JOINT REVENUE VOLATILITY REPORT

THE GOVERNOR'S OFFICE OF PLANNING AND BUDGET

DECEMBER 2011

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Purpose

During the 2008 General Legislative Session, House Bill 49 Budget Reserve Account and Disaster Recovery Account Amendments, modified policy related to Budget Reserve Accounts or "Rainy Day Funds" in three main ways: (1) automatic transfers of revenue surpluses were capped at 6% of General Fund appropriations and 7% of Education Fund appropriations without restricting the Legislature from appropriating additional funds into such accounts; (2) clarified that these funds could only be used in the fiscal year in which appropriations exceeded estimated revenues, paid for settlements, or paid for retroactive tax refunds; (3) required this joint revenue volatility report starting in 2011 and every three years thereafter.

Outline

According to the Budgetary Procedures Act (63J-1-205), this report will present: (1) a discussion of the tax base and the tax revenue volatility of the revenue streams that provide the source of funding for the state budget; (2) the historical balances in the Budget Reserve Accounts; (3) an analysis of the adequacy of the balances of the Budget Reserve Accounts in relation to the volatility of the revenue streams.

There are six sections in this report: **1 Introduction** provides the policy framework or context regarding revenue volatility as it relates to the state budget process; **2 State Budget** describes the various sources of funding that exist to fund the Utah State budget; **3 Tax Base** shows how the economy and the tax system are related and interact to generate revenue; **4 Tax Revenue Volatility** analyzes the sources that contribute to volatility and quantifies the magnitude of these effects; **5 Policy Adequacy** compares competing policy objectives relative to Utah's revenue volatility and a hypothesized optimal Budget Reserve Account; **6 Conclusion** summarizes the main points presented in this report.

1 Introduction

The revenues the State of Utah collects can change quickly. For example, in the 2008 General Legislative Session, Fiscal Year 2009 free revenue was initially expected to reach $5,313.6 million but actual collections only reached $4,567.4 million, only 86% of initial expected revenues, a difference of $746.2 million. However, dramatic swings are not always shortfalls. In Fiscal Year 2006, free revenue grew 19.1% in one year. This report analyzes the size of swings in Utah's revenue collections in relation to rainy day fund balances and other budget tools that help manage revenue volatility.

In Utah, state government expenditures cannot exceed forecast revenue collections. Volatile revenues make predicting future revenue collections difficult. This directly impacts plans for future spending. Various mechanisms exist to absorb, mitigate, or defer the impacts of revenue volatility, these include: designing robust systems of taxation; conservatively forecasting revenue; saving funds in reserve for unexpected shocks; shifting the timing of collections or expenditures; restructuring or expanding debt; providing different levels of public goods and services; raising or cutting taxes or fees to balance the unexpected changes in revenue; or transferring the volatility to other units of government.

2 State Budget

Within the United States, state governments organize their own systems of public finance. There is great diversity in the mixture of the source of funding both among and within states. Some states centralize control over revenue collections, while others allow political subdivisions relative autonomy in setting tax or fee policy. Approximately 10 states control over 60% of direct state and local expenditures, with Hawaii controlling 77%. Approximately 10 states control less than 40% of direct expenditures, with Florida controlling 36%. In FY2009, the federal government transferred $536 billion to state and local governments, 90% went to states while 10% was transferred directly to local governments. State govern-

2 State Budget - *continued*

ments transferred $471 billion to local governments. Local governments transferred $20 billion to state governments. As of 2009, there were nearly 90,000 state and local governments in the United States that spent roughly $2 trillion, representing roughly 14% of the economy. Of this spending: 29% was on Education; 22% on Social Services; 14% on Public Safety and the Environment; 13% on Transportation and Utilities; 9% on Insurance Trusts (eg, pensions, unemployment compensation); 4% on Administration; and 4% on Interest on Debts. These governments had $2.7 trillion in outstanding debt and held $4.7 trillion in cash and securities. The way public finance is structured directly affects the revenue volatility of governments; tax policy also shapes the economies of the various states.

According to the U.S. Census Bureau, 2009 Annual Survey of State and Local Government Finances, governments in Utah maintained almost $19 billion in funds to use for public purposes in Fiscal Year 2009. Slightly over half of this amount, 52% was sourced to the State with the remaining revenue being source to Locals.

Table 1 - Utah Revenue Sources, Fiscal Year 2009

	millions and share of total revenue					
	Utah		**State**		**Local**	
Taxes	8,729	47%	5,423	56%	3,306	37%
Sales	3,296	18%	2,398	25%	898	10%
Property	2,323	12%	0	0%	2,323	26%
Individual Income	2,320	12%	2,320	24%	0	0%
Corporate Income	246	1%	246	3%	0	0%
Other	544	3%	459	5%	85	1%
Charges	5,630	30%	3,561	37%	2,070	23%
Education	1,295	7%	1,209	12%	86	1%
Hospitals	1,120	6%	1,070	11%	50	1%
Other Miscellaneous	1,044	6%	671	7%	373	4%
Interest, Sales, etc.	705	4%	361	4%	344	4%
Other Charges	651	3%	153	2%	498	6%
Waste	464	2%	7	0%	456	5%
Transportation	235	1%	71	1%	164	2%
Resources, Parks, etc.	117	1%	20	0%	98	1%
Net Transfers	4,329	23%	768	8%	3,561	40%
from Federal	4,329	23%	3,849	39%	480	5%
from State			-3,086	-32%	3,086	35%
from Local			5	0%	-5	0%
Revenues	18,688	100%	9,752	100%	8,937	100%

Source: U.S. Census Bureau, calculations GOPB

The revenue streams available for funding budgets are grouped into three main categories: Taxes, Charges, and Transfers. As a whole, Utah collected 47% of revenue from taxes with sales tax the largest category at 18% of total revenue; the property tax and income taxes were 12% and 13%, and other taxes 3%. Charges represented 30% of revenue, the largest category being tuition from higher education at 7% of all revenue. Utah collected 23% of all revenue from federal transfers. These figures are similar to the nation as a whole, with slightly less reliance on taxes, more on charges, and average federal support.

The stream of revenue for the State show collections of: $5.4 billion in taxes, 56% of total; $3.6 billion in charges, 37% of total; $3.8 billion in transfers from the federal government (roughly half is for health programs), 39% of total; $3.1 billion in transfers to local governments (largely to school districts). Table 1 shows that the State relies on sales and income taxes for roughly 90% of tax revenue. The Census Bureau separates general from selective sales taxes, which includes taxes on motor fuel, alcoholic beverages, tobacco products, public utilities, insurance premiums, and gross receipts. For the State, the general sales tax is almost 75% of all sales taxes; just over half of the selective sales tax is the motor fuel tax. Within Local governments: cities, counties, and transit districts depend on sales tax, the property tax, and charges; school districts depend on the property tax and indirectly on the income tax through transfers from the State.

The purpose of this report is to investigate the volatility of tax revenue as one of the sources of funding for the state budget. It will not review the volatility of charges or transfers which represent a significant share of the funding resources within Utah government. There are differences between free revenue available for the General and Education Funds ($4.6 billion FY2009), and all taxes under investigation within this report. The Transportation Fund collects significant taxes and there are many taxes that flow to restricted accounts. Roughly half of the resources used to fund the Utah State budget, and the important public goods and services it represents, are derived through taxation.

3 Tax Base

A tax is a compulsory charge, usually levied relative to some type of economic activity. The tax base is a share of this activity, encompassing: the wages people earn, the profits businesses make, or the purchases of goods or services. A tax base may be value or unit based; the property tax is generally a percentage of the value of a property, while most fuel taxes are based on the number of gallons purchased.

Table 2 - Utah Economic Growth and Volatility

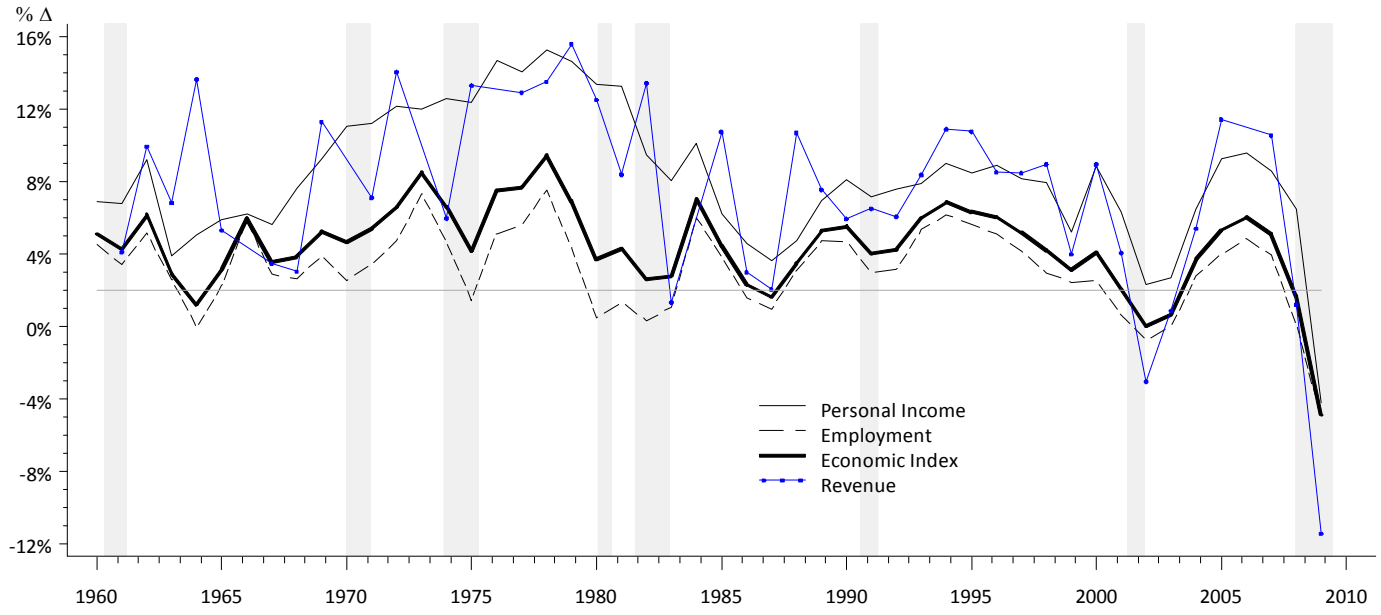
	Employment		Personal Income		Economic Index		Tax Revenue	
Decade	Mean	σ	Mean	σ	Mean	σ	Mean	σ
1960	3.3%	0.017	6.6%	0.017	4.1%	0.015	10.3%	0.077
1970	4.7%	0.019	13.0%	0.015	6.8%	0.017	14.7%	0.059
1980	2.3%	0.020	8.0%	0.035	3.8%	0.016	9.6%	0.074
1990	4.3%	0.013	7.8%	0.011	5.2%	0.012	7.8%	0.022
2000	1.3%	0.030	5.6%	0.043	2.4%	0.033	4.6%	0.083
1960-09	3.2%	0.023	8.2%	0.037	4.4%	0.024	9.4%	0.072

Taxes affect economic activity, whether directly or indirectly by changing taxpayer incentives. A tax on wages may influence people to work less. Taxing pollution may alter how much energy people want to consume. The design of a system of taxation attempts to balance these economic efficiency impacts with other priorities (eg, fairness, sufficiency, simplicity, transparency). There is no perfect tax system because people disagree about the tradeoffs among competing priorities. However, some tax systems are better than others at accomplishing a given mix of policy priorities. A tax system with a broad base and low rates may yield a desirable mix of efficiency, equity, and stability; but it may not be desirable if the tradeoff is sacrificing growth that could impair future revenue sufficiency.

Analysis of a tax base reveals the principal source of volatility in revenue derived from taxes. Constructing a broad economic baseline allows comparison of individual tax bases and will also allow a standard measure against which to compare the volatility of revenues. The Utah Economic Index was constructed as a weighted average of the growth in personal income and employment from 1960 to present from the Bureau of Economic Analysis.

The index aligns well with the Philadelphia Federal Reserve's Utah coincident index from 1984 to present, but with lower growth in expansions and less severe contractions in recessions. The measure shows average economic growth of 4.4% for Utah since 1960. It shows mixed growth in the 1960s, robust if uneven growth in the 1970s, modest, but mixed growth in the 1980s, a strong boom in the 1990s, and a weak 2000s with strong mid-decade growth bookended with recessions. As measured by the standard deviation (σ) in the growth rates, economic volatility was about the same in the 1960s, 1970s, and 1980s. Economic growth in the 1990s were less volatile with a standard deviation of about 75% of the prior periods. Economic volatility in the 2000s increased dramatically, nearly double that from the prior periods, caused largely by the Great Recession.

Figure 1 - Utah Economic and Revenue Growth



3 Tax Base - *continued*

Some economic activity is highly variable. Figure 2 below presents the distribution of the growth in eight major tax bases since 1960. Table 3 shows the correlation of the various bases with the economic index and reports the standard deviation of the growth rates.

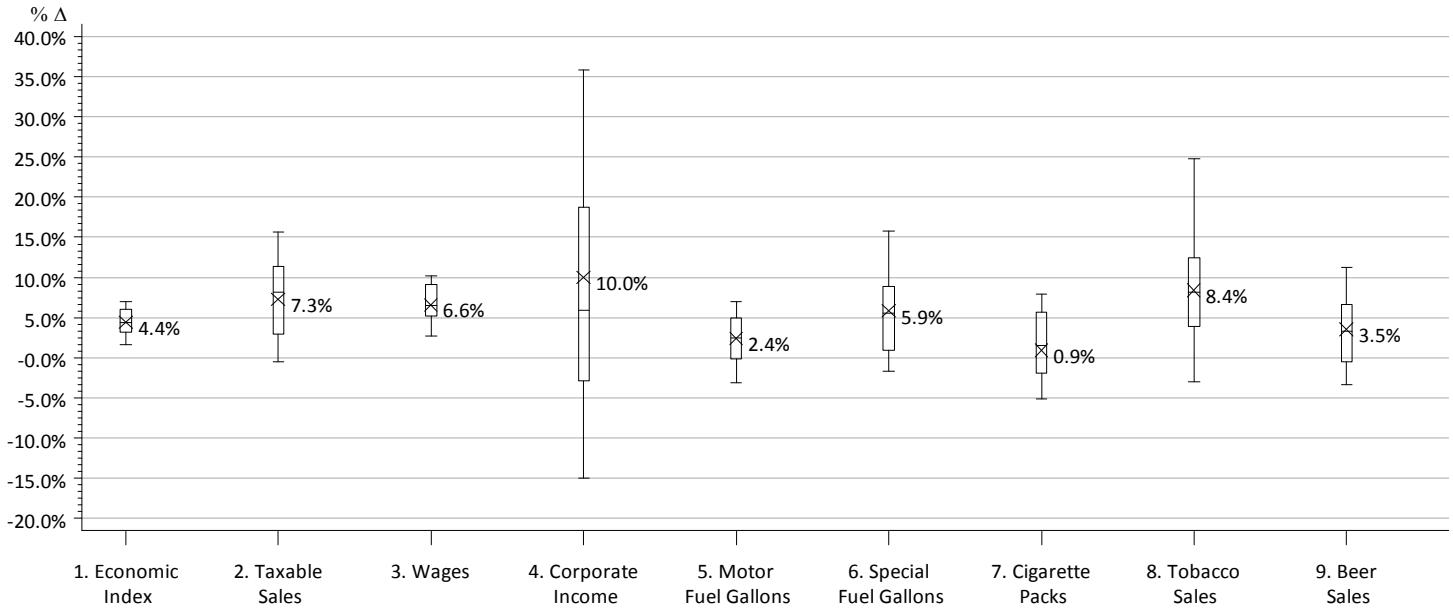
Table 3 - Correlation and Volatility

Tax Base	R	σ
1. Economic Index	1.00	0.024
2. Taxable Sales	0.66	0.069
3. Wages	0.72	0.031
4. Corporate Income	0.58	0.246
5. Motor Fuel Gallons	0.51	0.036
6. Special Fuel Gallons	0.39	0.085
7. Cigarette Packs	0.23	0.080
8. Tobacco Sales	-0.01	0.090
9. Beer Sales	0.04	0.077

All of the tax bases exhibit a wider distribution of growth rates than the economic index, most have higher average growth. The box plots show that corporate income is by far the most volatile tax base with a standard deviation an order of magnitude larger than the others. Regarding corporate income growth rates, there were 16 years in which corporate income fell, and another 16 years in which it grew by more than 15%. The interquartile range spans from almost 20% to slightly negative with average growth of 10% but a median growth rate of just over 5%. The most stable tax base is wages, with average growth of 6.6%. The amount of motor fuel sold is also very stable, but it is one of the slowest growing with average growth of 2.4%. The slowest growing tax base is the number of cigarette packs sold in the state, explained by changing patterns of consumption over this time period. Both tobacco and beer sales growth are not correlated with economic growth. The growth in taxable sales and wages are most correlated with economic growth, while movements in corporate income and special fuel use have a weaker relationship with the broader economy.

Each tax base has a corresponding structure by which it is taxed. This can depend on the geographical location of the economic activity as is the case with the sales tax, or the attributes of a taxpayer (eg, amount of income or marital status) in the case of the income tax. The tax base for the individual income tax is roughly 75% wages, with the remaining 25% associated with the amount of capital gains or small business profits. The volatility in the overall tax base for income taxes is somewhere between the stable growth of wages and the highly volatile growth in corporate income (a proxy for capital gains and small business profits). Some tax structures are dependent on the price of a commodity or the nature of production, as is the case with Utah's severance taxes, with rates or exemptions dependent on conditions. A tax base can be affected by the rules of the tax system in measuring the base independent of the actual activity. Expanding or narrowing a tax base can occur by eliminating or adding deductions or exemptions that change the basis upon which tax rates are applied. As such, altering the tax base is itself a contributing factor to volatility. Policy changes can contribute significantly to the measured volatility of a tax base.

Figure 2 - Tax Base Growth Distributions 1960-2009



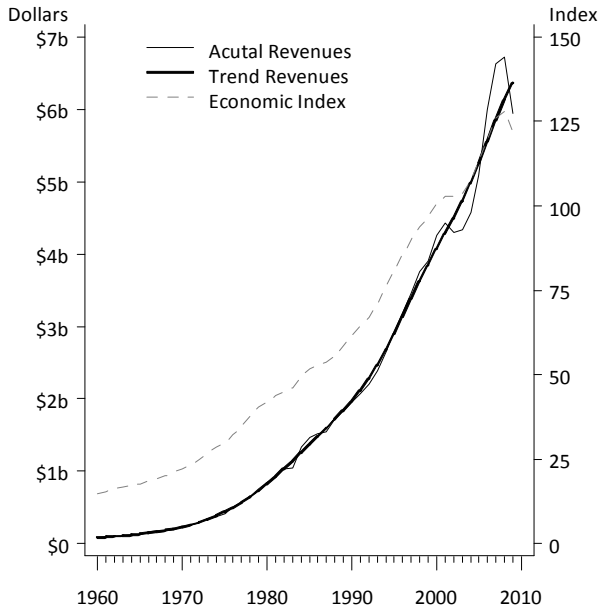
4 Tax Revenue Volatility

There are three sources of tax revenue volatility:

(1) changes in economic activity which affect a tax base;
(2) the interaction of the tax base and rate structure;
(3) policy changes which modify the tax system.

Revenue has grown faster, contracted more steeply, and been more volatile than the economy. As figure 1 and figure 3 show, revenues in Utah have grown quickly over the last 50 years. Revenue appears to grow as quickly as personal income, but is more volatile. The average growth in the economic index has been 4.4% compared with growth of 9.4% in tax revenue. The dispersion of growth is much wider for total taxes, with 30 out of the 50 years having growth of between 5% and 15% as shown in figure 4. There were 8 years with growth exceeding 15%, half of which had growth exceeding 20%. There were 2 years with revenue declines, and 10 years had growth between 0% and 5%.

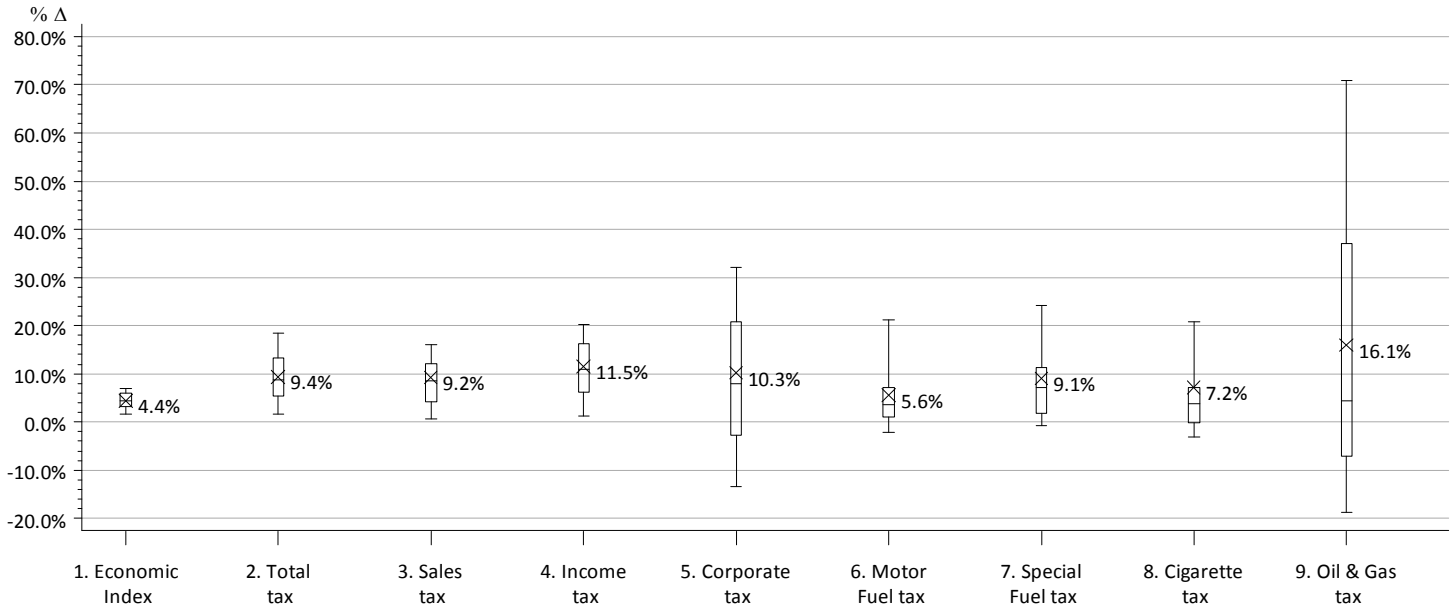
Figure 3 - Utah Revenues and Economic Index



The sales tax grew about as quickly as total tax at 9.2%, almost matching the distribution of total tax. The average growth in individual income tax was 11.5%, but had more variability than the sales tax. The corporate tax averaged 10.3%, less than individual income tax, but had one of the widest distribution of growth rates. Corporate tax declined in 1 out of every 4 years, and had some of the steepest one year losses of any taxes. The fuel taxes had average growth below that of all taxes, with narrow distributions, but did have significant rates of growth in years in which rates were changed. The cigarette tax also had lower average growth at 7.2%, with a relatively tight interquartile range, but also had significant growth in years in which tax policy changed. The most volatile tax was the oil and gas severance tax, with the highest average growth at 16.1%, but the median growth was around 5%.

The principal driver of changes in total tax revenue for the state of Utah is movements in the individual income, sales, and corporate taxes. At the beginning of the 1960s: income tax was 25% of total but has now moved to 40%; the sales tax moved from 30% to about 40% mid period before falling to again to be about 30% of total; the corporate tax has moved between 7% and 3% throughout the period; all other tax revenue has moved from 40% of total revenue to about 25% in this time frame, largely due to decreasing reliance on fuel taxes which moved from 25% to about 5% of total.

Figure 4 - Tax Revenue Growth Distributions 1960-2009



4 Tax Revenue Volatility - *continued*

The correlation of growth in the economic index and various taxes are presented in table 4 along with the respective standard deviations. Total tax is more correlated with the index than any particular tax, it is also the most stable with a standard deviation 85% that of the sales tax, 64% of income tax, and 30% of the corporate tax. The growth in the major taxes are roughly as correlated with the economic index as the respective tax bases. The fuel taxes are only weakly correlated with economic growth, and are roughly as volatile as the major taxes. Growth in cigarette taxes are negatively correlated with economic growth, this may be explained by the timing of the rate increases on these products. The growth in severance taxes are not correlated with economic growth and are very volatile, almost double the volatility of the next most volatile corporate tax.

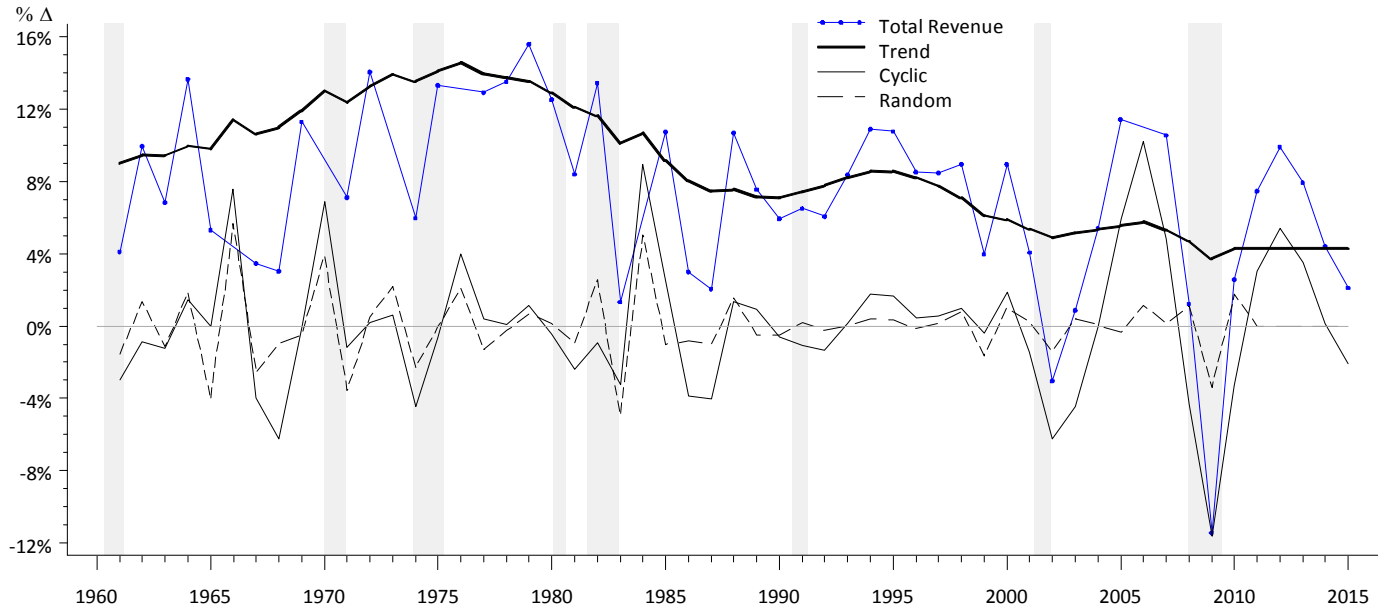
Table 4 - Correlation and Volatility

Tax	R	σ
1. Economic Index	1.00	0.024
2. Total tax	0.69	0.072
3. Sales tax	0.58	0.084
4. Income tax	0.50	0.112
5. Corporate tax	0.55	0.233
6. Motor Fuel tax	0.18	0.085
7. Special Fuel tax	0.28	0.116
8. Cigarette tax	-0.19	0.141
9. Oil & Gas tax	0.05	0.438

The growth in tax revenues can be separated into three principal components: a trend, cyclical movement around the trend, and a random term. As figure 5 shows, the trend component of tax revenue growth over this period has fallen. In the 1960s and 1970s, trend growth was above 10%, in the 1980s it started to decline, then bounced around 8% in the 1990s, before leveling around 4% in the 2000s. The contribution of cyclic growth was pronounced in the 1960s and 1970s, then appears to dampen into the 1980s. The cyclic component of revenue swings generally occurs with national recessions, with a few notable exceptions. In the mid 1960s and again in the late 1980s, Utah experienced economic difficulty that was not linked to a broader national downturn. The 1990s was a muted period for the cyclic component, before spiking with the recession in early 2000. The recent boom and bust cycles appear more pronounced and longer lasting than those from the 1960s and 1970s.

The unobserved component model used to decompose the volatility of the revenue streams also produces a forecast of future revenue and its volatility. The model shows that volatility, as measured by the respective standard deviations of the component parts, has recently increased 10% for total collections, the cyclic component increased 44%, and the random component increased 17%. Applying the random component volatility measure using portfolio theory can show how diversification of the tax portfolio can reduce revenue volatility. Applying the cyclic component volatility measure using hedging strategy can show how large rainy day funds need to be or how much insurance to purchase as a hedge against cyclic changes. These changes in volatility have limited implications for evaluating the effectiveness of the strategies to adapt to revenue volatility, because these *ex post* measurements may not be predictive of future conditions.

Figure 5 - Decomposition of Utah Revenue Growth



4 Tax Revenue Volatility - *continued*

An important aspect of analyzing the volatility of tax revenue is the relationship between the volatility of a revenue stream, and its likely impact on overall revenue collections. Table 5 shows the current size and share of the various revenue streams. In order to analyze this relationship, the rolling five year standard deviation of the growth in Individual Income, Sales, and Corporate Income taxes were weighted by their respective share of total tax revenue. This provides a measure of both the volatility of a tax source, and its relative importance to overall collections. Figure 6 shows the change in this measure over time. The large spikes in Individual Income and Sales tax weighted volatility are consistent with rate increases in the years in question. In general, weighted volatility was decreasing from the mid-1980s through the 2000s. However, beginning in the early 2000's the weighted volatility of the income tax began to increase. Corporate tax increased mid-decade, but exhibited no more extra volatility with the most recent recession. The other taxes experienced much more volatility along with the most recent recession. Individual Income tax and Sales tax have recently been the most volatile when weighted by their share of total tax revenues.

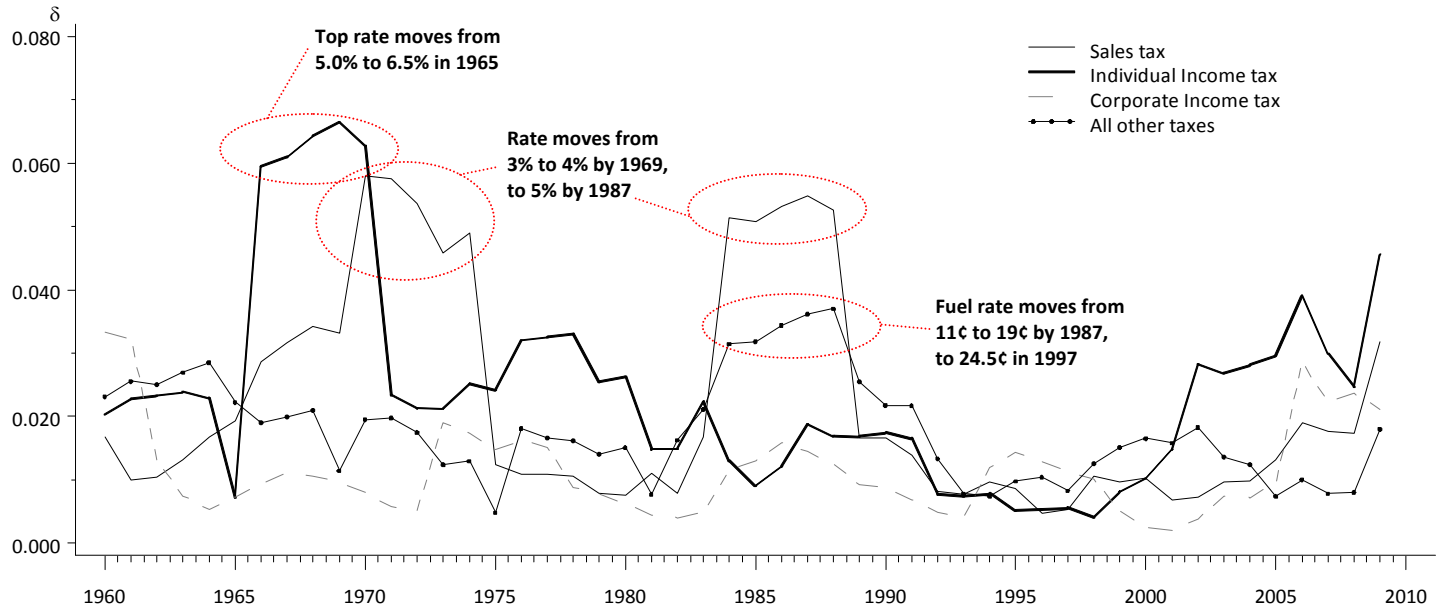
Table 5 - Utah Tax Revenues FY2011

Fund	Source	FY2011	
EF	Individual Income Tax	2,298,175	43.5%
GF, RF	Sales and Use Tax	1,790,566	33.9%
EF	Corporate Tax	260,739	4.9%
TF	Motor Fuel Tax	252,501	4.8%
	Other	176,191	3.3%
GF	Beer, Cigarette, and Tobacco	125,497	2.4%
TF	Special Fuel Tax	102,183	1.9%
GF	Insurance Premiums	75,892	1.4%
GF	Liquor Profits	62,314	1.2%
GF	Oil and Gas Severance Tax	59,855	1.1%
GF	Metal Severance Tax	27,118	0.5%
EF	Mineral Production	26,692	0.5%
GF	Cable/Satellite Excise Tax	25,362	0.5%
EF	Education Fund	2,612,243	49.4%
GF	General Fund	2,046,263	38.7%
TF	Transportation Fund	435,413	8.2%
	All Funds	**5,283,085**	

5 Policy Adequacy

In this framework, the calculations for an optimal sized budget reserve account depend on the preferences of policymakers. Intuitively, if revenues are volatile but there is desire for expenditures to grow consistently over a business cycle, then it may be possible to save excess boom time revenue to ensure there is sufficient savings during the busts. It is not clear that this is the policy objective policymakers prefer. During boom periods, there may be significant pressure to enhance public goods and services to support the growing economy (eg, more roads, expanded universities). During the busts, pressure to cut public expenditures to balance budgets may act as an efficiency enhancing mechanism. Whether a rainy day fund is adequate, or large enough, depends on the intended use of budget reserve funds.

Figure 6 - Moving 5 Year Standard Deviations Weighted by Share of Revenue



5 Policy Adequacy - *continued*

If the intent of the Budget Reserve Accounts is to hedge against current year revenue forecast errors (ie, the final revenue forecast made 4 months before the fiscal year closes), the largest such negative errors were 1.4% and 1.3% during the last two recessions. If the policy intent is to cover unexpected revenue declines in the next budget year, then the largest negative revenue forecast error was 11.3% for the General Fund (GF) and 14.2% for the Education Fund (EF)—expensive insurance indeed. The revealed preference of policymakers shows that even with such massive changes in expectations, it was preferable to hold some insurance in reserve and not draw reserve balances to zero as was nearly done during the 2002 recession. Reserves were partially drawn on in FY2009, but the share of reserves increased because appropriations were dramatically reduced. In FY2010, reserves were drawn on more heavily, 2.9% GF and 4.2% EF, but left balances of 5.7% GF and 4.0% EF.

The academic literature that proposes optimal rainy day fund balances is also often paired with rules restraining spending during booms. Utah maintains similar spending restraints, with the State Appropriations and Tax Limitation Act, but exempts more than half of General and Education Fund Appropriations. Also, some policymakers may prefer to face more risk rather than have government hold substantial savings to self-insure against the relative volatility of revenue.

The adequacy of the Budget Reserve Accounts in relation to the volatility of Utah's revenue streams is dependent on the nature of the policy objectives being optimized. If current year revenue shortfalls are the sole intent, 6% GF and 7% EF reserves are more than adequate. In using reserves over longer periods to dampen the effects of austerity from economic shocks, optimality depends on policymakers' intent.

Table 6 - Budget Reserves and Revenue Forecast Errors

	Reserves		Forecast Error	
	General & Education		General & Education	
Year	millions	percent	4 months	16 months
1987	20.0	1.6%	3.8%	
1988	43.9	3.2%	7.8%	3.0%
1989	47.9	3.2%	6.1%	4.4%
1990	52.6	3.2%	4.1%	2.5%
1991	56.7	3.3%	1.0%	0.4%
1992	58.3	3.1%	0.7%	1.5%
1993	31.7	1.6%	1.0%	1.9%
1994	41.7	1.9%	2.4%	5.5%
1995	65.6	2.8%	3.1%	3.9%
1996	71.5	2.7%	-0.1%	2.9%
1997	78.9	2.6%	1.4%	2.5%
1998	88.5	2.9%	2.0%	0.6%
1999	94.7	2.9%	0.4%	-1.9%
2000	108.7	3.2%	3.9%	4.9%
2001	120.3	3.2%	-1.4%	0.0%
2002	19.5	0.5%	0.3%	-9.1%

	General		Education		General		Education	
					4	16	4	16
2003	26.5	1.4%	0.6	0.0%	2.2%	2.0%	0.4%	-3.9%
2004	53.6	3.1%	13.3	0.7%	2.4%	2.2%	3.0%	3.3%
2005	105.6	5.6%	40.5	1.9%	3.5%	6.8%	5.7%	9.6%
2006	131.6	6.5%	123.4	5.6%	5.4%	11.7%	13.3%	18.6%
2007	170.6	8.9%	142.8	5.1%	3.5%	9.0%	6.7%	7.1%
2008	194.3	8.0%	234.7	6.7%	-1.3%	-2.1%	-1.7%	-3.8%
2009	188.9	8.6%	230.0	8.2%	0.8%	-11.3%	0.5%	-14.2%
2010	105.0	5.7%	104.8	4.0%	0.9%	-3.6%	-1.7%	-5.5%
2011	122.5	5.9%	110.0	4.1%	2.4%	11.9%	2.4%	4.9%

6 Conclusion

Utah tax revenue exhibits greater volatility than the economy at large. This volatility is influenced by changes in economic activity which affect the tax base, the interaction of the tax base and rate structure, and policy changes which modify the tax system. Of the major tax bases (ie, wages, taxable sales, corporate income), corporate income has the highest degree of volatility. The most stable tax base is taxable sales. While actual tax collections on corporate income are generally most volatile, they did not exhibit increased volatility during the recent recession. When weighted by their share of total tax revenue, taxes on individual income and sales have recently been the most volatile revenue sources.

If the intent of Utah's Budget Reserve Accounts is to cover losses from errors in the revenue forecast for the current budget, then the existing policy of capping reserves at 6% of General Fund Appropriations and 7% of Education Fund Appropriations is more than adequate. If the intent of these rainy day funds is to reduce the severity of budget cuts over multiple years, then optimal reserve size depends on the extent to which policymakers want to insulate spending priorities from economic downturns.