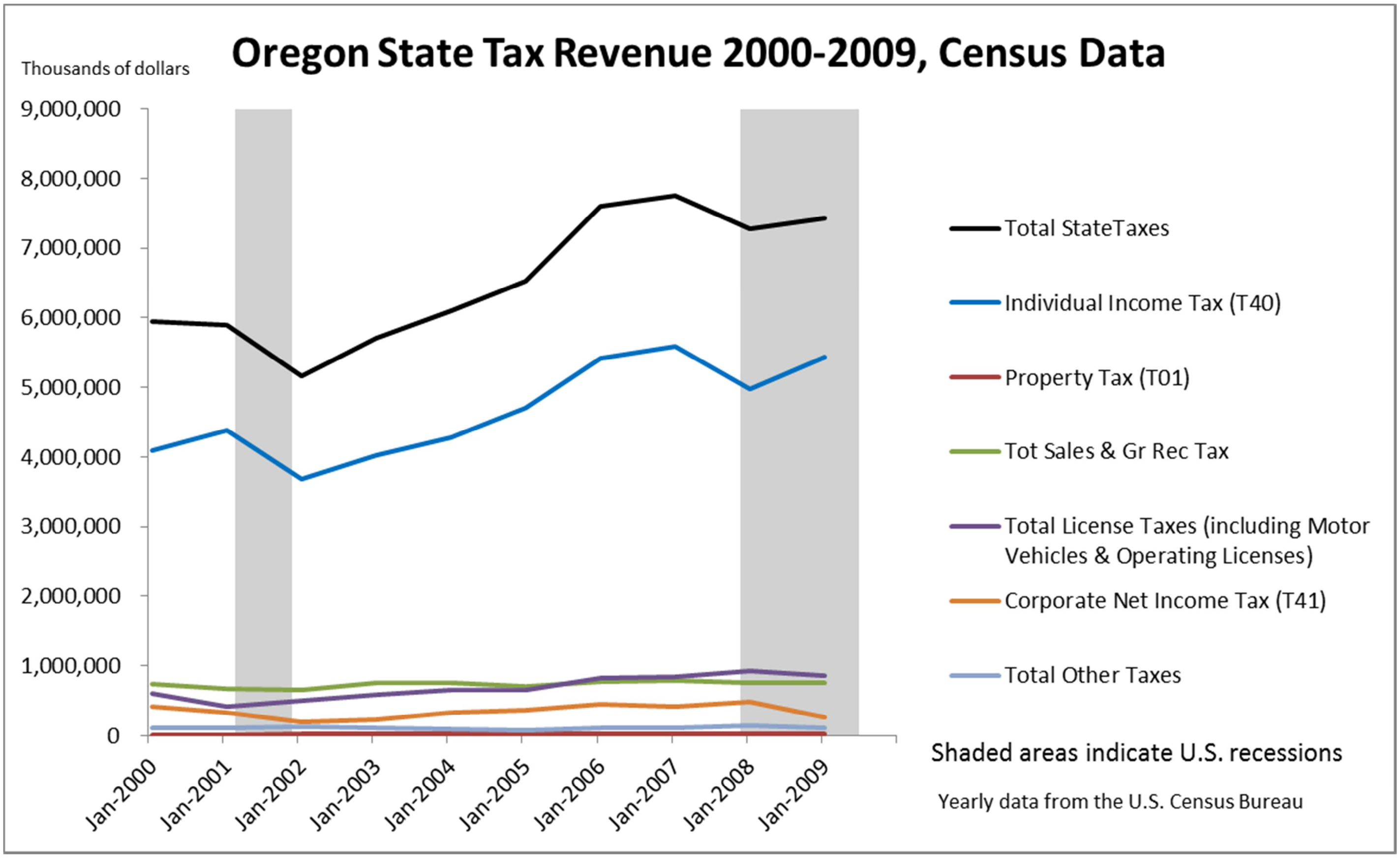
decomposition of wage and employment effects. We find that changes in employment, rather than changes in wages, explain most of the variation in the overall trend in income tax revenue.

III. Background

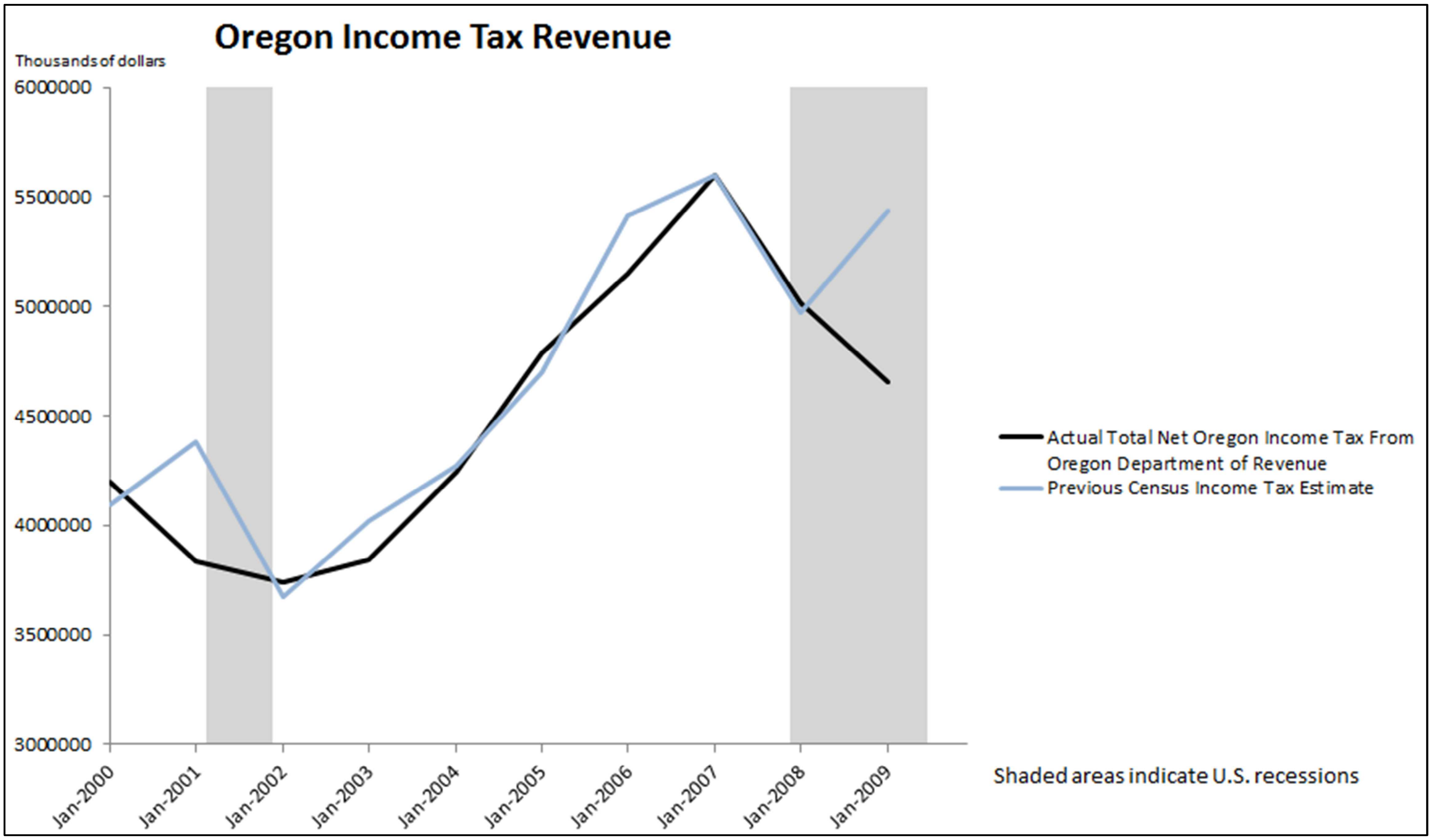
Tax revenue decreases during economic contractions because it depends on the level of economic activity. Lost profits decrease corporate taxes, lost jobs decrease income taxes, and lost consumption decreases sales taxes. The financial crisis of 2008 resulted in a severe contraction of economic activity. Consequently, state level tax revenue severely decreased for most states in the nation. The magnitude of the economic contraction theoretically determines the magnitude of the decrease in tax revenue. These macroeconomic relationships lead to the expectation that the decrease in Oregon state tax revenue resulting from the 2008 financial crisis should be significantly larger than the decrease in tax revenue from the 2001 recession.

We expect changes in income tax revenue to be affected primarily by employment and wage changes. In theory, wages change slowly in the short run and have not declined in recent US economic history. This implies that changes in employment, which can occur swiftly, explain most of the variation in the total income tax from wages. The types of jobs that are lost in each recession can also have an impact on total tax revenue; for example, losing many low paying jobs can be offset by the gain of a few high paying jobs.

Our client initially tasked us with two questions: why did Oregon's tax revenue appear to do better than expected in the recent recession and could this have been caused by higher earning individuals doing well enough to offset losses from lower earning individuals? In order to answer these we first had to confirm our client's initial assertion that tax revenue did not drop significantly. However, the Oregon Department of Revenue (ODR) had not yet released the official 2009 report; the only reliable source appeared to be the census data from the Bureau of Labor Statistics. From their data we developed this graph:

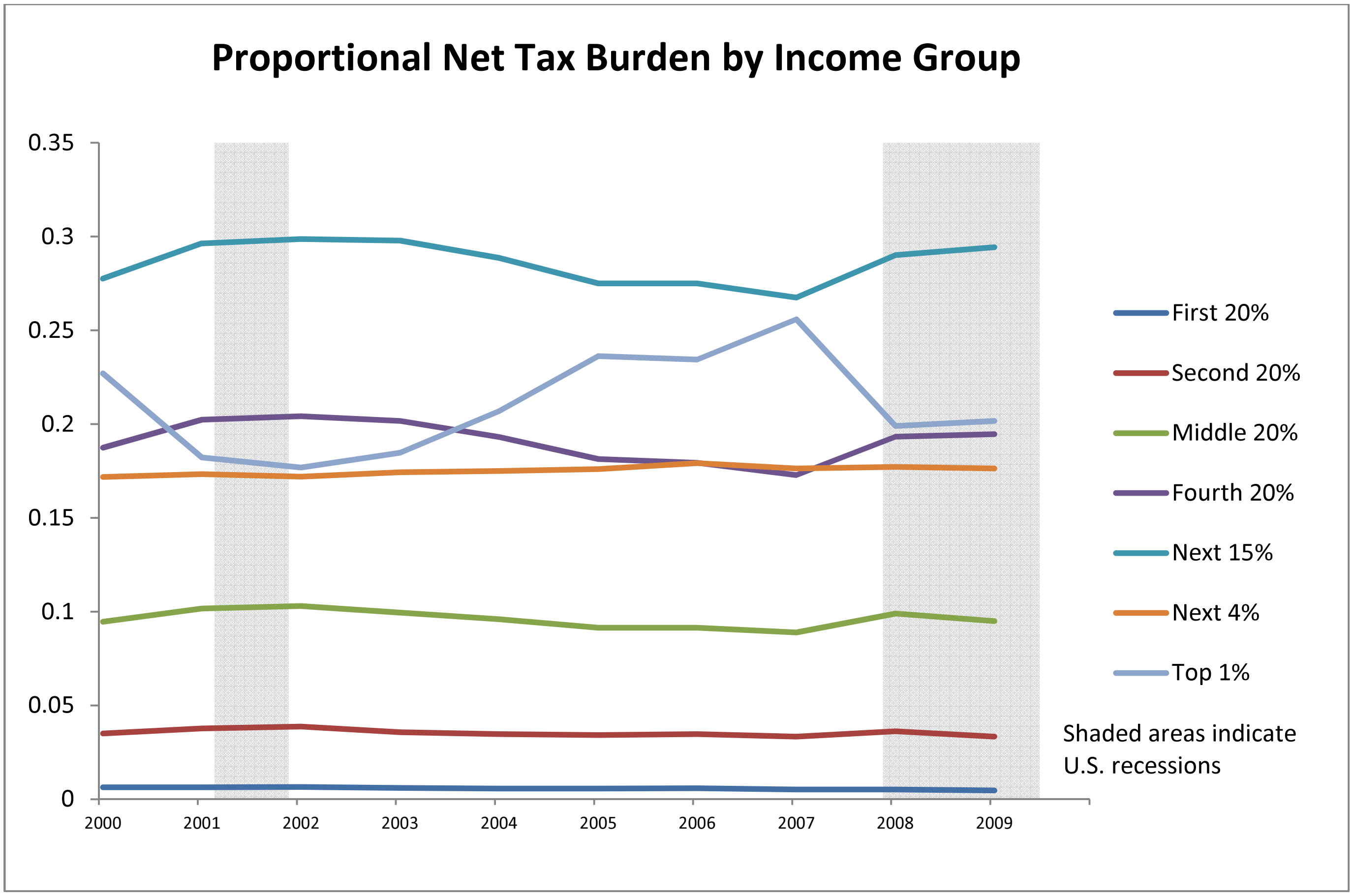


We ascertained two important facts from these data: total tax revenue appears much less severe in the most recent recession than in 2001 (even rising in 2009) and individual income tax contributes the lion's share of total tax revenue in Oregon. After confirming that tax revenue did indeed seem to be behaving erratically, we proceeded to determining whether a changing income distribution could have created this effect. However, the Oregon Department of Revenue eventually released its full 2009 report. A comparison of the ODR data to the census data is illustrated below:



Actual tax revenue was not behaving in the manner predicted by the census surveys! In fact, it appears that the census was substantially off for the past two recessions. This is most likely due to the small sample sizes conducted for the state of Oregon between decennial censuses. In light of this reporting anomaly, we turned from our focus on income distribution to instead consider the Oregon economy as a whole.

Our client's inquiry about the possibility of upper income brackets taking on a larger share of the tax burden is still relevant to understanding the context for wage and employment effects. Using data from the ODR, we plotted the proportion of tax burden for wage groups representing the first four quintiles of tax filers as well as the next 15, 4 and 1 percent; the gray shaded areas mark months of recession in the U.S:



The data shows a relatively steady share for every income group except the top 1% of tax payers. The burden of the top 1% decreases during the immediate period before the two recessions and increases during the period of growth in the middle of the decade. Movements in the other wage categories are largely caused by the shifts in the top 1%. This group accounts for the vast majority of capital gains, a very volatile component of taxable income. Most of the volatility in this group, thus, can be attributed to capital gains and losses. The stability in the proportion of net tax burden outside of capital gains reflects stability in the proportion of wage income. This indicates that the effect of income inequality is not significant. Wealthy tax payers are not doing better to offset job losses in the lower brackets; in fact, the wealthiest tax payers group experience large falls in net tax burden due to recessions.

IV. Objectives and Data Sources

Our primary objective is to investigate the relationship between employment, wage rates, and the Oregon state tax revenue by studying its largest component, income tax revenue. Due to the relative stability in wages, we believe the majority of variation is caused by employment changes rather than wage changes. We will manipulate data on the employment and wage levels of different industry sectors in Oregon to create a model of total taxable wage income; we will then apply an approximation of the Oregon tax bracket and deductions to model total wage income tax revenue. We can check the correlation between our estimates and the reported values from the ODR to determine whether our model is a good fit. If so, we can explore the characteristics of specific industry sectors over time to distinguish the effects of industry specific employment changes. Using algebraic decomposition, we can also isolate the effects of wage growth and employment changes to see which is more influential in determining income tax revenue.

The Oregon Department of Revenue provides detailed annual tax revenue statistics. This data contains the number of filers each year categorized by adjusted gross income (AGI) level and includes information on the sources of their income such as wages, pensions, and capital gains. The data includes gross and net tax burden but does not decompose the tax burden into its varied sources. While income for AGI includes categories such as capital gains, business income, and dividends, we will focus on the determination of salary income through employment and wage data.

Using the Bureau of Labor Statistics Occupational Employment Statistics database, we retrieve employment and wage data for the state of Oregon for the years 2000 to 2009. The data contains levels of employment for occupations categorized by major economic sectors. They also contain measures of mean annual wage rates for each occupation and each major sector. A breakdown of the 10th, 25th, 75th, and 90th percentile wages is also available.

It is also important to study Oregon's tax laws and history to account for any possible changes in tax structure. The main source of tax revenue comes from personal income taxes, supplemented by corporate income taxes, property taxes, tobacco and alcohol taxes, licensing fees and other taxes. Since 1985, the income tax is based on a federal measure of adjusted gross income (AGI); this includes business income, capital gains, dividends, and other sources (ODR 2009). Also, since tax year 1987, the personal exemption credit has been indexed for inflation. The specific burden of income tax is currently divided by five brackets; the income levels for a single filer are:

First $3,050 is taxed at 5%

Next $4,550 is taxed at 7%

Next $117,400 is taxed at 9%

Next $125,000 is taxed at 10.8%

Over $250,000 is taxed at 11%

The income levels for a joint filing are doubled. The two highest brackets were introduced for the first time in 2009 and so should only affect the analysis of the 2009 tax returns.

V. Methodology and Findings

Modeling Income Tax Revenue via Occupational Wage and Employment Data

Income tax revenue, employment, and wages are of central concern to this project. Therefore, it is desirable to model the dynamics between these variables in order to characterize and analyze their interactions. The Oregon Department of Revenue publishes income tax revenue figures; however, these do not contain direct measures of employment. The United States Department of Labor's "Occupational Employment Statistics" offers information regarding occupational employment and wages, but does not address income tax revenue. Although the interaction between employment, wages, and income tax revenue was not measured by either data set, each data set contained the information that the other was lacking. In order to observe some of the interaction between employment, wages, and income tax as well as consider how changes in one variable impact the others, we attempted to build a model that estimates income tax revenue from the employment and wage data.

Before delving into the mechanics of the model, certain aspects that impact its accuracy and functionality must be considered. The employment and wage data do not encompass the employment and wages situation in its entirety. For example, certain occupations may have complete data regarding the number of workers, average wages, etc. for a given year while this data is not available in other years. Also, some occupations' data may be listed within larger, more generalized occupational categories in certain years. However, on the whole the data still capture a general snapshot of employment levels and wage earnings for the Oregon economy from year to year. It was our hope that discrepancies in the recording of particular occupations during certain years would balance each other out over the decade of information in terms of the bigger picture involving trends in the data.

Additionally, as will be seen in its description below, the model itself is simplistic. It does not account for every factor that generates tax liabilities and revenue. For this reason, the tax figures generated by the model and categorical changes it measures are not meant to be interpreted as having numerical precision but rather as capturing general trends and interactions. Specifically, the model considers occupational employment and income and tries to predict the tax liability/revenue from the total wages. Despite its shortcomings, the model does divide occupations into general income categories and generates associated wage tax revenue depending on these categories, their employment levels, and differences in tax codes from year to year.

The model was designed as follows. For every year in the data (2001-2009), each occupation in the Department of Labor's "Occupational Employment Statistics" was grouped into one of five categories based on the average annual wages of that occupation. Note that a certain occupation could be in different wage categories during different years if its average wages changed from year to year. The five categories were \$0-24,999, \$25,000-49,000, \$50,000-74,999, \$75,000-99,999, and \$100,000-plus average annual wage occupations (these may be referred to generically as "category" or "categories" rather than average wage categories from here on). Once the occupations that made up each wage category for each year were grouped together, the number of employees for each occupation in that category for each year was recorded. Therefore, although roughly accurate, the employment for each average wage category necessarily included individuals who earned wages that were outside of their average wage category. For example, in 2008, veterinarians had an average annual wage income of \$76,130. The occupation "veterinarians" was therefore placed in the \$75,000-99,999 average wage category and the total number of people employed as veterinarians was added to the employment of the \$75,000-99,999 category even though there were likely individuals working as veterinarians that earned incomes outside of this range.

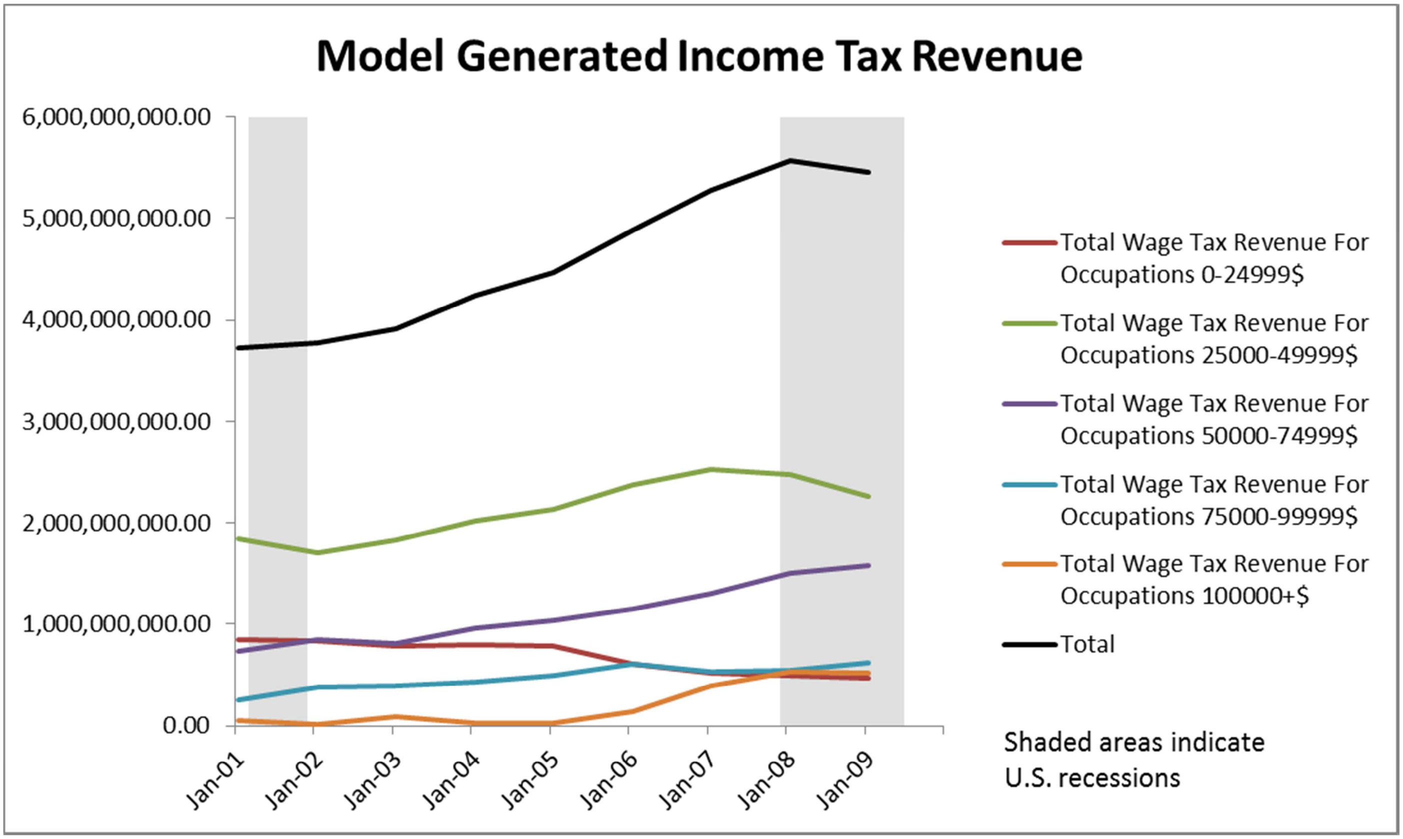
From here, the model calculates each average annual wage category's contribution to income tax from wages for each year in the following way. First, a weighted average annual wage for each average wage category is calculated. This roughly translates to the income of the average individual in each such category. Then, based on the tax codes for each year, a tax liability for the weighted average annual wage income is determined. This roughly translates to the tax liability of the average individual in each annual average wage category. This average tax liability is then multiplied by the total employment in each annual average wage category for each year. This translates to the wage tax liability or tax revenue from wages from that annual average wage category. To get the total tax revenue for each year, the wage tax liabilities of the five annual average wage categories are added together. The "weighted average annual wage" for each category is calculated as:

$$\frac{\sum[(total\ employment\ per\ occupation\ in\ category)(mean\ wage\ per\ occupation\ in\ category)]}{(total\ employment\ of\ category)}$$

In summary, there are 5 average wage categories: \$0-24,999, \$25,000-49,000, \$50,000-74,999, \$75,000-99,999, and \$100,000 plus. For each category a weighted average wage is calculated. From this weighted average wage an average tax liability is determined based on the tax codes and related tax information. This average tax liability is then multiplied by the number of people in each category to determine the total tax liability of the individuals in this category. The sum of the tax liabilities from each wage category represents the tax revenue collected by Oregon. This is done for each year from 2001 through 2009. As an example, the years 2008-2009 are shown below.

Average Annual Wage Categories:	**$0-2499**	**$25000-49999**	**$50000-74999**	**$75000-99999**	**$100000+**	
	Total Wages Paid In Category	**=Sum of [(Total Employment*Mean Wage) by Occupation]**				
2008	6929737100	31445300000	18028205500	6366794600	6188092100	
2009	6528444900	28996975500	18923715700	7329551700	6062471800	
	Total Employment					
2008	321740	925470	298550	74470	51610	
2009	296470	857240	316150	85010	50670	
	"Weighted Average" Annual Wage Income	**=Total Wages Paid In Category/Total Employment**				
2008	21538.31386	33977.6546	60385.88344	85494.75762	119901.0289	
2009	22020.59197	33825.97114	59856.76325	86219.87649	119646.1772	
	Category Indivual Average Tax Liability	**=Each Year's Tax Codes Applied to Weighted Average Annual Wage Income**				
2008	1552.388247	2671.928914	5048.669509	7308.468186	10405.0326	
2009	1577.963277	2640.447403	4983.218692	7355.898884	10364.26595	
	Total Wage Tax Revenue	**=Category Individual Average Tax Liability * Total Employment**				**Total=Sum of Wage Tax Revenues**
2008	499465394.6	2472790052	1507280282	544261625.8	537003732.4	5560801087
2009	467818772.7	2263497131	1575444590	625324964.1	525157355.7	5457242813

Because the model considers only occupational employment and wage data, its estimate is more accurately described as an estimate of income tax revenue *from wage income* (loosely speaking; we are referring to income reported to the U.S. Department of Labor regarding various occupations including pay factors such as wages and salary). Additionally, the data from which the model generates its figures is probably most hazy regarding occupational and wage data for top earners. Aside from missing figures for some top earning occupations, these individuals also had a smaller portion of their income come from wages and salaries. This is because they are more likely to have income that is not tied to a specific occupation; for example, they may have a greater portion of their earnings generated by capital gains. The highest earning individuals are therefore underrepresented by the model. However, the data, and therefore the model, does include wage income for many high earning occupations and still captures most of the overal fluctuations in occupational employment and wages that impact tax revenue from wage income. For the years 2001 through 2009, the model generates the following tax revenue figures from the occupational employment and wage data:



<u>Employment Effects vs. Wage Effects</u>

Because we are concerned with characterizing aspects of the Oregon economy related to income tax revenue, employment, and wages, it will be useful to see what the model just described can indicate about their interaction. Specifically, we would like to see the impact of employment and wage changes on income tax revenue (from wage earnings), each in seclusion. We want to know how our model suggests employment changes would have impacted income tax revenue over the past decade if other variables in the model, wages, were held constant. We also want to see how wage changes impacted income tax revenue while holding employment constant. Once this is accomplished, we hope to have a general idea of the proportional role that changes in each variable played in impacting income tax revenue.

In order to consider the impact of employment on income tax revenue, wages had to be held constant within the model. Our model calculates the yearly income tax of each average wage category by applying Oregon tax rules to the weighted average individual's income in each category. This yields an income tax liability for the average individual in each category. This is then multiplied by employment in that category for each year to generate the total tax revenue/liability for each category each year. To hold wages constant and see what the model generates for income tax revenue when the only variation comes from employment, we simply held the weighted average income of each income category constant throughout the nine years considered. The weighted average income for each category in 2001 was thus reentered for each of the subsequent years so that each income category's average individual income did not change from 2001 through 2009. The model then calculated each categories yearly income tax liability from the same income number and multiplied this by employment, which was allowed to change with actual employment changes, to generate each categories income tax liability for each year.

Holding employment constant to allow the model to generate income tax revenue when only wages are allowed to vary is trickier with our model. We cannot hold the employment number for each year constant because the weighted average wage of each wage category from which average income tax liability is calculated is produced in such a way that prevents this. As note previously, the weighted average income of each wage category for each year is calculated as:

$$\frac{\sum[(total\ employment\ per\ occupation)(mean\ wage\ per\ occupation)]}{(total\ employment\ of\ category)}$$

This is, in effect, total wages paid to individuals in each category divided by the total employment of each category. Therefore, if the total employment of each category alone is held constant, this weighted average wage becomes distorted because the total wages of each occupation vary with employment. Therefore, simply holding the employment of each wage category constant would mean that when employment for a given year was higher than the constant base number used in the model,

$$\sum[(total\ employment\ per\ occupation)(mean\ wage\ per\ occupation)]$$

, is still pushed upward by employment yet is divided by a smaller employment figure; thus the weighted average wage would be overstated. Similarly, if employment were to drop below the constant base year number, weighted average wage would be understated if the employment figure in the model alone were held constant.

In order to prevent this distortion and be able to hold employment constant at the base year (2001) level an adjustment to the weighted average wage was necessary. This adjustment was done in the following way. For each average wage category for each year, an alternative figure for Total Wages was calculated on a separate space on the spread sheet. This alternative number was:

$$That\ Year's\ Total\ Wage\ Figure -$$
$$[(That\ Year's\ employment) - (Base\ Year's\ Employment)] \times That\ Year's\ Weighted\ Avg.Wage$$

Where, again, that year's total wage figure is calculated as:

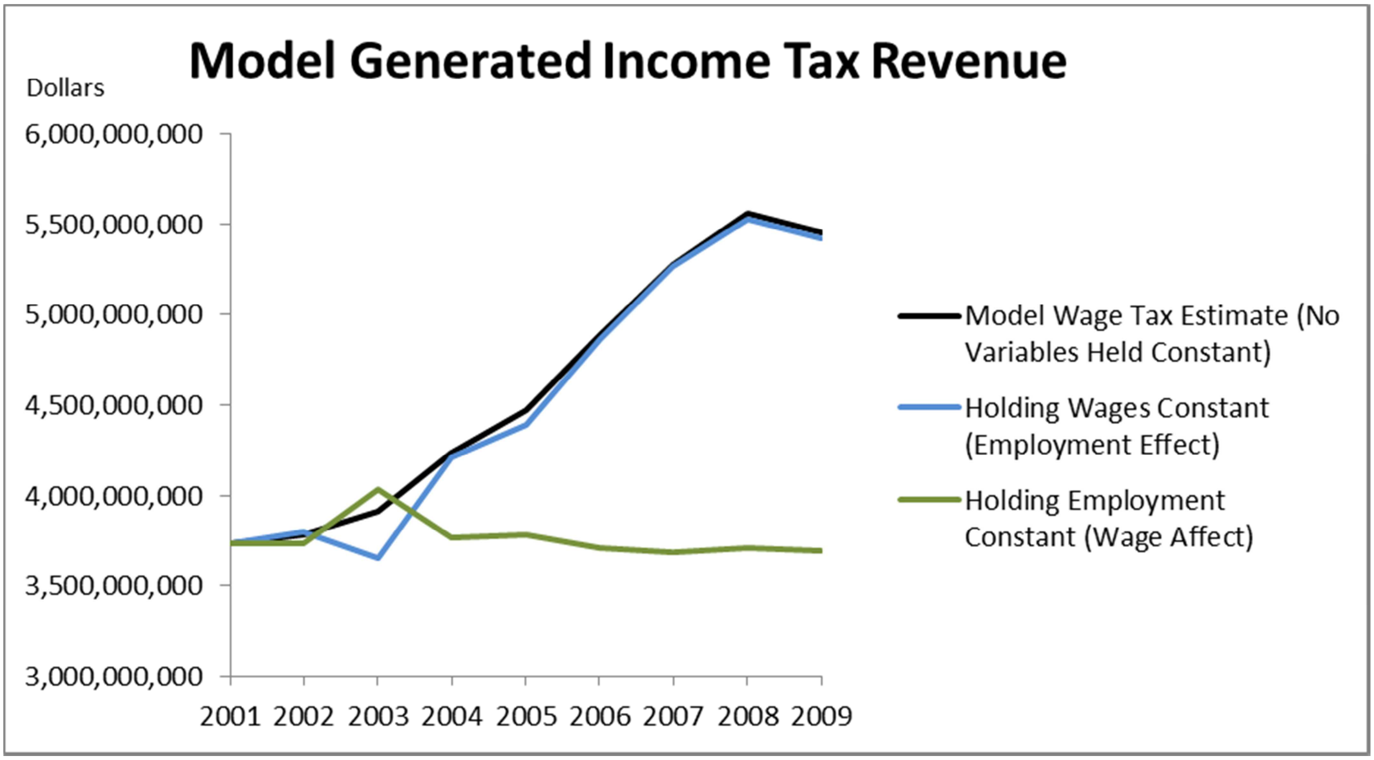
$$\sum[(total\ employment\ per\ occupation\ in\ category)(\ mean\ wage\ per\ occupation\ in\ category)]$$

And that year's weighted average wage is calculated as:

$$\frac{\sum[(total\ employment\ per\ occupation)(mean\ wage\ per\ occupation)]}{(total\ employment\ of\ category)}$$

The effect of this adjustment is to subtract the increase in total wages for each category each year that were caused by increases in employment. From here these new figures replace the original total wage figures and employment is held constant at the 2001 year level for each average income category each year.

We can now consider the roles that the model suggests changes in employment and changes in wages play in determining income tax revenue. Below is a graph that displays the total income tax revenue that the model generates when wages are held constant, when employment is held constant, and when neither is restricted (the original income tax revenue total).



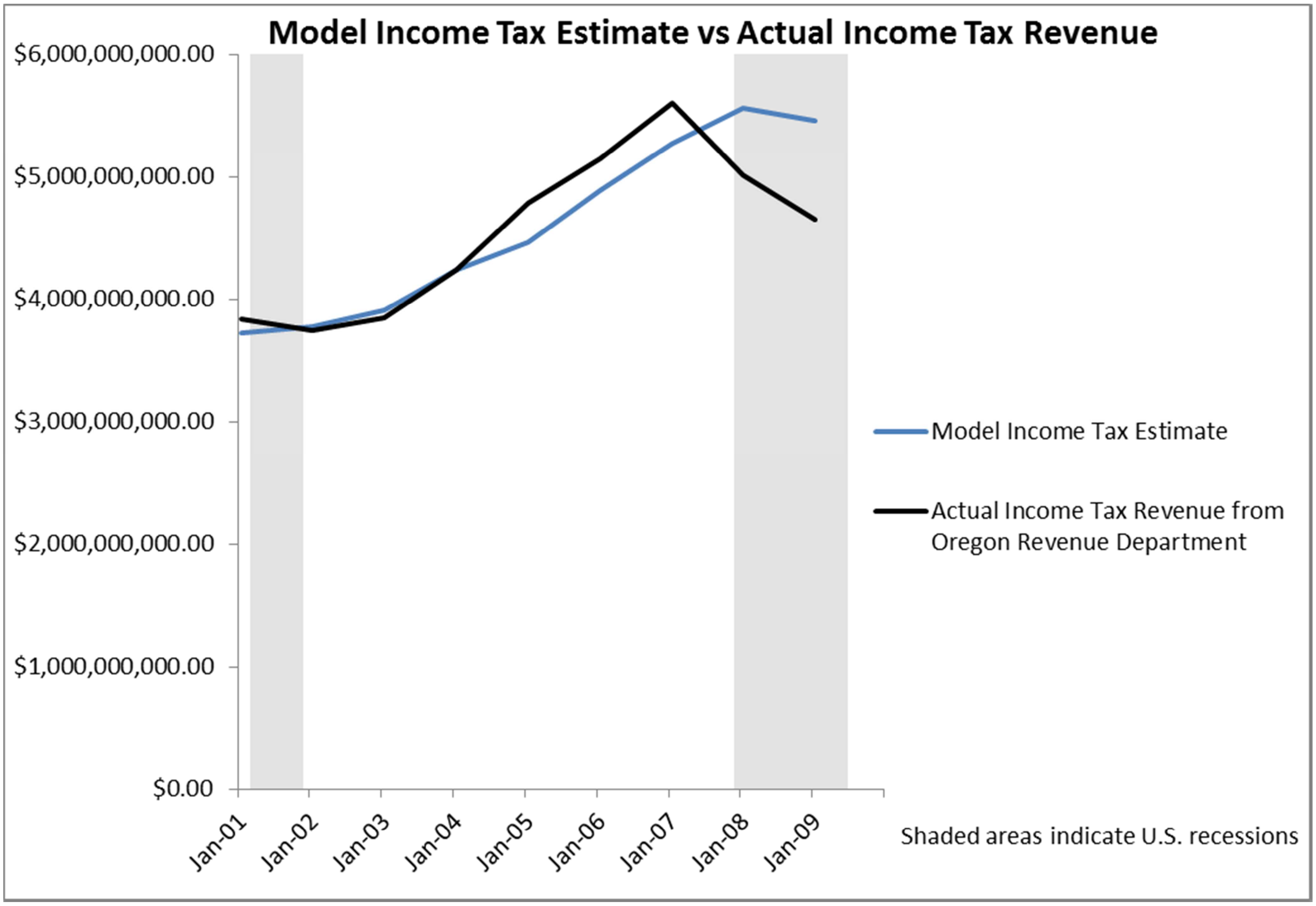
The model suggests that changes in employment have driven changes in income tax revenue from wage earnings to a much greater extent than changes in wage levels in Oregon over the past decade.

Pertinence to Total Oregon Income Tax Revenue and Model Viability

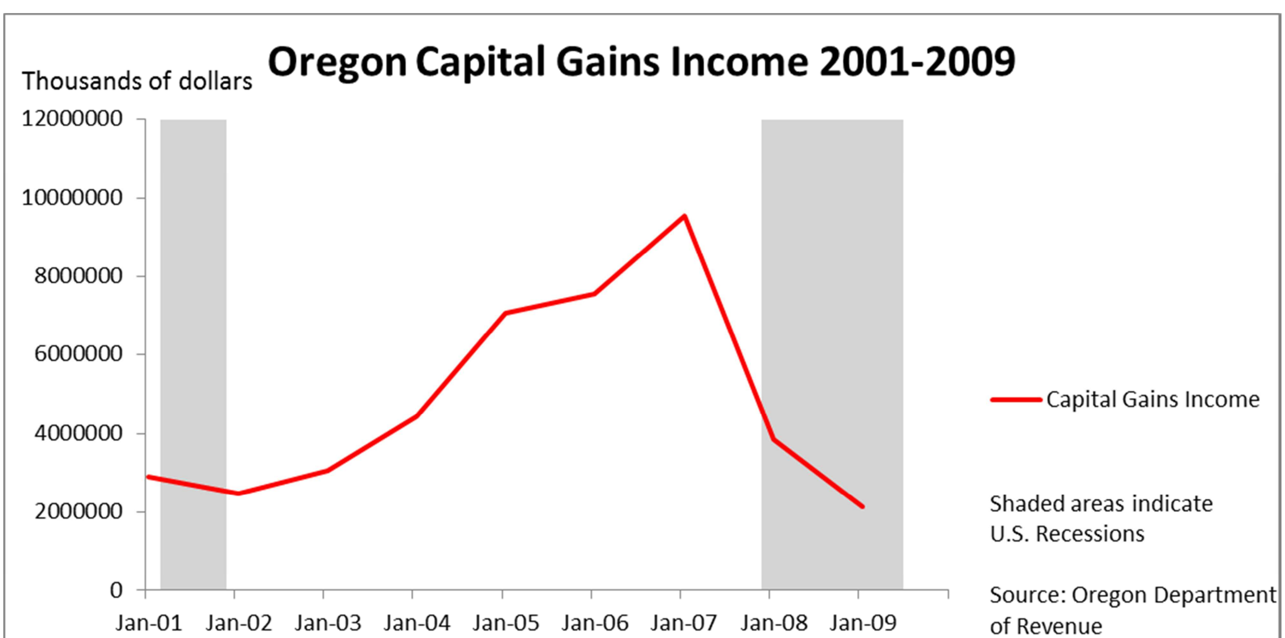
As noted above, the model is intended to capture general interactions and trends between employment, occupational income, and tax revenue. The income tax revenue figure it generates measures tax revenue from occupational income (wages, salaries, etc.); it does not account for tax revenue stemming from other sources of taxable income such as capital gains, retirement income, or dividends and interest income. Additionally, the model indicates that changes in the tax revenue figure it generates are motivated mostly by employment shifts rather than wage shifts. In this section we will consider the viability of this observation and the pertinence of the model's observations to the relationship between *overall* income tax revenue, employment, and wages.

Although the model only considers income tax revenue from income earned in occupational work (i.e. wages and salaries), over the past decade this type of income has accounted for, on average, 68.6 percent of adjusted gross income in Oregon. (Oregon Department of Revenue Personal Income Tax Statistics) Therefore the model is useful for considering changes within a large component of Oregon income tax revenue. The Oregon Revenue Department notes that most of the variation in total income tax revenue stems from changes in capital gains income. (Oregon Personal Income Tax Statistics 2007-2009 yearly reports) Although capital gains income is likely strongly affected by factors that impact employment, it is not directly motivated by the employment level or wage levels.

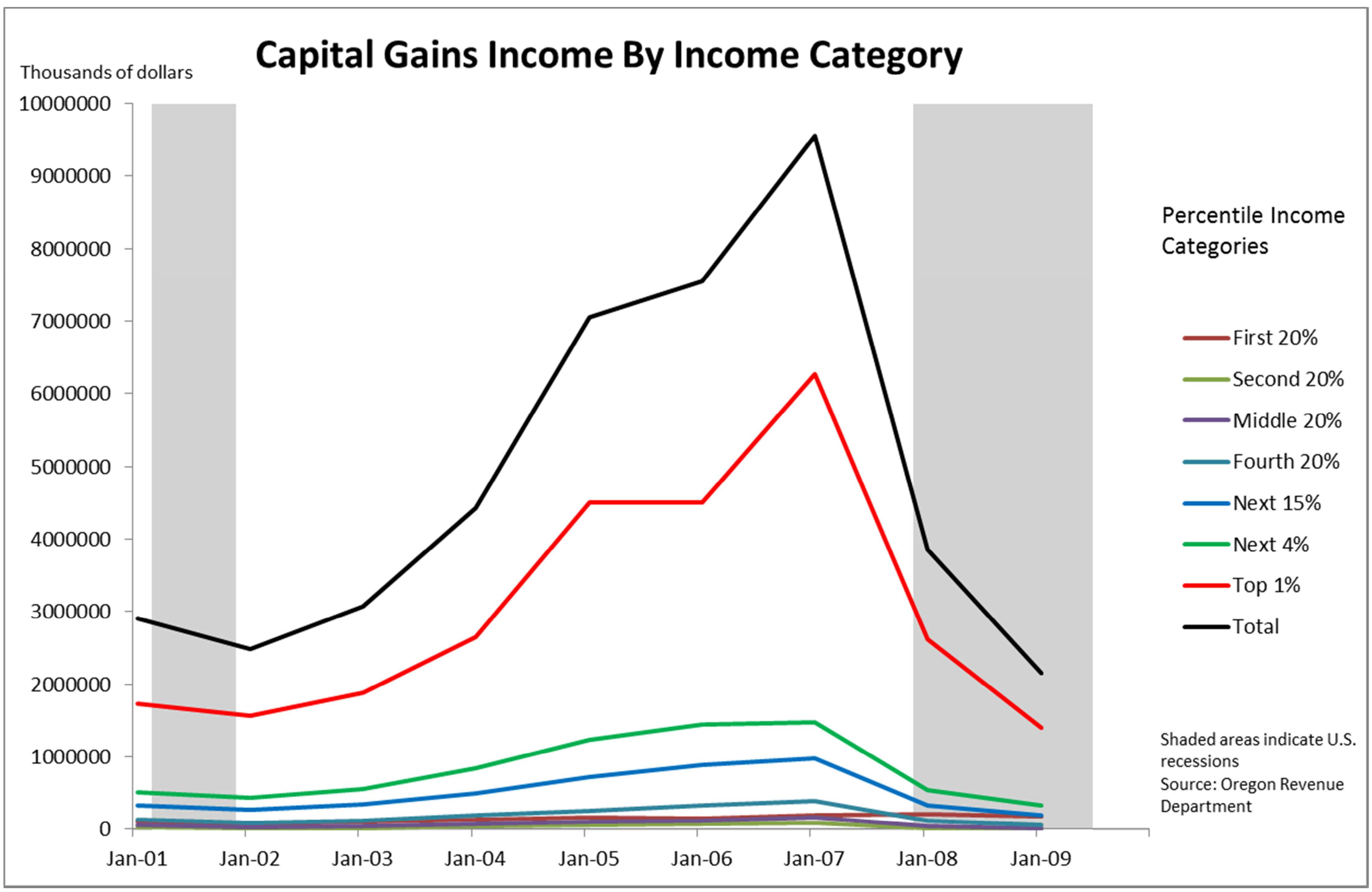
Therefore the relationship between employment, wages, and income tax revenue in Oregon appears to be as follows. Occupational income makes up the largest component of overall taxable income. Our model indicates that changes in occupational income over the past decade were motivated most by employment changes rather than wage changes. At the same time, a smaller component of total taxable income, capital gains income, is most volatile, responsible for some of the most visible deviations in income tax revenue, and is not directly motivated by employment or wage levels. Consequently, Oregon income tax revenue's base/majority component is occupational income, which is motivated most by employment shifts, while capital gains income, because of its greater volatility, is responsible for some of the greater fluctuations in Oregon income tax revenue. The following graph presents the income tax revenue figures generated by our model as well as the actual total income tax revenue for Oregon.



The model's income tax figure, as noted previously, is meant to measure the general movement (rather than precise numerical values) of income tax revenue motivated by employment and wage factors from year to year. The shape of the line of the model's estimates likely deviates from that of actual total income tax revenue due to the volatility of capital gains which is not considered by the model. The following figure illustrates this by singling out the movement of capital gains income (pre-tax) during the same time span.



This project started under the pretense that Oregon tax revenue had not fallen as much as expected given the rise in unemployment. The client proposed the idea that higher income individuals could possibly have offset some of the tax revenue effects of lost jobs if their contribution to tax revenue managed to offset losses from lower income individuals. Although later data releases revealed that this original anomaly had, alas, not occurred, the capital gains income data do illustrate an area of taxable income where high earning individuals vary from others in their tax liability and is subject to greater change during a recession. Higher earning individuals, the top 1% in particular, earn less of their income from occupational wages or salaries and earn a greater amount of their income from capital gains. As noted previously, during the past decade capital gains income has been the most volatile contributor to taxable income in Oregon. Higher earning individuals earn the greatest portion of capital gains income and their earnings from capital gains around periods of recession have in fact "suffered" most. During recessions, then, it appears that the highest earning individuals swung income tax revenue downwards through lost capital gains income and its volatile impacts on total income tax revenue. The graph below shows the capital gains income of the past decade broken down into categories of individuals by income group.



This project considers the characteristics of Oregon's income tax revenue, employment, and wages situation over much of the past decade. Data covering all these variables simultaneously is only available from 2001-2009. Additionally, the type of data available has yearly frequencies, meaning that there are nine observations from which to draw conclusions. This has restricted our ability to try to characterize the behavior of and the relationships between these variables from a more statistically based approach, hence the algebraically crafted model described above. However, we may still be able to be critical of our model from a statistical standpoint.

Considering regression equations where the yearly actual income tax revenue is the dependent variable, we may be able to conclude that the employment and wage generated income tax revenue figure from our model is a valuable explanatory variable. It must be noted that we are dealing with, again, only nine observations. Therefore the statistical findings from the following regressions are likely unstable.

Occupational income makes up the majority of taxable income while capital gains income plays a notable role in determining variation in taxable income and hence income tax revenue. Therefore we set up the following test of the viability of our model in terms of accurately describing changes in income tax revenue generated by occupational income.

We set the dependent variable to be actual income tax revenue as reported by the Oregon Revenue Department. We then ran several regressions with various explanatory variables, one of which was the occupational income tax revenue from our model. Another considered explanatory variable of note was capital gains income in Oregon (pre-tax) to account for the volatility of capital gains income in total income tax revenue. We then compared the various models generated through the regressions by their statistical properties. To do this comparison, we utilized the Schwartz Criterion (SIC) and the Akaike Info Criterion (AIC). These are statistical measures that allow the comparison of the goodness of fit of different regression models. Specifically, they reward goodness of fit and penalize for including greater numbers of explanatory variables (using more degrees of freedom). Selecting the "best" model using these statistics entails selecting the model with the lowest AIC or SIC statistic depending on which criterion is settled upon (if they do not make the same selection).

In running the following regressions, we worked with the first differences of the considered variables. This is the change in the variables from previous year. Additionally, the potential explanatory variable "covered employment" was converted to annual frequency via annual averaging. The lowest SIC and AIC statistics are highlighted in yellow. Highlighted in green are the explanatory variables of the model selected as best by the AIC and SIC statistics. As seen below, the model selected by the AIC and SIC statistics includes our model's income tax revenue figure as an explanatory variable. Therefore, we may be able conclude that the employment and wage generated income tax revenue figure from our model is a valuable explanatory variable.

Regression variables:

1st difference(Actual Oregon income tax revenue) [dependent variable]

1st difference(Capital Gains Income) =GGI [potential explanatory variable]

1st difference(Our model's income tax revenue figure) =MIT [potential explanatory variable]

1st difference(Oregon "covered employment") = CE [potential explanatory variable]

1st difference(Number of tax returns) =TR [potential explanatory variable]

C=constant [potential explanatory variable]

Explanatory Variables Included In Regression	**R^2**	**SIC Statistic**	**AIC Statistic**	**Durbin-Watson Statistic**
CGI C	**0.880145**	**26.96417**	**26.94431**	**1.514998**
CGI MIT C	**0.990601**	**24.67844**	**24.64865**	**1.880601**
MIC C	**0.306391**	**28.71979**	**28.69993**	**1.911865**
CGI TR C	**0.970171**	**25.83328**	**25.80349**	**1.991958**
CGI CE C	**0.936749**	**26.58492**	**26.55513**	**2.026160**
MIT TR C	**0.878555**	**27.23727**	**27.20748**	**1.081788**
CE TR	**0.926323**	**26.47757**	**26.45771**	**2.241396**
CGI CE TR	**0.968213**	**25.89686**	**25.86707**	**1.981367**

Distributional Employment Changes (1999-2009)

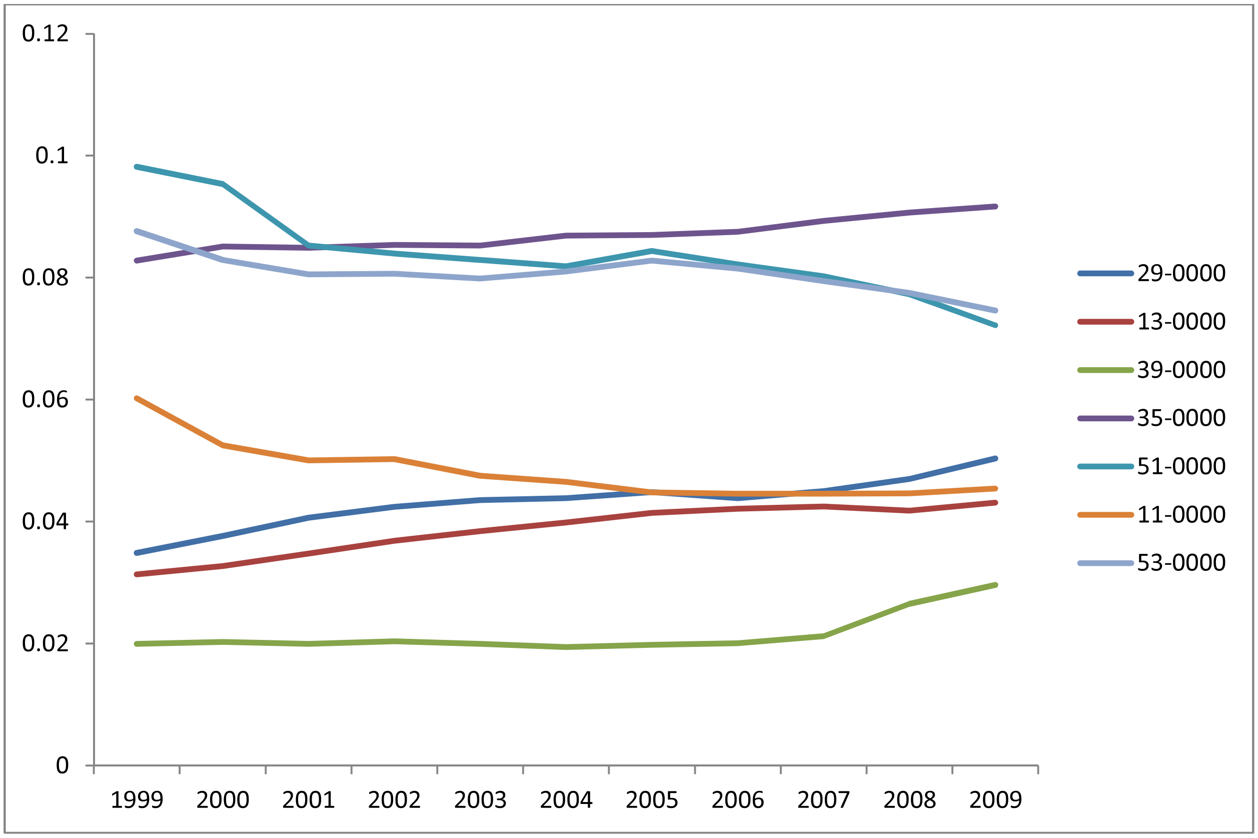
Employment has been demonstrated as the base determinant of income tax revenue. In order to further characterize Oregon's economy in relation to our findings, we now consider the distributional employment changes of the past decade. The following analysis utilizes the data used to derive our occupational income tax revenue model. This means that the findings in this section are best interpreted as capturing general trends and movements.

These data are organized according to 22 major sectors of the economy. These sectors are characterized by broad occupational titles, such as legal or computer science occupations. We have the total employment numbers for each major sector every year from 1999-2009. First, we organized these data by the proportion of the total economy each sector accounts for, each year. Then, we subtracted the proportion of 2009 from that of 1999 to find the change in proportional employment for that sector. We selected the sectors which have experienced the greatest total proportional change over the time period and examined them more closely.

Top Positive Growth:	Full Name	Proportional Change * 100
29-0000	Healthcare practitioner and technical occupations	1.546
13-0000	Business and financial operations occupations	1.179
39-0000	Personal care and service occupations	0.962
35-0000	Food preparation and serving related occupations	0.884

Top Negative Growth:	Full Name	Proportional Change * 100
51-0000	Production occupations	-2.599
11-0000	Management occupations	-1.483
53-0000	Transportation and material moving occupations	-1.302

As you can see, healthcare, business/financial jobs, and personal/food services grew the most over the time period, whereas production, management, and transportation occupations contracted the most. It is important to note that these changes are the total changes over the period, and each sector experienced different growth at different times.



That these sectors were the ones to undergo the most change should not surprise anyone – it could be considered common knowledge that manufacturing related jobs have been on the decline nationally, and that healthcare and services are on the rise. However, it may come as a surprise that management steadily declined while business and financial operations rose.

Perhaps the most interesting curve here is personal care and service occupations. After maintaining a steady proportion of the overall economy, it shot up in 2008 and continued to grow in 2009. Unfortunately, our data set did not reveal any real insights – the vast majority of the 2008 growth was filed under the generic "all other" workers section. And, for 2009, the sector appears to have only grown slightly; the proportion went up because it retained its jobs compared to the economy as a whole.
We then chose to examine healthcare practitioner and technical occupations and production occupations more closely. These two fields experienced the greatest change over the period and we wished to know the outcomes of specific jobs within the major sector.

Healthcare is undoubtedly dominated by registered nurses. In 2009 they accounted for over 30,000 jobs out of 82,000 total healthcare occupations. However, their share of the total has declined from 41% in 1999 to 38% in 2009, alongside a proportional decline for licensed vocational nurses. This may be due to improved specificity in job titles through the years; in 1999 healthcare was separated into 31 jobs compared to 50 in 2009. The 1999 jobs showed near unilateral nominal growth after a decade, with general and family practitioners as a notable outlier. Yet most occupations have shown negative or near-zero proportional growth due to the growth of job titles not accounted for in 1999. The largest of these are: an "other" category for physicians and surgeons, an "other" category for health technicians, general dentists, and occupational health and safety specialists. Most of these missing titles in 1999 are accounted for by 2001, and show no significant proportional differences compared to healthcare as a whole in 2009.

Production jobs were compared between years 2000 and 2009 because 1999 simply did not have enough comparable job titles to perform a reasonable analysis. Unlike healthcare and registered nurses, production jobs do not have a single category that dominates all the others proportionally. In fact, most jobs maintained their proportion of the total production economy for the entire period, with a few exceptions (electronic equipment assemblers, team assemblers, and packaging and filling machine operators). The only job title to show significant gains in the period were electronic equipment assemblers, growing from 1170 jobs in 2000 to 8320 in 2009. In terms of the sharp decline in production jobs from 2000-2001, almost every job lost equally except for the semiconductor processors. Semiconductor processors dropped from 8700 in 2000 to 4200 in 2001, and continued to decline to 2570 in 2007, with no data afterwards. Significant job titles present in 2009 and not in 2000 include: "other" production workers, "other" assemblers and fabricators, and "other" metal and plastic workers. Unfortunately, not much information can be gleaned from the growth of these non-specific categories. While production jobs appear volatile in the graph near recession years, the overall trend seems clear – most every job title took losses throughout the sector and the gains in general working categories were not nearly enough to offset the net loss.

VI. Conclusion

Examining Oregon income tax revenue from 2001 to 2009 provided insight about total tax revenue because income tax is responsible for the majority of overall revenue; furthermore, total revenue and income tax revenue historically follow the same trend. Taxable income can be described by two components: occupational income, which is the largest, and capital gains income, which is the most volatile. We found that during recessions and expansions, the highest earning individuals account for a large proportion of variation in income tax revenue because of fluctuations in capital gains income. To explore the variation in income tax revenue caused by the occupational income component, we created a model.

We modeled occupational income tax revenue by applying tax rates to estimates of occupational income computed from employment and wage data. A theoretical and statistical analysis gave us confidence to characterize the wage and employment dynamics in Oregon income tax revenue from our model. When we decomposed the effects of wage changes from employment changes in our estimates of occupational income tax revenue, we found that employment changes accounted for almost the entire overall trend. Thus, we concluded that changes in employment and changes in capital gains drive the majority of the variation in total tax revenue; changes in the wage rate have little effect. The industry sectors which experienced the largest percentage increases in employment were healthcare, finance, and personal care; sectors which experienced the largest decreases in employment were production, management, and transportation.

Looking forward, we believe that analysis of subjects related to ours could be valuable. Capital gains is a very volatile component of state tax revenue in Oregon. Research considering the implications of different capital gains state tax policies, potentially through cross state analysis, could yield insight regarding state tax revenue volatility in connection with the business cycle. Additionally, the inclusion of other sources of tax revenue such as property taxes, license fees, and corporate taxes in a model similar to ours would provide a more realistic and accurate model. A model with all sources of tax revenue could also provide greater insight into the relationships between specific sources of tax revenue.