ScholarOne - Research on the Balance of Per-Student Expenditure in Public K-12 education in the United States

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Abstract

The pursuit of educational equity plays a pivotal role in cultivating societal parity. This study aims to evaluate the patterns and inequalities in the mean per-student educational spending in public K-12 schools across the 50 states of the United States and the Federal district, spanning the years 2006 to 2021 while accounting for the effects of inflation. The study’s results demonstrate an overall rise in per-student expenditure, yet it also highlights the presence of persistent and probably expanding disparities among different states. The differences identified in this research are attributed to the structural aspects of school financing in the United States. The text finishes by presenting policy ideas that address disparities and promote educational fairness, focusing on marginalized populations. These recommendations emphasize the strategic involvement of the government, market, and educational institutions in providing public services.
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ABSTRACT
The pursuit of educational equity plays a pivotal role in cultivating societal parity. This study aims to evaluate the patterns and inequalities in the mean per-student educational spending in public K-12 schools across the 50 states of the United States and the Federal district1, spanning the years 2006 to 2021 while accounting for the effects of inflation. The study's results demonstrate an overall rise in per-student expenditure, yet it also highlights the presence of persistent and probably expanding disparities among different states. The differences identified in this research are attributed to the structural aspects of school financing in the United States. The text finishes by presenting policy ideas that address disparities and promote educational fairness, focusing on marginalized populations. These recommendations emphasize the strategic involvement of the government, market, and educational institutions in providing public services.

Keywords: Education Inequity, Public Elementary and Secondary Education, Per-pupil Expenditure, United States, Education Policy

1. INTRODUCTION
The correlation between educational equity and the more comprehensive socioeconomic structure of society has been extensively documented [1], as discrepancies in educational opportunities play a substantial role in perpetuating the growing socioeconomic gap. Numerous studies continuously establish a robust correlation between educational attainment and crucial life outcomes, encompassing financial prospects, familial stability, civic engagement, and lifespan. The increasing disparity in these outcomes among persons with different educational backgrounds highlights the significant impact that education has on an individual's overall quality of life. The implementation of early intervention strategies in education, specifically within the K-12 context, can significantly influence various aspects of individuals' lives. Factors such as the competence of instructors, parental engagement, and the adoption of innovative

instructional methods all contribute significantly to shaping students' achievements [2].

The core of achieving educational fairness is around the distribution of resources, a manifestation of which may be observed in the per-student funding. Adequate allocation of financial resources is commonly associated with the provision of higher-quality educational settings, updated infrastructure, and a more proficient teaching faculty. Consequently, the inequitable allocation of financial resources towards education serves as a significant factor in the unequal dispersion of educational assets, thereby resulting in disparities in educational achievements [3]. The present study investigates the equity of educational quality in public K-12 schools in the United States through an analysis of per-pupil budget statistics. The primary objective of this initiative is to investigate the various determinants that impact educational equity and offer current and relevant data to guide the formulation of public policies. This will facilitate the implementation of specific measures aimed at enhancing fairness in the educational system.

The data utilized in this research are derived from the Public Elementary-Secondary Education Finance Data spanning from 2006 to 2021 [4]. These data were assembled and analyzed with GraphPad Prism 10, establishing a solid statistical basis for the subsequent discourse and findings.

2. EXAMINATION OF PER-STUDENT SPENDING IN U.S. PUBLIC K-12 EDUCATION

2.1 Overview of Per-Student Funding Trends in U.S. Public K-12 Schools

Given the substantial fluctuations in the price level inside the United States over sixteen years, analyzing the financing inputs for education in public K-12 schools in the U.S. using constant pricing [5] is imperative.

![Figure 1. Per-pupil Spending and GDP Per Capita](image)

The relative indexes for the Consumer Price Index (CPI) over sixteen years were computed as follows: 1.000, 1.047, 1.060, 1.079, 1.105, 1.143, 1.145, 1.163, 1.180, 1.205, 1.243, 1.263, 1.259, 1.307, and 1.344. The final dataset on the actual funding for public K-12 education in the United States during sixteen years
2021 USD) was generated by computing the ratio between per-pupil education funding and the CPI index.

Through a comparative analysis of the input data on per-student education funding in the U.S. public K-12 education system, the per capita GDP data in the U.S. (measured in 2021 USD), and the input data on per-student education funding in the U.S. public K-12 education system (also measured in 2021 USD), information regarding the U.S. public K-12 education per pupil funding input and the U.S. per capita GDP data was derived for the period spanning from 2006 to 2021. This is seen in Figure I.

According to the data in Figure I, the per capita financing for public K-12 schools in the United States reached an unprecedented level of $14,347.42 in 2021. Over sixteen years, the per capita GDP and funding for public K-12 education in the United States exhibited fluctuations. However, it demonstrated a consistent rising trajectory, displaying a positive correlation distribution. Excluding the effects of inflation, the per capita spending on public K-12 education in the United States, measured in 2021 USD, fell between 2009 and 2013. However, starting from 2013 and continuing until 2021, there has been a consistent upward trend in spending, culminating in a new record high of $14,347.42 in 2021. One notable observation is that the per capita GDP in the United States is seeing a greater rate of increase compared to the growth rate of per capita education spending on public K-12 schooling. The GDP per capita and public K-12 education per child funding in the United States have consistently grown, increasing from $37,078.70 in 2006 to $55,812.38 in 2021. This trend indicates a sustained development in both economic output and investment in primary and secondary education.

### Disparities

This article examines the disparity in per-pupil education funding within the United States public K-12 education system, with a focus on the primary indicator of per-student education expenditures. This indicator has the capability to visually represent the distribution of resources in the public K-12 education system in the United States. To enhance the precision of analysis, this study employs multiple methodologies, including extreme deviation, extreme value ratio, standard deviation, and coefficient of variation, to measure and examine the phenomenon under investigation.

**Extreme deviation:** \( R = I_{\text{Max}} - I_{\text{Min}} \)

Extreme deviation in U.S. public K-12 education can be assessed by measuring the disparity between the districts with the greatest and lowest levels of per-pupil education spending. This metric captures the absolute difference between these two extremes. The observed phenomenon can indicate the unevenness in the regional development of public K-12 education in the United States. The greater the magnitude of this disparity, the more the allocation of resources across various locations is imbalanced.

**Extreme Disparity Rate:** \( E = \frac{I_{\text{Max}}}{I_{\text{Min}}} \)

The extreme deviation rate measure quantifies the ratio between the greatest and lowest spending levels among states, providing insight into the extent of regional funding discrepancies within the United States. The rate in question serves as an indicator for the dispersion of data, with a value of 1 denoting an ideal state of equal distribution in the allocation of resources. On the other hand, a larger rate of extreme deviation indicates a higher level of inequality in the distribution of educational resources.

### 2.2 Evaluating Variations in Per-Student Educational Investments Across U.S. States

#### 2.2.1 Criteria for Measuring Financial Disparities

This article examines the disparity in per-pupil education funding within the United States public K-12 education system, with a focus on the primary indicator of per-student education expenditures. This indicator has the capability to visually represent the distribution of resources in the public K-12 education system in the United States. To enhance the precision of analysis, this study employs multiple methodologies, including extreme deviation, extreme value ratio, standard deviation, and coefficient of variation, to measure and examine the phenomenon under investigation.
Standard deviation: \[ \sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} \]

The standard deviation is a statistical measure used to quantify the extent of variability in per-student funding for higher education across several places within a specific time period. A large standard deviation indicates a significant variability in the amount of funding allocated to individual students. This observation highlights a significant disparity in the distribution of financial resources for public K-12 education across various regions within the United States.

Coefficient of Variation: \[ V_\sigma = \frac{\sigma}{\bar{x}} \]

The coefficient of variation (CV) serves as a statistical tool that aids in the interpretation of the relative dispersion of data points. The coefficient of variation (CV) provides a dimensionless measure of variability by calculating the ratio of the standard deviation to the mean. This is particularly important when examining the equitable distribution of funds to students over time or across other states. A greater coefficient of variation (CV) reveals more significant discrepancies in the allocation of educational funding. When a coefficient of variation (CV) exceeds 0.5, it serves as a conspicuous indication of a substantial disparity in the allocation of resources.

Through the utilization of statistical methodologies, we undertake a quantitative examination of the disparities in financial resources distributed to individual students within the public K-12 education system in the United States. The utilization of quantitative analysis is crucial for comprehending the equitable allocation of educational resources, hence facilitating the implementation of targeted approaches that strive to achieve an equitable distribution of financial resources in education.

2.2.2 Comparative Analysis Using Financial Indicators

The disparity in per-pupil education expenditure can be assessed by determining the range and standard deviation of spending in U.S. public K-12 education from 2006 to 2021, as seen in Table 1.

<table>
<thead>
<tr>
<th>Year</th>
<th>Averages</th>
<th>Maximum Value</th>
<th>Minimum Value</th>
<th>Range</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>14347.42</td>
<td>New York: 26571.27</td>
<td>Idaho: 9052.83</td>
<td>17518.44</td>
<td>4214.50</td>
</tr>
<tr>
<td>2020</td>
<td>13500.81</td>
<td>New York: 25518.51</td>
<td>Idaho: 8271.57</td>
<td>17246.94</td>
<td>3947.81</td>
</tr>
<tr>
<td>2019</td>
<td>13187.35</td>
<td>New York: 25139.20</td>
<td>Idaho: 7984.82</td>
<td>17154.38</td>
<td>3902.08</td>
</tr>
<tr>
<td>2018</td>
<td>12559.11</td>
<td>New York: 24048.21</td>
<td>Utah: 7627.66</td>
<td>16420.55</td>
<td>3798.52</td>
</tr>
<tr>
<td>2017</td>
<td>12201.15</td>
<td>New York: 23090.74</td>
<td>Utah: 7178.51</td>
<td>15912.23</td>
<td>3638.99</td>
</tr>
<tr>
<td>2016</td>
<td>11763.21</td>
<td>New York: 22366.37</td>
<td>Utah: 6953.12</td>
<td>15413.25</td>
<td>3497.96</td>
</tr>
<tr>
<td>2015</td>
<td>11391.79</td>
<td>New York: 21205.58</td>
<td>Utah: 6574.55</td>
<td>14631.03</td>
<td>3498.76</td>
</tr>
<tr>
<td>2014</td>
<td>11002.62</td>
<td>New York: 20607.48</td>
<td>Utah: 6499.93</td>
<td>14107.55</td>
<td>3301.48</td>
</tr>
<tr>
<td>2013</td>
<td>10723.50</td>
<td>New York: 19817.61</td>
<td>Utah: 6555.27</td>
<td>13262.34</td>
<td>3249.43</td>
</tr>
<tr>
<td>2012</td>
<td>10607.66</td>
<td>New York: 19552.22</td>
<td>Utah: 6206.18</td>
<td>13346.04</td>
<td>3077.81</td>
</tr>
<tr>
<td>2011</td>
<td>10608.28</td>
<td>New York: 19076.03</td>
<td>Utah: 6212.22</td>
<td>12863.81</td>
<td>2953.43</td>
</tr>
<tr>
<td>2010</td>
<td>10600.06</td>
<td>Washington: 18666.85</td>
<td>Utah: 6036.66</td>
<td>12603.19</td>
<td>2803.56</td>
</tr>
<tr>
<td>2009</td>
<td>10498.66</td>
<td>New York: 18126.02</td>
<td>Utah: 6356.26</td>
<td>11769.76</td>
<td>2612.29</td>
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<tr>
<td>2008</td>
<td>10258.88</td>
<td>New York: 17173.43</td>
<td>Utah: 5765.13</td>
<td>11408.30</td>
<td>2427.66</td>
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<tr>
<td>2007</td>
<td>9666.38</td>
<td>New York: 15981.17</td>
<td>Utah: 5683.41</td>
<td>10297.76</td>
<td>2243.09</td>
</tr>
</tbody>
</table>
The data analysis reveals a substantial increase in the disparity of per-pupil education funding for public K-12 education in the United States. Specifically, the variance expanded from $9,447.64 in 2006 to $17,518.44 in 2021, representing a significant growth of approximately $8,000 over sixteen years. Furthermore, there has been a progressive rise in the allocation of education funding per student throughout several states. The standard deviation of per-pupil education funding for public K-12 education in the United States was 2,054.67 in 2006. Over 15 years, from 2006 to 2021, this value has increased steadily to 4,214.50. This is a nearly twofold increase compared to the value observed in 2006.

Between 2006 and 2021, New York consistently maintained the highest level of per-pupil education spending in the public K-12 sector for fifteen years. This trend can be attributed to the strong correlation between New York’s economic development and its investment in education. Nevertheless, it is noteworthy that Utah continually maintained the lowest levels of per-pupil education spending within the public K-12 sector throughout the duration spanning from 2006 to 2018.

In general, the data presented indicate that there has been a rise in per-pupil expenditure on public K-12 education in the United States. However, it is essential to note that there has also been a simultaneous growth in absolute inequality in education spending across states, and this trend is expected to continue expanding. Hence, it is imperative to acknowledge and rectify the discrepancy in educational spending among different states.

Table 1. Absolute Differences in U.S. Per-Pupil Education Expenditures for K-12 Education, 2006-2021

<table>
<thead>
<tr>
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</thead>
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<td>Extreme Disparity Rate</td>
<td>2.94</td>
<td>3.09</td>
<td>3.15</td>
<td>3.15</td>
<td>3.22</td>
<td>3.22</td>
<td>3.23</td>
<td>3.17</td>
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<td>Coefficient of Variation</td>
<td>0.29</td>
<td>0.29</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.31</td>
<td>0.30</td>
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</thead>
<tbody>
<tr>
<td>Extreme Disparity Rate</td>
<td>3.02</td>
<td>3.15</td>
<td>3.07</td>
<td>3.08</td>
<td>2.85</td>
<td>2.98</td>
<td>2.81</td>
<td>2.74</td>
</tr>
<tr>
<td>Coefficient of Variation</td>
<td>0.30</td>
<td>0.29</td>
<td>0.28</td>
<td>0.26</td>
<td>0.25</td>
<td>0.24</td>
<td>0.23</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Table 2. Relative Differences in U.S. Per-Pupil Education Expenditures for K-12 Education, 2006 to 2021

The analysis of per-pupil education expenditures in U.S. public K-12 education from 2006 to 2021 allows for the observation of relative differences by computation of extreme deviation rates and coefficients of variation. The data acquired is presented in Table 2. The data analysis reveals a substantial disparity in per-pupil expenditure for public K-12 education in the United States between 2006 and 2021. The magnitude of the discrepancy between states with the highest and lowest funding levels fluctuates between 2.81 and 3.23, indicating an imbalance in per-pupil education spending across the nation. Regarding the extreme disparity rate trajectory, it exhibited an ascending pattern between 2006 and 2015, culminating in its peak value of 3.23 in 2015. From 2015 to 2021, there was a discernible decline in the rate of extreme disparity. There has been a discernible pattern of gradual reduction in the disparity among states regarding
per-pupil investment in public K-12 education in the United States.

Based on the coefficient of variation data spanning from 2006 to 2021, it can be observed that the coefficient of variation for per-pupil education funding in U.S. public K-12 education exhibits fluctuations ranging from 0.22 to 0.3. These fluctuations are relatively minor, suggesting that the disparity in per-pupil funding across states has maintained a relatively stable condition over the sixteen years. Notably, no discernible trend indicates a significant expansion or contraction in this disparity.

2.3 Investigating Economic Factors Contributing to Funding Imbalances in U.S. Public K-12 Schools

This section critically examines the economic factors that contribute to the inequitable allocation of per-pupil education funding within the United States public K-12 education system. The United States, established with the fundamental idea of providing equal opportunities, confronts educational discrepancies that are primarily influenced by historical and regional economic, social, and cultural inequalities [6]. The discrepancies above are evident in the unequal progress observed in various places and can be alleviated by promoting economic growth and social development.

The funding structure for primary and secondary education, which plays a crucial role in determining the quality of education, frequently encounters difficulties related to insufficient financial resources and disparities, particularly in districts characterized by elevated poverty rates. Economic downturns, such as the current one precipitated by the COVID-19 epidemic, amplify these inequalities. The persistent problem of unequal funding is frequently associated with racial and socioeconomic divisions, exacerbated by the dependence on state support that is subject to fluctuations and susceptibility during periods of economic decline [7].

In the United States, education is predominantly financed by local property taxes, which contributes to the perpetuation of economic inequalities. This is because wealthier districts can collect more tax revenues, providing superior school buildings and resources. Despite implementing state and federal initiatives to correct these disparities through the provision of funds, these measures frequently need to tackle the underlying inequities adequately [8].

Structural economic policies, such as taxation, minimum wage regulations, and social welfare programs, significantly influence. These policies impact the levels of family income and, consequently, the resources that are accessible for educational purposes. Moreover, it should be noted that labor market policies that influence teacher wages and working conditions indirectly affect the quality and fairness of education. This is because offering competitive compensation and creating favorable work environments are crucial factors in retaining highly skilled educators, particularly in economically disadvantaged regions [9].

In brief, the research elucidates the intricate dynamics of economic variables that impact the allocation of funds per student in public K-12 schools, underscoring the need for comprehensive legislative measures to foster a more equal educational environment.

3. CONCLUSION

The significant disparities in per-student education expenditure among states underscore the pressing necessity to tackle educational fairness in public K-12 schools in the United States. Despite an overall increase in financing, the widening disparity between states with high and low expenditure levels indicates that the measures implemented thus far need to be revised compared to the escalating educational investment demands. The origins of this matter are complex, intertwined with historical and persistent economic, social, and cultural divisions, and are exacerbated by the
dependence on local property taxes as a means of financing schools, perpetuating socioeconomic inequalities.

The endeavor to achieve complete parity in educational expenditure may prove to be a challenging objective. However, this research emphasizes the significance of concerted efforts to reduce these fiscal disparities. Such endeavors are crucial to provide equitable chances for individuals residing in socioeconomically disadvantaged neighborhoods. This undertaking requires the implementation of permanent policy reforms that seek to mitigate, rather than exacerbate, current divisions. Implementing inclusive public policy-making processes that facilitate the participation of the general public and ensure the equitable consideration of diverse interests and values is of utmost importance. These processes must align with the broader society's objectives, maintain educational standards, and avoid being solely influenced by political or market forces.

When considering the complex relationship between government, market forces, and educational institutions, ensuring that all efforts are grounded in the principles of public benefit, inclusion, and fairness is crucial. The government plays a crucial role in providing public services and maintaining a competitive yet fair market. Furthermore, it is imperative to guarantee that the participation of the government in market dynamics is congruent with the tenets of the free market and the well-being of the general population. In order to promote educational equity, it is imperative for policy measures to prioritize the augmentation of educational funding on a comprehensive scale while concurrently striving to attain a more equitable allocation of educational resources. Potential measures could encompass adopting federal policies designed to maximize educational investments, enhance assistance for schools located in economically disadvantaged states, and utilize federal grants, tax incentives, or other financial mechanisms to alleviate imbalances across states.

It is essential to acknowledge the limitations of this study, including its dependence on financial data that may not comprehensively reflect the entirety of educational resource utilization or the direct influence on educational quality. Although Consumer Price Index (CPI) adjustments for inflation are often used, they fail to account for regional variations in the cost of living, which significantly impact the actual purchasing power of educational funding. The emphasis on data at the state level may mask discrepancies that exist at a more localized level. Additionally, the lack of a direct correlation between expenditure and long-term educational outcomes necessitates further investigation into the effects of educational investment on broader social advantages in the long run.

AUTHORS’ CONTRIBUTIONS

ACKNOWLEDGEMENTS

REFERENCES


