The Relationship Between Homes, Education, and Inequalities:

A National Snapshot of Home Prices and Primary School Test Scores

Summary Page

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This brief aims to equip local policy makers, educational leaders, and equity minded citizens with the knowledge to pursue research on how to best fund primary education in their community.

Findings

By leveraging test score data from grades 3 – 8 and house price data from nearly 3,000 counties from 2008 to 2018, we find that:

The relationship between home prices and test scores have a correlation of 0.26, however this relationship varies widely by:

- Race of student
- Locale of county
- Current test scores
- Grade of student

Recommendations

1. Reassess how covid has altered learning gaps and home prices in your county, and if altering property taxes could help recoup losses in learning.

2. Begin data analysis locally to better understand where your county fits into the relationship between home prices and test scores.

3. Check current property tax rates in your county, and if these rates could better be utilized to fund education.

4. Find other avenues in which education could be funded locally and see they could generate more money than property taxes

I. Background

In America, public school funding comes from a variety of sources including federal, local, and state resources (Chen, 2021). It is estimated that 44% of school funding comes from local property taxes, and for this reason school districts located in upper echelon areas typically have better-funded schools. The Learning Policy Institute released a policy brief, "How Money Matters for Schools," which shows that increased funding is strongly associated with improved learning outcomes (Learning Policy Institute, 2018). Moreover, lower performing students live near homes priced 2.4 times less than their stronger performing counterparts (Rothwell, 2012). Taken together it seems that one of the largest funding streams for schools flows unequally across learners, only exacerbating pre-existing educational gaps. Thus, our analysis seeks to describe and predict how house prices drive student test scores.

The problem we are addressing is unequivocally an issue of equity. Historically, low-income families and students of color face inequitable challenges to educational opportunities, which have various negative long-term outcomes. Equal, equitable, and high-quality access to education is imperative to creating a successful and strong citizenry in America. Inequitable education opportunities invariably perpetuate cycles of poverty; therefore, it is essential to understand and be informed about how the American public education system is supported, and the general inequalities that exist within it. Although our research does not necessarily solve the problem of inequitable education, it gives unique insights into how house prices reflect, and potentially predict, student test scores.

Because schools are heavily funded by property taxes, the American K-12 public education system is structurally inequitable and preserves a cycle of poverty. The K-12 public education system funding process must be altered to better suit the needs of underrepresented groups and communities. Our qualitative analysis and exploratory quantitative analysis show a striking trend between county-level home prices and test scores, and particularly captures immense disparities between Black and Hispanic students compared to their White counterparts. It is the responsibility of local, state, and federal leaders to be privy of this issue and redistribute education funds accordingly. Our hope is that this brief can serve as a first step for local leaders to begin analysis of their own community's unique composition.

II. Data

Data for this brief comes from two primary sources: The Educational Opportunity Project at Stanford University (SEDA) and Zillow's Home Value Index (ZHVI) data. Both sources and code may be found in the references section.

Educational & Demographic Data

Test score data was provided through SEDA, which compiled school-level standardized test score data across all public schools in America. This data records test scores of grades 3 through 8, from 2009 to 2018, and are disaggregated on student characteristics such as poverty level, sex, and race.

Unlike other sources on educational outcomes, SEDA simplifies educational data in several ways. First, SEDA aggregates school-level measures up into the county level. This is particularly useful since policy makers typically initiate property tax legislation at the county-level. (Ballotpedia 2021). Second, SEDA data standardizes test scores across states, grade-levels, and subject matter. This allows us to present clear analysis that can assess disparities in educational achievement across different learning contexts.

Lastly, educational data measures academic achievement in terms of years ahead or behind the national average in test scores. Table 1 presents an example of our educational data; we can see that Los Angeles County schools have been a year behind the national average in learning, but Fairfax, Virginia students are more than a year ahead in learning outcomes.

Demographic data on counties, families, and students in public schools have also been compiled by SEDA researchers. Demographic data mainly comes from The American Community Survey (ACS) and are connected to counties by Federal Information Processing Standards (FIPS) codes. Further information on demographic covariates is discussed below.

Housing Data

Zillow provided home price data, containing seasonally adjusted home values of single-family houses from 1998 to 2021 throughout American counties. This provides our analysis with home prices that are comparable across time and counties. Similarly, as the SEDA data, Zillow home price data contained FIP codes for each county in America.

Final Dataset

Constructing the final dataset only required access to both datasets via download links, and then our team was able to merge information on county demographics, home prices, and test scores by FIPS code. This left the final dataset to contain home price, demographic, and test score data on 2,829 counties across 2009 to 2018. The most disaggregated unit of observation was a specific county, by a year, the grade, the subject, and the race or socioeconomic status of the student. However, for ease of analysis, our team made use of aggregating data up into

simpler units of observation. Please refer to table or figure notes to see how data was manipulated to produce information.

The final dataset provided us with approximately 75 variables to explore regarding how home prices can affect different types of students and counties. For the sake of this brief, we are focusing on only a number of these variables as ones of interest: first, data on test scores by race and socioeconomic status; second, the locale of the county; lastly, the price of homes. Table 2 highlights some variables and their description as well.

Table 1: Test Score Data in Fairfax, Virginia, and Los Angeles California

County	Grade	Test Scores	Years Ahead/Behind National Average
Fairfax	3	4.1	1.1
	4	5.2	1.2
	5	6.4	1.4
	6	7.6	1.6
	7	8.4	1.4
	8	9.3	1.3
Los Angeles	3	2.2	-0.8
	4	3.2	-0.8
	5	4.2	-0.8
	6	5.0	-1.0
	7	6.1	-0.9
	8	7.1	-0.9

***Data was aggregated to county, by grade observations. Test scores are recorded for all students.

Table 2: Summary of Variables

Group	Variable	Description
Test Scores	Race	Score of White, Black, Asian, Hispanic, and Native American
	Socioeconomic Status	Scores of students eligible or ineligible for state's free or reduced free lunch program
	Sex	Male or Female
Demographics	% Race	Percent of White, Black, Asian, Hispanic, Native American, or Mixed Race in county public schools
	% Welfare	Percent of students eligible for state's free or reduced free lunch program
	Diversity Index	Proportion of white to minority students, non-economically disadvantaged to disadvantaged
	Median Income	Log income by certain races
	% Unemployment	Percent of unemployment county wide
Homes	House Price	Seasonally adjusted, single home house price

III. Analysis

To best understand how home prices affect certain demographics of students, we decide to compare data several ways. First, using pooled data, we look at general relationships between home prices and test scores for all student groups. Next, we investigate whether home prices and test scores' relationship matters more in different demographic contexts, i.e., in rural or urban areas. Lastly, we attempt to measure the relationships geographically, as to understand not only where test scores are strongest, but to understand if home prices or property taxes explain this performance.

Test Scores, Home Prices & Student Characteristics

In general home prices and learning are weakly related, with only a correlation of 0.26. Using a simple regression model, we find that a percent increase in home values increases learning by 0.0065 years. This implies a doubling of home value from current prices would only increase learning by .65 years. This relationship however is more important in higher grades, as every higher grade improves more with a percent increase in home prices. Table 3 maps this relationship, for instance eighth graders reap .028 more years of learning than third graders with a percent increase in home prices.

Table 3: Heterogeneous effects of a percent increase in home prices on learning	
4th grade:	0.0008 years
5th grade:	0.0013 years
6th grade:	0.0014 years
7th grade:	0.0024 years
8th grade:	0.0028 years
Note: Point estimates should be interpreted as "in comparison to the 3rd grade." Estimates are interactions of a bivariate regression of test scores on log-home price & grade. Unit of observation is county, by-grade.	

Digging deeper into this relationship, we find that housing values impact learning differentially by race. Figure 1 maps this relationship, by looking at the blue trend lines, we find that White students' scores are most impacted by home prices, however black students are also highly impacted by increased home prices. More troubling however are the relatively flat relationships for Asian, Hispanic, and economically disadvantaged students. This indicates that higher home prices, and stronger taxes on such home prices might not close learning gaps as universally as current policies might want. Implications of these results are discussed later.

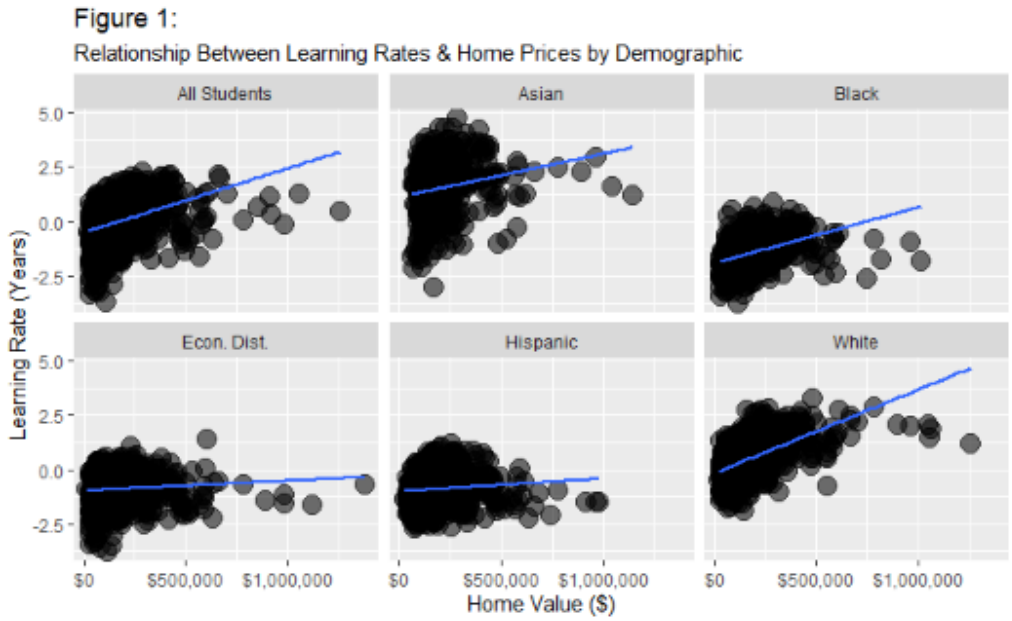


Figure 1: This relationship maps home prices and test scores by race, with yearly test scores and home prices pooled into one value. Unit of observation is county, by student type.

Test Scores, Home Prices & Community Characteristics

While race does play an important role in the relationship between scores and home prices, the community itself can drive both measures in unique ways. First, because counties span cities, suburbs, and rural communities, we again ran a simple regression model to map this relationship. What we find is home prices in suburban majority locales most strongly impact student learning, as home prices increase by a percent, learning increases .006 years more in the suburbs. Moreover, urban cities (our comparison group) home values matter least for learning. Table 4 explains this relationship. We also plot this relationship by counties' majority locale, we find similar results as shown in figure 2.

Table 4: Heterogeneous effects of a percent increase in home prices on learning	
Suburb	.006 years
Town	.0046 years
Rural	.004 years
Note: Point estimates should be interpreted as "in comparison to rural counties." Estimates are interactions of a regression of test scores on a log-home price and locale. Unit of observation is county, by-locale.	

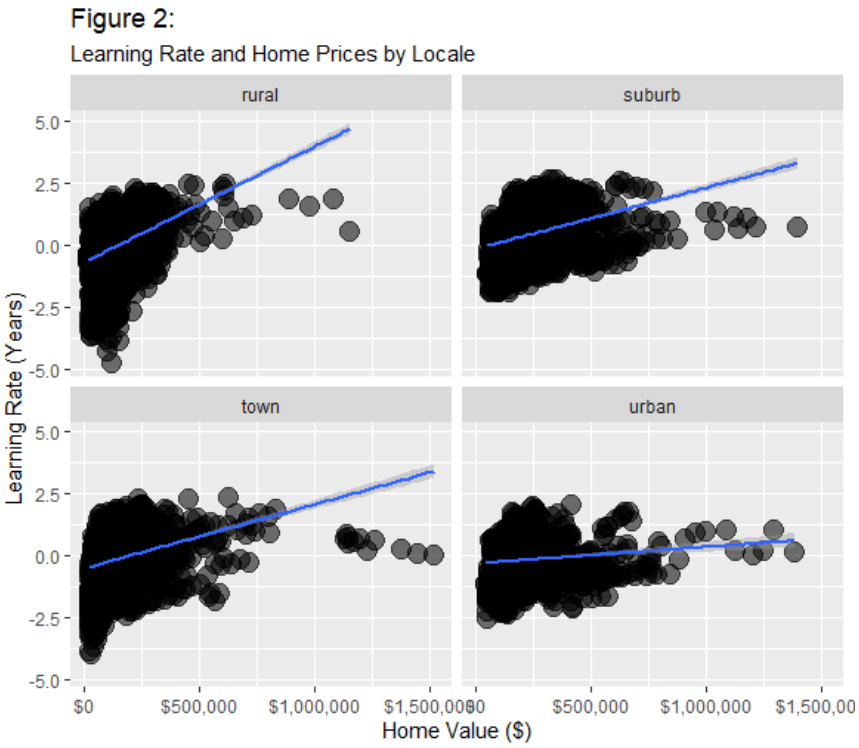
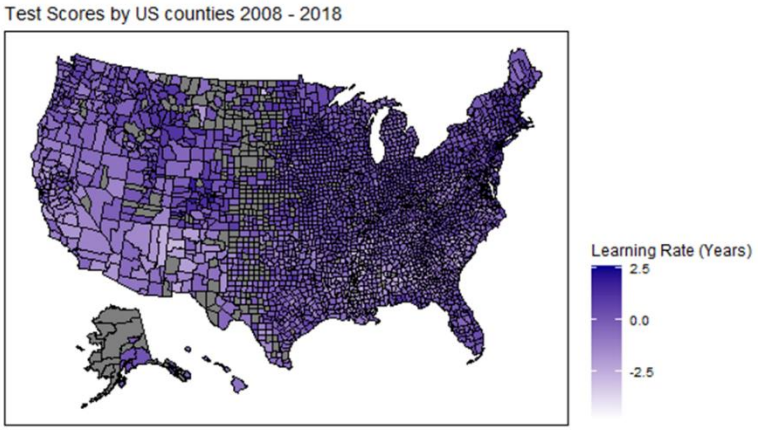


Figure 2: This relationship maps home prices and test scores by locale, with yearly test scores and home prices pooled into one value. Counties are identified as one of four locales if a specific locale takes up the majority of space. Unit of observation is county, by-locale.

Test Scores, Home Prices & Geography

Plotting the relationship geographically, we find the weakest learners are primarily spread across the southern US, moreover the strongest learners are typically within the northeast and Pacific northwest. However, looking at the 100 strongest and weakest performing counties in America we find that while poor preforming counties have extremely low home prices, the prices of homes in strong counties vary widely for strong counties. While intensity of property tax could explain these differences between high and low preforming counties, we do not have this data.



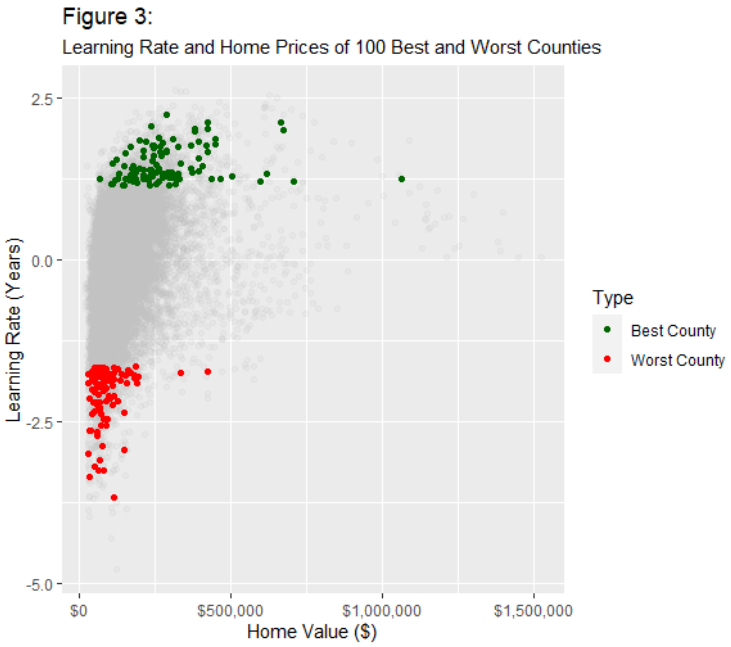


Figure 3: Grey dots represent all other counties. Graph was made with pooled test score data, best and worst counties were chosen by lowest average test score across all grades from 2008 – 2018. Unit of observation is county.

IV. Discussion of the Impacts of the COVID-19 Pandemic

Over the past year both home prices and schooling have taken drastic hits due to the COVID-19 pandemic. As such, we have recently seen a divergence between growing home prices and plummeting attendance & test-scores. Notably, home sales and construction have hit a 10-year low as the real estate industry has struggled during the pandemic (Gascon & Hass 2020; Demsas, 2021). This stagnation in the supply of homes, coupled with hesitancy to sell has pushed home prices up 9.5% in 2020.

On the other side, students have struggled to adjust to new realities of remote learning. While current statistics on learning are not readily accessible, recent developments from The Brookings Institute point to that fact that math performance has dropped by 5 to 10 percentage points since the start of the pandemic. More troubling is that fact that 25% of students from pre-pandemic schooling have gone missing in the current year's testing cycle, where most are thought to be marginalized or economically disadvantaged students (Kuhfeld et al, 2020).

The long-term effect of COVID-19 on housing prices and test scores is still unknown as of writing. However, based on current trend and relationships presented in this brief, mindful policy with regards to property taxes could play an important role in how to leverage rising home prices to combat what learning losses could occur.

V. Conclusion

In sum, this brief achieved what it set out to do because we were able to explain a simple relationship between test scores and home prices, which allows us to assume educational outcomes. As mentioned previously, better-funded schools better benefit students, and students who have access to more educational resources while in school have positive long-term outcomes.

As a warning, this analysis is extremely exploratory, as it only includes a discussion of inequities within the American public school system, and a preliminary quantitative exploration of how house prices predict test scores. Local policy makers ought to leverage data science teams to better understand the relationship between property taxes, home prices, and test scores in their county.

Our suggestion is three-fold. First, additional data procurement is necessary. Information on property tax rates, prices of not only homes, and growth of counties to measure additional properties to tax are important metrics to consider. Second, a data science team could utilize machine learning algorithms to create a model to predict the home price-test score relationship taking account of the complexities between race, location, and other demographic characteristics that are strongly interconnect. Third, although test scores are a good metric to understand how students are performing in the present, our analysis does not analyze how current test scores impact other outcomes like labor market participation, democratic citizenship, and/or general human flourishing. A data science team could provide a longitudinal study of test scores and income through adulthood to predict how present school funding truly predicts the success of students. Creating a more advanced machine-learning longitudinal study would increase political feasibility for change, as it would concretely demonstrate how school funding predicts outcomes. Qualitative analysis in this field exists, but our exploratory quantitative analysis could help a data science team create an innovative explanation for how housing prices and present test scores predict tangible long-term outcomes.

VI. References

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Data Here:
https://drive.google.com/drive/folders/1IFQ0GwESLjQ5k_6PVf4VLmZZJWaYbva?usp=sharing