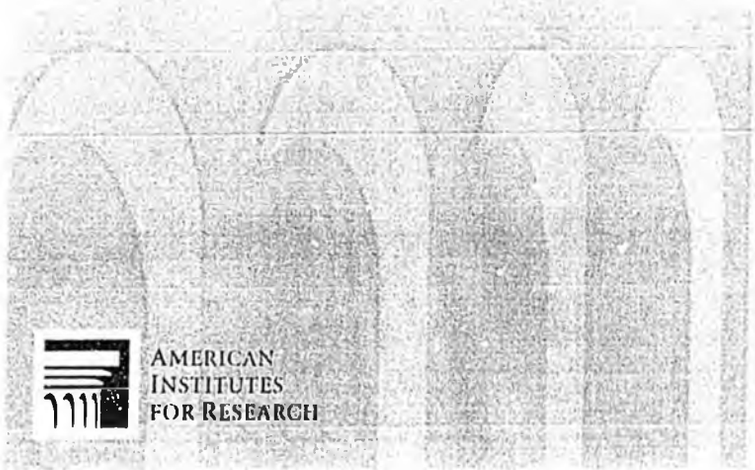
ALASKA LEGISLATURE COMMITTEE FILES, 2003-2004 8672
11114 SENATE HEALTH, EDUCATION & SOCIAL SERVICES

Alaska School District Cost Study

Energy Cost Differences due to:

- Climate
- Price of fuels (type & transportation costs)
- Prototype differences – efficiency of alternative fuels



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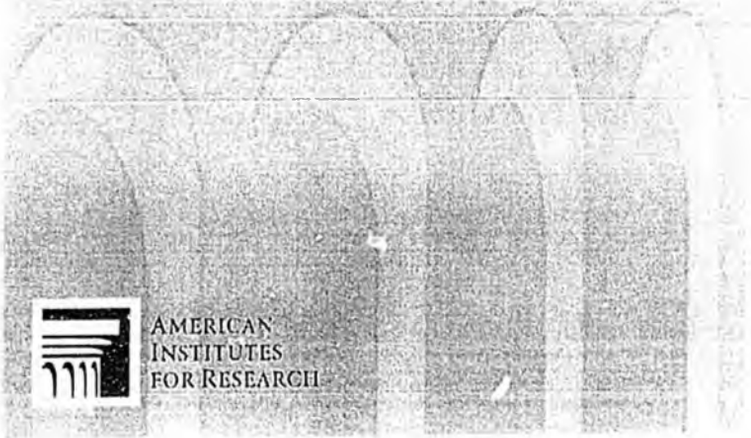
Alaska School District Cost Study

Prototype characteristics

- Structural characteristics of the building Square footage
- Insulation
- Placement and number of outlets for electrical usage
- Type of fuel source used
- Operating Hours for facility



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Alaska School District Cost Study

3 School Prototypes

Prototype Number	Climate Zone
1	Moderate
2	Cold
3	Very Cold

- **Buildings Considered**
  - School Buildings
  - District Buildings
  - Outbuildings
- **Price Data Collection**
  - District Surveys
    - Collected on each school site
    - Price includes transportation and storage
    - Conversion of Prices to kBTU

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Alaska School District Cost Study

Exhibit IV-2. Comparison of Energy Index Values by Region

Region	N	Mean	Standard Deviation	Minimum	Maximum
Statewide	53	2.65	1.64	0.74	9.31
Far North	10	4.54	2.09	1.81	9.31
Interior	3	1.87	0.40	1.61	2.33
South Central	9	1.80	0.86	1.00	3.79
Southeast	17	1.79	1.13	0.74	4.62
Southwest	14	3.08	1.06	1.31	4.97

Alaska School District Cost Study

Cost of Goods

Alaska School District Cost Study

Data Collection

- TWG Input
- DIstrict Survey
  - Paper (Instructional & Office Supplies)
  - Windowpane (Small Capital Items)
- Cost of good & Cost of Good + Transportation
- School-site data

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Alaska School District Cost Study

Exhibit V-2. Comparison of Total Goods Index Values by District Enrollment

Enrollment	N	Mean	Standard Deviation	Minimum	Maximum
Statewide	53	2.05	0.94	1.00	6.81
0 to <250	13	2.50	1.53	1.08	6.81
250-999	25	1.98	0.52	1.16	3.08
1000-2499	6	2.19	1.00	1.22	4.09
2500-9999	6	1.69	0.27	1.46	2.15
10,000+	3	1.18	0.16	1.00	1.28

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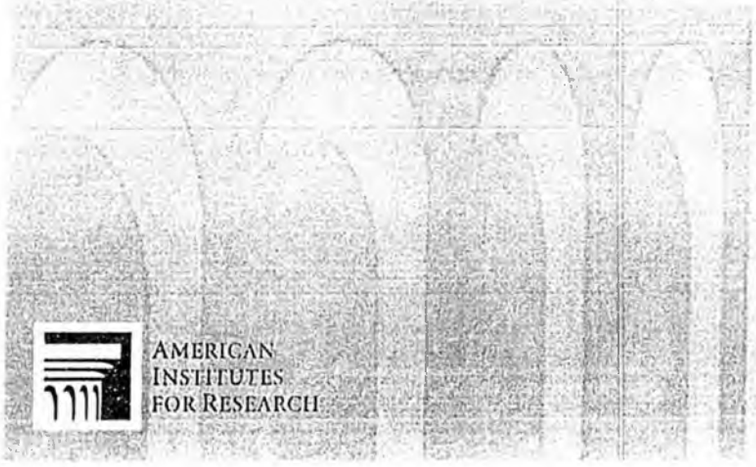
Alaska School District Cost Study

Costs of Travel

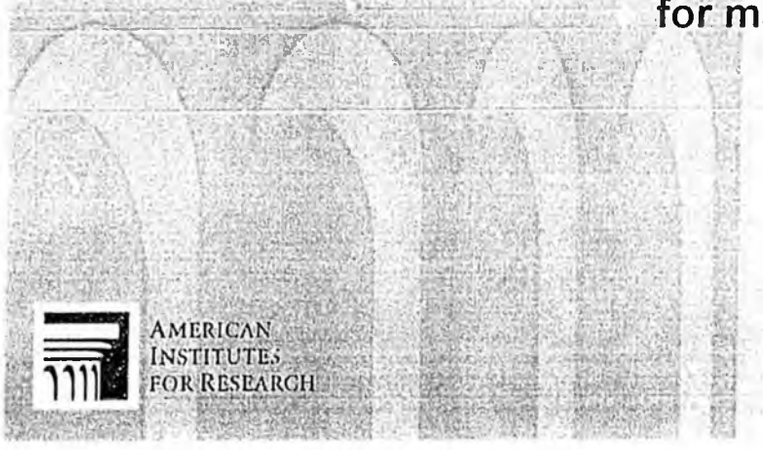
- Purchased Services
- Professional Development
- Travel between Schools and District Office



Alaska School District Cost Study

Data Collection

- **Discussions with TWG**
- **District Surveys**
  - Travel from district office:
    - to each school site
    - to Anchorage
    - for maintenance



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Alaska School District Cost Study

Purchased Services

- Contracted maintenance/technician
- 2 components:
  - Cost of labor
  - Cost of travel

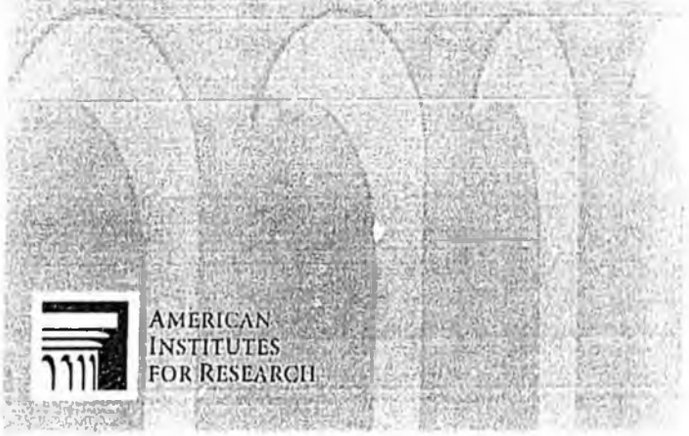

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Exhibit VI-2. Comparison of Total Travel Index Values by Distance

Distance	N	Mean	Standard Deviation	Minimum	Maximum
Statewide	53	3.51	3.78	1.00	17.18
Less than 10 miles	6	1.42	0.65	1.00	2.72
At least 10 miles	4	1.29	0.09	1.22	1.39
At least 50 miles	12	2.01	1.36	1.06	5.48
At least 100 miles	23	4.06	3.96	1.03	15.10
At least 500 miles	8	6.82	5.43	1.36	17.18

Exhibit VI-3. Comparison of Total Travel Index Values by District Enrollment

Enrollment	N	Mean	Standard Deviation	Minimum	Maximum
Statewide	53	3.51	3.78	1.00	17.18
0 to <250	13	2.62	1.52	1.08	5.48
250-999	25	3.35	3.54	1.03	15.10
1000-2499	6	8.10	6.56	1.06	17.18
2500-9999	6	2.66	2.81	1.04	8.26
10,000+	3	1.14	0.13	1.00	1.22

Alaska School District Cost Study

Recommendations and Implementation Issues

- Adopt the new cost index.
- Improve personnel databases.
- Adopt data collection on non-personnel elements.
- Update every 3 to 5 years.
- Use an economist for labor market analysis.
- Phase in the new index over time

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Alaska School District Cost Study:

Volume I – Summary of Results

Submitted to:

Ms. Heather Brakes
Legislative Budget & Audit Committee
State Capitol, Room 121
Juneau, AK 99801-1182

Submitted by:

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Joe Robinson
Phil Esra, Editor

With contributions by
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January 2003

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Acknowledgements

This study benefited from the input and participation of many people. The study team would like to express their appreciation for the efforts of the Technical Working Group, whose members provided critical guidance over the course of the project. Members of the Working Group are as follows:

- Kerry Jarrell (Bering Strait SD)
- Michael Fisher (Fairbanks North Star Borough SD)
- Melody Douglas (Kenai Peninsula Borough SD)
- Dave Jones (Kodiak Island Borough SD)
- Dennis Niedermeyer (Lake and Peninsula Borough SD)
- Lucienne Harger (North Slope Borough SD)
- Barbara Stocker (Sitka Borough SD)
- Karen Goodwin (Southeast Island SD)

We greatly appreciate their support during the data collection phase of this project and owe a great debt of gratitude for helping us accomplish a 100 percent response rate on virtually all of our data collection instruments. They not only provided encouragement, but help to the beleaguered school business offices who attempted to interpret our needs. This group of hardy individuals also contributed to the design of our approach to addressing the costs of goods services, and travel.

A special word of thanks goes to Melody Douglas and Dave Jones, who worked closely with AIR in the final stages to review assumptions and make follow-up phone calls to individual school business officers to check data elements that were used in the construction of the final index numbers. There willingness to work in collaboration with the AIR research team made the results of our work a better product.

The Oversight Committee also provided critical guidance, and helped coordinate our requests for data during the course of the study. Its members are Pat Davidson, Representative Hugh Fate, Eddy Jeans, David Teal, and Senator Gene Therriault.

In particular, Eddy Jeans and his staff were instrumental in helping us obtain data from ADEED and in serving as liaisons with school business officials and superintendents. Elizabeth Sweeney spent countless hours on the phone with the research team, both reviewing the Chart of Accounts and individual district fiscal audits, and guiding decisions about assignment of budget shares. Karen Lipson worked with the research team to quickly provide personnel data in whatever form necessary. Tim Mearig obtained important building and facility data for the energy prototype analysis and served as a liaison with school district facilities managers.

The study team would like to thank all of the school and district personnel who responded to our surveys and requests for information. Without their efforts, this study would not have been possible.

Joanne Lieberman, who laid the foundation for the project and managed it in its early stages, was instrumental in creating a well-conceived study, and demonstrated an uncanny ability to anticipate every contingency and plan for every eventuality.

Gur Hoshen, Ann Win, and Bob Morris all provided technical assistance through their programming skills using SAS statistical software.

Last, but certainly not least, we wish to acknowledge the hard work and significant effort put forth by Phil Esra, who has provided tremendous editorial support in developing this document.

Executive Summary

The purpose of this study is to develop an improved methodology for measuring differences in the cost of school resources across geographic locations within Alaska. State policy makers in Alaska have long recognized the importance of adjusting state education aid for geographic cost differences and, for the past five years, have utilized a cost adjustment index derived from a study conducted by the McDowell Group (1998). The present study is intended to develop a geographic cost of education index (GCEI) that will replace the existing cost adjustment and provide a more sophisticated approach to measuring cost differences. The application of such geographic cost adjustments in state aid is intended to equalize the purchasing power of the educational dollar across local school districts.

The costs of four major categories of school inputs are analyzed as part of this study:

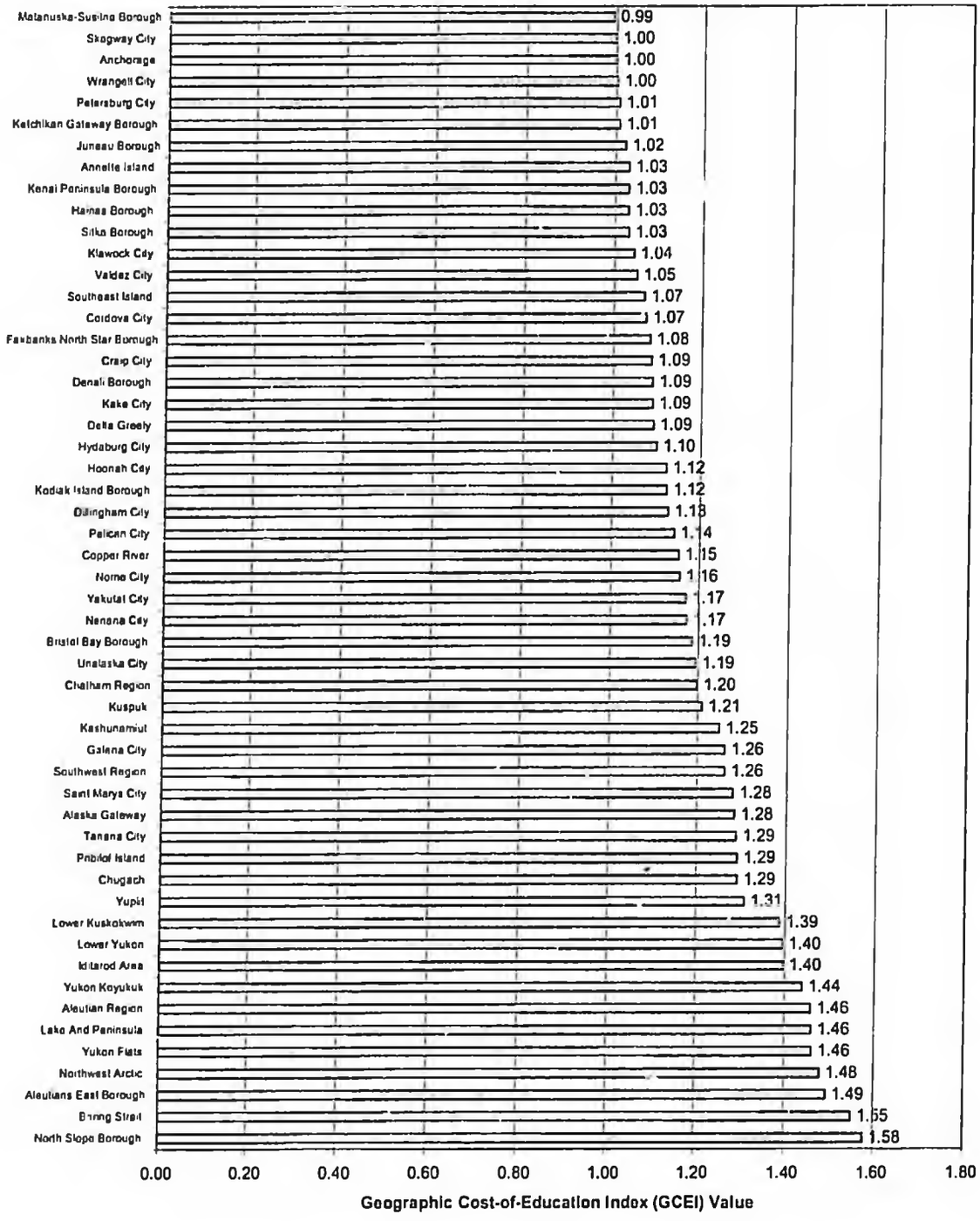
- personnel services
- energy services
- supplies, materials, and small capital items
- travel

The AIR research team collaborated closely with a group of eight school business officers representing a diverse sample of districts from across Alaska. These eight school business officers formed a Technical Working Group (subsequently referred to as the TWG) that provided feedback on components of the methodology for this analysis, assistance in the design of data collection instruments, and support in data collection efforts.

Overall Variations in Costs

Based on the study's analysis, the purchasing power of the educational dollar varies tremendously in the State of Alaska. The highest-cost district needs to spend about 1.6 times what the lowest cost district spends in order to provide comparable educational services. Using Anchorage School District as the benchmark (i.e., with a GCEI of 1.00), the analysis of costs reveals that the North Slope Borough School District exhibits the highest cost of education, with an index value of 1.58 (see exhibit). This means that this district needs to spend about 58 percent more than the Anchorage School District to provide comparable educational services to the students it serves. On the other end of the spectrum is the Matanuska-Susitna Borough School District, with an index value of 0.99. This means that this district needs to spend about 1 percent less than the Anchorage School District to provide comparable educational services.

A GCEI for Alaska School Districts



NOTES TO EXHIBIT: The districts listed on the vertical axis in this diagram are sorted in ascending order according to the value of the geographic cost-of-education index (GCEI), with the lowest on top.

Organizing the school districts by region reveals that the highest-cost districts in Alaska are located in the Far North (with average GCEIs of 1.38) and the Southwest (with average GCEIs of 1.31). The lowest-cost districts in the state are located in the Southeast (with an average GCEI of 1.07).

Differences between the values of the AIR GCEI and the current Alaska cost index for education may reflect a combination of methodology differences and changes in the costs of educational services since the last cost index was calculated. The largest differences are most likely attributable to methodological differences underlying the two studies' calculations.[1] The range, standard deviation, and mean values of the GCEI and the current Alaska cost index are quite similar. The AIR GCEI ranges from a low of 0.99 to a high of 1.58, while the range of the current Alaska cost adjustment is from 1.00 to 1.74. The standard deviation of the AIR GCEI is 0.17, and the standard deviation of the current adjustment is 0.21. Moreover, the correlation between the AIR GCEI and the Alaska cost index is 0.91, suggesting that the general patterns of variation in costs are quite similar between the AIR GCEI and the current Alaska cost index. More than 70 percent (38) of the districts exhibit a GCEI with less than a 0.10 difference from the current Alaska cost index. Forty-four percent (24) of the school districts in Alaska exhibit less than a 0.05 difference from the current Alaska cost index.

Personnel Cost Differences

Looking at the four major component indices reveals what one would expect. School personnel costs play a major role in explaining the variations in the overall costs of education across local school districts. The school personnel category accounts for a major portion of school district budgets, ranging in Alaska from 45 to 90 percent of total expenditures, with a median of 78 percent. AIR used econometric models of the school personnel labor market to provide a basis for simulations of the compensation levels that would be required if all districts employed *comparable* teachers, school administrators, and classified personnel. The key is comparability: what are the costs in different parts of the State of Alaska for school personnel with ***comparable*** levels of experience, education, and other demographic characteristics?

Using Anchorage as the basis for calculation of the index values (i.e., setting the Anchorage index to a value of 1.00), personnel costs range from a low of 0.93 in Southeast Island School District to a high of 1.28 in North Slope Borough School District. In other words, the highest-cost district pays, on average, about 28 percent more than Anchorage for comparable personnel, while the lowest-cost district pays about 7

[1] The actual values of the two indices are presented for purposes of comparison in Exhibit I-6 In Appendix I of the report entitled "*Alaska School District Cost Study: Volume II-The Technical Report.*"

percent less than Anchorage for comparable school personnel. Comparing these two districts to each other, North Slope pays 38 percent more than Southeast Island for comparable personnel.

Energy Cost Differences

A second component index, energy cost, is influenced by several factors. Alaska's significant climate variation across districts affects the consumption of fuels and energy required to provide heat to classrooms and school buildings. In addition, the degree of remoteness of each district affects the prices of these fuel and energy sources.

The study's approach to calculating energy costs relies on an engineering computer simulation model. This model requires the development of prototype buildings to permit estimation of the energy requirements to provide heating, cooling, and power for all aspects of school and district operations. Each prototype is associated with a specific climate parameter expressed in terms of heating degree-days. The estimated energy consumption levels necessary for the prototype buildings in different climatic zones are then combined with information on the unit energy prices at each school site throughout Alaska to estimate the cost of energy services.

The results of this analysis show a range of index values for the cost of energy services per square foot from 0.74 in the Juneau School District to 9.31 in the North Slope School District. Typically, the school districts with the highest index values are located within the very cold climate zone, largely represented by the Far North region. High costs in less cold districts can be attributed to the relative costs of energy sources faced by these districts.

Costs of Supplies, Materials, and Small Capital Items

The third component index, supplies, material, and capital equipment, is most influenced by geographic differences in shipping costs. The base prices of supplies purchased by districts in different parts of the state may vary to some extent because of volume purchasing, but this difference is small compared to the difference associated with the cost of transporting these items from the major centers of commerce to the remote areas of the state. The costs range from a low of 1.00 in Anchorage School District to a high of 6.81 in Pelican City School District.

In general, larger districts (i.e., districts with higher enrollment figures) tend to exhibit lower costs of goods. Larger districts are able to purchase items in bulk more easily than smaller districts. Another factor contributing to the lower index values for districts with greater enrollments is their proximity to the suppliers of these goods. These districts operate in or near Alaska's major centers of commerce. Transportation costs are

lower, and competition among suppliers in these centers of commerce drives down prices.

Travel Costs

The fourth component index is the cost of travel. Because of the remote locations of some schools and communities in Alaska, travel costs can have a significant impact on the expenditures necessary to operate schools in the state. The majority of the low-cost districts in this index are city school districts and districts located near Anchorage or in another relatively accessible area of the state. These districts tend to have very low costs associated with travel between the district office and the school(s) in the district. For those districts located near Anchorage, travel costs to Anchorage for statewide training tends to be a relatively low-cost item. Districts located close to a center of commerce enjoy low costs for maintenance service travel, resulting in lower cost index values in this travel input index.

Summary of Recommendations

AIR makes a number of recommendations regarding implementation of the GCEI:

- Adoption of the new GCEI presented in this report.
- Improvements and expansion of the personnel databases currently collected by ADEED.
- Adoption of new data collections on non-personnel items including energy fuels; supplies, materials, and capital items; and travel costs.
- Updating the GCEI every 3 to 5 years.
- Using a professional economist for the analysis of personnel costs.
- Phasing in the new index over time to avoid disrupting district budgets.

Table of Contents

Exhibits

I. Introduction

The purpose of this study is to develop an improved methodology for measuring differences in the cost of school resources across geographic locations within the State of Alaska. State policy makers in Alaska have long recognized the importance of adjusting state education aid for geographic cost differences and, for the past five years, have utilized a cost adjustment index derived from a study conducted by the McDowell Group (1998). The present study is intended to develop a geographic cost of education index (GCEI) that will replace the existing cost adjustment used by the State of Alaska and provide a more sophisticated approach to measuring cost differences. The application of such geographic cost adjustments in state aid is intended to equalize the purchasing power of the educational dollar across local school districts.

The costs of four major categories of school inputs are analyzed as part of this study:

- Personnel services
- Energy services
- Supplies, materials, and small capital items
- Travel (as it affects maintenance services, administrative oversight of school operations, district level meetings for professional staff, and statewide professional meetings)

With the exception of energy services, each of these categories includes subcategories of inputs for which separate cost indices were calculated. For example, the personnel service index is derived from separate indices for teachers, administrators and other professional staff, and classified staff. Each subcategory is weighted to reflect its relative importance within each school district's budget.

Combining these subcategories into larger indices requires a technique developed by economists to take into account the substitution between inputs that occurs in response to relative differences in the prices of the inputs across districts.[2] Using this technique, the calculation of the GCEI value for a district 'j' weights each component cost index by the average of the budget share allocated to this input by the district 'j' and the Anchorage School District. This weight will subsequently be referred to as the budget share weight.[3] This weighting allows the overall GCEI to reflect the relative amount of a district's budget allocated to each input.

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[2] For example, as the cost of using external skilled maintenance workers increases relative to the cost of internal maintenance workers (classified employees), one would expect districts to use internal employees more often to maintain the quality and level of services.

[3] This technique is referred to as a ***superlative*** or true cost index. For a more technical discussion, the reader is referred to the work of Diewert (1976) and Caves, Christensen, and Diewert (1982). The budget share weight for input 'i' in district 'j' is defined by $(1/2) \cdot [S_{ij} + S_{iA}]$ where S_{ij} = the budget share of input 'i' in district 'j' and S_{iA} is the budget share for input 'i' in Anchorage (i.e., district 'A').

The following is an overview of the study's analysis and its results. A more detailed description of the methodology and the assumptions underlying this analysis may be found in a separate document entitled "*Alaska School District Cost Study, Volume II-The Technical Report*" (subsequently referred to as the *Technical Report*).

The AIR research team worked in close collaboration with a group of eight school business officers representing a diverse sample of districts from across Alaska. These eight school business officers formed a Technical Working Group (subsequently referred to as the TWG) that provided feedback on components of the methodology for this analysis, assistance in the design of data collection instruments, and support in data collection efforts.

Limitations to the Scope of the Present Study

It is important to point out what this study does do and what it does *not* do. The study develops a cost adjustment index that reflects the variations in the prices paid for comparable school inputs in different geographic locations in the state. However, this study does ***not*** address cost differences associated with pupil needs, nor does it address other factors related to the scale and concentration of district operations. For example, it does not address differences in the levels of staff and other non-personnel resources required to meet the different needs of students who are from disadvantaged backgrounds, students who are English language learners, or students with physical or mental disabilities. In addition, this study does not address the different administrative staffing requirements that may be associated with operating school districts in remote and sparsely populated regions of the state. While the study does address the differential costs of personnel travel within large remote school districts and does address the costs of transporting goods within these remote locations, it does not address the increased need for staff that may be required to provide necessary administrative and support services.[4]

Overview of the Report

Section II presents an overview of the results of the study, focusing on the range of costs represented by the GCEI. Sections III through VI describe the methodology and the results of the analysis for each of the four categories of inputs (personnel, energy, supplies and equipment, and travel). Section VII describes the procedure for assigning the budget weights and the calculation

[4] These additional cost factors related to the measurement of pupil needs and the costs of operating districts in sparsely populated and remote regions of the state must be addressed through more comprehensive studies designed to estimate the costs of providing adequate educational services in Alaska. The previous work done by Chambers and Parrish (1984) represents one model for conducting these kinds of studies, while a newer proposal for costing out an adequate education in New York State prepared by Chambers, Smith, Parrish, and Guthrie (2002) provides an even more comprehensive and more up-to-date approach to addressing these complex issues. The newer methodology for measuring adequacy in education focuses more attention on the relationship between outcome standards for students and the levels of resources necessary to achieve those standards.

of the GCEI. Section VIII discusses implementation issues and issues related to the utilization and updating of the GCEI.

II. Overview of the GCEI

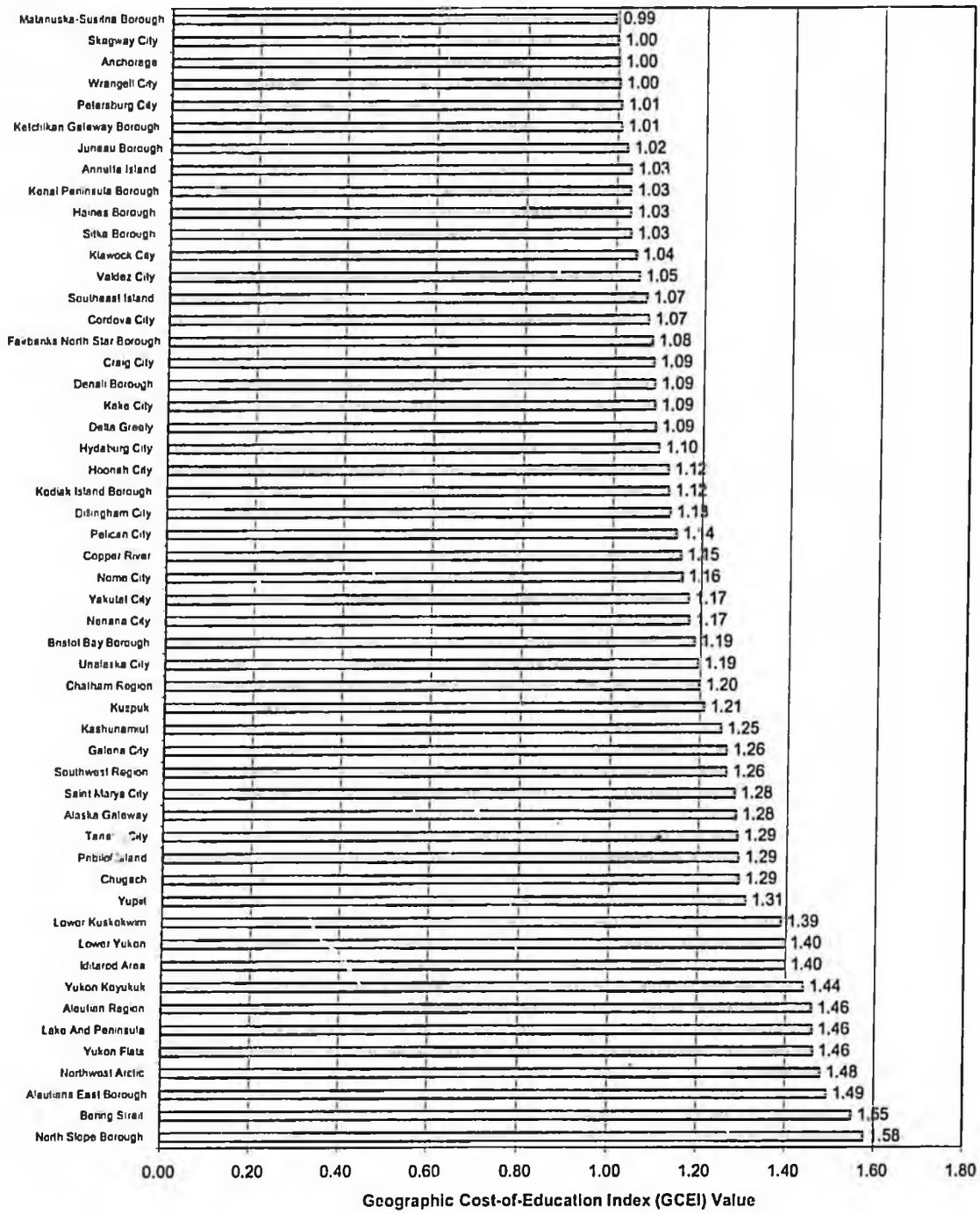
Based on the study's analysis, the purchasing power of the educational dollar varies tremendously in the State of Alaska. The highest-cost district needs to spend about 1.6 times what the lowest cost district spends in order to provide comparable educational services.

Another way to understand these variations is to select a benchmark district to which all districts can be compared. Following the conventional approach that has been used in Alaska for these kinds of studies, we use Anchorage, the largest and most urbanized district in the state, as the benchmark.[5] Thus, the value for the GCEI in Anchorage has been arbitrarily set at 1.00. Using Anchorage as the base, the analysis of costs reveals that the North Slope Borough School District exhibits the highest cost of education, with an index value of 1.58 (Exhibit II-1). This means that this district needs to spend about 58 percent more than the Anchorage School District to provide comparable educational services to the students it serves.

On the other end of the spectrum is the Matanuska-Susitna Borough School District, with an index value of 0.99. This means that Matanuska-Susitna needs to spend about 1 percent less than the Anchorage School District to provide comparable educational services.

[5] In most studies, the district attended by the average student is used as the benchmark school district. This is so that the GCEI, when applied to state aid allocations, will have no impact on the overall amount of aid to be allocated. That is, the GCEI would be neutral with respect to the total allocation of state education aid. In these situations, the district attended by the average student, which is in actuality a fictitious district that has been created purely for statistical purposes, is assigned a GCEI value of 1.00. In the case of Alaska, state policy makers have chosen to scale everything to Anchorage, which is far and away the largest school district in the state.

Exhibit II-1. A GCEI for Alaska School Districts



NOTES TO EXHIBIT: The districts listed on the vertical axis in this diagram are sorted in ascending order according to the value of the geographic cost-of-education index (GCEI), with the lowest on top.

Organizing the school districts by region (Exhibit II-2) reveals that the highest-cost districts in Alaska are located in the Far North (with average GCEIs of 1.38) and the Southwest (with average GCEIs of 1.31). The lowest-cost districts in the state are located in the Southeast. As discussed later in this report, the factor behind these numbers appears to be the impact of the degree of districts' remoteness on personnel salaries, transportation costs for goods and services, and travel costs for district staff. In addition, climatic factors have a significant impact on the cost of energy services. The attractiveness of living in the urban centers of Alaska in terms of access to shopping, medical services, and other cultural amenities clearly plays a role in personnel costs.

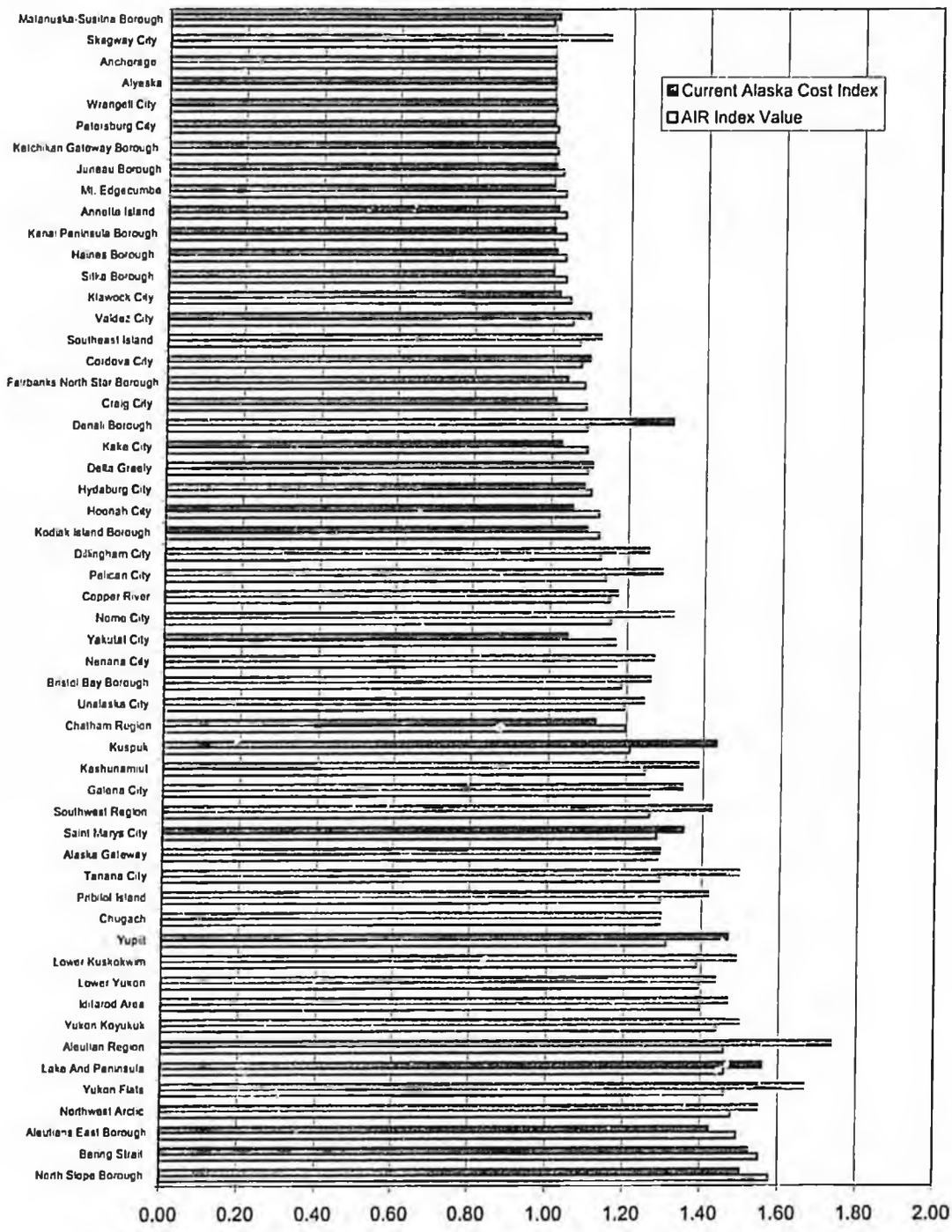
Exhibit II-2. Variations in the Geographic Cost of Education Index by Region

Region	Number of Districts	Mean	Standard Deviation	Minimum	Maximum
Statewide	53	1.20	0.17	0.99	1.58
Far North	10	1.38	0.15	1.16	1.58
Interior	3	1.09	0.00	1.08	1.09
South Central	9	1.11	0.11	0.99	1.29
Southeast	17	1.07	0.06	1.00	1.20
Southwest	14	1.31	0.11	1.13	1.49

Exhibit II-3 compares the GCEI derived from this study with the education cost adjustment that is the current law in Alaska. Districts are in ascending order according to the AIR GCEI calculated in the present study. Differences between these cost index values may reflect a combination of methodology differences and changes in the costs of educational services since the last cost index was calculated. The largest differences are most likely attributable to methodological differences underlying the two studies' calculations.[6] The range, standard deviation, and mean values of the GCEI and the current Alaska cost index are quite similar. The AIR GCEI ranges from a low of 0.99 to a high of 1.58, while the range of the current Alaska cost adjustment is from 1.00 to 1.74. The standard deviation of the AIR GCEI is 0.17, and the standard deviation of the current adjustment is 0.21. Moreover, the correlation between the AIR GCEI and the Alaska cost index is 0.91.

[6] The actual values of the two indices are presented for purposes of comparison in Exhibit I-6 In Appendix I of this report.

Exhibit II-3. Current Alaska Index Compared to the AIR GCEI



However, there are a number of districts that exhibit significant differences between the two index values. Nine districts exhibit a difference of 0.15 or more (positive or negative) and 17 districts exhibit a difference of 0.10 or more. A difference of 0.01 means a one-percent difference relative to the benchmark district of Anchorage. For example, the Aleutian Region district exhibits a GCEI of 1.46, while the current Alaska cost index is 1.74, a difference of 0.28. In addition, the Denali Borough, Kuspuk, Nome City, Pelican City, Southwest Region, Tanana City, Yukon Flats, and Yupiit School Districts exhibit GCEI values that differ by 0.15 or more from the current values.

On the other hand, slightly more than 70 percent (38) of the districts exhibit a GCEI with a less than 0.10 difference from the current Alaska cost index. Forty-four percent (24) of the school districts in Alaska exhibit less than a 0.05 difference from the current Alaska cost index.

The next few sections present separate discussions of the four major components of the overall GCEI.

III. Personnel Costs

The Methodology

Because expenditures on school personnel dominate school district budgets, previous research on geographic cost differences in education has focused on analysis of labor markets for school personnel.[7] This has led to a growing recognition among education policy makers nationwide that districts in different parts of a state face different conditions in local labor markets, and that these conditions impact the ability of local school districts to recruit and employ comparable school personnel.

Many schools in Alaska are located in remote regions of the state, creating challenges in recruiting and employing professional school personnel. Costs of living are higher in the remote regions of the state because the cost of transporting consumer goods and services to these communities results in higher prices. In addition, access to cultural amenities and to shopping and medical facilities is more difficult in remote communities than it is in more urban areas such as Anchorage or Fairbanks. The degree of isolation can be significant, particularly during winter months, because of the time required to reach the more urban centers of the state. All of these factors impact the compensation (salaries and benefits) that must be paid to attract comparable school personnel.

This study addresses these personnel cost differences through sophisticated econometric models of the labor market for school personnel. The study goes beyond simply using average

[7] For a summary of the early work done on this topic see Chambers (1981a).

wages or annual salaries; the analysis starts by examining all of the factors that are associated with variations in school personnel. For example, the econometric model includes personal characteristics, characteristics of job assignments, and characteristics of the schools, districts and regions in which school personnel live and work. Because of differences in the labor markets for subcategories of personnel, separate statistical analyses were conducted for teachers, school administrators, and classified personnel.

These econometric labor market models for school personnel then provide the basis for a series of simulations of the compensation levels that would be required if all districts employed *comparable* teachers, school administrators, and classified personnel. The key is comparability: what are the costs in different parts of the State of Alaska for school personnel with ***comparable*** levels of experience, education, and other demographic characteristics?

The Results

As one would expect, school personnel costs play a major role in explaining the variations in the overall costs of education across local school districts. The school personnel category accounts for a major portion of school district budgets, ranging in Alaska from 45 to 90 percent of total expenditures, with a median of 78 percent.

Exhibit III-1 shows the personnel cost differences among Alaska's school districts. This graph displays the district personnel index values, with the lowest at the top and the highest at the bottom. Using Anchorage as the basis for calculation of the index values (i.e., setting the Anchorage index to a value of 1.00), personnel costs range from a low of 0.93 in Southeast Island School District to a high of 1.28 in North Slope Borough School District. In other words, the highest-cost district pays, on average, about 28 percent more than Anchorage for comparable personnel, while the lowest-cost district pays about 7 percent less than Anchorage for comparable school personnel. Comparing these two districts to each other, North Slope pays 38 percent more than Southeast Island for comparable personnel.

Exhibit III-1: Personnel Cost Index

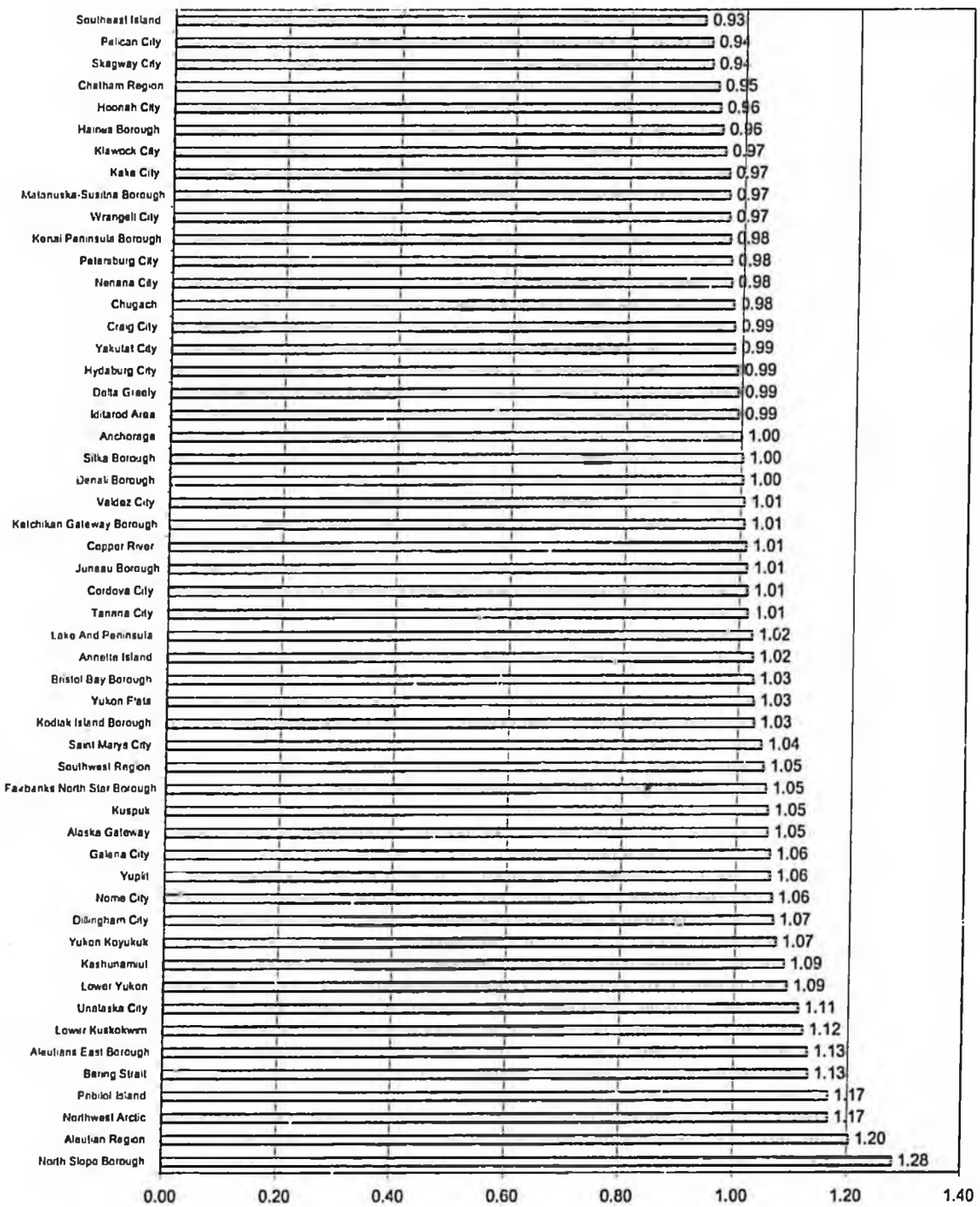


Exhibit III-2 displays the descriptive statistics associated with the personnel cost differences for various regions of the state. School districts located in the Southwest and Far North regions of the state exhibited the highest average costs while the districts located in the Southeast were among the lowest-cost districts in the state. In terms of distance from the nearest center of commerce, personnel costs generally were higher for the districts furthest (500 miles or more) from a major center of commerce, with an average index of 1.16 (16 percent above Anchorage).

Exhibit III-2. Descriptive Statistics for Personnel Cost Indices By Region[8]

District Characteristics	N	Mean	Standard Deviation	Minimum	Maximum
Region of the state					
Statewide	53	1.03	0.07	0.93	1.28
Far North	10	1.08	0.09	0.98	1.28
Interior	3	1.02	0.03	0.99	1.05
South Central	9	1.01	0.03	0.97	1.05
Southeast	17	0.98	0.03	0.93	1.02
Southwest	14	1.09	0.05	1.02	1.20
Distance from the nearest center of commerce*					
Statewide	53	1.03	0.07	0.93	1.28
Less than 10 miles	6	1.00	0.04	0.93	1.05
At least 10 miles	4	0.99	0.03	0.96	1.02
At least 50 miles	12	0.97	0.02	0.94	1.00
At least 100 miles	23	1.04	0.04	0.98	1.12
At least 500 miles	8	1.16	0.07	1.06	1.28

*The centers of commerce used for this analysis include Anchorage, Fairbanks, Juneau, Ketchikan, and Kodiak

IV. Costs of Energy Services

The Methodology

There are several factors that influence each district's energy costs. Alaska's significant climate variation across districts affects the consumption of fuels and energy required to provide heat to classrooms and school buildings. In addition, the degree of remoteness of each district

[8] Data sources: Teacher data from regression analysis for teacher salaries and benefits. Administrator data from tobit model for administrators. Classified personnel data from regression analysis for classified personnel salaries.

affects the prices of these fuel and energy sources. Also, some districts may operate older school buildings that require more fuel or energy to maintain similar comfort levels within classrooms.

The study's approach to calculating energy costs relies on an engineering computer simulation model. This model requires the development of prototype buildings to permit estimation of the energy requirements to provide heating, cooling, and power for all aspects of school and district operations. The AIR research team (including SBW Consulting engineers) consulted with officials in the Alaska Department of Early Education and Development (ADEED), the TWG, and the Anchorage School District to develop a series of prototype school buildings. Each prototype building encompasses a set of structural and operational characteristics of school buildings including square footage; the allocation of square footage among end uses (classroom and office space); the levels of insulation in the walls and ceilings; the heating, ventilation, and air conditioning systems; the lighting and equipment power densities; and the hours of operation. In addition, each prototype is associated with a specific climate parameter expressed in terms of heating degree-days.

The parameters that define each prototype are entered into an engineering simulation model to estimate the energy consumption levels required in the different climatic regions of the state. Part of this model also simulates the different efficiency levels of alternative sources of energy such as natural gas, electricity, fuel oil, wood, and liquid propane. The results of these prototype simulations serve as points from which equations are calculated to capture each school's individualized projected energy consumption, given its specific heating degree-days and fuel type used for each end use.

Finally, the estimated energy consumption levels necessary for the prototype buildings in different climatic zones are combined with information on the unit energy prices at each school site throughout Alaska to estimate the cost of energy services. With the assistance of the TWG, the AIR research team collected data on these price levels for each school site from the school district offices. Energy costs were calculated at the school building level and aggregated to the district level using the square footage of school buildings at each site as weights.

The Results

The results of this analysis (Exhibit IV-1) show a range of index values for the cost of energy services per square foot from 0.74 in the Juneau School District to 9.31 in the North Slope School District. Typically, the school districts with the highest index values are located within the very cold climate zone, largely represented by the Far North region. High costs in less cold districts can be attributed to the relative costs of energy sources faced by these districts. For example, energy prices per BTU (*British Thermal Unit*) within the Bristol Bay School District

were second only to the North Slope Borough School District.[9] This resulted in a relatively high index value for Bristol Bay that was not caused by climate. For the North Slope Borough School District, it is clear that the combination of an extremely cold climate and the highest energy costs give this district the highest index value. It is likely that a significant component of these differences in energy prices can be attributed to variations in the cost of transporting fuels to the different school sites.

Located near the Bristol Bay School District is the Dillingham City School District. Unlike its neighbor, Dillingham has a low energy cost index value. While Dillingham is still in a high-cost area for energy prices, schools in the Dillingham School District generate their own electricity and use the waste heat to heat their schools, thereby saving a substantial amount of money. This is also reflected in their assigned budget weight for energy, which is among the lowest in the state at 6 percent of the total operating fund.

[9] A recent report entitled "Bristol Bay, Alaska, Comprehensive Economic Development Strategy" highlights the high cost of energy in the region and can be found on the Department of Commerce and Economic Development website at: http://www.dced.state.ak.us/cbd/oedp/pubs/BBNA_CEDS2002.pdf

Exhibit IV-1. Energy Cost Index

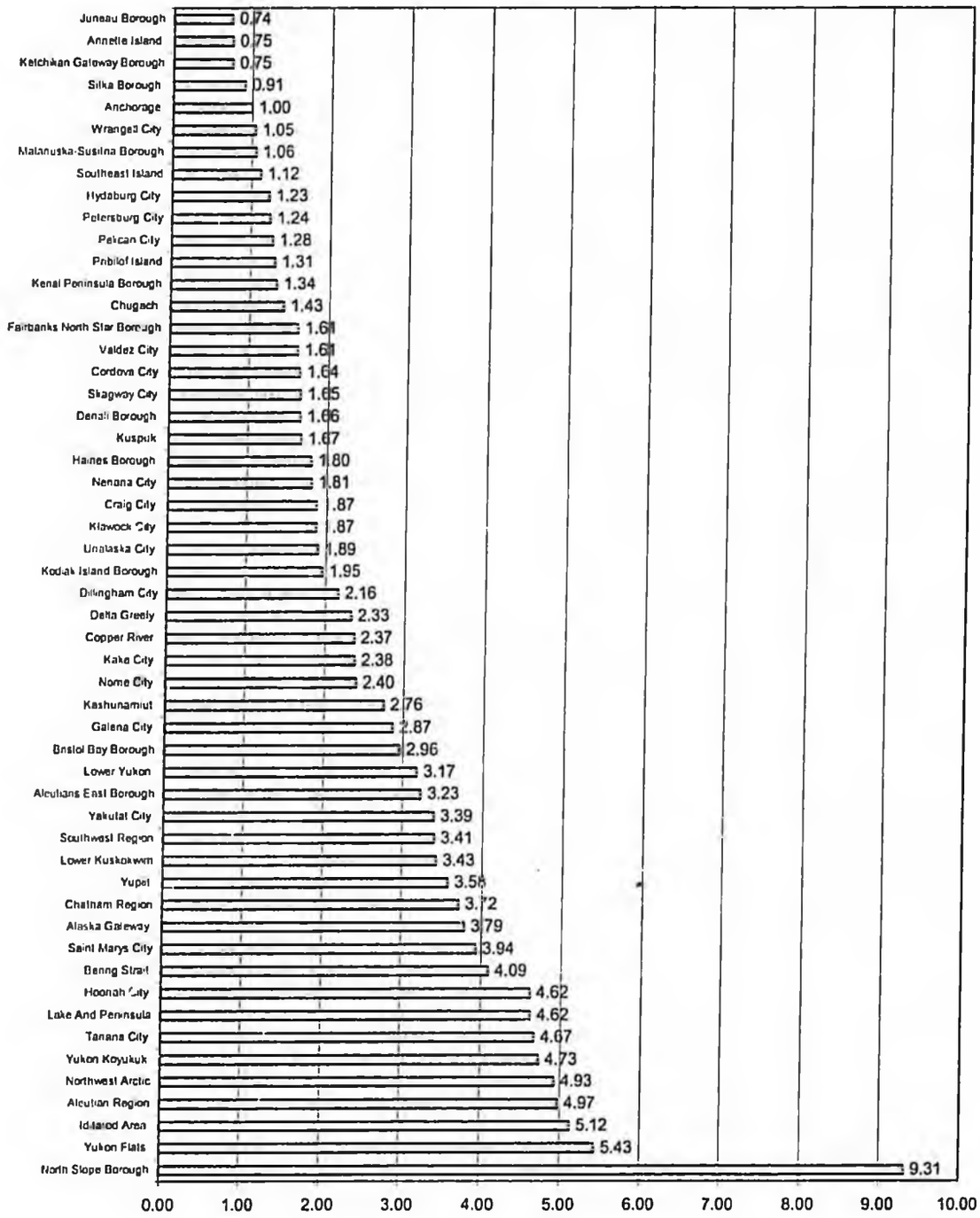


Exhibit IV-2 reveals that geographic location plays a significant role in the energy index values. Those districts located in the Far North region typically face a climate harsher than the rest of the state, and the cost of transporting fuel supplies here can also be much higher. Outside

of the Far North region, the highest-cost districts tend to be in the Southwest region, where they may also face high costs for transportation of fuel. Schools located in the Far North region tend to have more efficiently insulated school buildings than school districts in other regions, but the fact remains that they face higher costs to heat their buildings.

Exhibit IV-2. Comparison of Energy Index Values by Region

Region	N	Mean	Standard Deviation	Minimum	Maximum
Statewide	53	2.65	1.64	0.74	9.31
Far North	10	4.54	2.09	1.81	9.31
Interior	3	1.87	0.40	1.61	2.33
South Central	9	1.80	0.86	1.00	3.79
Southeast	17	1.79	1.13	0.74	4.62
Southwest	14	3.08	1.06	1.31	4.97

V. Costs of Supplies, Materials and Small Capital Items

The Methodology

Shipping cost is the major factor underlying cost differences in supplies, materials, and capital equipment across local schools and districts in Alaska. The base prices of supplies purchased by districts in different parts of the state may vary to some extent because of volume purchasing, but this difference is small compared to the difference associated with the cost of transporting these items from the major centers of commerce to the remote areas of the state. After extensive deliberations between the TWG and the AIR research team, a limited set of items was selected to represent the purchases of school districts. This set of items reflects the impact of transportation costs on the final prices paid.

The index developed for this portion of the GCEI is based on variations in the prices paid across the state for one case (10 reams) of white copier paper (8.5" by 11") and one 4' by 5' windowpane. AIR obtained this price information with a district questionnaire that requested information for each of the schools within the district. The total cost of the items reflects not only the cost of the item itself, but also the shipping and storage costs incurred for delivery of the item to the specific school site. The ream of copier paper was chosen as a proxy for instructional supplies, such as textbooks, and also for office supplies consumed by administrators. The windowpane represents the cost of bulky items that would commonly be purchased out of capital outlay expenditures. For districts located in the Far North region, this was usually a triple-paned

window, while schools in less harsh climates more often purchased single- or double-paned windows.

The district questionnaire took into account the fact that using only one method of transportation is not feasible for some districts. For example, districts located above the Bering Strait will not always be able to ship goods by barge. The questionnaire asked for the percentage of time an alternative shipping method was utilized for each school site. All calculations were made at the school level and then aggregated to the district level by pupil enrollment weights.

The Results

Exhibit V-1 displays the aggregate cost index for supplies, materials, and small equipment items. The districts are sorted in order from lowest to highest cost. The costs range from a low of 1.00 in Anchorage School District to a high of 6.81 in Pelican City School District.

Exhibit V-2 shows the relationship between the cost of goods and district size (measured by enrollment). In general, larger districts tend to exhibit lower costs of goods. Larger districts are able to purchase items in bulk more easily than smaller districts. Another factor contributing to the lower index values for districts with greater enrollments is their proximity to the suppliers of these goods. These districts operate in or near Alaska's major centers of commerce. Transportation costs are lower, and competition among suppliers in these centers of commerce drives down prices.

These trends do not hold true for all districts. Chugach and Chatham School Districts are relatively close to Anchorage and Juneau, respectively. However, they have index values above the average value in this input category. Both districts reported high transportation costs, as did Pelican City School District. All reported prices of goods were verified for accuracy with the respondent by the data collectors at AIR and by representatives from ALASBO. Any corrections necessary were made, and the remaining data have been deemed accurate.

Exhibit V-1: Index for the Cost of Supplies, Materials, and Small Capital Equipment

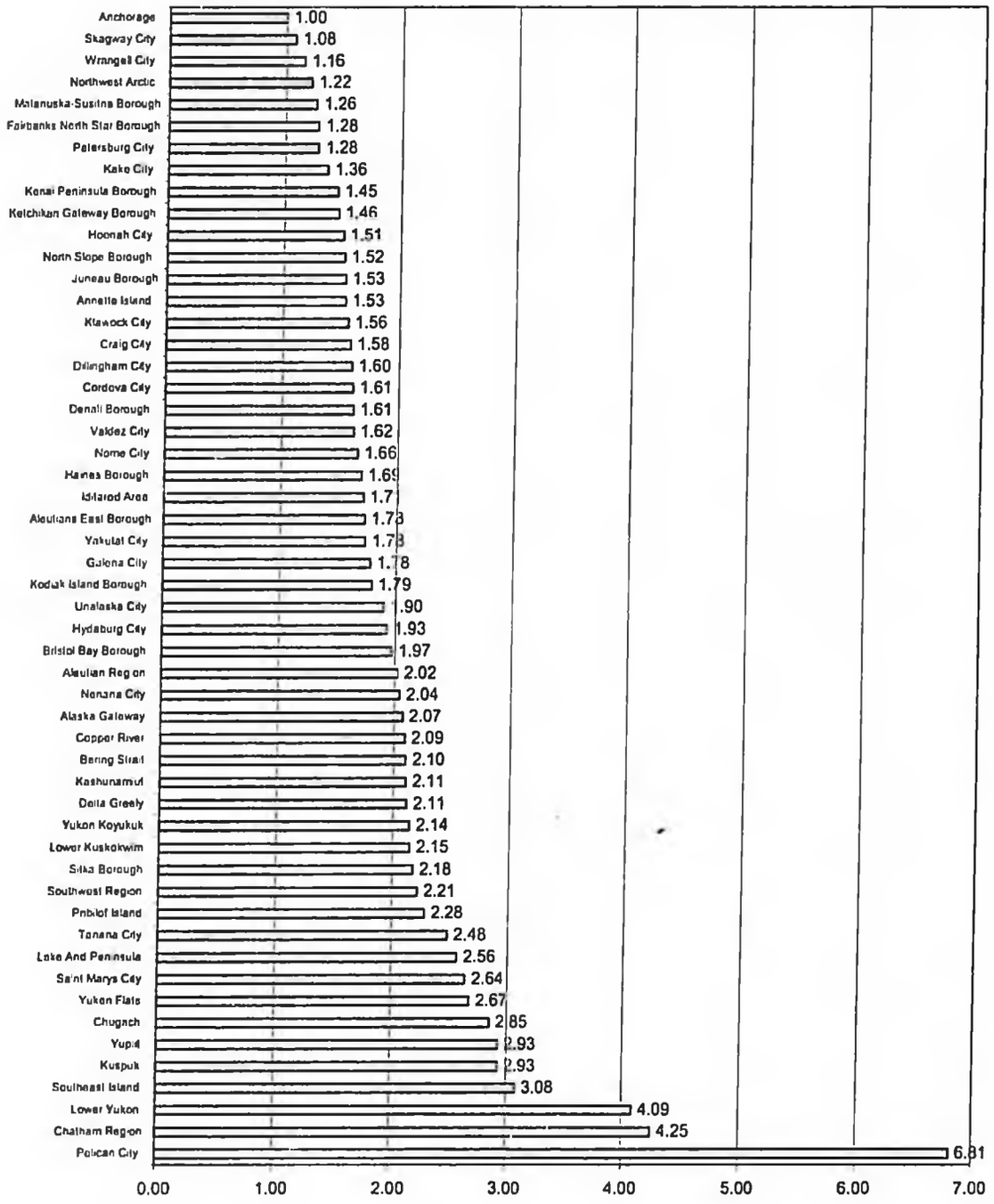


Exhibit V-2. Comparison of Total Goods Index Values by District Enrollment

Region	N	Mean	Standard Deviation	Minimum	Maximum
Statewide	53	2.05	0.94	1.00	6.81
0 to <250	13	2.50	1.53	1.08	6.81
250-999	25	1.98	0.52	1.16	3.08
1000-2499	6	2.19	1.00	1.22	4.09
2500-9999	6	1.69	0.27	1.46	2.15
10,000+	3	1.18	0.16	1.00	1.28

VI. Costs of Travel

The Methodology

Because of the remote locations of some schools and communities in Alaska, travel costs can have a significant impact on the expenditures necessary to operate schools in the state. Travel cost affect the cost of maintenance services, itinerant instructional services, professional development activities, administrative oversight of school activities, and statewide meetings for professional staff. The distances of the district offices from the centers of trade impact access to skilled maintenance personnel and technicians.

With the advice of the TWG, the AIR research team estimated the cost of a specified service call by a skilled technician. The cost included the amount of time for the call (16 hours), the cost of the time required to travel to the school site, and the cost of transportation, lodging (where necessary), and meals. The rate for the service technician was based on the Anchorage rate adjusted to the nearest center of trade. For schools located in a center of trade, there was generally no cost associated with travel time. The cost of transportation was based on the mode of transportation most commonly used between the school site and the corresponding center of trade (i.e., airfare for air travel, or mileage reimbursement for automotive travel). Lodging and meals were set at $150 per day.

Travel costs associated with itinerant services and other services necessitating trips between the district office and the school site were estimated based on the appropriate mode of transportation and whether or not such travel was commonly associated with an overnight stay (common in some remote locations because of limited schedules of carriers). The data on the modes of transportation and the common airfares paid for travel were gathered through the questionnaires administered during the data collection process. Similarly, travel for statewide

meetings was based on the cost of transportation, lodging, and meals for a trip to Anchorage from each of the school sites.

All travel costs and the costs of the maintenance services were assigned to the school site and aggregated to the district level based on the relative enrollment of the school. The three subcomponents of travel were aggregated into a single index for travel using the appropriate budget share weights described earlier.

The Results

The majority of the low-cost districts in this index are city school districts and districts located near Anchorage or in another relatively accessible area of the state. These districts tend to have very low costs associated with travel between the district office and the school(s) in the district. For those districts located near Anchorage, travel costs to Anchorage for statewide training tends to be a relatively low-cost item.

Districts located close to a center of commerce enjoy low costs for maintenance service travel, resulting in lower cost index values in this travel input index. This is evidenced in Exhibit VII-2, as there is a general trend of higher index values associated with travel in the more remote districts of the state.

Exhibit VII-3 reveals that districts in the middle ranges of enrollment (i.e., between 1,000 to 2,499 students) have the highest costs of travel relative to smaller or larger districts. This can be confirmed intuitively: districts with the highest enrollment numbers are located in areas where they have easier access to travel and readily available maintenance services, combined with a concentration of schools near the district office. Districts comprising the lowest enrollment category tend to be city school districts, making travel cost between schools and the district office almost negligible. However, the average travel index value for these schools is higher than for the largest district enrollment category. Since some small districts are in remote areas of the state, they will have higher travel index values associated with them. Districts with mid-range enrollments usually span a large area and can be in very remote areas of the state, thus generating higher index values for the districts in these categories.

Exhibit VI-1. Index for the Cost of Travel

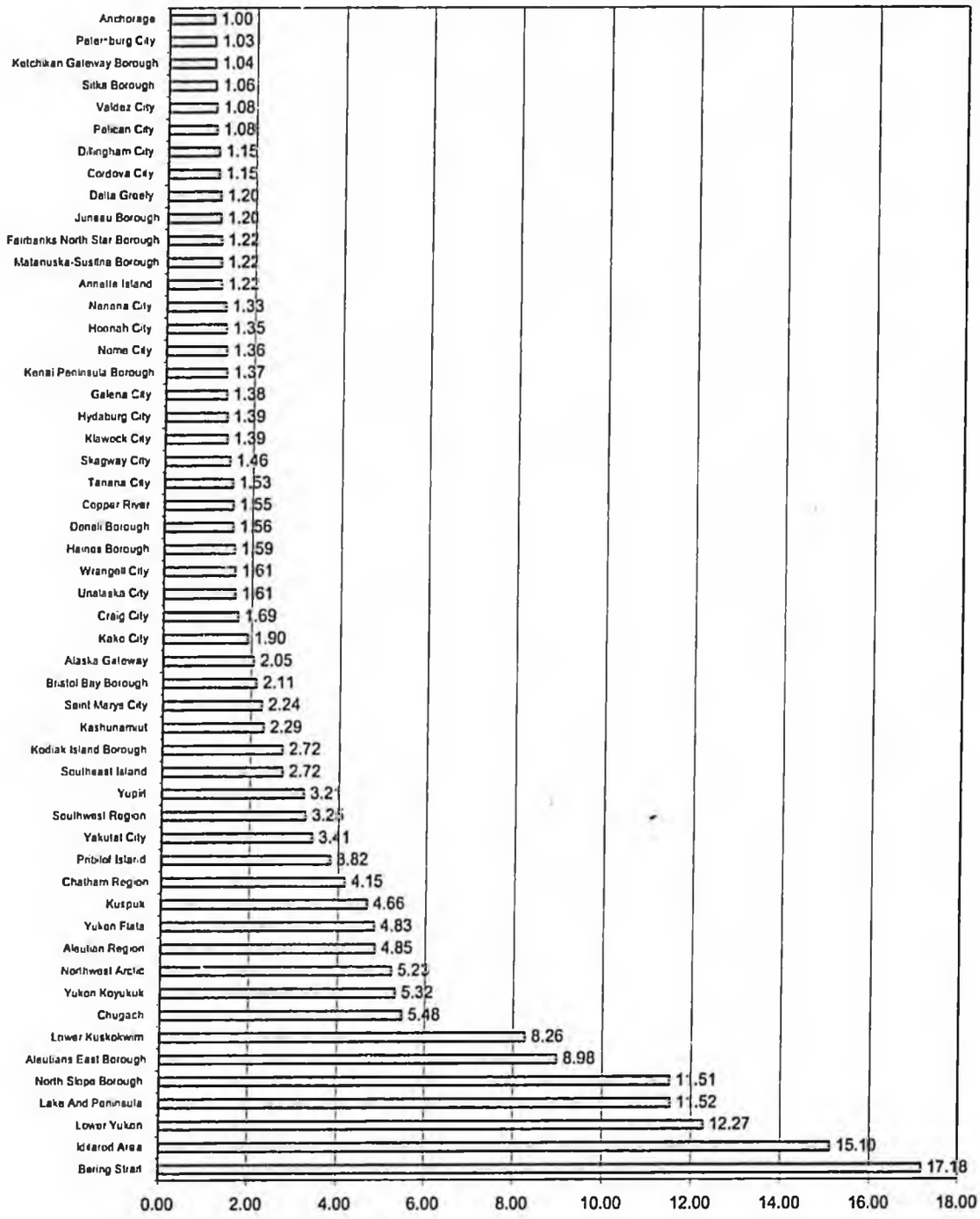


Exhibit VI-2. Comparison of Total Travel Index Values by Distance

Region	N	Mean	Standard Deviation	Minimum	Maximum
Statewide	53	3.51	3.78	1.00	17.18
Less than 10 miles	6	1.42	0.65	1.00	2.72
At least 10 miles	4	1.29	0.09	1.22	1.39
At least 50 miles	12	2.01	1.36	1.06	5.48
At least 100 miles	23	4.06	3.96	1.03	15.10
At least 500 miles	8	6.82	5.43	1.36	17.18

Exhibit VI-3. Comparison of Total Travel Index Values by District Enrollment

Region	N	Mean	Standard Deviation	Minimum	Maximum
Statewide	53	3.51	3.78	1.00	17.18
0 to <250	13	2.62	1.52	1.08	5.48
250-999	25	3.35	3.54	1.03	15.10
1000-2499	6	8.10	6.56	1.06	17.18
2500-9999	6	2.66	2.81	1.04	8.26
10,000+	3	1.14	0.13	1.00	1.22

VII. Overall Geographic Cost of Education Index

This project has undertaken a comprehensive analysis to address the various factors that affect the ability of districts in Alaska to access comparable school resources in the different regions of the state. The end product is a geographic cost-of-education index (GCEI), which addresses the following question:

> *How much more or less does it cost to recruit and employ comparable school personnel (i.e., teachers, administrators, and classified personnel); and to pay for comparable energy services (i.e., heating, lighting and power); comparable supplies, materials, and small capital equipment; and travel costs as they affect maintenance and operations, itinerant services, professional development, administrative oversight, and statewide professional meetings in different geographic locations around the state?*

The GCEI is a cost adjustment index that permits translation of nominal dollar values into *real* dollars of purchasing power for school resources and services. It can be used to provide equal purchasing power by adjusting funding levels for individual school districts.

Determination of Budget Shares and Application of the Index Values

To calculate the GCEI, the AIR research team first needed to estimate the budget shares allocated by each district for each of the inputs. AIR utilized audited budget data provided by the ADEED. The budget shares were calculated based on the "operating budget" reported in the audited budget files. The operating budget data are organized into a matrix by function and object of expenditure. The assignment of each function and object cell in the budget matrix is presented in the *Technical Report* for this project. Once the budget cells were assigned to a component cost index, AIR calculated the index values for the four categories of inputs: personnel, energy, goods, and travel. A final overall GCEI was then calculated using the aggregate budget shares for each of these four categories of inputs. Exhibit VII-1 shows how each of the index values for the four major categories of inputs contributes to the overall GCEI. This exhibit reflects the overall contribution of each of the four input categories based on two elements: (a) the *relative costs* (i.e., reflected by the component geographic cost index) and (b) the *relative budget weights* (i.e., each district's budget share averaged with that of Anchorage for each input category). To arrive at the overall GCEI, one needs simply to multiply the four input category values in the exhibit together.

EXHIBIT VII-1(a). GCEI Values and the Relative Impact of the Four Component Indices

District Name	GCEI	Personnel Contribution	Energy Contribution	Travel Contribution	Goods Contribution
Alaska Gateway	1.28	1.04	1.15	1.03	1.04
Aleutian Region	1.46	1.16	1.08	1.11	1.06
Aleutians East Borough	1.49	1.10	1.08	1.23	1.03
Anchorage	1.00	1.00	1.00	1.00	1.00
Annette Island	1.03	1.02	0.98	1.01	1.02
Bering Strait	1.55	1.10	1.12	1.22	1.04
Bristol Bay Borough	1.19	1.02	1.08	1.05	1.02
Chatham Region	1.20	0.96	1.10	1.07	1.06
Chugach	1.29	0.99	1.03	1.16	1.10
Copper River	1.15	1.01	1.05	1.02	1.06
Cordova City	1.07	1.01	1.03	1.01	1.02
Craig City	1.09	0.99	1.03	1.05	1.02
Delta Greely	1.09	0.99	1.05	1.01	1.03
Denali Borough	1.09	1.00	1.04	1.02	1.03
Dillingham City	1.13	1.05	1.04	1.01	1.02
Fairbanks North Star Borough	1.08	1.04	1.02	1.01	1.01
Galena City	1.26	1.04	1.08	1.02	1.11
Haines Borough	1.03	0.97	1.03	1.01	1.02
Hoonah City	1.12	0.96	1.12	1.02	1.02
Hydaburg City	1.10	0.99	1.01	1.02	1.07
Iditarod Area	1.40	0.99	1.19	1.14	1.03
Juneau Borough	1.02	1.01	0.99	1.01	1.02
Kake City	1.09	0.98	1.06	1.04	1.01
Kashunamiut	1.25	1.07	1.06	1.04	1.06
Kenai Peninsula Borough	1.03	0.98	1.01	1.02	1.02
Ketchikan Gateway Borough	1.01	1.01	0.98	1.00	1.02
Klawock City	1.04	0.97	1.04	1.01	1.02
Kodiak Island Borough	1.12	1.02	1.04	1.03	1.03
Kuspuk	1.21	1.05	1.04	1.06	1.05
Lake And Peninsula	1.46	1.02	1.17	1.16	1.06
Lower Kuskokwim	1.39	1.10	1.09	1.12	1.04
Lower Yukon	1.40	1.08	1.09	1.12	1.06
Matanuska-Susitna Borough	0.99	0.98	1.00	1.01	1.01
Nenana City	1.17	0.99	1.03	1.01	1.14
Nome City	1.16	1.05	1.06	1.01	1.02
North Slope Borough	1.58	1.23	1.15	1.09	1.02
Northwest Arctic	1.48	1.13	1.16	1.12	1.01
Pelican City	1.14	0.95	1.01	1.00	1.18
Petersburg City	1.01	0.98	1.02	1.00	1.01
Pribilof Island	1.29	1.13	1.02	1.07	1.05
Saint Marys City	1.28	1.03	1.10	1.04	1.08
Sitka Borough	1.03	1.00	1.00	1.00	1.03
Skagway City	1.00	0.95	1.03	1.01	1.01
Southeast Island	1.07	0.94	1.01	1.07	1.06
Southwest Region	1.26	1.04	1.08	1.06	1.06
Tanana City	1.29	1.01	1.20	1.01	1.04
Unalaska City	1.19	1.09	1.04	1.02	1.03
Valdez City	1.05	1.01	1.03	1.00	1.02
Wrangell City	1.00	0.98	1.00	1.02	1.01
Yakutat City	1.17	0.99	1.09	1.06	1.03
Yukon Flats	1.46	1.02	1.26	1.08	1.06
Yukon Koyukuk	1.44	1.06	1.18	1.11	1.04
Yupiit	1.31	1.05	1.07	1.08	1.08

EXHIBIT VII-1(b). GCEI Values and the Budget Weights of the Four Component Indices

District Name	GCEI	Personnel Budget Weight	Energy Budget Weight	Travel Budget Weight	Goods Budget Weight
Alaska Gateway	1.28	0.81	0.04	0.11	0.05
Aleutian Region	1.46	0.79	0.06	0.05	0.08
Aleutians East Borough	1.49	0.79	0.08	0.07	0.05
Anchorage	1.00	0.87	0.04	0.04	0.05
Annette Island	1.03	0.85	0.05	0.06	0.04
Bering Strait	1.55	0.80	0.06	0.08	0.05
Bristol Bay Borough	1.19	0.82	0.06	0.07	0.04
Chatham Region	1.20	0.83	0.04	0.08	0.04
Chugach	1.29	0.77	0.08	0.07	0.09
Copper River	1.15	0.81	0.05	0.06	0.08
Cordova City	1.07	0.84	0.05	0.06	0.05
Craig City	1.09	0.82	0.07	0.04	0.05
Delta Greely	1.09	0.84	0.05	0.06	0.05
Denali Borough	1.09	0.82	0.04	0.08	0.06
Dillingham City	1.13	0.84	0.05	0.05	0.05
Fairbanks North Star Borough	1.08	0.88	0.04	0.04	0.04
Galena City	1.26	0.66	0.06	0.07	0.20
Haines Borough	1.03	0.87	0.03	0.06	0.03
Hoonah City	1.12	0.81	0.07	0.07	0.05
Hydaburg City	1.10	0.75	0.05	0.06	0.12
Iditarod Area	1.40	0.78	0.05	0.11	0.06
Juneau Borough	1.02	0.89	0.04	0.04	0.04
Kake City	1.09	0.82	0.06	0.07	0.04
Kashunamiut	1.25	0.81	0.04	0.06	0.08
Kenai Peninsula Borough	1.03	0.84	0.07	0.05	0.04
Ketchikan Gateway Borough	1.01	0.86	0.03	0.06	0.05
Klawock City	1.04	0.84	0.04	0.07	0.04
Kodiak Island Borough	1.12	0.86	0.03	0.06	0.05
Kuspuk	1.21	0.83	0.04	0.08	0.04
Lake And Peninsula	1.46	0.77	0.06	0.10	0.06
Lower Kuskokwim	1.39	0.84	0.05	0.07	0.05
Lower Yukon	1.40	0.83	0.04	0.08	0.04
Matanuska-Susitna Borough	0.99	0.88	0.03	0.05	0.04
Nenana City	1.17	0.70	0.04	0.06	0.19
Nome City	1.16	0.85	0.04	0.07	0.04
North Slope Borough	1.58	0.84	0.04	0.06	0.06
Northwest Arctic	1.48	0.79	0.06	0.09	0.05
Pelican City	1.14	0.79	0.04	0.06	0.09
Petersburg City	1.01	0.85	0.03	0.07	0.04
Pribilof Island	1.29	0.81	0.05	0.07	0.06
Saint Marys City	1.28	0.79	0.05	0.07	0.07
Sitka Borough	1.03	0.87	0.04	0.04	0.04
Skagway City	1.00	0.82	0.04	0.06	0.07
Southeast Island	1.07	0.83	0.06	0.06	0.05
Southwest Region	1.26	0.81	0.05	0.07	0.07
Tanana City	1.29	0.78	0.03	0.12	0.05
Unalaska City	1.19	0.83	0.04	0.07	0.05
Valdez City	1.05	0.87	0.03	0.05	0.04
Wrangell City	1.00	0.85	0.04	0.05	0.05
Yakutat City	1.17	0.83	0.05	0.07	0.05
Yukon Flats	1.46	0.75	0.05	0.14	0.06
Yukon Koyukuk	1.44	0.78	0.06	0.10	0.05
Yupiit	1.31	0.80	0.06	0.05	0.07

VIII. Recommendations and Implementation

This section presents six recommendations to the Alaska State Legislature (ASL) based on this report. In each case, the recommendation is followed by a discussion of some of the details associated with implementation.

RECOMMENDATION 1: Adopt a New Cost Adjustment. *The ASL should replace the current Alaska cost index for education with the new AIR GCEI.*

The purpose of this report has been to produce a GCEI that can be used to adjust nominal distributions of state aid to reflect real purchasing power for the individual school districts in Alaska. The GCEI produced in this report is intended to replace the previous cost adjustment developed by the McDowell Group more than five years ago. A major difference between the AIR and McDowell studies is that, while both rely to some degree on existing information about educational spending patterns in Alaska School Districts, the AIR GCEI applies a methodology that goes beyond simply reflecting current spending behavior by school districts. The AIR GCEI includes only those factors that are *beyond the control of local school district decision makers.*

RECOMMENDATION 2: Improve Personnel Databases. *The ASL should direct the ADEED to improve and maintain the quality of the school personnel data systems in order to permit utilization of the hedonic wage model for updating the personnel components of the GCEI in the future. Specifically, this recommendation includes the following components:*

(a) Improve the quality of the current Certified Staff Assignment Reporting (CSAR) system by running routine auditing checks on the files to ensure that information reported on individual personnel are accurate.
(b) Convert the current data collected on certification for school personnel into an electronic form that is capable of being merged with the CSAR files.
(c) *Develop a data system similar in structure to the CSAR for classified staff (e.g., paraprofessionals, clerical support staff, custodial and skilled maintenance staff, and technical or managerial staff) so that these data may also be utilized for analysis of patterns of compensation using the hedonic wage method.*

Two categories of variables are necessary for the analysis of personnel compensation: the *personal qualifications and job assignment characteristics* and the *cost factors*. The first group of variables includes those that we want to control for (hold constant) in the simulations necessary to calculate the personnel cost indices. However, it is important to have as many control variables as possible that might impact the patterns of employment of different categories of school personnel. While the current Certified Staff Accounting Report (CSAR) was sufficient for the analysis in this project, AIR believes that there are some improvements that ADEED

could make in its data collection procedures that would improve the quality of the database and analysis of personnel compensation.

First, AIR suggests that ADEED be charged with responsibility for maintaining and auditing the personnel files for accuracy. Data-checking routines should be put in place to examine changes over time and to search for inconsistencies in the information reported to ADEED. During the course of the analysis, AIR discovered some inconsistencies in the way data were reported for the same school district employees over time. For example, experience levels of the same employees over time sometimes decreased, and the birth dates for the same employees differed over time. If these data are to be used as the basis for future analysis of personnel compensation, it is important that they accurately reflect employee qualifications. It should be noted that if districts are informed that these personnel data will be used in the future to determine school funding distributions, they will be more likely to spend the time to ensure the accuracy of the records.

Second, AIR recommends that the ADEED consider using the certification applications of teachers to create electronic records of teacher examination test scores and colleges attended, both of which are on the applications. The test scores and the data on the colleges could be used by analysts to determine the average selectivity or quality of the colleges attended as a proxy for quality of the individuals who are employed by public schools. ADEED should also consider reorganizing the CSAR to permit analysts to ascertain the percentage of teacher assignments for which each teacher is appropriately or fully certified. ADEED should also attach a unique identifier to each certified employee, so that they may be more easily tracked throughout the years. These changes would provide a stronger and more comprehensive set of personal qualifications that would help in the analysis of variations in personnel compensation.

Third, given the differences in the labor markets for classified and certified personnel, AIR recommends that ADEED consider implementing a data collection for classified personnel similar to the one for certified personnel, adapted to the needs of that population of employees. Such a data collection should gather some of the following data elements, permitting future analyses to control more accurately for qualifications of classified staff:

- Identification codes to permit tracking of personnel over time
- Compensation in the form of hourly wage rates
- Job title (e.g., school secretary, custodian, skilled maintenance, teacher aide)
- Total hours of work per week and per year
- Educational preparation (e.g., high school diploma, vocational training in a relevant field)
- Years of experience in this type of work
- Years working for the present district
- Date of birth

- Gender
- Race-ethnicity

While AIR collected some of these data during this project, it was clear that many districts did not keep all of this information in an easily accessible form. Establishing such a regular and periodic data collection would provide the state with a valuable source of information about staffing of public schools and a source of data that could be used to analyze patterns of compensation for updating the GCEI. Having data that would allow tracking these patterns over time would allow ADEED to determine the stability of these patterns of variation, which is currently not possible given the single year of data collected for the present study. We do not know the extent to which turnover might be a factor in analyzing the patterns of compensation of classified personnel, as there were no time series data that would allow us to determine turnover rates as we were able to do for certified personnel.

RECOMMENDATION 3: Adopt Data Collection on Non-Personnel Elements. *AIR recommends that the ADEED develop regular and periodic data collections to gather information on the prices of energy services; the prices of certain supplies, materials, and small capital equipment; and the prices of travel between the schools and district office and the district office and Anchorage.*

While some of the factors that affect the costs of non-personnel inputs will not change substantially (if at all) over time, there are a number of factors that may be subject to change on a year-to-year basis. For example, it is expected that the following elements involved in the calculation of the non-personnel cost indices will be subject to change over time:

- prices of energy sources (e.g., heating oils or utility rates)
- airfare or other travel costs used to determine the cost of traveling between the school sites and the district office and between the district office and Anchorage or other centers of commerce
- delivered prices of the selected items used to estimate the relative cost of transporting goods to the districts from the centers of commerce

AIR suggests that the ADEED adapt the AIR data collection instruments for collecting some of the critical elements used as part of the analysis contained in this report. The procedures AIR utilized for the current project are relatively efficient and could easily be adapted with the help of school business officers such as those who served on the TWG for this project.

A key ingredient to the success of this kind of data collection is establishing each component as a standard part of the reporting system by ADEED. ADEED should expect a 100

percent response for maintaining and updating the GCEI, and district officials will adapt their own database systems to facilitate their ability to respond to such requests for data.

RECOMMENDATION 4: Frequency of Updates. *AIR recommends that the ASL conduct a study of school district cost differences at an interval of approximately every three to five years.*

Previous research suggests that the GCEI values are not likely to change very much from one year to the next or, for that matter, over a period of years. Such cost indices reflect relative differences in the costs of educational services. That is, while the absolute prices of certain inputs (e.g., the wages of school personnel) may change over time, the factors that affect the differences in prices across local school districts do not change very rapidly over time. Indeed, Chambers has done numerous studies of wage differences across school districts in the U.S., and has found that the correlations between these index values estimated at different points in time are quite high. Chambers (1981c) reported that the correlations between the Missouri GCEI for the 1974-75 and 1975-76 school years was 0.94. In California, the correlation across two different years, with a major property tax limitation measure passed between the two years (the famous Proposition 13), was 0.87. In a nationwide study of geographic cost differences using data for 1987-88, 1990-91, and 1993-94 (Chambers, 1997a), the correlation between the geographic cost indices for each pair of years (87-88 with 90-91, and 90-91 with 93-94) was 0.98, while the correlation across the six-year span was 0.96.

As a dramatic test of how such indices change over time, we decided to take the equivalent of the GCEI index values developed out of the previous Alaska cost study conducted by Chambers and Parrish (1984) and compare them to the values calculated in the current project.[10] The correlation between these two indices, which were calculated 18 years apart, exceeded 0.85.

The analysis of the Alaska personnel data is consistent with the findings of previous research on the stability of the index values over time. As part of our current project, the AIR research team acquired the personnel data files for four different school years from ADEED. Using these data, we were able to estimate a variety of statistical models and test the stability of these index values for different years. Correlations among the personnel indices calculated for different years were all well above 0.90, and for adjacent years these correlations were above

[10] The earlier study by Chambers and Parrish was designed to develop a more comprehensive model of the cost of an "adequate" education in Alaska schools and included measures of cost differences arising out of differences in pupil need, scale of district and school operations, and the prices of comparable school inputs. Thus, the implicit cost index calculated from this model is not strictly comparable to the GCEI calculated in this report. In part this results from the fact that the budget weights used to aggregate the component index values into an overall index are based on the service delivery systems specified by a committee of educators selected from school districts in Alaska. Nevertheless, the basic component indices from which the 1984 GCEI was calculated were developed using methods very similar to those used in the current study.

0.95. (The actual parameter estimates for these statistical models are presented in Appendix E of the *Technical Report* along with the correlations among all of the indices.)

The personnel components, which dominate the GCEI calculations, tend to be stable over a five to six year period of time. The non-personnel elements may tend to vary over a shorter time period, but there are no data other than the overall patterns to rely on for some assurance on these non-personnel components. Thus, AIR suggests that five-year studies on personnel are likely to be sufficient for changes in that component. However, it would be useful for further analysis of the patterns of change in the non-personnel components to be conducted over the next few years to explore how rapidly these components change. Given that the overall patterns over an 18-year period have been fairly stable, the non-personnel components could be done every three years until a database has been developed to sufficiently test the stability of these components. The energy component relies heavily on an engineering component that predicts the energy consumption levels, and this relies heavily on climatic norms that do not change dramatically over time. However, energy costs are also impacted by price differences in the energy fuel sources. Travel costs and other prices of goods do change from year to year, but much of the difference in these is associated with relative distances and the associated travel or transportation costs between points in Alaska. While these may change over time, the relative differences may not vary as much as the absolute values.

Recommendation 5: Use an Economist for Labor Market Analyses. *AIR recommends that the ASL employ or contract with a professional economist or an individual with proven experience and training in labor market studies to conduct the analyses of the compensation of school personnel that underlie the personnel cost index components.*

It is important to employ an individual with experience in labor market analysis and in the use of procedures such as the hedonic wage model. While the techniques appear fairly simple on the surface, this analysis does require an understanding of the conceptual framework and its limitations in empirical application. There are some significant judgments that need to be made in the selection of the independent variables, the measurement of the dependent variable, the choice of functional form, and the application of statistical techniques that require highly specialized training and experience. Employing an economist ensures that the person conducting future studies is familiar with standard techniques of analysis of labor markets. Because of changes over time in the labor markets, one cannot simply re-estimate the exact equations used for the current analysis of school personnel. It may also be important to take into account the potential for new measures of school, district, and regional characteristics that may be included in this analysis.

RECOMMENDATION 6: Phase in the New Index. *AIR recommends that the ALS develop procedures to phase in new GCEI numbers over time.*

It is important to recognize that the index values derived from the econometric models described in this report represent only approximations to the complex, real-world transactions that make up the labor markets for school personnel. While cost adjustments do not change rapidly over time, there are a number of factors that may result in some significant changes in the relative costs over time. For the current study, a completely different methodology was used to calculate the new GCEI than was used for the current district cost adjustment. In the future, even with a constant methodology, there may be changes in the index numbers that could have substantial impact on district budgets. Some of this occurs because of the statistical nature of the procedures used to estimate these index numbers. Even these estimates' relatively small standard error of one percent implies a confidence interval of plus or minus two percent. This means that over a five-year period, changes of as much as four percent could easily be accounted for by statistical error alone. A four percent change in budgets can mean hundreds of thousands of dollars in the budget of a given district. Therefore, in order not to cause any major disruptions in the flow of services, the ASL should consider methods for adjusting or phasing in new GCEI numbers over a period of approximately five years. For example, the allocations of aid could be adjusted so that any gap in funding resulting from changes in the GCEI over time would be closed at a rate of, for example, 20 percent per year. At the end of a five-year period, the full impact of the index value would be felt. Alternatively, the state could adopt a moving average technique that averages the values of the indices over a period of time (e.g., three years) so that changes are less disruptive.

Bibliography

Alexander, Celeste D, Timothy Gronberg, Dennis Jansen, Harrison Keller, Lori Taylor, and Philip Uri Treisman. "A Study of Uncontrollable Variations in the Costs of Texas Public Education." Prepared for the 77th Texas Legislature (November 1, 2000).

Augenblick, John and Kathleen Adams. "An Analysis of the Impact of Changes in the Funding of Elementary/Secondary Education in Texas: 1974/75 to 1977/78." Denver, CO: Education Commission of the States (1979).

Barro, S.M. "The Impact of Intergovernmental Aid on Public School Spending." Unpublished doctoral dissertation, Stanford University, Department of Economics (1974).

Brazer, Harvey E. "Adjusting for Differences Among School Districts in the Costs of Educational Inputs: A Feasibility Report." In *Selected Papers in School Finance 1974.* Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education (1974).

Caves, Douglas W., Laurits R. Christensen, and W. Erwin Diewert. "Multilateral comparisons of output, input, and productivity using superlative index numbers," *The Economic Journal,* 92, 73-86 (March 1982).

Caves, Douglas W., Laurits R. Christensen, and W. Erwin Diewert. "The economic theory of index numbers and the measurement of input, output, and productivity." *Econometrica,* Vol. 50, No. 6, 1393-1414 (November 1982).

Chambers, J.G. "Measuring Geographic Differences in Public School Costs." Washington, DC: U.S. Department of Education, National Center for Education Statistics (working paper, 1997a).

Chambers, J.G. "Volume III - The Measurement of School Input Price Differences: A Technical Report on Geographic and Inflationary Differences in the Prices of Public School Inputs." Washington DC: U.S. Department of Education, National Center for Education Statistics (1997b).

Chambers, J.G. "Public School Teacher Cost Differences Across the U.S.: the Development of a Teacher Cost Index." Final report to the National Center for Education Statistics, Task 2 of the Elementary Secondary Education Statistics Project, NCES Report #95–758. Palo Alto, CA: American Institutes for Research (1995).

Chambers, J.G. and T.B. Parrish. "The development of a program cost model and a cost-of-education index for the State of Alaska: Final Report, Volumes I-IV." Stanford, CA: Associates for Education Finance and Planning, Inc. (1984).

Chambers, J.G. "Cost and price level adjustments to state aid for education: A theoretical and empirical review." In K. Forbis Jordan (Ed.), *Perspectives in state school support programs* (2nd annual yearbook of the American Educational Finance Association). Cambridge, MA: Ballinger Publishing Co. (1981a).

Chambers, J.G. "The hedonic wage technique as a tool for estimating the costs of school personnel: A theoretical exposition with implications for empirical analysis." *Journal of Education Finance* (Winter, 1981b).

Chambers, J.G. "The impact of bargaining and bargaining statutes on the earnings of public school teachers: A comparison in California and Missouri." *Review of Economics of Education* (Fall, 1981c).

Chambers, J.G. and P.E. Vincent. "Interim development and progress report on alternative cost-of-education models and indices (SRI International Report Number 3)." Prepared for the Florida Department of Education (1980).

Chambers, J.G. "Educational cost differentials across school districts in California." Report prepared under subcontract to the Education Finance Center of the Education Commission of the States for the School Finance Equalization Project of the California State Department of Education (1978).

Chambers, J.G., James Smith, Thomas Parrish, and James Guthrie. "A Proposal for Determining Adequate Resources for New York Public Schools" Palo Alto, CA: American Institutes for Research and Management Analysis and Planning, Inc. (2002).

Diewert, W.E. "Exact and superlative index numbers," *Journal of Econometrics* 4 (November 1976), 115-145.

Diewert, W.E. "The economic theory of index numbers: a survey." Discussion Paper No. 79-09, Department of Economics, University of British Columbia (March 1979).

Goldhaber, Dan D. "An Alternative Measure of Inflation in Teacher Salaries." In Selected Papers in School Finance, 1997. William J. Fowler, Jr., editor. Washington, DC: U.S. Department of Education, National Center for Educational Statistics (1999).

Guthrie, James and Richard Rothstein. "Enabling 'Adequacy' to Achieve Reality: Translating Adequacy into State School Finance Distribution Arrangements." In Helen F. Ladd, Rosemary Chalk, and Janet S. Hansen (Eds.), *Equity and Adequacy in Education Finance.* Washington, DC: National Academy Press (1999).

Grubb, W. Norton and James Hyman. "Construction Teacher Cost Indices: Methodological Explorations with California Unified School Districts." In *Selected Papers in School Finance 1975.* Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education (1975).

McMahon, Walter W. "Interstate Cost Adjustments." In William J. Fowler, Jr. (Ed.), *Selected Papers in School Finance.* Washington, DC: U.S. Department of Education, National Center for Educational Statistics (1994).

Rothstein, Richard and James R. Smith. "Adjusting Oregon Education Expenditures for Regional Cost Differences: A Feasibility Study." Sacramento, CA: Management Analysis & Planning Associates, L.L.C. (1997).

Wendling, Wayne. "Cost-of-Education Indices for New York State School Districts." Denver, CO: Education Commission of the States (1979).

Wynne, Mark and Fiona Sigalla. "The Consumer Price Index." *Federal Reserve Bank of Dallas Economic Review* (2nd quarter, 1994).

Alaska School District Cost Study:

Volume II – The Technical Report

Submitted to:

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Legislative Budget & Audit Committee
State Capitol, Room 111
Juneau, AK 99801-1182

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January 2003

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Chapter I. Introduction

Background and Motivation

The purpose of this report is to present the technical details underlying the development of the Geographic Cost of Education Index (GCEI) for the State of Alaska. The GCEI developed by the AIR research team is being proposed to replace the current cost adjustment used by the State of Alaska to adjust state aid to education. The application of such geographic cost adjustments in state aid are intended to equalize the purchasing power of the educational dollar across local school districts.

The analysis focuses on four categories of school inputs: school personnel; energy services; supplies, materials, and small capital equipment; and travel as it affects maintenance and operations, professional development, itinerant services, administrative oversight of schools, and attendance at statewide professional meetings.

Many schools in Alaska are located in remote regions of the state, and this creates challenges in recruiting and employing professional school personnel. Costs of living are higher in the remote regions of the state because the cost of transporting goods and services to these communities results in more expensive consumer goods and services. In addition, access to cultural amenities as well as shopping and medical facilities is more difficult in remote communities than it is in more urban areas such as Anchorage or Fairbanks. The degree of isolation can be significant, particularly during winter months, because of the distances and time required to reach the more urban centers of the state.

All of the factors mentioned above impact the compensation (salaries and benefits) that must be paid to attract comparable school personnel as well as personnel in other occupations across the state. Moreover, the distances between Alaska's schools and the state's centers of commerce also impact the costs paid for many other schooling inputs. It affects the costs of fuels for heating and providing power to school buildings. It raises the prices paid for various instructional and non-instructional supplies and materials, all of which have to be transported to these remote locations. The distances of schools from district offices also impact the costs of offering itinerant services, providing professional development, holding meetings among staff, and transporting materials and supplies among the sites. Similarly, the distances of the district offices themselves from centers of commerce impacts the access to trained professionals and technicians as well as to various sources of supplies, materials, and equipment necessary to the operations of the school district.

Finally, Alaska's harsh climate and the variations in the climate across districts affect the relative consumption of fuels required to provide heat and power. Also, some districts may

operate older school buildings that require greater utilization of alternative power sources to maintain comfort levels within classrooms.

This project has undertaken a comprehensive analysis to address the various factors that affect the ability of districts in Alaska to access comparable school resources in the different regions of the state. The end product is a geographic cost-of-education index (GCEI), which addresses the following question:

> *How much more or less does it cost to recruit and employ comparable teachers, administrators, and other school personnel, and to pay for comparable non-personnel inputs (e.g., energy services, supplies, books, and materials) and services (e.g., maintenance and operations, professional development) in different geographic locations around the state?*

The GCEI is a cost adjustment index that permits translation of nominal dollar values into *real* dollars of purchasing power for school resources and services. It can be used to provide equal purchasing power by adjusting funding levels for individual school districts.

Scope of the Study

With this background in mind, it is important to point out what this study does do and what it does not do. Specifically, the current study develops a cost adjustment index that reflects the variations in the prices of comparable school inputs. However, the current study does not address cost differences associated with the composition of pupil needs, nor other factors related to the relative concentration of student populations. For example, it does not address differences in the levels of resources required to meet the different needs of students who are from disadvantaged backgrounds, students who are English language learners, or students who have certain physical or mental disabilities.

In addition, this study does not address the different administrative staffing requirements that may be associated with operating school districts in remote and sparsely populated regions of the state. While the study does address the differential costs of personnel travel within large, remote school districts and it does address the costs of transporting goods within these remote locations, it does not address the increased need for staff that may result from providing the appropriate administrative and support services needed to operate these districts.

These additional cost factors related to the measurement of pupil needs and the costs of operating districts in sparsely populated, remote regions of the state must be addressed through more comprehensive studies designed to estimate the costs of providing adequate educational services in Alaska. The previous work done by Chambers and Parrish (1984) represents one model for conducting these kinds of studies, while a newer proposal for costing out an adequate education in New York State prepared by Chambers, Smith, Parrish, and Guthrie (2002) provides

an even more comprehensive and more up-to-date approach to addressing these complex issues. The newer methodology for measuring adequacy in education focuses more attention on the relationship between outcome standards for students and the levels of resources necessary to achieve those standards.

Collaboration with Alaska Policy Makers and Educators

In preparing to collect and analyze data in the creation of a Geographic Cost-of-Education Index (GCEI), the AIR research team collaborated with the educators and policymakers most knowledgeable about the factors affecting the cost of providing services in Alaska.

First, the AIR research team met with the School District Cost Study Oversight Committee. This Oversight Committee (OC) included representatives of the Alaska State legislature, legislative staff, and the Alaska Department of Education and Early Development (ADEED). The OC provided us guidance and helped coordinate our requests for data during the course of the study. Members of the AIR research team have had telephone meetings with ADEED staff about topics ranging from school facilities to school personnel. ADEED staff have provided AIR with valuable existing data sources pertaining to the following cost factors: certified personnel, classified personnel, school and district building facilities, fuel usage, and student populations.

Second, AIR established and met with a Technical Working Group (TWG) of eight school business officials representing a geographically diverse sample of Alaska school districts. During a series of meetings held during the course of the past 12 months, we discussed the goals and objectives of the project and came to an agreement on the overall strategy for conducting the work to be done. The TWG provided us feedback on our data collection instruments and strategies, and facilitated the data collection through direct connections with the school business officers in the remaining school districts throughout the state. With the assistance and support of the TWG, we were able to obtain an overall response rate of 100 percent on all of the major surveys and survey items we collected from local school districts.

The AIR research team met with the TWG early in the project in a meeting scheduled to coincide with the Alaska Association of School Business Officials (ALASBO), which was held in December of 2001. Subsequent to the ALASBO meeting, the AIR team met periodically through a series of teleconferences with the TWG. These meetings were designed to help us understand the perspectives of local school districts on the major factors affecting the cost of educational services across the state. These meetings gave us a better understanding of the cost factors from the district perspective and provided input from these local school personnel on approaches to collecting data on the cost factors affecting resource allocation in their districts.

We were able to learn what information they had that was not readily available from state sources, and how best to use this information in constructing appropriate cost adjustments.

Finally, the AIR research team met with the OC and two representatives of the TWG at a meeting in Anchorage in November of 2002. During this meeting preliminary results of the analysis were presented and discussed extensively. Further revisions in the data collection and analysis were carried out to respond to various issues and concerns raised about particular data elements during these two days of meetings. The two representatives of the TWG contacted the remainder of the TWG who in turn verified certain data elements with other school business officials in Alaska School Districts. This report presents the final numbers on all of the index components based on the original analysis and the revised data elements collected as a result of this meeting in Anchorage.

Overview

The analysis presented in the subsequent chapters focuses on the prices of the inputs purchased by schools to develop a GCEI. This series of indices addresses differences in the costs of school personnel, the costs of energy services, the costs of transporting goods and services to school sites, and the costs of within-district travel necessary for the operation of schools and their programs.

Chapter II presents an overview of the results of the study, with a focus on the range of costs we found across the state. We determine which districts are at the high and low ends of the cost spectrum, and compare the index numbers with actual expenditures.

Chapter III details the personnel cost component of the index. Personnel cost is the largest piece of education spending, and we present here a discussion of the methodology behind the multiple models we used to determine personnel index values. This chapter also contains a discussion of which model is most appropriate to use, and presents the actual index values. Chapters IV and V provide similar discussions of the energy and transportation/travel components of the index.

Chapter VI weighs the alternate approaches to calculating the GCEI. The fixed-market-basket approach is compared to the superlative index, and the individual component indices are discussed. Chapter VII offers conclusions and discusses implementation issues related to utilization and updating of the index.

Chapter II. Overview of Study Results

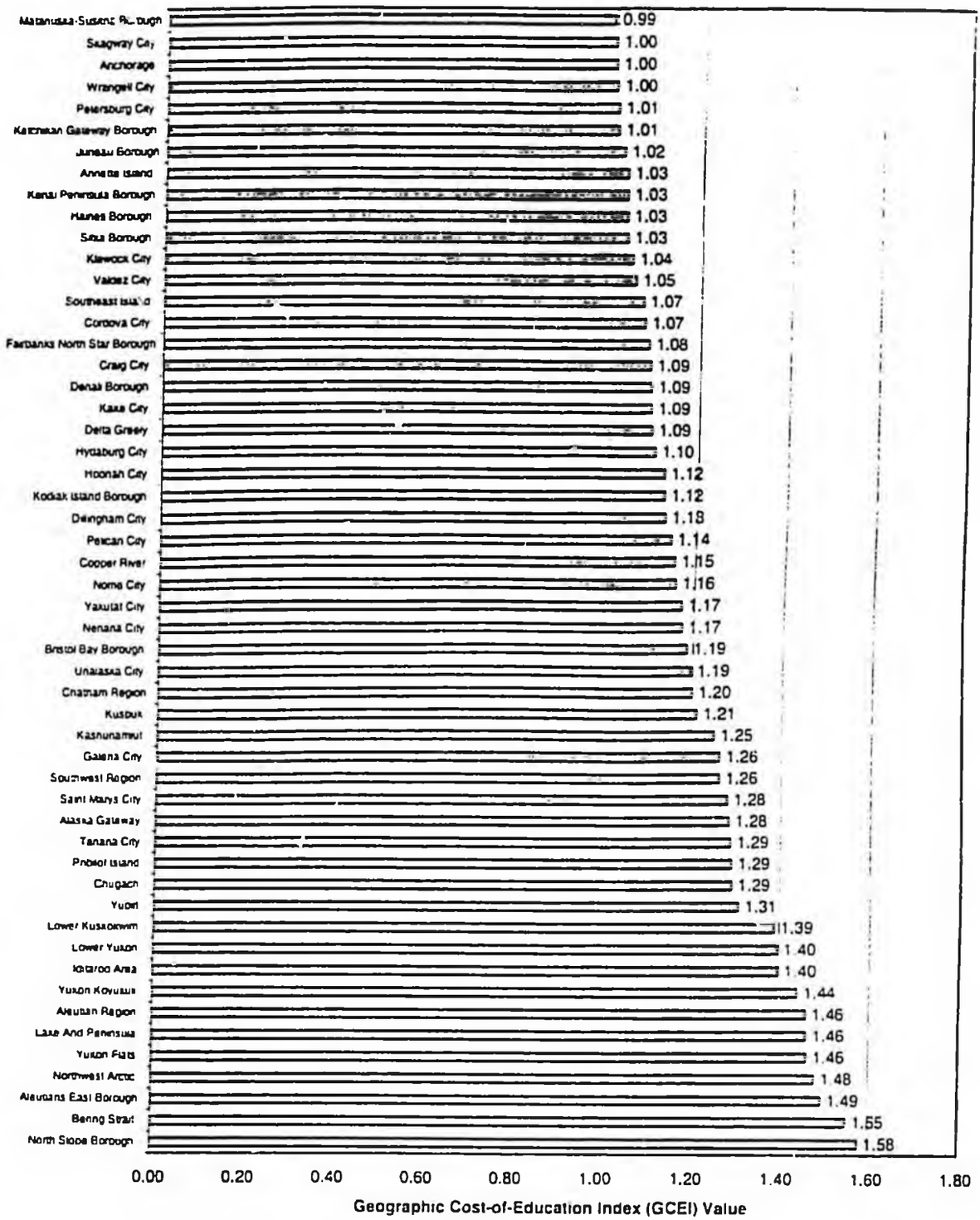
Based on the analysis conducted as part of this study, the purchasing power of the educational dollar varies tremendously in the State of Alaska. The highest cost district needs about 1.6 times what the lowest cost district needs in order to provide comparable educational services.

Another way to understand these variations is to select a benchmark district to which all districts can be compared. Following the conventional approach that has been used in Alaska for these kinds of studies, we use Anchorage, the largest and most urbanized district in the state, as the benchmark.[1] Thus, the value for the GCEI in Anchorage has been arbitrarily set at 1.00. Using Anchorage as the base, the analysis of costs reveals that the North Slope Borough School District exhibits the highest cost of education, with an index value of 1.58 (Exhibit L[illegible]). This means that this district needs to expend about 58 percent more than the Anchorage School District to provide comparable educational services.

On the other end of the spectrum is the Matanuska-Susitna Borough School District, with an index value of 0.99. This means that this district needs to expend about 1 percent less than the Anchorage School District to provide comparable educational services to the students it services.

[1] In most studies, the district attended by the average student is often used as the benchmark school district. The reason for this is so that the GCEI, when applied to state aid allocations, will have no impact on the overall amount of aid to be allocated. That is, the GCEI would be neutral with respect to the total allocation of state education aid. In these situations, the district attended by the average student, which is in actuality a fictitious district that has been created purely for statistical purposes, is assigned a GCEI value of 1.00. In the case of Alaska, the State policy makers have chosen to scale everything to Anchorage, which is far and away the largest school district in the State.

Exhibit II-1. A GCEI for Alaska School Districts



NOTES TO EXHIBIT: The districts listed on the vertical axis in this diagram are sorted in ascending order according to the value of the geographic cost-of-education index (GCEI), with the lowest on top.

Organizing the school districts by region (Exhibit II-2) reveals that the highest-cost districts in Alaska are located in the Far North (with average GCEIs of 1.38) and the Southwest (with average GCEIs of 1.31). The lowest-cost districts in the state are located in the Southeast. Factors driving these numbers appear to be the impact of remoteness on personnel salaries, transportation costs for goods and services, and travel costs, as well as the differences in climatic factors that impact energy services as well as the relative attractiveness of these regions as places to live and work.

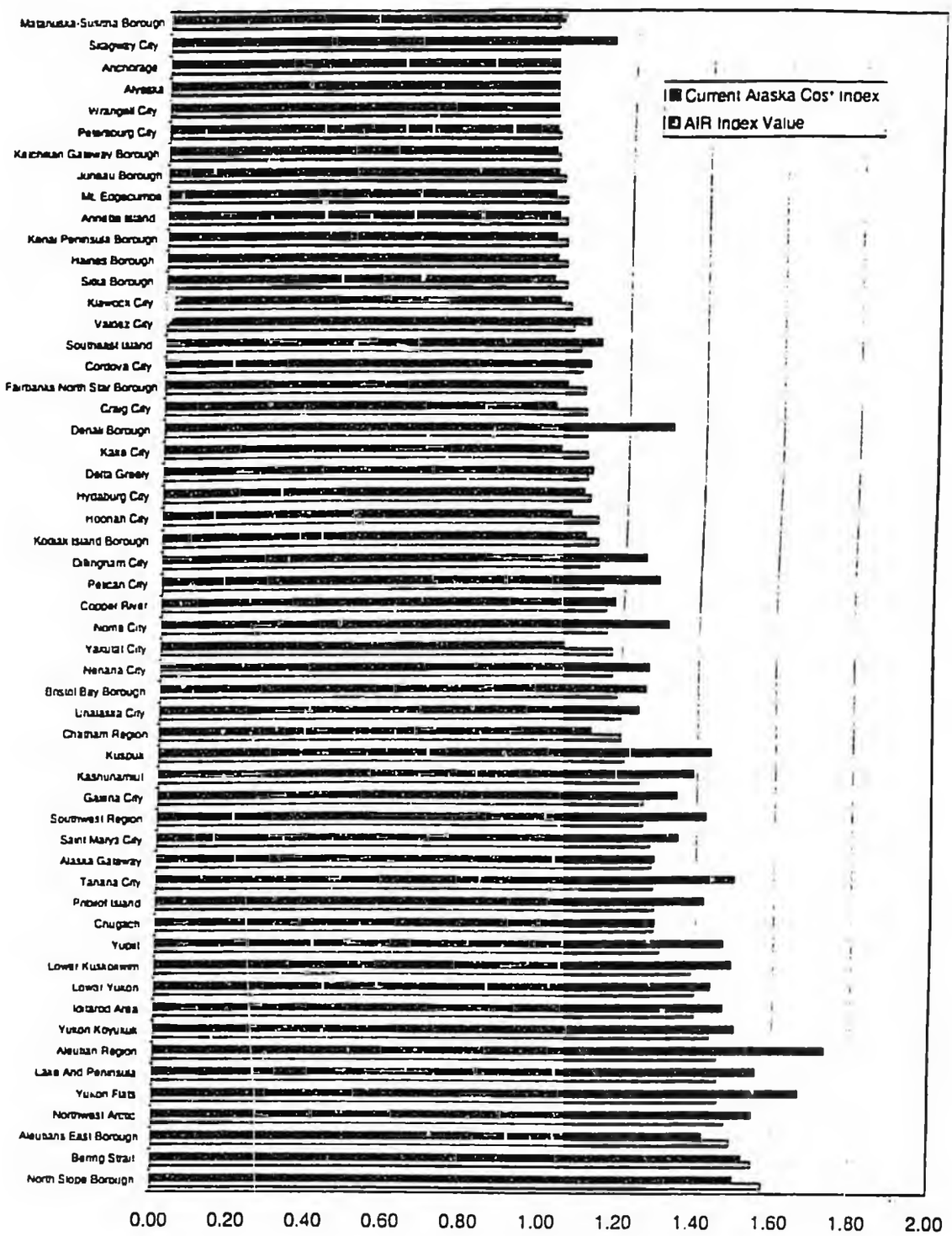
Exhibit II-2. Variations in the Geographic Cost of Education Index by Region

Region	Number of Districts	Mean	Standard Deviation	Minimum	Maximum
Statewide	53	1.20	0.17	0.99	1.58
Far North	10	1.38	0.15	1.16	1.58
Interior	3	1.09	0.00	1.08	1.09
South Central	9	1.11	0.11	0.99	1.29
Southeast	17	1.07	0.06	1.00	1.20
Southwest	14	1.31	0.11	1.13	1.49

Exhibit II-3 compares the GCEI derived from the AIR study with the education cost adjustment that is the current law in Alaska. Districts are sorted in ascending order according to the value of the GCEI calculated in the AIR study. Differences between these cost index values may reflect a combination of methodology and changes in the costs of educational services since the last cost index was calculated. The largest differences are most likely attributed to methodological differences in the two studies underlying the calculations.[2] The range, standard deviation, and the mean values of the GCEI and the current Alaska cost index are quite similar. The GCEI calculated by AIR ranges from a low of 0.99 to a high of 1.58, while the range of the current Alaska cost index is from 1.00 to 1.74. The standard deviation of the AIR GCEI is 0.17, and the range of the current Alaska cost index is 0.21. Moreover, the correlation between the AIR GCEI and the Alaska cost index is 0.91.

[2] The actual values of the two indices are presented for purposes of comparison in Exhibit I-6 In Appendix I of this report.

Exhibit II-3. Current Alaska Index Compared to the AIR GCEI



However, there are a number of districts that exhibit significant differences in the respective index values. Nine districts exhibit a difference of 0.15 points or more (positive or negative) and 17 districts exhibit a difference of 0.10 or more. A point difference of 0.01 means a one percent

difference relative to the benchmark district of Anchorage. For example, the Aleutian Region district exhibits a GCEI of 1.46, while the current Alaska cost index is 1.74, a difference of 0.32 points. In addition to the Aleutian Region School District, Denali Borough, Kuspuk, Nome City, Pelican City, Southwest Region, Tanana City, Yukon Flats, and Yupiit exhibit GCEI values that differ by 0.15 points or more from the current values.

On the other hand, slightly more than 70 percent (38) of the districts exhibit a GCEI with a less than 0.10 point difference from the current Alaska cost index. Forty-four percent (24) of the school districts in Alaska exhibit less than a 0.05 point difference from the current Alaska cost index.

Chapter III. School Personnel Inputs

Introduction

Alaska school districts spend anywhere from 45 to 90 percent of their budgets on the salaries and benefits of school personnel. This is by far the largest component of educational expenditures, and, therefore, is likely to exert the greatest influence over the variations in the costs of educational services across the state.

Two alternative approaches were used to analyze variations in the costs of school personnel. The first approach builds on the work of Goldhaber (1999) and Alexander et al. (2000), and relies on alternative sources of wage data to illustrate the relationship between labor markets for school personnel and for individuals in other non-education occupations within a region. We refer to this approach as the *comparable wage model* below.

The second approach is the *hedonic wage model* first adapted for the purpose of estimating geographic cost of education indices by Chambers (1981b) and which is now widely used by economists for this purpose.[3] Each of these approaches is described in more detail below. The goal in each case is to develop an index that reflects only those components of the variations in the compensation of school personnel that are outside the control of local school officials.

Controllable Versus Uncontrollable Factors in Analysis of School Personnel Inputs

The first step in the process of estimating the costs of school personnel involves understanding the full range of factors that affect the patterns of variation in the compensation of school personnel. The factors that drive these variations can be divided into two categories: *controllable* and *uncontrollable*.

What do we mean by *controllable* versus *uncontrollable* factors? Uncontrollable factors are those that are not subject to the choice of district or school officials. For example, the climate, labor market conditions, or other factors that affect the cost of housing in a region in which a district or school is located cannot be changed by school officials. These factors **do** impact the willingness of individuals to supply labor to the employer (in this case, the school district).

[3] See for example, Chambers, J.G (1978, 1980, 1981a, 1981b, 1995), Chambers, J.G. and T.B. Parrish (1984, 1981b), Augenblick and Adams (1979), and Wendling (1979).

On the other hand, districts and schools can select the personnel and, hence, the characteristics of the staff they employ. These are, therefore, *controllable* factors. Over the long run, districts can adjust the levels of experience, education, and the job assignments of individual school personnel. Through the processes of selection and promotion, school district officials can determine whether they hire inexperienced or experienced teachers, teachers with full or partial certification, and teachers with different education levels, and they can assign these teachers to different schools within their districts. The salary scales can also influence the retention rates of teaching staff. The balance of experienced and inexperienced teachers, the percentage who hold master's degrees, and the class assignments of these teachers are all factors that may impact the willingness of an individual to accept a job, and they are all within the control of the district.

In the face of sudden changes in conditions (catastrophic or unforeseen events), *controllable* factors can temporarily be outside of local control. For example, if sudden changes in the economy cause changes in the population that result in declining enrollments in schools, this can result in a district facing a teaching force with a higher level of experience than they would have otherwise chosen. Thus, in these short-run events, even teacher characteristics can be outside local control and may be considered to be part of the *cost factors* in calculation of the cost-of-education index. This can only be determined as a matter of policy and based on evidence that external changes have occurred that create such changes for the district.

The Comparable Wage Model

One approach to addressing uncontrollable district cost variations is to use a measure of the cost of living in the district. The basic premise is that areas with a high cost of living will have to pay higher salaries to attract school employees, thereby increasing the cost of education. A cost-of-living index therefore becomes a proxy for a cost-of-education index.

There are two strategies for estimating variations in the local cost of living. One approach is to examine the cost of a specified collection of goods and services used by consumers in each community. This method is called the "market basket" approach, because the total costs of a "basket" of consumer goods and services in each community are compared to illustrate differences in the cost of living. The market basket approach is used to create familiar indices such as the Consumer Price Index. Three states (Florida, Colorado and Wyoming) currently use a geographic consumer price-of-living index they create for themselves to adjust distributions of state education aid across local districts.

The main problem is that the cost of living as measured by the prices of consumer goods and services and the cost of education are not necessarily the same thing, though they are related. On the surface, calculating a geographic cost-of-living index can be quite straightforward—although it can present some rather formidable theoretical and empirical challenges, as anyone

involved in the production of various wage indices by the U.S. Bureau of Labor Statistics will tell you. The problem is that such cost-of-living indices do not fully capture all of the factors that impact decisions by employers and employees in the labor market.

Specifically, such indices do not generally account for variations in the amenities that characterize a regional labor market (to the extent that these factors influence the price of goods and services such as housing and haircuts, they would be partially reflected in a market basket—however, the weights are likely to be inappropriate). Therefore, cost adjustments based on a market basket may overcompensate districts that face a high cost of goods and services but which also have a number of amenities that make them a desirable place in which to work (Rothstein and Smith 1997).

Moreover, the basket of goods and services purchased by consumers is not the same as the basket of inputs purchased by districts to produce educational services. Consumers purchase housing, food, entertainment, energy services, and transportation, while school districts are purchasing the services of teachers and other school personnel, instructional supplies and materials, travel, and energy services. While some of these items are the same, school districts clearly purchase these items in different proportions than consumers. Thus, a geographic cost-of-living index is not necessarily appropriate to adjust educational dollars for differences in costs. By design, it measures only one component in the school district's basket of inputs—namely, labor.

The second approach to estimating the cost of living is the "comparable wage" approach. Because all types of workers tend to demand higher wages in areas with a higher cost of living or with fewer regional amenities, systematic regional variations in wages should reflect variations in the cost of attracting workers to a region. Therefore, one can calculate the cost of attracting educators by observing regional variations in the salaries of comparable workers who are not educators (Rothstein and Smith, 1997; Guthrie and Rothstein, 1999; Goldhaber, 1999). This approach takes advantage of the fact that the same factors that affect non-education wages also impact the wages of educational personnel.

There are a number of advantages to using a comparable wage model to measure the cost of education. The greatest advantage is that the wages of comparable non-education workers are clearly beyond the control of school administrators; there are no debates about the problematic distinction between controllable and uncontrollable costs. On the surface, calculating a comparable wage index can be quite straightforward. While there are still many complex measurement issues involved (Alexander et al. 2000), the comparable wage model can be compared relatively easily and directly.

There are also a number of disadvantages to the comparable wage model. First, a comparable wage model relies on comparability among workers. If comparability breaks down,

then an index developed from a comparable wage model becomes a poor proxy for the cost of hiring educators. For example, if tastes for goods and services or local amenities differ according to worker types (perhaps professionals are more susceptible to the lure of city lights than other workers), then it can be inappropriate to include all types of workers in a comparable wage index. (On the other hand, a comparable wage index based on an overly small set of workers would be susceptible to measurement error.) Furthermore, if there are unobserved variations in the qualifications of individual workers across geographic regions, then the observed variations in the wages will reflect more than those factors that affect the supply of labor.

Finally, by design, a comparable wage index generally measures the wage variations in a broad labor market like a metropolitan area. It does not capture variations in the cost of education within a labor market.

A Comparable Wage Model for Alaska

The lack of data on consumer prices precludes us from using the market-basket approach to measure the cost of education in Alaska. However, data generously provided by the Department of Labor and Workforce Development permit credible estimates of a comparable wage index. In constructing a comparable wage model for Alaska, we follow the approach used in the Texas Cost-of-Education Index Study.

Wage Variations in Alaska

The Department of Labor provided information on average quarterly earnings by occupation for 27 labor market areas in Alaska. The data span the period from 1996 through mid-year 2001 at a level of occupational detail that differentiates between motorboat mechanics and motorcycle mechanics.

The data reveal substantial variation in wages across Alaska. Average annual earnings for the 2000-01 school year are nearly 3 times higher in North Slope Borough (the market with the highest average wage) than they are in Lake and Peninsula (the market with the lowest average wage).

There are two reasons why average wages might vary so dramatically across Alaska. First, all types of workers may demand higher wages in some parts of the state to reflect a higher cost of living or to compensate for the absence of attractive local amenities. Second, some types of workers—like lawyers—are paid more than other workers in all parts of the state, so areas with many lawyers will have higher average wages than areas with relatively few lawyers, all other things being equal.

The first source of local wage variation is common to all types of workers and would also be reflected in educator salaries; the second source is limited to specific types of workers and is unlikely to be reflected in educator salaries. Consequently, the first step in estimating local wage levels involves adjusting for the local mix of occupations so that the second source of wage variation is excluded. If every occupation were represented uniformly across the state, these adjustments would be straightforward—one would simply calculate the average wage for each occupation, use it to calculate the local deviation from the state wage for that occupation, and then calculate the local wage level as the average of the local deviations from the state wage. For example, if we observed that Juneau carpenters are paid 25 percent more than the state average carpenter wage, Juneau engineers are paid 25 percent more than the state average engineering wage, Juneau nurses are paid 25 percent more than the state average nursing wage, and so on, we would conclude that the wage level in Juneau is approximately 25 percent above the state average and adjust school district funding accordingly.

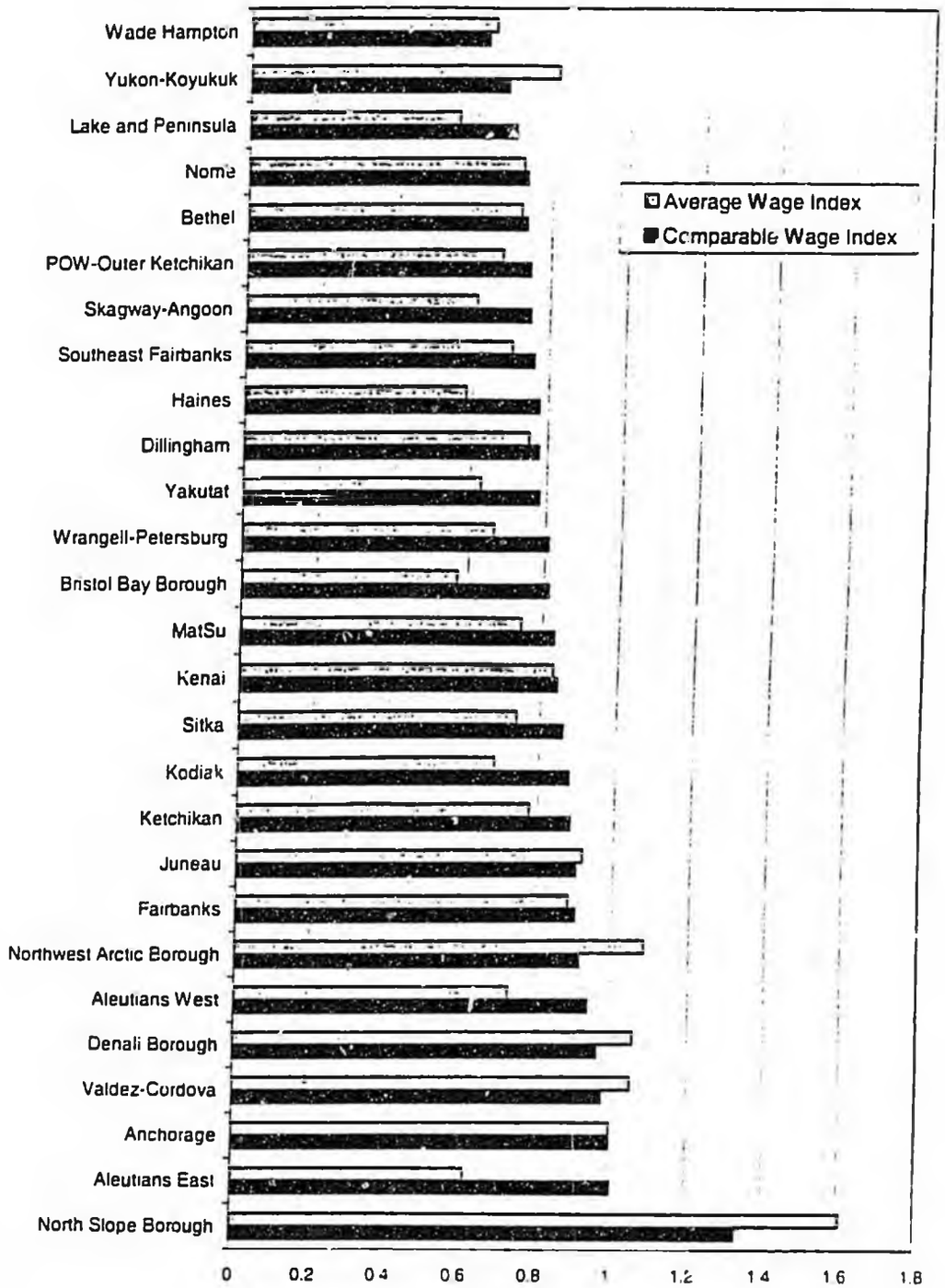
However, some occupations are observed in only a few Alaska communities (e.g., there are no drilling jobs where there is no oil). Therefore, the state average wage for these occupations would be a biased benchmark from which to compare local deviations. For example, if a particular high-wage occupation is found only in Anchorage, then Anchorage's deviation from the state average for that occupation would be zero, and averaging in that zero would make the wage level in Anchorage appear artificially low. But restricting our analysis to those occupations found in all parts of the state would also be inappropriate, because it would waste most of the available information on wages.

To construct a comparable wage index for each labor market, we used regression analysis to estimate the local wage level, with an indicator variable for each occupation and each market. The comparable wage index may be calculated by dividing the predicted wage level in each market by the wage level in Anchorage.

Our analysis reveals that much of the variation in average wages in Alaska arises from variations in occupational mix. Once we adjust for occupational mix, a very different picture emerges. Where average wages vary by nearly a factor of 3, the comparable wage index varies by no more than a factor of 2 (Exhibit III-1).

Adjustment for occupational mix also changes the relative position of a number of areas. In particular, consider the Aleutians East, where the average wage is well below the mean, but the index value is second only to the North Slope. Or consider Wade Hampton, which becomes the lowest-wage market in Alaska once the occupational mix is taken into account.

Exhibit III-1. Comparable Wage Index and Average Wage Index by Labor Market Area



To better ensure comparability to educators, we considered limiting the analysis only to those occupations that the Department of Labor and Workforce Development has identified as requiring a college degree. Unfortunately, restricting the sample in this way greatly reduces the

precision with which the index values are measured. Seventeen of the Alaskan labor markets are measured with such error that the index value is insignificantly different from the least-cost area. For the remaining areas, the Northwest Arctic Borough and Kenai post the highest cost factors.

Caveats

The fine level of occupational detail ensures that workers who are being measured have very similar jobs, but unfortunately does not guarantee that they have similar qualifications or demographic characteristics. Therefore, it is difficult to determine the extent to which geographic wage differences within job categories are due to differences in the qualifications and characteristics of the people in those jobs as opposed to differences in the factors that affect the cost of living. In large samples, differences in qualifications and characteristics will tend to cancel out (perhaps the dentists are more experienced than average in Anchorage but the accountants are less so). However, a small community in which wages are generally low because most workers are young and inexperienced is indistinguishable from one in which wages are generally low because the cost of living is low.

It is important to point out that teachers and school personnel exist in almost all locations within the state, which is not true of other occupational categories. Moreover, it is difficult to determine the extent to which wage differences in other job categories are due to differences in the qualifications and characteristics of the people in those jobs as opposed to differences in the factors that affect true cost differences (cost of living and regional or job amenities). Because of these concerns, the cost adjustment produced by comparable-wage analysis approach is only one independent variable used in the creation of the cost-of-education index. The hedonic wage model, discussed below, incorporates this variable into the statistical analysis that supports the geographic cost-of-education index presented in Chapter II.

Hedonic Wage Model

The hedonic wage model uses econometric methods to examine the patterns of variation in compensation of school personnel in relation to personal characteristics, job assignment attributes, and the characteristics of schools, districts and regions in which teachers live and work. The word hedonic derives from the word *hedonism*, which refers to the pursuit of pleasure. In this context, the model conceptualizes the two sides of the labor market, the employer and the employee, each side attempting to attain the *greatest pleasure* resulting from the employment transaction. Employers are seeking to hire the best qualified applicants from a given pool, while employees are seeking to obtain the best and most attractive job in the market. The compensation resulting from this transaction is thus related to both the attributes offered by the employee to the employer and vice versa. The hedonic wage model, simply stated, uses econometric techniques to reveal the implicit relationship between compensation and these two collections of employee and employer characteristics.

Using this relationship, the analyst can then apply simulation techniques to answer the question: *how much more or less does it cost to recruit and employ comparable personnel in different geographic locations within a state.* This is accomplished by holding constant the *controllable characteristics* and estimating what the wages would be if all districts purchased some standardized personnel (e.g., personnel with identical levels of educational preparation, professional experience, and other demographic and professional characteristics).

Data for This Analysis

Data for this analysis came from a number of sources. The Alaska Department of Education and Early Development provided data on districts, certified personnel, and students. Data on classified personnel were collected directly from the 53 school districts in the state as part of our data collection activities (See Appendix B for a discussion). In addition, the individual school districts responded to surveys about compensation practices, locational characteristics, and a host of other issues. We were able to obtain data on certified personnel for four school years (1998-99, 1999-2000, 2000-2001, and 2001-2002). Access to such panel data permitted us to test the stability of the index numbers over time.

We also constructed a number of indicators of community characteristics using data from the Alaska Department of Labor and Workforce Development (DoLWD), the U.S. Bureau of the Census, and the National Oceanographic and Atmospheric Agency (NOAA). For all Census and NOAA data, the residential area is defined as the place in which the school is located. Because confidentiality concerns prevent the release of comparable wage data at such a fine level of locational detail, the definition of the region in which the school is located is somewhat broader for the comparable wage index. For those data, we assign each school to the DoLWD labor market in which it is located.

Data on the 2001-2002 school year are particularly rich, allowing us to measure not only the salaries paid to district personnel, but also the dollar value of housing benefits. Data on benefits are not available for prior school years, but data are available on salaries and individual characteristics. These additional data permit us to test for the stability across time of the compensation models, and for the sensitivity of the salary indices to the inclusion of benefits information. Using multiple years of salary data also permit us to identify those individuals who are not employed by the district the following year, and to incorporate the pattern of employee turnover into the estimation. We found that salary indices for full-time teachers are strikingly insensitive to variations in specification, to the use of alternative years of data, to the inclusion or exclusion of information on housing benefits, and to the formal modeling of turnover. In contrast, the salary indices for other certified personnel are highly influenced by analysis of

turnover (not surprising given that the turnover rate for this group is 60 percent higher than the turnover rate for full-time teachers).[4]

The Salary Models

Following the general outline for hedonic wage model of teacher salary, we constructed models of educator salaries as a function of individual characteristics, the characteristics of the working environment, and the characteristics of the community in which the school is located.

The factors included in this analysis are outlined in Exhibit III-2. Undoubtedly, we have omitted community characteristics that could influence wages. However, these characteristics should also be reflected in the wages paid to other types of workers in the community. The comparable wage index was included to capture these effects.

Exhibit III-2. Factors Included in the Alaska Compensation Models

Individual Characteristics	School and Environmental Factors
• Total years of experience • Educational attainment • Age, gender and ethnicity • An indicator for whether the teacher is a new hire • Percent FTE spent teaching • Assignment: o Elementary education teacher o Multiple-grade teacher o Math and science teacher o Special education teacher o Bilingual education teacher o Head teacher o Principal o Assistant Principal o Counselor o Librarian o Professional staff[5]	• Percent of students who were: o Asian o Black o Hispanic o Native Alaskan • An indicator for whether the school is a high school. • School district membership • Distance to nearest center of commerce (in miles) • Climate[6] • An indicator for whether the community has water access[7] • Total labor force participation rate • An indicator for whether the community has electricity or gas services. • Comparable wage index[8]

[4] The turnover rate for administrators was 21 percent, while the turnover rate for teachers was 13 percent.

[5] The professional staff category includes job codes 20, 24, 25, 26, 27, 28, and 29.

[6] The climate measures are the average annual number of heating and cooling degree days at the closest weather reporting station, and an indicator for whether rainfall at the closest reporting station is less than 25 inches.