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What Is The Price of Local School Quality[1]?

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The recent dissolution of Philadelphia's School Reform Commission has put the future of Philadelphia's public schools back in the news. Central to this issue is how to adequately fund the school district, which is currently projected to run a deficit of $905m within the next five years. Moreover, there is a widespread conjecture that one of the reasons the city's schools have funding problems is due to the flight of many households from the city to the higher quality school districts of the suburbs, thus shrinking Philadelphia's tax base and further exacerbating the problem. Addressing a crowd in Philadelphia, State Sen. Vincent Hughes (D., Phila.) said: "*In the suburbs, they're spending $10,000 more" (per student,) "That is the fight we've got to win. Damn it, show me the money. It is about the money. Don't get distracted*.[2]"

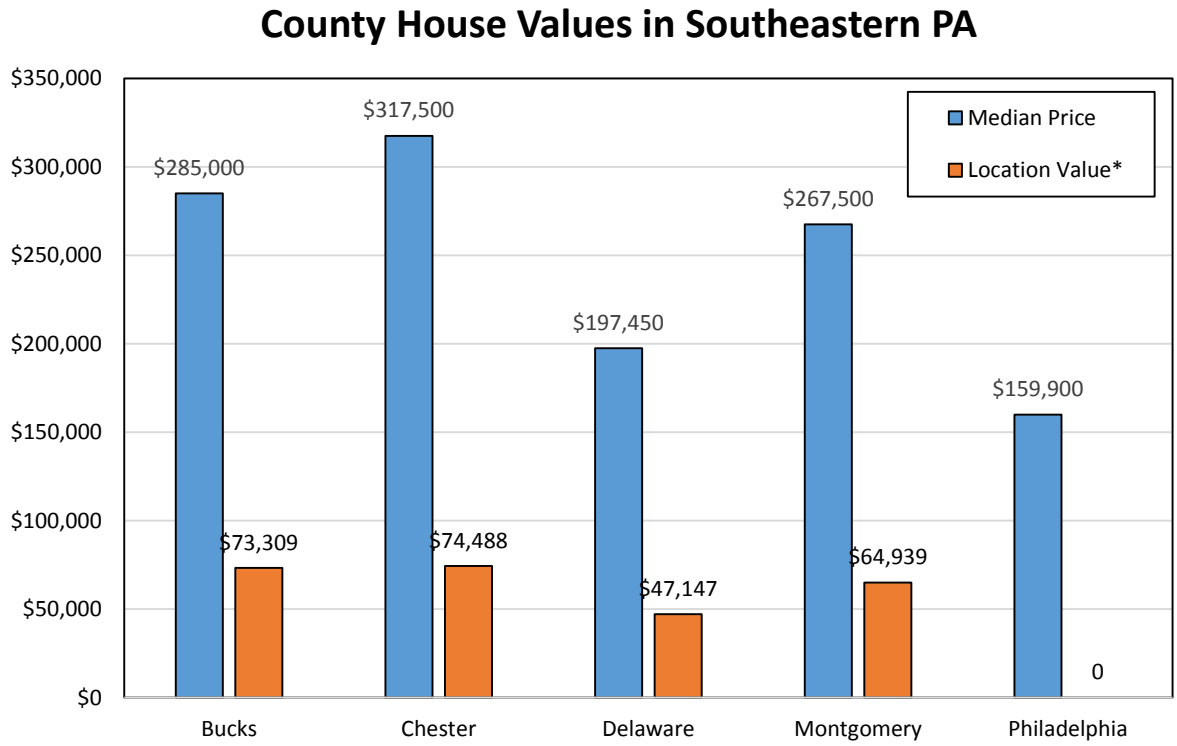
The purpose of this paper is to analyze just how much dollar value that local households place upon school quality, and what the fiscal implications of this are for improving both the fiscal solvency and educational quality of Philadelphia's public schools.

There is a widespread perception that one of the biggest factors affecting people's decision to purchase a suburban home rather than one in the city is the quality of local schools. However, while house prices and school quality are indeed positively correlated, computing an explicit and specific dollar value that homebuyers place on the value of their school district is complicated by having to disentangle the value of other locational characteristics[3] of home's community from the quality of the local school(s) in that community. For example, consider the following bar chart, which compares the 2017 median price of homes in Philadelphia County to those of its surrounding PA counties, along with the relative locational value of the suburban counties, compared to Philadelphia:

[1] The author would like to acknowledge two anonymous reviewers employed in Philadelphia city government who provided critical feedback on the first draft of this paper.

[2] http://www.philly.com/philly/education/in-a-historic-vote-a-divided-src-moves-to-abolish-itself-20171116.html

[3] These would include other public services such as police, fire, roads, trash collection and parks, as well as local dining and shopping amenities, quantity and quality of greenspace and general quality of life.



*"Location Value" measures the relative value of a location in each suburban county, compared to Philadelphia.

As can be readily observed from the chart, all of Philadelphia's suburban counties have generally higher house prices than Philadelphia, and usually by a large margin. However, this large differential is due to a number of factors: suburban housing is typically larger, newer, nicer and in better condition than much of Philadelphia's housing stock. And, suburban communities typically have better streets, lower crime, better maintained parks and public spaces and an overall generally higher quality of life (and higher level of income) than Philadelphia, particularly compared to many of Philadelphia's more distressed and economically impoverished neighborhoods. Lastly, there is of course the general view that the average quality of schools in most suburban districts is higher than in Philadelphia.

To separate out these factors, a special regression[4] was computed that separates the structure value of suburban homes from their locational values. The structure value is the value of the house itself, whereas the location value is the value of the land, and includes the value of all of the parcel's locational attributes, including local school quality. The locational value reported in the above chart is the relative value of the average residential parcel in each county, compared to Philadelphia. It is given by the orange bars. The difference between the orange bars and blue bars can be interpreted as the typical structure value of a house in those counties.

As can be observed, the locational value of a suburban dwelling can be very different from its total value, as evidenced by the difference between the blue bars and orange bars. In Bucks County, a typical residential parcel has a value that is approximately $73,000 greater than the typical residential parcel in

[4] The regression is termed a "hybrid hedonic". It unpacks the total value of a house into the value of its individual components and attributes. See Rosen (1974) for details.

Philadelphia County. This number implies that the average Bucks county resident would pay a premium of just over $73,300[5] to live in Bucks county rather than Philadelphia, presumably because of a perceived higher quality of life and higher quality of public services (including schools)[6]. The locational premiums that residents of Chester, Delaware and Montgomery counties are willing to pay to live there (and not Philadelphia) are approximately $74,500, $47,100 and $64,900, respectively. These are very large numbers when compared to the current median price of a typical Philadelphia home, which is only $159,900.

What do these numbers imply for what households are paying for higher quality suburban schools? While the average price premium of a suburban home over a city home is $266,800, most of this premium is for the value of the structure. The locational premium (essentially, the value of suburban land over city land) is an average of only $65,000. Multiplying the land premium times the total premium gives 24.3%, which implies that only 24.3% of the difference between the price of suburban homes and city homes is explained by locational factors and public services. The remaining 75.7% is explained by the fact that the average suburban house is just qualitatively and quantitatively superior to the average city house.

Only 24.3% of the difference in prices is attributable to location. Of this, a significant percent is explained by just the general quality-of-life and proximity to retail, dining, entertainment and employment opportunities, with the rest being explained by the value of public services. Of this subset, schools quality is only one type of public service received by a household, in addition to police, fire, trash collection, roads, parks, etc. Hence the fraction of a suburban home's value that is attributable to perceived higher school quality is relatively small. **Thus, differences in school quality would seem to explain only a relatively small amount of the difference between city and suburban house prices.**

Normally, hedonic regression could be applied to a dataset of home sales that occur in different school districts that have different levels of quality, in order to explicitly compute just how much value households place on the value of their particular schools. But, disentangling the value of local schools from the value of other local public services and amenities is challenging because school district boundaries are often contiguous with municipal and county boundaries. So, when a household purchases a home in a given township, they are also simultaneously purchasing a home in that township's school district. Consequently, it is empirically challenging to identify how much of the home's location value is composed of the value that the buyer places on the local schools and not on other locational attributes of the house.

Fortunately, there exists a substantial and well-regarded research literature that has resolved this issue. A number of researchers have identified regions where either school district boundaries are not perfectly contiguous with municipal boundaries, or there was a boundary change in the geographic definition of either the local town or school district that resulted in a significant number of households changing either their municipality or their school district. An example of the former would be a school district that encompasses multiple municipalities or towns. An example of the latter would be when one or more municipalities combine, typically when a larger city incorporates one or more of its suburbs[7]. Almost all of these studies have used regression to examine how house prices change between similar

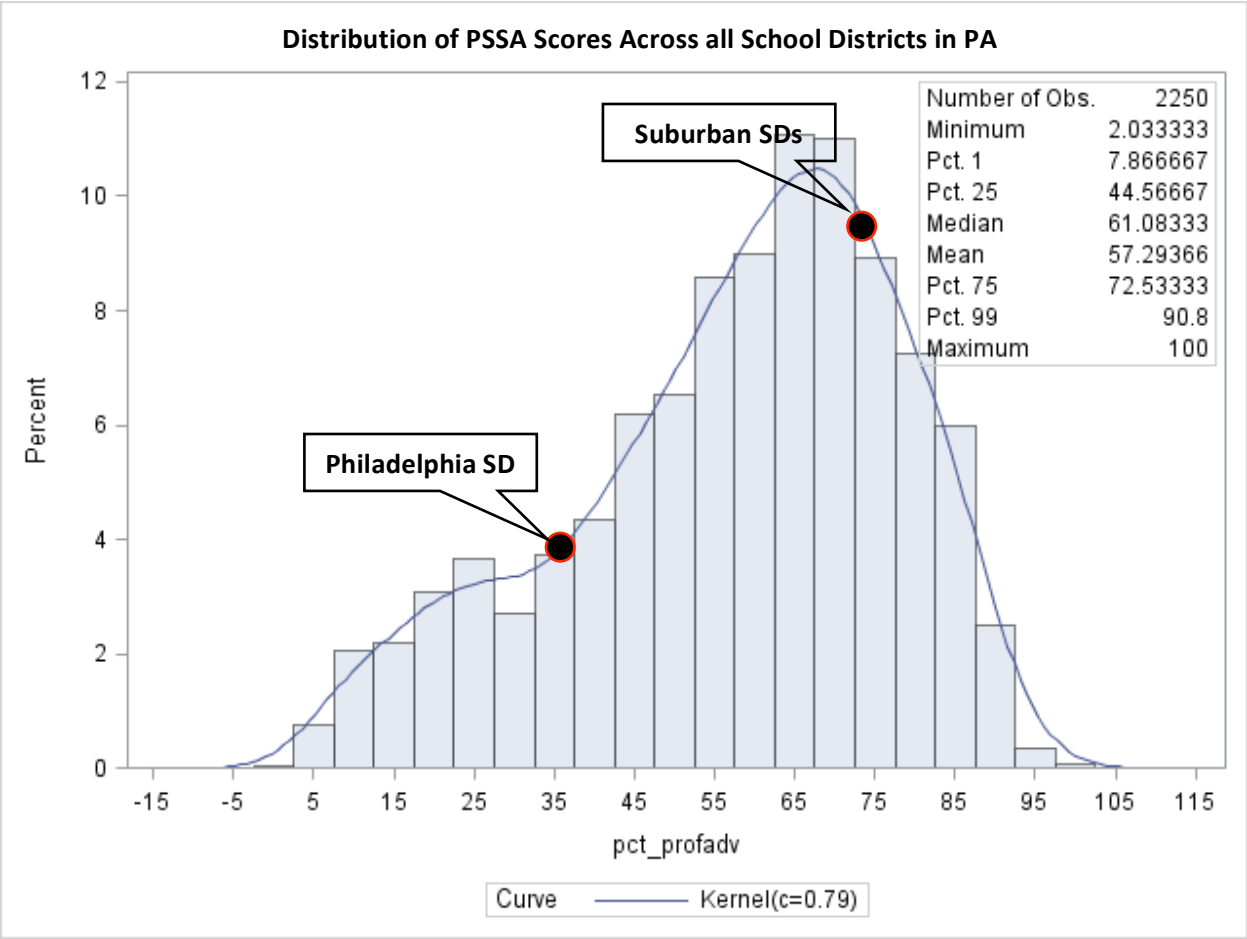
[5] Note: all dollar figures in this report have been rounded to the nearest hundred.
[6] Note: different levels of taxation across counties and municipalities can also drive location values.
[7] These events are more common in southern and western states; e.g. Phoenix and Houston.

homes in the same town but different school districts, or how house prices change when a home is rezoned into a new school district. School quality is typically measured as how an individual school performs on state-administered standardized tests, since this is a neutral and objective measure of school performance that is reliably defined and administered across different school districts[8]. Across all research studies, the results have been remarkably consistent and robust: **a one-standard deviation increase in a school district's performance on state-administered standardized tests typically increases house prices in that district by 2-5%**[9].

To examine what this finding might mean for the typical home in Philadelphia, data on home sales in the 4-county region from the past year were combined with data on school-level scores from the Pennsylvania System of School Assessment (PSSA) test, which is the Commonwealth's standardized test for examining competency in English, math and science. Since actual test scores were not available, the total percent of students who scored as either "proficient" or "advanced" was used as the metric for school quality. The average percent of students scoring in either level of attainment was averaged across all three categories to obtain an average attainment score for each school. The following chart shows the distribution of this percentage across all 2,250 schools in the Commonwealth for 2017:

[8] A study by the Philadelphia Federal Reserve examining home sales in Montgomery County PA found that households generally value scores on statewide standardized tests more than other indicators of school quality. Source: Crone (2006).

[9] Nguyen-Hoang, Phuong, and John Yinger (2011) provide an excellent survey of this literature, in which they reviewed and summarized the findings of 50 peer-reviewed research studies that examined and measured the relationship between school quality and house prices.



"PSSA Score" is measured as the total percent of students in each school district who scored "Proficient" or "Advanced" on the PSSA Exam.

In all of Pennsylvania, the 'typical' school district (as represented by the median) has 61.1% of its students perform "well[10]" on the PSSA exam. In Philadelphia, only 30.2% of students perform well. In Philadelphia's suburban school districts[11], 73.5% of students perform well. The latter two are represented by the dots on the above distribution. Philadelphia's location on the distribution places it in in the bottom 25% of school districts, where less than 44.6% of students perform well on the PSSA.

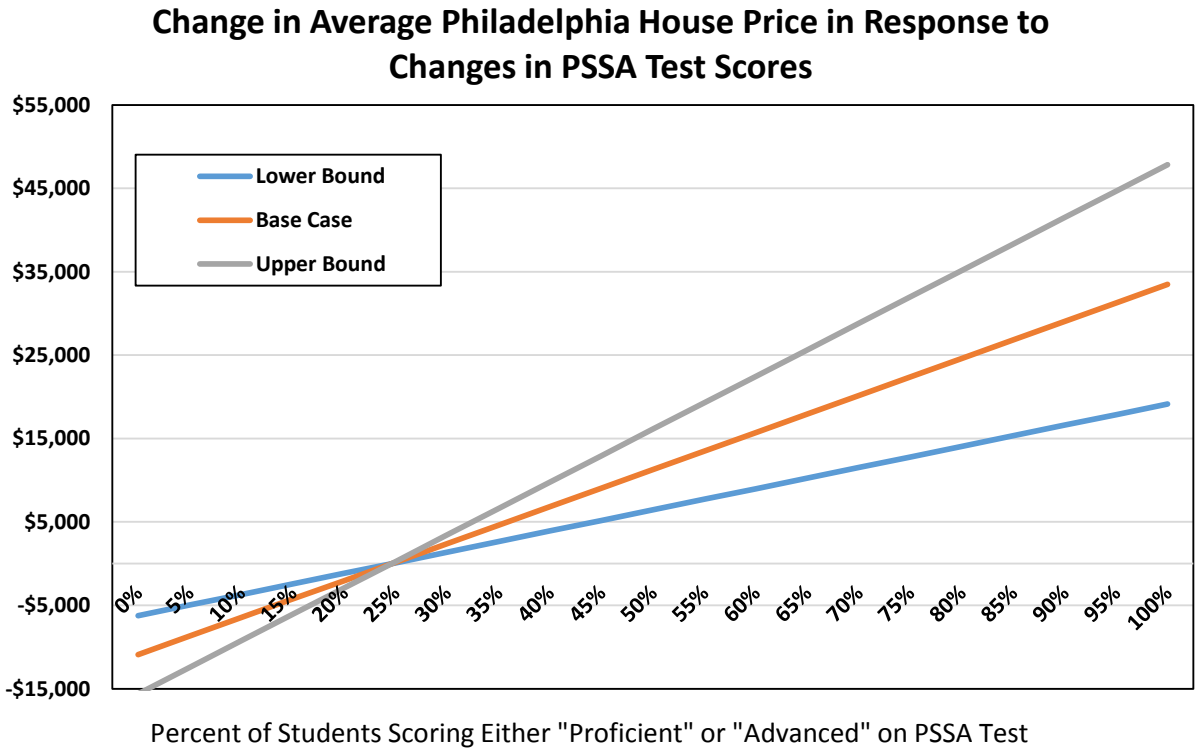
To determine what increases in house values could be obtained by improving Philadelphia's schools, the results of the previous research are applied to Philadelphia's current level of performance on the PSSA

[10] For the sake of brevity, we define the percent of students who perform "well" on the exam as being the "percent of students scoring either as proficient or advanced."

[11] Low-performing school districts are omitted from the sample of suburban schools since Philadelphia is generally not competing with these school districts for residents. Hence, school quality is a highly unlikely factor in explaining either the location choice of these households or any differences in house prices. These are schools whose percentage of students who perform well on the PSSA is less than that of Philadelphia. These schools only constitute about 10% of all suburban schools in the region.

exam. Across all 241 schools that reported PSSA results in Philadelphia's school district, the median score was 24.6% with a standard deviation of 15.5%. The existing research states that each one standard deviation increase (decrease) in test scores results in a 2-5% increase (decrease) in house values. The current average house price in Philadelphia is $196,725[12]. **This implies that an increase in Philadelphia's median PSSA score of 24.6% to 40.1% (an increase of one standard deviation) would result in the average home increasing in value by somewhere between $3,900 and $9,800.** Mathematically, this works out to every percentage point increase being worth at least $254 and at most $635 in increased housing value.

Using these results, a basic spreadsheet model was created to compute the full spectrum of possible changes in house values for all of the possible outcomes in PSSA scores. The results are shown in the following chart, which gives the change in the value of the average-priced Philadelphia home as PSSA scores range from 0% to 100%. The lower bound is represented by price changes of only 2% for every standard deviation, the upper bound is represented by price changes of 5% per standard deviation, and the base case is a price change of 3.5%, which is the average of the upper and lower bounds found in the research literature.



At one extreme, if Philadelphia's PSSA median attainment score of 24.6% were to fall to 0% (i.e. zero students achieved scores of "proficient" or "advanced"), the average house value is predicted to decline by as little as $6,200 and as much as $15,600. At the other extreme, if 100% of students were to achieve

[12] Source: Kevin C. Gillen. Philadelphia House Price Indices Q3: http://drexel.edu/lindyinstitute/initiatives/reports/

scores of "proficient" or "advanced", the average house is predicted to increase in value by a at least $19,100 and as much as $47,900.

Of course, these extremes are highly unlikely outcomes. A more feasible and practical question would be: "***How much more would a Philadelphia house be worth if the quality of its public schools were as good as either the rest of Pennsylvania's or Philadelphia's own suburbs?***" These results are computed by multiplying the number of percentage points between Philadelphia's median score (24.6%) and those of the Commonwealth (61.1%) and suburbs (73.5%) to the value of each percentage point, which ranges from a minimum of $254 to a maximum of $635 per point.

Increase in Average House Value by PSSA Attainment Level

	PSSA Increase	2%	3.5%	5%
State	36.5%	$9,300	$16,200	$23,200
Region	48.9%	$12,400	$21,700	$31,000

Each row shows the predicted increase in the value of the average Philadelphia house if its school quality were to achieve either the Statewide or Regional (suburban) average level of quality. **If the percent of Philadelphia public school students attaining "proficient" or "advanced" scores on the PSSA were to rise from the city's median of 24.6% to the Commonwealth's median of 61.1%, that would be an increase of 36.5 percentage points in the city's median score. This is predicted to result in an increase in value of a minimum of $9,300 and a maximum of $23,200, with a midpoint of $16,200. Similarly, if Philadelphia's schools were to obtain the same level of attainment on the PSSA as its (higher-performing) suburban counterparts, this would result in an increase of 48.9 percentage points in its median score, resulting in an increase in average home values between $12,400 and $31,000, which has a midpoint of $21,700.**

Clearly, these gains are substantial, but are also likely to be under-estimated. The reason is that these percent increases were applied to the average home value in the city, which is fairly low compared to values in both its suburbs and in most other large metro areas. Since it is well known that both house prices and the relative importance of (and hence, willingness-to-pay for) a good education increases with household income levels, then the dollar increases in house values as a result of higher quality schools will be much larger for higher-priced homes.

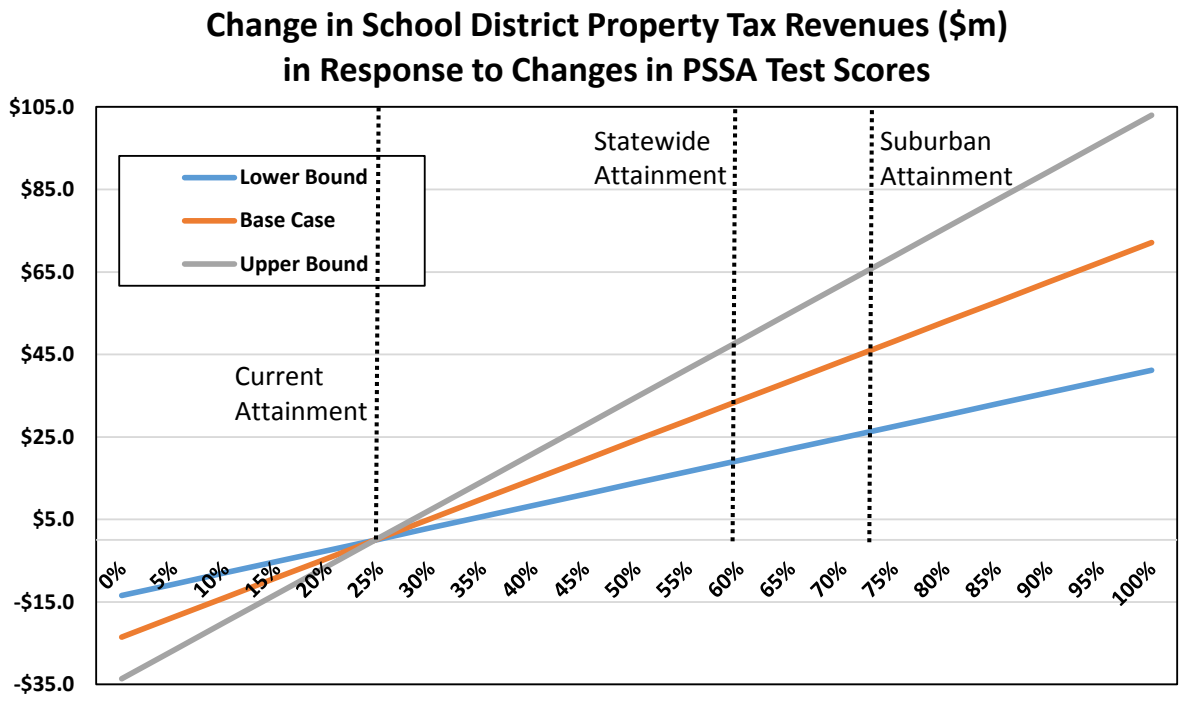
For example, consider a household where the parents are in their early thirties, have college degrees and office jobs in Center City, and have young children approaching school age. Since they are both relatively affluent and are likely to be concerned about school quality, they would likely have a higher propensity to relocate to suburbs for reasons of school quality. A representative home for this family would not be the average Philadelphia home, which is a 1,200 square-foot rowhome built 75 years ago as workforce housing in a working-class neighborhood. Rather, suppose they occupy a new townhome in a revitalizing neighborhood adjacent to Center City currently valued at $425,000. If Philadelphia's schools were to obtain either the median level of achievement of either the Commonwealth's or local suburban schools, that dwelling's predicted increase in value would look like this:

Increase in a $425,000 House's Value by PSSA Attainment Level

	PSSA Increase	2%	3.5%	5%
State	36.5%	$20,000	$35,000	$50,000
Region	48.9%	$26,800	$46,900	$67,000

Starting from a base value of $425,000, such a dwelling is predicted to increase in value by $20,000 to $50,000 if Philadelphia's schools were to achieve the Commonwealth's median level of quality, and by somewhere from $26,800 to $67,000 if its schools were to achieve its suburb's median level of quality.

We next examine the fiscal implications of this increased tax base, particularly for the school district. Philadelphia levies a real estate tax rate of 1.3998% on all property in the city, of which approximately 55%[13] of all revenue generated is explicitly earmarked for the school district. Currently, the city's total assessed value of all residential property is $66.6bn, of which $55.1 is taxable[14]. The results showing the expected dollar changes in house prices for different educational attainment scenarios were used to compute the percent change in house values for each scenario. These percent changes were than applied to the aggregate taxable value of $55.1bn to obtain the total change in the value of the city's taxable residential real estate. Lastly, the tax rate for the school district's portion of the real estate tax was applied to this value to obtain the expected additional revenue for the school district as house values rise in response to improved school quality. The results are shown in the following chart:



[13] The tax rate for the school district's portion of the real estate tax is 0.7681%. Source: Phila. Dept. of Revenue

[14] Source: Phila. Ofc. Of Property Assessment. A significant percent of Philadelphia real estate is exempt due to various property tax exemption programs offered by the city.

The horizontal axis gives the percentage of students scoring as "proficient" or "advanced" on the PSSA, while the vertical axis gives the total change in expected annual revenues to the school district in response to the capitalization of these changes into house values. The results are interpreted as follows:

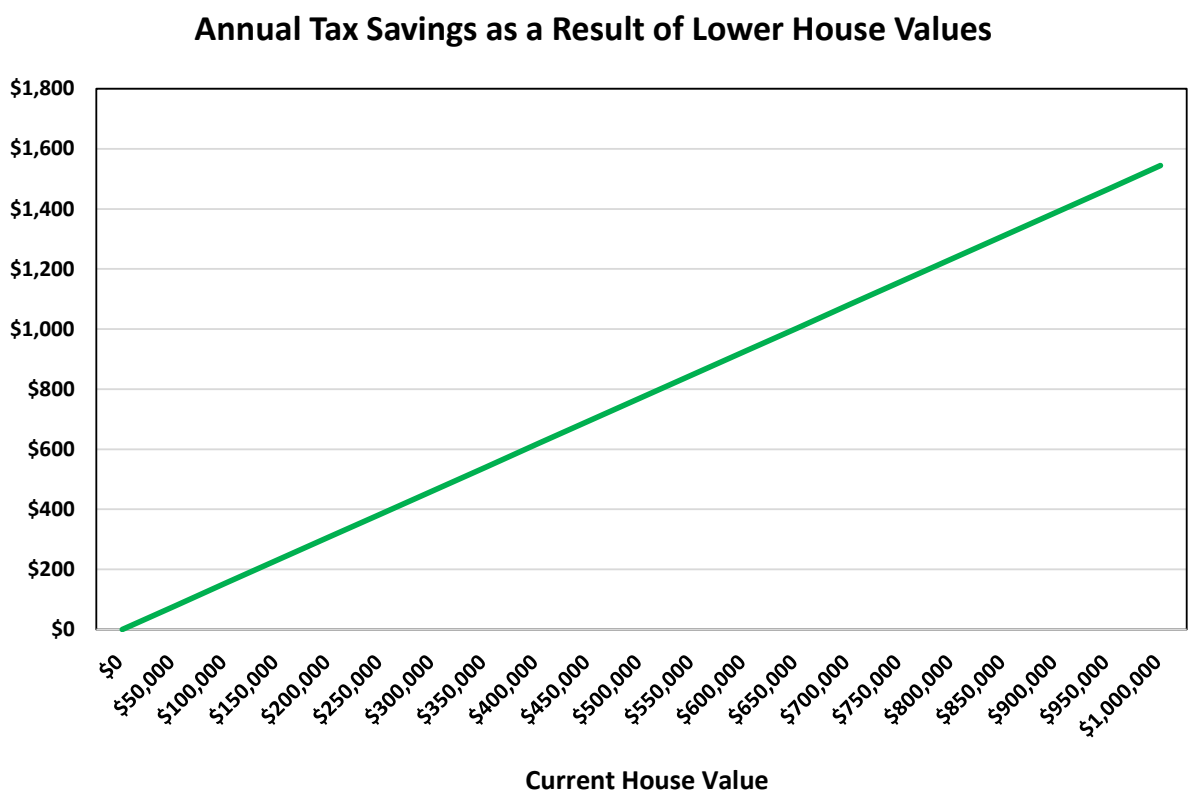
- The left-most vertical dashed line represents the school district's current level of attainment on the PSSA, where the median percentage score is 24.6%.
- As attainment increases (moving from left to right), house values and then tax revenues rise. The blue line represent the lower bound of 2% gains, the gray line represents the upper bound of 5% gains, and the orange line represents the 3.5% average of the two.
- If Philadelphia's schools could achieve the Statewide average of PSSA attainment (61.1%), this is predicted to result in additional annual tax revenues of a minimum of $19.9m and a maximum of $49.9m, with a median of $34.9m. This is scenario is represented by the middle vertical dashed line.
- If Philadelphia's schools could achieve the average of PSSA attainment of its suburban counterparts (73.5%), this is predicted to result in additional annual tax revenues of a minimum of $26.7m and a maximum of $66.8m, with a median of $46.8m. This is scenario is represented by the right-most vertical dashed line.

The implications of this funding for the school district can be derived by comparing these additional revenues to the district's current fiscal state. According to a report from the district's CFO[15], the district is expected to run a deficit of $138m by 2019, and that this is projected to increase to $905m by 2022. By contrast, the best case scenario in the above analysis is predicted to generate additional annual revenues of only $66.8m. Even if Philadelphia could achieve suburban-level quality on its PSSA performance overnight, this additional revenue is insufficient to cover the school's deficit. **Hence, the results indicate that while the additional revenues from improved school quality could be substantial, the Philadelphia school district would still require substantial internal cost-saving reforms and/or additional funding to make it fiscally solvent.**

Of course, if the school district cannot achieve either significant improvements to either its educational attainment or fiscal health, Philadelphia's parents always have the option of sending their kids to private schools. Since house values will remain depressed by relatively low school quality, the savings from the subsequently lower property tax bills could be used for private school tuition. To examine to what extent this makes sense, the annual property tax bill was first computed for different house values by applying the 1.3998% rate to a range of values. Then, the tax bill was recomputed using the predicted higher values if Philadelphia's schools achieve suburban-level attainment on the PSSA exam[16]. The difference between these two tax bills can then be interpreted as the typical household's tax "savings" from having relatively lower-quality schools, which they can reallocate to private school tuition. The following chart shows the annual tax savings for different house values:

[15] Source: http://thenotebook.org/articles/2017/03/23/philadelphia-s-school-budget-picture-remains-bleak-despite-surplus-this-year

[16] Since the research literature finds that house values can increase from anywhere from 2% to 5% for each standard deviation increase in test scores, this range's midpoint of 3.5% was used.



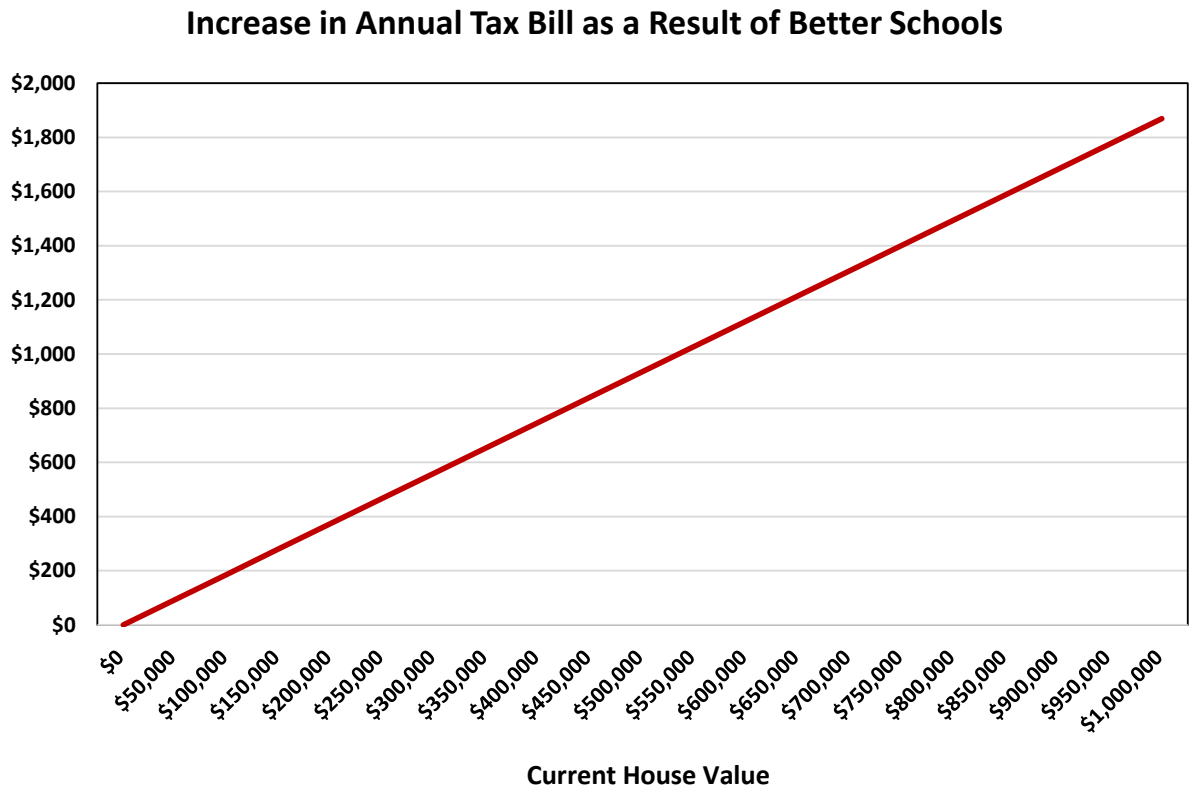
House values range from a low of $50,000 to a high of $1m. Compared to what property tax bills would be if Philadelphia's schools had suburban-level quality, household's annual tax savings range from a low of $77 per year to a high of $1,544 per year.

To see how this compares to private school tuition, data was collected on the annual tuition for the top five highest-ranked private schools located in Philadelphia[17]. Since a significant percentage of students attending these schools receive financial aid, the tuitions were adjusted for both the average percent receiving aid and the average amount of aid. The average annual cost of a top-ranked private school in Philadelphia is $25,529, whereas the average annual savings in property taxes due to lower-quality public schools is a maximum of $1,544 per year. **This implies that Philadelphia households who choose to send their children to private school (instead of public schools) pay a significant premium to do so.** Of course, there are cheaper private schools, but the lower level of their annual tuition is in the $8,000-$10,000 range, which is still well above the estimated annual savings in lower property taxes.

Lastly, since suburban-quality schools also come at a price—in the form of higher property taxes—we examine what property tax bills in Philadelphia would be if it had to impose suburban levels of property taxation in order to achieve suburban levels of school quality. Since actual property tax rates in the suburbs vary from one municipality to another, the average effective (as opposed to statutory) tax rate for each of the four counties was computed by dividing their average property tax payment by the

[17] Source: https://www.niche.com/k12/search/best-private-high-schools/m/philadelphia-metro-area/ A table of these schools is given in the appendix.

county's average house value[18]. The average of this rate across all four counties was computed to obtain a blended property tax rate, which is 1.58675%. This tax rate was then applied to home values ranging from $50,000 to $1m to obtain a suburban-level tax bill. The city-level tax bill was computed by applying the city's tax rate of 1.3998% to the same range of values. These two numbers were then netted against each other to obtain the increase in tax bills if Philadelphia imposed suburban levels of taxation in its goal to obtain suburban levels of school quality. The results are shown in the following chart:



The increase in annual taxes range from a low of $93 for a $50,000 house to a high of $1,870 for a $1m house. This is a 13.36% increase in real estate tax bills, regardless of house value. By contrast, if Philadelphia were to obtain the same level of proficiency on the PSSA exam as its suburban counterparts, that would be an increase in the median score from 24.6% to 73.5%; a nearly 200% increase in the median score.

On the face of it, this would seem to suggest that improving Philadelphia's schools represents both an easy and high-yielding policy goal: simply increase property tax bills by 13.6% and use the resulting revenue to increase school quality by 200%. But, of course, this assumes that the only factor explaining the different levels of performance on the PSSA between Philadelphia and its suburbs is simply a matter of funding. But, both the student bodies and social environments are also very different: most suburban school districts have much higher levels of household income and educational attainment, as well as a

[18] Source: https://smartasset.com/taxes/pennsylvania-property-tax-calculator

generally safer environment, than do many of the city's neighborhoods. These are also important factors in explaining educational outcomes.

So, rather than suggesting an easy policy option for improving the city's schools, it implies quite the opposite: Philadelphia would not only have to increase funding for its schools, it would also have to increase its general levels of income, education and public safety to suburban levels in order to achieve suburban-level quality of education. But while the city may not be able to make this change, households do: **another interpretation of these results is that household who relocate from the city to the suburbs may have to endure a 13.36% average increase in property taxes, but they receive a nearly 200% improvement in school quality; a very incentivizing and favorable cost-benefit ratio**.

This paper has analyzed how Philadelphia's house values are affected by current school quality and could be affected by improvements to this quality, with the fiscal and household-level implications of these. The main results are as follows:

- Differences in school quality explain only a relatively small amount of the total differential between city and suburban house prices.
- Consequently, significant improvement in the quality of Philadelphia's public schools are likely to only modestly increase the value of the city's homes, and thus, tax base. Conversely, this also implies that the city would need unrealistically large increases in the value of its housing stock to cover its projected $905m deficit.
- Based upon the findings of previous peer-reviewed research, the typical Philadelphia home with a current average value of $196,725 could be expected to appreciate in value from $3,900 to $9,800 for every one standard deviation improvement on the Commonwealth's PSSA standardized exam.
- If Philadelphia's school quality were to rise to the average of the Commonwealth's, the typical Philadelphia home is projected to increase in value from $9,300 to $23,200. If Philadelphia's school quality were to rise to the average of its better-performing suburban counterparts, the typical Philadelphia home is projected to increase in value from $12,400 to $31,000.
- For a higher-valued dwelling of $425,000, the predicted increase in value ranges from $20,000 to $50,000 for the Commonwealth scenario and from $26,800 to $67,000 for the suburban scenario.
- If Philadelphia's schools could achieve the Commonwealth's average of PSSA attainment, projected tax revenues to the school district resulting from higher house values would range from an additional $19.9m to $49.9m per year. If city schools achieve the suburb's level of attainment, the projected increase in revenues would range from $26.7m to $66.8m per year.
- The school district is projected to run a budget deficit of $138m by 2019, and $905m by 2022. Hence, it seems highly unlikely that the school district can resolve its fiscal problems by "growing" its way to solvency via improved school quality and tax collections, and therefore must implement significant cost cutting measures and/or seek additional sources of funding besides the city's current level of the real estate tax.
- The discount that Philadelphia homeowners receive in lower property tax bills is estimated to range from $77 per year to $1,544 per year, compared to what they would pay if city schools had suburban levels of educational attainment.

- Since annual cost of private schools in Philadelphia ranges from $8,000 to just over $25,000 per year, then the tax savings from lower public school quality fall significantly short from the price that must be paid if city households alternatively seek to provide their children with a private school education.
- The incentive for households with school-age children to relocate from the city to the suburbs would seem to be very strong: the data indicate that households would have to bear a 13.36% average increase in property taxes, but would receive a nearly 200% improvement in school quality in return.

For any questions or suggestions for future research topics, please contact Kevin.Gillen@Houwzer.com.

Although Dr. Gillen holds a position as a Senior Research Fellow with the Lindy Institute for Urban Innovation at Drexel University, the findings and opinions presented in this paper are solely those of the author and do not necessarily reflect the views or opinions of either the Lindy Institute or Drexel University.

APPENDIX

Top Philadelphia-based Private Schools

School	Rank in PA	Tuition	%Aid	Avg. $Aid
Germantown Friends	1	$35,755	33%	
William Penn Charter School	10	$36,375	41%	
Friends Select School	17	$34,035		
Springside Chestnut Hill Academy	18	$36,000	44%	$19,000
St. Joe's Preparatory Academy	30	$22,300		
Nazareth Academy	38	$13,000		
Average		**$32,893**	39%	$19,000

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