Rainy Day Funds, Risk-Sharing, and Simple Rules: How would States Fair?

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Abstract

Using a switching regression approach, Wagner and Elder (2007) estimated the cyclical characteristics of each of the US states and used these estimates to calculate a distribution for the amount of savings each state should accumulate to weather recessions of a given severity. Because states' business cycles are not perfectly synchronized, there is a potential benefit from pooling fiscal resources over the business cycle. Elder and Wagner (2013) use the estimated cyclical characteristics mentioned above, along with the estimated synchronicity among states, to estimate a distribution of the benefits of pooling fiscal resources to weather recessions. One important question not specifically examined by Elder and Wagner (2013) concerns the structure of the agreement between the states in terms of specific deposit and withdrawal rules. In this essay, using the historical experience of the US states, we calculate the benefits from pooling fiscal resources under various of deposit and withdrawal rules.

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I. Introduction

Nearly every state utilizes some form a formal savings instrument such as a rainy day fund or a budget stabilization fund to help mitigate the periods of fiscal distress that are associated with economic downturns and other unpredictable shocks. In the most recession downturn, for instance, 41 states made mid-year budget cuts in 2009, followed by an additional 39 states in 2010.[1] State revenues and projected spending growth do appear to have stabilized in recent years partially because of an injection of more than $25 billion in enacted taxes and fees during the darkest days of the recession.[2]

While individual state responses to downturns depends, in part, on the structure of the state's revenue portfolio, the effectiveness of any rules governing their rainy day funds, and their political will, the lack of synchronization in state economies over the business cycle provides a mutually beneficial opportunity in which states can share resources and reach the same level of pre-recession readiness at a lower cost. In other words, since the timing of when different states enter and exit downturns is asymmetric, implying that some states will be growing while other states are contracting, the pooled aggregate savings required to mitigate fiscal shocks will be lower than the sum required by individual states using the same metric. Using a Markov-switching model to characterize the business cycle behavior of state economies, Elder and Wagner (2013) estimated the diversification or pooling benefits to states resulting from the diversity in their business cycles. For instance, if every state had the goal of maintaining a

[1] *The Fiscal Survey of the States*, June 2014, published by the National Governor's Association and the National Association of State Budget Officers.

[2] *The Fiscal Survey of the States*, June 2014, published by the National Governor's Association and the National Association of State Budget Officers.

constant growth rate in their funds available to spend in three out of every four recessions that might occur in a given time period (or to be in the 75th percentile), Elder and Wagner (2013) estimate that states can pool their resources and lower their savings by roughly 30 percent relative to the aggregate amount of savings required if each state realizes the objective individually. With properly structured rules to prevent moral hazard problems and the like, risk-sharing through a national or federal rainy day fund would appear to be a fruitful option for policymakers to consider.

One important question not specifically examined by Elder and Wagner (2013) concerns the operational structure of a national rainy day fund in terms of the specific deposit and withdrawal rules that may govern such a fund's usage. In this paper, we explore several potential deposit and withdrawal mechanisms for a national rainy day fund and estimate the benefits to individual states under the alternative scenarios.

II. Business Cycle Synchronization and Risk-Sharing Benefits

Assuming state-level economic activity can be characterized by Hamilton's (1989) simple two-regime Markov-switching model, Owyang, Piger, and Wall (2005) were the first to demonstrate that individual states "differ significantly" in the timing of their expansionary and contractionary periods. Using each state's coincident index developed by Crone and Clayton-Matthews (2005) as the measure of economic activity, Owyang et al. (2005) find that 11 states share the same business cycle phase as the US more than 90 percent of the time, while Alaska and Hawaii are the least synchronized states in the nation (they share the same phase with the US just 21 and 57 percent of the time, respectively).[3]

[3] In addition, Owyang, Piger, and Wall (2005) find that expansion growth rates across states depends on the state's educational attainment and age composition, while mean estimated recession growth rates are more strongly affected by the state's industry mix.

The benefit of pooling fiscal resources comes from that fact that states' business cycles are not perfectly synchronized. The rules to be examined below for when states would contribute to a pooled fund and when they could withdraw from a pooled fund are related to the states' economic conditions relative to its trend. Following Owyang et al. (2005), Wagner and Elder (2007), and Elder and Wagner (2013), we measure each state's economic activity using the growth in each state's monthly coincident index published by the Federal Reserve Bank of Philadelphia (e.g., Crone and Clayton-Matthews, 2005). The index is the estimated unobserved shared component of four observable monthly economic indicators – nonfarm payroll employment, average hours worked in manufacturing, the unemployment rate, and wage and salary disbursements (deflated by the consumer price index), and as Crone and Clayton-Matthews (2005) note, can be thought of as an estimate of the underlying condition of each state's economy.

Given the discretionary changes in expenditures, tax rates, and tax bases that occur over time, modeling the cyclical properties of one or both of those series is unlikely to yield an accurate view of a state's economy because of the influence of policy changes. In addition, any rules governing a rainy day fund should be based on factors that are out of the influence of legislators in an effort to mitigate moral hazard problems that might arise. One example of such a rule discussed below is that states contribute to a pooled fund when there is a "budget surplus" and can withdraw from the fund in periods when there is a "budget deficit". There are likely moral hazard issues if the rules are dependent upon the actual budget balance because legislators may have an incentive to increase spending or lower taxes, resulting in a budget deficit, which could then be covered by a withdrawal from a pooled fund. Hence, instead of the rules being dependent upon the actual budget position of a state government, we advocate that any such rules depend on the relationship between the state's coincident index and it's trend value. However, for the remainder of this paper we use the terms revenue, spending, and budget position interchangeably with the state's coincident index, the trend of the coincident index, and the relationship between the coincident index and its trend, respectively.

As a first pass at examining the degree of business cycle synchronization among the states, we calculate the difference between the growth rate in each state's coincident index and its trend using monthly data over the period over the period from 1979:07 – 2012:03. Table 1 shows the resulting distribution resulting from the 1128 pairwise sets of correlations.

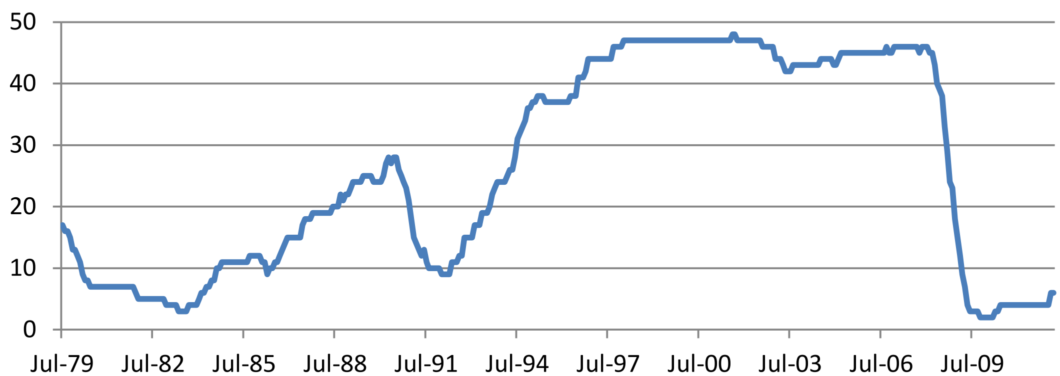
Table 1: Correlation of (Coincident Index-Trend)

Correlation	Number of Pairwise Correlations
0.9	877
0.8	628
0.7	492
0.6	378
0.5	300
0.4	235
0.3	189
0.2	156
0.1	136
0.0	111

Table 1 shows the total number of pairwise correlations that are less than the corresponding correlation. For example, there are 492 pairwise correlations less than 0.7 and 235 pairwise correlations less than 0.4. There are 251 pairwise correlations between 0.9 and 1 while there are 111 correlations less than 0. There are primarily three states that dominate the negative correlations (North Dakota, Oklahoma, and Wyoming account for 104 of the negative pairwise correlations). There is clearly some degree to which states' business cycles are not perfectly synchronized and hence pooling fiscal resources should theoretically result in some benefit.

Alternatively, another way to exhibit the degree of synchronization between states is to examine the number of states that are either above or below trend. This is important because, as mentioned above and to be discussed in more detail below, the rules guiding contributions and withdrawals to a pooled fund should be based on a state being above or below trend. If all states are either above or below trend in a given period then there is no pooling benefit and therefore, the greatest benefit of pooling fiscal resources occurs as the nation transitions between phases of the business cycle and some states are above trend and others are below trend. As can be seen in Figure 1, there is a fair degree of differences between states being above or below trend in any given time period.

Figure 1 – Number of States Above Trend



To adjust for state sizes, we normalize the value of each state's coincident index by setting it equal to the state's general fund revenue in 1979.[4] In addition to measuring each state's economic activity, we also assume that each state's revenue follows a similar pattern as its economic index in terms of period-by-period growth. So instead of using the actual general fund revenue series (which contain policy changes), we assume that general fund revenue follows the same cyclical pattern as the state's economic index. For illustrative purposes, we show the relative size of the state budgets in Table 2. The average size of the largest 5 states are more than

[4] There are various methods to account for differences in size such as using the average of general fund revenue or general fund expenditures or use the last period instead of the 1979 value.

24 times the average of the smallest 5 states with California being 45 times larger, and New York being almost 37 times larger than Vermont.

Table 2: Relative size of the state revenues in 1979

CA	45.0	**MN**	8.6	**OR**	4.8	**NE**	2.3
NY	36.7	**VA**	8.2	**OK**	4.8	**ME**	1.9
PA	18.8	**WA**	8.0	**SC**	4.7	**RI**	1.9
TX	18.1	**MD**	7.9	**IA**	4.6	**ID**	1.5
MI	17.5	**IN**	7.6	**CO**	4.6	**MT**	1.5
IL	17.3	**GA**	7.4	**AZ**	4.1	**DE**	1.4
OH	14.1	**LA**	7.3	**MS**	4.0	**ND**	1.3
NJ	11.4	**KY**	6.2	**WI**	3.6	**NV**	1.3
FL	11.3	**AL**	5.9	**KS**	3.5	**WY**	1.2
MA	11.1	**MO**	5.9	**AR**	3.2	**NH**	1.1
WV	9.4	**TN**	5.8	**NM**	3.0	**SD**	1.1
NC	8.6	**CT**	5.1	**UT**	2.4	**VT**	1.0

III. Modeling State Business Cycles and Trend Estimation

A critical step in our exploratory analysis of pooled deposit and withdrawal rules rests in the estimation of each state's business cycles and trend growth. The trend is important because the rules to be discussed below guiding when states should deposit funds and when they should withdraw funds are dependent upon the states’ revenues being above or below trend. One way to think about the trend is that it's the goal or target level of spending that would prevail if the state's budget were structurally balanced. In other words, this is the amount of funds that each state would ideally like to have to spend each period. When government revenue is above the trend, we assume that the state government is running a surplus and when the government revenue is below the trend, we assume that the state government is running a deficit.

Each state’s business cycle is assumed to be generated by a simple two-regime, Markov switching model. This model assumes that there are two possible regimes, high- and low-growth with each regime having a different mean growth rate, μ_H and μ_L. The probability of transitioning between the two regimes is based a two-state Markov chain. Conditional on being in a high-growth regime in the current period, the probability of being in a high-growth regime the following period is P_{HH} and the probability of being in a low-growth regime the following period is $1\text{-}P_{HH}$. Alternatively, if the current period is characterized by a low-growth regime, the probability of being in a low-growth regime the following period is P_{LL} and the probability of transitioning to a high-growth regime the following period is $1\text{-}P_{LL}$. Hamilton (1989) developed an algorithm to statistically estimate the high- and low-growth rates as well as the transition probabilities. To simplify matters, we estimate the growth rates and transition probabilities directly from the data based on the period-by-period growth rates of the coincident indices. Over any given sample period, the "high" growth rate is assumed to be equal to the average of the positive growth rates, the "low" growth rate is assumed to be equal to the average of the negative growth rates, and the transition probabilities are based on the number of times the growth rates switch from positive to negative or negative to positive.[5]

Again, it is assumed that each state's general fund revenue follows a pattern similar to the state's coincident index. Based on this procedure, an estimate of the high- and low-growth rates are determined along with conditional transition probabilities describing the likelihood of transitioning between the two regimes. The trend is based on the estimated parameter values obtained from this regression. The unconditional probability of a high-growth regime is $P_H = \frac{1-P_{LL}}{2-P_{HH}-P_{LL}}$ and the unconditional probability of a low-growth regime is $1\text{-}P_H$. Finally, the annualized growth of the trend is the expected growth rate which is given by $(1 + P_H\mu_H + P_L\mu_L)^{12}$.

Once the slope of the trend is determined for each individual state, an adjustment is made for the initial value of the trend based on the current phase of the business cycle that each state is

[5] Note that if during a given sample period, there are no negative growth rates, P_L is equal to zero.

in during the initial period of the sample. This adjustment is necessary because, as stated above and discussed in more detail below, the deposit and withdrawal rules examined below depend on whether the government revenue series is above or below trend. If a state is currently at the peak of their business cycle and the initial value for the trend is set equal to the initial value of the government revenue series, then it is highly likely that there will be relatively few periods where government revenue will be above trend (see Figure 2) so the frequency of deficits will dominate the periods of surpluses. In contrast, if a state is currently close to or at the trough of their business cycle and the initial value for the trend is set equal to the initial value of the government revenue series, then it is highly likely that there will be relatively few periods where government revenue will be below trend (see Figure 3) and hence periods of surpluses overly dominate periods of deficits.

Figure 2

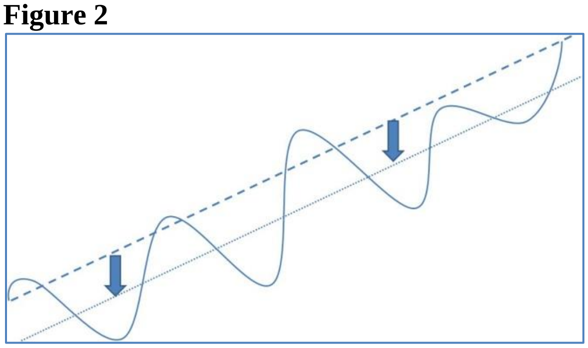
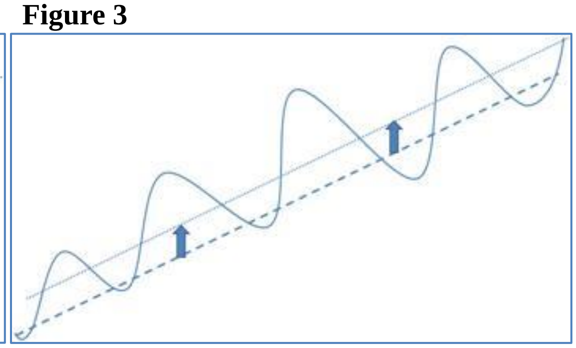


Figure 3



In the case of Figure 2, the trend line is adjusted downward and in the case of Figure 3, the trend line is adjusted upward. For each state, the initial value of the trend line is adjusted so that the ratio of surpluses to deficits is at a target level.[6]

As we previously discussed, we assume that the trend line represents the desired path of government spending and the size-adjusted coincident indices represent the path of government revenue. The budget position for each state is therefore calculated as the difference between

[6] 1950, the positive percentage GDP gaps have been approximately the same size as the negative percentage GDP gaps loosely corresponding to a ratio of 1.0.

revenue and spending, and the cumulative budget position represents the accumulated savings or debt of each state. The maximum level of accumulated debt represents the amount that each state must initially have in order to avoid any policy changes such as reductions in spending or increases in tax rates. Summing up the maximum levels of accumulated debt represents the total amount that the states would have to have accumulated prior to the sample period if they were to savings individually.

Since the state business cycles are not perfectly synchronized, it should be possible to pool their fiscal resources so that states with positive budget balances would contribute all, or some portion, to a pooled fund and states experiencing negative budget balances would make withdrawals from the pooled fund to cover all, or a portion, or their budget shortfall. The simplest possible set of rules governing contribution and withdrawals would dictate any positive balance would be contributed and any negative balance would be withdrawn, but various other rules could also exist. One example of such an alternative scheme would involve contributions to be made if revenue were above expenditures (trend) by a certain amount; for example, if revenues were above trend by 2 percent, then any additional revenues above that threshold would be contributed or, instead of all revenues above trend being contributed, possibly only a certain fraction of revenues above trend would be contributed. Withdrawal rules could be structured in an analogous fashion.

Consider an example assuming there are only two states and ten periods in the sample. Suppose the coincident indices for the two states, normalized to be 100 in period 0 are shown in Table 3 (these are the assumed government revenue paths for each state).

Table 3: Simple Example

	Revenue Path	
Period	**State A**	**State B**
1	105.00	104.00
2	110.25	101.92
3	106.94	99.88

4	112.29	97.88
5	117.90	101.80
6	123.80	105.87
7	120.09	110.11
8	126.09	107.90
9	122.31	112.22
10	118.64	109.98

Assume that State A has an estimated high-growth regime growth rate of 5 percent and an estimated low-growth regime growth rate of -3 percent. For State B, the high-growth regime growth rate is assumed to be 4 percent and the low-growth regime growth rate is assumed to be -2 percent. Finally, suppose that State A has an estimated P_H of 0.6 and State B has an estimated P_H of 0.5.

Based on these parameter values, the trend for State A grows at 1.8 percent per period and the trend for State B grows at 1 percent per period. The trend is the assumed to be the desired (constant growth) level of government spending. The period-by-period budget positions for each state are computed by subtracting the expenditures (trend) from the revenue (coincident index) for each period. When government revenue is above government spending, the state has a positive budget position (surplus) and when government revenue is below government spending, the state has a negative budget position (deficit).

Setting the period 0 trend value for State A to be 105.32 and for State B to be 99.52, the ratio of the surpluses to deficits is equal to the target level of 1.0. The revenue, expenditures, and budget positions for the two states are shown below in Table 4.

Table 4: Budget Positions for Simple Example

	Revenue		Expenditures		Budget Position	
Period	State A	State B	State A	State B	State A	State B
1	105.00	104.00	107.22	100.51	-2.20	3.51
2	110.25	101.92	109.15	101.52	1.13	0.42
3	106.94	99.88	111.11	102.53	-4.15	-2.63
4	112.29	97.88	113.11	103.56	-0.80	-5.66
5	117.90	101.80	115.15	104.59	2.78	-2.78
6	123.80	105.87	117.22	105.64	6.60	0.25
7	120.09	110.11	119.33	106.69	0.78	3.43
8	126.09	107.90	121.48	107.76	4.64	0.16
9	122.31	112.22	123.66	108.84	-1.33	3.40

10	118.64	109.98	125.89	109.93	-7.23	0.07

Based on the budget positions in the Table 3, the accumulated budget positions for each state are shown in the Table 5:

Table 5: Accumulated Budget Positions

	Budget Position		Accumulated Budget Positions	
Period	**State A**	**State B**	**State A**	**State B**
1	-2.22	3.49	-2.22	3.49
2	1.10	0.40	-1.11	3.89
3	-4.17	-2.65	-5.28	1.25
4	-0.82	-5.67	-6.10	-4.43
5	2.76	-2.79	-3.34	-7.22
6	6.58	0.23	3.24	-6.98
7	0.76	3.41	4.00	-3.57
8	4.61	0.14	8.61	-3.43
9	-1.36	3.38	7.25	-0.05
10	-7.25	0.05	0.00	0.00

The largest negative accumulated balance for State A occurs in the fourth period and is -6.10, while the largest negative accumulated balance for State B is -7.22 and occurs in period five. If no pooling exists and each state saves its surpluses and spends down their savings when they experience deficits, then if State A had initial savings of 6.10 and State B had initial savings of 7.22 then they could each make it through this 10 period example without raising taxes or reducing government spending. Therefore, without pooling, the aggregate amount of individual initial savings is 13.32. The level of the largest negative accumulated balance for an individual state is strongly determined by the timing, and hence the sequence of positive and negative budget positions.

If, on the other hand, the states pooled their fiscal resources, contributing surplus amounts to a pooled fund and withdrawing from the pooled fund during times of deficits then the period-by-period pooled balance and the accumulated budget position for the two states would be:

Table 6: Pooled Versus Accumulated Positions

	Budget Position	Accumulated

Period	State A	State B	Pooled	Budget Position
1	-2.22	3.49	1.27	1.27
2	1.10	0.40	1.51	2.78
3	-4.17	-2.65	-6.82	-4.03
4	-0.82	-5.67	-6.49	-10.53
5	2.76	-2.79	-0.03	-10.56
6	6.58	0.23	6.81	-3.75
7	0.76	3.41	4.17	0.42
8	4.61	0.14	4.76	5.18
9	-1.36	3.38	2.03	7.21
10	-7.25	0.05	-7.20	0.00

The largest pooled negative accumulated balance is 10.56 meaning that if the two states had an initial pool of savings of 10.56 from which they could withdraw from, then they could make it through the sample without any need for raising taxes or reducing spending. The pooled savings amount is 20.7 percent lower than the aggregate individual savings amount.

An alternative way of thinking about the benefits from pooling is to assume that each state, instead of savings any surpluses, would simply like to have an accumulated amount of savings at the beginning of the sample that is sufficiently large as to be able to withdraw from their savings during periods of deficits. Using this metric, summing up all of the deficits for each state individually, State A would need to have accumulated savings of 15.81 and State B would need to have accumulated savings of 11.11 so the aggregate amount of individual savings is 26.92. If the states pooled their fiscal resources, the sum of the pooled negative budget positions is 20.55. Therefore, if the states pool their fiscal resources, the states have to save 23.7 percent less than they would have to save individually.

In the example above, if each state contributes to a pool when they are above trend and withdraws funds when they are below (or analogously, they contribute when they have a surplus and withdraw when they have a deficit), then, over the entire sample period, States A and B contribute and withdraw 15.81 and 11.11, respectively. In total, the states contribute and withdraw 26.93 over the 10 periods.

In practice, if states contribute or withdraw unequal amounts, then there will be a non-zero accumulated balance in the pool at the end of the sample period that is equal to the sum of the net contributions/withdrawals of all the participating states. Theoretically, this ending balance could be divided and returned to the states in proportion to their net contributions over the sample period or, alternatively, this amount could be used to pre-fund future pools from which states can withdrawal during below trend periods. The point here is that what is important in this analysis is how the pool is pre-funded and not necessarily how much states contribute or withdraw during the sample period. Moreover, since the pooled fund essentially acts as a type of insurance for the states, it is less important that a state may contribute more or less than it withdraws over some time period because the mere existence of the fund provides a mechanism from which they can draw funds during below trend periods and therefore mitigate any necessary tax increases or spending reductions.

In terms of how to pre-fund or accumulate the necessary initial amount of pooled savings, a simple method is for each state to contribute to the fund proportionally to its size. In the example above, the two states are equally sized so they would each contribute half of the necessary accumulated pooled savings. One problem with basing the contribution rates simply on the size of a state is that it may be possible that a state would have to contribute more if they were involved in a pooling scheme than they would if they were saving individually. An alternative method of pre-funding would be to base the contributions on the benefit to each state of belonging to the pool compared to each state having to save individually. The maximum a state would be willing to contribute to belong to a pool would be the amount that state would need to save individually. Therefore, normalizing the aggregate individual savings so that they sum to the necessary pooled savings yields individual contribution amounts that are each less than the amount each state would need to save individually. In the example above, if the states were saving individually, State A needed to accumulate 6.10 and State B needed to accumulate 7.22, and the total pooled savings is 10.56. Therefore, if state A contributes 4.84 (45.8 percent of the aggregate individual savings) and State B contributes 5.72 (54.2 percent of the aggregate individual savings) then the accumulated pooled savings is 10.56. This method of pre-funding takes into account how much each state potentially needs to withdraw making those states contribute more that withdraw more.

The complete sample is broken down into the 1980's, 1990's, and the 2000's to allow for differences in trends over the subsamples. Ten years is the longest time frame that Elder and Wagner (2013) examine and seems to be a reasonably long time frame to contract to pool fiscal resources.[7] The exact benefit of pooling fiscal resources depends on how the trend is determined as well as the rules governing deposits to and withdrawals from the pooled fund. Four different sets of rules are examined below:

1. states contribute any "above trend" amounts and withdraw any shortfall when revenue is below trend
2. states contribute to a pooled fund when their revenue is more than 2 percent above trend and withdraw any amount that is below trend
3. states contribute any amount above trend and withdraw only when revenue is at least 2 percent below trend
4. states contribute when revenue is more than 2 percent above trend and withdraw when revenue is at least 2 percent below trend

The benefit of pooling, as mentioned above, is measured as the difference between the total pooled savings and the aggregate individual savings amounts relative to the aggregate individual savings amounts (assuming the states were following the same rules individually as they would under pooling). The reduction in the pooled savings amounts for each of the four rules, for each of the subsamples is shown in Table 7.

[7] Other time frames were examined but the results were similar to those reported below.

Table 7

Savings Rule	Withdrawal Rule	Ratio 1	Ratio 2	Ratio 3
0	0	28.3	23.2	23.7
2	0	15.2	3.5	11.0
0	-2	60.2	167.1	86.3
2	-2	27.2	71.9	43.7

For example, under the first rule, where all above trend amounts are contributed to the pool and any below trend amounts can be withdrawn from the pool, during the first ten-year sample period, the total amount of pooled savings is 28.3 percent below the aggregate individual savings amounts. In the second subsample, the pooling benefit is 23.2 percent and in the third subsample, the benefit is 23.7 percent. Under the second rule, where each state contributes to the pool only when their revenue is at least 2 percent above trend and withdraws any amount below trend, the pooling benefit is 15.2 percent in the first subsample, 3.5 percent in the second subsample, and 11.0 percent in the third subsample.

Under the first rule where states contribute to the pooled fund when their revenue is above trend and then withdraw when their revenue is below trend, the amounts that each state contributes over the sample period are shown in Table 8 relative to the total revenue in the sample period. For example, in the first sample period, California contributes and withdraws an amount that is equal to 1.1% of their total revenue over the sample period. During the second sample period, California contributes and withdraws an amount that is equal to 1.4% of the total revenue during the sample period, and contributes and withdraws an amount that is equal to 1.3% of their total revenue during the third sample period.

There is also a higher degree of variation in terms of the size of the contribution rates relative to each states total revenue in the sample. Florida, New Mexico, North Dakota, and Utah all have contribution rates less than 1 percent while 22 states have contribution rates greater than 2 percent with Michigan and Wisconsin having ratios over 4 percent. During the second sample period, there are 22 states with contribution rates less than 1 percent and only 4 states with contribution rates greater than 2 percent. In the third sample period, 7 states have contribution rates less than 1 percent and 8 states have contribution rates over 2 percent (with Nevada having a rate of 4.6 percent). Not surprisingly, the amount states contribute (and withdrawal) is highly related to the volatility of each state's revenue around its trend.

Table 8 reports the results concerning how much each state contributes (and withdraws) to a pooled fund *during* the sample period. An additional question that needs to be addressed is how much each state might contribute to the pooled fund *before* the sample period in order to pre-fund the pool. In terms of funding the initial pool from which states can withdrawal, as mentioned above, prefunding the pool could be based on size or based on the relative amounts that each state would have to save individually. These results are reported in Tables 9A-9C.[8] To calculate how much each state should contribute if the prefunding contributions are based on the size of each state, the total amount of pooled savings that needs to be accumulated (for example, this amount is 19,014 in the first sample period) is divided by the sum of the relative sizes shown in Table 2 and then multiplied by the respective relative sizes shown in Table 2.

One problem with this approach is that it is possible that a state may be forced to contribute more to a pooled fund than they would have to save if they did not participate in a pool. The first column of Tables 9A-9C shows the amount that each state would have to save individually. For example, in the first sample, California's largest negative accumulated budget position is 2,035 so they would have to have accumulated savings of 2,035 from which to withdrawal during the sample in order to avoid a negative accumulated budget position.[9] If the pooled balance is allocated based on size, then California would have to contribute 2,325 (second

[8] Tables 9A, 9B, and 9C are based on the first rule where states contribute when revenue is above trend and withdraw when revenue is below trend.

[9] Illinois has a zero for individual savings because they start the sample period with a large surplus and never have a negative accumulated budget position.

column of Table 9A) if they participated in a pool, which is actually more than they would have to accumulate if they had not participated in the pool. There are 17 states that have a similar situation in the first sample period, having to contribute more to a pool than they would if they had saved on their own (there are 16 in the second sample period and 17 in the third).

An alternative to basing the contributions to the pool on the size of a state is to base the pre-funding contributions on the relative individual savings of each state. Therefore, states that are more volatile would tend to contribute more to a pooled fund. Using this method to determine pre-funding contribution will, by construction, allow all states to contribute less to a pool than they would have to save individually. Specifically, the reduction in the aggregate individual savings, relative to the pooled savings, are shown in Table 7; these are the amounts by which the individual savings could be reduced in order to accumulate a sufficiently large pooled fund. For example, in the first sample period, the sum of the individually savings amounts is 26,519 and the pooled savings is 19,014, so the total pooled savings is 28.3 percent below the amount that each state would have to save individually (23.2 percent and 23.7 percent for the second and third sample period respectively). The individual savings amounts that each state would contribute based on this method are shown in the third column of Table 9. The final column of Tables 9A, 9B, and 9C shows the amount each state would have to contribute to a pooled fund relative to the total level of general fund revenue in the various sample periods (the last column in the Tables 9A-9C are the third column divided by total sample period revenue for each state). For example, Alabama would have to contribute an amount equal to 1.11 percent of their total revenue during the sample period to pre-fund a pool. Over all three sample periods, the median ratio is 0.49 while there are 24 ratios greater than 1 percent there are also 27 ratios less than 0.2 percent.

IV. Conclusion

Table 8

State	Sample 1 Contributions %	Sample 2 Contributions %	Sample 3 Contributions %
AL	2.1%	0.5%	1.8%
AZ	2.2%	1.6%	2.9%
AR	1.8%	0.6%	1.2%
CA	1.1%	1.4%	1.3%
CO	1.0%	0.7%	1.5%
CT	1.4%	2.0%	1.1%
DE	2.2%	1.6%	1.7%
FL	0.7%	1.1%	2.4%
GA	1.7%	1.3%	1.5%
ID	2.4%	0.6%	3.2%
IL	3.7%	1.0%	1.3%
IN	2.5%	0.6%	1.4%
IA	2.4%	0.5%	1.0%
KS	1.6%	0.9%	1.2%
KY	2.4%	0.4%	1.3%
LA	1.8%	0.5%	0.7%
ME	3.0%	2.7%	1.7%
MD	2.4%	1.9%	1.6%
MA	1.7%	2.0%	1.0%
MI	5.1%	1.6%	2.0%
MN	1.5%	0.4%	0.8%
MS	1.5%	0.8%	0.9%
MO	1.5%	1.0%	1.2%
MT	1.5%	0.6%	2.3%
NE	1.8%	0.5%	0.9%
NV	2.7%	1.5%	4.6%
NH	2.8%	1.9%	1.2%
NJ	1.3%	1.5%	1.2%
NM	0.8%	1.0%	1.9%
NY	1.0%	1.4%	0.9%
NC	1.9%	1.1%	1.7%
ND	0.6%	0.6%	1.2%
OH	3.3%	1.1%	1.5%
OK	2.9%	1.0%	1.6%
OR	3.4%	1.2%	2.2%
PA	2.5%	1.3%	1.2%
RI	2.7%	2.6%	2.3%
SC	2.2%	1.4%	1.8%
SD	1.3%	0.4%	0.8%
TN	1.8%	0.8%	1.2%
TX	1.5%	0.8%	1.2%
UT	0.8%	0.8%	1.6%
VT	2.0%	1.2%	1.1%
VA	1.8%	1.3%	1.3%
WA	2.4%	0.9%	1.8%
WV	1.9%	0.4%	1.1%
WI	4.5%	1.7%	1.7%
WY	2.3%	0.4%	1.8%

Table 9A: Contribution to Pool (Sample 1)

State	Individual Savings	Contribution Based on Size	Contribution Based on Individual Savings	Based on Individual Savings (Relative to Total Revenue)
AL	546	305	391	1.11
AZ	614	211	440	1.54
AR	258	167	185	0.98
CA	2035	2325	1459	0.49
CO	43	237	31	0.10
CT	493	262	353	1.00
DE	172	75	124	1.28
FL	352	584	252	0.31
GA	811	380	581	1.13
ID	32	77	23	0.29
IL	0	896	0	0.00
IN	283	392	203	0.48
IA	221	239	158	0.64
KS	184	182	132	0.66
KY	218	321	156	0.45
LA	31	377	22	0.05
ME	311	99	223	1.76
MD	986	410	707	1.37
MA	1314	572	943	1.23
MI	3896	904	2794	3.08
MN	545	445	390	0.75
MS	204	206	146	0.64
MO	194	305	139	0.40
MT	9	75	6	0.09
NE	122	117	88	0.69
NV	92	67	66	0.80
NH	234	57	168	2.02
NJ	993	591	712	0.92
NM	118	156	85	0.45
NY	2060	1894	1477	0.63
NC	896	446	643	1.14
ND	8	69	6	0.08
OH	1977	731	1418	1.87
OK	93	248	67	0.23
OR	551	249	395	1.47
PA	1456	969	1044	0.98
RI	296	96	213	1.77
SC	528	245	378	1.25
SD	49	56	35	0.57
TN	478	299	343	0.96
TX	195	937	140	0.12
UT	85	122	61	0.41
VT	113	52	81	1.20
VA	784	424	563	1.04
WA	660	412	474	0.98
WV	268	184	192	0.94
WI	700	485	502	1.21
WY	11	62	8	0.12

Table 9B: Contribution to Pool (Sample 2)

State	Individual Savings	Contribution Based on Size	Contribution Based on Individual Savings	Based on Individual Savings (Relative to Total Revenue)
AL	379	363	291	0.36
AZ	990	326	760	0.99
AR	236	198	182	0.39
CA	3844	3385	2951	0.41
CO	418	285	321	0.46
CT	0	414	0	0.00
DE	215	107	165	0.74
FL	1577	1013	1211	0.55
GA	1234	533	947	0.77
ID	101	95	78	0.30
IL	1344	995	1032	0.47
IN	469	517	360	0.31
IA	210	290	161	0.25
KS	333	212	256	0.54
KY	165	364	126	0.15
LA	445	440	342	0.36
ME	439	146	337	1.27
MD	1003	522	770	0.76
MA	0	776	0	0.00
MI	2675	1012	2054	0.89
MN	358	539	275	0.22
MS	388	220	298	0.59
MO	640	390	492	0.59
MT	122	85	94	0.48
NE	108	141	83	0.26
NV	290	104	223	0.84
NH	0	78	0	0.00
NJ	820	917	630	0.35
NM	434	207	333	0.68
NY	1367	2545	1050	0.21
NC	1069	607	820	0.60
ND	107	83	82	0.45
OH	1289	980	989	0.47
OK	482	307	370	0.56
OR	751	286	577	0.80
PA	1888	1101	1449	0.65
RI	0	125	0	0.00
SC	564	332	433	0.60
SD	15	64	12	0.08
TN	678	392	520	0.59
TX	1423	1261	1093	0.37
UT	322	172	247	0.57
VT	50	71	38	0.27
VA	953	588	732	0.60
WA	515	539	395	0.32
WV	108	175	83	0.21
WI	1663	551	1277	1.02
WY	3	84	2	0.01

Table 9C: Contribution to Pool (Sample 3)

State	Individual Savings	Contribution Based on Size	Contribution Based on Individual Savings	Based on Individual Savings (Relative to Total Revenue)
AL	2011	545	1534	0.91
AZ	2703	544	2062	1.10
AR	723	352	551	0.50
CA	1899	4970	1449	0.09
CO	467	489	356	0.22
CT	632	621	482	0.23
DE	370	169	282	0.53
FL	4445	1633	3390	0.63
GA	1568	893	1196	0.41
ID	824	160	629	1.09
IL	1437	1485	1096	0.24
IN	746	738	569	0.25
IA	727	383	555	0.46
KS	641	316	489	0.50
KY	479	565	365	0.21
LA	10	608	8	0.00
ME	122	202	93	0.15
MD	514	676	392	0.17
MA	22	1068	17	0.00
MI	10	1531	8	0.00
MN	321	796	245	0.09
MS	758	373	578	0.50
MO	1342	656	1024	0.51
MT	663	130	506	1.12
NE	276	212	211	0.30
NV	1720	209	1312	1.81
NH	117	129	89	0.20
NJ	601	1237	458	0.11
NM	951	298	726	0.70
NY	1034	3332	789	0.07
NC	3176	1054	2422	0.72
ND	96	106	73	0.21
OH	36	1382	28	0.01
OK	804	403	613	0.46
OR	1664	495	1269	0.75
PA	1219	1617	930	0.18
RI	261	166	199	0.35
SC	1234	515	941	0.58
SD	125	91	95	0.31
TN	642	609	490	0.25
TX	4231	2187	3227	0.44
UT	1003	293	765	0.76
VT	29	114	22	0.06
VA	1232	869	940	0.33
WA	2897	843	2210	0.82
WV	415	274	316	0.37
WI	1192	802	909	0.34
WY	428	92	326	0.94

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