

The Impacts of Overlay Provisions on School Funding Formulas

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Abstract

States often make modifications, known as overlay provisions, to their funding formulas to constrain revenue variations from year to year. Some of these provisions are meant to restrict declines in revenues, while others limit revenue increases. In this study, we seek to understand better the types of overlay provisions that are used in public school funding, and the impacts that these provisions can have on equity in school funding. We begin by reviewing the various OPs that could be used by states. We then turn to an analysis of Indiana's 2004 foundation aid program, and the impact of the state's three different OPs on the level and distribution of education funding received by districts, and in particular, on horizontal and vertical equity. Our results show that these provisions directly led to horizontal and vertical inequity in the state's funding formula. Removing these OPs, however, would likely harm districts with falling enrollments because their decline in marginal revenues would exceed their decline in marginal costs.

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Introduction

States play a very active role in funding K-12 education. Over forty states currently use foundation aid programs to distribute monies to public school districts across much of the United States (Park, 2004). These formulas were often initiated in response to legal action claiming inequities existed in funding across school districts due to the differing wealth of districts. A common practice is for states to use a foundation grant to assign revenues to districts. In its simplest form, a foundation grant would set total revenues equal to a specified per-pupil dollar amount (“foundation level”) multiplied by current enrollments. In this way, the dollars received by a district for basic education operations are in direct proportion to its size and unrelated to its wealth. The formula then specifies the shares of total revenues that are to be paid by state and local sources.

This simplistic view of foundation aid programs ignores the fact that states often make modifications to their funding formulas to constrain revenue variations from year to year. Some modifications often referred to as “hold harmless provisions” are meant to restrict declines in revenues, while others limit revenue increases. These modifications may take different forms, such as ceilings and floors on the change in the foundation grant, supplemental funding for districts with falling enrollments, alternatives to the foundation grant for calculating total revenue, and/or the use of past enrollments in foundation grant calculations. Such provisions are often made for political reasons by representatives who seek to protect the level of funding given to their districts. We refer to any modification that restricts the increase or decrease in revenue from year to year as an overlay provision (OP).

Although speculation exists that these provisions may have unintended consequences on the fairness by which states distribute education funding (Crampton, 1994; Duncombe and Yeager, 1997; Downes and Pogue, 2002; Baker and Duncombe, 2004), the effects of OPs on specific education finance goals and objectives has not been examined in a systematic way. It is not clear, for example, how the use of OPs would affect goals such as vertical equity. On one hand, these provisions may distort the intended dollar adjustments made in the state's foundation aid program for vertical equity considerations, and thus reduce the additional funding given to districts with more at-risk students. On the other hand, because these provisions often increase per-pupil funding for districts with falling enrollments, and such districts tend to be located in lower socioeconomic areas with more at-risk students, such provisions could lead to stronger and not weaker connections between per-pupil revenues and vertical equity factors.

In this study, we seek to understand better the types of overlay provisions that are used in public school funding, and the impacts that these provisions can have on equity in school funding. We begin by reviewing the various OPs that could be used by states. We then turn to an analysis of Indiana's 2004 foundation aid program, and the impact of the state's three different OPs on the level and distribution of education funding received by districts, and in particular, on horizontal and vertical equity. Our results show that these provisions directly led to horizontal and vertical inequity in the state's funding formula. Removing these OPs, however, would likely harm districts with falling enrollments because their decline in marginal revenues would exceed their decline in marginal costs.

Literature Review

Although most every state uses a funding formula for distributing revenues for public education, no two are alike in their specific details. Park (2004) describes how states' funding formulas differ in the weights and adjustments made to the foundation grant and whether districts are permitted to raise revenue above and beyond the amount prescribed by the foundation grant. It is common for states to adjust the foundation grant to allocate more revenues to districts with more disadvantaged students to help achieve goals such as vertical equity. However, states vary in the factors used to represent disadvantaged students, and no consensus exists on the dollar increases that should be assigned to these factors (Baker and Duncombe, 2004; Odden and Picus, 2004; Sielke et al., 2001).

The summaries of state funding systems collected by Sielke et al. (2001) show that approximately half of all states use one or more overlay provision when allocating revenues to school districts.¹ These provisions are usually added to funding formulas to protect districts from large revenue declines when states make significant changes in their aid program (Reschovsky, 1994; Downes and Pogue, 2002). States often continue to use OPs, however, even when aid programs are not modified as a way to appease political constituencies when enrollment declines would lead to large revenue declines, or to address other issues (Iatarola, 2003; Baker and Duncombe, 2004). As noted by Reschovsky (1994, p.192), "As the design of newly targeted aid programs almost inevitably results in reductions in aid to some school districts, it is not surprising, given political realities, that most school finance systems include 'hold harmless' grants and 'minimum aid' grants even for the wealthiest of school districts." Crampton (1994) also points out that OPs may also be used to limit reductions in categorical aid

programs. Not all OPs, however, are meant to limit losses for school districts. States can also enact provisions that cap the growth in revenue from year to year.

There are a number of reasons why overlay provisions may lead to problems in school funding formulas. It has been suggested that OPs help perpetuate past aid distributions (Downes and Pogue, 2002; Dee and Levine, 2004), create new inequities in funding, reduce incentives for schools to become more efficient, and hurt growing school districts by not providing enough money to cover their rising educational costs. There is some evidence that OPs are particularly harmful to central city districts (Duncombe and Yinger, 1997) and rural districts (Baker and Duncombe, 2004). Crampton (1994) argued that OPs may create inequities across districts and expand them over time. As noted by Downes and Pogue (2002, p.348), “What many may not recognize is the degree to which hold-harmless provisions lock-in past aid distributions and create current aid distributions that differ dramatically from those that would result from literal application of aid formulae.”

In addition, the reallocation of dollars due to OPs may affect a state’s ability to achieve other goals such as horizontal and vertical equity. Recent studies by Duncombe and Johnston (2004), Picus, Odden, and Fermanich (2004), Paquette (2004), Vesely and Crampton (2004), Hirth and Eiler (2005), and many others have examined whether states provide equal funding for equal districts (horizontal equity) and differential funding for districts with different needs (vertical equity). Because OPs can lead to education dollars being distributed in ways that differ from a strict application of a state’s foundation grant, the total revenue that districts actually receive to address vertical equity may be quite different from what was intended by the state.

Alternatively, there are possibly some benefits to the use of OPs. Downes and Pogue (2002) argue that OPs protect districts against financial harm due to sampling and measurement

error in data used in aid formulas. By phasing in the revenue changes from a foundation grant, an OP may give school districts more time to make changes in their production processes that would minimize negative impacts of funding cuts on education. For example, it may be difficult for a district to absorb a 10 percent revenue reduction in one year, but if phased in over several years, the district could more thoughtfully consider the best way to realign students, teachers, and other resources to minimize the total effect. Likewise, a district experiencing a 10 percent increase in revenue may use the dollars inefficiently if forced to make funding decisions too quickly.

Overlay provisions may also help school districts align marginal revenues and marginal costs from year to year. This could occur when there are some fixed education costs because a foundation grant strictly applied would provide too much additional revenue for growing districts and would reduce revenue by too much for declining districts.² It seems clear that some costs of school districts are relatively fixed in the short run. Researchers have examined this issue through studies of the economies of scale in education (see, for example, Fox, 1981; Riew, 1986; Monk, 1987; 1990; Niskanen, 1998; Andrews, Duncombe, and Yeager, 2002; Heinesen, 2005).³ Baker and Duncombe (2004) observed that the vast majority of studies found evidence in support of economies of scale, and that the literature has shown that per-pupil costs are considerably higher for small school districts. This would support the argument for some form of subsidy for smaller schools/districts and protection from revenue declines that would follow from the strict reliance on a foundation grant. Nearly half of all states provide for some type of financial adjustment for districts based on their size and/or sparsity (Baker and Duncombe, 2004; Park, 2004).⁴

Due to discontinuities in the production of education, the marginal costs for small changes in enrollments may be even smaller than would be estimated through a cost function. For example, the marginal cost for a district that gains ten students might be very low if the students can be easily incorporated into existing classrooms without increasing the number of teachers or administrative staff. Similarly, if a district were to lose ten students, the reduction in marginal cost might be low if the district were forced by enrollment patterns to offer the same number of classrooms as before. As a result, school districts with falling enrollments would be hurt even more if they were funded by a foundation grant because their total costs have remained constant while revenues declined.

Taken together, these issues argue in favor of some protection in funding formulas for districts with falling enrollments and perhaps limitations in marginal revenue increases for growing districts. This protection could be accomplished through making economies of scale adjustments to the per-pupil foundation level, or by using OPs. Without some protection, districts with falling enrollments would have a more difficult time providing the same level of educational services as before and may be adversely affected by the strict application of a foundation grant where revenues change in direct proportion to enrollments. When total financial resources for education are fixed, however, this protection must come at the expense of other school districts with rising enrollments. If the marginal costs of education are low, then it might be argued that such cross-subsidization is appropriate because growing districts do not need total revenues to increase in proportion with enrollments. Such deviations away from the strict application of a foundation grant, however, can adversely affect the funding provided to districts for traditionally disadvantaged students.

Even though OPs are widely used in funding formulas, little has been reported in the school finance literature about the types of provisions used and the effects that they have on the level and distribution of school funding. Clearly they lead to reallocations of funding from one group of school districts to another (primarily from growing to declining districts), and may increase or decrease total education funding depending on the type of OP, the number of districts affected, and the magnitudes of the adjustments. For these and other reasons, it is important to assess the impacts of these provisions on school funding (Hoxby, 1998). Education policymakers need to understand how OPs might affect equity, especially since states are routinely compared to each other in terms of equity (Carey, 2004; Costrell, 2005; *Education Week*, 2005; *The Education Trust*, 2005). Depending on how the provisions reallocate funding, they could hinder or even help a state achieve gains in equity.

Forms of Overlay Provisions

There are a variety of overlay provisions that states may use in their funding formulas for public school districts. In one way or another, OPs are designed to prevent districts from experiencing large fluctuations (usually declines) in education revenues from year to year. These are particularly relevant for states that use foundation grants to provide total revenues to school districts. In its simplest form, funding formulas assign total revenues to district j in year t (TR_{jt}) based on a foundation grant (FG_{jt}), which we define as current enrollments (E_{jt}) multiplied by a designated per-pupil foundation level (FL_{jt}):

$$(1) \quad TR_{jt} = FG_{jt} = E_{jt} * FL_{jt}$$

In practice, the per-pupil foundation level may be weighted to provide different levels of per-pupil funding based on the number of disadvantaged students in the district and other

considerations such as cost-of-living, and thus may not be constant across districts. Equation (1) shows that year to year changes in enrollments would lead to proportional changes in the foundation grant and hence total revenues for districts.

One form of OP that could be used is to specify different per-pupil funding levels by district size without using a cost study to inform the size of the adjustments. This may be necessary in states where revenues act as a significant constraint on spending. According to Christenson’s (2001) description of Wyoming’s school funding plan:

“The Legislature does recognize that the operation of small schools generally costs more due to significant diseconomies of scale as fixed costs are spread over relatively few students. To ensure delivery of the basket to students attending small schools, the model disproportionately subsidizes small schools to compensate districts for these additional operating costs.” (p.8)

In either case, districts with falling enrollments would receive a smaller reduction in revenues under this option than if revenues were solely determined by a fixed per-pupil foundation level.

States can also provide additional funding (A_{jt}) above and beyond the foundation grant to school districts with declining enrollments:

$$(2) \quad A_{jt} = \begin{cases} 0 & \text{if } E_{jt} \geq E_{jt-1} \\ d * (E_{jt-1} - E_{jt}) & \text{if } E_{jt} < E_{jt-1} \end{cases}$$

where d = additional per-pupil funding for districts with falling enrollments. This could be modified to apply only when the enrollment decline exceeds a specific threshold (e.g., more than 100 students) and/or may be capped. Total revenue for each district would then be calculated as the sum of the foundation grant plus the additional funding ($TR_{jt} = FG_{jt} + A_{jt}$).

Another form of OP is that states can restrict the year-to-year change in the foundation grant:

$$(3) \quad TR_{jt} = \begin{cases} FG_{jt-1} + \alpha_1 & \text{if } FG_{jt} - FG_{jt-1} \geq \alpha_1 \\ FG_{jt} & \text{if } \alpha_1 > FG_{jt} - FG_{jt-1} > \alpha_2 \\ FG_{jt-1} + \alpha_2 & \text{if } FG_{jt} - FG_{jt-1} \leq \alpha_2 \end{cases}$$

where α_1 = upper bound (“ceiling”) on change in the foundation grant, and α_2 = lower bound (“floor”) on change in the foundation grant. For example, Vermont’s 1998-99 funding formula included a floor provision that small districts experiencing a greater than 10% decline in enrollments would have their revenue reduction limited to 10%. The year-to-year change could be represented as a percentage change or a fixed dollar change, and states may impose a ceiling, floor, or both. Crampton (1994) provides a good description of the ceiling and floor used in New York’s funding system in 1994.

Rather than restrict the foundation grant, states could also protect districts by providing them with alternatives to the foundation grant, such as the following:

$$(4) \quad TR_{jt} = \text{Max}(FG_{jt}, TR_{jt-1} * (1 + r_t))$$

where r_t = minimum permitted growth rate in the prior year’s total revenue. The growth factor could be positive, negative, or zero; for example, if $r_t = -0.01$, then this option would set total revenue in year t equal to the maximum of the foundation grant or 99% of total revenue from the prior year. This provision operates as a floor even though it does not restrict the change in the foundation grant per se because it places a lower bound on the total revenue for school districts equal to the previous year’s total revenue times a growth factor. When the total revenue from the foundation grant is lower than the second option, total revenue is set equal to the second option. Florida, for example, ensured that districts would have a guaranteed increase in funding of 1% in terms of weighted enrollments (Wood et al., 2001). In Massachusetts, districts received at least the same level of funding as the previous year plus a minimum aid increase of \$100 per pupil (Hatch, 2001). Nebraska used a stabilization factor that limited the decrease in state aid to 85%

of the previous year's aid less an adjustment for assessed valuation (LaCost, Inbody, and Knoche, 2001). Alaska phased in the revenue reduction for school districts with large declines in enrollments (10% or more) over a four-year period (Berman, Hull, and McDiarmid, 2001).

Another form of OP arises when states use a weighted average of past enrollments (\bar{E}_{jt}) rather than current enrollments in their foundation grant for computing total revenues:

$$(5.1) \quad FG_{jt} = \bar{E}_{jt} * FL_j$$

$$(5.2) \quad \bar{E}_{jt} = \sum_{k=1}^{k=t} w_{t-k} E_{jt-k},$$

where w = weights given to prior enrollments. If a state sets $\bar{E}_{jt} = 0.60 * E_{jt-1} + 0.40 * E_{jt-2}$, for example, then the enrollment figure used in the foundation grant is equal to 60% of enrollments from the previous year and 40% of enrollments from two years prior. Relying on a weighted average of past enrollments rather than current enrollments in the funding formula has the effect of phasing in the effects of declining enrollments on revenues. At the same time, this provision will restrict the growth in revenues for districts with rising enrollments, in effect lowering the per-pupil revenues that they receive. Kansas, Maine, Missouri, and Nevada are all examples of states that used past enrollments in their foundation grant calculations (Sielke et al., 2001).

Indiana: A Case Study

We now turn to the state of Indiana to examine in more detail the types of OPs that one state has used and the effects that these provisions had on education finance goals. Indiana's foundation aid program has changed substantially over time (Johnson and Lehnen, 1993; Toutkoushian and Michael, 2004; Hirth and Eiler, 2005). What makes Indiana a particularly interesting case study for our purposes is that between 1993 and 2004, the state's foundation aid program included not one but several overlay provisions. Indiana's funding formula did not

provide for adjustments in the foundation level due to non-equity considerations such as district size, cost-of-living, grade level, or other attributes that may affect the cost of providing basic education. Nonetheless, the state’s method for calculating total revenues for school districts was quite involved, as depicted in Figure 1:

----- Insert Figure 1 Here -----

In the state’s 2004 funding formula, the foundation grant for each district was set equal to the per-pupil foundation level (\$4,350) multiplied by the Complexity Index (CI_{jt}) and the adjusted enrollment count ($wADM_{jt}$):

$$(6) \quad FG_{jt} = \$4,350 * CI_{jt} * wADM_{jt}$$

where $wADM_{jt}$ = weighted average of enrollments from the previous five years.⁵ The use of a weighted average of past enrollments rather than current enrollments in the foundation grant is one overlay provision in the state’s funding formula. As noted earlier, this limits the reduction in revenues for districts with falling enrollments at the expense of growing districts.

The state’s Complexity Index is derived from five factors that were chosen for additional funding to help achieve vertical equity. These factors are: (a) the percentage of adults in the district with less than a high school education ($NoHS_j$); (b) the percentage of single parent families in the district ($OneP_j$); (c) the percentage of families in the district with dependent children and living in poverty (Pov_j); (d) the percentage of children in each district eligible for free lunch at school ($FreeL_j$); and (e) the percentage of children in each district with limited English proficiency (LEP_j). The Complexity Index⁶ in any year is computed as follows:

$$(7) \quad CI_j = 1 + \beta_1 * NoHS_j + \beta_2 * OneP_j + \beta_3 * Pov_j + \beta_4 * FreeL_j + \beta_5 * LEP_j$$

with β_1^* through β_5^* = weights assigned by the state to each vertical equity factor.⁷

The second OP used by Indiana is that the foundation grant was restricted to fall within plus or minus 2% of the per-pupil revenue in 2003 times the enrollment level in 2004:

$$(8.1) \quad FG \text{ Ceiling} = 1.02 * (TR_{jt-1} / ADM_{jt-1}) * ADM_{jt}$$

$$(8.2) \quad FG \text{ Floor} = 0.98 * (TR_{jt-1} / ADM_{jt-1}) * ADM_{jt}$$

Therefore, the foundation grant must be at least 98% of the previous year's revenue per pupil multiplied by current enrollments (floor), and cannot exceed 102% of the previous year's revenue per pupil multiplied by current enrollments (ceiling).

A third OP in Indiana's funding formula is that districts were given three options for calculating their total revenue: the foundation grant, variable grant, and minimum guarantee grant. In the option we refer to as a variable grant (VG_{jt}), total revenue was set equal to the previous year's weighted per-pupil revenue multiplied by its current weighted enrollment level:

$$(9) \quad VG_{jt} = (TR_{jt-1} / wADM_{jt-1}) * wADM_{jt}$$

School districts with rising enrollments tend to benefit the most from the variable grant option.

The minimum guarantee grant (MGG_{jt}) computed total revenue by increasing the prior year's total revenues by a percentage (r_t) determined by the Legislature:

$$(10) \quad MGG_{jt} = TR_{jt-1} * (1 + r_t)$$

In 2004, the state set $r_t = 0.01$, meaning that each district's total revenue for 2004 would be at least 1% greater than total revenue in 2003. By state law, total revenue for each district was then set equal to the *maximum* of these three options:

$$(11) \quad TR_{jt} = \max[FG_{jt}, VG_{jt}, MGG_{jt}]$$

To demonstrate how the foundation aid program worked in Indiana, Table 1 shows how total revenue was calculated for the Goshen Community School District. Because the total revenue from the foundation grant (\$28.5 million) was below the floor (\$29.15 million), the

foundation grant was adjusted upward to this floor. The final total revenue for Goshen Community Schools was set equal to the foundation grant floor because this total was higher than the totals from either the variable grant (\$29.09 million) or the minimum guarantee grant (\$28.9 million). The steps in Table 1 also illustrate the complexity involved in the state's funding formula for calculating total revenue.

----- Insert Table 1 Here -----

In Table 2, we illustrate how total revenue was determined for three public school districts with changing enrollments over a four-year period. Enrollments from 2000 to 2004 grew rapidly (+9.7%) for Goshen Community Schools, moderately for Elkhart Community Schools (+2.7%), and declined for the largest district in the state, Indianapolis Public Schools (-4.9%). As shown in Table 2, Goshen Community Schools received their revenue according to the foundation grant floor. For Elkhart Community Schools, neither the ceiling nor floor affected the foundation grant calculation. However, the district's total revenue was set equal to the variable grant because this option provided the district with the largest dollar figure of the three alternatives. Finally, Indianapolis Public Schools received their funding based on the minimum guarantee grant. These differences in revenue sources were driven mainly by the different trends in enrollments for the districts. The minimum guarantee option tended to provide more revenue than other options to districts with falling enrollments.

----- Insert Table 2 Here -----

In recent years, Indiana has experienced a large shift in the source of grant funding among these three options. Prior to 2000-01, nearly half of the public school districts were funded through the foundation grant option. By 2003-04, however, fewer than one in five districts were deriving their revenues from the foundation grant. Some state education policy

makers were concerned about the increased reliance on the minimum guarantee grant for several reasons. First, it prevented education dollars from being redistributed away from districts with falling enrollments and towards districts with growing enrollments. Second, the guaranteed funding base for districts could reduce the incentive for districts with falling enrollments to become more efficient in their use of resources. Third, districts with shifts in the size of their disadvantaged populations may not receive corresponding changes in funding under the minimum guarantee option, and thus it could have an adverse effect on equity within the state.

To examine the impacts of these overlay provisions on public school funding in Indiana in 2004, we performed a series of simulations. The three OPs are as follows:

- OP#1: Use weighted-average enrollments in place of actual enrollments
- OP#2: Impose ceiling and floor on the foundation grant
- OP#3: Add variable grant and minimum guarantee grant options to funding formula

We considered the following eight models in our simulations:

Model	Description
I	No OPs used in the state's funding formula
II	One OP (#1) used in funding formula
III	One OP (#2) used in funding formula
IV	One OP (#3) used in funding formula
V	Two OPs (#2 and #3) used in funding formula
VI	Two OPs (#1 and #3) used in funding formula
VII	Two OPs (#1 and #2) used in funding formula
VIII	All three OPs used (i.e., actual 2004 funding formula)

The first model shows how the funding formula would operate if all three overlay provisions were eliminated. In Models II through IV, we included only one OP in the funding formula to help identify how each contributes to school funding in the state. For example, Model IV uses actual enrollments in the foundation grant calculation and does not impose a ceiling or floor on the foundation grant revenue, nor does it provide the variable and minimum guarantee grant

options to districts. Models V through VII examine the effects on school funding when two of the three OPs were used in the funding formula. These can also be viewed as removing one OP from the actual funding formula. Finally, in the eighth option, we added all three of the overlay provisions to the state's funding formula, which is the actual formula used in 2004.

These simulations were performed by applying the altered school funding formulas to actual data for all public school districts in Indiana. From each simulation, we first calculated the total and per-pupil revenues for each school district and whether funding for districts would increase or decrease when the overlay provisions were added. Table 3 provides a comparison of the distribution of per-pupil revenues under the different scenarios considered here. If all of the provisions were eliminated from the state's funding formula, and no other changes were made to the other parameters in the foundation aid program, districts would receive an average of \$4,862 per pupil for general education. Accordingly, the state could have replaced the OPs with a substantial increase in the per-pupil foundation level and/or weights for the five Complexity Index factors while holding total spending level for public schools constant. Looking across Models II through IV, it can be seen that the introduction of options to the foundation grant had the largest impact on total education funding (+\$289 million), compared to imposing a ceiling/floor on the foundation grant (+\$175 million) or using weighted-average enrollments in place of actual enrollments (+\$31 million). The variability in per-pupil funding is also greatly increased in Models III and IV relative to the situation where no OPs are used in the funding formula, and are close to the funding level and variability for the actual funding formula (Model VIII). The results for Models V through VII, when two of the three OPs were added to the funding formula, were very similar to Models II through IV, suggesting considerable overlap among provisions. The main differences occur when the foundation grant options were added to

the funding formula. Intuitively, this makes sense because only a small fraction of Indiana school districts received funding through the foundation grant, and thus changing the foundation grant calculation with either of the first two OPs would have had little effect on most districts.

----- Insert Table 3 Here -----

As noted earlier, it is possible that OPs can affect equity in school funding by influencing the distribution of revenues across districts. To examine this issue, we began by focusing on the correlations between per-pupil revenues and the five vertical equity factors used by Indiana in its Complexity Index (Table 4). We examine these five factors in this study because of their use in the state’s foundation aid program. The results show that across all of the models, per-pupil revenues are positively correlated to varying degrees with these five factors. The correlations tend to be strongest for the factors *Pov*, *FreeL*, and *OneP*. When all of the OPs were removed from the state’s funding formula, the correlations were the highest for all five factors; however, they were still less than one due to the correlations among the five factors. As OPs were added to the funding formula, the bivariate relationships between them and per-pupil revenues became weaker. The largest decline in correlations was seen when the ceiling/floor were added to the foundation grant (Model III) or the variable and minimum guarantee grant options were introduced (Model IV). These results suggest that the OPs were affecting the dollar allocations to districts for vertical equity needs.

----- Insert Table 4 Here -----

To examine the impact on vertical and horizontal equity more precisely, we used the approach developed by the authors (in press). In this procedure, we regressed per-pupil revenues (PR_j) from each model against Indiana’s five vertical equity factors:

$$(12) \quad PR_j = b_0 + b_1 NoHS_j + b_2 OneP_j + b_3 Pov_j + b_4 FreeL_j + b_5 LEP_j + \varepsilon_j$$

and compared the estimated weights for these factors to the weights that were prescribed in the state's funding formula. The prescribed weights are shown in Table 5:

----- Insert Table 5 Here -----

For example, because the legislature set the weight for *NoHS* equal to 0.2000 in the Complexity Index, districts should have received 20% more revenue (\$870) for each student who was estimated to come from a family where the highest education level was less than a high school diploma, holding the other four factors constant. This can also be expressed as an additional \$8.70 per pupil for every one percent of the district's population with less than a high school diploma.

The measure of vertical equity that we used for each factor is represented by the ratio of the estimated (b_j) to prescribed (β_j) weights:

$$(13) \quad VE_j = \frac{b_j}{\beta_j}, \quad j = 1, \dots, 5$$

As the ratios approach 100% for each factor, the state is said to be making progress towards vertical equity. Therefore, if there were perfect vertical equity in Indiana's funding formula, the variable *NoHS* would have an estimated coefficient of +8.70 when per-pupil revenues were regressed against all five factors. Because these measures of equity are relative to the standards set by the state for vertical and horizontal equity, they should be interpreted as relative and not absolute measures of equity. This procedure is useful in the absence of objective standards of what factors should be used to achieve equity and what dollar amounts are needed for these factors. However, when the prescribed weights are identified through adequacy research, the vertical equity measures become more objective.

We then measured horizontal equity by the standard error of the above regression model, and the percentage of deviations in per-pupil revenues that were not explained by these vertical

equity factors, $(1-R^2) \times 100\%$. This quantity represents the percentage of deviations in per-pupil revenues that was not accounted for by the state's five vertical equity factors. The standard error of the estimate likewise measures the variations in per-pupil revenues among school districts with the same values of the five Complexity Index factors. As these statistics approach zero, horizontal equity within the state is said to improve and vice-versa. The estimated coefficients for the five Complexity Index variables in each model are shown in Table 6:

----- Insert Table 6 Here -----

After all of the OPs were removed from the state's funding formula (Model I), all five vertical equity factors had positive and significant effects on per-pupil revenues. In addition, the coefficients were very close to their intended values, and the variables collectively explained almost all of the variation in per-pupil revenues. When either the ceiling/floor on the foundation grant (OP#2) or the options to the foundation grant (OP#3) were added to the funding formula, however, these relationships changed dramatically. Note that in Models III through VIII, when at least one of these OPs was used, only one of the five vertical equity factors (*Pov*) had a positive and significant effect on per-pupil revenues, and collectively the vertical equity factors account for only about 30 percent of the variations in per-pupil revenues. Furthermore, the estimated coefficient for *Pov* is nearly ten times as large as was intended in the state's Complexity Index. At the other extreme, *LEP* had a negative but insignificant effect on per-pupil revenues, even though this factor had a positive weight in the Complexity Index.

In Table 7, the regression results are used to examine horizontal and vertical equity. The first two rows show alternative measures of horizontal equity, and the last five rows contain the vertical equity measures which are the ratios of the estimated coefficients for each factor to the prescribed weights. Recall that the optimum ratio for vertical equity is 100% for each factor, and

movements toward 100% would be interpreted as improvements in vertical equity. Similarly, the optimal value for horizontal equity is 0%, and movements towards 0% are consistent with gains in horizontal equity.

----- Insert Table 7 Here -----

When all of the overlay provisions were removed from Indiana's funding formula, it came very close to achieving both vertical and horizontal equity. The unexplained variation in per-pupil revenues across districts fell to less than 1% and the standard error of the estimate fell from about \$450/pupil to \$17/pupil. The minor adjustments made by the state in the Complexity Index for school districts with high *CI* values introduced small non-linearities into the relationships between these factors and per-pupil revenues and thus prevented perfect equity from being realized in this application. Adding either the ceiling/floor on the foundation grant or the options to the foundation grant to the funding formula led to inequity along both the vertical and horizontal dimensions.

Summary and Discussion

The means by which states provide funding for public education vary greatly across the United States, and there are many variations in the specific details of how these distributions are made. In this paper, we focus on the different overlay provisions that states can use to help protect school districts from large revenue changes. We found that overlay provisions can contribute significantly to horizontal and vertical inequity in funding. In Indiana, the ceiling/floor limitations and use of weighted-average past enrollments in the foundation grant had relatively small impacts on funding in the state when the foundation grant options were also used because relatively few school districts were funded through the foundation grant. However,

if considered separately, the ceiling/floor provision would have had an impact that was comparable to the provision of alternatives to the foundation grant. The provisions also resulted in an increase in the level and variability of funding for the state. However, if such provisions were not in place, it is likely that the state would have adjusted other parameters in the funding formula, such as the per-pupil foundation level, so that total funding would have increased above the values shown here.

In 2005, Indiana made a series of modifications to the way in which total revenue is calculated in its funding formula. Perhaps the most controversial changes were that the state eliminated the minimum guarantee grant, and the ceilings and floors were removed from the foundation grant. Despite these changes, the state's funding formula still contained three overlay provisions. First, the weighted average of past enrollments was kept in the foundation grant calculation, although the weights attached to past enrollments were changed. Second, districts that would experience a large change in per-pupil revenues (more than \$50) between 2004 and 2005 from the foundation grant had their total revenue phased in, or transitioned, to the new foundation grant figure over a six-year period. Finally, the variable grant option was retained in the funding formula, and districts received the maximum of the foundation grant and 99% of the variable grant.

The findings that we presented here with regard to the impacts of overlay provisions are important for education policymakers to consider when refining foundation programs. States attempt to achieve a variety of goals through their funding systems, including equity among districts, fiscal neutrality for taxpayers, adequacy of education funding, and ensuring that districts have enough money to cover their day-to-day operating costs. In practice, overlay provisions can be expected to introduce inequity in school funding along both the horizontal and

vertical dimensions. Regardless of the costs and benefits, overlay provisions will continue to be an inevitable part of school funding as long as funding formulas are designed and approved through the political process. Our study is intended to show how analysts might quantify these costs and use this information to make more informed decisions about education funding policies. Unless legislators are aware of the consequences of each specific OP that is introduced, the funding formula may perform quite differently than originally intended.

Finally, in light of these results we offer some comments on how school funding systems might be improved. First, when information is available on the relationship between education costs and enrollments (conditional on output), this can be used to adjust the per-pupil foundation level and better align marginal revenues and marginal costs. This would seem to be a more precise way of making these adjustments than with overlay provisions, and reduce the need for them in funding formulas. For this approach to work, however, political leaders in the state would have to be willing to use this mechanism in lieu of OPs. Given that some districts would still experience revenue declines when enrollments fall under this scenario due to discontinuities in the production function, politicians may prefer to add in provisions that further limit revenue reductions for their districts and thus enhance their perceived chances of being reelected.

A second policy that states may consider, if they are resigned to the fact that OPs cannot be eliminated from the funding formula, is to make adjustments so that additional revenues for vertical equity concerns are distributed independently of the regular funding formula. This would work as follows: a state would first calculate the total revenue required for providing basic educational services if none of its students had special needs. In the case of Indiana, this would mean that the Complexity Index is removed from the total revenue calculation. The total revenue amount could be modified as before by OPs and/or economies-of-scale adjustments

using the parameters from a cost function. After this total has been determined, the state would then make additional revenue distributions for students for vertical equity factors. In this way, the OPs would not affect the additional revenues received by districts for meeting vertical equity concerns. Nonetheless, the OPs would still have an effect on horizontal equity because comparable districts could receive different levels of funding, and depending on how the OPs are correlated with vertical equity factors, they may also affect vertical equity.

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Figure 1: Depiction of Indiana’s Foundation Program for Public School Districts, 2004

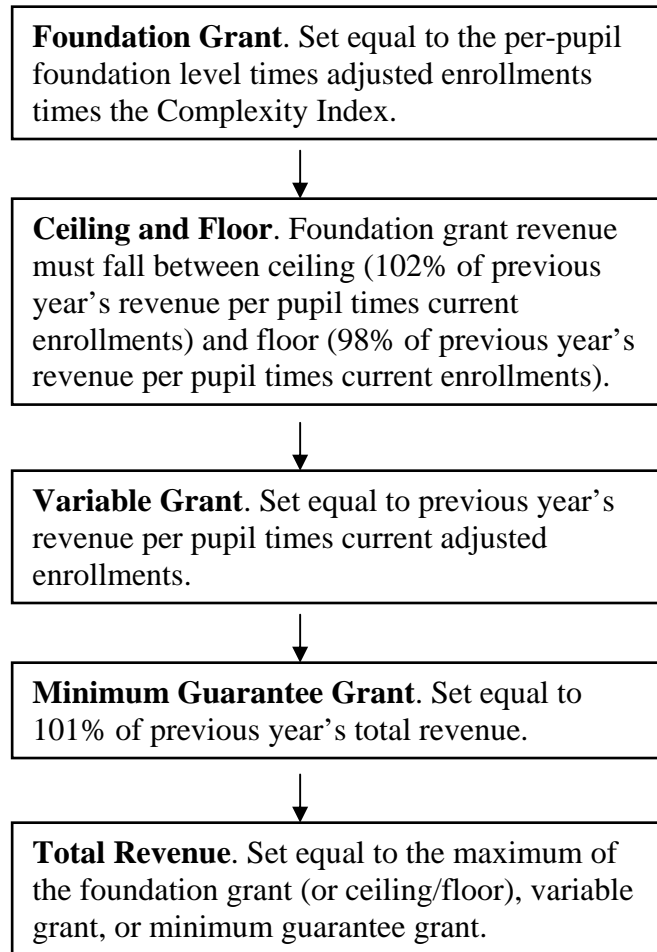


Table 1: Details of Total Revenue Calculation for Goshen Community School District

Step 1: Calculate Foundation Grant (*FG*)

$$\begin{aligned} FG &= (\text{Foundation level per pupil})(\text{Complexity Index})(\text{adjusted 2004 enrollments}) \\ &= (\$4,350)(1.1823)(5,537) = \$28,476,846.37 \end{aligned}$$

Step 2: Calculate Ceiling for Foundation Grant (*Ceiling*)

$$\begin{aligned} Ceiling &= (\text{2003 revenue per pupil})(\text{2004 enrollments})(1.02) \\ &= (\$5,253.93)(5,660.5)(1.02) = \$30,334,676.11 \end{aligned}$$

Step 3: Choose Minimum from Steps 1 and 2 (*Min*)

$$Min = FG = \$28,476,846.37$$

Step 4: Calculate Floor for Foundation Grant (*Floor*)

$$\begin{aligned} Floor &= (\text{2003 revenue per pupil})(\text{2004 enrollments})(0.98) \\ &= (\$5,253.93)(5,660.5)(.98) = \$29,145,065.43 \end{aligned}$$

Step 5: Choose Maximum from Steps 3 and 4 (*Max*)

$$Max = Floor = \$29,145,065.43$$

Step 6: Calculate Variable Grant (*VG*)

$$\begin{aligned} VG &= (\text{2003 revenue} / \text{2003 adjusted enrollments})(\text{2004 adjusted enrollments}) \\ &= (\$28,579,649.42 / 5,439.5)(5,537) = \$29,091,896.33 \end{aligned}$$

Step 7: Calculate Minimum Guarantee Grant (*MGG*)

$$\begin{aligned} MGG &= (\text{2003 revenue})(1.01) \\ &= (\$28,579,649.42)(1.01) = \$28,865,445.91 \end{aligned}$$

Step 8: Find Total Revenue

$$\begin{aligned} TR &= \text{Max}(\text{Step 5, Step 6, Step 7}) \\ &= \$29,145,065.43 \text{ (from Foundation Grant floor)} \end{aligned}$$

Table 2: Examples of Total Revenue Calculations for Three Indiana School Districts

	Goshen Community Schools	Elkhart Community Schools	Indianapolis Public Schools
Enrollments			
Enrollments in 2000	5,160.00	12,249.50	45,048.50
Enrollments in 2004	5,660.50	12,579.97	42,859.57
Change in Enrollments	+500.50	+330.47	-2,188.93
Total Revenue Options			
Foundation Grant	\$28,476,846	\$64,782,192	\$252,157,453
Foundation Grant Ceiling	\$30,334,668	\$67,051,240	\$273,557,634
Foundation Grant Floor	\$29,145,073	\$64,421,775	\$262,829,884
Variable Grant	\$29,091,896	\$65,082,855	\$268,424,936
Minimum Guarantee Grant	\$28,865,446	\$64,960,519	\$275,056,224
Total Revenue Source	FG Floor	Variable Grant	Min Guarantee

Table 3: Descriptive Statistics for Per-Pupil Total Revenues for Indiana's Public School Districts, 2004

Model	Per-Pupil Revenues				Total Revenues	
	Mean	Standard Deviation	Minimum	Maximum	State Total	Change from Model I
Model I : No OPs	\$4,862.34	\$212.10	\$4,460.06	\$6,035.32	\$4,803,605,680	-----
Model II: Use weighted-average enrollments	\$4,909.88	\$261.37	\$4,355.98	\$6,193.34	\$4,834,241,210	+ \$30,635,530
Model III : Add ceiling and cap on foundation grant	\$5,084.81	\$486.15	\$4,558.36	\$8,723.97	\$4,978,966,921	+\$175,361,241
Model IV: Add options for variable and minimum guarantee grants	\$5,211.78	\$531.46	\$4,599.74	\$8,644.11	\$5,092,667,179	+\$289,061,499
Model V: Add ceiling, floor, variable grant and minimum guarantee grant	\$5,216.08	\$535.97	\$4,615.59	\$8,723.97	\$5,093,069,300	+\$289,463,620
Model VI: Use weighted-average enrollments and add variable grant and minimum guarantee grant	\$5,208.46	\$534.27	\$4,559.92	\$8,644.11	\$5,089,604,440	+\$285,998,760
Model VII: Use weighted-average enrollments and add ceiling and floor	\$5,097.95	\$484.85	\$4,558.36	\$8,723.97	\$4,982,392,345	+\$178,786,665
Model VIII: All three OP are used (actual funding formula in 2004)	\$5,212.62	\$538.46	\$4,572.91	\$8,723.97	\$5,088,270,640	+\$284,664,960

Notes: Data are for 292 public school districts in Indiana.

Table 4: Correlations of Per-Pupil Revenues with Five Components of Indiana’s Complexity Index, 2004

Complexity Index Component	Model I: No OPs	Model II: Add OP#1 to Model I	Model III: Add OP#2 to Model I	Model IV: Add OP#3 to Model I	Model V: Add OP#2 and #3	Model VI: Add OP#1 and #3	Model VII: Add OP#1 and #2	Model VIII: Add all three OP
% Adults in 2000 who Did Not Graduate from High School (<i>NoHS</i>)	+0.702	+0.662	+0.286	+0.304	+0.304	+0.303	+0.302	+0.303
% Single-Parent Families in 2000 (<i>OneP</i>)	+0.792	+0.683	+0.446	+0.451	+0.450	+0.449	+0.462	+0.447
% Population in 2000 Below Poverty Level (<i>Pov</i>)	+0.834	+0.776	+0.511	+0.523	+0.520	+0.524	+0.521	+0.520
% Students Eligible for Free Lunch in 2003 (<i>FreeL</i>)	+0.965	+0.871	+0.512	+0.508	+0.503	+0.507	+0.520	+0.501
% Students with Limited English Proficiency in 2003 (<i>LEP</i>)	+0.402	+0.276	+0.158	+0.127	+0.123	+0.125	+0.151	+0.120

Notes: Data are for 292 public school districts in Indiana. OP#1 = Use weighted-average enrollments in place of actual enrollments. OP#2 = Impose ceiling and floor on the foundation grant. OP#3 = Add variable grant and minimum guarantee grant options to funding formula. Per-pupil revenues for each year represent the total revenues designated for the General Fund of each school district through the state’s foundation program, divided by actual or projected enrollments for the fall semester of each year. The data for the variables *NoHS*, *OneP*, and *Pov* were obtained from the 2000 U.S. Census. The data for the variables *FreeL* and *LEP* were obtained from each school district for the 2003 school year.

Table 5: Weights for Five Components of Indiana’s Complexity Index, 2004

Complexity Index Component	Mean (std. dev.)	Weights in Indiana’s 2004 Complexity Index	Prescribed Weights in Regression Model
% Adults in 2000 who Did Not Graduate from High School (<i>NoHS</i>)	18.37% (6.67%)	0.2000 (=\$870 / \$4,350)	+8.70
% Single-Parent Families in 2000 (<i>OneP</i>)	22.82% (7.59%)	0.1011 (=\$440 / \$4,350)	+4.40
% Population in 2000 Below Poverty Level (<i>Pov</i>)	8.38% (4.91%)	0.0506 (=\$220 / \$4,350)	+2.20
% Students Eligible for Free Lunch in 2003 (<i>FreeL</i>)	20.00% (11.08%)	0.2529 (=\$1,100 / \$4,350)	+11.00
% Students with Limited English Proficiency in 2003 (<i>LEP</i>)	1.40% (3.10%)	0.0713 (=\$310 / \$4,350)	+3.10

Notes: *NoHS* = percentage of the school district’s population in 2000 ages 25 and older with less than a 12th grade education. *OneP* = percentage of families in the school district in 2000 with a single parent. *Pov* = percentage of families in the school district in 2000 with incomes below the poverty level and with children under the age of 18. *FreeL* = percentage of students in the school district in 2003 who are eligible for free lunch. *LEP* = percentage of students in the school district in 2003 who have been identified as having limited proficiency in English.

Table 6: Multiple Regression Model of Vertical Equity Factors on Per-Pupil Revenues for Education in Indiana, 2004
 (Dependent variable = Per-pupil revenues (Y_j) from each model)

Estimated Coefficients (standard errors)

Variable	Model I: No OPs	Model II: Add OP#1 to Model I	Model III: Add OP#2 to Model I	Model IV: Add OP#3 to Model I	Model V: Add OP#2 and #3	Model VI: Add OP#1 and #3	Model VII: Add OP#1 and #2	Model VIII: Add all three OP
% Adults in 2000 who Did Not Graduate from High School (<i>NoHS</i>)	8.47** (0.19)	10.83** (1.27)	-0.78 (4.66)	1.05 (5.09)	1.50 (5.15)	0.93 (5.12)	0.26 (4.63)	1.49 (5.18)
% Single-Parent Families in 2000 (<i>OneP</i>)	4.84** (0.22)	2.63 (1.45)	9.01 (5.33)	7.76 (5.82)	8.59 (5.89)	7.57 (5.86)	7.52 (5.29)	8.44 (5.92)
% Population in 2000 Below Poverty Level (<i>Pov</i>)	2.95** (0.37)	4.94* (2.44)	27.39** (8.94)	32.99** (9.77)	33.11** (9.87)	33.53** (9.82)	27.61** (8.88)	33.57** (9.97)
% Students Eligible for Free Lunch in 2003 (<i>FreeL</i>)	11.67** (0.20)	14.22** (1.32)	7.81 (4.83)	8.32 (5.27)	7.72 (5.33)	8.38 (5.30)	8.66* (4.79)	7.66 (5.36)
% Students with Limited English Proficiency in 2003 (<i>LEP</i>)	4.20** (0.35)	-3.86 (2.35)	3.05 (8.61)	-2.49 (9.41)	-3.16 (9.51)	-2.80 (9.46)	0.93 (8.55)	-3.42 (9.57)
Intercept	4332** (4.3)	4330** (28.9)	4504** (105.9)	4576** (115.6)	4565** (116.9)	4574** (116.3)	4516** (105.1)	4563** (117.6)
F-statistic (5, 286)	9240.63**	259.77**	24.28**	24.47**	24.07**	24.41**	25.05**	23.86**
R-squared	0.99	0.82	0.30	0.30	0.30	0.30	0.30	0.29
Std. error of estimate	16.78	112.00	410.86	448.63	453.56	451.18	407.84	456.28

Notes: Data are for 292 public school districts in Indiana. Estimated coefficients and their standard errors (in parentheses) are shown in each column. OP#1 = Use weighted-average enrollments in place of actual enrollments. OP#2 = Impose ceiling and floor on the foundation grant. OP#3 = Add variable grant and minimum guarantee grant options to funding formula. Per-pupil revenues for each year represent the total revenues designated for the General Fund of each school district through the state's foundation program, divided by actual or projected enrollments for the fall semester of each year. The data for the variables *NoHS*, *OneP*, and *Pov* were obtained from the 2000 U.S. Census. The data for the variables *FreeL* and *LEP* were obtained from each school district for the 2003 school year.

Table 7: Vertical and Horizontal Equity Measures for Indiana, 2004

Equity Measures	Model I: No OPs	Model II: Add OP#1 to Model I	Model III: Add OP#2 to Model I	Model IV: Add OP#3 to Model I	Model V: Add OP#2 and #3	Model VI: Add OP#1 and #3	Model VII: Add OP#1 and #2	Model VIII: Add all three OP
<i>Horizontal Equity</i>								
(1-R ²) x 100%	0.6%	18%	70%	70%	70%	70%	70%	71%
Std. error of estimate	16.78	112.0	410.86	448.63	453.56	451.18	407.84	456.28
<i>Vertical Equity</i>								
% Adults in 2000 who Did Not Graduate from High School (<i>NoHS</i>)	97.4%	124.5%	-9.0%	12.1%	17.2%	10.7%	2.99%	17.1%
% Single-Parent Families in 2000 (<i>OneP</i>)	110.0%	59.9%	204.7%	176.4%	195.2%	172.0%	190.9%	191.8%
% Population in 2000 Below Poverty Level (<i>Pov</i>)	134.2%	224.3%	1,245.2%	1,499.5%	1,505.0%	1,524.1%	1,255.0%	1,525.9%
% Students Eligible for Free Lunch in 2003 (<i>FreeL</i>)	106.1%	129.3%	71.0%	75.6%	60.18%	76.2%	78.7%	69.63%
% Students with Limited English Proficiency in 2003 (<i>LEP</i>)	135.5%	-124.4%	98.3%	-80.3%	-101.9%	-90.3%	30.0%	-110.3%

Notes: *NoHS* = percentage of the school district's population in 2000 ages 25 and older with less than a 12th grade education. *OneP* = percentage of families in the school district in 2000 with a single parent. *Pov* = percentage of families in the school district in 2000 with incomes below the poverty level and with children under the age of 18. *FreeL* = percentage of students in the school district in 2003 who are eligible for free lunch. *LEP* = percentage of students in the school district in 2003 who have been identified as having limited proficiency in English.

Endnotes

¹ Our review of the state descriptions included in Sielke et al. (2001) identified the following states as having at least one form of overlay provision in their school funding formulas: Alaska, Delaware, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Louisiana, Maine, Massachusetts, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New Mexico, Ohio, Pennsylvania, South Dakota, Utah, Vermont, Washington, Wisconsin, and Wyoming.

² Grouping expenditures into fixed and variable costs is arguably more difficult in educational settings than in other sectors of the economy. Items such as pencils, paper, and textbooks clearly are variable costs because they would be expected to vary in direct proportion to enrollments. However, most other inputs used in the production of education would seem to fall somewhere between the extremes of “fixed” and “variable” costs. Buildings are primarily fixed costs in the short run, although the use of modular classrooms helps to add some variability to even this expenditure item. Teachers are often viewed as a variable cost, and yet could be treated as fixed if schools faced with enrolment changes maintain about the same number of teachers and instead adjust the student-teacher ratio. Teacher union contracts may also limit a district’s ability to reduce the number of teachers when enrollments fall. Although some administrative functions, such as a Superintendent, are considered fixed costs, these may increase as the district grows due to hiring assistant superintendents and other administrative staff to help handle additional duties that are related to size.

³ With economies of scale adjustments, the per-pupil foundation level is set equal to the minimum cost of education for a specific level of output (O_{jt}) as measured by a cost function relating enrollments to per-pupil costs (PC_j):

$$FL_{jt} = PC_{jt} = b_0 + b_1E_{jt} + b_2E_{jt}^2 + b_3O_{jt}$$

where b_0 to b_3 are estimated parameters of the cost function, and O_{jt} = output measure for the district. The cost function may also include socioeconomic factors that could serve to shift the cost function. If $b_1 < 0$ and $b_2 > 0$, the per-pupil cost curve would exhibit economies and diseconomies of scale. Such adjustments require good estimates of how district size affects the minimum expenditures conditional on output, and estimated marginal costs may differ substantially from actual marginal costs.

⁴ There is a considerable amount of controversy, however, as to whether states should either provide more money to smaller school districts or merge small districts to save money (see Odden and Picus, 2004).

⁵ The following formula was used in 2004 to calculate the weighted average enrollments (“adjusted ADM”) in Indiana’s funding formula:

$$wADM_{jt} = ADM_{jt} + .20*(ADM_{jt-4} - \text{Max } ADM(t-3 \text{ to } t)) + .40*(ADM_{jt-3} - \text{Max } ADM(t-2 \text{ to } t)) \\ + .60*(ADM_{jt-2} - \text{Max } ADM(t-1 \text{ to } t)) + .80*(ADM_{jt-1} - ADM_{jt})$$

⁶ Between 1993 and 2003, the At-Risk Index was used to provide additional funding to school districts for the vertical equity factors *NoHS*, *OneP*, and *Pov*. In 2003, the At-Risk Index was replaced by the Complexity Index, which provided for adjustments in per-pupil funding for the three factors in the At-Risk Index plus *LEP* and *FreeL*.

where $\text{Max } ADM(t-k \text{ to } t)$ = maximum *ADM* count for years *t-k* to *t*. When the enrollments in a given year are less than the corresponding maximums, the difference is set equal to zero. Accordingly, enrollment adjustments are only made when a school district has falling enrollments.

⁷ An additional upward adjustment is made to the Complexity Index when the resulting value for a school district exceeds 1.25. The adjustments generally range between 0.02 and 0.04, and only affected eight of the 292 school districts in Indiana. As a result, the weights shown here are slightly lower than what would be true if the additional adjustment could be taken into account. More details on this adjustment can be found in the *2003-05 Digest of Public School Finance in Indiana* (Indiana Department of Education, 2003).