Ohio's Economic Future

Eric A. Hanushek
Stanford University

Testimony for the
Ohio Senate Education Committee
January 31, 2018

Thank you for the opportunity to testify here today. I am here in part because of my allegiance to Ohio, having graduated from North Olmsted High School. I am also here because I have come to believe that the economic future of Ohio and of the United States is highly dependent on improving the public schools.

My testimony provides a very truncated view of a growing body of research into the economic future of states and nations. To support the conclusions that I give in my testimony, I have attached the background analysis as an appendix to this testimony.

Ohio clearly faces important challenges. In 2010, Ohio ranked 33rd in the nation in terms of Gross State Product per capita. This ranking is a product of historical resources, development patterns, and growth over time. Importantly, in the period 1970-2007, its growth in income per capita was 43rd in the nation, indicating that, without substantial changes, Ohio's relative economic position is likely to fall.

The answer: *Improve the public schools to ensure a better economic future.*

Education has long been thought of as an important component of any economic development strategy. Because of the central role of worker skills in local economies, people have always looked to schools to promote development.

Recently, research has provided two new dimensions to the discussion. First, there has been growing and correct appreciation of "high quality" education. It is possible to push up graduation rates if there is no regard for the skills and achievement of the graduates, but, if workers' skills are not appropriate for the modern economy, then this solution will not be sufficient for economic growth. Second, the relative quality of workers is an important element in explaining state income differences and in determining future economic growth rates.

One of the implications of this research into the economic circumstances of states is that there is a clear metric for development: the measured achievement of workers, which in turn reflects the performance of schools. A second implication is that states should place their policy emphasis on improving schools.

Current research suggests that improving Ohio's schools could lead to enormous long term economic gains. For example, if Ohio could bring it students up to the achievement levels of Minnesota (the highest achieving state over the past two decades), it could expect its income per capita to be on average by about five and a half percent above what would be expected with its current school

performance. This increase would arise from greater economic growth and would hold over the next century.

The route to this improvement will of course be difficult. Many past efforts, in both Ohio and nationally, have failed. Nonetheless, Ohio has made gains in the past, and it is important for the economic future that these improvements continue. Experience also provides a guide to understand what works and what doesn't. We know, for example, that simply spending more on schools without changing policies and incentives has not been a successful strategy. *How* educational funds are spent proves to be more important than how *much* is spent.

The research underlying the economic discussion (summarized in the attached background analysis) is straightforward. The simple economic premise is that the economic performance of an economy depends on the skills of its workforce. In order to relate this idea to a state's schools, it is necessary to understand how many students will remain in the state, which students tend to leave, and which workers come into the state from other states and other countries. When this done, history shows that there is a strong relationship between the long run economic growth of states (1970-2010) and the achievement levels of the work force.

Potential Gains

Figure 1 shows how test scores of workers relate to growth. States that have a higher-skilled labor force tend to grow faster. Importantly, this picture accounts for differences in school attainment and for the initial income levels of states. Once the skills of the population – here measured by math achievement – are known, information about school completion adds nothing to the explanation of growth. This is important: Just extending time in school adds nothing to the economic outcomes if the students are not learning.

This graph shows that Ohio 's low growth partially reflects low skills and partially reflects the fact that economic performance is below what would be expected given its skills; i.e., it falls below the line of expected performance.

Overall, Ohio does slightly above the national average as seen by the National Assessment of Educational Progress (NAEP). But this overstates where public schools in Ohio stand. Ohio has a population that is "easier" to educate – essentially with fewer disadvantaged students than found on average in other states. This implies that Ohio students should be doing better than they actually are doing, and by the experience of other states, it shows that higher achievement is feasible.

Figure 1. Economic Growth (1970-2010) and Cognitive Skills across States

The historical growth patterns permit projecting what improving Ohio's schools would mean. It is possible to project the economic results from various school improvement programs. Here I show four separate scenarios, ranging from a one-quarter standard deviation improvement in test scores to bringing all Ohio children up to the "basic level" as defined by NAEP.

If, for example, Ohio students began performing at the level of Minnesota students (historically the best state performance level), history suggests that the level of GDP would average more than five percent higher than that with no improvement in schools. Putting the added growth in terms of current dollars, it would amount to over $1.5 trillion. (See Table 1)

Table 1. Summary of Economic Impacts of School Improvement in Ohio

	Value of reform		
	In $ billion	In % of current GDP	In % of discounted future GDP
Scenario I: 0.25 SD	1,546	262	5.6
Scenario II: Top-performing state	1,524	258	5.5
Scenario III: Top-performing in East North Central region (Wisconsin)	658	112	2.4
Scenario IV: Basic level	652	111	2.4

While it is possible to go through the details of various improvements, suffice to say that the economic gains from improvement are enormous. Moreover, by historic standards, they are feasible. The gains that Ohio made between 1992-2011 would be sufficient – if duplicated over the next decade – to give the ¼ standard deviation improvements, yielding by historical patterns an average GDP that was five percent above the no-improvement GDP

Potential Policies

Continuous improvement is not, however, guaranteed. Ohio, for example, has slipped back some since 2011. What do we know about what needs to be done?

Because so much has been written about improvements, I will simply give the quick summary of my conclusions about the research evidence.

1. How much is spent is much less important than how money is spent. There is no consistent relationship between resources and student outcomes.
2. Teacher quality is the key. Improving school outcomes is directly linked to improving teacher quality.
3. Teacher quality is difficult to regulate. There are not good descriptions of who will be a good teacher, whether in terms of required training, important background and experiences, or other traits that could be used to regulate and certify teachers.
4. Providing incentives for improved achievement is the clearest way to get improvements. Several aspects of incentives have been identified as having positive impacts, although none has been shown to solve achievement problems by itself.
    a. Establish a strong accountability system that rewards good performance;
    b. Evaluate and reward good teachers while not retaining ineffective teachers;

c. Promote competition among schools so that parental choices can enter;
d. Provide local decision making autonomy rather than seeking centralized control.

5. Evidence suggests that targeted preschool programs substantially improve the education futures of disadvantaged students, thus operating to improve the chances of bringing all students to basic skills levels.

This list clearly has controversial elements and is difficult to put into place. But the point of the previous discussion of economic outcomes is that the rewards for having highly-effective schools are enormous. Put differently, the costs in terms of foregone outcomes for inaction are large.

Thank you for the opportunity to discuss these issues with you. I am more than happy to take questions, either now or in the future.

You can contact me at:

hanushek@stanford.edu. Phone: 650-736-0942; Website: hanushek.stanford.edu

APPENDIX: Ohio's Economic Future Lies with School Improvement: Background Analysis

Ohio's Economic Future Lies with School Improvement: Background Analysis

Eric A. Hanushek*

January 2018

* Hoover Institution, Stanford University; hanushek@stanford.edu. Website: hanushek.stanford.edu

1. The Importance of Education

Ohio clearly faces important challenges. In 2010, Ohio ranked 33rd in the nation in terms of Gross State Product per capita. This ranking is a product of historical resources, development patterns, and growth over time. In the period 1970-2007, its growth in income per capita was 43rd in the nation, indicating that, without substantial changes, the relative economic position is likely to fall. The answer: improve its schools to ensure a better future.[1]

Education has long been thought of as an important component of any economic development strategy. Because of the central role of worker skills in local economies, people have always looked to schools to promote development.

Recently, two new dimensions have entered the discussion. First, there has been growing and correct appreciation of "high quality" education. It is possible to push up graduation rates if there is no regard for the skills and achievement of the graduates, but if workers' skills are not appropriate for the modern economy then this solution will not be sufficient for economic growth. Second, the relative quality of workers is an important element in explaining state income differences and in determining future economic growth rates. Workers' cognitive skills are a factor in international differences in income and growth.[2] Recent extensions of this to economic outcomes across states underscore the necessity of a highly skilled workforce.

One of the implications of this research into the economic circumstances of states is that there is a clear metric for development: the measured achievement of workers, which in turn reflects the performance of schools. A second implication is that states should place their policy emphasis on improving schools.

History and current research suggest that improving Ohio's schools could lead to enormous long term economic gains. For example, if Ohio could bring it students up to the achievement levels of Minnesota (the highest achieving state over the past two decades), it could expect its income per capita to be on average over five and a half percent above what would be expected with its current school performance. This increase would arise from greater economic growth and would hold over the next century.

The route to this improvement will of course be difficult. Many past efforts, in both Ohio and nationally, have failed. Nonetheless, Ohio has made gains in the past, and it is important for the economic future that these improvements continue. Experience also provides a guide to understand what works and what doesn't. We know, for example, that simply spending more on schools without changing policies and incentives has not been a successful strategy. *How* educational funds are spent proves to be more important than how *much* is spent, suggesting that policies leading to improved school quality offer real hope.

[1] This paper builds on several prior analyses of economic growth and outcomes across U.S. states: Hanushek, Ruhose, and Woessmann (2016, (2017a, (2017b).

[2] Hanushek and Woessmann (2015)

2. Historical Relationship of Cognitive Skills and Economic Gains

A key element of any successful economy, whether a nation or a state, is the quality of its workforce. This section summarizes the relationship between workers' human capital and economic growth. It then highlights the current educational standing of Ohio.

A. Foundational Research

This analysis focuses on the aggregate effects of schooling on state economic development, a topic that has received relatively little attention. For state policy, two economic impacts of education are relevant. The first is simply the impact on individual citizens: how different are economic outcomes if an individual has more human capital?[3] The second involves the macroeconomic outcomes for the state: how is state economic development altered by changing the human capital of the state? The impact of education on individuals has been extensively studied[4] and is largely subsumed in the consideration of aggregate outcomes; therefore, this analysis will focus on the aggregate picture.

While policy discussions of state economic development span a variety of topics, a primary policy instrument is invariably the nature and performance of public schools. Unfortunately, the existing analysis frequently suffers from poor and indirect measures of schooling outcomes. Instead of actually measuring the skills of individuals, many studies rely on a simple proxy – school attainment, as measured by the average years of schooling of the population. This measure has prima facie support, because a primary purpose of schooling is increasing the skills (e.g., ability to read, write, and do basic math) of citizens. It is also a convenient measure to use because of its ready availability in individual, state, and national data.

However, school attainment (in years) is not synonymous with skill attainment, because time in school coincides with a wide range of learning outcomes. Using school attainment as a proxy for measurement of skills obscures the fundamental role of skills in determining economic growth. More importantly, it distracts the analysis from school quality.

This analysis builds on new estimates of the human capital stock of workers in each state. These estimates, which combine school attainment and achievement for workers, provide a more accurate picture of how human capital affects aggregate state income and income growth.

Developing the combined measures of human capital is difficult. While school attainment of the labor force is readily available from census data, achievement is not. The regular testing of students in each state with the National Assessment of Educational Progress (NAEP) provides information on the achievement of workers who live in the same state in which they were educated. But this information gives an inaccurate picture of the overall skills of the adult workforce because of extensive migration across states and immigration of workers from abroad. Moreover, past analysis suggests that both internal migration and international immigration are highly selective; i.e., migrants tend to be more skilled than the average person in their state or country of origin.

[3] Economists refer to the productive capacities of individual as human capital. The analogy to physical capital is intended to underscore the fact that individuals and society make investments designed to enhance the skills of individuals and these investments are subsequently rewarded in the labor market.

[4] See Mincer (1974), Card (2001), Heckman, Lochner, and Todd (2006), and Hanushek et al. (2015).

States differ dramatically in their "hold" on their citizens (see Figure 1). For the median state in 2007, less than 60 percent of those born in the state still live there as an adult. However, states range from less than 20 percent (Nevada) to almost 80 percent (Louisiana). Ohio retains a much above-average proportion of its citizens: 74 percent.

Similarly, immigration into the U.S. has increased over time, and the distribution of immigrants across states has widened. The percent of state residents not born within the United States in 2007 ranges from almost zero in West Virginia to over 30 percent in California. In Ohio, only four percent of the adult population is comprised of immigrants.[5]

These characteristics of Ohio imply that, more than most other states, Ohio controls its own destiny. Differences in school quality will show up directly in the labor force of Ohio.

A better understanding of the distribution of skills across states can be determined by tracing workers back to their place of education. We integrate information on education quality in the state or country of schooling with the distribution of workers in each state's labor market to estimate the quality of workers in each state. Our calculations use historic test scores for students in each state (NAEP) and in foreign countries (PISA).[6] We also consider the varied migration patterns by level of education to control for the selectivity of migration.

Migration and immigration affect each state differently. These forces lead to net improvements in the skills of adults for some states and net diminution of skills (compared to locally educated quality) in others. Ohio, like most states in the center of the country, loses skills through migration to other states (see Map 1). In general, states on the coasts come out ahead through migration and immigration.

Building on this information, we can then analyze how aggregate income levels across states relate to the skills of the workers. For the nation as a whole, we find that differences in workers' human capital account for 20 to 35 percent of the current variation in per-capita GDP among states, with roughly even contributions by school attainment and cognitive skills.[7] In some ways, this role of human capital in variation in GDP is surprisingly large, because both labor and capital are free to move across states and thus to tend to equalize rewards to workers of different skills.

For policy purposes, however, it is more important to know how student performance filters into future economic development. In order to estimate the potential impact of school quality on the future economy, we first consider some simple models of economic growth for states. These models build directly on prior analysis of country differences in economic growth rates, which has shown that there is a very strong relationship between measured student achievement (as found in international math and science scores recorded on the PISA exams) and the long run growth of nations (Hanushek and Woessmann (2012, (2015)). Moreover, there are strong reasons to believe that this relationship is causal; i.e., if a nation increases the cognitive skills of its population, it can expect to see an improvement in its long-run economic growth rate.

---

[5]Foreign immigrants to Missouri have slightly fewer years of schooling than native residents, but they are estimated to have significantly higher achievement (Hanushek, Ruhose, and Woessmann (2017b)).

[6] These calculations build on data from the National Assessment of Educational Progress (NAEP) and the Programme for International Student Assessment (PISA). See the complete description in Hanushek, Ruhose, and Woessmann (2017b).

[7] Details of this work can be found in Hanushek, Ruhose, and Woessmann (2017b).

Not only does this relationship hold for countries, it also holds across U.S. states. Some perspective on this can be seen in Figures 2 and 3, which simply plot state GDP per capita against the school attainment and the cognitive skills of the adults in each state. Clearly, there is a strong relationship between the level of human capital and the GDP in each state.

The economic analysis builds on the measures of the human capital stock that incorporate migration and immigration previously as described and then estimates statistical models explaining state growth in GDP per capita from 1970-2010. The overall results are remarkably similar to the international findings. In a simple growth model based just on school attainment as the measure of human capital (without regard for educational quality), attainment is significantly related to state growth rates. But, as with the international models, these estimates are quite misleading: any trace of the impact of pure school attainment disappears when the measure of educational quality is included. Figure 4 shows the net effect of cognitive skills on state growth. The plotted relationship represents a statistical model that has controlled for 1970 GDP per capita in each state and for school attainment. Including initial state income allows for the fact that states starting behind can grow faster just by copying what more advanced states are doing. Including attainment offers the possibility that level of schooling provides some additional information, but attainment is always statistically insignificant once measures of what is actually learned are included. Importantly, the estimated growth model for states produces exactly the same results as the international estimates.

Any such research necessarily involves uncertainty and various methodological concerns. In this case, because the estimates of the growth relationship with cognitive skills for states are essentially identical to the relevant international coefficient, we can rely on the extensive robustness analysis, sensitivity testing, and causality analysis of the international work. Thus, we can use the estimated growth model to project the economic consequences of improving schools in Ohio with somewhat greater confidence.

B. Where Does Ohio Stand?

Before looking at the economic implications of schooling reform, it is useful to see exactly where Ohio stands in terms of its current schooling. In terms of school attainment, Ohio falls right in the middle of the country. Table 1 shows that high school and college completion of the adult population in 2015 in Ohio are very close to the country average.

But, as just described, economic growth is most closely related to measured cognitive skills, and in this area, there is a mixed picture. Figure 5 shows a comparison of states using the results from NAEP tests of 8th grade math in 2015. Here Ohio ranks seventeenth in the nation. While behind the top states (the average student in Ohio would compare to the 37th percentile student in Massachusetts), it provides a relatively positive picture. Unfortunately, Ohio has slipped in recent years, leaving open the question of where Ohio schools are moving in the future.

Moreover, this figure actually *overstates* the quality of schools in Ohio. Ohio has a population distribution that is generally "easier to educate" than found for the nation as a whole. In particular, Table 2 shows that the state has a noticeably greater percentage of white students (71.9 percent versus 49.5 percent for the nation), largely reflecting a much smaller percentage of Hispanic students (4.9 percent) than found in the rest of the nation (24.8 percent). Moreover, fewer Ohio students are eligible for free and reduced price lunches, the common measure of poverty status.

By virtue of an easier to educate population, one might expect Ohio test scores to be above the national average regardless of the quality of its schools. Figure 6 suggests the magnitude of the problems. If only white students are compared, the average Ohio student drops to the national average of the nation's white students.

In sum, while there are some bright spots in the skills of the Ohio population, there is also clear room for improvement of the schools. And, linked with the importance of added skills for the growth of the Ohio economy, there is clearly room for the Ohio schools to do better.

3. Projected Gains from School Improvements in Ohio

The cross-state growth models provide a clear picture of the importance of school improvement for economic outcomes. As was seen in Figure 4, enhanced student achievement produces positive gains in state economic growth – and the impact is quite substantial.

The analysis here considers a range of educational improvement policies and then estimates the economic impact of each policy on the state.[8] The various scenarios include:

I. Increasing average achievement by ¼ standard deviation.
II. Bringing each state up to the current best state (Minnesota).
III. Bringing each state up to the current best in the geographic division.
IV. Bringing all students in a state up to the NAEP basic level.

The calculations of the economic impact are straightforward. First, we can estimate the expected future growth of a state with the current worker skill level. This growth can then be compared to the growth that would be achieved with better schools according to each of the previous scenarios. The estimated impact uses the previously estimated state growth models and projects GDP per capita. The gains in GDP do accrue in the future, so in a standard way the calculations give more weight to near term gains than gains in the more distant future.[9]

The economic impact on each state varies considerably based on differences in the current economic and human capital positions of that state. For example, the gains in economic outcomes from bringing all students up to basic skills (Scenario IV) is shown in Figure 7. This improvement means least in North Dakota and Massachusetts, where the fewest low-performing students are currently found. It means the most in Alabama and California, where the greatest number of low-performing students are found. But even in North Dakota and Massachusetts the present value of gains (over the lifetime of

[8] Additional projections can be found in Hanushek, Ruhose, and Woessmann (2017a).
[9] The technical background for these calculations is straightforward. The calculations assume that the cross-state growth models hold in the future; that reforms of the schools take ten years to accomplish; and that the labor force improves through replacing retiring workers with better-educated workers. Future values of GDP are discounted at three percent to calculate the present value of future gains. See Hanushek, Ruhose, and Woessmann (2017a).

somebody born today) would amount to 70 percent of current state GDP. For the states farthest from having all workers at basic levels, it would amount to more than three times their current state GDP.

For Ohio, bringing all students up to a basic level of performance – a policy akin to the goals of No Child Left Behind – would yield a present value of added GDP from growth greater than the current GDP (Scenario IV).[10] This growth is equivalent to raising the average level of GDP by 2.4 percent above what is expected with no change in school quality.

Table 3 summarizes the results for each of the scenarios listed above for Ohio. The first column shows the present value of reforms in billions of 2015 dollars. The next two columns put these gains into the perspective of current GDP or the present value of GDP that would be obtained without school improvement.[11]

The most straightforward improvement is shown in the first row, which depicts the scenario where Ohio improves achievement by one-quarter standard deviation over the next ten years.[12] The present value of this improvement, which allows for the time to improve school performance and for the time to replace retiring workers, is $1.5 trillion dollars, or 2.62 times the current value of GDP. An alternative way to view this is that the gains for Ohio would be 5.6 percent higher GDP on average for the next 80 years (the expected life of somebody born today). Such an increase is much larger than Ohio needs to balance its budget and meet its current service demands. In 2095, the level of GDP is over 20 percent larger than would be seen without quality improvements.

The second row shows estimates of what economic gains would accrue if Ohio moved its school quality so that achievement matched the top state (Minnesota). This results in an increase very similar to the previous scenario, because Minnesota currently is about 0.25 standard deviations ahead of Ohio. The third scenario – equally the North Central region's best (Wisconsin) is smaller but still equal in present value to Ohio's current GDP.

The fourth scenario essentially accomplishes the proficiency goals of NCLB but over an additional 10-year period. The gains for Ohio of getting students to NAEP basic are roughly half those of reaching Minnesota levels: the present value of average gains is slightly less than 2 ½ times the current level of Ohio GDP.

The simple conclusion is that there are enormous economic gains to be had from improving the output of Ohio schools. The level of improvement in educational achievement we consider is, by historical standards, within the feasible range for most states, including Ohio. The largest gains come from a coordinated improvement in performance, as all states are linked by flows of people over time.

---

[10] NAEP classifies students as following into different performance categories: below basic, basic, proficient, and advanced. The basic level, which seems to be the minimal skills necessary for full participation in the economy, is defined as: "Partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade."

[11] It is also possible to provide a sense of the results by looking at the U.S. total, as well as the standard deviation across states, of economic outcomes. Appendix Table A1 summarizes the aggregate U.S. results and provides an indication of how the states differ.

[12] In terms of NAEP scores this would amount to roughly a 7-9 point improvement over a ten year period. If put in terms of the individual student distribution, a student at the median of the distribution (the 50th percentile) would move to the 60th percentile of the current distribution. Gains of this magnitude have been shown to be possible by a number of states; Hanushek, Peterson, and Woessmann (2012).

But even ignoring the impact of migration, it is clear that Ohio can promote a better economic future for its citizens through educational reform, because historically the youth of Ohio have tended to remain in Ohio. The projected gains, based on historical relationships, would not only make the citizens of Ohio better off, but also show how states' current fiscal problems can be tackled by improving human capital.

4. Commonly Discussed Potential Policies[13]

The very large economic gains of course require substantial improvements in student performance (which translate into a better future workforce). What kinds of gains are possible?

History has shown very uneven gains across the states. Figure 8 displays the gains in NAEP scores between 1992 and 2011. The fastest improving states could in fact match the goals in each of the four scenarios if they kept up the same pace in the future.

Ohio's improvements have been above the national average, although noticeably below that in the fastest improving states. Importantly, if Ohio can maintain its historic rate of improvement over the next decade, it could achieve the one-quarter standard deviation change previously considered in Scenario I. Maintaining this rate of increase, however, will require further improvements on Ohio's schools.

It must be said that, though it has been a goal of politicians' platforms since Sputnik, improving schools has proven difficult. Spending on U.S. schools has dramatically increased, quadrupling in real terms since 1960, yet the performance of 17-year-olds in mathematics and reading (according to NAEP) has shown no improvement since 1970.

The increases in spending have gone largely toward dramatic declines in pupil-teacher ratios, from 25.8 in 1960 to 15.3 in 2008. Real teacher salaries have also gone up, but more modestly: an eight percent increase from 1994 to 2008. Unfortunately, research shows that these are not the factors that drive improvements in student outcomes.

A. The Importance of Teacher Quality

The most consistent factor affecting student achievement is the quality of teachers. The impact of differences in teacher quality are startling.

A direct way of seeing the potential impact of teachers is to look at differences in the growth of student achievement across teachers. It is natural to define good teachers as those who consistently obtain high learning growth from students, while poor teachers are those who consistently produce low learning growth. Numerous studies have investigated the advantage of having good teachers, and they indicate clearly how much difference can come to a student based on teacher assignment.[14] One study found that teachers near the top of the quality distribution got an entire year's worth of additional learning out of their students compared to teachers near the bottom.[15] Furthermore, this analysis considered kids just from minority and poor inner-city families, indicating that family background is not

[13] This section builds directly upon Hanushek (2016).
[14] Hanushek and Rivkin (2010)
[15] Hanushek (1992)

the sole determinant of student outcomes and that good teachers can overcome deficits that might stem from poorer learning conditions in the home.

A second perspective comes from combining existing quantitative estimates of differences in teacher quality with achievement gaps by race or income. Having a good teacher as opposed to an average one for 3-4 years in a row would, by available estimates, close the average achievement gaps found in NAEP. Closing the black-white achievement gap, which is a little larger than the average income gap, would take good teachers 3.5-5 years in a row.

Perhaps the most salient approach is to calculate the impact of effective teachers on the future earnings of students. A teacher who raises the achievement of a student will tend, other things being equal, to raise a student's earnings throughout that student's work life. Using 2010 earnings, for example, a teacher in the 75th percentile (when compared to the average teacher) would on average raise each student's lifetime income by somewhat more than $14,300.[16] With a class of 25 students, this teacher would *each year* add $358,000 in future income compared to an average teacher.[17]

But there is a darker side to this analysis. Below-average teachers actually *subtract* from student earnings at a similar rate. The 10th percentile teacher, compared to an average teacher, subtracts over $668,000 per year for each group of 25 students he teaches.

B. Institutional structures and incentives in the school system

Existing evidence suggests that policies should incentivize hiring and retaining high quality teachers. Additionally, while based on somewhat thinner evidence, it appears that administrators are important to student learning, so incentives must be similarly developed to keep the best administrators.[18] The relevant incentives are created by the rules and regulations that set rewards and penalties for the people involved in the education process.

Four interrelated policies to improve teacher quality can be gleaned from the existing research. First, school systems must evaluate and directly reward good teacher performance. Second, school systems should promote more competition, so that parental demand will create strong incentives to improve individual schools. Third, there should be greater autonomy in local decision-making, so that individual schools and their leaders can take actions to promote student achievement. And fourth, school systems should set up an accountability system that rewards good school performance. We will discuss each in more detail.

---

[16] This calculation gives the expected earnings increases over and above any influence that higher achievement might have on the continuation in schooling and overall attainment. If the added impact on years of schooling obtained is considered, this figure might be twice as high; compare Hanushek (2011) and Hanushek et al. (2015).

[17] These calculations use estimates of the variation in teacher quality from existing value-added studies, and from labor market studies of the value of added achievement to project added earnings for teachers at different quality levels (see Hanushek (2011)). The estimates for different size classes assume that added students over the range of the projections have no impact on class achievement. This assumption is controversial; see Krueger (1999) and Hanushek (2003). Class size or number of students taught refers to full-time equivalents for teachers with multiple classes of students. See also the similar economic estimates from a very different methodology in Chetty, Friedman, and Rockoff (2014).

[18] The more limited work on the role of principals, but an important part of administrator effectiveness appears to involve personnel decisions and ensuring that there are highly effective teachers in the school; Branch, Hanushek, and Rivkin (2012).

Direct Rewards. Given the importance of high teacher quality, a candidate for improvement is the specific form of accountability that aims incentives directly at teachers. While convincing evidence on the effects of performance-related teacher pay is scarce, the more rigorous studies tend to find a positive relationship between financial incentives for teachers and student outcomes.

Most existing evaluations of performance pay systems focus on whether existing teachers change their behavior – what is referred to as the "effort" margin. There are many reasons to believe, however, that the "selection" margin—the attraction of new teachers and the retention of the more effective ones – is more important. The effect of pay on selection is difficult to analyze because it generally involves considering longer-run incentives and the evaluations must track teachers moving in and out of schools. One evaluation keyed to the selection margin in schools in Washington, DC, where the pay and retention system emphasizes rewarding the best teachers while dismissing the worst, finds strong achievement results.[19]

A key element of rewarding performance is having an interconnected teacher evaluation system and personnel system. On this score, several states have made gains, largely by requiring or pushing the idea of linking a portion of teacher evaluations to the performance of students. These changes have occurred through the actions of state legislatures, although the courts also have been involved.[20]

In sum: the most effective way to get good teachers is for schools to be able to fire teachers who do poorly, making room for more promising candidates. It does no good to attract good teachers with higher salaries if there are no positions available, or if they are the first to be fired under age- or tenure-based contracts. The "selection" margin is far more effective in teaching than the "effort" margin, as it is in every other business. And this margin is effectively closed in most of America's public schools, including Ohio's.

School accountability. It is difficult to imagine any reform program – whether one of autonomy, choice, direct performance rewards, or other – working well without a good system of student testing, measurement, and accountability. Thus, the ideas about the various institutional structures are closely linked, since an accountability system helps link other incentives to student outcomes.

Many countries around the world have been moving toward increased accountability of local schools for student performance. The United Kingdom has developed an elaborate system of "league tables" designed to give parents full information about the performance of local schools. The United States had a federal law ("No Child Left Behind") that all states must have an accountability system that meets certain general guidelines, although this was replaced in 2015 by a new federal system ("Every Student Succeeds Act"). Under this new law, individual states have considerably greater latitude in designing their accountability system, and the results of this change are currently unknown.

[19] The Washington, DC, system increases the base pay for the best teachers while firing the least effective, thus changing the career pay according to performance. See the evaluation by Dee and Wyckoff (2015, (2017).
[20] See changes in state policies in National Council on Teacher Quality (2015). An important California court case (*Vergara v. California*) ruled that a set of state tenure and dismissal laws were unconstitutional because they harmed the children that must be in classes with teachers who otherwise would have been dismissed. Unfortunately, this ruling was overturned in a higher court.

Evidence on the impact of accountability systems has begun to accumulate. While there is some uncertainty, strong evidence from U.S. states indicates that appropriately devised state accountability systems lead to better student performance.[21]

Systems that give vouchers to students in repeatedly poor-performing schools so that they can attend private schools combine accountability with parental choice. In Florida, for instance, the threat of becoming subject to private-school choice has been shown to increase teacher and school performance, particularly to the benefit of disadvantaged students.[22] Unfortunately, the Florida courts ruled in 2006 that this approach violated the state constitution, and it was eliminated.[23]

Curriculum-based external exit exams are another way to introduce accountability into the school system. Students in countries with external-exit exam systems tend to outperform students in countries without such systems. In Canada and Germany, the two federal education systems where the existence of external exams varies across regions, students similarly perform better in regions with external exams.[24]

Choice and competition. Choice and competition through school vouchers were proposed a half-century ago by Milton Friedman.[25] The simple idea is that parents, interested in the schooling outcomes of their children, would seek out productive schools, yielding demand-side pressure on each school to produce effective education, ensure high-quality staff and institute a good curriculum. Schools that fail to do this would face the possibility of being shut down, and new schools that do better could open, expand, and thrive.

In many school systems around the world (with The Netherlands being the most obvious example), privately-managed though publicly funded schools provide alternatives for students. The limited examples of private school choice in the U.S. range from the publicly funded school vouchers in Milwaukee, Cleveland, and Washington, DC, to privately financed voucher alternatives. The evaluations of these generally show that the choice schools do at least as well as the regular public schools, if not better.

Autonomy and decentralization. Several institutional features of a school system can be grouped under autonomy or decentralization. This includes fiscal decentralization, local decision-making power, and parental involvement. Almost any system of improved incentives for schools depends on having individual school and district personnel heavily involved in decision-making.

American states vary in the amount of local autonomy they give to districts. One systematic form of school autonomy is “charter schools” -- public schools that are allowed to perform quite autonomously. (Note that these are actually hybrids of choice schools and public-school autonomy, because they survive only if sufficient numbers of students attend them). The evidence, in Ohio and elsewhere, is mixed but indicates that in a variety of places charter schools outperform regular public

[21] Carnoy and Loeb (2002), Hanushek and Raymond (2005), Figlio and Loeb (2011).
[22] Figlio and Rouse (2006).
[23] More general voucher programs are now available in Florida including the McKay Scholarships for special education and the Florida Tax Credit Scholarship Program; see EdChoice (2017).
[24] See, for example, Bishop (1995, (1997) and Woessmann et al. (2009). The college entry examinations in the U.S. do provide external exit examinations on a voluntary basis, but no research exists about potential impacts on the K-12 schools.
[25] Friedman (1962)

schools after the initial start-up phase. The evidence also suggests, in part, that the regulations governing them and the particular competitive public schools they face have an influence on their success. For example, charters in Massachusetts perform much better relative to traditional public schools than charters in Indiana or Illinois. Unfortunately, the precise causes of these performance differences are unknown.[26]

Early Childhood. Considerable attention has recently gone to discussing the importance and availability of early childhood education. There are two primary parts to this discussion. First, research shows that early education is valuable because subsequent learning builds on it. Second, disadvantaged children are less likely to have high quality early childhood education than more advantaged children. Both parts are backed by evidence.

These facts, however, do not indicate the correct policies that might be pursued. In particular, the gains found for early childhood programs are concentrated mostly in poor families. Providing fully subsidized programs to all participants would thus be a significant transfer to middle- and upper-income families, one that may not deliver improved educational outcomes. Additionally, little is known about how a high-quality program might be broadly run. The strongest evidence about program effectiveness (from the Perry Preschool and Abecedarian Programs) comes from very expensive programs that exceed anything that might become a widespread governmental program. Effective policy making in this area simply requires more information. But this is not an argument for delaying all action.

Developing high-quality preschool programs for disadvantaged students should receive policy attention. Particularly in terms of a goal of bringing all students up to basic skill levels, preschool programs for disadvantaged students would offer an improved starting point for schools and would help to meet the goal.

5. Conclusions

Ohio has an opportunity to improve its economy by improving the quality of its schools in respect to educational outcome. Past evidence shows that dramatic economic improvements can follow the increased skills of the population. Even though many youth have in the past migrated to other parts of the country, the strength of the Ohio economy will continue to rest mainly on those current students who will become the backbone of the future labor force.

Improving the quality of schools is a difficult task that demands policy attention. Simply increasing funding for schools, one oft-proposed solution, is unlikely to lead to increased academic performance unless more attention is given to how money is spent.

The key to improvement lies in the quality of the teachers and leaders in the schools. In the past, salaries and incentives for these personnel have not been directly related to student performance. If improvements are to be realized, past evidence indicates that existing incentives must be changed.

One of the overarching conclusions from the evidence on incentive programs is that the policies tried so far contain no miracles. Each of the policies sketched above has general support from the evidence; but each alone, as implemented so far, is incapable of erasing our educational problems.

[26] CREDO (2013)

While some argue that the existing changes – charters or accountability, for example – have been too radical, the evidence suggests the opposite.

The costs of not improving our educational system in Ohio are extraordinarily large. We have to push harder on the incentives that we know will have positive impacts. Just as importantly, we have to actively consider truly dramatic options. To achieve true change, we must not shy from large changes in parental choice, teacher evaluations and pay, and strengthened accountability.

References

Bishop, John H. 1995. "The impact of curriculum-based external examinations on school priorities and student learning." *International Journal of Educational Research* 23, no. 8: 653-752.

Bishop, John H. 1997. "The effect of national standards and curriculum-based exams on achievement." *American Economic Review* 87, no. 2: 260-264.

Branch, Gregory F., Eric A. Hanushek, and Steven G. Rivkin. 2012. "Estimating the Effect of Leaders on Public Sector Productivity: The Case of School Principals." NBER Working Paper W17803. Cambridge, MA: National Bureau of Economic Research (January).

Bureau of Economic Analysis. 2013a. "Annual state personal income and employment, SA1-3 Personal income summary." http://www.bea.gov/iTable/iTableHtml.cfm?reqid=70&step=1&isuri=1. U.S. Department of Commerce.

Bureau of Economic Analysis. 2013b. "GDP per state, regional economic accounts." http://www.bea.gov/regional/downloadzip.cfm. U.S. Department of Commerce.

Bureau of Economic Analysis. 2013c. "Implicit price deflator for GDP, National Income and Product Account Tables, Table 1.1.9." http://www.bea.gov/iTable/iTable.cfm?reqid=9&step=3&isuri=1&903=13#reqid=9&step=3&isuri=1&903=13. U.S. Department of Commerce.

Card, David. 2001. "Estimating the return to schooling: Progress on some persistent econometric problems." *Econometrica* 69, no. 5: 1127-1160.

Carnoy, Martin, and Susanna Loeb. 2002. "Does external accountability affect student outcomes? A cross-state analysis." *Educational Evaluation and Policy Analysis* 24, no. 4 (Winter): 305-331.

Chetty, Raj, John N. Friedman, and Jonah Rockoff. 2014. "Measuring the impacts of teachers II: Teacher value-added and student outcomes in adulthood." *American Economic Review* 104, no. 9 (September): 2633–2679.

CREDO. 2013. *National charter school study 2013*. Stanford, CA: Center for Research on Education Outcomes, Stanford University.

Dee, Thomas S., and James Wyckoff. 2015. "Incentives, Selection, and Teacher Performance: Evidence from IMPACT." *Journal of Policy Analysis and Management* 34, no. 2: 267-297.

Dee, Thomas S., and James Wyckoff. 2017. "A Lasting Impact: High-stakes teacher evaluations drive student success in Washington, D.C." *Education Next* 17, no. 4 (Fall): 58-66.

EdChoice. 2017. *The ABCs of school choice*. Indianapolis, IN: EdChoice.

Figlio, David, and Susanna Loeb. 2011. "School accountability." In *Handbook of the Economics of Education, Vol. 3*, edited by Eric A. Hanushek, Stephen Machin, and Ludger Woessmann. Amsterdam: North Holland: 383-421.

Figlio, David N., and Cecilia Elena Rouse. 2006. "Do accountability and voucher threats improve low-performing schools?" *Journal of Public Economics* 90, no. 1-2 (January): 239-255.

Friedman, Milton. 1962. *Capitalism and freedom*. Chicago: University of Chicago Press.

Hanushek, Eric A. 1992. "The trade-off between child quantity and quality." *Journal of Political Economy* 100, no. 1 (February): 84-117.

Hanushek, Eric A. 2003. "The failure of input-based schooling policies." *Economic Journal* 113, no. 485 (February): F64-F98.

Hanushek, Eric A. 2011. "The economic value of higher teacher quality." *Economics of Education Review* 30, no. 3 (June): 466-479.

Hanushek, Eric A. 2016. "Education and the nation's future." In *Blueprint of America*, edited by George P. Shultz. Stanford, CA: Hoover Institution Press: 89-108.

Hanushek, Eric A., Paul E. Peterson, and Ludger Woessmann. 2012. *Achievement growth: International and U.S. state trends in student achievement*. Cambridge, MA: Program on Education Policy and Governance, Harvard Kennedy School.

Hanushek, Eric A., and Margaret E. Raymond. 2005. "Does school accountability lead to improved student performance?" *Journal of Policy Analysis and Management* 24, no. 2 (Spring): 297-327.

Hanushek, Eric A., and Steven G. Rivkin. 2010. "Generalizations about using value-added measures of teacher quality." *American Economic Review* 100, no. 2 (May): 267-271.

Hanushek, Eric A., Jens Ruhose, and Ludger Woessmann. 2016. "It pays to improve school quality: States that boost student achievement could reap large economic gains." *Education Next* 16, no. 3 (Summer): 16-24.

Hanushek, Eric A., Jens Ruhose, and Ludger Woessmann. 2017a. "Economic gains from educational reform by US States." *Journal of Human Capital* 11, no. 4 (Winter): 447-486.

Hanushek, Eric A., Jens Ruhose, and Ludger Woessmann. 2017b. "Knowledge capital and aggregate income differences: Development accounting for U.S. states." *American Economic Journal: Macroeconomics* 9, no. 4 (October): 184-224.

Hanushek, Eric A., Guido Schwerdt, Simon Wiederhold, and Ludger Woessmann. 2015. "Returns to skills around the world: Evidence from PIAAC." *European Economic Review* 73: 103-130.

Hanushek, Eric A., and Ludger Woessmann. 2012. "Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation." *Journal of Economic Growth* 17, no. 4: 267-321.

Hanushek, Eric A., and Ludger Woessmann. 2015. *The knowledge capital of nations: Education and the economics of growth*. Cambridge, MA: MIT Press.

Heckman, James J., Lance J. Lochner, and Petra E. Todd. 2006. "Earnings functions, rates of return and treatment effects: The Mincer equation and beyond." In *Handbook of the Economics of Education, Vol. 1*, edited by Eric A. Hanushek and Finis Welch. Amsterdam: North Holland: 307-458.

Krueger, Alan B. 1999. "Experimental estimates of education production functions." *Quarterly Journal of Economics* 114, no. 2 (May): 497-532.

Mincer, Jacob. 1974. *Schooling, experience, and earnings*. New York: NBER.

National Center for Education Statistics. 2014. *National Assessment of Educational Progress (NAEP)*. http://nces.ed.gov/nationsreportcard/naepdata/.

National Council on Teacher Quality. 2015. *State teacher policy yearbook, 2015*. Washington: National Council on Teacher Quality.

Ruggles, Steven, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. 2010. "Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. University of Minnesota.

Woessmann, Ludger, Elke Luedemann, Gabriela Schuetz, and Martin R. West. 2009. *School accountability, autonomy, and choice around the world*. Cheltenham, UK: Edward Elgar.

Figure 1. Percent of People Born in the State and Still Living There

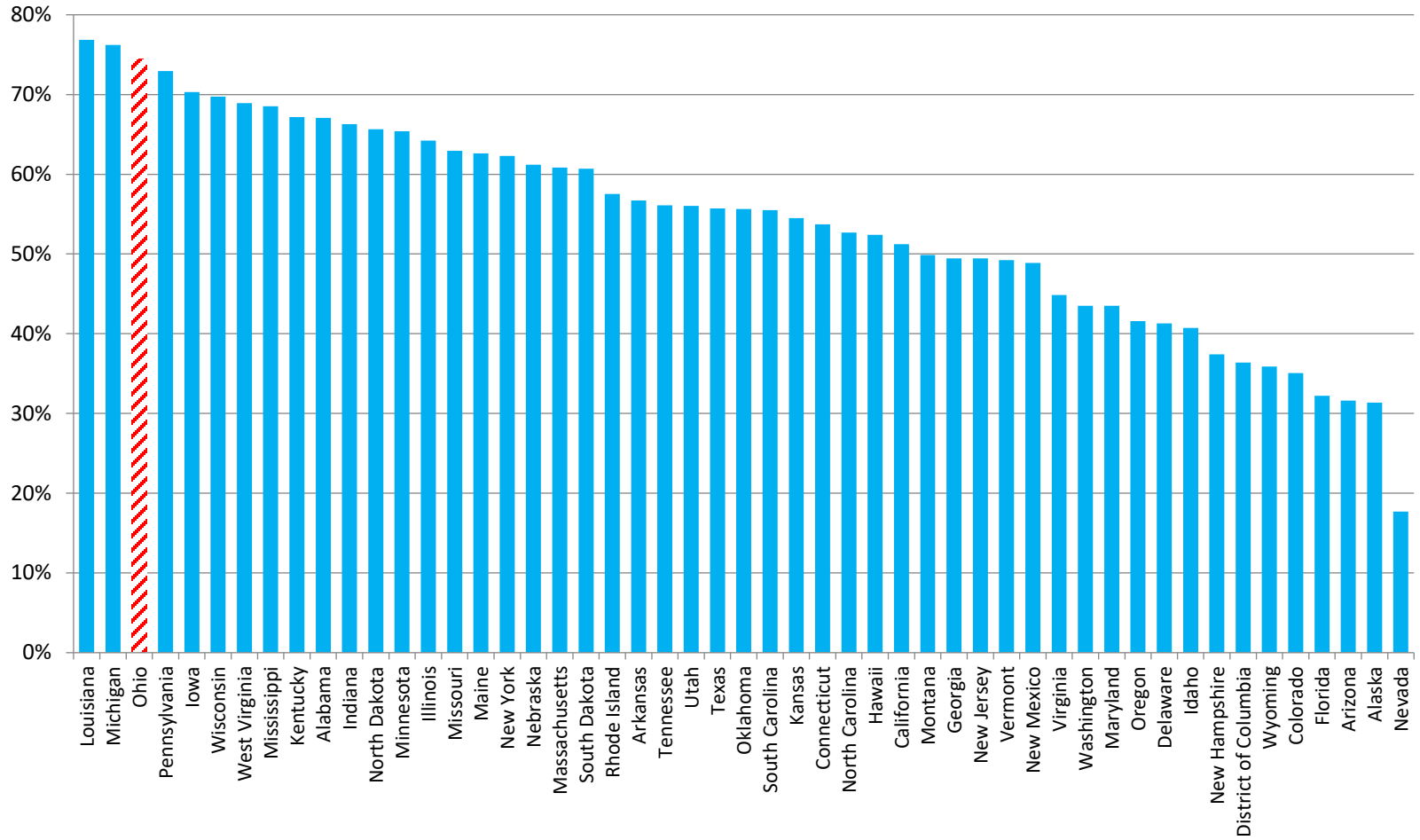
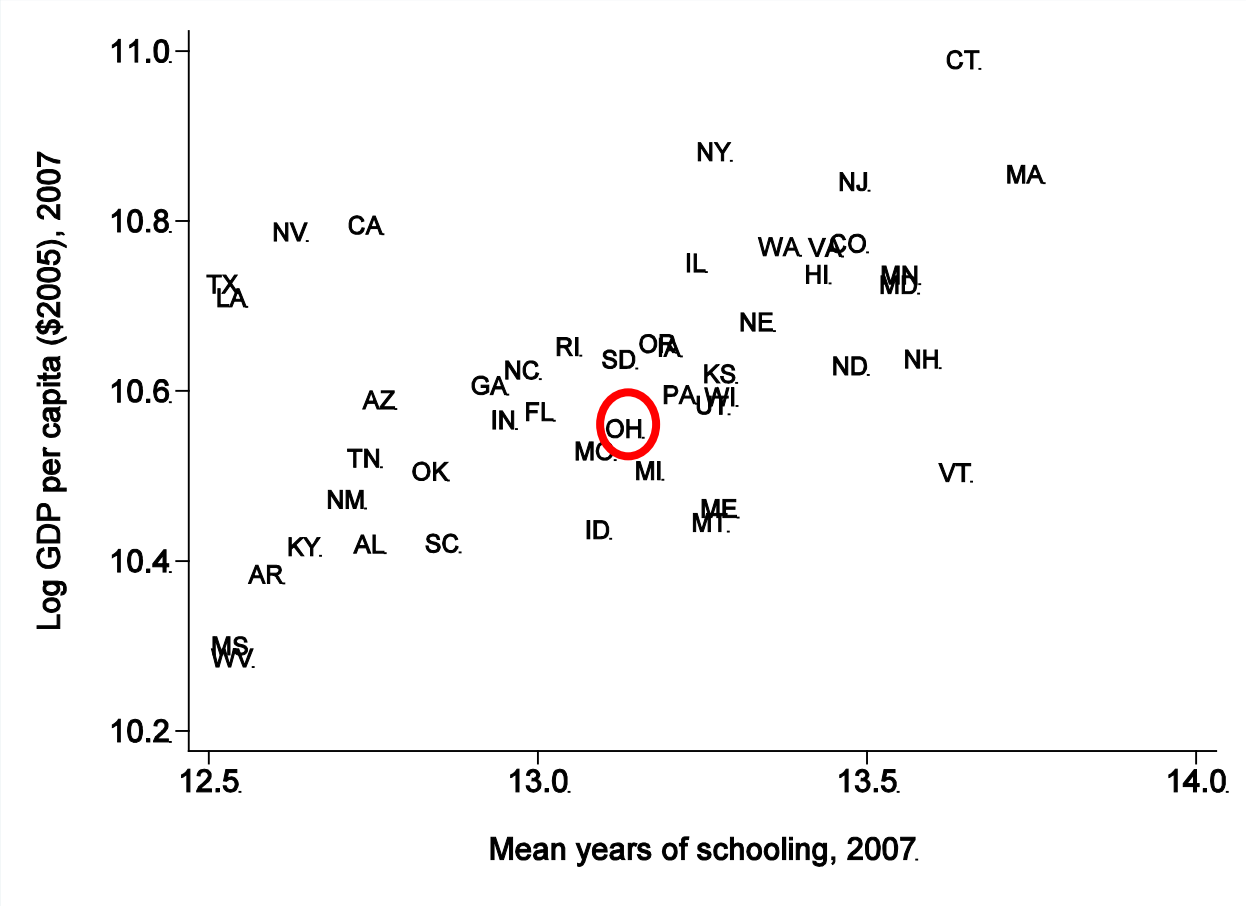
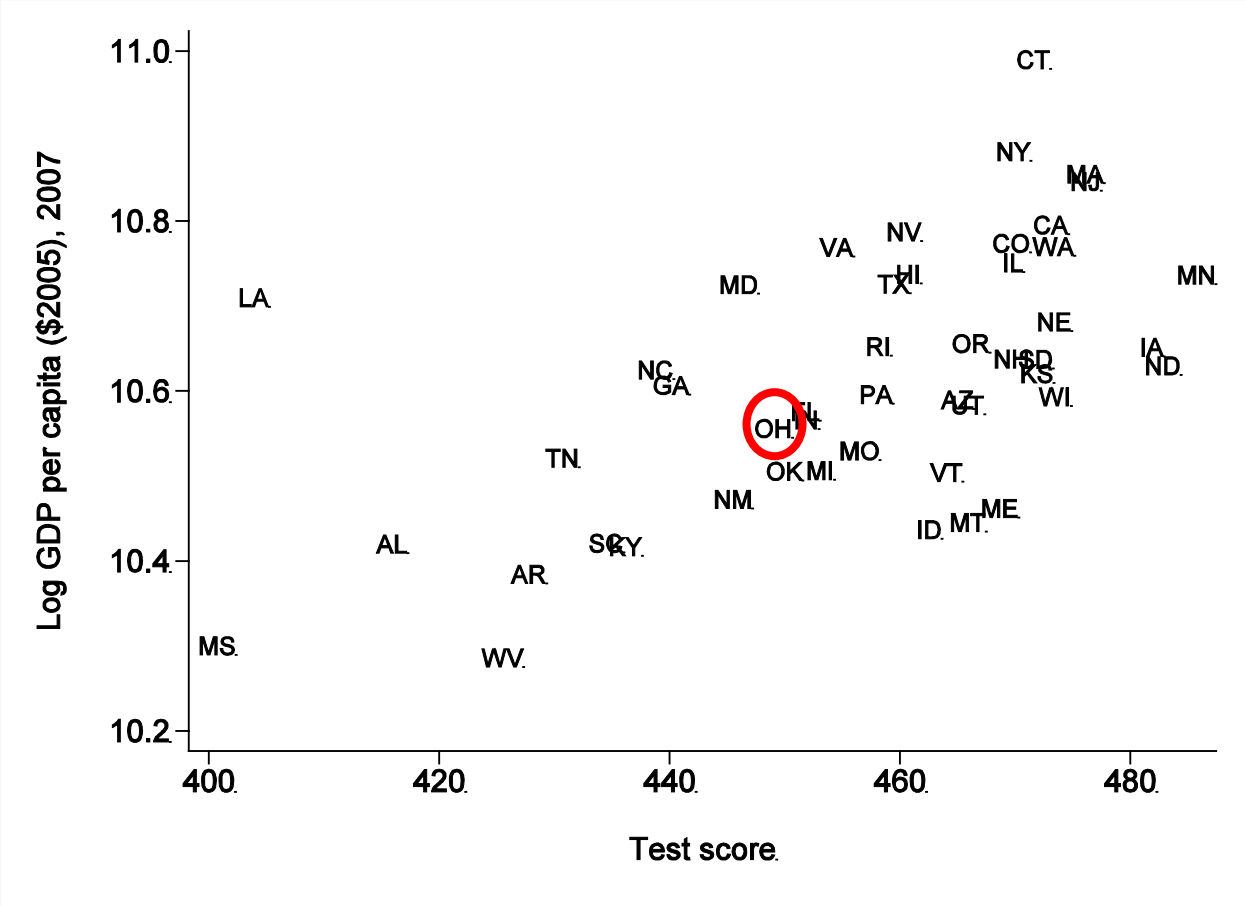


Figure 2: Years of Schooling and GDP per Capita across U.S. States, 2007



Notes: Scatterplot of average years of schooling of the working-age population and log real GDP per capita across U.S. states, 2007. Source: Authors' calculations based on data from Bureau of Economic Analysis (2013a, (2013b, (2013c) and Ruggles et al. (2010).

Figure 3: Cognitive Skills and GDP per Capita across U.S. States, 2007



Notes: Scatterplot of cognitive skill measure (adjusted for selective interstate migration and for international migration by the 90th percentile) and log real GDP per capita across U.S. states, 2007. Source: Authors' calculations based on data from Bureau of Economic Analysis (2013a, (2013b, (2013c), Ruggles et al. (2010), and National Center for Education Statistics (2014).

Figure 4. Economic Growth (1970-2010) and Cognitive Skills across States

Notes: Added-variable plot of a regression of the average annual rate of growth (in percent) of real GDP per capita in 1970-2010 on the initial level of (log) real GDP per capita in 1970, average test scores adjusted for internal migrants by education and for international migrants by the 90th percentile in country of birth in 1970, average years of schooling in 1970, and (log) real physical capital per worker in 1970 (mean of the unconditional variables added to each axis).

Figure 5. Ohio Performance in 8th Grade Mathematics, 2015

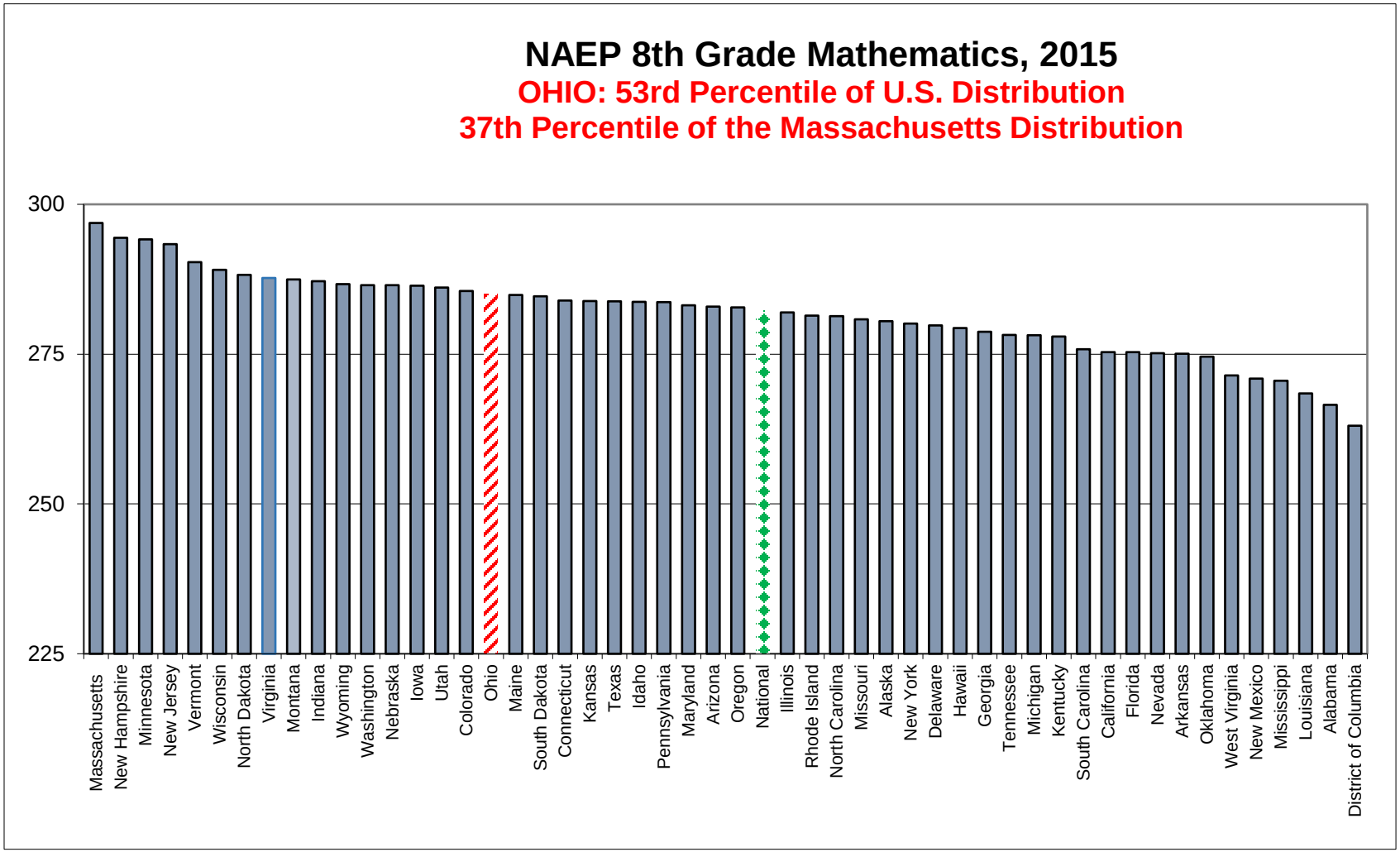


Figure 6. Ohio Performance in 8th Grade Mathematics: White Students, 2015

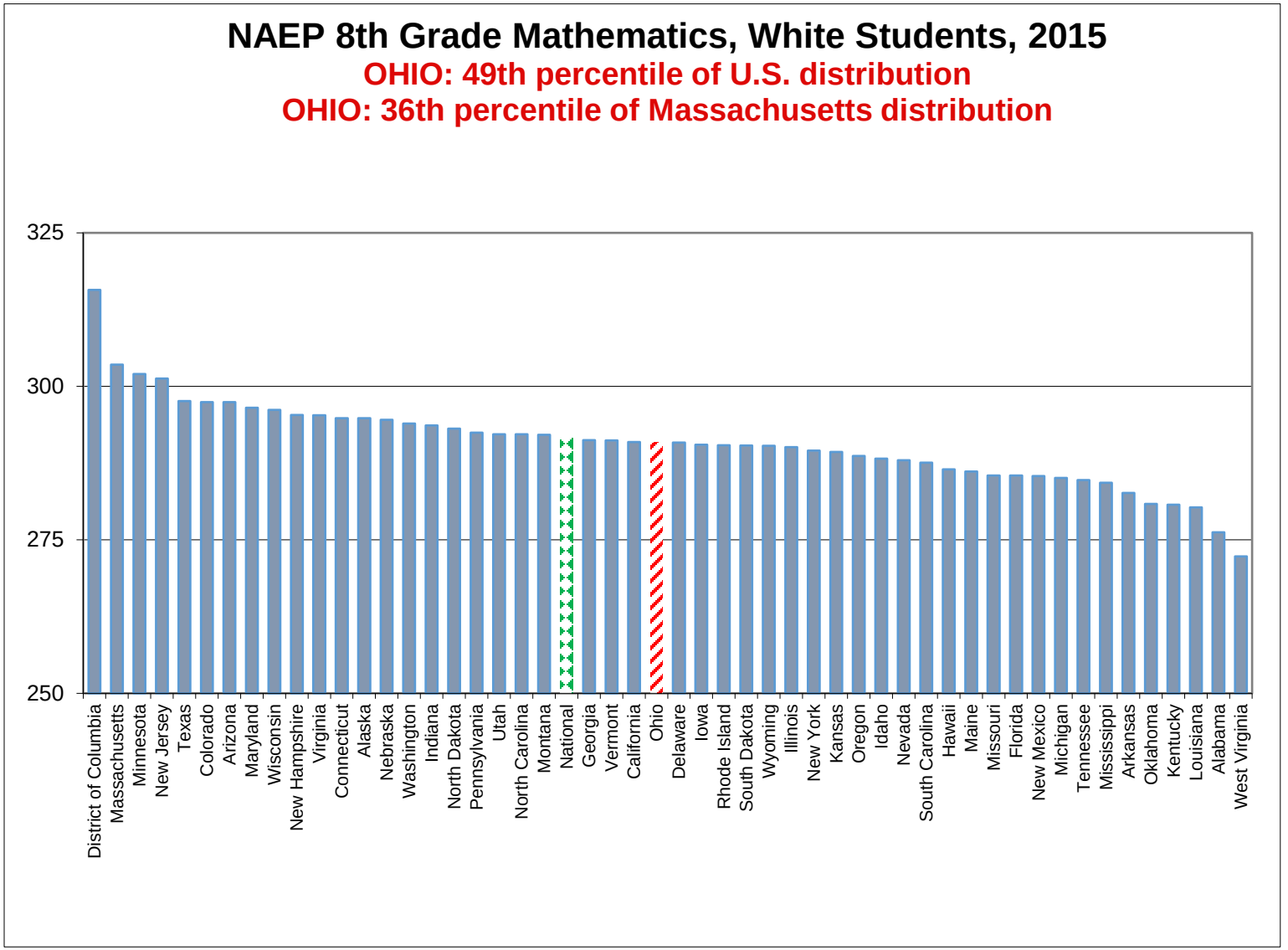


Figure 7. Effect on GDP of Scenario IV: Getting Every Student at Least to the Basic Level (in % of Current GDP)

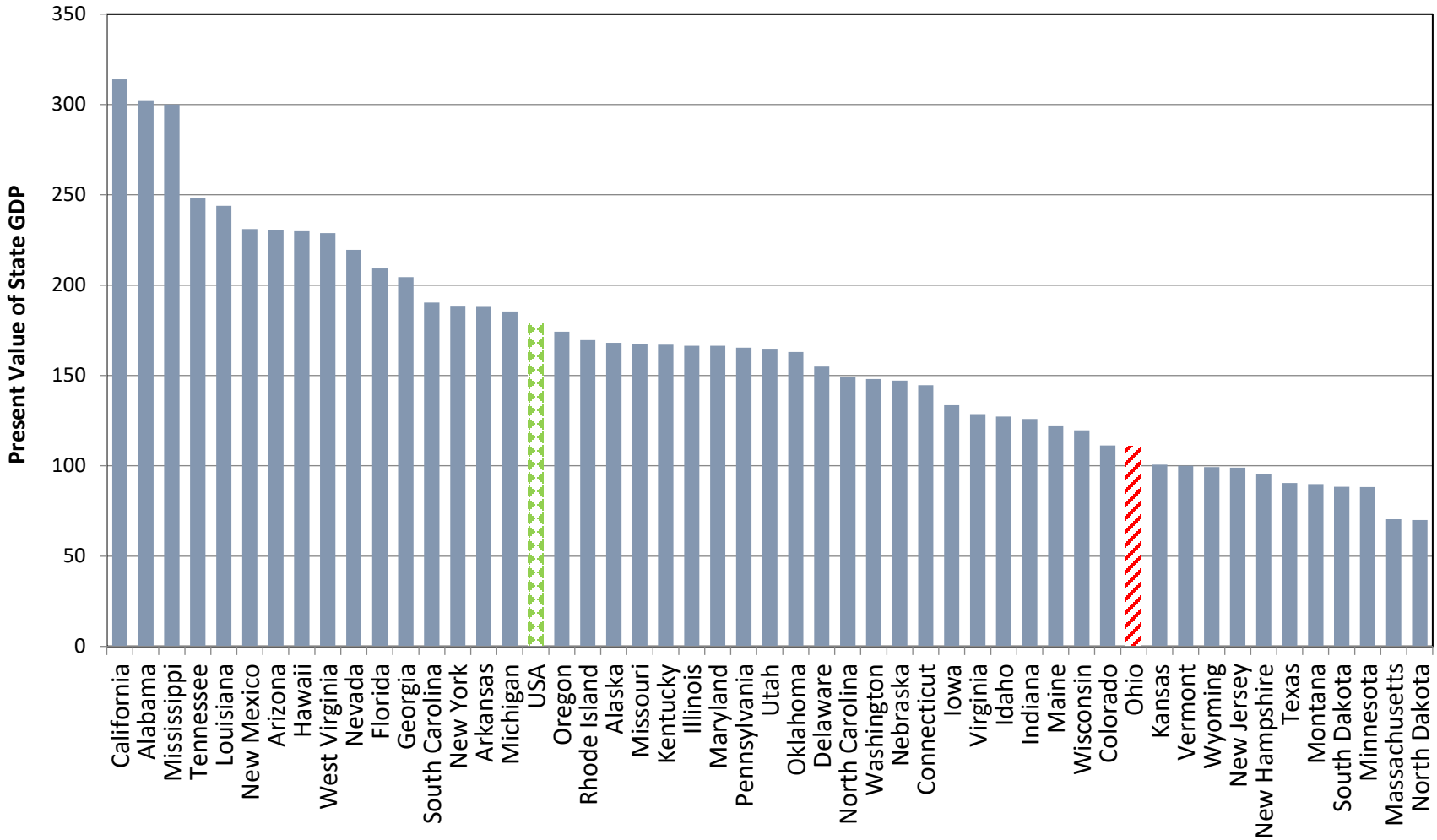
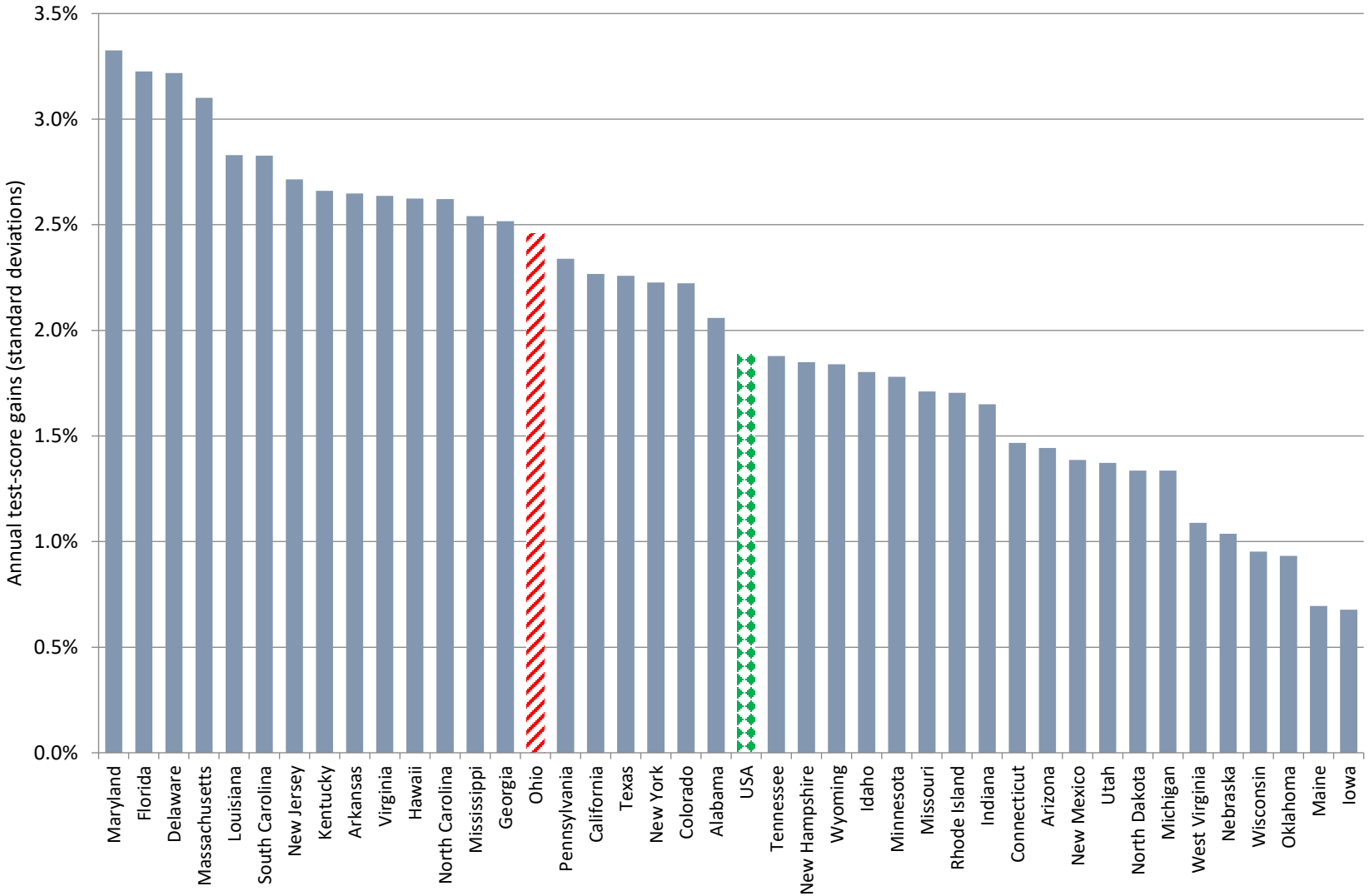
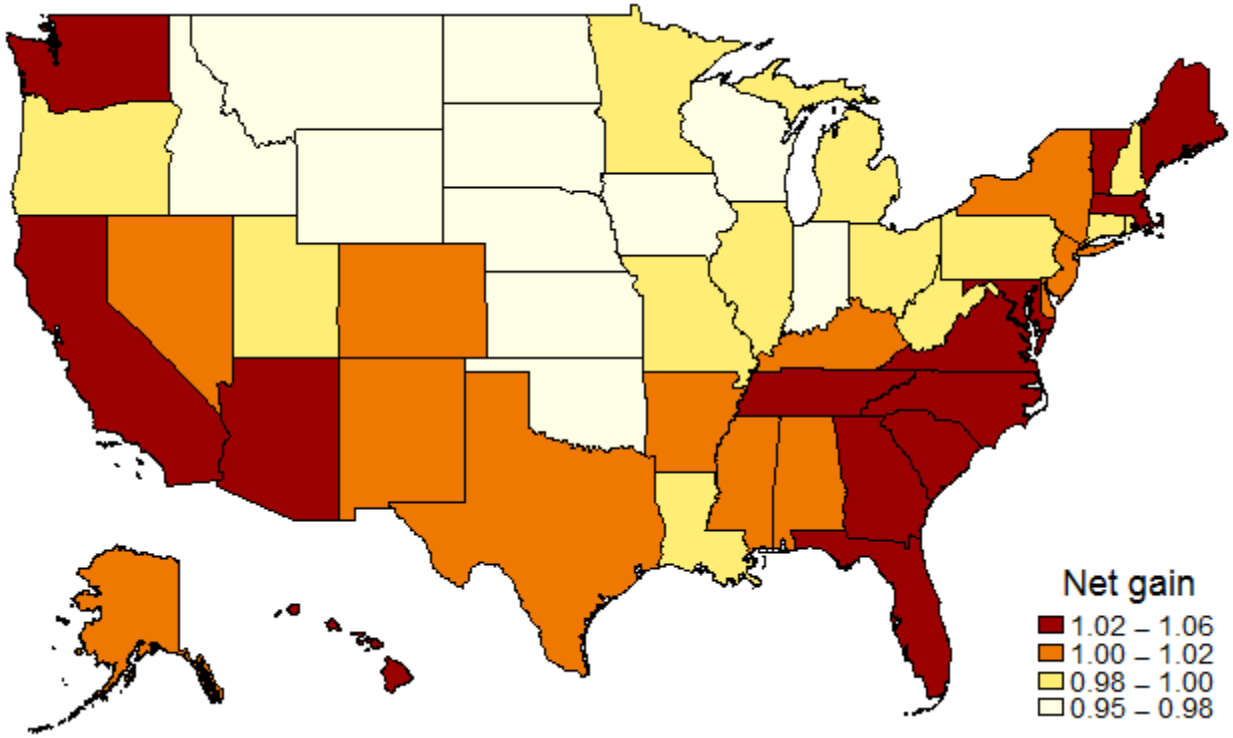


Figure 8. Historical Achievement Growth, 1992-2011



Map 1. Proportionate Gains and Losses of Human Capital in Workforce due to Migration and Immigration



Source: Hanushek, Ruhose, and Woessmann (2017b)

Table 1. School Attainment in Ohio, 2015

(population 25 years old and above)

	High School and above	Bachelors and above
United States	87.2%	30.7%
Ohio	89.7%	26.7

Source: {U.S. Department of Education, 2017 #10816}

Table 2. Characteristics of Public School Population in Ohio, 2014

	White (percent)	Black (percent)	Hispanic (percent)	Free and Reduced Price Lunch (percent)
United States	49.5	15.5	25.4	51.8
Ohio	71.9	16.4	4.9	45.1

Source: {U.S. Department of Education, 2017 #10816}

Table 3. Summary of Economic Impacts of School Improvement in Ohio

	Value of reform		
	In $ billion	In % of current GDP	In % of discounted future GDP
Scenario I: 0.25 SD	1,546	262	5.6
Scenario II: Top-performing state	1,524	258	5.5
Scenario III: Top-performing in East North Central region (Wisconsin)	658	112	2.4
Scenario IV: Basic level	652	111	2.4

Appendix Table A1. Summary of Economic Impacts of School Improvement across All States

	Value of reform		
	In $billion	In % of current GDP	In % of discounted future GDP
I. Increase of 0.25 SD	47,249	262	5.6
II. All to U.S. best	75,938	422	9.0
III. All to division best	35,648	198	4.2
IV. All to NAEP basic	32,229	179	3.8