

# **Oregon Personal Income Tax Revenue Model**

## **Review of Methodology**

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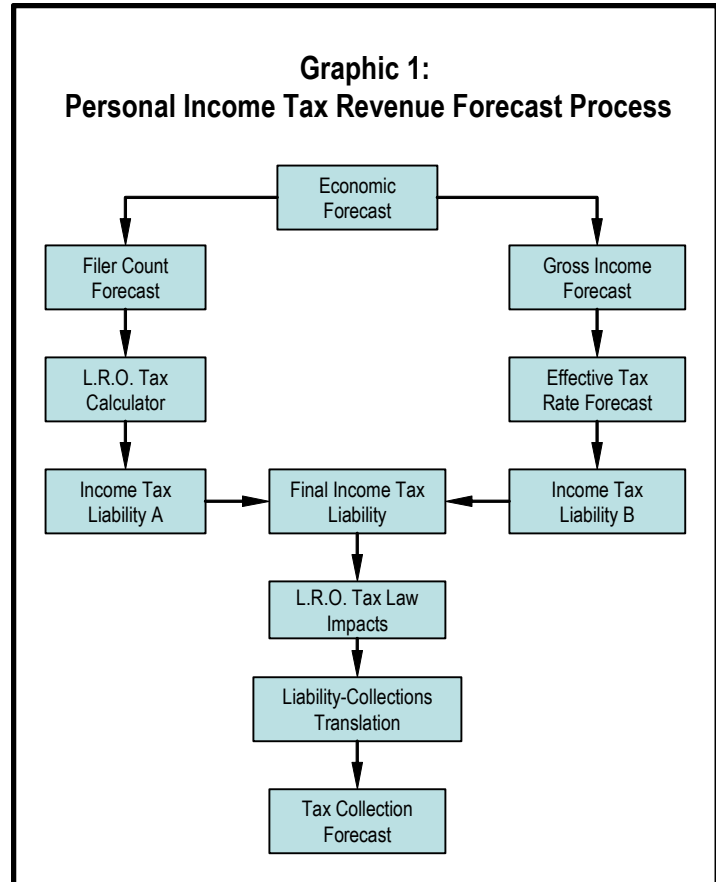
## I. Introduction and Summary

This paper presents the methodology used by the Office of Economic Analysis (OEA) to model and forecast personal income tax revenues as part of the quarterly General Fund revenue forecast process. Personal income tax revenues account for approximately 87 percent of all General Fund revenues and receive a commensurate amount of attention in the forecast process, as depicted in this methodology review.

Inputs to the Personal Income Tax forecast are the product of the quarterly Oregon economic forecast. This forecast is documented in the OEA report entitled *The Oregon Economic Model: Biennial Review of Methodology*.

The personal income tax revenue model consists of three distinct components: the filer distribution model, the gross income and liability model, and the liability-collections translation model. Graphic 1 details the steps involved in developing the personal income tax revenue forecast.

The following sections present the individual components in detail.



## Section II. Filer Distribution Model

The Filer Distribution Model (FDM) characterizes the number of Oregon Full-year Resident Tax filers by filing status (“Single” = Single and Married Filing Separately, “Joint” = Married Filing Jointly and Head of Household) and gross income level (24 distinct income brackets ranging from “< \$0” to “> \$1 million”). (see additional discussion in Section III). These projections are used in concert with the results of the Gross Income-Liability Model (GILM) to produce the final tax liability forecast, and ultimately the Personal Income Tax revenue forecast.

A “top down” approach is used to estimate the number of filers by income level. The following equations are used to model and project total Single and Joint filers:

$$\text{LOG}(\text{SF}_{\text{total}}) = 7.5 + 1.03 \cdot \text{LOG}(\text{EMP}_{\text{retail}}) + [\text{AR}(1)=0.65]$$

$$\text{LOG}(\text{JF}_{\text{total}}) = 11.3 + 8.6 \cdot \text{WAGE}_{\text{private}} + 0.27 \cdot \text{LOG}(\text{EMP}_{\text{total}}) + [\text{AR}(1)=0.82]$$

Where

SF<sub>total</sub> - Total number of single filers (including Married Filing Separately)

JF<sub>total</sub> - Total number of joint filers (including Head of Household)

EMP<sub>retail</sub> - Oregon Retail sector employment

EMP<sub>total</sub> - Oregon non-farm employment

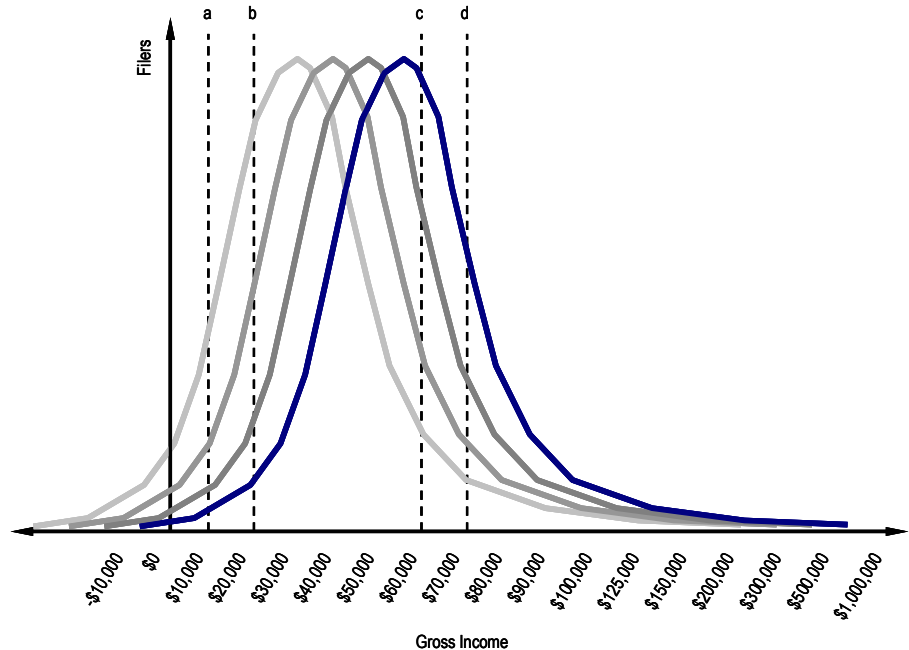
WAGE<sub>private</sub> - Wage rate in Oregon private, service providing sector employment.

Totals within each filing status are distributed across income categories according to the historical trend in the percentage change of each income category’s share of total filers (referred to as the “Share Growth Rate”). Specifically, while a category’s share of the total behaves in a non-linear manner over time, the percentage change in the share is reasonably linear and negatively sloped within limited time intervals.

This is due to the fact that the distribution of filers is marching steadily upward with respect to income as a product of inflation and productivity growth.

Graphic 1 provides a stylized illustration of this process. Income ranges above the median income (the interval c-d, for example) will experience an increasing share of total filers as the median income rises. The share growth rate will initially be quite high given the small absolute value of the share out in the tails of the distribution. As the share increases, the percent change

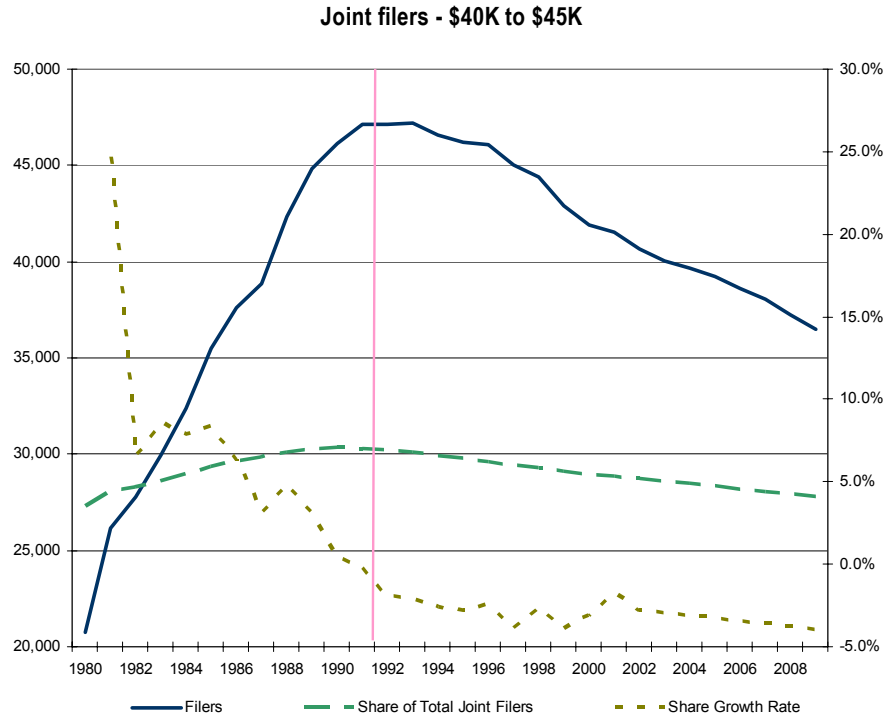
**Graphic 1: Effect of Rising Nominal Incomes on Bracket Share Over Time**



will decline, even though the change in number of filers may actually accelerate towards the center of the distribution.

At some point, the median income will eventually pass through the income range. Total number of filers will remain essentially flat, while the change in share approaches zero. (In fact, due to the increase in total filers over time, change in bracket share will go negative before the median income passes to the high side of the bracket.) Finally, as the bracket falls farther below the median income, bracket share will fall at an increasingly faster rate until it approaches zero.

Chart 1 presents historical and projected counts of Joint filers in the \$40,000 to \$50,000 bracket. The median income for Joint filers reached \$40,000 in 1992, denoted by the vertical line. Note the high initial changes, in percentage terms, associated with relatively small share of all Joint filers in the early 1980s (3.5%). Actual changes in the share of total filers exhibit considerable deviation from trend, resulting from economic fluctuations and stochastic variation.



Projected share growth rates are based on 1989 to 2001 trends. Additional factors are used to moderate excessive trends in the share growth rates. In particular, growth rates for the highest income brackets actually accelerated during the late 90s due to rapidly increasing capital gains income. Increasing growth rates for these brackets in future years is extremely unlikely. Similar considerations apply to lower income brackets, which declined at faster than normal rates during the robust economic expansion.

Forecasts of the number of filers in the resulting 48 categories are entered into the Legislative Revenue Office's Tax Calculator. The tax calculator computes the current law tax liability for each return in a sample of 2000 income tax filings. These sample liabilities are then multiplied by a weighting factor in order to develop a total liability for each income class and filing status. The weighting factor is based on the ratio of the sample returns to total returns (as determined in the income distribution model) for each income class and filing status. The weighted tax liabilities are then summed to produce annual personal income tax liability forecasts by year.

Appendix A provides estimation results and summary charts from the most recent filer distribution forecast.

### III. Gross Income and Liability Model

This model is based on data from Oregon full-year resident tax returns dating back to the 1980 tax year. Gross taxable income is delineated by eight sources: wages and salaries, dividends, interest, capital gains, retirement, proprietors, Schedule E<sup>1</sup>, and all other sources<sup>2</sup>. Each source is specified separately as a function of appropriate exogenous variables. In addition, an effective tax rate is computed using final tax liability and modeled as a function of exogenous variables.

Specifications are as follows

$$\begin{aligned}\text{LOG}(\text{GI}_{\text{wages}}) &= 20.7 + 0.93 \cdot \text{LOG}(\text{PI}_{\text{wages}} + \text{PI}_{\text{other\_lab}}) + [\text{AR}(1)=0.85] \\ \text{LOG}(\text{GI}_{\text{dividends}}) &= 16.7 + 0.49 \cdot \text{LOG}(\text{PI}_{\text{dir}}) + 0.30 \cdot \text{LOG}(\text{MKT}_{\text{w5000}}) \\ \text{LOG}(\text{GI}_{\text{interest}}) &= 19.6 + 0.34 \cdot \text{LOG}(\text{PI}_{\text{wages}}) + 0.04 \cdot \text{IR}_{3\text{mo\_tbill}} + 0.039 \cdot \text{IR}_{3\text{mo\_tbill}}(-1) + [\text{AR}(1)=0.65] \\ \text{LOG}(\text{GI}_{\text{cappains}}) &= 11.5 + 1.14 \cdot \text{LOG}(\text{MKT}_{\text{w5000}}) + [\text{MA}(4) = -0.86] \\ \text{LOG}(\text{GI}_{\text{retirement}}) &= -0.12 + 1.24 \cdot \text{LOG}(\text{POP}_{\text{OR}_{65+}}) + 0.97 \cdot \text{LOG}(\text{PI}_{\text{total}} - \text{PI}_{\text{wages}}) + 0.32 \cdot \text{LOG}(\text{MKT}_{\text{w5000}}) + \\ &[\text{AR}(1)=-0.50] \\ \text{LOG}(\text{GI}_{\text{proprietors}}) &= -304.7 + 0.72 \cdot \text{LOG}(\text{PI}_{\text{proprietors}}) + 2.10 \cdot \text{LOG}(\text{EMP}_{\text{retail}}) + [\text{AR}(1)=1.0] \\ \text{LOG}(\text{GI}_{\text{schedule\_e}}) &= 14.4 + 1.1 \cdot \text{LOG}(\text{CORP\_PROFIT}) + [\text{AR}(1)=0.78] \\ \text{LOG}(\text{GI}_{\text{other}}) &= -2.1 + 4.14 \cdot \text{LOG}(\text{EMP}_{\text{retail}}) \\ \text{Eff\_tax\_rate} &= 0.05 + 0.005 \cdot \text{DMY}_{\text{tax\_rate}} + 0.053 \cdot \text{FDIST}_{1\text{mil}} + 0.04 \cdot ((\text{GI}_{\text{schedule\_e}} + \text{GI}_{\text{proprietors}}) / \text{GI}_{\text{wages}}) + \\ &[\text{AR}(1)=0.58]\end{aligned}$$

Where

GI -	Gross Income from the source indicated
PI <sub>total</sub> -	Total Oregon Personal Income
PI <sub>wages</sub> -	Wage and Salary Component of Personal Income
PI <sub>other_lab</sub> -	Other labor component of Personal Income
PI <sub>dir</sub> -	Dividends, Interest and Rent component of Personal Income
PI <sub>proprietors</sub> -	Proprietors' Income component of Personal Income
MKT <sub>w5000</sub> -	Wilshire 5000 stock index
EMP <sub>retail</sub> -	Oregon Retail Employment
CORP_PROFIT -	U.S. Corporate Profits
POP_OR <sub>65+</sub> -	Oregon 65 and older population
IR <sub>3mo_tbill</sub> -	Discount rate of 3 month Treasury Bill
FDIST <sub>1mil</sub> -	Filer Distribution Model, Ratio of \$1 million-plus filers to Total filers
DMY <sub>tax_rate</sub> -	Dummy variable for 1982 through 1984 tax rate increase

Estimation results are provided in Appendix A.

<sup>1</sup> Schedule E income includes rents, royalties, and S-Corp income.

<sup>2</sup> Other income includes alimony, unemployment, farm, and tax refund income. The majority, however, is comprised of unassigned income due to lack of detailed data from the federal return.

## **Time lag and near-term liability estimation**

Income and liability data come from Oregon tax returns and associated federal return data. Given the number of extensions and the time necessary to audit and summarize return data, information on a given tax year becomes available approximately one year following the end of the tax year. In the meantime, collections related to that tax year are received from the start. Approximately 98 percent of these collections are in six months before the initial tax return data are available.

Reasonable estimates of liability can be made as early as nine months into a tax year, based on three-fourths of withholding and three of four estimated payments. The relationships between specific payments, e.g., withholding, and overall liability are quite stable from year to year (see “Translation of Liability to Personal Income Tax Collections”).

With respect to a given forecast, this means that income and elasticity/effective rate figures are constrained to produce the estimated liability figure. Subject to this constraint, it is still important to pay attention to the income component details to produce meaningful growth figures for the following tax year.

## **Final Adjustments and Forecaster Judgement**

The final liability forecast produced by the models must be adjusted to account for tax law changes not sufficiently represented in the data. Using a variety of adjustment factors and tax parameters, the Legislative Revenue Office also uses the tax calculator to estimate the anticipated impact of these changes on tax liability. The net result of these impacts are introduced as an add factor in the liability forecast.

In addition, historical relationships and trends are not a perfect predictor for future incomes and liabilities. If OEA and its advisors have reason to expect systematic departures from the results of the model, the gross income and liability forecasts can be adjusted accordingly. Both of these processes can have significant impacts on the final revenue forecast.

#### IV. Translation of Liability to Personal Income Tax Collections

Once a forecast of tax liability is developed, it must be translated into a collections forecast as the budget is formulated based on anticipated receipts during the budgeting period. On the one hand, month to month errors in the timing of collections are relatively inconsequential relative to forecast error for the budget period as a whole, primarily a function of error in the liability forecast. On the other, month to month error will make it more difficult to identify underlying trends and patterns in the collections data. There are three significant issues related to the translation of tax liability to tax collections: distribution of liability by payment type, historical and expected timing of receipts, and discrepancies between dollars owed and dollars ultimately received.

##### Distribution of liability by payment type

Collection of personal income tax liability occurs in two phases, prospective payments made throughout the year and reconciliation with ultimate liability during the subsequent tax filing season. Prospective payments take two forms, withholding on wage and salary income and estimated payments on all other income. Tax law dictates minimum requirements for prospective payments to avoid penalties, generally equal to the prior year's tax (safe harbor) or 90 percent of the current year's tax.

The accompanying table presents the distribution of liability by type of payment. Note that the year-to-year variation is quite small, less than a percentage point in either direction, with the exception of tax year 2001. An 8.6 percent decline in liability, coupled with pervasive use of the safe harbor method for determining estimated payments, resulted in much higher prospective payments relative to liability. This in turn led to significantly greater refund levels in the spring of 2002.

Tax Year	Percent of Total Liability						Volume
	Prospective Payments			Reconciliation			
	Withholding	Estimated Payments	Total	Final Payments	Refunds	Net	
1994	82.5%	18.0%	100.6%	14.2%	-14.8%	-0.6%	29.0%
1995	82.8%	17.2%	100.0%	14.5%	-14.5%	0.0%	29.0%
1996	82.2%	17.1%	99.3%	15.8%	-15.1%	0.7%	30.9%
1997	80.7%	18.1%	98.8%	17.3%	-16.1%	1.2%	33.3%
1998	81.3%	18.3%	99.6%	16.2%	-15.7%	0.4%	31.9%
1999	81.1%	18.1%	99.1%	16.3%	-15.4%	0.9%	31.7%
2000	81.5%	18.2%	99.7%	15.6%	-15.2%	0.3%	30.8%
2001	90.2%	17.6%	107.8%	11.3%	-19.1%	-7.8%	30.4%
Average	82.8%	17.8%	100.6%	15.1%	-15.7%	-0.6%	30.9%
Std. Deviation	3.1%	0.5%	3.0%	1.8%	1.5%	3.0%	1.5%

Note: "Volume" refers to the absolute value of Final Payments and Refunds

Collections by tax year data are only available back to 1994. Given the limited observations, efforts to model these relationships are still underway. For instance, there is a clear relationship between liability growth and the distribution of reconciliation between final payments and refunds. It remains to be seen how this relationship will hold up between the extremes – excessive growth between 1994 and 2000, unparalleled decline in 2001.

##### Timing of receipts.

Historically, the timing of collections has been relatively consistent across tax years. This is a product of tax laws regarding the submission of both prospective payments – withholding for wage and salary income, as well as quarterly estimated payments for all other sources of income – and final payments. In addition, refunds tend to motivate timely submission of tax returns and must be distributed by the state within 45 days of April 15<sup>th</sup> or the date of receipt, whichever is later, to avoid interest charges. Thus, while variation occurs from year to year, it tends to be small in relative terms.

The table below presents the average timing of collections by payment type for tax years 1994 through 2002. The average distribution of collections across time during this timeframe is currently used to translate the liability forecast into projected collections.

**Average timing of collections, Tax Years 1994-2002**

	Withholding	Estimated	Final	Refunds
1	25.3%	1.1%	0.0%	0.0%
2	24.2%	37.9%	0.1%	0.0%
3	24.5%	25.3%	0.4%	0.0%
4	26.0%	7.8%	8.8%	0.0%
5	0.0%	27.9%	4.9%	35.7%
6	0.0%	0.0%	64.7%	41.5%
7	0.0%	0.0%	4.3%	8.3%
8	0.0%	0.0%	5.7%	8.0%
9	0.0%	0.0%	2.1%	1.1%
10	0.0%	0.0%	1.0%	0.8%
11	0.0%	0.0%	0.6%	0.6%
12	0.0%	0.0%	0.6%	0.6%
13	0.0%	0.0%	0.5%	0.3%
14	0.0%	0.0%	0.5%	0.3%
15	0.0%	0.0%	0.4%	0.4%
16	0.0%	0.0%	0.8%	0.6%
17	0.0%	0.0%	1.5%	0.9%
18	0.0%	0.0%	1.5%	0.3%
19	0.0%	0.0%	0.9%	0.4%
20	0.0%	0.0%	0.6%	0.2%

Tax year 1994 as the start year is dictated by the availability of historical data – collections data is available much farther back in time, but not related to specific tax years – while tax year 2002 as the end year allows for sufficient collections history. As time passes, this window will be expanded to include additional tax years. Year-to-year variation will also be analyzed for patterns and trends that might be incorporated to improve the accuracy of the collections forecast.

**Dollars owed versus dollars received.**

The final liability estimate for historical tax years is determined based on all tax returns received within one year following the end of the associated tax year. This allows the Department of Revenue to produce and publish statistical reports in a reasonably timely manner. Ongoing compliance and auditing processes result in additional and amended returns that will result in additional dollars owed. In addition, penalties and interest are factored into collection totals, but are not represented in the base liability estimate. Historically speaking, dollars collected for a given tax year will be roughly 6-7 percent greater than the final liability estimate published by DOR.

## Appendix A: Estimation Output and Summary Charts from the Filer Distribution Model

### Dependent Variable: LOG(SF\_TOTAL)

Method: Least Squares  
 Date: 02/11/03 Time: 08:24  
 Sample(adjusted): 1981 2001  
 Included observations: 21 after adjusting endpoints  
 Convergence achieved after 8 iterations

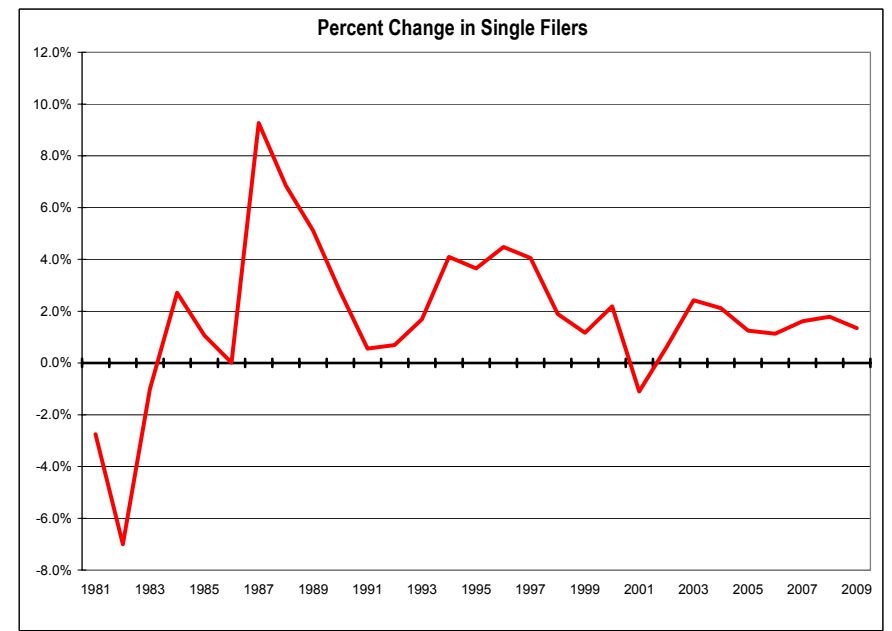
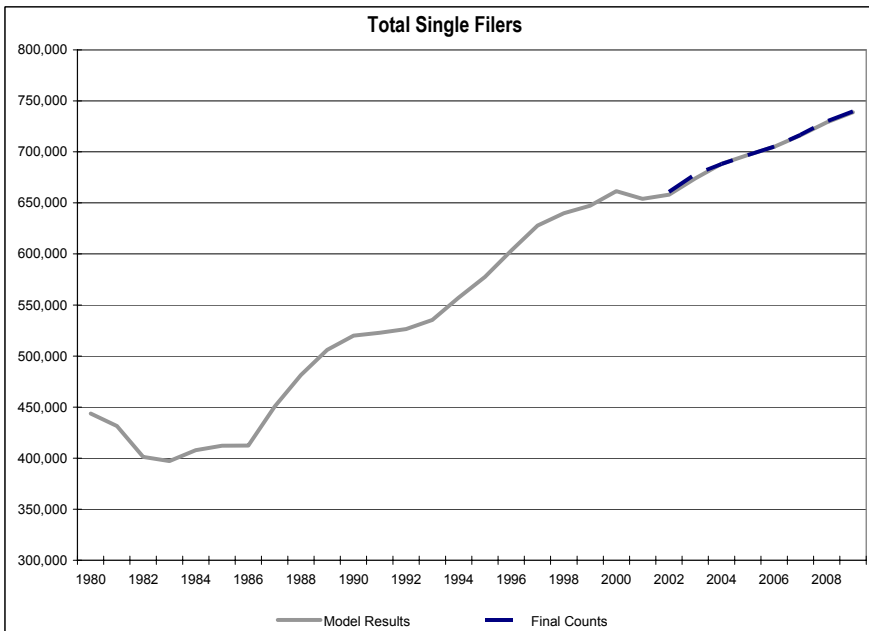
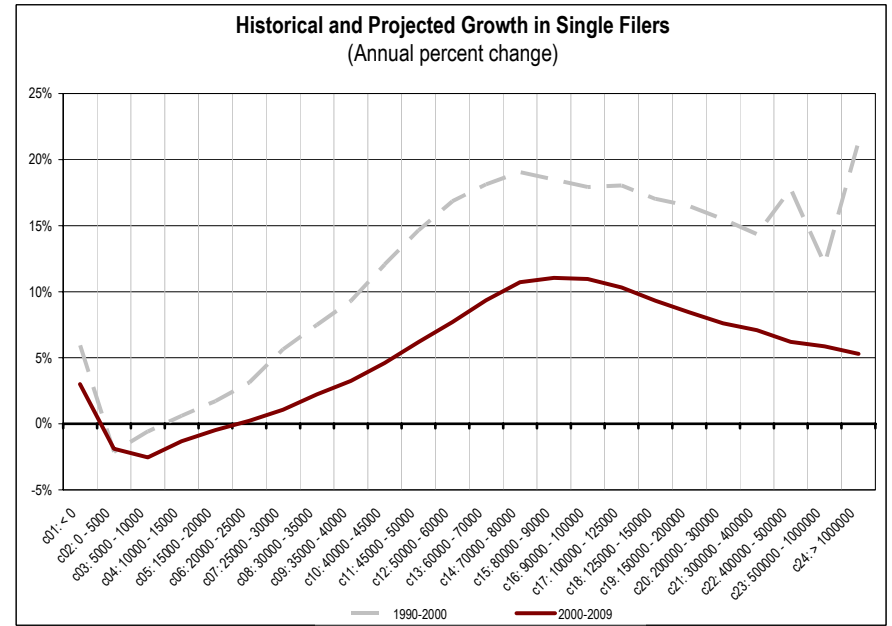
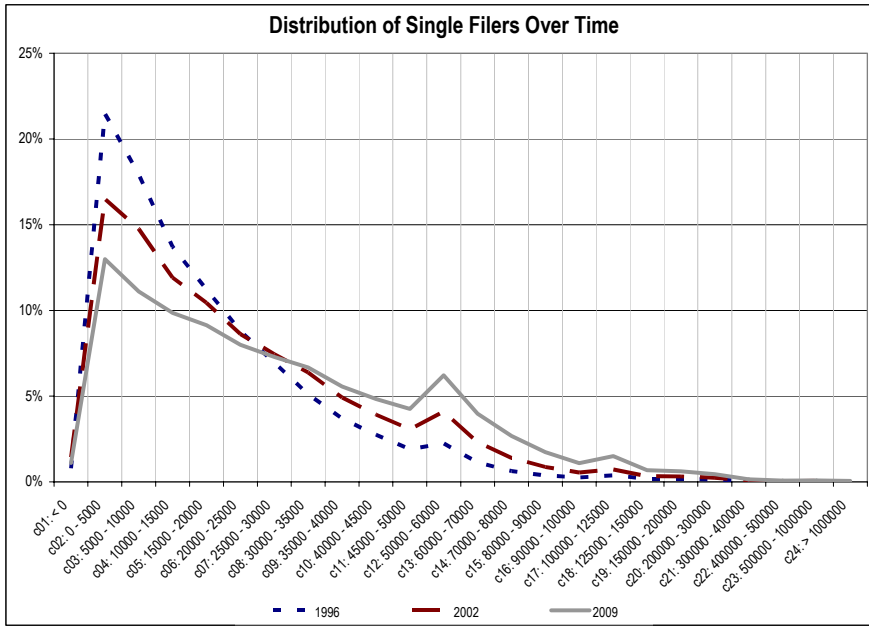
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.527	0.355	21.223	0.000
LOG(EMP_RETAIL)	1.029	0.064	16.114	0.000
AR(1)	0.649	0.147	4.417	0.000
R-squared	0.993	Mean dependent var		13.151
Adjusted R-squared	0.992	S.D. dependent var		0.179
S.E. of regression	0.016	Akaike info criterion		-5.310
Sum squared resid	0.005	Schwarz criterion		-5.161
Log likelihood	58.754	F-statistic		1256.800
Durbin-Watson stat	1.718	Prob(F-statistic)		0.000
Inverted AR Roots	0.650			

### Dependent Variable: LOG(JF\_TOTAL)

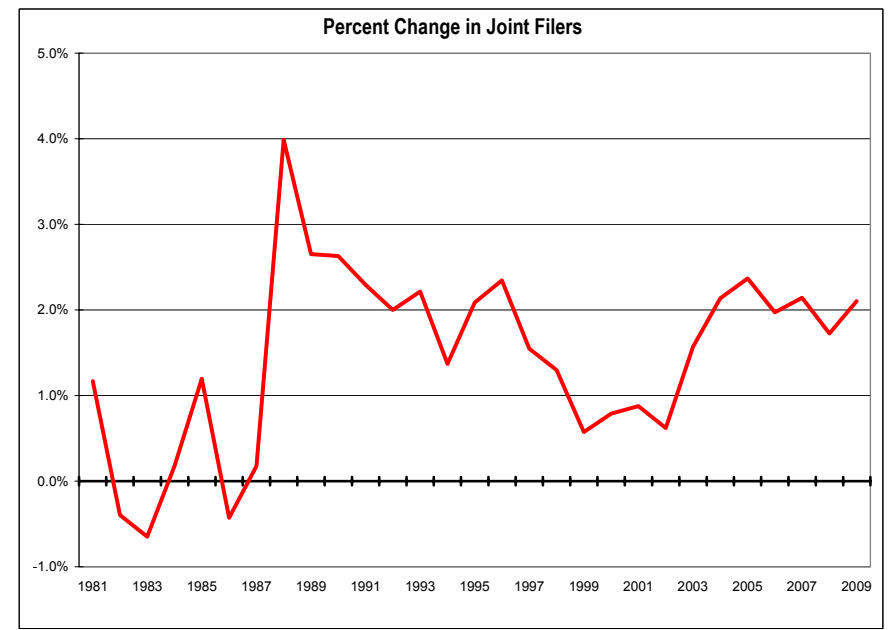
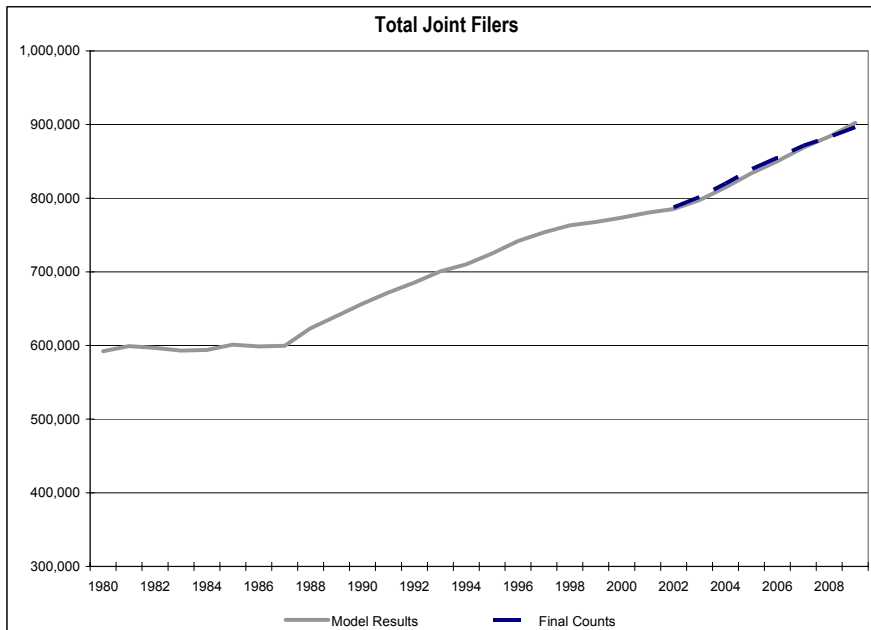
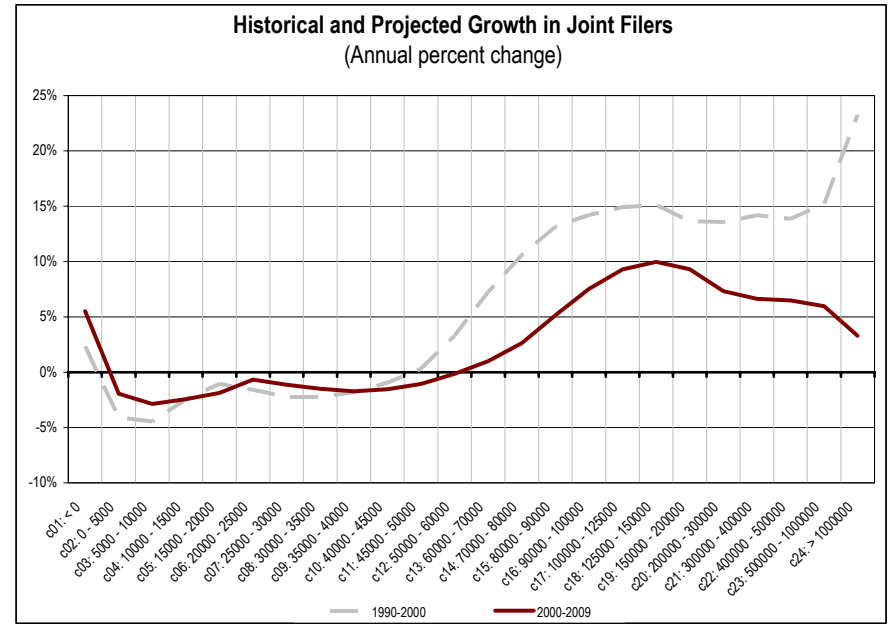
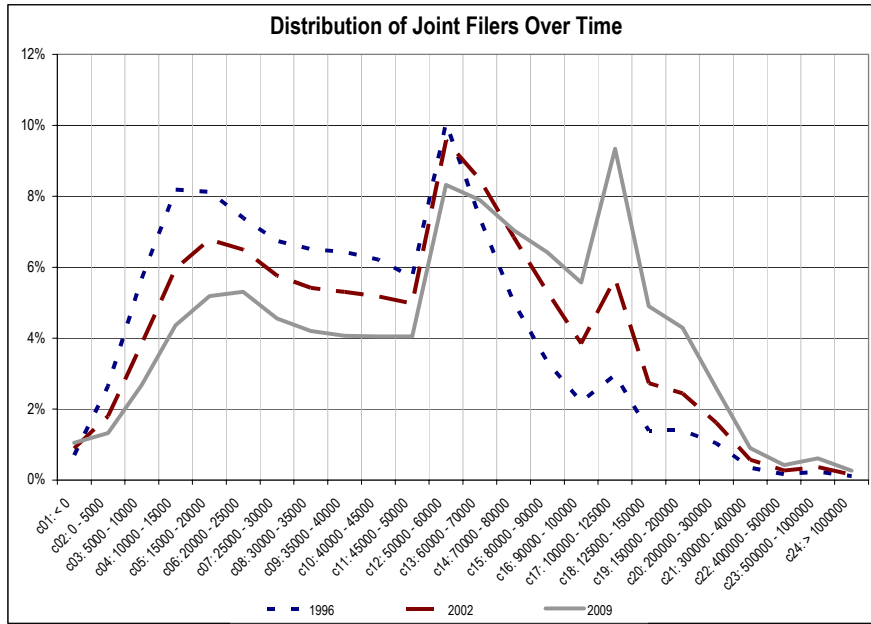
Method: Least Squares  
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 Sample(adjusted): 1981 2001  
 Included observations: 21 after adjusting endpoints  
 Convergence achieved after 17 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.289	0.602	18.761	0.000
WAGE_PRIVATE	8.564	3.536	2.422	0.027
LOG(EMP_TOTAL)	0.273	0.092	2.953	0.009
AR(1)	0.820	0.160	5.122	0.000
R-squared	0.990	Mean dependent var		13.417
Adjusted R-squared	0.989	S.D. dependent var		0.104
S.E. of regression	0.011	Akaike info criterion		-6.011
Sum squared resid	0.002	Schwarz criterion		-5.812
Log likelihood	67.115	F-statistic		587.127
Durbin-Watson stat	1.530	Prob(F-statistic)		0.000
Inverted AR Roots	0.82			

# Appendix A: Estimation Output and Summary Charts from the Filer Distribution Model



# Appendix A: Estimation Output and Summary Charts from the Filer Distribution Model



## Appendix B: Estimation Output from the Gross Income and Liability Model

### Dependent Variable: LOG(GI\_WAGES)

Method: Least Squares

Date: 04/24/03 Time: 08:20

Sample(adjusted): 1981 2001

Included observations: 21 after adjusting endpoints

Convergence achieved after 18 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20.664	0.209	98.778	0.000
LOG(PI_WAGES+PI_OTHLAB)	0.929	0.052	17.753	0.000
AR(1)	0.846	0.159	5.308	0.000
R-squared	0.9993	Mean dependent var		23.9201
Adjusted R-squared	0.9993	S.D. dependent var		0.3745
S.E. of regression	0.0102	Akaike info criterion		-6.2109
Sum squared resid	0.0019	Schwarz criterion		-6.0617
Log likelihood	68.2149	F-statistic		13601.9400
Durbin-Watson stat	1.9467	Prob(F-statistic)		0.0000
Inverted AR Roots	0.850			

### Dependent Variable: LOG(GI\_INTEREST)

Method: Least Squares

Date: 04/23/03 Time: 11:05

Sample(adjusted): 1982 2001

Included observations: 20 after adjusting endpoints

Convergence achieved after 11 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.551	0.377	51.892	0.000
LOG(PI_TOTAL)	0.343	0.087	3.964	0.001
IR_3MONTH	0.043	0.008	5.259	0.000
IR_3MONTH(-1)	0.039	0.007	5.312	0.000
AR(1)	0.647	0.114	5.692	0.000
R-squared	0.893	Mean dependent var		21.405
Adjusted R-squared	0.864	S.D. dependent var		0.106
S.E. of regression	0.039	Akaike info criterion		-3.436
Sum squared resid	0.023	Schwarz criterion		-3.187
Log likelihood	39.363	F-statistic		31.253
Durbin-Watson stat	1.927	Prob(F-statistic)		0.000
Inverted AR Roots	0.650			

### Dependent Variable: LOG(GI\_DIVIDENDS)

Method: Least Squares

Date: 04/23/03 Time: 11:04

Sample: 1980 2001

Included observations: 22

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	16.742	0.394	42.455	0.000
LOG(PI_DIR)	0.490	0.174	2.824	0.011
LOG(MKT_W5000)	0.299	0.097	3.075	0.006
R-squared	0.976	Mean dependent var		20.394
Adjusted R-squared	0.973	S.D. dependent var		0.437
S.E. of regression	0.071	Akaike info criterion		-2.315
Sum squared resid	0.097	Schwarz criterion		-2.166
Log likelihood	28.461	F-statistic		384.449
Durbin-Watson stat	1.564	Prob(F-statistic)		0.000

### Dependent Variable: LOG(GI\_CAPGAINS)

Method: Least Squares

Date: 04/23/03 Time: 11:04

Sample(adjusted): 1981 2001

Included observations: 21 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.498	0.345	33.314	0.000
LOG(MKT_W5000)	1.768	0.246	7.185	0.000
LOG(MKT_W5000(-1))	-0.617	0.246	-2.512	0.022
R-squared	0.978	Mean dependent var		21.080
Adjusted R-squared	0.975	S.D. dependent var		0.864
S.E. of regression	0.137	Akaike info criterion		-1.013
Sum squared resid	0.336	Schwarz criterion		-0.863
Log likelihood	13.632	F-statistic		391.473
Durbin-Watson stat	1.711	Prob(F-statistic)		0.000

## Appendix B: Estimation Output from the Gross Income and Liability Model

### Dependent Variable: LOG(GI\_RETIREMENT)

Method: Least Squares

Date: 04/23/03 Time: 11:05

Sample: 1985 2001

Included observations: 17

Convergence achieved after 9 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.115	4.139	-0.028	0.978
LOG(POP_OR_65)	1.238	0.341	3.634	0.003
LOG(PI_TOTAL-PI_WAGES)	0.974	0.091	10.747	0.000
LOG(MKT_W5000)	0.317	0.022	14.501	0.000
AR(1)	-0.490	0.258	-1.896	0.082
R-squared	0.999	Mean dependent var		21.789
Adjusted R-squared	0.999	S.D. dependent var		0.557
S.E. of regression	0.022	Akaike info criterion		-4.601
Sum squared resid	0.006	Schwarz criterion		-4.356
Log likelihood	44.112	F-statistic		2679.966
Durbin-Watson stat	2.479	Prob(F-statistic)		0.000
Inverted AR Roots	-0.490			

### Dependent Variable: LOG(GI\_SCHED\_E)

Method: Least Squares

Date: 04/24/03 Time: 09:10

Sample: 1985 2001

Included observations: 17

Convergence achieved after 11 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.429	2.827	5.104	0.000
LOG(CORP_PROFIT)	1.136	0.420	2.705	0.017
AR(1)	0.781	0.063	12.453	0.000
R-squared	0.983	Mean dependent var		20.966
Adjusted R-squared	0.981	S.D. dependent var		1.016
S.E. of regression	0.140	Akaike info criterion		-0.937
Sum squared resid	0.274	Schwarz criterion		-0.790
Log likelihood	10.965	F-statistic		414.945
Durbin-Watson stat	1.511	Prob(F-statistic)		0.000
Inverted AR Roots	0.780			

### Dependent Variable: LOG(GI\_PROPRIETORS)

Method: Least Squares

Date: 04/23/03 Time: 11:05

Sample(adjusted): 1981 2001

Included observations: 21 after adjusting endpoints

Convergence achieved after 184 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-307.685	195768.900	-0.002	0.999
LOG(PI_PROPRIETORS)	0.724	0.297	2.438	0.026
LOG(EMP_RETAIL)	2.090	0.681	3.069	0.007
AR(1)	1.000	0.067	14.818	0.000
R-squared	0.989	Mean dependent var		21.125
Adjusted R-squared	0.988	S.D. dependent var		0.526
S.E. of regression	0.059	Akaike info criterion		-2.669
Sum squared resid	0.058	Schwarz criterion		-2.470
Log likelihood	32.022	F-statistic		532.456
Durbin-Watson stat	1.495	Prob(F-statistic)		0.000
Inverted AR Roots	1.000			

### Dependent Variable: LOG(GI\_OTHER)

Method: Least Squares

Date: 04/23/03 Time: 11:04

Sample: 1990 2001

Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.058	1.800	-1.143	0.280
LOG(EMP_RETAIL)	4.139	0.322	12.860	0.000
R-squared	0.943	Mean dependent var		21.082
Adjusted R-squared	0.937	S.D. dependent var		0.405
S.E. of regression	0.101	Akaike info criterion		-1.587
Sum squared resid	0.103	Schwarz criterion		-1.506
Log likelihood	11.523	F-statistic		165.372
Durbin-Watson stat	1.921	Prob(F-statistic)		0.000

## Appendix B: Estimation Output from the Gross Income and Liability Model

### Dependent Variable: EFF\_TAX\_RATE

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Method: Least Squares

Date: 04/23/03 Time: 11:04

Sample(adjusted): 1981 2001

Included observations: 21 after adjusting endpoints

Convergence achieved after 8 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.051	0.002	31.217	0.000
DMY_TAX_RATE	0.005	0.001	7.252	0.000
FDIST_1MIL	0.053	0.009	6.099	0.000
(GI_SCHED_E+GI_PROPRIETORS)	0.040	0.013	3.194	0.006
AR(1)	0.577	0.174	3.320	0.004
R-squared	0.970	Mean dependent var		0.058
Adjusted R-squared	0.962	S.D. dependent var		0.004
S.E. of regression	0.001	Akaike info criterion		-11.457
Sum squared resid	0.000	Schwarz criterion		-11.208
Log likelihood	125.297	F-statistic		128.081
Durbin-Watson stat	2.228	Prob(F-statistic)		0.000
Inverted AR Roots	0.580			