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Indexing of State Tax Collection Variability

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Abstract: Over the years researchers have performed several studies on the various states tax regimes and its stability. From time to time states face large budget shortfalls and have to scramble in order to cut expenditures or issue bonds to cover the shortage. One of the complications that states face is that not all taxes respond with equal variability to economic conditions. Additionally, economic factors influence some states greater than others. Choosing the particular tax mix that a state uses is a political decision that is influenced by a number of factors that include of historic, regional and economic issues. It is not a foregone conclusion that politicians would necessarily want an entirely stable tax regime, it is entirely possible that they could wish for a lighter tax burden when economic times are difficult, or conversely they could look for taxes that may be inversely correlated since the state would need to provide more services for their constituents. This study does a statistical analysis of the various taxes that states use and to create an index similar to the concept of Beta that is used in investing to show the degree of variability that different taxation methods generate. Six years of data was analyzed to provide the rate of change in collections of four major classes of tax; sales and use, individual income tax, corporate income and franchise tax, and natural resources) from 44 states in order to determine the volatility of that source of income. The results of this study show that sales and personal income taxes are relatively stable while resource and corporate taxes show high fluctuations relative to overall collections.

Key words: State Taxes; tax variability; tax stability
JEL codes: H2, M4

1. Introduction

We are in an era where several states are experiencing large budget gaps between forecasted revenue and actual collections. Notably among these is California which is currently experiencing a 22% gap between revenues and expenditures. One of the problems that politicians are having in forecasting is the variability of state tax revenues. Budget gaps occur when state expenditures exceed state revenues. Most states are required by law to balance their budgets. There are generally three factors that go into budget gaps; expenditures which tend to increase relative forecast expenditures during economic downturns, revenue shortfalls also occur during economic slowdowns, and tends to exacerbate the budget gap, finally faulty models tend to error on the optimistic side of both revenues and expenditures.

One of the elements I in is involved with that is the variability that occurs in various types of state tax Rev. this study looks to examine the variations in state tax collections in order to show which are stable and which are

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more variable. In this examination we will create an index much like that is used with returns and finance along the lines of Beta. It is hoped that by creating a Beta (tax) index that it will be possible to better forecast which taxes are more variable and which our more stable. Also in selecting a state's tax regime it might be possible to select taxes that tend to be more stable, so that revenue shortfalls do not compound budget gaps during difficult economic times.

By examining the variability of various tax components, legislators (and staff) could see which components of their tax regime are more likely to produce shortfalls. Since each state has its own tax regime that is composed of various elements some states will have greater variability in other states will have more stable tax regimes. It is believed that states with greater variability are more likely to suffer from budget gaps. By knowing the magnitude of variation different revenue sources inherently contain, legislators could either be able to more quickly recognize when collections would be less than predicted or would budget with additional leway in order to compensate for the variation.

2. Beta

Beta is a term that is widely used in finance. The beta coefficient, in terms of finance and investing, describes how the expected return of a stock or portfolio is correlated to the return of the financial market as a whole. An asset with a beta of 0 means that its price is not at all correlated with the market; that asset is independent. A positive beta means that the asset generally follows the market. A negative beta shows that the asset inversely follows the market; the asset generally decreases in value if the market goes up.

Correlations are evident between companies within the same industry, or even within the same asset class (such as equities), as was demonstrated in the Wall Street crash of 1929. This correlated risk, measured by Beta, creates almost all of the risk in a diversified portfolio.

The beta coefficient is a key parameter in the capital asset pricing model (CAPM). It measures the part of the asset's statistical variance that cannot be mitigated by the diversification provided by the portfolio of many risky assets, because it is correlated with the return of the other assets that are in the portfolio. Beta can be estimated for individual companies using regression analysis against a stock market index.

2.1 Definition

The formula for the Beta of an asset within a portfolio is

$$\beta_a = \frac{\mathrm{Cov}(r_a, r_p)}{\mathrm{Var}(r_p)}$$

Where r_a measures the rate of return of the asset, r_p measures the rate of return of the portfolio of which the asset is a part and Cov (r_a,r_p) is the covariance between the rates of return. In the CAPM formulation, the portfolio is the market portfolio that contains all risky assets, and so the r_p terms in the formula are replaced by r_m, the rate of return of the market.

Beta is also referred to as financial elasticity or correlated relative volatility, and can be referred to as a measure of the sensitivity of the asset's returns to market returns, its non-diversifiable risk, its systematic risk or market risk. On an individual asset level, measuring beta can give clues to volatility and liquidity in the marketplace. On a portfolio level, measuring beta is thought to separate a manager's skill from his or her willingness to take risk.

The beta movement should be distinguished from the actual returns of the stocks. For example, a sector may

be performing well and may have good prospects, but the fact that its movement does not correlate well with the broader market index may decrease its beta. However, it should not be taken as a reflection on the overall attractiveness or the loss of it for the sector, or stock as the case may be. Beta is a measure of risk and not to be confused with the attractiveness of the investment.

The beta coefficient was born out of linear regression analysis. It is linked to a regression analysis of the returns of a portfolio (such as a stock index) (x-axis) in a specific period versus the returns of an individual asset (y-axis) in a specific year. The regression line is then called the Security Characteristic Line (SCL).

$$SCL: r_{a,t} = \alpha_a + \beta_a r_{m,t} + e_{a,t}$$

α_a is called the asset's alpha coefficient and β_a is called the asset's beta coefficient. Both coefficients have an important role in Modern portfolio theory.

For an example, in a year where the broad market or benchmark index returns 25% above the risk free rate, suppose two managers gain 50% above the risk free rate. Since this higher return is theoretically possible merely by taking a leveraged position in the broad market to double the beta so it is exactly 2.0, we would expect a skilled portfolio manager to have built the outperforming portfolio with a beta somewhat less than 2, such that the excess return not explained by the beta is positive. If one of the managers' portfolios has an average beta of 3.0, and the other's has a beta of only 1.5, then the CAPM simply states that the extra return of the first manager is not sufficient to compensate us for that manager's risk, whereas the second manager has done more than expected given the risk. Whether investors can expect the second manager to duplicate that performance in future periods is of course a different question.

2.2 Beta Volatility and Correlation

$$\beta = (\sigma / \sigma_m)r$$

That is, beta is a combination of volatility and correlation. For example, if one stock has low volatility and high correlation, and the other stock has low correlation and high volatility, beta can decide which is more "risky".

$$\sigma \geq |\beta| \sigma_m$$

In other words, beta sets a floor on volatility. For example, if market volatility is 10%, any stock (or fund) with a beta of 1 must have volatility at least 10%.

2.3 Adaptations

For the purposes up this study the percentage change from one year to the next year was used in place of the rate of return in order to calculate the Beta(tax). This can be justified as the rate of return on a stock with no dividends would be the change in the price of the stock. By calculating the rate of change, one less year is available for calculations than data collected.

2.4 Data

The data that was used in this study came from the consolidated annual financial reports (CAFR) of the various states that were involved in the study. Data was unable to be obtained for the states of Connecticut, Wisconsin, and New Jersey. Furthermore, data for the states of Nebraska and New York were an unusable format. We therefore ended up with data from 45 states. Revenue sources for the states included 83 different categories. The four categories are included in this study were selected on the because of the relative size of those categories to the overall state revenue collections and the number of states that had that form of tax collections. The years involved depended on the states, but ranged from 1999 through 2006. Data for individual years for some states were excluded due to significant changes in tax regime, i.e., a difference in the collection of franchise tax for the

state of Texas or for a large difference in the amount of tobacco tax on cigarettes. Only 14 data points were lost due to these exclusions.

3. Methodology

Each state's CAFR was analyzed to extract the revenues from the report the difference between one year and the next year was calculated in order to get a percent change. This procedure was also done for the total revenues of each state for each year. The correlation and variation for between total revenues and each type of tax was calculated and from that the beta for each type of tax was calculated.

4. Results

The results of the study indicate that some taxes are very stable while other taxes tend to have wide variation in their collection amounts. The results are shown in the following table.

Table 1 Results

Tax	Beta
Sales and use tax	0.440379
Personal Income Tax	0.140945
Corporate income and franchise tax	1.512235
Natural resource tax	2.235843

The results in from the sales and use tax as well as the personal income tax tend to be less variable than overall collections, while the corporate income and franchise tax, and natural resource taxes tend to be more variable than overall collections. These results are somewhat intuitive due to the fact that corporate income and franchise tax are based on profits, and corporations will tend to cut prices and have reduced sales during periods of recession. Because of their fixed costs, corporations tend to have greater swings in their income. Personal income taxes are based more on an individual's revenue as opposed to a "profit". Deductions are allowed by the various legislatures, however, these are only loosely analogous to expenses. During the period studied there were no severe economic downturns that greatly increased unemployment, or limited wages, which would indicate a greater reduction in personal incomes. The variation which does exist is most likely explained by variations in capital gains, self employment incomes and changes in bonuses. The natural resource tax is the most variable of the taxes which were included in this study. It should be noted that the period of 1999 to 2006 showed a tremendous change in the price for energy related resources, and it also showed a great increase in the price of metals such as gold silver and copper. Sales and use tax was somewhat surprising in its lack of variation compared to overall collections, again during the period studied there was not any severe recessions and therefore it would be difficult to conclusively conclude that these taxes do not have increased potential for variability in an atmosphere of strained economic times. Another explanation would be that the majority of sales are for necessities and that consumers do not reduce their habits as much as overall collections would indicate it is consistent however with personal income tax collections having a low variability that consumers would also have a low variability rate.

5. Limitations

This study suffers from several limitations the most notable being that a severe economic downturn was not included in the years examined. These particular years were chosen because these ate the years that were available online from the consolidated annual financial reports of the states. Without the testing through a period of a significant recession it would be difficult to make any firm conclusions about the variability of the various taxes that are involved. Another limitation is that one of the larger states New York was not included because of incompatible data for the study.

6. Further Research

The potential for research in this area is quite fast in addition to extending it for the total of 83 different categories that were listed in the various cancers. Regional indexes could also be setup is quite likely that regents would suffer from the same economic conditions and therefore would have similar betas whereas other areas could be countercyclical in nature. Additionally the information from additional prior-years and from future years can be added to enrich the source of data that is involved in this analysis.

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