STATE INCOME TAX REVENUE VOLATILITY: CAUSES AND EFFECTS

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INTRODUCTION

RECENT EVENTS IN STATE BUDGETING MAKE AN investigation into the variability of personal income tax receipts a timely study. The 2001 recession that followed the dot-com equity market boom and bust created challenging fiscal distress first because of state budgetary surpluses and then because of subsequent deficits. The ensuing recovery generated a revenue surge that resulted in significant state surpluses which in turn increased demands for tax cuts. The current healthy fiscal status provides a window for tax reform so that future budgeting efforts need not suffer through such deficit-to-surplus extremes that states have experienced during the past 10 years.

In addition to enumerating needed and vital national tax reforms, *Simple, Fair, and Pro-Growth: Proposals to Fix American's Tax System* (2005), the recommendations of the President's Advisory Panel on Federal Tax Reform, provides a prototype upon which subnational reformers can pattern their efforts. The President's panel first clearly explicates good tax principles and then allows their recommendations to follow from these characteristics. They build on the significant intellectual contributions by Slemrod (1990), Brunori (2001), Steuerle (2004), and Slemrod and Bakija (2004) that summarize the literature prescribing the attributes of good tax policy. Brunori (2001) elaborates five basic principles for state tax systems. He suggests that states need tax codes that provide adequate revenue, minimize distortions, treat citizens fairly and equitably, facilitate economical administration, and achieve accountability. The NCSL (1992) recommends that a tax system must demonstrate sufficiency, stability, and certainty.

Because reform efforts could possibly influence the volatility of income tax revenues, this paper focuses on the variability of subnational individual income taxes. It first describes the recent trends in income tax receipts. The paper next considers the traditional way of measuring income tax volatility using elasticity estimation. Additional understanding about personal income tax revenue variability comes by dissecting tax calculation formulas to isolate the stochastic components which generate volatility. This decomposition naturally classifies volatility sources as emanating from either the tax base or tax rate. This classification meshes nicely into the tax reform debate since such discussions often consider broadening the base and lowering the rates.

VARIABILITY OF TAX REVENUES

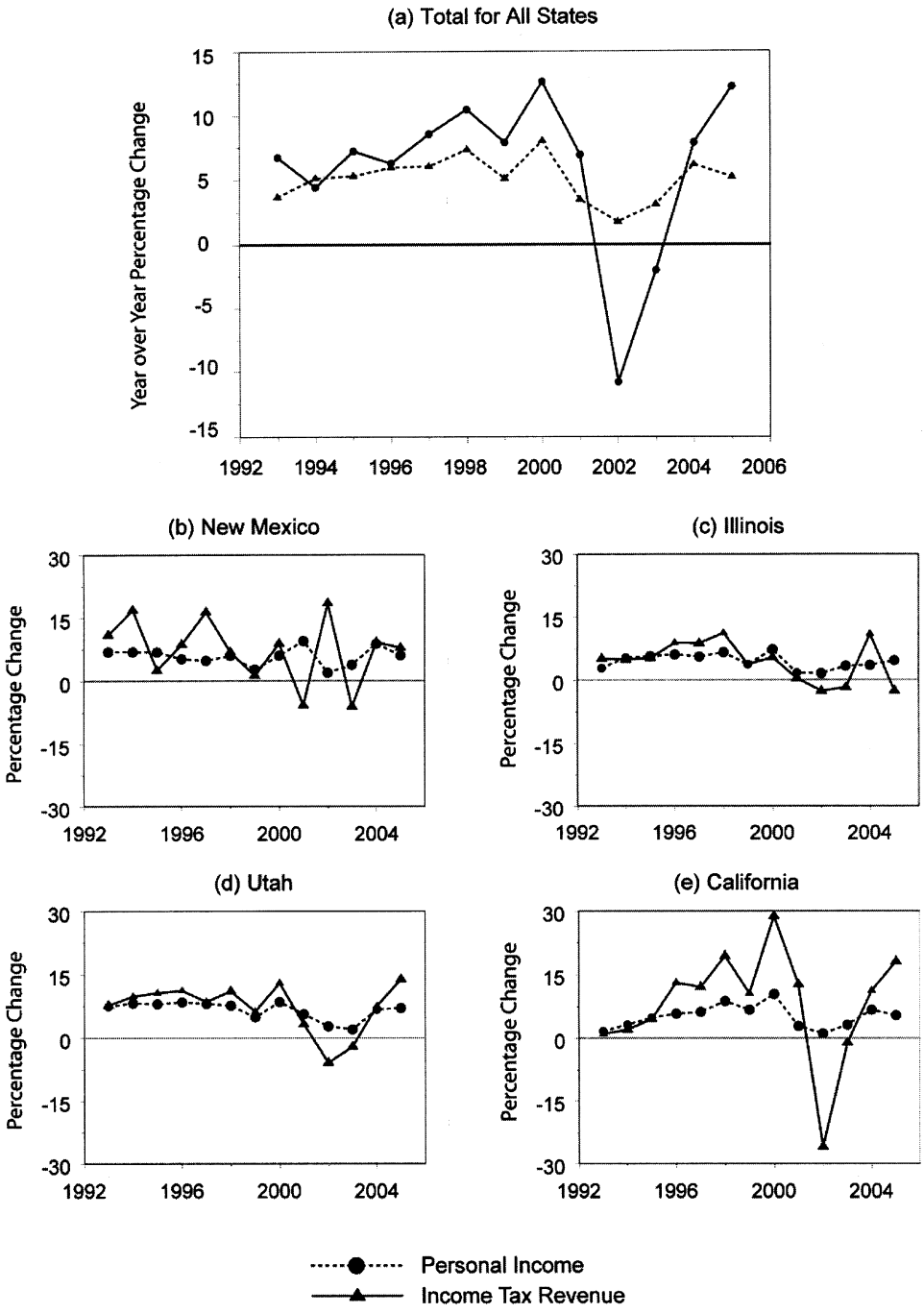
Because variability in tax revenues complicates state budgeting proceedings, it is important to understand recent patterns in tax collections. It is also important to understand previous attempts to measure variability relative to the business cycle.

Recent Trends in Income Tax Receipts

During recent history, the volatility of income tax receipts has challenged state government officials. As shown in Figure 1, income taxes aggregated over all states grew steadily between 1992 and 2000. The approximately 13 percent increase in 2000 confronted many state governments with critical decisions about how to deal with very large surpluses. The 2001 recession, however, plunged state governments into severe deficit situations. Income tax revenues in 2004 and 2005 returned state governments to more positive fiscal ground. Both national and state forecasts anticipate very strong income tax revenues in future fiscal years.

Because Dye and McGuire (1991) find that the specifications and structures of individual income and general sales taxes affect their growth rates and variability, it is also important to consider how individual states deviate from the general pattern for the United States. The time series for income tax revenues for the four states shown in Figure 1 reaffirm the variety documented by Dye and McGuire (1991). The graphs for California and Utah follow the general pattern for the United States. The extreme volatility shown in California's graph corresponds to the well-known budget challenges it faced during the recession. While Illinois revenues also declined during the recession, their attenuated amplitude in fluctuations suggests much less fiscal stress. The volatility of New Mexico exceeds that of Illinois and shows less predictable variation over the business cycle.

Figure 1: **Income Tax Revenue versus Personal Income**



Revenues and the Business Cycle

The graphs in Figure 1 demonstrate that the percentage change in personal income taxes varies more than the percentage change in personal income. Except for 1994, personal income tax revenues increased much faster than personal income during the record long expansion that followed the 1991 recession. With the onset of the 2001 recession, personal income taxes plunged far below the more modest declines in personal income. In 2004 and 2005, tax revenues again exceeded increases in personal income.

Consider now the traditional way of measuring income tax volatility using elasticity estimation. These statistics are identical to the betas used to meter equity market volatility. A rich public finance literature thoroughly summarized by Holcombe and Sobel (1997) provides the foundation for the appropriate econometrics. Recent work by Bruce, Fox, and Tuttle (2006) estimates and compares tax base elasticities. This literature clearly documents the high volatility of income taxes relative to many other revenue sources.

Holcombe and Sobel (1997) report estimates for short- and long-run personal income elasticities. The box plot in Figure 2 summarizes the results of their estimation efforts for short-run personal income taxes. The boundaries of the box part of the plot show that 50 percent of the elasticity estimates lie between the left-hand side of the box which corresponds to Idaho (.87) and the right-hand side of the box which corresponds to Pennsylvania (2.06). The additional information in the graph reveals that 70 percent of the states have personal income tax elasticities greater than one. Both California and Ohio have exceptionally large elasticities.

The diagrams for individual states in Figure 1 also show that the significantly different patterns in revenue receipts are only partially explained by personal income. In fact, the four example states of New Mexico, Illinois, Utah, and California exhibit remarkably similar patterns in personal income between 1992 and 2005. New Mexico's revenue fluctuations alternate above and below the personal income line. This is consistent with its extreme negative elasticity value. The smaller revenue fluctuations relative to the personal income baseline are consistent with a smaller elasticity value for Illinois. California's comparatively extreme variation of tax revenue relative to its aggregate personal income is also evident in the graph.

The variety of tax revenue patterns identifies the need to know more about each state individually. It also encourages further research to determine why personal income tax revenues vary so markedly among individual states. Some insights into explaining these differences occur by investigating how the variation in adjusted gross income (AGI) is influenced by its constituent parts. The potential effects of deductions, exemptions, and tax rates are also relevant.

VARIANCE IN TAXABLE INCOME

Slemrod and Bakija (2004) discuss the economic principles and issues for determining taxable income. In practice, both federal and sub-national income taxes begin with the computation of AGI. In general, this calculation sums wages and salaries, returns to capital (interest, dividends, capital gains, rents, and royalties), and small business and farm income to get AGI.

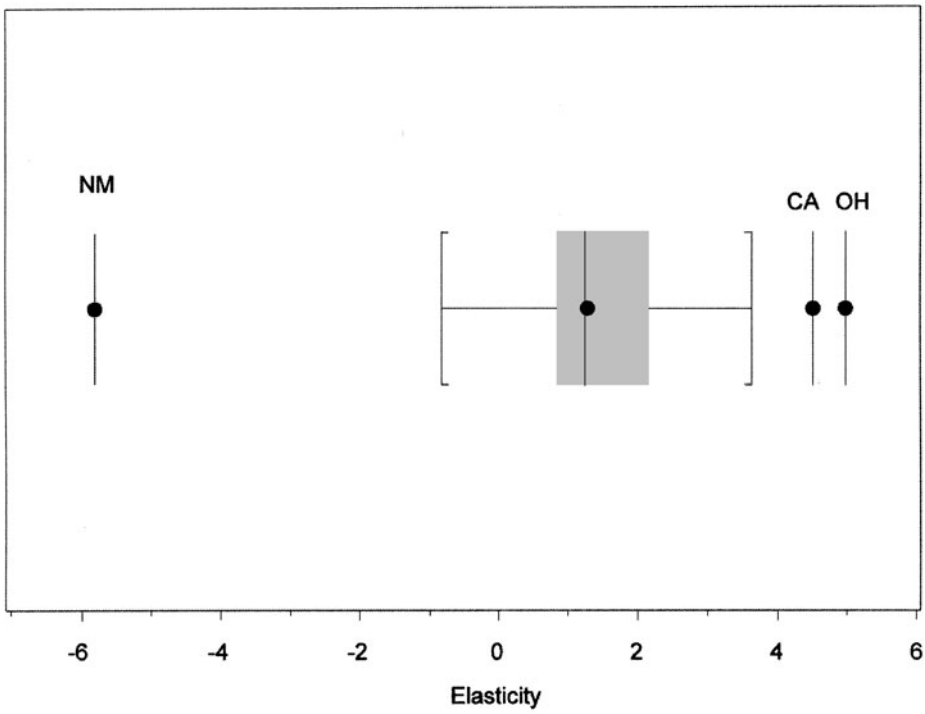
AGI

Similar to national summaries, publicly available statistics calculated from federal returns for Utah citizens reveal that total income results primarily from wages, interest, dividends, and income reported on Schedules C, D, E, and F. State refunds, alimony, IRA, unemployment, and Social Security contribute lesser amounts.

Figure 3 shows how sources of income vary over time. Because wages comprise approximately 75 percent of income, as expected, the pattern for total income closely tracks wages. The influence of lower interest rates is clearly seen in the decline in interest income beginning in 2001. Since interest rates remain low, even well into the recovery, interest income continues to decline through 2004. In contrast, dividends, Schedules C, D, E, and F, and IRA income components track business cycle ups and downs. As would be expected, Social Security and pension income respond much less to business cycle influences.

Some have identified capital gains as a possible explanation for the consistently high growth in personal income taxes between 1996 and 2001. Capital losses also offer a possible reason for the sharp drop off in revenue in 2002 and 2003. Because capital gains constitute a nontrivial part of AGI and capital gains/losses have a very high volatility, these two facts explain why this component of AGI can significantly augment revenues during

Figure 2: **Short-Run Elasticities, Holcombe-Sobel (1997) Error Corrected**



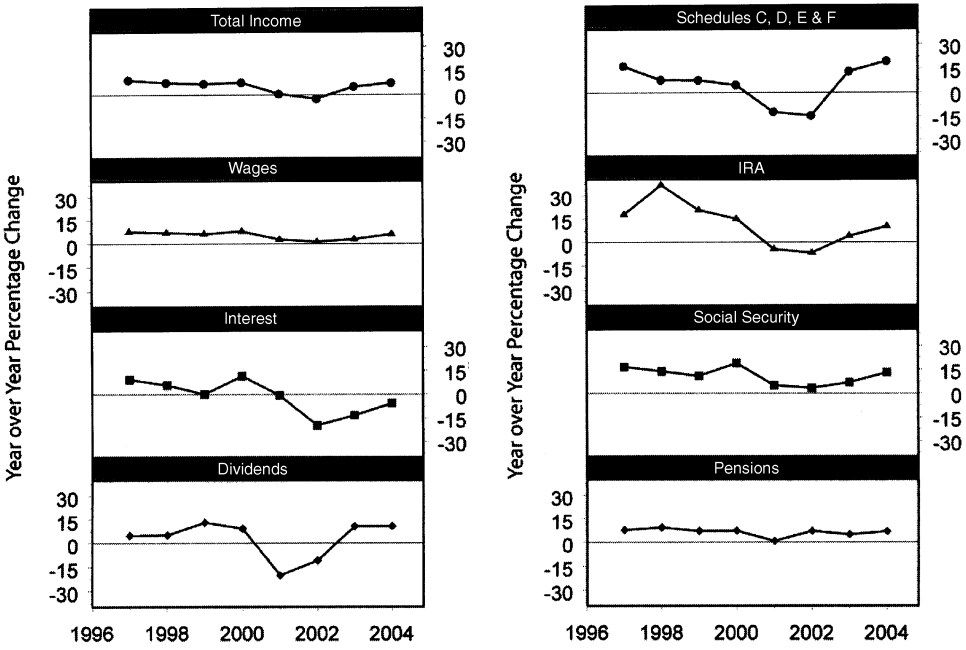
First Quartile		Second Quartile		Third Quartile		Fourth Quartile	
New Mexico	**-5.80**	**Idaho**	**0.87**	Arkansas	**1.33**	Rhode Island	2.24
North Dakota	-0.83	Minnesota	0.93	West Virginia	1.45	Virginia	2.46
Louisiana	-0.43	North Carolina	1.02	Alabama	1.56	Utah	2.55
Colorado	-0.26	Massachusetts	1.08	Missouri	1.60	Wisconsin	2.55
Arizona	0.27	Iowa	1.10	Oklahoma	1.63	New York	3.05
Montana	0.38	New Jersey	1.10	Kentucky	1.70	Michigan	3.13
Delaware	0.43	Maryland	1.11	South Carolina	1.75	Mississippi	3.22
Vermont	0.47	Georgia	1.11	Indiana	1.82	Hawaii	3.63
Oregon	0.80	Illinois	1.21	Maine	1.87	**California**	**4.51**
Kansas	0.85	**Nebraska**	**1.23**	**Pennsylvania**	**2.06**	**Ohio**	**4.97**

expansions and contribute to extreme declines during recessions.

Exemptions

Now consider exemptions as the first major category deducted from AGI in the process of calculating taxable income. In general, it would be expected that the number of exemptions and their value would not vary significantly over the business cycle. This means that the correlation between AGI and exemptions should be close to zero and thus would be an insignificant contributor to the volatility of income tax revenue. Given this prior expectation, it is surprising to find that the value of exemptions increased during the recent recession. This probably occurred because of attempts to stimulate the economy using fiscal policy tax cuts. One way to decrease taxes is to increase the value of exemptions. To the extent that exemption values might regularly increase during recessions,

Figure 3: **Sources of Income, Percentage Year over Year Changes**



then this would further decrease taxable income and thus increase volatility.

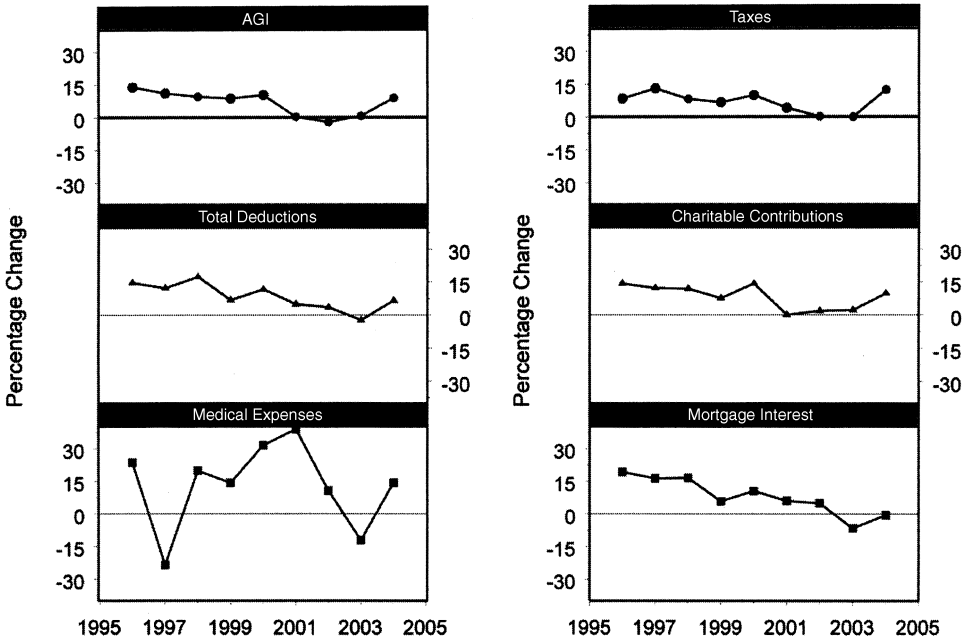
Deductions

Deductions constitute the second major classification of reductions in AGI as taxable income is calculated. It would be expected that standard and itemized deductions would affect the volatility of tax revenues with different impacts. Those claiming the standard deduction would receive the same tax benefit regardless of the phase of the business cycle. Those itemizing deductions, on the other hand, would claim deductions which might be dependent on the business cycle. Deductions for charitable contributions and taxes, for example, would certainly increase during expansions and decrease during recessions. Some volatility in standard deductions might occur synchronously with the business cycle as some taxpayers elect to switch back and forth between claiming the standard deduction and itemizing their expenses.

The information graphed in Figure 4 gives insights into the behavior of itemized deductions. Once again the graph of the rate of change in AGI gives the reference pattern needed to evaluate each itemized deduction category in conjunction with the business cycle. Although total deductions follow the declining rate of growth in AGI between 1995 and 2002, the rate for total deductions continues to decline through 2003 in contrast to AGI, which bottoms out a year earlier in 2002. One cause for this becomes apparent when looking at the mortgage interest deduction. As taxpayers refinanced their mortgages at lower interest rates during the recession, the amount of their interest deduction decreased. Because interest rates continued to decline through 2003, this partly explains why the rate of growth in total deductions continued to decline. This pattern might not continue to be replicated again and again over multiple business cycles and is probably unique to the current time-series span.

Figure 4 also shows that charitable contributions follow the business cycle pattern. Because numerous Utah citizens make large charitable contributions related to income, it makes sense that these contributions would closely follow the pattern observed for AGI. Deductions for taxes also generally mimic the pattern found for AGI. Medical expense deductions appear to ebb and flow without any relationship with the business cycle.

Figure 4: **Itemized Deductions**



A positive correlation between AGI and deductions should decrease the volatility of income taxes. Increases in AGI cause taxable income to grow. If deductions increase in conjunction with AGI, then the larger size of deductions will moderate the increases in taxable income caused by AGI.

Volatility Experiments and Simulations

The mantra to broaden the base and lower the rates means that the discussion of tax rates cannot occur independently from the definition of the base. With careful planning, however, an appropriate experimental design for tax simulations can reveal helpful conclusions about the effects of tax rates on income tax revenue volatility. In general, lower rates can automatically reduce the variance of tax receipts. However, the broader base may increase the variance of the taxable income since the broader base has a larger magnitude. Simulation can help assess the relative impacts of these conflicting effects.

Alternative Definitions for Taxable Income

By using three different taxable income definitions, the effect of tax rates on revenue volatility can be isolated. The first definition is federal AGI that is modified so that it excludes income earned by Native Americans and interest earned by holding U.S. Treasury securities. This gives taxable AGI. The second is the definition specified in the current Utah code. This starts with federal AGI and then deducts Native American income and interest on U.S. Treasury securities. Next deductions and exemptions are subtracted in calculations similar to those found at the federal level. Finally, the current code allows taxpayers to deduct half of their federal income taxes. Other minor adjustments occur, but the mentioned exemptions and deductions constitute the major portion of reductions. The third definition of taxable income is defined as AGI but with a phase out of an exemption designed to protect low income taxpayers.

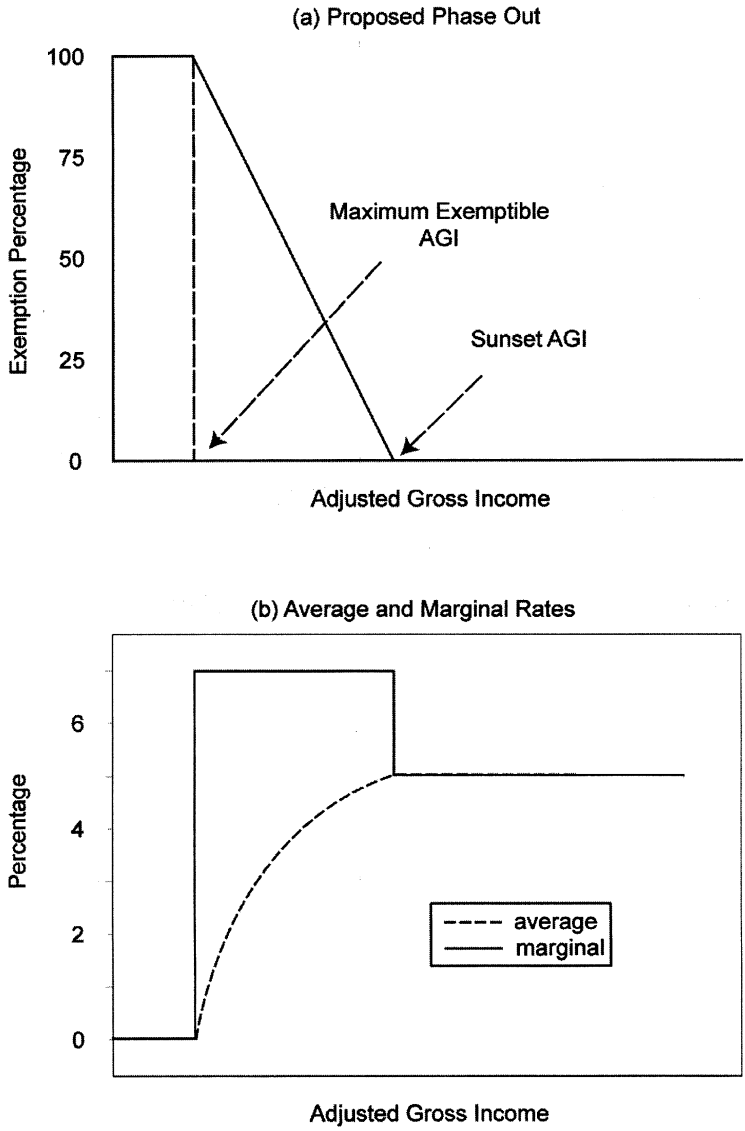
Alternative Rates

The rate structure for personal income taxes involves significant complexity. Its variety ranges from the simplicity of the flat tax proposed by Hall and Rabushka (1995) to the variety of marginal effective rates documented for the federal income tax in *Simple, Fair, and Pro-Growth: Proposals*

to Fix American's Tax System (2005). In the case of a variety of tax brackets and marginal rates, the effect of rates on the overall variance of revenue can become sufficiently complex to require simulations in order to ascertain their influence.

Some policy makers fail to connect deductions, exemptions, and phase outs with changes in effective tax rates. As an illustration, consider that a widely recognized problem with the flat tax is its impact on lower-income citizens. In order to provide relief to these taxpayers, deductions and exemptions are often proposed to protect them from any tax liability. These deductions are then phased out for more affluent taxpayers. In Utah, for example, a proposed phase out of exemptions under one tax reform proposal is shown in Figure 5. The

Figure 5: **Utah Personal Income Tax Proposal, Exemption Phase Out**



objective of the phase out is to exempt low income citizens according to a base household amount and the number of exemptions claimed on federal income tax forms. The level of AGI that is excused from taxation acts to totally protect all taxpayers whose AGI is below the maximum exemptible amount shown in the diagram. This proposal then diminishes the percentage of the exemptible AGI that can be deducted over a range of income as shown in the graph. At the sunset level of AGI, all income is taxed at a flat rate.

Although the Utah proposal is billed as a flat tax, the exemption of AGI alters both the marginal and average tax rates for any taxpayer in the range between the maximum exemptible income and the sunset level of AGI. For incomes up to the maximum exemptible income, their average and marginal rates are both zero. With a flat rate of 5 percent, the diagram shows that as the phase-out begins, the marginal rate immediately jumps to a higher level. The average tax rate depicted as the dashed line in the middle of the graph gradually climbs to the 5 percent level when the phase out completes at the sunset level of AGI. This diagram shows a very interesting tradeoff between the lower average rate and higher marginal rate and emphasizes that the flatness of the tax only applies to those with incomes which lie outside the phase-out range.

Simulations of Alternative Tax Structures

Five different combinations of taxable income and tax rates allow investigation of their effects on the volatility of income tax revenue. The results of the simulation rank these combinations in order of increasing volatility as follows:

1. A flat rate imposed on taxable AGI
2. A flat rate imposed on current taxable income
3. A flat rate applied to AGI with phased out exemptions
4. Current graduated rates and tax brackets applied to current taxable income
5. Current graduated rates and expanded tax brackets imposed on current taxable income.

The simulations use data from Utah individual income tax returns. Rather than looking at the variance of a time series, AGI is arbitrarily varied between 75 percent and 125 percent for each individual's 2004 tax-year situation. As would be expected, the percentage changes in AGI and taxable AGI are almost identical. This gives the benchmark against which alternative combinations of taxable income and rates can be compared.

Now consider the other two taxable income definitions. In the case of Utah's current code, exemptions do not vary with changes in AGI. This is appropriate because exemption values are only dependent on the number and value of exemptions and don't change within a given tax year. Mortgage interest deductions don't change either since they are not dependent on AGI. All other deductions, however, are allowed to change proportionately to changes in AGI. Similarly, federal income tax deductions also vary with AGI.

Flat Tax

State income tax reform efforts often consider Hall and Rabushka's (1995) flat tax proposal. Simulation results help determine whether the rates or taxable income definitions dominate in the variance of revenue. Two different flat rate alternatives are simulated that would generate identical revenue to that forthcoming from applying the existing marginal rates and brackets to the income reported on 2004 Utah returns. The first option assesses AGI at the flat rate of approximately 4.1 percent for all taxpayers. Alternatively, taxpayers could be allowed all the reductions available in the current definition of taxable income and pay at a 6.5 percent rate. The flat tax rate of 4.1 percent simply alters all values of AGI proportionately. The 6.5 percent flat rate similarly alters taxable income. The comparison of the volatilities clearly shows that the definition of taxable income almost entirely explains the difference in volatility.

Bracket Effects

Potentially, graduated marginal tax brackets should influence the volatility of income tax revenue. As income increases in an expansion, it moves a larger and larger portion of taxable income into brackets that have higher marginal rates. Therefore, higher AGI should produce even higher levels of tax revenue. Similarly, declining AGI in a contracting economy should cause even greater declines in tax revenue. One would expect that numerous income brackets with divergent rates would increase the volatility of income tax receipts.

Simulations allow comparison of three different sets of brackets. The experimental design uses the current definition of taxable income in order to facilitate the comparison of rates. The baseline comparison calculates taxes using the flat rate of 6.5 percent applied to current taxable income as described earlier. The second uses the current brackets and rates. Because in Utah neither the current brackets nor rates have been updated for years, the status quo system almost qualifies as a flat tax. For example, all income over $4,313 for those filing in either the single or married filing separately categories is taxed at a 7 percent rate. Those in the married filing jointly or head of household categories pay 7 percent on all income above $8,626. A very high percentage of taxpayers and their incomes are in the highest tax bracket. Finally, the third comparison expands the current brackets by a factor of four and uses the same tax rates specified in the present tax code.

Simulations confirm that multiple brackets and tax rates do increase the volatility of tax receipts. The flat nature of the current brackets translates into a volatility which is not too different from the flat rate. Finally, multiplying all of the brackets by a factor of four gives a much more volatile revenue stream.

Phase Outs

Even though the final comparison of rates contrasts two different definitions of taxable income, it really does focus on rates. The definition of taxable income explained in Figure 5 means that all taxpayers with income less than maximum exemptible AGI have no tax liability. Those with income between maximum exemptible and the sunset level of AGI are taxed at a higher marginal rate than those whose income exceeds the sunset value. In summary, this means that the phase-out structure assesses income at three different marginal rates and those caught in the phase-out range pay the highest marginal rate.

Consider what happens as income increases for those in the phase-out range. Every time one of these taxpayers earns an extra dollar, their tax liability increases by the flat rate. However, this also reduces the value of their exemption. This means that as incomes increase, tax revenues increase even faster than income and this once again increases volatility. Just the opposite is true when income decreases. Taxable income goes down but the value of the exemption goes up. In addition to this effect that occurs for those in the phase-out zone, increasing and decreasing incomes cause taxpayers to migrate in and out of the exempt and full flat tax categories. This gives an increase in volatility in comparison to a pure flat tax based on AGI without any exemptions.

SUMMARY AND CONCLUSIONS

Both the recent plunge and subsequent recovery in personal income tax receipts at the state level have challenged government policy makers. Comparisons of individual states against the national norm show that although the individual income tax revenue streams generated in each state share some patterns, each state has unique characteristics and reacts differently to the national business cycle. This invites the question of why state tax codes generate such a variety of volatility reactions.

Consideration of the variance of tax revenues shows that the variance of taxable income and the tax rate structure jointly influence personal income tax volatility. Looking further into the definition of taxable income reveals that tax revenue volatility depends on the variance of AGI, the variance of exemptions, the variance of deductions, and their respective correlations.

Among the ingredient categories that constitute AGI, wages and salaries dominate. Income reported on Schedules C, D, E, and F also plays an important although lesser role. Because of its extreme volatility, capital gains/losses contribute significantly to variation in AGI even though its weight in the portfolio of income sources only reaches approximately 5 percent. Exemptions don't vary significantly with the business cycle and therefore don't affect volatility very much. Deductions such as charitable contributions can follow the business cycle. Others, such as mortgage interest have significant other fluctuations explainable by interest rates and mortgage refinancing that deviate from the ups and downs of the business cycle.

An appropriate experimental design allows simulations to generate insights about the influence of tax rates on income tax volatility. It also fosters understanding of the interaction between taxable income and tax rates. Comparison of alternative definitions of taxable income generates the conclusion that exemptions, deductions, and phase outs all can increase revenue volatility. Comparing flat tax proposals confirms the prior expectation that variation in revenues when comparing flat tax rates

occurs almost entirely because of the definition of taxable income. Graduated marginal tax rates for bracketed income also increase income tax volatility. The same conclusion of increased volatility holds true for the multiplicity of implicit rates that arise when exemptions and deductions are phased out for higher-income taxpayers.

Because individual income taxes provide such an important revenue source for government financing at both the federal and subnational levels, it is very critical to understand the characteristics of this tax. Knowledge about the volatility of individual income tax revenues can help improve forecasting and the associated budgeting.

References

Bruce, Donald, William F. Fox, and Markland H. Tuttle. Tax Base Elasticities: A Multi-State Analysis of Long-Run and Short-Run Dynamics. *Southern Economic Journal* 73 (2006): 315-341.

Brunori, David. *State Tax Policy: A Political Perspective*. Washington, D.C.: The Urban Institute Press, 2001.

Dye, Richard F. and Therese J. McGuire. Growth and Variability of State Individual Income and General Sales Taxes. *National Tax Journal* 44 (March 1991): 55-66.

Hall, Robert E. and Alvin Rabushka. *The Flat Tax*. Stanford, California: Hoover Institution Press, 1995.

Holcombe, Randall G. and Russell S. Sobel. *Growth and Variability in State Tax Revenue: An Anatomy of State Fiscal Crises*. Westport, Connecticut: Greenwood Press, 1997.

National Conference of State Legislatures (NCLS). *Principles of a High-Quality State Revenue System*. 2nd ed. Washington, D.C.: NCSL, 1992.

President's Advisory Panel on Federal Tax Reform. *Simple, Fair, and Pro-Growth: Proposals to Fix America's Tax System*. Washington, D.C., 2005.

Slemrod, Joel. Optimal Taxation and Optimal Tax Systems. *Journal of Economic Perspectives* 4 (Winter 1990): 157-178.

Slemrod, Joel and Jon Bakija. *Taxing Ourselves: A Citizen's Guide to the Debate over Taxes*. 3rd ed. Cambridge, Massachusetts: MIT Press, 2004.

Steuerle, C. Eugene. *Contemporary U.S. Tax Policy*. Washington, D.C.: The Urban Institute Press, 2004.