An Empirical Analysis of the Effect of Performance-Based Budgeting on State Government Expenditures

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ABSTRACT

This paper examines the economic effects of the adoption and implementation of performance-based budgeting (PBB) at the state government level. We examine the association between the implementation of PBB and aggregate state expenditures from the General Fund and Other State Funds, and further analyze whether PBB affects combined functional spending: Future-oriented expenditures (Public Education, Higher Education, and Transportation), Social expenditures (Public Aid, and Public Health/Medicaid), Public safety expenditures (Correctional Facilities) and Other expenditures. We find that the implementation of PBB is negatively associated with total expenditures from General Fund and positively associated with total expenditures from Other State Funds. The effect of PBB on combined functional spending is significantly negative for Future-oriented expenditures and Socially-oriented expenditures from the General Fund, but there is a positive relationship between PBB and Future-oriented expenditures (transportation projects) and Socially-oriented expenditures from dedicated Other State Funds. We conclude that PBB is effective in getting state governments to reorganize their spending priorities.

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1. Introduction

Published empirical research on the real economic effects of alternative budgeting systems among state and local governments is sparse. Nevertheless, it is accepted wisdom that the implementation of an appropriate budgeting system can influence the financial efficiency and/or effectiveness of government. As noted by Tyer and Willand (1997), governments at all levels across the US have successively been changing their budgeting systems, transitioning from line-item budgeting to program budgeting to incremental and zero-based budgeting, and finally, in many cases, to performance-based budgeting (PBB).

The origins of PBB can be traced to the accounting reforms proposed by the Hoover Commission, a body appointed by President Truman in 1947 to make recommendations to reorganize the Executive Branch of the Federal Government (Kelly and Rivenbank, 2003). Under *The Budget and Accounting Procedures Act* of 1950, the federal government required its agencies to provide performance and program costs to support budget requests. State governments began to transition to PBB because of the belief that it provided the flexibility to enable them to perform efficiently and effectively using their limited resources.

In introducing PBB, state legislatures were effectively granting state agencies more flexibility in the use of their budgeted resources. In turn, the state agencies were held accountable for the services and products they provided. The underlying idea is that the state agencies were thereby provided the proper incentive to deliver services and products efficiently and effectively because their performance was measured against clearly defined objectives. As part of this incentive system, full

disclosure of the budgets and the achievements of the state agencies were to be made to the citizens of the state. This, in turn, provided an incentive for state legislatures to reduce spending on functions or programs deemed to be ineffective, and to provide additional resources to those programs or functions judged to be relatively effective. In theory, at least, the implementation of PBB should be associated with changes in spending priorities or greater accountability for the funds expended. Greater efficiency or effectiveness of state governments should also be associated with a more favorable economic climate, leading to relatively faster economic growth.

As support for these expectations, a variety of national organizations including the National Association of State Budget Officers (NASBO), the Government Accounting Standards Board (GASB), Government Accountability Office (GAO), the Government Finance Officers Association, and the National Academy of Public Administration, have conducted surveys to assess the effect of the adoption and implementation of PBB in state governments. According to a GASB survey (2002), more than 50 percent of all respondents (state and local officials) indicated that the implementation of performance measures had increased the efficiency and the effectiveness of their various governmental programs, and approximately 70 percent agreed that their governmental entity has been better off since implementing performance measures.

In spite of the belief expressed in the surveys that PBB has been beneficial in increasing efficiency or effectiveness of state governments, there are few empirical studies of its effectiveness. Among the studies to date, only three actually use empirical data to examine the issue: Klase and Dougherty (2008), Lee and Wang (2009), and Ho (2011). Of these three, only Klase and Dougherty (2008) focus on the effect of PBB on state governments.

Given this background, we examine whether the adoption and implementation of PBB has any real economic effects. Presumably, because PBB places emphasis on program outcomes and output, its adoption should result in greater emphasis on

outcome effectiveness relative to funds expended. Thus, there are *a priori* reasons to theorize that the implementation of PBB will have differential effects on the decision choices of state governments (particularly the legislature). Systematic consideration of results in PBB has the potential to "improve expenditure prioritization (the capacity to allocate limited resources to where they will do the most good)" (Robinson and Last, 2009, p.2) and "encourage line ministries to spend more efficiently and effectively by making them aware that their performance will influence their level of funding and by reducing or streamlining the controls that impede good performance" (Robinson and Last, 2009, p.3). This reasoning motivates the examination of spending by functional area at the state level as well as on total spending.

In the sections which follow, we first examine the literature on the progression from line-item budgeting to PBB, and the motivation behind the eventual adoption of PBB. We also review the literature on the effects on spending and other behavior associated with the implementation of PBB. In Section 3, we present our methodology, including our data sources, and the statistical analyses we performed. In Section 4, we present our findings, and the sensitivity tests we conducted to evaluate the robustness of our results. Our conclusions are presented in Section 5.

2. Literature Review and Hypotheses Examined

2.1 Evolution of Budgeting Systems

State government budgeting systems have evolved over the past century to meet various needs, including achieving financial control over expenditures, management, planning, setting priority for scarce funds, and achieving greater accountability (Legislative Research Commission, 2001). Because the initial focus of budgeting was on financial controls over expenditure and to guard against misuse of funds, it is not surprising that line-item budgeting (LIB) was the first budgeting

system to be developed and implemented widely. LIB provides control over expenditure by specifying allowable spending on inputs. Problems with LIB that became apparent over the years included the sole emphasis on inputs, and the failure to consider the objects of the expenditures in any systematic way. The expansion of governmental activity during the New Deal and World War II heightened interest in performance budgeting in order to use financial resources efficiently (Tyer and Willand, 1997). However, with the introduction of performance budgeting (PB), the difficult problem of output measurement and the little ability to apply cost information began to emerge as significant hindrances to true budget reform. Schick (1971) found that performance budgeting as a reform was superficial in state budget practices in the 1950s.

The next major movement in budget came in the 1960s with the introduction of Planning and Programming Budgeting systems (PPBS) at the federal level and its adoption by some state governments. PPBS was designed to increase the efficiency of resource allocation and to emphasize long-range planning (Tyer and Willand, 1997). Although PPBS received some support through being adopted by some states, Schick (1971) notes that it failed to live up to its potential at both the federal and state level. At the state level, it appeared to have failed to actually penetrate state decision-making even though most states said they were using or developing it.

Fiscal crises in the mid-1970s forced governments to find ways to justify the use of resources. To meet this need, the concept of Zero-Based Budgeting (ZBB) was introduced as a way to set priorities among different programs and to foster accountability. ZBB was different from the incremental budgeting system (which typified LIB, PB, and PPBS) in one significant respect. Under the incremental budgeting system, the funding for existing programs was assumed to be maintained at existing levels unless the state government made a deliberate decision to change spending priorities. Naturally, changing established spending patterns established in the past encountered enormous political difficulties, and thus, the ability to fund new programs in the midst of the financial crises was difficult. In this setting, ZBB

promised to give the state governments the structure to overcome bureaucratic inertia and change the spending priorities (Chan, 2002). However, because ZBB required complicated time-consuming and burdensome deliberations, it soon proved infeasible as a budgeting system for state governments.

Given these difficulties with the previous systems, the 1990s saw considerable interest in a results-oriented budgeting system that emphasized efficiency and effectiveness, namely Performance-Based Budgeting (PBB). The National Advisory Council on State and Local Budgeting (1998, p. 3) argued that: "A good budget process moves beyond the traditional concept of line item expenditure control, providing incentives and flexibility to managers that can lead to improved program efficiency and effectiveness".

2.2 Motivation for Adopting PBB and Perceived Effects of Implementation

As noted previously, the PBB system was advocated as a means to improve the performance of state governments in delivering services and products to its citizens more efficiently and effectively. By focusing on expected outcomes relative to the amounts to be expended, and then subsequently comparing the actual outcomes to the expectations, it is hoped that budgetary discipline can be imposed by the legislature and the executive branch. For example, the Little Hoover Commission (State of California, 1995) concluded in the letter to the California Legislature that "PBB is a valuable mechanism with winners on all sides". Specifically, the commission argued that policy makers gain a better understanding of the impact of varying levels of expenditures, and also ensure accountability without blanket restrictions that stifle innovation. In addition, program managers are provided the flexibility to change their internal processes and increase their relative efficiency to reach their goals. Finally, programs are more customer-focused, and the public can see a clear connection between spending and services provided.

However, such discipline can be effective only if the political will also exists to close, for example, inefficient agencies or sharply reduce their appropriations.

Because such actions are likely to have strong political consequences, it is far from self-evident that, in actual implementation, PBB will necessarily have any measurable effects on observed efficiency and effectiveness.

For this reason, a review of the literature on the benefits of PBB as perceived by state government officials is informative. Surveys of state officials to determine the perceived effectiveness of their budgeting systems have been carried out by both national organizations and individual researchers. Appendix I summarizes the results reported in surveys conducted by national organizations on the perceptions of state officials about the effectiveness of their budgeting systems.

The results in Appendix I show a wide variety of methods used by a diverse group of organizations. However, despite the differences in survey methods, the general conclusion to be drawn from these studies is that PBB is widely seen by the state officials and legislatures who are using that system to be successful in inducing consideration of outcome and performance measures in making spending decisions.

In addition to the surveys by national organizations, numerous researchers have also conducted surveys of state governments to determine how PBB is being implemented, what the determinants of a successful adoption of PBB were, and whether PBB (as implemented) was perceived to be successful. Among these are Broom (1995), Melkers and Willoughby (1998), Jordan and Hackbart (1999), Joyce and Sieg (2000), Melkers and Willoughby (2001), Melkers and Willoughby (2005), Moynihan (2005), Hou, Lunsford, Sides, and Jones (2011), and Pattison (2011). Appendix II presents a summary of the major findings from these studies.

The results in Appendix II show that, although PBB has been gaining in popularity since 1990, it has not been universally adopted. Furthermore, even among the states which have adopted PBB, its degree of penetration in the actual decision-making processes among legislators and the executive branch is diverse. In particular, there appears to be a difference between "performance funding" and "performance budgeting", according to Jordan and Hackbart (1999). In the case of "performance funding", the spending priorities are established using the PBB results

of the prior year, with more effective programs receiving more funding if needed, and the less effective ones receiving reduced funding. In the case of "performance budgeting", the only stipulation is that the budget adopted includes both input and output measures. Jordan and Hackbart (1999) found only 10 states used both performance funding and performance budgeting, 34 states used performance budgeting and 13 other states used some form of performance funding.

According to GAO's 2005 survey, state officials use performance information (including outcome measures and performance evaluations) to identify the potential impact of proposed policy changes, and based on these analyses, make policy decisions that reduce costs while maintaining program effectiveness. If such is the degree to which state officials use PBB information, then an empirical examination of state spending patterns should provide some evidence of systematic benefits from the implementation of PBB, particularly when contrasted with other states where PBB is not implemented.

2.3 Empirical Studies of Effects of the Implementation of PBB

Empirical studies of the actual effect of PBB implementation on spending behavior or efficiency are relatively sparse. The few studies conducted do not necessarily arrive at the same conclusions. Stiefel, Rubenstein, and Schwartz (1999) analyzed the relationship between the performance of public schools in Chicago and patterns of budget allocation by constructing and using *adjusted performance measures*. They concluded that, even though the total spending differences between low-performing schools and high-performing schools were small, there were significant differences in the distribution of discretionary spending across function. They concluded that "high performing schools average almost five percentage points more discretionary spending on instruction and less on instructional support and administration" (p. 82).

Kluvers (2001) surveyed municipalities in Victoria, Australia which were known to be using PBB, and reported that "the question of whether performance

indicators, if used, had provided useful information was answered in the affirmative by an overwhelming majority of survey respondents. However, this result is tempered by the fact that only a small number of councils reported actually using performance indicators". Kluvers further concluded that managers tended to use the performance indicators primarily to   allocate resources or to increase productivity..Furthermore,   the use of performance indicators appeared to foster a changed attitude toward planning and to influence   could influence spending over time.

Crain and O'Roark (2004) examined the impact of PBB innovation on state expenditures in the US by using panel data from 1970 through 1997. They concluded that   PBB did have an impact on state spending per capita by at least two percentage points , but also find that PBB didn't affect all state government programs equally.

Melkers and Willoughby (2005) surveyed local government officials in 47 countries and 168 cities in the United States. They found that the presence of performance measures in budget documentation (which they called performance-measurement transparency was significantly correlated with budget effects in a negative direction ($b = - 0.147$, significant at 0.05 level). At the same time, they found that   the comprehensive use of performance measures across departments (which they called performance-measurement density) had a much stronger and positive influence on the budget ($b = 0.341$, significant at 0.01 probability level).

Rather than relying on the survey on state budget officials, Klase and Dougherty (2008) conducted an empirical analyses using   the available data for the 50 states for the years 1986-2001. Employing a fixed effect model with five PBB implementation variables (three reflect different PBB implementation phases, and the other two reflect budget officials' perceptions), they found that the implementation of performance budgeting has a statistically significant and positive effect on state per capita expenditures. They also found that states with PBB

implementation legislation tended to spend an average of $332 per capita more than states without implementation legislation.

Lee and Wang (2009) analyzed the effect of PPB practices on spending behavior across three countries, the United States, Taiwan, and China (Guangdong Province) over multiple years before and after PBB implementation. They reported that   that PBB had differential impact on the spending growth rate in different countries (regions): there was a significant relationship between PBB and spending growth in Taiwan (coefficient of 20.103). However, the regression coefficients were negative for the United States (- 0.192) and China (-0.1903) but not statistically significant.

Ho (2011) conducted a case study of PBB exercise in the city of Indianapolis in the years from 2008 to 2010 to examine the budget implications of applying performance information at the sub-departmental program level. The regression results indicated that the number of performance measures in a department was significantly and positively correlated with program budget variation. However, after controlling for other factors.he also found that the number of outcome-related performance measures had significantly negative effects on program budget variation

While many researchers found that PBB could play an important role in resource allocation, there are also questions about the degree to which the implementation of PBB have yielded incremental benefits. Jordan and Hackbart (1999) argued that allocation decisions were hardly affected by performance reporting: "in those states undertaking performance funding, only a marginal share of the funds (estimated at 3 percent) were subject to the influence of performance evaluation". Willoughby and Melkers (2000) found that performance measurement was most essential for managerial decisions and communication purposes, even though its impact on appropriation outcomes was quite limited.

Melkers and Willoughby (2001) concluded that: "[F]ew states indicate any link between performance information and actual appropriations. This was not

alarming, however, given the time-consuming nature of performance measurement development and data-collection processes." (p.62).   However, four years later, Melkers and Willoughby (2005) confirmed that: "[M[ost markedly, and substantiating past research about state governments, few claimed performance measurement as effective in determining appropriation levels…..[T]his is not surprising, considering the intent behind most performance-related initiatives has been much broader than simply cutting costs" (p. 186).

A more recent study by Hou, Lunsford, Sides, and Jones (2011) examined variations in PBB practices in 11 sample states in different time periods using a series of anonymous interviews. They concluded that PBB had not been fully exploited and that just a part of its design purpose had been achieved. They also concluded that PBB was relied on much more by the states during economic upturns than during economic downturns.

2.4 Hypotheses Examined

Before describing the hypotheses we examine in this study, it is important to describe the expenditure classifications provided by state governments in the sources that we used. Budget reporting by state governments, in general, conform to general guidelines issued by the National Advisory Council on State and Local Budgeting, Government Finance Officers Association (1998) and the National Association of State Budget Officers (1999). State government expenditures are divided into four main (aggregate) categories, according to the revenue source: Expenditures from General Fund (TEXP_GF), Expenditures from Federal Fund, Expenditures from Other State Funds (TEXP_OSF), and Bonds. The General Fund (GF) is the fund into which revenues from various state taxes are deposited. Other State Funds (OSF) are funds generated from user-fees and other revenue sources whose usage is restricted by law, while Federal Funds are the funds provided by the Federal Government. Under the Bonds category are the expenditures from the sale of bonds, most often to finance capital projects. We focused in this paper on the expenditures in the General Fund and the Other State Funds because we could not

identify any plausible reason why expenditures of funds in the Federal Funds and Bonds should be influenced by the budgeting system in use.

Another division of expenditures is provided by function. In general, state governments provide functional expenditures by aggregate funding source in six categories: Elementary and Secondary Education Expenditures (ESE), Higher Education Expenditures (HE), Public Assistance Expenditures (PA), Medicaid Expenditures (ME), Corrections Expenditures (CE), Transportation Expenditures (TE), and All Other Expenditures (OTH). The OTH varied from from state to state, but it typically included Employers Contribution to Pensions, Employer Contributions to Health Benefits, Child Health Insurance Program, Public Health, Community and Institutional for Mental Health, Community and Institutional for Development for the Disabled, Environmental Programs, Parks and Recreation, Housing, and General Aid to Local Government.

Based on the literature to date, it is reasonable to expect that the implementation of PBB will have some observable effect, although the exact nature of these effects is open to question. Since the adoption and continued implementation of PBB are not costless, its continued existence can only be justified if state officials see some associated marginal benefit. Thus, because surveys have repeatedly shown that officials in states which have adopted PBB believe it has some value, we theorize that its implementation will lead to some cost savings. Specifically, because the expenditures from the General Fund are subject to relatively more discretion on the part of the legislature or the executive branch, we hypothesize that PBB will be relatively more effective in restraining expenditures from the General Fund:

H1.1: Effect on Aggregate State Expenditures from the General Fund

The implementation of PBB is expected to be associated with relatively lower state expenditures in the General Fund.

Expenditures from the Other State Funds (OSF) are restricted by law to specific purposes for which the associated revenues are raised. This limitation implies a matching of the expenditures to the output, suggesting that under PBB, higher expenditures may be expected because of the linkage to output. This leads to the second hypothesis:

H1.2: Effect on Aggregate State Expenditures from Other State Funds
The implementation of PBB is expected to be associated with relatively higher state expenditures in Other State Funds.

Robinson and Last (2009) have noted that PBB can make "fiscal space for new spending initiatives" without an increase in aggregate spending through its ability to impose aggregate fiscal discipline and expenditure prioritization. If so, then it is reasonable to expect that PBB will have differential effects on functional spending. Classifying expenditures by function bring to bear the issue of the immediate or long-term impact of the spending. As noted by Mandl, Dierx, and Ilzkovitz (2008), government spending can be divided into two broad classes: (1) Future-oriented, and (2) spending with immediate social or economic impact.

Because PBB is designed to relate outputs to the associated inputs, we hypothesize that it may have the unfortunate effect of focusing on outputs that are immediately measurable. If so, future-oriented projects funded from the General Fund may tend to face decreased funding, while such projects funded from designated funds (Other State Funds) will tend to receive more funding under PBB. The rationale here is that, for General Fund future-oriented projects, the inability to immediately identify the expected outcomes in full may result in either reduced funding or funding at levels not different from other programs. In contrast, if the funds for the future-oriented projects were dedicated (as in the case of Other State Funds projects), the restriction on the diversion of the funds to other purposes will force PBB implementers to pay more attention to the future expected benefits. Thus,

we expect Other State Funds future-oriented projects to receive increased funding under PBB. This reasoning leads to the following two formalized hypotheses:

H2.1: Future-Oriented Programs Funded From General Fund (EDU_GF and TRA_GF)

Programs with future-oriented outcomes (Primary, Secondary and Higher education, EDU_GF; and Transportation expenditures, TRA_GF), if funded from General Fund , will tend to be funded at relatively lower levels under PBB.

H2.2: Future-Oriented Programs Funded From Other State Funds (EDU_OSF and TRA_OSF)

Programs with future-oriented outcomes (EDU_ OSF and TRA_ OSF), if funded from Other State Funds , will tend to be funded at relatively higher levels under PBB.

Our expectations regarding the effect of PBB on expenditures with immediate social impact are similar tothe argument made for General Fund expenditures   but different from Other State Fund expenditures.. Specifically, in the General Fund case, the primary emphasis of PBB in relating inputs to outputs means that funds will be scaled back from programs if there is insufficient evidence of positive outcomes, given the   competing needs for the funds. In contrast, when funds are specifically designated for a specific purpose, PBB is expected to lead to higher relative spending for programs funded from Other State Funds. More formally, the following two hypotheses are formulated:

H3.1: Social Programs Funded From General Fund (SOC_GF)

Programs oriented towards providing immediate social benefits (Public Aid, and Public Health/Medicaid) will tend to be funded at relatively lower levels under PBB when funded from the General Fund.

H3.2: Social Programs funded from Other State Funds (SOC_OSF)

Programs oriented towards providing immediate social benefits (Public Aid, and Public Health/Medicaid) will tend to be funded at relatively higher levels under PBB when funded from Other State Funds.

We have no *a priori* expectations about how PBB might affect spending under either Public Safety (Correctional Facilities – denoted PS), or in the Other Expenditures (OTH) category, whether funded from General Funds or from Other State Funds.

3. Methodology

3.1 Data Sources and Sample Selection

For this study, we collected state budget data for all 50 states for fiscal year 2000-2009 from the NASBO publication, *Budget Processes in the States* (published in 1999, 2002, and 2008), and from the annual *The Fiscal Survey of States* (published by the National Governors Association and NASBO). To determine if a state was using PBB for any particular year, we used the first reference, and then cross-checked from the second source to verify when changes in budgeting and financial management systems were adopted or legislated. From these sources, we adopted a dummy variable for states using PBB (i.e, score of unity if PBB is implemented, and zero otherwise).

In most cases, states indicated that more than one budgeting system was in use. Since each budget approach may affect spending, in order to isolate the independent effect of PBB, we also identified other budget approaches used by the state. The alternative budgeting systems were (a) Program Budgeting (PROG); (b) Incremental Budgeting (INCR); and (c) Zero-based Budgeting (ZERO).[1] We coded these other budgeting systems the same way as we coded PBB. Because of the failure to include outcomes in any systematic way in establishing the budget targets in the PROG and INCR methods, our *a priori* expectations are that both will be associated with higher spending. In contrast, we expect both PBB and ZERO to be associated with

Studies aimed at explaining overall efficiency levels need to take exogenous and multifaceted factors into account (Mandl, Dierx, and Ilzkovitz, 2008). These exogenous factors include state population, income level and politics which can shape state expenditure. For this reason, we included the following control variables in the study:

(1) total resident state population (POP);

(2) state average unemployment (UNEM);

(3) the proportion of the state's House of Representatives held by Democrats (HD_DEM), and by Republicans (HD_REP);

(4) the proportion of the state's Senate held by Democrats (SD_DEM) and by Republicans (SD_REP);

(5) whether the Governor for the state for that year was a Democrat (GOV_DEM), or a Republican (GOV_REP);

(6) whether both houses of the Legislature and the Governor were of the same party (coded as Single-Party Control, SPC).

For purposes of this analysis, we recoded the control of the legislature as dummy variables, with HD-DEM and SD-DEM representing the Democratic Party holding a simple majority of the seats in the House and Senate respectively. Given that the seats held by Independents for 49 states were not significant (less than 2 percent), the dummy variables for Democrats and Republicans were judged to be self-exclusive, with only one of them appearing in the regressions.[3]

The expected signs for the control variables are positive for POP and GDP_PC, and negative for UNEM. Both population and per capital income are expected to be associated with higher spending, either because of need, or because of greater affordability. On the other hand, high unemployment is likely to lead to greater stress on a state's finances, thus leading to a decrease in total spending. Among the political factors, HD_DEM, SD_DEM, and GOV_DEM are all expected to be positively signed (while conversely, HD_REP, SD_REP, and GOV_REP would be negatively signed). This reflects the common perception that the Democratic Party

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tends to believe in bid government while the Republican Party believes in reducing the size of government at all levels. At the same time SPC (single party control) is expected to be positively signed, reflecting the belief that total political dominance by one political party is more likely to lead to unrestrained spending than when the political power structure is divided between the two main political parties.

3.2 Regression Model Estimated

To derive the regression equation that we estimated, we began with the assumption that the key underlying economic factors which drive the level of aggregate expenditures by state governments from their own internal resources (i.e, excluding federal government grants) are a multiplicative function of total population (POP), the gross domestic product per capita (GDP_PC), and the rate of unemployment (UNEM). Two factors underlie this assumption: (1) it seems much more likely that a percentage change on total population (or any of the other factors) would be better reflected by a percentage change in total expenditures that a simple linear increase; and (2) the effect of the economic factors on total expenditures are more likely to be multiplicative and joint than independent and linear. That is, the effect of one percentage increase in the total population of the state will interact with the current gross domestic product per capital (or the unemployment rate) to affect the level of state expenditures. Thus, the multiplicative regression model seems to us to be a more logical model to estimate than a linear regression model.

Based on the reasoning above, aggregate state government expenditures can be expressed as:

$$\text{Expenditures} = \alpha(\text{ POP })^{\beta 1} * (\text{GDP\_PC})^{\beta 2} * (\text{UNEM})^{\beta 3} \qquad (1)$$

Taking the natural log of both sides yields:

$$\text{Log(EXP)} = \log \alpha + \beta_1 \log (\text{POP}) + \beta_2 \log(\text{GDP\_PC}) + \beta_3 \log(\text{UNEM}) + e \qquad (2)$$

To this basic relationship, the control variables discussed earlier were added, namely the political factors and the other budgetary systems (other than PBB). This leads to the main regression equation that is estimated:

$$\text{Log(EXP)}_{i,t} = \log \alpha + \beta_1 \log (\text{POP})_{i,t} + \beta_2 \log(\text{GDP\_PC})_{i,t} + \beta_3 \log(\text{UNEM})_{i,t}$$

$$+ \lambda_1 (\text{HD\_DEM})_{i,t} + \lambda_2 (\text{SD\_DEM})_{i,t} + \lambda_3 (\text{GOV\_DEM})_{i,t} + \lambda_4 (\text{SPC})_{i,t}$$

$$+ \gamma_1 (\text{PBB})_{i,t} + \gamma_2 (\text{PROG})_{i,t} + \gamma_3 (\text{INCR})_{i,t} + \gamma_4 (\text{ZERO})_{i,t} + e_{i,t} \tag{3}$$

where,

EXP = total expenditure by state and year (with different definitions of expenditures; specifically;

TEX_GF & TEX_OSF = Total expenditure by state and year from the General Fund and Other State Funds respectively;

EDU_GF & EDU_OSF = Educational expenditures from the General Fund and Other State Funds respectively;

TRA_GF & TRA_OSF = Transportation expenditures from the General Fund and Other State Funds respectively;

SOC_GF & SOC_OSF = Social expenditures from the General Fund and Other State Funds respectively;

PS_GF & PS_OSF = Public safety (correctional facilities) expenditures from the General Fund and Other State Funds respectively;

OTH_GF & OTH_OSF = Other expenditures from the General Fund and Other State Funds respectively.

subscript i = 1 to 50 for different states;
subscript t =1to 10 for year 2000 to year 2009.

The adoption of the multiplicative regression form allows the following intuitive interpretation of the results. First, the coefficients estimated represent elasticities of the dependent variables with respect to changes in the independent variables. Thus, for the γ coefficients, taking the exponent enables the percentage effect on total expenditures of the implementation of the alternative budgetary systems to be estimated. For example, a statistically γ_1 coefficient of -0.05 would imply that, with the adoption of PBB, a state's total spending would be expected to decline to 95.1 percent (exponent of -0.05) of the current expenditure level.

3.3 Descriptive Statistics of the Data

Table 1 presents a summary of the information gathered from NASBO's periodic *Budget Processes in the States*, and from the annual *The Fiscal Survey of States* for the years 2000 to 2009. A value of 1 indicates that the state was indicated to be using PBB either as the sole budgeting system or as one of several systems that may be in use during that year.

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Insert Table 1 here
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As shown in Table 1, there were 15 states which implemented PBB and disclosed relevant information about PBB in state budgeting reports for all 10 years. These are Colorado, Florida, Hawaii, Louisiana, Missouri, Montana, Nebraska, New Mexico, North Carolina, Oregon, Texas, Virginia, Washington, Wisconsin and Wyoming. The gravest issue involving the consequentiality of adoption dates is that some states adopted PBB for several years only to abandon them some years later (NCSL, 2008). In Table 1, Alabama, Arkansas, Maine and West Virginia are shown to have demonstrated this pattern. However, Arkansas resumed PBB in 2009. Some other states discussed and possibly even initiated PBB in some agencies (e.g., California), but never got unto the PBB bandwagon by implementing it across the board in all state agencies.

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Insert Table 2 here
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Table 2 presents a summary of the key variables used in the study. For TEXP_GF, the range was from $370 million (5.914 in log term) to $102,950 million (11.542 in log term), with a mean of $6,573.64 million. Per capital GDP (GDP_PC) averaged $39,648.95, while the average population was 3.660 million. Table 2 also presents the range of values for spending by function in the 50 states. The values for

the seven functional areas varied greatly. But one observable fact is that, over the years 2000 to 2009, the major categories of spending at the state level were EDU_GF (mean of $4.211 billion), OTH_OSF (mean of $1.851 billion), and OTH_GF (mean of $1.680 billion).

Additional insights provided by the data in Table 2 are the means of the political factors and the budgetary systems. From the means provided, it can be inferred that across all 50 states and the 10 years covered by the study, the Democratic Party was the majority party in the state Houses of Representatives 51.9 percent of the time, 46.9 percent of the time in the majority in the state Senates, and in the gubernatorial mansion 46.3 percent of the time. Finally, the mean of SPC at 0.46 indicates that one single party controlled the House, Senate, and the gubernatorial post at the state level on average is 46 percent of the time.

On the budgeting practices side, PBB was implemented 45.9 percent of the time, while PROG was practiced a dominant 83.5 percent. Incremental budgeting was implemented 70 percent of the time, and Zero-based budgeting was implemented only 28.8 percent of the time. Note that states rarely adopted and implemented only one budgeting system, so the relative frequencies of implementation provide enough richness in the data to enable the relative effectiveness of the different systems to be inferred, albeit only indirectly.

4. Results

The availability of continuous data for 10 years provided a basis for applying a panel analysis approach. To aid in choosing beween the fixed effects and the random effects approaches, the Hausman test for random effects was performed for all versions of the regression analyses. In all cases but one, the Hausman test could not reject the null hypotheses of no correlation between the effects and regressors. Thus, the generalized least squares coefficients from the random effects were both consistent and efficient, while the fixed effects coefficients were consistent but

inefficient. The Breusch-Pagan Lagrange multiplier test also indicated a rejection of the null hypotheses that the variances of the groups were zero. Thus, the use of a pooled regression model was confirmed to be inappropriate for the data.

Finally, to deal with heterocedasticity, all the t-values reported in this paper are based on White's robust standard errors. Although various fixed effects and random effects panel models were tried out, the method which tended to yield the most consistent results was Nerlove's (1971) variance components model. As a test of robustness of both the multiplicative model and the random effects panel approach, we also provide results obtained with a one-way (time) fixed effects model and a cross-sectional OLS model for specific years.

4.1 Aggregate Expenditures

To enable Hypotheses 1.1 and 1.2 to be evaluated, Equation (3) was estimated with TEXP_GF and TEXP_OSF as the dependent variables. The results are presented in Table 3, with TEXP_GF in the first set of columns, and TEXP_OSF in the second set.

****
Insert Table 3 here
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With TEXP_GF as the dependent variable, all the economic variables are significant and have the expected signs – POP and GDP_PC are positive, and UEMP is negative. However, two of the political factors (HD_DEM and SD_DEM) have negative signs instead of the positive signs expected. The results here suggest that at the state level, control by the Democratic Party of the House and the Senate is associated with lower spending from the General Fund, while the presence of a Democratic Governor is associated with higher spending from the General Fund. Finally, single party control is associated with lower spending from the General Fund, contrary to our prior expectations. This finding may reflect the fact that, with a slight majority of the House of Representatives in the sample period held by

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Democrats while the Senate was held by Republicans (in a slight majority), the resulting conflict of ideologies may result in budgets proposed in the Democratic majority House being always subject to negotiations that wind up trimming the budget.

Turning now to the budgetary systems, the results in Column A of Table 3 support Hypothesis 1.1. Specifically, PBB is associated with a two percent reduction in General Fund expenditures (exponent of -0.02 = 98 percent). In contrast, PROG is associated with a 2.4 percent increase in spending (exponent of 0.023 = 1.024), while INCR is linked to a 4.2 percent increase in spending. Finally, ZERO is also associated with an increase in spending of 7.4 percent (exponent of 0.072 = 1.074).

The second set of columns in Table 2 allows Hypothesis 1.2 to be evaluated. In considering the factors that affect expenditures from Other State Funds (which are dedicated for specific expenditure purposes), we note that per capital income is not statistically significant. This is reasonable since the funds here are generated principally based on usage, unlike the General Funds where a wealth or income effect is to be expected. Here SPC is significant and positive, consistent with the expectation that a single party in control of all levers of political power is likely to spend more freely than when negotiations with the opposition party is needed.

Turning now to the budgetary system, the results here also support Hypothesis 1.2. The coefficient for PBB is a positive 0.037, implying that PBB is associated with a 3.8 percent increase in relative spending. The other two budgeting systems (PROG and INCR) also have positive coefficients, but the estimated increase in spending under these alternative approaches (36.7 percent and 39.6 percent respectively, based on exponents of 0.313 and 0.334) are much higher than that of PBB. Note that ZERO has a negative sign. Thus, the results suggest that the emphasis on outcomes implied by PBB and ZERO can lead to meaningful relative restraints on spending.

4.2 Panel Analysis – Functional Spending

The findings that PBB implementation is associated with reduced aggregate

spending for expenditures in the General Fund but more spending where the Other State Funds are concerned lend even more importance to the hypotheses involving functional spending. Table 4 presents the results of evaluating Hypotheses 2.1 and 2.2 using Equation (3) and the Nerlove (1971) variance components method.

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Insert Table 4 here
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The first two set of columns in Table 4 show the evaluation of the hypothesis that PBB is expected to result in relative spending restraints for General Fund future-oriented expenditures. We classified educational expenditures (EDU_GF) and transportation expenditures (TRA_GF) as meeting this standard of being future-oriented. The results in these first two sets of columns support this hypothesis. In the case of EDU_GF, PBB has a coefficient of -0.056, while both PROG and INCR have positive coefficients. However, ZERO also has a negative coefficient (-0.059). Thus, the use of PBB and ZERO both result in reduced spending on the more future-oriented educational spending.

Turning attention to transportation spending from the General Fund, we should note that nine states do not expend General Fund resources on transportation projects. Moreover, even for the states where some funding for transportation is made out from General Fund, the level of spending is relatively low. Thus, for most states, most transportation spending is made out of the dedicated Other State Funds. Within this limitation, we note that PBB has the sole, statistically significant negative coefficient (-0.709) among the budgetary systems. In contrast, ZERO has a positive and statistically significant coefficient. The second set of columns in Table 4 presents the results for expenditures made from the dedicated Other State Funds. Hypothesis 2.2 presents the expectations that PBB will tend to encourage increased spending in this context. The results here are a little mixed. For EDU_OSF, the coefficient for PBB is not statistically significant. However, of the budgetary

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practices, only PROG has a statistically significant coefficient (a positive 0.278). For TRA_OSF, the observed coefficient for PBB is positive and statistically significant (consistent with Hypothesis H2.2). However, the coefficients for both PROG and INCR are also significant and positive. Their relative magnitude compared to PBB's (0.210 and 0.147 compared to 0.115) indicates that PBB has a greater restraining effect than these other two budgetary systems. ZERO has a negative (and statisticaly significant) sign here as well, lending weight to the argument that Zero-based budgeting tends to have a very pronounced influence in lowering spending.

We theorized in Hypothesis 3.1 that PBB would tend to constrain spending on social programs when the programs are funded from the General Fund, but will have the opposite effect if funded from the dedicated Other State Funds. The results of estimating Equation 3 with SOC_GF and SOC_OSF as the dependent variables are presented in Table 5.

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Insert Table 5 here
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The results in Table 5 show that, consistent with Hypothesis 3.1, the expected negative sign for PBB is observed for the expenditures from the General Fund. However, PROG and ZERO both also have negative coefficients. Thus, the restraining effect of PBB on social spending from the General Fund is not unique to PBB. The second set of columns present the case where SOC_OSF is the dependent variable. Here again, consistent with Hypothesis 3.2, a positive sign is observed for PBB which is matched by ZERO and INCR. However, both ZERO and INCR have much higher coefficients (0.441 and 0.190 respectively), compared to PBB (with a coefficient of 0.187). Thus, it would appear that the spending increases under PBB is more restrained than under ZERO and INCR

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Insert Table 6 here

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Table 6 presents the results for the estimation of Equation 3 for the other expenditures for which we have no *a priori* expectation about how PBB would affect spending behavior. The results in Table 6 show that PBB, PROG and ZERO all have negative coefficients for PS_GF, so it is not clear that PBB has any relative advantage here. For the cases where OTH_GF, PS_OSF, and OTH_OSF are the dependent variables, PBB is not statistically significant. However, the coefficients for the other three budgetary systems are significant in the case of OTH_OSF, with those for PROG and INCR being positive while ZERO's is negative.

4.3 Robustness Tests

The results reported so far are based on a multiplicative regression model estimated using the variance components estimation method of Nerlove (1971). We have also used all the sample observations available. To determine if the results reported so far as robust to alternative specifications, two other approaches were tried. The first approach involved estimating a linear model using a one-way (time) fixed effects panel analysis with the sample restricted only to states that used either PBB over the entire period, or did not use PBB at any time during the 10-year period. The second approach restricted the analysis to the three specific years (2000, 2002, and 2008) where the NASBO comprehensive surveys were actually conducted to determine the budgetary systems in use. Ordinary least squares were used to estimated the relationships in this case.

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Insert Table 7 here
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The results of restricting the sample only to the subset of states which used PBB or did not use PBB over the sample period are presented in Table 7. As is

apparent from the table, PBB has a negative coefficient (-3.309) in the regression with untransformed TEXP_GF as the dependent variable. It is the only one of the four budgetary systems that is statistically significant, so its effect in reducing expenditure levels is apparent. In the second regression with TEXP_OSF as the dependent variable, PBB has a positive coefficient. Although both PROG and ZERO also have positive coefficients, the fact that PBB has coefficient signs consistent with what was observed previously lends additional credibility to the previous results.

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Insert Table 8 here
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Table 8 presents the results when the sample is restricted only to the three years when the surveys of the states were carried out. These results are also based on OLS, unlike the fixed effect and random effect panel results presented earlier. The results show that, in 2000, 2002, and 2008, PBB has negative coefficients (although only significant in 2008) when TEXP_GF is the dependent variable. When attention is shifted to the case where TEXP_OSF is the dependent variable, PBB has a positive coefficient in both 2002 and 2008, although they are not statistically significant. The consistency of the signs with the a priori expectations expressed in Hypothesis 1.1 and 1.2 lends additional credibility to the results reported earlier.

5. Conclusions

This paper has attempted to examine the empirical evidence in support of the notion that there are real economic effects to the implementation of PBB. This is a logical position to take since many states have attempted, in various guises and in different periods, to implement PBB. Thus, given the expenditure of time and effort,

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and the results from surveys of state budget officials that PBB is seen as making a contribution, there is a keen interest in actually examining the evidence to determine if there are demonstrable benefits.

Our results, based on the data for all 50 states over the period 2000 to 2009, demonstrate that there is detectable reduction in aggregate spending from the General Fund of about two percent. For programs funded through the dedicated Other State Funds, PBB implementation is associated with an aggregate spending increase of about 3.8 percent. In the functional spending area, there is evidence that PBB is associated with reduced spending for programs with a future-orientation (education and transportation) when they are funded from the General Fund. In contrast, when these projects are funded from the dedicated Other State Funds, PBB is associated with an increase in expenditures of about 12.2 percent for transportation projects. This same trend is evident for socially-oriented expenditures where PBB is associated with a reduction of about 0.8 percent for expenditures from the General Fund. In contrast, for socially-oriented programs funded from dedicated Other State Funds, PBB is associated with a 20.5 percent increase in relative spending.

The results of this study should serve as a wake-up call to skeptics. PBB has, in fact, led to shifts in spending patterns which are suggestive of potential improvements in the efficiency and effectiveness of governments. However, further research is needed in this area. In particular, while this study has focused on the effect of PBB on expenditure behavior, measures of outcomes are needed before any inference about improved efficiency or effectiveness can be made. Thus, efforts to measure and report outcomes are a very necessary part of the effort to improve government effectiveness and efficiency. Empirical studies such as this one which offers evidence of the real effect of alternative budgeting systems on government expenditure behavior are useful as exploratory steps.

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Appendix I

Surveys conducted by national organizations on the effectiveness of states budgeting systems

Organizations	Method	Results
Little Hoover Commission, State of California (1995)	Survey experiences of several states that are considered on the leading edge of the PBB movement.	PBB stresses holding departments accountable for outcomes, prioritizing spending based on a program's ability to successfully reach goals, and comparative data allows policy makers to understand the array of results that can be accomplished through different levels of spending.
The Florida Office of Program Policy Analysis and Government Accountability (OPPAGA) (1997)	In-depth study of five states and survey of these and the remaining 45 states.	They find that there are benefits to be found in any implementation of performance-based efforts, and state agencies reported a greater focus on results, opportunities for re-engineering and a heightened sense of mission.
GASB (2002)	Survey of state budget offices, state agency staff, and local government by a large mail survey in order to address survey group's perceptions of the impact of performance measurement on cost savings, efficiency, effectiveness and program results, enhanced communication, and so on.	They find that the percentage of respondents from state budget offices who found performance measures to be "very effective" or "effective" on "affecting cost savings" , "improving effectiveness of agency programs", "reducing duplicative services" and "reducing/eliminating ineffective services/programs" are 13.8%, 23.5%, 15.7% and 9.6% respectively. But higher percentage of state budget offices (more than 30%) think that performance measurement can lead to "improving communication between departments and programs", "improving communication with the executive budget office ", and "improving communication with the legislature and legislative staff' (p. 20).
GAO (2005)	Survey five states: Arizona, Maryland, Texas, Virginia, and Washington.	They find that "performance information has influenced legislative budget deliberations in the states examined. Although a number of factors, including political choice, influence budget decisions, when legislators do use performance information they find specific types of

		performance information useful in performing different functions. They use outcome measures and performance evaluations in budget deliberations to identify potential impacts of a proposed policy change, make policy decisions that reduce costs while maintaining effectiveness, and make changes to improve program effectiveness" (p. 3). They also reach the conclusion "during periods of fiscal stress, states supplemented existing tools with priority-setting and efficiency initiatives to respond to revenue shortfalls" (p. 12).
The Pew Center on the States (2008)	Grading 50 states to evaluate how states manage resources.	States that received the highest grades (Washington, Utah, Virginia) are making better management a top priority. On the contrary, states that received lower marks have limited performance information. Great strides in efficiency and effectiveness in some states which using PBB to mold their budgets hold out evidence that PBB is a promising tool for managers and policy makers, and meet the expectations and demands of citizens.
NASBO (2008)	Demonstrating the diversity in state budgeting practices by state-by-state compilation of data.	By 2008, nearly all states had begun collecting some form of performance measurements, however only 39 states require the reporting of performance measurements in conjunction with agency budget requests, and only 25 states claim to be utilizing full PBB.
The Pew Center on the States (2009)	Surveys the implementation of PBB and its effects in Virginia, Utah, Maryland and Indiana.	Concludes that PBB can help achieve a better economic and fiscal future, and can also help states make "smart" spending decisions in boom years and "intelligent" budget cuts when necessary in lean years.
Department of Budget and Management (DBM), State of Maryland (2011)	Annual performance report.	In 2010, performance for 50% of measures are moving in favorable direction, 23.1% are holding steady while 26.9% are moving in an unfavorable direction. According to the summary of performance by priority area , "A safer Maryland, green Maryland, and education have the most measures moving in a favorable direction, each with 50% or more of the measures moving favorably", and "efficient government and economic growth have the largest number of measures moving in an unfavorable direction".
Senate Research Center, State of Texas (2011)	Provide a step-by-step explanation of the budget process in Texas.	PBB is a part of strategic planning and can affect the amount an agency is appropriated by the legislature.

Appendix II

Surveys conducted by researchers on the effectiveness of states budgeting systems

Researcher	Method	Main Results
Broom (1995)	Case studies of PBB in five states	They found that agency managers, legislators, stakeholders use the information of performance based systems. And the authors were optimistic that performance information would gain wider use in budget decision-making mainly because performance-based efforts are being "sustained, nurtured and refined".
Melkers and Willoughby (1998)	Survey PBB requirements in 47 out of 50 states	31 states have legislation that requires performance-based budgeting, and about 16 states have some form of performance-based budgeting instituted by administrative requirements. They also think that while states are requiring performance information in budget submissions, the effectiveness and contribution of performance measures to the budget process in the states remains unclear.
Jordan and Hackbart (1999)	Based on response of state executive-branch budget officers from 46 of the 50 states, they analyze the role of performance budget and performance funding.	They find that 3 states strongly agree and 23 states agree that "performance indicators are an important tool for making budget allocation decisions"(p. 78). Along with the survey, they developed performance budget model and performance funding model, and regression results show that : the number of budget analysts has significant and positive effects on performance budgeting and performance funding ; per capita income, tax effort, pre-audit function and republican governors can not influence the usage of performance budgeting or funding significantly. The authors find only 10 states indicated that they both used performance budgeting and performance funding, 34 states use some form of performance budgeting and 13 states use some form of performance funding.
Joyce and Sieg	Using data from exhaustive surveys in 49 of	Almost half of the states have made some attempt at developing a statewide cost accounting

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(2000)	the 50 states, and analyze the extent to which performance information is available and used at each stage of the budget process	system, but only 10 of them were using these measures to set targets for performance. "Turning to use of measures by the central budget office, in only four states—Missouri, Texas, Louisiana, and Virginia—is the use of performance measures by the budget office extensive; 19 other states report 'some' use. As might be expected, there is even less use of performance information in state legislatures"（p.26）.
Melkers and Willoughby (2001)	Survey legislative and executive budgeters from the 50 states.	The budgeters been surveyed indicate that "performance budgeting has been most successful in improving the effectiveness of agency programs and improving decision making in government". They further list the different opinions on effects of PBB between executive-branch budget officers and Legislative budget officers, and get that "executive-branch budget officers ranked performance budgeting's effect on cost savings and in reducing duplicate services almost equally. Legislative budget officers indicated that performance budgeting has been most effective in reducing duplicative services" (p. 60).
Melkers and Willoughby (2005)	Examine the effects of performance measurement on budgetary decision making, communication, and other operations at local governments level in U.S. by analyzing data drawn from the local government respondents from administrators and budgeters in 47 counties and 168 cities.	The survey's mean respondents show that many administrators and budgeters describe performance measurement as "somewhat effective" for budgeting: the means of budget effects on "affecting cost savings", "changing appropriation levels" , "reducing / eliminating ineffective services / programs" , and "reducing duplicative services" are 1.97, 1.79, 1.78 , and 1.77 of 4.
Moynihan (2005)	Select three states with high (Virginia), medium (Vermont), and low (Alabama) experience and competence in managing for results	One of the find is that the benefit of international reputation for innovative and results-oriented government for State of Virginia "depend on having a system in place that could plausibly claim to enhance performance" (p. 229).
Hou, Lunsford, Sides, and Jones (2011)	Examine variations on PBB implementation in 11 states in the United States across three	They get two important conclusions, one is that states used PBB more in up economies than in down economies, another is for most states PBB is used more successfully as a management tool

	different periods by Interviewing with State Government Budget Officials.	as apposed to as a budgeting tool. But the one anonymous interview they conduct in 2010 also show an official's opinion , "the economic downturn has highlighted the importance of performance measurement and reporting. When there is less funding, the use of the fund is carefully scrutinized", and so they believe that PBB is becoming more important in Maryland as the economy worsens (p. 375).
Pattison (2011)	Commentary on a paper and providing some opinions of state budget officers on PBB.	Explain the less strong effect of PBB in lean times by discussion with a number of state budget officers, and find that with the downturn in revenue in economic crisis, "state officials consider that they have not had sufficient time or resources to devote to using performance information in order to determine where to cut and by how much" (p. 389).

Table 1
Performance-based Budgeting (PBB) in State Governments

States	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Alabama	0	0	0	0	0	0	0	1	0	0
Alaska	0	0	0	0	0	0	0	0	0	1
Arizona	0	0	0	0	0	0	0	0	0	0
Arkansas	0	1	1	1	1	1	0	0	0	1
California	0	0	0	0	0	0	0	0	0	0
Colorado	1	1	1	1	1	1	1	1	1	1
Connecticut	0	0	0	0	0	0	0	0	0	0
Delaware	0	0	0	0	0	0	0	0	0	0
Florida	1	1	1	1	1	1	1	1	1	1
Georgia	0	0	0	0	0	1	1	1	1	1
Hawaii	1	1	1	1	1	1	1	1	1	1
Idaho	0	0	0	0	0	0	0	0	0	0
Illinois	0	0	0	0	0	0	0	0	0	0
Indiana	0	0	0	0	0	0	0	1	1	1
Iowa	0	0	0	1	1	1	1	1	1	1
Kansas	0	0	0	0	0	0	0	0	0	0
Kentucky	0	0	0	0	0	0	0	0	0	0
Louisiana	0	0	1	1	1	1	1	1	1	1
Maine	0	0	1	1	1	1	0	0	0	0
Maryland	0	0	0	0	1	1	1	1	1	1
Massachusetts	0	0	0	0	0	0	0	0	0	0
Michigan	0	0	0	0	0	0	1	1	1	1
Minnesota	1	1	1	1	1	1	1	1	1	1
Mississippi	0	0	0	0	0	0	0	0	0	0
Missouri	1	1	1	1	1	1	1	1	1	1
Montana	1	1	1	1	1	1	1	1	1	1
Nebraska	1	1	1	1	1	1	1	1	1	1
Nevada	0	0	0	0	0	0	0	0	0	0
New Hampshire	0	0	1	1	1	1	1	1	1	1
New Jersey	0	0	0	0	0	0	0	0	0	0
New Mexico	1	1	1	1	1	1	1	1	1	1
New York	0	0	0	0	0	0	0	0	0	0
North Carolina	1	1	1	1	1	1	1	1	1	1
North Dakota	0	0	0	0	0	0	0	0	0	0
Ohio	0	0	0	0	0	0	0	0	0	0
Oklahoma	0	0	0	0	1	1	1	1	1	1
Oregon	1	1	1	1	1	1	1	1	1	1
Pennsylvania	0	0	0	0	0	0	0	0	0	0
Rhode Island	0	0	0	0	0	0	0	0	0	0
South Carolina	0	0	0	0	1	1	1	1	1	1
South Dakota	0	0	0	0	0	0	0	0	0	0
Tennessee	0	0	0	0	0	0	0	0	0	0
Texas	1	1	1	1	1	1	1	1	1	1
Utah	0	0	0	0	0	0	1	1	1	1
Vermont	0	0	0	0	0	0	0	0	1	1
Virginia	1	1	1	1	1	1	1	1	1	1
Washington	1	1	1	1	1	1	1	1	1	1
West Virginia	1	1	1	1	1	1	1	1	0	0
Wisconsin	1	1	1	1	1	1	1	1	1	1
Wyoming	1	1	1	1	1	1	1	1	1	1

Source: from the NASBO publication, *Budget Processes in the States* (published in 1999, 2002, and 2008), and the annual *The Fiscal Survey of States* from 2000-2009 (published by the National Governors Association and NASBO).

Table 2
Summary Statistics of Variables Used in Study

Variables	N	Mean	Std Dev	Minimum	Maximum	Untransformed Means
TEXP_GF (log)	497	8.791	1.051	5.914	11.542	6,573.64
TEXP_OSF (log)	497	8.346	0.943	4.844	10.191	4,211.62
EDU_GF (log)	497	8.003	1.167	3.871	10.822	2,990.94
TRA_GF (log)	310	3.072	2.046	0	7.875	21.59
SOC_GF (log)	497	6.907	1.203	3.807	9.887	999.04
PS_GF (log)	497	6.038	1.162	0	9.175	419.03
OTH_GF (log)	494	7.427	1.116	0.693	10.059	1,680.75
EDU_OSF (log)	491	6.647	1.402	0.693	9.376	770.49
TRA_OSF (log)	490	6.658	0.974	2.398	8.821	778.98
SOC_OSF (log)	434	5.275	1.681	0	8.771	195.31
PS_OSF (log)	480	3.294	1.271	0	5.883	26.95
OTH_OSF (log)	481	7.524	1.130	1.386	9.905	1,851.83
Economic Factors						
POP (log)	497	8.205	1.008	6.200	10.518	3,660.62
GDP_PC (log)	497	10.588	0.177	10.189	11.089	39,648.95
UNEM (log)	497	1.595	0.299	0.833	2.588	4.93
Political Factors						
HD_DEM	497	0.519	0.500	0	1	
SD_DEM	497	0.469	0.500	0	1	
GOV_DEM	497	0.463	0.499	0	1	
SPC	497	0.461	0.499	0	1	
Budgeting Systems						
PBB	497	0.459	0.499	0	1	
PROG	497	0.835	0.372	0	1	
INCR	497	0.700	0.459	0	1	
ZERO	497	0.288	0.453	0	1	

Explanatory Notes

TEXP_GF	= Total expenditures from the General Fund
TEXP_OSF	= Total expenditures from the Other State Funds
EDU_GF	= Educational Expenditures (both public and higher education) from General Fund
TRA_GF	= Transportation Expenditures from General Fund
SOC_GF	= Social Expenditures (public aid and public health/Medicaid) from General Fund
PS_GF	= Public Safety Expenditures (correctional facilities) from General Fund
OTH_GF	= Other Expenditures (miscellaneous) from General Fund
EDU_OSF	= Educational Expenditures (both public and higher education) from Other State Funds
TRA_OSF	= Transportation Expenditures from Other State Funds
SOC_OSF	= Social Expenditures (public aid and public health/Medicaid) from Other State Funds
PS_OSF	= Public Safety Expenditures (correctional facilities) from Other State Funds
OTH_OSF	= Other Expenditures (miscellaneous) from Other State Funds
PBB	= Performance-Based Budgeting (dummy variable)
PROG	= Program Budgeting (dummy variable)
INCR	= Incremental Budgeting (dummy variable)
ZERO	= Zero-Based Budgeting (dummy variable)
POP (log)	= Population (in thousands before the log transformation).
GDP_PC (log)	= Gross domestic product of the state (per capita)
UNEM	= State unemployment rate (as of July 1 of each year)
HD_DEM	= Democratic Party in the majority in the state's House of Representatives (dummy variable)
SD_DEM	= Democratic Party in the majority in the state's Senate (dummy variable)
GOV_DEM	= Governor of the state is a member of the Democratic Party (dummy variable)
SPC	= Single party control of the House of Representatives, the Senate, and the Governorship.

TABLE 3
Two-way Random Effects Analyses of the Effect of PBB and Other
Budgetary Systems on Aggregate Expenditures (Nerlove Variance
Components Method) - Test of Hypotheses 1.1 and 1.2

	Expected sign	Dependent Variable log (TEXP_GF)			Expected sign	Dependent Variable log (TEXP_OSF)		
		Coefficients	T-value #			Coefficients	T-value #	
Intercept		-9.757	-70.43	***		3.192	1.25	
Economic Factors								
POP (log)	+	0.967	2075.6	***	+	0.524	16.99	***
GDP_PC (log)	+	1.020	81.55	***	+	0.054	0.25	
UNEM (log)	-	-0.137	-36.83	***	-	-0.085	-1.87	&
Political Factors								
HD_DEM	+	-0.010	-15.84	***	+	-0.046	-3.65	***
SD_DEM	+	-0.009	-11.76	***	+	-0.177	-16.30	***
GOV_DEM	+	0.018	26.11	***	+	0.016	2.17	*
SPC	+	-0.047	-67.7	***	+	0.118	15.74	***
Budgeting Systems								
PBB	-	-0.020	-28.75	***	+	0.037	3.21	**
PROG	+	0.023	16.66	***	+	0.313	15.19	***
INCR	+	0.041	31.91	***	+	0.334	13.92	***
ZERO	-	0.072	35.22	***	-	-0.169	-12.01	***
Time series Length			10	unbalanced			10	unbalanced
Number of cross sections			50				50	
Variance components for Cross Sections			0.099				3.993	
Variance components for Time Series			0.019				0.086	
Variance components for Error			0.016				0.089	
Adjusted R-Square (Degrees of Freedom)			0.5088	485			0.090	485
Hausman Test for Random Effects	m Value		2.41				5.96	
	Pr>m		0.996				0.876	
Breusch Pagan Test (Two way) for random effects	m Value		411.64				345.43	
	Pr > m		<0.0001				<0.0001	

All variables are explained in Table 2.

= T-values based on White'& Huber's robust standard errors.

& = significant at probability of 0.10 (2-tailed).

* = significant at probability of 0.05 (2-tailed).

** = significant at probability of 0.01 (2-tailed).
*** = significant at probability of 0.001 (2-tailed).

Exponent of coefficients		
PBB	0.980	1.038
PROG	1.024	1.367
INCR	1.042	1.396
ZERO	1.074	0.844

TABLE 4
Two-way Random Effects Analyses of the Effect of PBB and Other Budgetary Systems on Future-oriented Expenditures (Nerlove Variance Components Method) - Test of Hypotheses 2.1 and 2.2

	Expected sign	Funding from the General Fund						Expected sign	Funding from dedicated Other State Funds					
		log (EDU_GF)			log (TRA_GF)				log (EDU_OSF)			log (TRA_OSF)		
		Coefficients	T-value	#	Coefficients	T-value	#		Coefficients	T-value	#	Coefficients	T-value	#
Intercept		-7.662	-46.93	***	-4.995	-0.19			-11.206	-2.06	*	-3.547	-7.03	***
Economic Factors														
POP (log)	+	1.093	984.26	***	0.691	5.35	***	+	0.367	9.98	***	0.809	363.14	***
GDP_PC (log)	+	0.622	41.90	***	0.449	0.19		+	1.357	2.77	**	0.307	6.71	***
UNEM (log)	-	0.067	17.80	***	-1.497	-1.90	&	-	0.014	0.10		0.027	1.61	
Political Factors														
HD_DEM	+	-0.094	-54.46	***	0.113	0.44		+	0.233	9.27	***	-0.086	-20.27	***
SD_DEM	+	0.010	10.27	***	0.211	0.91		+	-0.194	-6.06	***	0.015	3.24	***
GOV_DEM	+	0.003	3.83	***	-0.306	-1.24		+	0.201	10.00	***	0.016	4.98	***
SPC	+	-0.005	-10.25	***	-0.227	-1.06		+	0.094	5.28	***	-0.004	-1.53	
Budgeting Systems														
PBB	-	-0.056	-61.79	***	-0.709	-2.65	**	+	0.001	0.06		0.115	22.13	***
PROG	+	0.037	31.40	***	-0.430	-1.13		+	0.278	3.31	***	0.210	46.51	***
INCR	+	0.087	61.54	***	0.573	1.62		+	0.086	1.39		0.147	23.51	***
ZERO	-	-0.059	-29.48	***	0.848	2.40	*	-	-0.042	-1.34		-0.091	-18.53	***

(TABLE 4 continued)

			unbalanced					
Time series Length		10	unbalanced	10		10		10
Number of cross sections		50		41		50		50
Variance components for Cross Sections		0.329		5.016244		4.086		0.332
Variance components for Time Series		0.005		0.211617		0.047		0.015
Variance components for Error		0.023		0.853142		0.215		0.066
Adjusted R-Square (Degrees of Freedom)		0.2976	485	*0.1033*	*296*	0.0596	479	0.1859	478
Hausman Test for	m Value	1.76		*18.18*		3.54		1.81
Random Effects	Pr>m	0.992		*0.0011*		0.9815		0.999
Breusch Pagan Test (two way) for random effects.	m Value	713.3		122.04		503.41		403.78
	Pr > m	<0.0001		<0.0001		<0.0001		<0.0001

All variables are explained in Table 2.
= T-values based on White's robust standard errors.
& = significant at probability of 0.10 (2-tailed).
* = significant at probability of 0.05 (2-tailed).
** = significant at probability of 0.01 (2-tailed).
*** = significant at probability of 0.001 (2-tailed).

Exponent of coefficients

PBB	0.946	0.492	1.001	1.122
PROG	1.037	0.651	1.320	1.234
INCR	1.091	1.773	1.089	1.158
ZERO	0.943	2.336	0.959	0.913

TABLE 5
Two-way Random Effects Analyses of the Effect of PBB on Social
Expenditures
(Nerlove Variance Components Method) - Test of Hypothesis 3

		General Fund				Other State Fund		
	Expected	log (SOC_GF)			Expected	log (SOC_OSF)		
	sign	Coefficients	T-value #		sign	Coefficients	T-value #	
Intercept		-9.778	-37.31	***		3.985	0.57	
Economic Factors								
POP (log)	+	1.052	654.39	***	+	1.160	43.34	***
GDP_PC (log)	+	0.760	32.86	***	+	-0.871	-1.37	
UNEM (log)	-	-0.002	-0.38		-	0.187	0.99	
Political Factors								
HD_DEM	+	-0.022	-18.06	***	+	-0.059	-0.84	
SD_DEM	+	-0.045	-38.32	***	+	0.217	3.45	***
GOV_DEM	+	0.039	39.20	***	+	0.095	2.52	*
SPC	+	-0.018	-19.19	***	+	-0.060	-1.51	
Budgeting Systems								
PBB	-	-0.008	-5.59	***	+	0.187	2.69	**
PROG	+	-0.013	-7.70	***	+	0.092	1.17	
INCR	+	0.066	28.45	***	+	0.190	1.77	&
ZERO	-	0.005	2.08	*	-	0.441	3.99	***

Time series Length		10	unbalanced			10	unbalanced
Number of cross sections		50				48	
Variance components for Cross Sections		0.302				1.925	
Variance components for Time Series		0.027				0.068	
Variance components for Error		0.021				0.363	
Adjusted R-Square (Degrees of Freedom)		0.291	485			0.0966	422
Hausman Test for	m Value	4				1.53	
Random Effects	Pr>m	0.970				0.999	
Breusch Pagan Test (two way) for random effects.	m Value	448.38				306.2	
	Pr > m	<0.0001				<0.0001	

All variables are explained in Table 2.

\# = T-values based on White'& Huber's robust standard errors.

& = significant at probability of 0.10 (2-tailed).

* = significant at probability of 0.05 (2-tailed).

** = significant at probability of 0.01 (2-tailed).

*** = significant at probability of 0.001 (2-tailed).

Exponent of coefficients

PBB	0.992		1.205
PROG	0.987		1.096
INCR	1.068		1.209
ZERO	1.005		1.554

TABLE 6
Two-way Random Effects Analyses of the Effect of PBB and Other Budgetary Systems on Functional Expenditures from General Funds (Nerlove Variance Components Method)

	Expected sign	Funding from the General Fund						Funding from dedicated Other State Funds					
		log (PS_GF)			log (OTH_GF)			log (PS_OSF)			log (OTH_OSF)		
		Coefficients	T-value	#	Coefficients	T-value	#	Coefficients	T-value	#	Coefficients	T-value	#
Intercept		-14.231	-26.99	***	-4.481	-1.87		1.893	0.71		13.835	1.33	
Economic Factors													
POP (log)	+	1.025	214.20	***	0.903	82.18	***	0.770	71.54	***	0.270	2.21	*
GDP_PC (log)	+	1.090	22.79	***	0.544	2.55	*	-0.477	-1.93	&	-0.807	-0.91	
UNEM (log)	-	0.244	14.86	***	-0.763	-7.99	***	0.066	1.33		-0.267	-1.28	
Political Factors													
HD_DEM	+	0.049	23.00	***	0.006	0.50		0.083	3.27	***	-0.056	-1.10	
SD_DEM	+	-0.027	-8.89	***	-0.028	-2.08	*	-0.177	-8.35	***	-0.094	-2.83	**
GOV_DEM	+	-0.000	-0.17		-0.116	-9.30	***	-0.044	-2.38	*	-0.115	-3.82	***
SPC	+	0.030	13.25	***	-0.040	-3.95	***	0.014	0.94		0.102	3.75	***
Budgeting Systems													
PBB	?	-0.041	-13.23	***	-0.008	-0.60		-0.000	-0.02		0.080	1.56	
PROG	?	-0.100	-15.73	***	0.019	0.67		0.102	2.57	**	0.421	4.93	***
INCR	?	0.080	17.28	***	0.056	2.42	*	-0.073	-2.54	**	0.233	4.99	***
ZERO	?	-0.172	-10.83	***	-0.020	-0.89		-0.014	-0.52		-0.126	-2.59	**

(TABLE 6 continued)

Time series Length		10	unbalanced	10	unbalanced	10	unbalanced	10	unbalanced
Number of cross sections		50		50		50		50	
Variance components for Cross Sections		0.927		0.929		1.226		13.062	
Variance components for Time Series		0.009		0.129		0.012		0.181	
Variance components for Error		0.072		0.131		0.186		0.244	
Adjusted R-Square (Degrees of Freedom)		0.1454	485	0.1402	482	0.0655	468	0.0345	469
Hausman Test for	m Value	2.48		5.82		1.47		10.34	
Random Effects	Pr>m	0.996		0.885		0.999		0.411	
Breusch Pagan Test (two way) for random effects.	m Value	99.23		183.29		209.56		299.5	
	Pr > m	<0.0001		<0.0001		<0.0001		<0.0001	

All variables are explained in Table 2.
 # = T-values based on White's robust standard errors.
&   = significant at probability of 0.10 (2-tailed).
*   = significant at probability of 0.05 (2-tailed).
**   = significant at probability of 0.01 (2-tailed).
*** = significant at probability of 0.001 (2-tailed).

Exponent of coefficients

PBB	0.960	0.992	1.000	1.083
PROG	0.904	1.019	1.108	1.524
INCR	1.083	1.058	0.929	1.262
ZERO	0.842	0.980	0.986	0.881

Table 7
Analysis of the Effect of PBB on Aggregate Expenditures with
Sample Restricted to States either Implementing PBB in All Years or
not Implementing in Any Year (Model Estimated is a One-way
(Time) Fixed Effects Panel Analysis)

	TEXP_GF			TEXP_OSF		
	Coefficient	T-value		Coefficient	T-value	
Time fixed effects (omitted)	*None significant*			*None significant*		
Intercept	1.118	0.04		-4.614	-0.47	
Economic Factors						
POP (log)	2.059	15.46	***	0.571	15.63	***
GDP_PC (log)	0.140	0.91		0.021	0.53	
UNEM	-0.749	-0.35		0.666	0.86	
Political Factors						
HD_DEM	1.099	1.55		0.162	0.23	
SD_DEM	3.483	4.12	***	-1.223	-3.03	**
GOV_DEM	0.131	0.21		1.532	3.02	**
SPC	-1.069	-0.84		-0.149	-0.4	
Budgeting Systems						
PBB	-3.309	-4.03	***	0.970	2.96	**
PROG	-0.520	-0.28		1.255	2.11	*
INCR	0.511	0.55		0.362	0.86	
ZERO	0.284	0.8		1.296	3.73	***
Number of states included in analysis		34			34	
- No PBB implemented in any year		19			19	
- PBB implemented in all years (2000-2009)		15			15	
MSE		20.809			10.334	
R-Square		0.926			0.7111	
F Test for Fixed Effects	F Value	2.52			1.85	
	Pr > F	0.0085			0.0587	
Breusch Pagan Test	m Value	1.03			1.28	
(One Way)	Pr > m	0.3105			0.2571	

All variables are explained in Table 2.
&   = significant at probability of 0.10 (2-tailed).
*   = significant at probability of 0.05 (2-tailed).
**   = significant at probability of 0.01 (2-tailed).
*** = significant at probability of 0.001 (2-tailed).

Table 8
OLS Regression Analysis of Total Expenditures on PBB and Control Variables by Specific Year of Survey Report

	Dependent Variable =TEXP_GF									Dependent Variable = TEXP_OSF								
	2000			**2002**			**2008**			**2000**			**2002**			**2008**		
	Coefficients	T-value		Coefficients	T-value		Coefficients	T-value		Coefficients	T-value		Coefficients	T-value		Coefficients	T-value	
Intercept	-7.939	-2.66	**	-8.452	-1.97	*	-3.700	-0.66		2.526	1.20		-5.357	-1.81	&	-2.060	-0.43	
Economic Factors																		
POP (in million)	1.698	13.16	***	1.868	10.36	***	2.376	11.63	***	0.577	5.73	***	0.463	6.23	***	0.717	8.85	***
GDP_PC (in $M)	0.168	2.94	**	0.227	2.70	**	0.247	3.32	***	-0.051	-1.55	*	-0.027	-0.61		-0.025	-0.36	
UNEM (in percent)	-0.113	-0.37		-0.375	-0.82		-1.277	-2.26	**	0.140	0.50		0.957	2.63	**	0.550	1.09	
Political Factors																		
HD_DEM	-0.397	-0.61		0.649	0.55		2.497	1.63		-1.311	-1.84	&	1.623	1.41		0.321	0.19	
SD_DEM	2.243	2.50	*	2.585	1.86	&	3.744	2.47	*	0.031	0.04		-1.970	-1.95	*	0.325	0.21	
GOV_DEM	0.614	0.80		1.201	1.21		-1.825	-1.45		-1.135	-1.48		-0.817	-0.95		3.193	3.09	***
SPC	0.563	0.87		0.879	0.95		-1.702	-1.10		-0.498	-0.68		-0.597	-0.72		-0.481	-0.49	
Budgeting systems																		
PBBT	-0.949	-0.95		-1.437	-1.38		-4.757	-3.52	***	-0.146	-0.15		1.172	1.24		0.224	0.21	
PROGT	0.777	0.90		-0.500	-0.49		-0.229	-0.16		0.569	0.73		3.255	3.01	**	1.173	1.02	
INCRT	0.066	0.07		-0.205	-0.17		0.079	0.04		0.927	1.02		0.931	0.90		0.485	0.40	
ZEROT	-0.682	-0.56		-0.652	-0.38		1.072	0.59		1.588	1.28		2.999	2.02	*	0.399	0.37	
Adjusted R- Square	0.927			0.909			0.9133			0.5935			0.6262			0.6489		
Sample size	50			50			50			49			49			50		

All variables are explained in Table 2.
&   = significant at probability of 0.10 (2-tailed).
*   = significant at probability of 0.05 (2-tailed).
**   = significant at probability of 0.01 (2-tailed).
*** = significant at probability of 0.001 (2-tailed).

[1] *Program budgeting* may be defined as a budget approach in which inputs of resources and outputs of services are identified by programs without regard to the number of organizational units involved in performing various aspects of the program. *Line-Item Budgeting* is an approach under which the planned expenditures are grouped by administrative entities and objects of expenditure (usually functions). *Incremental Budgeting* is a budgeting approach under which the current budget prepared using a previous period's budget or actual performance as a basis with incremental amounts added for the new budget period. *Zero-based budgeting* is a budgeting approach which starts from a "zero base" and every function within an organization is analyzed for its needs and costs. The implemented budget is based on the estimated needs and costs without regard to past expenditures.

[2] On the expected expenditure-reduction effects of Zero-based Budgeting, see LaFaive (2003). The pros and cons of Incremental Budgeting are often contrasted with those of Zero-based Budgeting since they are seen as the most direct opposites.

[3] The data on the legislature make-up of the states were obtained from *The 2012 Statistical Abstract，The National Data Book* published by the US Census Bureau. State economic data (population, unemployment, and gross domestic product) were similarly collected from the US Census Bureau sources.