The Cost of Grade Retention for Taxpayers and Students

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Abstract:

Retention is costly for both taxpayers who fund additional instruction and for students who delay labor market entry. I argue that prior research substantially overstates the cost of retention because it omits two important factors. First, there is a delay between the intervention and the taxpayer's expenditure. Second, on average retention leads to less than a full year of additional schooling. I provide a general formula to calculate the cost of grade retention and apply it using data from Florida. I then project the achievement gains necessary to outweigh these costs. Retention at the discretion of teachers and parents is not likely to be cost effective. However, the benefits from retention in elementary grades under a test-based promotion policy could outweigh the costs of the intervention.

Keywords: Grade Retention; Finance; Test-Based Promotion; Accountability

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1. Introduction

Grade retention is common in American public schools, especially in elementary grades (Warren, Hoffman, and Andrew 2014). Most often, students are retained because teachers, administrators, and/or parents determine they would benefit from an additional year of instruction before moving to more difficult material (from here "discretionary" retention). Recently, several states and large school districts have adopted test-based promotion policies that require students in a particular grade, usually third, to score above a minimal threshold on a standardized test in order to be default promoted to the next grade (from here "policy-induced" retention) (ExcelinEd 2017).

Retention is an especially controversial intervention primarily because most studies find that it is correlated with lower student outcomes. However, that overall negative finding is heavily influenced by studies that employed research designs not capable of leading to causal interpretation. The most recent meta-analysis found that studies that used strong comparison groups and adequate statistical controls tended to find positive though often statistically insignificant effects (Allen et al. 2009). However, the results of several strong studies published since the period covered in that most recent review have been mixed (Vandecandelaere et al 2015; Dong 2010; Vandercandelaere, et al 2016; Fruehwirth, Navarro, and Takahashi 2016; Hughes et al. 2010; Moser, West, and Hughes 2012; Chen, et al (2010); Diris 2017; Gary-Bobo, Gousse, and Robin 2016; Schwerdt, West, and Winters 2017; Mariano and Martorell 2013; Eren, Depew, and Barnes 2017).

In this paper, I address another common concern about retention: Its cost. In addition to questions about its effectiveness, several authors have criticized the use of retention because it is a very expensive intervention (see as examples Jacob 2016; Eran, Depew, and Barnes 2017;

Roderick and Nagaoka 2005; Eide and Goldhaber 2005). The common assumption is that the year a student repeats a grade represents an additional year of schooling, and thus costs taxpayers the equivalent of the school system's average per-pupil current expenditure that year. Further, prior authors assume that retained students delay labor market entry for a year. Prior estimates using these assumptions put the total cost of retention at between $32,000 and $42,000 in today's dollars (Babcock and Bedard 2011; Eide and Goldhaber 2005). Thus, the academic benefits required to outweigh these previously estimated costs are exceptionally high.

The central insight of this paper is that prior research systematically overstates the cost of retention because it fails to account for two important factors. Namely, when projecting the cost of retaining a student a policymaker must take into account 1) that there is a substantial delay between when a student is retained and when the student represents an additional taxpayer expenditure and 2) that on average retention almost certainly leads to less than a full year of additional schooling. Even after accounting for these factors, retention is a relatively expensive intervention. But it is much less costly than commonly believed.

Section 2 describes how to project the present value for the additional taxpayer expenditure associated with retaining a student. I provide a general formula that holds regardless of locality or the reason that the student was retained. I then present an example using historical school finance data from Florida in order to demonstrate the calculation and highlight the influence of key variables and assumptions.

Section 3 takes the perspective of the student and describes how to calculate the present value of lost earnings due to retention. I then use recent econometric estimates to calculate the resulting increase in student test score performance necessary to justify retention from the student's perspective.

Section 4 discusses the likelihood that that there are meaningful differences in the value of key variables underlying the cost of discretionary and policy-induced retention. I then use recent empirical estimates to calibrate the cost of retention under Florida's third grade test-based promotion policy. Section 5 uses these cost estimates and prior empirical estimates of the policy's effects to evaluate whether the benefits of treatment under Florida's policy outweigh its costs.

Section 6 summarizes this article's contribution and concludes with discussion about whether the benefits of grade retention are likely to outweigh its costs. I also briefly compare the net effect of retention to some other notable interventions.

2. Additional Taxpayer Expenditure Due to Retaining Students

Retention is costly to taxpayers because it slows students' academic trajectory and thus can lead to additional time in public school at the taxpayer's expense. Prior authors state that the additional taxpayer expenditure due to retention is equal to the locality's per-pupil expenditure during the year that the student is retained. But there are two factors not yet considered in the research that could have large impacts on the additional taxpayer expenditure associated with retaining a student.

The first factor to introduce into the calculation is time. There is a delay between when a student is retained and when the student represents an additional taxpayer expenditure. Intuitively, a student repeating the third grade in a year is not simultaneously enrolled in the fourth grade. Previously retained students represent an additional taxpayer expenditure only when (and if) they remain enrolled in school during a year that they would not have been enrolled otherwise. Thus, it is appropriate to discount the future taxpayer expenditure back to the time that the student is retained.

There is a time-value to money. One way to think about the role of time in this context is to ask: How much money must the state set aside in the year it retains a student in order to fully fund its additional expenditure for the student in the future year that it occurs? The answer to that question depends upon the amount of time between the intervention and expenditure and the difference between the return that the state receives from investing the money it sets aside and increases in per-pupil spending during that time.

The second important factor not yet considered in the literature is that retaining a student only produces an additional future taxpayer expenditure if the student spends an additional year enrolled in school. Retention almost certainly leads to less than a full year of additional schooling on average. For example, taxpayers ultimately pay the same to fund a student's education if the student is promoted after the third grade and drops out of school eight years later when attending the eleventh grade or if the student was retained in the third grade but drops out of the tenth grade after the same number of years in school. Since retention is targeted to very low performing students, it is reasonable to expect that many retained students will nonetheless drop out of high school even if retention has a positive effect on their academic achievement.

As I describe in more detail in Section 4, prior research finds that policy-induced retention leads to significantly less than a full year of additional schooling (Schwerdt, West, and Winters 2017; Jacob and Lefgren 2009; Jacob and Lefgren 2007). Those estimates are unlikely to hold for discretionary retention, however. Unfortunately, I am aware of no plausibly causal estimate for the effect of discretionary retention on the additional time that a student spends enrolled in school.

Equations (2A) and (2B) present a general formula for calculating the additional taxpayer expenditure associated with retaining a student. Formally, let t represent the year when the student is retained, and T represent the year when the student would have dropped out or finished school had she not been retained. C_t denotes the per-pupil current expenditure in year t, r denotes the rate of return, and p denotes the proportion of an additional year of schooling caused by retention. The average present value of the additional expenditure due to retaining a student in year t paid at time $T+1$ can be calculated as:

$$\text{(2A)} \quad p * \frac{C_{T+1}}{(1+r)^{(T+1)-t}}$$

That is, the average additional taxpayer expenditure associated with retaining a student is the current per-pupil expenditure during the student's final year in school discounted back to the retention year and multiplied by the percentage of an additional year that the average retained student spends in school than they would if promoted.

For a policymaker thinking about the financial implications of retaining students, it is useful to convert this equation so that the future per-pupil expenditure in the retained student's final year $(T+1)$ is expressed relative to the per-pupil expenditure in the year retained (t). In particular, we could think of the current per-pupil expenditure during year $T+1$ as the current per-pupil expenditure in year t adjusted for annual rates of inflation (q) and real changes in educational expenditures (z).

$$\text{(2B)} \quad p * \frac{C_t * (1+q+z)^{T+1-t}}{(1+r)^{T+1-t}}$$

We can reasonably assume the value for several of the factors in the calculation. At the time of the retention decision, the only truly known value in the equation is the current per-pupil expenditure that year (C_t). It is perhaps most useful to treat the student's final enrolled year as grade 12, such that T represents the year when a student would finish grade 12 in absence of retention. The U.S. Federal Reserve targets a 2 percent inflation rate. Nationwide, educational spending increased by about 0.5 percent annually in the previous ten years.[1] Historically, the average return on a 10-year U.S. Treasury Bill is about 4 percent.

Appendix Table A1 reports the present value of the additional taxpayer expenditure for retaining a student in 2013-14 for each state and the national average by grade retained using the assumed values above. Because I lack a reasonable estimate for p, the table assumes that retention causes a student to spend a full additional year in school (that is, it assumes that p = 1). Thus, the reported figures are surely inflated and should be adjusted by multiplying by an assumed proportion of an additional year of schooling caused by retention.

2.2 Illustrative Example

An historical example helps to fix ideas and clarify the calculation. In this section, I present a detailed description of the additional taxpayer expenditure associated with retaining a student in the third grade within the Florida public school system in 2003-04. Though the specific values would differ, the structure of the calculations in this example holds regardless of the locality. I use historical expenditure data because it helps to clarify how each factor impacts the additional expenditure due to retaining a student. I choose this specific example because the cohort was the first subjected to the state's third-grade test-based promotion policy, which I explore further in Section 4.

[1] A policymaker using this equation might more reasonably use instead historical real spending increases in the locality.

Table 1 illustrates the impact of time and relative rates of return on the additional expenditure due to retaining a student. For simplicity, assume that regardless of retention in the third grade the student will be cumulatively promoted in each later grade. Thus, if the student is not retained in third grade she will graduate 9 years later in the spring of 2012, and if the student is retained in the third grade she will graduate 10 years later in the spring of 2013. That is, in the language of Equation (2B), the calculation in the table assumes that p = 1. (I relax this assumption later in the illustration.)

In addition, as in the general equation above, this illustration makes the simplifying assumption that there is no difference in per-pupil expenditure across grade levels. This assumption ignores that states often fund high school grades at a higher level than elementary grades. Including cross-grade expenditure differences does not materially change the results.[2]

Table 1 demonstrates the calculation for the additional expenditure associated with a full year of additional schooling due to retention in the third grade for this cohort. Columns (1) and (3) track the student's grade progression if retained or promoted after the third grade. Columns (2) and (4) report the state's average current expenditure per-pupil, which excludes capital outlay and debt services, for each year the student is enrolled. Florida assigned these dollars to schools based on a formula that funds school districts on a per-pupil basis according to a base amount that varies only for students with especially severe disabilities.[3] Thus, the calculation is not

[2] The results in Table 1 find that the present value of the additional expenditure associated with an additional year of schooling due to retaining a student within the third grade is $5,702 at an assumed 4 percent return rate and $6,594 at an assumed 2.5 percent return rate. The respective figures if I allow for differences in expenditures by grade level are $5,363 and $6,071.

[3] In distributing its funds, the Florida Education Finance Program (FEFP) uses cost factors to ensure that each program receives an equitable share in relation to its relative cost per student.

materially influenced by the distinction between fixed vs variable costs,[4] and does not depend upon the characteristics of students who are retained.[5] Column (5) is the additional expenditure for the student if retained in each particular year.

[TABLE 1 ABOUT HERE]

Prior authors would put the additional expenditure for third grade retention at $6,536, which is the per-pupil expenditure during the retained year. However, the state does not actually pay any more to educate the retained student that year or for any of the next eight years. The retained student does not represent an additional expenditure for the state until 2012-13, when the student is in the twelfth grade but would have graduated if not previously retained. That year, the school system spent $8,441 to educate the previously retained student that it would not have spent had the student been cumulatively promoted.

The per-pupil expenditure in the additional enrolled year ($C_{T+1} = \$8{,}441$) is considerably larger than the per-pupil expenditure during the retention year ($C_t = \$6{,}536$) because of the combined impacts of real changes in educational expenditures and inflation over time. In Equation (2B) the role of these factors is found in the term $(1 + q + z)^{T+1-t}$.[6]

[4] The analysis attempts to focus only on variable costs by including only current expenditures, which remove capital outlay and debt service. There are other expenditures that could be considered fixed within schools, such as teacher salaries, because they do not change rapidly in response to changes in student enrollment. However, many of these factors are not important in this calculation because even if retention is widespread its primary effect, at least in the short and medium term, is to change how students are allocated across grades, not to remove or add students into the school system.

[5] The demographics of retained students would have an impact in cases where districts allocate additional resources to fund students with various disadvantages. For instance, the Fair Funding model used by the New York City Public School District assigns additional dollars to schools base on the proportion of students who are learning English or are eligible for free lunch. In these cases, the expenditure in the student's additional year should be adjusted for the average demographic characteristics of the students retained. Florida's cost factors do not make adjustments for factors other than enrolling students with severe disabilities.

[6] An equivalent approach would be to remove inflation and real spending increases from the numerator in equation (2B) and instead subtract these factors from the rate of return in the denominator in the calculation.

Recalling the prior thought exercise, inflation and real spending increases over time make it so that, if kept in cash, the state would need to set aside $8,441 in 2003-04 in order to fully fund the later expenditure when it comes due nine years later.

But in practice the state does not keep the money set aside in cash but rather invests it and earns a rate of return, r. In the thought exercise, the higher the rate of return the less the state would need to set aside today in order to fund the future expenditure. In the Equation (2B) the role of this discounting is found in the term $(1 + r)^{T+1-t}$.

The values in the final row of columns (6), (7), and (8) represent the present value as of 2003-04 of the additional taxpayer expenditure associated with a full year of additional schooling assuming a return on investment of 6 percent, 4 percent, or 2.5 percent, respectively.[7] The rate of return has a large effect on the present value for the expenditure associated with retaining a student in the third grade. The preferred analysis uses a 4 percent rate of return. Using that assumption, if retention in the third grade led to a full year of additional schooling then the present value of the future expenditure at the time of retention as $5,702, or about 13 percent less than the per-pupil expenditure during the retained year. A higher rate of return reduces the net present value of the future expenditure. And if the return rate was only 2.5 percent, slightly less than the sum rates of inflation and real spending increases, then the additional expenditure due to retention is actually 1 percent more than the per-pupil expenditure during the retained year.

What if a student from this cohort was retained in a grade other than third? Regardless of the grade retained, 2013-14 would be the additional year that the student attends school, and thus the nominal expenditure associated with retention would be $8,441. However, the present value

[7] Since 1900 the average rate of return on a 10-year U.S. treasury bond was 4 percent. As of this writing, the current yield on a 10-year treasury is about 2.5 percent.

of the expenditure depends upon grade level retained because there is a difference in the time between retention and the final enrolled year ($T + 1 - t$ in Equation (2B)).

Figure 1 illustrates the present value of the expenditure for this cohort by grade retained if retention leads to a full year of additional schooling. Assuming a 4 percent rate of return, the present value of the additional taxpayer expenditure due to an additional year of schooling caused by retention in the eighth grade is 37 percent more than the present value of the expenditure associated with an additional year of schooling due to retaining a student in kindergarten.

[FIGURE 1 ABOUT HERE]

Figure 2 illustrates how the present value of the additional taxpayer expenditure due to retention in the third grade differs according to the fraction of an additional year of schooling caused by retention. Clearly, the proportion of an additional year of schooling due to retention has a large impact on the taxpayer expenditure.

[FIGURE 2 ABOUT HERE]

Figure 2 presents a full range of estimates because the literature lacks an estimate of the effect of discretionary retention on additional time in school needed to calibrate the calculation. Under the previously stated assumptions the present value of the additional expenditure associated with discretionary retention in the third grade in 2003-04 was at most $5,702, and could have been substantially less depending on how much longer retained students remain in school on average. The other numbers highlighted on the figure are relevant for considering the cost of policy-induced retention, which I discuss specifically in Section 4.

3. Costs Imposed on Retained Students

Retention is a somewhat unique intervention because it imposes financial costs on treated students. Students who spend an additional year in school due to retention would enter the labor market a year later and thus forgo earnings both in the final enrolled year and in later years due to having less experience. Formally, we can calculate the average present value of lost earnings due to delayed labor market entry as:

$$(3) \qquad p * \widetilde{w_1} * \sum_{j=2}^{R} \left(\frac{\widetilde{w_j} - w_j}{(1+d)^j} \right)$$

where $\widetilde{w_j}$ represents the earnings in year j if retained and w_j the earnings if cumulatively promoted, d is the discount rate for future earnings (which may differ from the discount rate for taxpayers in the prior calculation), R is the final year in the labor force, and p remains the fraction of an additional year of schooling caused by retention. In order to illustrate each effect, the equation separates forgone earnings during the student's additional year in school and reduced earnings in each additional year due to a lost year of experience.

Table 2 reports the present value of lifetime earnings lost due to a full year of additional schooling caused by retention from the perspective of the Florida public school student who repeated the third grade in 2003-04. Though the calculations are the same, I also report results for the average worker in the U.S. within that same cohort to provide additional context. Because high school graduation has a large effect on later earnings, and thus also on forgone earnings, the table separately calculates the cost of retention to students who eventually graduate or drop out of high school.

It is important to keep in mind that the calculations in Table 2 assume that retention does not impact the probability that students graduate from high school. In Equation (3) a graduation effect would emerge by increasing the difference between earnings each year if retained or promoted. I remove the issue of a graduation impact in part to focus attention on lost earnings due to delayed labor market entry, but also because the literature is not clear on this point. The only study to produce a plausibly causal estimate of the impact of discretionary retention on the probability of graduating high school failed to find a significant effect (Eide and Showalter 2001). Research consistently finds that policy-induced retention in middle school grades decreases the likelihood of graduating from high school (Manacorda 2012, Jacob and Lefgren 2009). However, the research on the effects of policy-induced retention in elementary grades, which characterizes most recently adopted polices, is mixed (Schwerdt, West, and Winters 2017; Eren, Depew, and Barnes 2017).

The calculation in Table 2 assumes that retained students forgo in their first potential year in the labor market the average annual earnings for a worker with a respective educational level between the age of 18 and 25, as reported by the Bureau of Labor Statistics (BLS).[8] This figure includes the lack of earnings for those within the category that are unemployed or do not participate in the labor market as part of the calculation. This figure requires no discounting adjustment because the cost occurs in the first potential employment year.

I use the estimates reported by Heckman, Lochner, and Todd (2006) to project the returns to experience each year. Column (2) in the table reports the net present value as of age 19 of lifetime earnings losses due to a year of less experience under various assumed discount rates.[9]

[8] IPUMS-CPS, University of Minnesota, www.ipums.org. I use the earnings data from 2016.

[9] Specifically, the return to experience is estimated as: $\ln y_i = \phi_0 + 0.132 - 0.0012 * exp$, where exp is the number of years since entering the labor force and ϕ_0 is earnings in the first year of labor market entry, which differs by locality and level of educational attainment.

The primary calculation uses a real discount rate of 3 percent (five percent discount rate minus an assumed two percent annual inflation).[10]

Column (3) reports that a full year of additional time in school due to retention decreased the present value of lifetime earnings for our Florida student by $11,673 if the student eventually drops out and $40,379 if the student graduates. This amounts to a 3.7 percent reduction in the present value of lifetime earnings for both groups.

[TABLE 2 ABOUT HERE]

Students who spend a full additional year in school forgo the entirety of the amount listed in Column (3). However, retention would only lead to forgone earnings if it causes the student to delay labor market entry. Thus, we must again adjust the calculation to account for the fraction of an additional year a retained student spends in school.

Figure 3 illustrates the present value cost of retention for the average retained student under various assumptions for the percentage of an additional year of schooling. I again present the full range of values because the literature lacks an estimate for the effect of discretionary retention on additional time spent in school. The proportion of an additional year of schooling caused by retention has a large impact on its cost to students. The other numbers highlighted on the figure are again relevant for the cost of policy-induced retention to be discussed in Section 4.

[FIGURE 3 ABOUT HERE]

In order to benefit students, the average academic achievement gains caused by retention must produce a larger increase in the present value of lifetime earnings than the student loses due

[10] This assumption follows that used by Chetty et al. (2014)

to delayed entry into the labor market. Table 3 reports the increase in eighth grade test scores projected to improve the present value of the student's lifetime earnings enough to equal the lost earnings due to delayed labor market entry.[11] Of course, the test score increase necessary to justify retention for the student declines linearly with reductions in the proportion of an additional year of schooling caused by retention. If retention leads to a full year of additional schooling, then it would need to produce a 0.29 standard deviation increase in eighth grade test scores in order to increase the present value of lifetime earnings enough to compensate for delayed entry into the labor market. However, if retention caused an additional 60 percent of a year in school the treatment would need to produce a 0.17 standard deviation increase in eighth grade test scores in order to balance the costs and benefits on average.

The balancing test score improvement does not vary by the initial level of earnings, and thus is the same regardless of educational attainment or locality. Though striking at first, this result is expected because both the increase in earnings due to test score improvements and decline in lifetime earnings due to later labor market entry are estimated as a proportion of earnings.[12]

Also, the result does not materially depend upon the individual's discount rate. The estimates resulting from changing the personal discount rate from 4 percent to 2 percent occur at

[11] The estimates are found in Appendix Table 4. Chetty et al. (2014) argue that the relationship between test scores and earnings stabilizes at age 28. I thus apply the age 28 estimates to all later ages. Following Chetty et al. (2014), I ignore the potential general equilibrium effect that the impact of educational improvements on earnings might decline if all students are better educated. Applying these estimates suggest that increasing student eighth grade math and reading test scores by one standard deviation leads to about a 12.6 percent increase in the present value of lifetime earnings at age 19.

[12] Note, that even the forgone earnings in the initial year is calculated as a proportion of lifetime earnings since the analysis projects out future year earnings with the Heckman, Lochner, and Todd (2006) conversion, using the initial year earnings as the base.

the fourth decimal place. That is not especially surprising given that the total forgone earnings shown on Table 2 are not very sensitive to meaningful changes in the personal discount rate.

4. Calibrating the Costs and Benefits of Policy-Induced Retention

The above equations apply to both discretionary and policy-induced retention. However, there are likely differences in the values for key variables, and thus the overall costs of retention in these two contexts. Further, policy-induced retention has potential spillover effects that should be considered as well.

I use recent estimates from evaluations of Florida's third grade test-based promotion policy to calibrate an example of the costs and benefits of policy-induced retention. One reason to focus specifically on Florida's policy is that the research provides estimates for its impact on the proportion of an additional year that a student spends in school. However, the research on policy-induced retention is not uniform. Thus, while the general framework is constant across programs and localities, it is best to consider the specific calculations below as measures of the cost of Florida's policy, not for policy-induced retention generally.

Factors that Influence the Costs of Policy-Induced Retention

Test-based promotion policies often require schools to provide additional interventions to treated students immediately before and during the retention year. In Florida students retained in the first year of the state's third grade test-based promotion policy were required to attend a summer reading camp, and also received additional reading instruction during the school year. I estimate that this cost in 2003-04 was $761 per-retained student. Because these additional interventions were funded at the time that they were provided, they require no discounting.[13]

More importantly, there is reason to suspect that policy-induced retention could lead to fewer years of additional schooling than discretionary retention. Just as is the case for discretionary retention, policy-induced retention likely leads to less than a full year of additional schooling because some retained students drop out of school after the same number of years as they would have had they been promoted. However, policy-induced retention might also lead to less additional schooling because it often takes the place of discretionary retention that would have otherwise occurred in a later grade.

It is worth noting that the issue of aggregating retention in an earlier grade is different than the cost of retaining a student in general. Policy-induced retention might have the same impact on later schooling as discretionary retention if both are compared to a policy that bans discretionary retention. Nonetheless, from a policy perspective it is important to understand the additional costs of policy-induced retention within the current context in which discretionary retention is common. Several states have recently adopted test-based promotion policies. For better or worse, no state has seriously considered banning discretionary retention.

Using a regression discontinuity design, Schwerdt, West, and Winters (2017) found that retention in the third grade under Florida's policy increased the final enrolled year for eventual graduates by 62.8 percent of a year.[14] They showed that treated students were significantly and

[13] The state created a $25,000,000 grant to fund the 2003-04 summer reading programs for third and twelfth grade students, and for students needing supplemental instruction during the school year. Similar to the calculations shown in Table 1, the cost per-retained student is adjusted using the cost factors reported in the FEFP, and for the fact that the grant was also used for supplemental instruction for twelfth graders.

[14] Schwerdt, West, and Winters (2017) describe the result for number of additional years in school as the impact of the treatment on age at which the student left school. Since there was no difference in the age of the treated and control groups at the time of treatment, age of exit and years of additional schooling are equivalent.

substantially less likely to be retained in a later grade, which is consistent with the treatment replacing retention that would have occurred in a later grade for a meaningful number of students. In their evaluation of policy-induced retention in the sixth and eighth grade in Chicago, Jacob and Lefgren (2007) similarly found that treatment increased the age at which students graduated from high school.[15]

Using a different research design, Winters (2017) found a nearly identical effect of Florida's treatment for the proportion of an additional year that eventual high school graduates spent in school. He further disaggregated the result and found that the treatment led to only 38.7 percent of an additional year of schooling for those who eventually drop out of high school. Because many treated students eventually drop out nonetheless, overall treated students spent an additional 46.8 percent of an additional year in school.

We return to Figure 2, which illustrates the relationship between the proportion of an additional year of schooling that is caused by retention and the present value of additional taxpayer expenditures due to retention. The numbers for eventual high school graduates and dropouts are adjusted to include the $761 per-pupil for the policy's required additional services during the retention year. Even so, the present value for the additional taxpayer expenditure for the average treated student who entered high school in Florida was $2,566. That amount is 61 percent less than the $6,536 taxpayer cost using prior authors' assumption that the cost of

[15] This analysis in Chicago also uses an RDD approach and thus there is no difference in the age of the treated and control students in the initial sixth and eighth grade year. Thus, we can interpret these findings as the results as the effect of the treatment on time spent in school. Overall, Jacob and Lefgren (2009) found that treatment did not on average increase the age at which students left school. However, this result includes the fact that in this case retention significantly increased the probability that students dropped out of high school, which was not the case for Florida's policy.

retention is the current per-pupil expenditure during the retained year (see the discussion of Table 1).

Similarly, as illustrated on Figure 3, accounting for the fact that policy-induced retention leads to substantially less than a full year of additional schooling also has large implications for the cost imposed on retained students. The delay in labor market entry due to retention under Florida's policy reduced the present value of lifetime earnings by only $4,669 for the average eventual high school dropout, and $24,227 for the average eventual high school graduate.

Spillovers of Test-Based Promotion Policies

Policy-induced retention appears to have important spill-over effects that should be accounted for in an assessment of its overall benefit. In addition to triggering retention, test-based promotion policies are also accountability policies that require students to meet a particular standard in order to avoid an unwanted intervention. Thus, these policies might encourage both students and schools to increase performance in order to avoid retention.

Previous research has found that adoption of test-based promotion policies leads to substantial and widespread increases in student achievement within the gateway grade (Roderick, Jacob, and Bryk 2002; Jacob 2005; Mariono et al 2009; Winters 2017).[16] These effects would increase the pre-treatment scores of students who were eventually retained, and thus should be added to the policy's overall effect on these students. It would also apply to the much larger group of students not retained under the policy.

5. Is Grade Retention Worth the Cost?

[16] In addition to the research on test-score spillovers, Babcock and Bedard (2011) found that increased early grade retention had a positive impact on the later earnings of both retained and cumulatively promoted students.

The analysis thus far shows that the financial cost of retention to both students and taxpayers is likely much smaller than suggested in prior research. However, even after making the proper adjustments retention is expensive relative to other interventions. Whether the benefits of retention outweigh its costs likely depends upon the context.

On one hand, recent research tends to find null or negative effects from discretionary retention and thus it is unlikely to be a cost effective intervention. Further, research consistently finds that policy-induced retention in middle school grades reduces the probability that students graduate from high school, and thus the long run effect of such policies is almost certainly negative.

On the other hand, though hardly uniform, the research on the effects of policy-induced retention in elementary grades tends to find positive effects that are often near or above those required to yield a positive impact on the present value of lifetime earnings shown on Table 3 (Schwerdt, West, and Winters 2017; Mariano and Martorrel 2013; Eren, Depeew, and Barnes 2017).[17][18] In addition, these estimates should be adjusted upward to account for spillovers on

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[17] The estimated effect of retention differs substantially according to how the researcher structures the comparison. There are two main types of comparisons within the literature: within-age and within-grade estimates. Within-age estimates compare retained and promoted students a certain number of years after retention, and thus the treated and comparison groups are the same age but the comparison group has completed an additional grade. Within-grade estimates compare retained and promoted students after they have completed a particular grade, and thus the two groups have been subjected to the same material but the retained students have received an additional year of instruction. Which comparison strategy is the most appropriate depends upon the research question the author intends to answer. For the purposes of comparing the overall costs and benefits of retention, the within-grade estimates are the most appropriate because they capture the effect of any additional time that the student spends in school. When they enter the labor market, retained students bring with them their final skillset upon completing school. Any skills that the student acquires during additional time that they spend in school due to retention is important for the benefits of retention, just as the forgone earnings due to the same additional time in school is an important part of the cost.

[18] Mariano and Martorrel (2013) found that fifth grade retention under New York City's test based promotion policy led to an increase of about 0.37 and 0.60 standard deviations on seventh grade reading and math scores, respectively. Eren, Depeew, and Barnes (2017) find that retention under a Louisiana's fourth grade test-based promotion policy led to a 0.149 standard deviation increase in eighth grade test scores when compared within-grade. Prior estimates of the impact of Chicago's policy all used a within-age comparison.

student performance prior to the retention decision (Roderick, Jacob, and Byrk 2002; Jacob 2005; Mariano et al. 2009, Winters 2017).

Though the effect might be different for other policies, we can use the previous findings in this paper to calibrate the effect using the prior estimates from Florida. Combining the estimated treatment and spillover effects and subtracting the impact of lost earnings due to delayed labor market entry yields the equivalent of an average net test score increase of 0.13 standard deviations for treated eventual high school dropouts and by 0.06 standard deviations for treated eventual high school graduates.[19] Such effects project to increase the present value of lifetime earnings by 1.6 percent for eventual high school dropouts and by 0.7 percent for eventual high school graduates. About 60 percent of treated students eventually dropped out of high school. Thus the weighted average net effect for a student treated under Florida's policy was equivalent to a 0.10 standard deviation test score improvement or a 1.3 percent increase in the present value of lifetime earnings.

It is worth noting again that the effect of policy-induced retention in elementary grades would change substantially if the intervention has a significant effect on the probability that students graduate from high school. Schwerdt, West, and Winters (2017) found that treatment under Florida's policy had no significant effect on the probability of high school graduation. However, though Eren, Depew, and Barnes (2017) found that the overall treatment under

[19] Schwerdt, West, and Winters (2017) found that treatment led to an average increase in eighth grade test scores of about 0.19 standard deviations, and Winters (2017) found a positive spillover effect in the initial third grade year of about 0.05 standard deviations which together suggest a 0.24 standard deviation increase. The loses shown on Table 2 are equivalent to a test score reduction of about 0.11 standard deviations for an eventual high school dropout and 0.18 standard deviations for an eventual high school graduate. Combining the spillover and treatment effects assumes that third grade test score increases due to spillovers have the same effect on later earnings as do eighth grade test score improvements. This assumption is actually conservative because Chetty et al (2014) find that test score increases in the third grade have a larger effect on later earnings than increases in the eighth grade.

Louisiana's fourth grade test-based promotion policy also had no effect on high school graduation, they did find evidence that the specific effect of retention decreased the probability that students graduated.

In addition to benefitting treated students on average, these results suggest that Florida's policy was cost effective from the taxpayer's perspective. Applying all of the estimates above and adding the money for the initial grant from the state suggests that the present value cost in the policy's first year was about $83 million, or $3,903 per treated student.[20] The anticipated net increase in the present value of lifetime earnings for treated students sums to about $133 million.[21] In addition, as also found by Babcock and Bedard (2011), applying the spillover effect from the policy to the much larger body of students who were not retained by it leads to an estimated impact on the net present value of lifetime earnings statewide that dwarfs the cost of the policy to taxpayers.

6. Conclusion

This paper's primary contribution is to correct an error made in prior calculations of the cost of grade retention for both students and taxpayers. I present a general framework for these calculations that holds regardless of context. I show that under the most plausible assumptions retention is far less costly than previously thought. Nonetheless, prior estimated treatment effects suggest that discretionary retention and policy-induced retention in middle school are unlikely to

[20] In the policy's first year the state retained 21,425 students. 12,880 of them eventually dropped out (or otherwise left the public school system without a diploma) and 8,545 eventually graduated. The calculations apply these numbers to the figures reported in Figure 2.

[21] Calculated by applying the number of treated students by eventual graduation status described in the previous note to the increase in the present value of lifetime earnings described previously in this section.

be cost effective interventions. However, Florida's experience gives reason to believe that policy-induced retention in elementary grades could be a cost effective reform.

It is tempting to compare the net benefit of policy-induced retention in Florida to that of other policies of similar scope. For instance, reducing class sizes by about a third under Tennessee's Project Star experiment cost about 27 percent more per treated student but increased test scores by about twice as much as the net effect of retention under Florida's policy.[22] However, such comparisons are often made difficult because of the various contexts in which interventions are implemented. For instance, Florida adopted a class size reduction policy at an estimated yearly per-pupil cost that was either similar to or above the per treated student taxpayer cost for its test-based promotion policy detailed above, [23] and yet, though the analysis did not meet the standards of a randomized experiment, Chingos (2012) found that the policy had little to no impact on student test scores.

It is also difficult to truly compare the net benefit of Florida's policy to other interventions without more direct evidence on its long term effects. The projected earnings increases due to the treatment described in this paper are useful, but they would be misleading if the treatment impacts later outcomes in ways not captured by test scores. For example, prior research suggests that the impact of early childhood education on test scores fades quickly (Bailey et al. 2015) but that the intervention leads to persistent improvements in non-cognitive

[22] Krueger (1999) estimates costs at $7,400 in 1996, which adjusted for inflation was about $8,876 in 2004, the first year of Florida's policy as shown on Table 1. Krueger (1999) found that the impact of attending such a small class was to increase test scores by about 0.22 standard deviations, and Nye, Hedges, and Konstantopoulos (1999) found that five years later the effect persistent effect ranged from 0.11 to 0.20 standard deviations. In a follow-up on the Star program, Chetty et al. (2011) found no effect of class size on earnings at age 27, though the relationship was estimated imprecisely.

[23] Chingos (2012) reports that the policy was projected to cost about $20 billion in the first eight years and then about $4 billion in operating costs for each year going forward. According to the National Center for Education Statistics, Florida public schools enrolled 730,650 students in 2003.

skills that manifest in improved outcomes later in life (Deming 2017, McCoy et al. 2017). Though the evidence is limited thus far, there is some reason to believe that policy-induced retention could also have effects on outcomes other than test scores. Ozek (2015) found that treatment under Florida's policy led to more disciplinary incidents in the short run, though the effect faded over time. Schwerdt, West, and Winters (2017) found that the treatment under Florida's policy substantially increased the student's high school grade point average. Eren, Depew, and Barnes (2017) find that retention under an eighth grade test-based promotion policy in Louisiana decreased the probability that the student was convicted of a juvenile crime.

Additional research on the long run effects of retention and how to most effectively structure test-based promotion policies is much needed. In the meantime, it is important that discussions about grade retention utilize accurate measures not only of its impact but also its costs. The findings in this paper help to inform these important policy conversations with a more complete assessment of the costs of retention than previously available.

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Table 1
Calculating Present Value of Additional Taxpayer Expenditure Due to Retaining a Florida Student in Third Grade in 2003-04

Year	Retained		Promoted					
	Grade	$ Per-Pupil	Grade	$ Per-Pupil	Retained - Promoted	Net Present Value (6%)	Net Present Value (4%)	Net Present Value (2.5%)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2002-03	3	$6,261	3	$6,261	$0	$0	$0	$0
2003-04	3	$6,536	4	$6,536	$0	$0	$0	$0
2004-05	4	$6,919	5	$6,919	$0	$0	$0	$0
2005-06	5	$7,516	6	$7,516	$0	$0	$0	$0
2006-07	6	$8,260	7	$8,260	$0	$0	$0	$0
2007-08	7	$8,778	8	$8,778	$0	$0	$0	$0
2008-09	8	$8,561	9	$8,561	$0	$0	$0	$0
2009-10	9	$8,869	10	$8,869	$0	$0	$0	$0
2010-11	10	$8,988	11	$8,988	$0	$0	$0	$0
2011-12	11	$8,374	12	$8,374	$0	$0	$0	$0
2012-13	12	$8,441	n/a	$0	$8,441	$4,713	$5,702	$6,594

Note: Table tracks the state per-pupil expenditure by year for Florida students promoted from or retained in the third grade following the 2002-03 school year. Columns (1) and (2) track the grade progression for a student who is either respectively retained or promoted in the third grade and cumulatively promoted in all later grades. Columns (2) and (3) report the true current expenditure per-pupil (excluding capital outlay and debt service) in Florida during each respective year. Column (5) reports the difference between Column (2) and Column (4); Column (6) adjusts the amount in Column (5) to discount as of 2003-04 at a rate of 6%, Column (7) adjusts the amount in Column (5) to discount as of 2003-04 at a rate of 4%, and Column (8) adjusts the amount in Column (5) to discount as of 2003-04 at a rate of 2.5%.

Table 2
Change in Present Value of Lifetime Earnings Due to Full Year Delayed Labor Market Entry: Florida 2002-03 Entering Third Grade Cohort

		Assumed Discount Rate	Forgone Earnings initial Year	Lost Earnings due to Exp. Until Age 65 NPV	Total (1 + 2)
			(1)	(2)	(3)
High School Dropout	Florida	2.0%	-$3,348	-$8,392	-$11,740
		3.0%		-$8,325	-$11,673
		4.0%		-$7,987	-$11,335
	National	2.0%	-$5,556	-$13,926	-$19,482
		3.0%		-$19,372	-$19,372
		4.0%		-$18,810	-$18,810
High School Graduate	Florida	2.0%	-$11,582	-$29,028	-$40,610
		3.0%		-$28,797	-$40,379
		4.0%		-$27,627	-$39,209
	National	2.0%	$12,888	-$58,076	-$45,189
		3.0%		-$44,932	-$44,932
		4.0%		-$43,630	-$43,630

Note: Author calculations using data from 2016 IPUMS-CPS, University of Minnesota, www.ipums.org. Column (1) is the average earnings for an individual with the respective education level between the age of 18 and 25. Column (2) is the calculated present value of lifetime earnings lost due to a year less experience after applying the estimates from Heckman, Lochner, and Todd (2006). Column (3) is the sum of Columns (1) and (2).

Table 3

Standard Deviation Improvement in 8th Grade Test Scores Required to Equal Cost of Retention to Student

		Discount Rate	Full Additional Year	90% Additional Year	60% Additional Year	40% Additional Year
Florida	High School Dropout	2.0%	0.29	0.26	0.17	0.12
		3.0%	0.29	0.26	0.17	0.12
		4.0%	0.29	0.26	0.17	0.11
	High School Graduate	2.0%	0.29	0.26	0.17	0.12
		3.0%	0.29	0.26	0.17	0.12
		4.0%	0.29	0.26	0.17	0.11
National	High School Dropout	2.0%	0.29	0.26	0.17	0.12
		3.0%	0.29	0.26	0.17	0.12
		4.0%	0.29	0.26	0.17	0.11
	High School Graduate	2.0%	0.29	0.26	0.17	0.12
		3.0%	0.29	0.26	0.17	0.12
		4.0%	0.29	0.26	0.17	0.11

Note: Table reports the standard deviation increase in eighth grade test scores projected to produce an increase in the present value of lifetime earnings equal to the lost such earnings due to delayed labor market entry, as reported on Table 2. Each column adjusts the effect based on the proportion of additional schooling assumed to be caused by retention. Projections use estimates for the relationship between eighth grade tests scores and later earnings reported by Chetty, et al. (2014).

Figure 1
Present Value of Additional Taxpayer Expenditure by Grade Retained:
Florida 2002-03 Third Grade Cohort

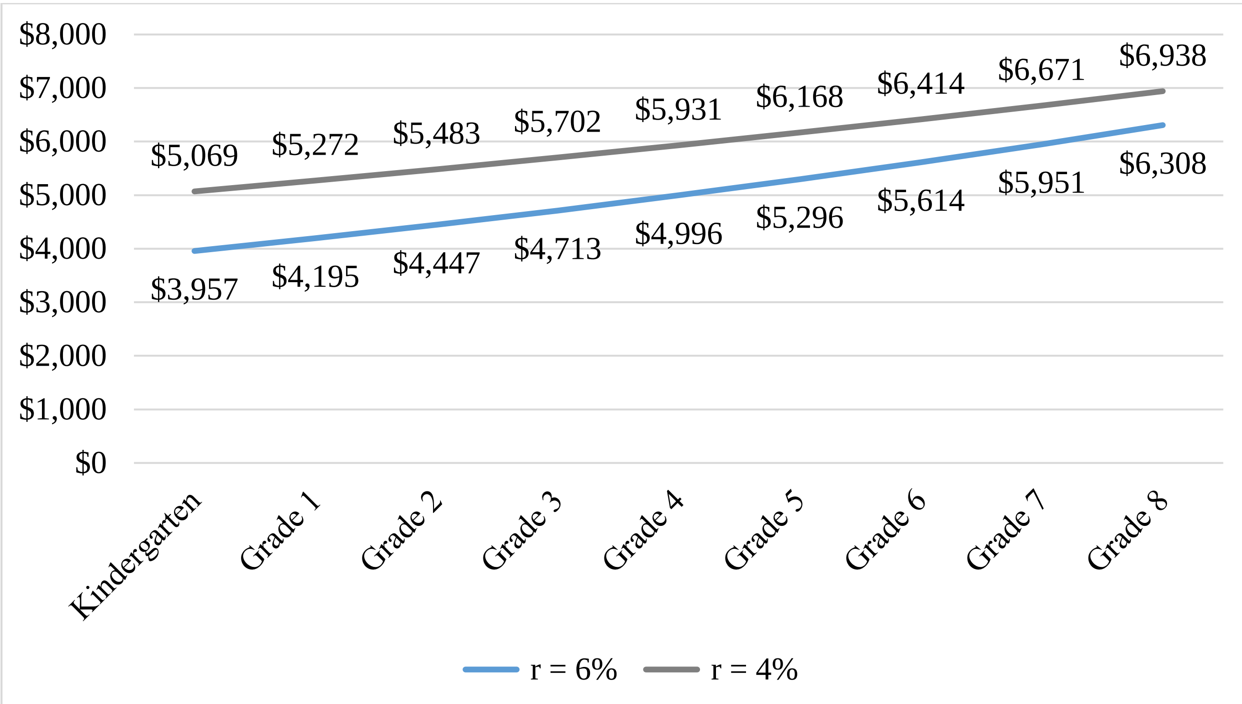
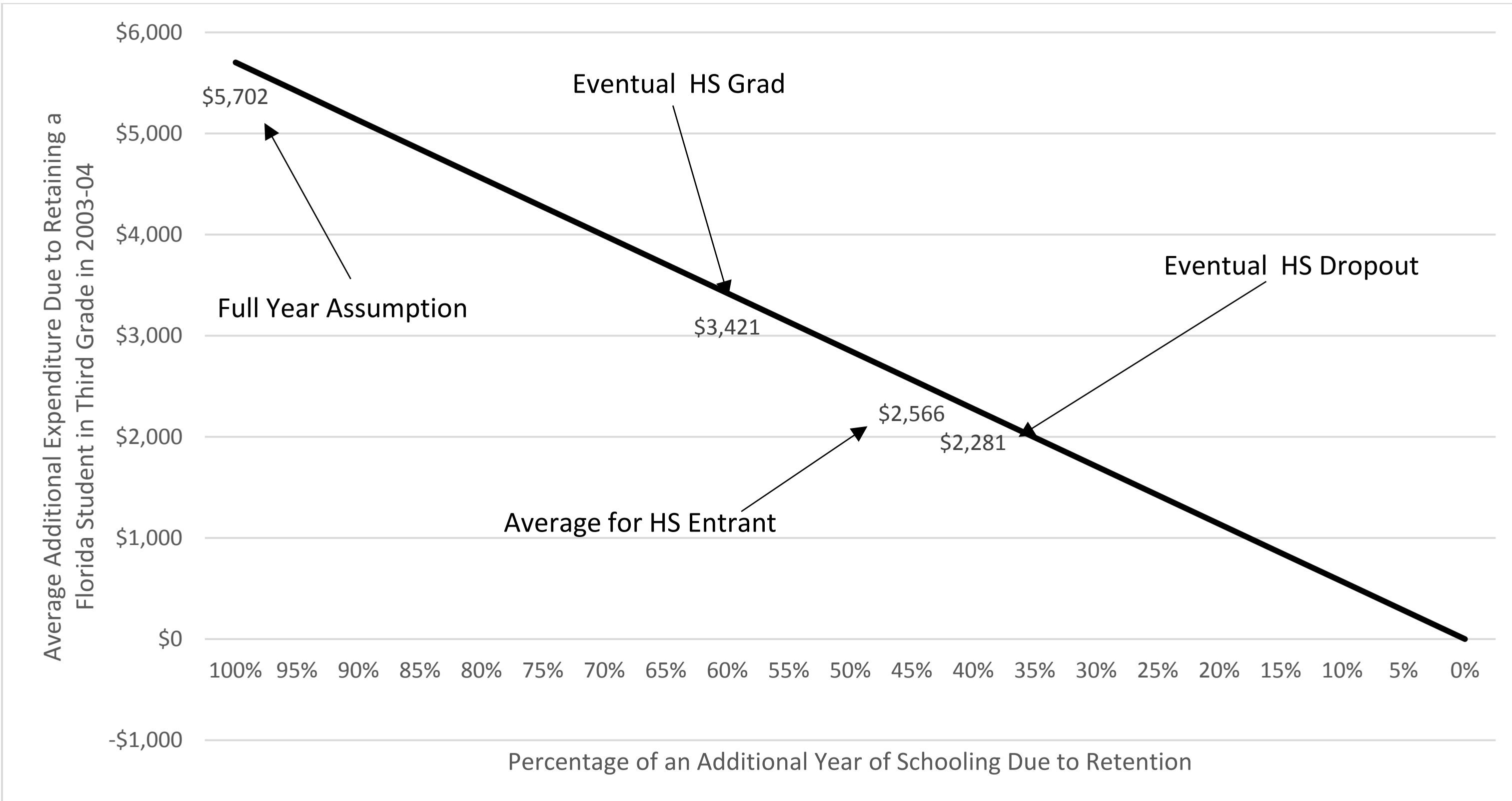
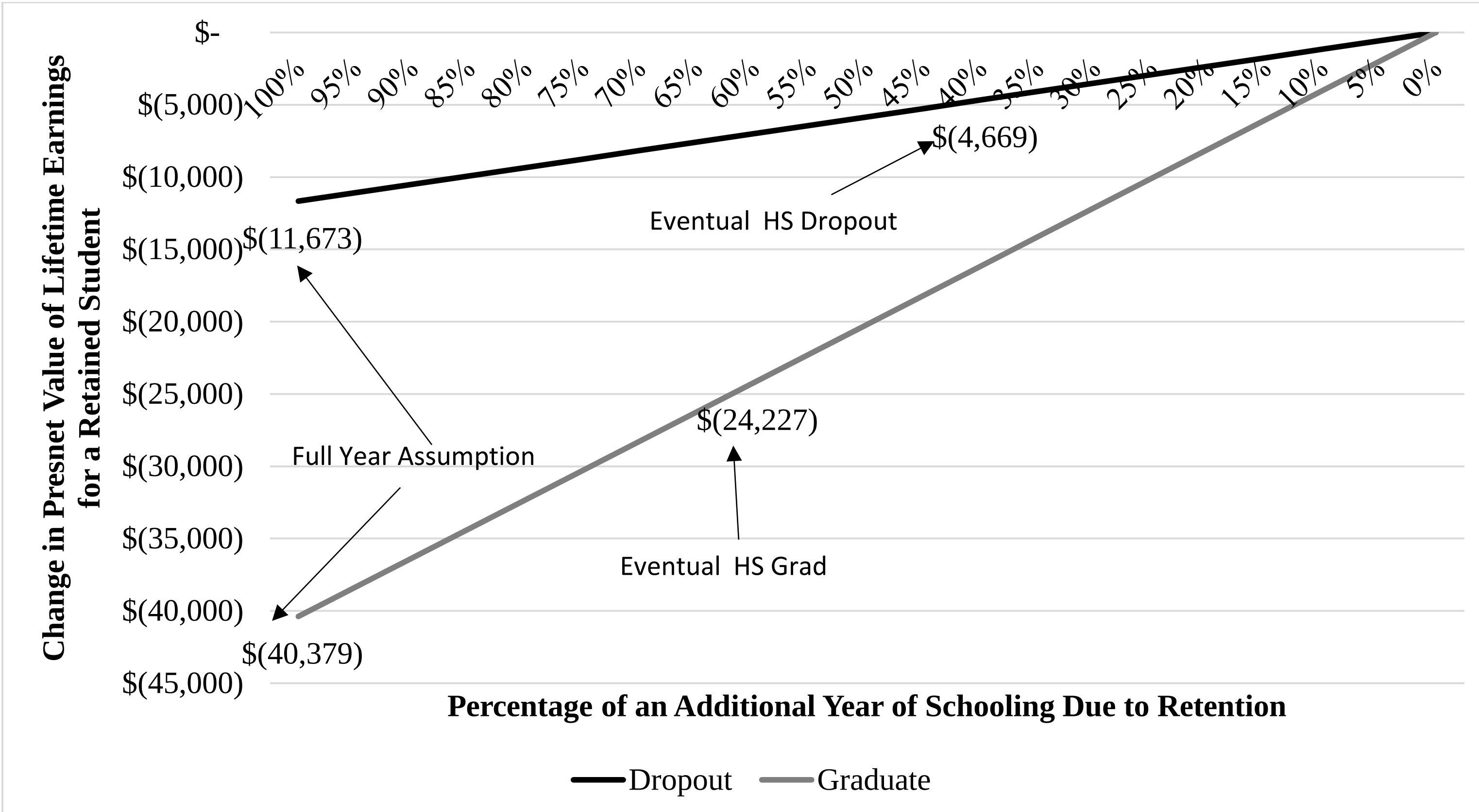


Figure 2
Additional Taxpayer Expenditure Under Various Assumptions for Additional Time Spend in School Caused by Retention: Florida 2002-03 Third Grade Cohort



Note: Calculation assumes a 4% rate of return. "Eventual HS Grad" and "Eventual HS Dropout" highlights values for students who experienced the additional time in school found for either those who dropped out or graduated from high school according to the estimates from Florida's test-based promotion policy. "Average for HS Entrant" highlights the values for students who experienced the additional time in school for the average treated student observed to enter the ninth grade according to prior empirical estimates.

Figure 3
Present Value of Lost Earnings Due to Retention Under Various Assumptions for Additional Time Spend in School



Note: Calculation assumes a 4% rate of return. Full Year Assumption refers to figures that assume that retention leads to a full year of additional schooling. “Eventual HS Grad” and “Eventual HS Dropout” highlights values for present value of lost lifetime earnings for students who either dropped out or graduated from high school according to the estimates from Florida’s test-based promotion policy.

Appendix Table 1
Estimated Taxpayer Cost of Retaining a Student by Grade and State, Assuming Retention Leads to a Full Year of Additional Schooling

	2013-14 Current Expend Per Pupil	Grade Level Retained								
		0	1	2	3	4	5	6	7	8
United States	$11,066	$9,296	$9,432	$9,570	$9,710	$9,852	$9,996	$10,143	$10,291	$10,442
Alabama	$9,036	$7,591	$7,702	$7,814	$7,929	$8,045	$8,162	$8,282	$8,403	$8,526
Alaska	$18,466	$15,512	$15,739	$15,969	$16,203	$16,440	$16,680	$16,924	$17,172	$17,423
Arizona	$7,457	$6,264	$6,355	$6,448	$6,543	$6,638	$6,736	$6,834	$6,934	$7,036
Arkansas	$9,752	$8,191	$8,311	$8,433	$8,556	$8,682	$8,809	$8,938	$9,068	$9,201
California	$9,671	$8,124	$8,243	$8,363	$8,486	$8,610	$8,736	$8,864	$8,994	$9,125
Colorado	$9,036	$7,590	$7,701	$7,814	$7,928	$8,044	$8,162	$8,281	$8,403	$8,526
Connecticut	$18,401	$15,457	$15,683	$15,913	$16,145	$16,382	$16,621	$16,865	$17,111	$17,362
Delaware	$13,793	$11,586	$11,756	$11,928	$12,103	$12,280	$12,459	$12,642	$12,827	$13,014
District of Columbia	$20,577	$17,285	$17,538	$17,794	$18,055	$18,319	$18,587	$18,859	$19,135	$19,415
Florida	$8,955	$7,522	$7,632	$7,744	$7,857	$7,972	$8,089	$8,207	$8,327	$8,449
Georgia	$9,236	$7,758	$7,872	$7,987	$8,104	$8,222	$8,343	$8,465	$8,589	$8,714
Hawaii	$12,400	$10,416	$10,568	$10,723	$10,880	$11,039	$11,201	$11,365	$11,531	$11,700
Idaho	$6,577	$5,525	$5,606	$5,688	$5,771	$5,855	$5,941	$6,028	$6,116	$6,206
Illinois	$13,213	$11,099	$11,261	$11,426	$11,593	$11,763	$11,935	$12,110	$12,287	$12,467
Indiana	$9,396	$7,893	$8,008	$8,126	$8,244	$8,365	$8,488	$8,612	$8,738	$8,866
Iowa	$10,647	$8,943	$9,074	$9,207	$9,342	$9,478	$9,617	$9,758	$9,901	$10,046
Kansas	$10,240	$8,601	$8,727	$8,855	$8,985	$9,116	$9,250	$9,385	$9,522	$9,662
Kentucky	$9,411	$7,906	$8,021	$8,139	$8,258	$8,379	$8,501	$8,626	$8,752	$8,880
Louisiana	$10,853	$9,116	$9,250	$9,385	$9,522	$9,662	$9,803	$9,947	$10,092	$10,240
Maine	$13,267	$11,144	$11,308	$11,473	$11,641	$11,811	$11,984	$12,160	$12,337	$12,518
Maryland	$14,217	$11,943	$12,117	$12,295	$12,475	$12,657	$12,842	$13,030	$13,221	$13,414

Massachusetts	$15,886	$13,345	$13,540	$13,738	$13,939	$14,143	$14,350	$14,560	$14,773	$14,989
Michigan	$10,649	$8,945	$9,076	$9,209	$9,344	$9,481	$9,619	$9,760	$9,903	$10,048
Minnesota	$11,427	$9,599	$9,739	$9,882	$10,026	$10,173	$10,322	$10,473	$10,626	$10,782
Mississippi	$8,265	$6,942	$7,044	$7,147	$7,252	$7,358	$7,465	$7,575	$7,686	$7,798
Missouri	$9,938	$8,348	$8,470	$8,594	$8,720	$8,848	$8,977	$9,108	$9,242	$9,377
Montana	$10,941	$9,191	$9,325	$9,462	$9,600	$9,741	$9,883	$10,028	$10,175	$10,323
Nebraska	$11,877	$9,977	$10,123	$10,271	$10,422	$10,574	$10,729	$10,886	$11,045	$11,207
Nevada	$8,275	$6,951	$7,053	$7,156	$7,261	$7,367	$7,475	$7,584	$7,695	$7,808
New Hampshire	$14,601	$12,265	$12,444	$12,626	$12,811	$12,998	$13,189	$13,382	$13,578	$13,776
New Jersey	$18,780	$15,775	$16,006	$16,240	$16,478	$16,719	$16,964	$17,212	$17,464	$17,720
New Mexico	$9,403	$7,898	$8,014	$8,131	$8,250	$8,371	$8,494	$8,618	$8,744	$8,872
New York	$20,156	$16,931	$17,179	$17,430	$17,685	$17,944	$18,207	$18,473	$18,743	$19,018
North Carolina	$8,287	$6,961	$7,063	$7,166	$7,271	$7,377	$7,485	$7,595	$7,706	$7,819
North Dakota	$12,032	$10,107	$10,255	$10,405	$10,557	$10,712	$10,868	$11,027	$11,189	$11,353
Ohio	$11,434	$9,605	$9,746	$9,888	$10,033	$10,180	$10,329	$10,480	$10,633	$10,789
Oklahoma	$7,995	$6,716	$6,814	$6,913	$7,015	$7,117	$7,221	$7,327	$7,434	$7,543
Oregon	$9,959	$8,365	$8,488	$8,612	$8,738	$8,866	$8,996	$9,127	$9,261	$9,396
Pennsylvania	$13,824	$11,612	$11,782	$11,955	$12,130	$12,307	$12,487	$12,670	$12,856	$13,044
Rhode Island	$15,372	$12,913	$13,102	$13,294	$13,488	$13,685	$13,886	$14,089	$14,295	$14,504
South Carolina	$9,608	$8,071	$8,189	$8,308	$8,430	$8,553	$8,679	$8,806	$8,934	$9,065
South Dakota	$9,036	$7,590	$7,701	$7,814	$7,928	$8,045	$8,162	$8,282	$8,403	$8,526
Tennessee	$8,662	$7,277	$7,383	$7,491	$7,601	$7,712	$7,825	$7,939	$8,056	$8,173
Texas	$8,602	$7,226	$7,331	$7,439	$7,547	$7,658	$7,770	$7,884	$7,999	$8,116
Utah	$6,546	$5,498	$5,579	$5,661	$5,743	$5,827	$5,913	$5,999	$6,087	$6,176
Vermont	$18,066	$15,176	$15,398	$15,623	$15,852	$16,084	$16,319	$16,558	$16,800	$17,046
Virginia	$10,955	$9,203	$9,337	$9,474	$9,613	$9,753	$9,896	$10,041	$10,188	$10,337
Washington	$10,305	$8,656	$8,783	$8,911	$9,042	$9,174	$9,308	$9,444	$9,583	$9,723
West Virginia	$11,371	$9,552	$9,692	$9,833	$9,977	$10,123	$10,271	$10,422	$10,574	$10,729
Wisconsin	$11,345	$9,530	$9,670	$9,811	$9,955	$10,100	$10,248	$10,398	$10,550	$10,705
Wyoming	$15,903	$13,359	$13,555	$13,753	$13,954	$14,158	$14,366	$14,576	$14,789	$15,006

Note: Calculations assume: annual inflation = 2%, real education spending increase = 0.05%, rate of return = 4%, and retention leads to a full additional year of schooling. Each figure can be adjusted by multiplying it by an assumed percentage of an additional year of schooling due to retention.