A Vision for Regional Cost Adjustment: The 2020 Hedonic Wage Index

Submitted to:
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Updating Wyoming's Hedonic Wage Index
Executive Summary

Since 2002, Wyoming has used a Regional Cost Adjustment (RCA) to enhance the equity and efficiency of the school funding model. The RCA applies to the salary components of the school funding model and partially offsets regional differences in labor cost. It is an amalgam of two alternative labor cost indices—the Wyoming Cost-of-Living Index (WCLI) and the 2005 Wyoming Hedonic Wage Index (HWI). Both labor cost indices are constructed so that the state average has an index value of 100, and the RCA is constructed as the greatest of three possible values: the WCLI, the 2005 Wyoming Hedonic Wage Index (HWI) or 100. For school year 2020-21, more than half of the districts were treated as equivalent to one another (i.e. assigned an RCA of 100) despite large differences in labor cost among them according to both the 2005 Wyoming HWI and the WCLI.

Although one component of the RCA—the WCLI—is updated annually, the other has never been updated. As a result, this key component of the Wyoming RCA, which determines the RCA values for half the school districts in Wyoming, has become an increasingly outdated measure of regional differences in labor costs.

To increase the efficacy of the RCA, this report provides the Legislature with an up-to-date alternative to the 2005 Wyoming HWI. The 2020 Wyoming HWI, which was estimated using data from the 2013-14 through 2019-20 school years, improves upon the 2005 Wyoming HWI in a number of important ways, not the least of which is the improved timeliness of the index values.

Replacing the 2005 Wyoming HWI with the 2020 version in the calculation of the RCA would lead to little or no change in index values for most Wyoming school districts, but substantial changes for a few. The districts most affected by such a move would be Fremont County School District #6, Sheridan County School District #1 and Sheridan County School District #3 (where the RCAs would be revised upward) and Natrona County School District #1 and Sweetwater County School District #1 (where the RCA would be revised downward).

As an alternative, the Legislature could choose to eliminate the best-of-three approach to index construction and simply replace the RCA with the 2020 Wyoming HWI, rebased as the Legislature sees fit. Such a change would improve the equity of the system, and could be calibrated to be revenue neutral for the state.

Whichever option the Legislature chooses, a mechanism for regular updates to the HWI should be put in place. The Wyoming economy is dynamic and labor market conditions in Wyoming are constantly changing. For the RCA to work as intended, it must accurately reflect current differences in labor cost, and not be allowed to drift out of date.

Introduction

Since 2002, Wyoming has used a Regional Cost Adjustment (RCA) to enhance the equity and efficiency of the school funding model. RCAs level the playing field so that all school districts can recruit and retain the same sort of high quality personnel despite local conditions that make some districts more attractive to teachers than others. All other things being equal, regions with a high cost of living are less attractive to teachers than regions with a low cost of living, so districts in high cost of living areas must pay higher wages if they want to attract highly qualified teachers. Similarly, regions that have a lot of natural beauty or other local amenities are more attractive to teachers than other regions, so districts without such amenities may need to offer a salary premium to attract teachers. Just as inflation adjustments allow the state to equalize school district purchasing power over time, regional cost adjustments allow the state to equalize purchasing power over locations.

The 2005 Wyoming Hedonic Wage Index (HWI) has been a major component of Wyoming's RCA since the 2006-07 school year. At that time, a consultant used data on teacher compensation to estimate how much more or less each district would have needed to pay in 2005 to be able to hire equivalent school personnel. He used those estimates to construct the 2005 Wyoming HWI as a function of the Wyoming Cost of Living Index (WCLI), population density, three measures of geographic location, three measures of student demographics and the average supplemental salary districts paid at that time.

Much has changed since 2005. The cost of living has risen much more rapidly in some parts of the state than in others, altering the geographic pattern of salaries within the state. The housing component of the Wyoming Cost of Living Index (WCLI) in Converse County, for example, was 12 percentage points below the state average in 2005, but 2 percentage points above the state average in 2019. Population density has increased in most of the state, but decreased in Hot Springs, Washakie, Platte and Carbon counties. Student populations have become more diverse.

The 2005 Wyoming HWI has not changed. As a result, this key component of the Wyoming RCA has become an increasingly fuzzy measure of regional differences in labor costs. To increase the efficacy of the RCA, this report provides the Legislature with an up-to-date alternative to the 2005 Wyoming HWI.

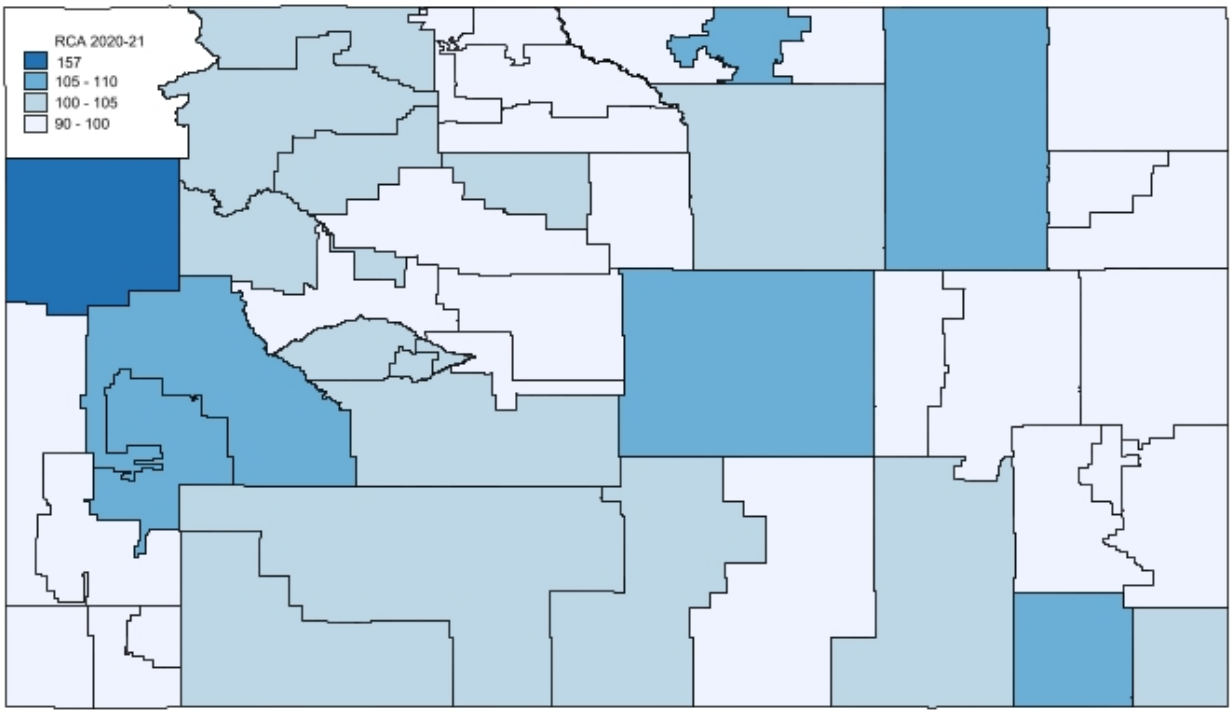
The Wyoming RCA

The Wyoming RCA—which only applies to the salary components of the school funding model—is an amalgam of two alternative labor cost indices: the WCLI and the 2005 HWI. Both labor cost indices are constructed so that the state average has an index value of 100. Locations where labor costs are 10 percent above the state average have an index value of 110 while locations where labor costs are 10 percent below the state average have an index value of 90. The WCLI used in the construction of the RCA is a three-year (i.e. six period) moving average of the

biannual WCLI published by the by the Wyoming Department of Administration & Information's Economic Analysis Division.[1]

Each district's RCA is the larger of the moving average WCLI, the 2005 Wyoming HWI or 100. In other words, districts where labor costs are below the state average are treated as if their costs were equal to the state average. This approach, wherein no districts are below average, limits the equalizing influence of the RCA. For school year 2020-21, more than half of the districts were treated as equivalent to one another (i.e. assigned an RCA of 100) despite large differences in labor cost among them according to both the 2005 Wyoming HWI and the WCLI.

Figure 1: The 2020-21 Regional Cost Adjustment (RCA)



Source: Wyoming Legislative Service Office

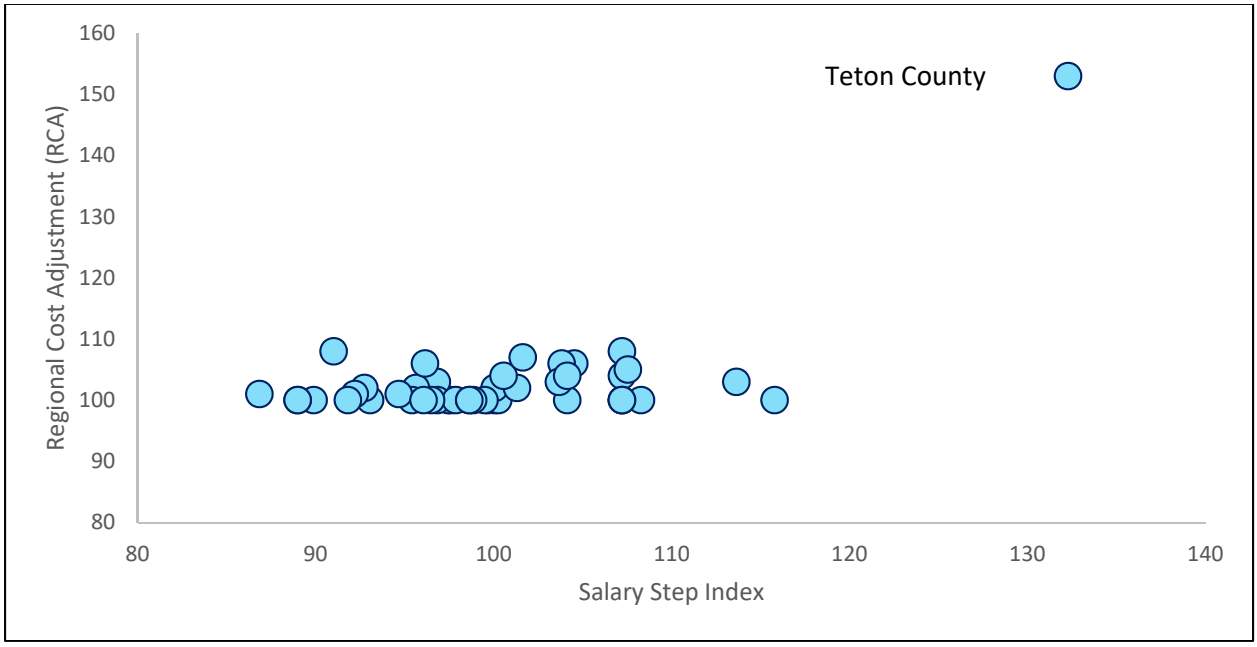
As the figure illustrates, the 2020-21 RCA ranged from 100 to 157. The lowest index values were found in the rural and eastern parts of the state while the highest index value was in Teton County. However, that range is somewhat misleading. There was a 50 percentage point gap between the RCA for Teton County School District #1 and the districts with the second-highest value of the RCA (i.e. the two districts in Sublette County and Sheridan County School District #2, which all had an RCA of 107). With the exception of Teton County School District #1, all Wyoming districts had an RCA between 100 and 107 for the 2020-21 school year.

Figure 2 illustrates the relationship between the RCA and teacher starting salaries. The horizontal axis on this figure plots an index of the first step on the 2019-20 teacher salary

[1] For more on the Wyoming Cost of Living Index, visit http://eadiv.state.wy.us/WCLI/Cost.html

schedule for each Wyoming district. As with the WCLI or Wyoming HWI, this index was constructed so that an index value of 100 equaled the state average. The vertical axis plots the corresponding RCA.

Figure 2: Comparing the First Step on the Teacher Salary Schedule with the RCA, 2019-20



Source: Author's calculations.

As the figure illustrates, during 2019-20 there was substantial variation in starting salaries among the school districts with an RCA of 100. Starting salaries among districts with an RCA of 100 ranged from 11 percent below the state average to 16 percent above the state average.

At the other extreme, Teton County School District #1 paid starting salaries that were 32 percent higher than the average district, despite an RCA that would have allowed the district to pay salaries that were 53 percent higher than the state average. This pattern implies that either the RCA overstates the labor cost differential in Teton County, or that Teton County School District #1 systematically offers below-market wages and therefore attracts teachers with below average qualifications.

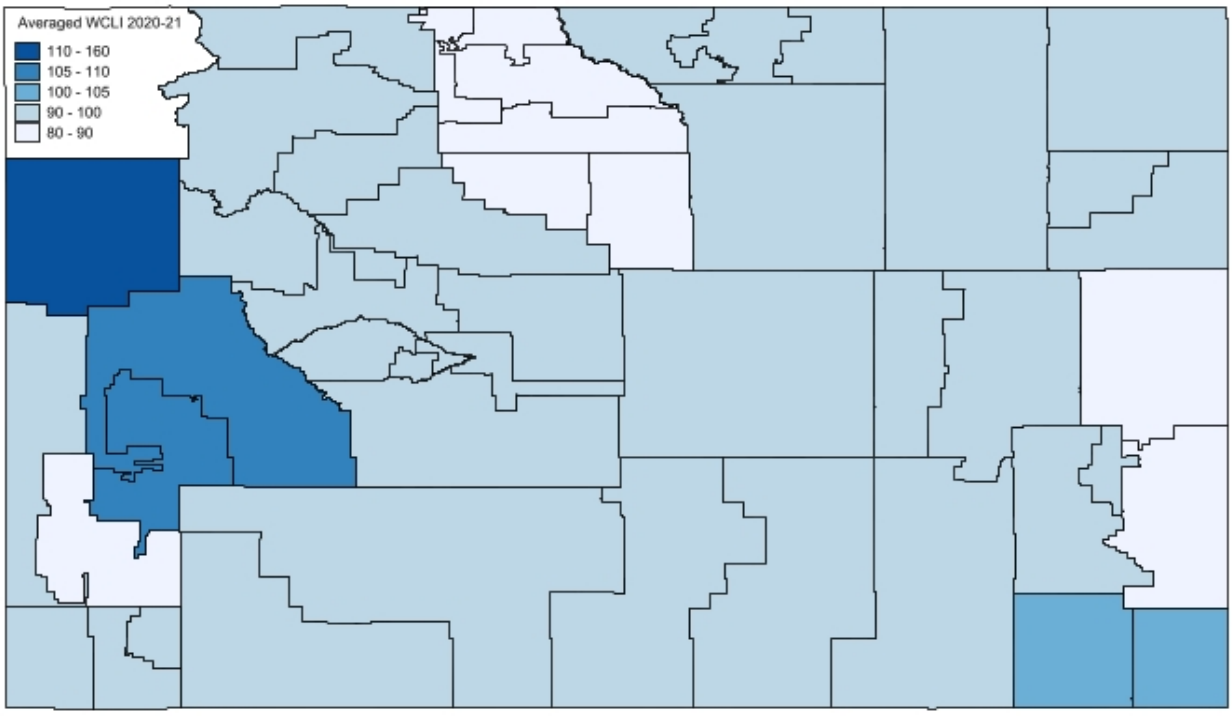
For school year 2020-21, 26 districts had an RCA of 100. Another 18 districts had an RCA above 100 because their 2005 Wyoming HWI was above 100 and above their current WCLI. Only four districts had an RCA above 100 because their current WCLI was above 100 and above their 2005 Wyoming HWI. In other words, given the values of the 2005 Wyoming HWI, only four districts benefited from including the WCLI in the calculation of the RCA. This is the lowest number of districts to benefit from the inclusion of the WCLI in the calculation of the RCA since the legislature adopted the current formulation.

More on the WCLI

The WCLI is modeled after the U.S. Bureau of Labor Statistics' (BLS's) Consumer Price Index for urban consumers (CPI-U). It is produced bi-annually by the Wyoming Department of Administration & Information's Economic Analysis Division. Twice a year, the Economic Analysis Division collects data on prices for food, housing, apparel, transportation, medical services, and recreation and personal care. The WCLI is a weighted average of the prices for each of these components, where the weights reflect the share of the typical urban consumer's budget devoted to each component.

The WCLI used in the RCA is the average of the six consecutive semi-annual index reports completed by January 1 of the immediately preceding school year. Figure 3 illustrates the geographic distribution of the WCLI used in the RCA for the 2020-21 school year. Darker colors indicate higher index values.

Figure 3: The WCLI Index Used in the RCA, 2020-21



Source: Wyoming Legislative Service Office.

The three-year average WCLI used in the RCA for 2020-21 ranged from a low of 90 to a high of 157, implying that the cost of living in Teton County was 74 percent (157/90) higher than the cost of living in Big Horn or Washakie Counties.

As discussed in Taylor (2015), there is reason to believe that the WCLI overstates regional differences in the cost of hiring. More than 95 percent of the geographic variation in the WCLI comes from variation in the housing component, and the WCLI puts more weight on housing than does either the cost-of-living index used in Colorado's school funding formula, or the U.S.

cost of living index for small "Class D" cities. Furthermore, high housing costs are frequently associated with natural beauty or other factors that make a community a particularly attractive place to live. Those attractive amenities mean that wages do not need to fully cover the cost of living, and that cost of living indices—which cannot capture amenities—overstate the cost of hiring in locations with such amenities (Stoddard 2005).

More on the 2005 Wyoming HWI

The 2005 Wyoming HWI is based on a hedonic wage model of base salaries estimated by Bruce Baker using data from the 2003-04 and 2004-05 school years. The uncontrollable cost factors that drove differences in the 2005 Wyoming HWI were:

- the WCLI,
- four measures of geographic isolation,
    - distance to Yellowstone National Part
    - distance to a city with a population of at least 15,000
    - distance to a city with a population of at least 50,000
    - population density
- three measures of student demographics,[2]
    - school-level unduplicated "at risk" counts,
    - the percent of special education students, and
    - the percent of mobile students
- the district average supplemental salary.

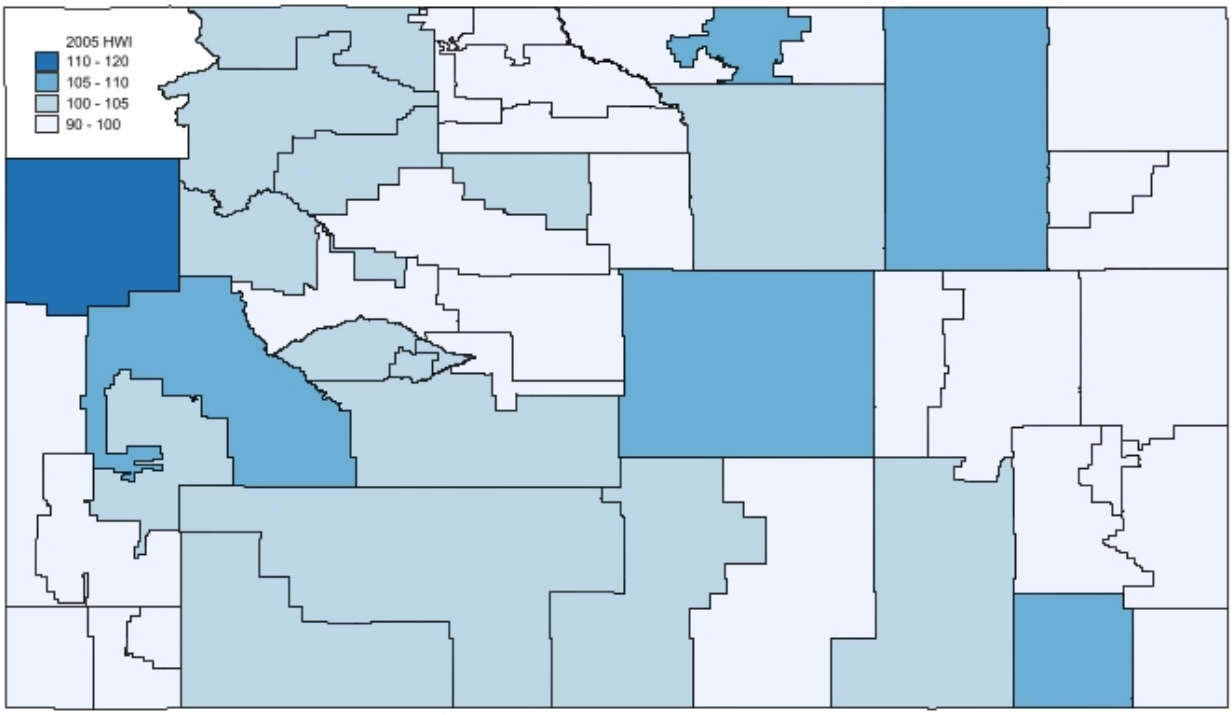
The index values used in the RCA for 2020-21 were based on the values of these uncontrollable cost factors as they were circa 2005.

Figure 4 illustrates the geographic distribution of the 2005 Wyoming HWI. Darker colors indicate higher index values.

As the figure illustrates, the 2005 Wyoming HWI also indicated substantial variation in the teacher salary cost from one part of Wyoming to the next. The lowest index values were found in the rural and eastern parts of the state (i.e. those farthest from Yellowstone National Park) while the highest index values were in Teton County. The 2005 Wyoming HWI for Teton County School District #1, the school district with the highest index value, was 118, while the 2005 Wyoming HWI for Platte County School District #2, the school district with the lowest index value, was 93. Thus, the 2005 Wyoming HWI indicated that labor costs differed by as much as 27 percent (118/93) from one part of Wyoming to the next.

[2] For construction of the index, all three variables were averaged across 2003-04 and 2004-05.

Figure 4: The 2005 Wyoming Hedonic Wage Index Used in the RCA, 2020-21



Source: Baker (2005).

An Up-To-Date Alternative to the 2005 Wyoming HWI

To help inform the Legislature, this analysis presents a 2020 Wyoming HWI. The 2020 Wyoming HWI improves on the 2005 Wyoming HWI in four important ways:

1. The analysis underpinning the 2020 Wyoming HWI uses more recent data and a much longer time series. The 2005 Wyoming HWI was estimated using two years of data covering the 2003-04 and 2004-05 school years. This analysis covers the seven school years from 2013-14 through 2019-20.[3] All 10,679 individuals with complete data who taught full time in a Wyoming public school for at least one year during that period are included in the analysis.[4] Using a longer time series allows for a richer specification of controllable and uncontrollable cost factors and should lead to more precisely measured regional cost adjustments.
2. Teachers are likely to consider their total salary not just their base salary when deciding whether or not to accept a new position or stay in their existing one, and school districts have great discretion over the size of the supplements they offer for extra duties such as tutoring

[3] Data on earnings, teacher characteristics and job assignments were drawn from the Wyoming Department of Education (WDE) 602 fall data collection files for each school year.

[4] Due to data quality concerns, teacher records with full-time-equivalent (FTE) total salaries greater than $120,000 or less than 80 percent of the first step on the district's salary schedule were excluded from the analysis, as were individuals with a reported FTE less than 0.9 or greater than 1.1, or an FTE in teaching greater than 110 percent of the individual's total FTE. Individuals with contracts for fewer than 150 days or more than 200 days were also excluded.

after school, or advising the debate team. Some types of supplements, such as "rural inconvenience (isolation) pay" are not associated with extra duties and should never be excluded from the salary measure used for hedonic wage analysis. Therefore, unlike in the Baker analysis, this analysis treats most forms of supplemental salary as just another part of an individual's compensation package, and estimates a hedonic model of total salary, not just base salary.[5]

3. The 2020 hedonic wage model uses a much richer set of discretionary factors (see Table 1). In addition to the number of contract days and the teacher demographic characteristics included in Baker's 2005 analysis (indicators for gender, race, advanced degrees, total teaching experience, and secondary school assignment) this analysis also includes an indicator for whether or not the teacher attended a Wyoming university and whether or not the teacher's bachelor's degree was in education. (As opposed to a degree in mathematics or history, for example.) The model includes district-specific teaching experience and an indicator for first-year teachers to add further richness to the specification of teacher characteristics

   In addition to controls for teacher demographics, the model also includes controls for the subject matter of the teaching assignment; for whether or not the teacher was assigned to a school with more than 1,000 students; for whether or not the teacher was assigned to a middle school, elementary school, high school, or K-12 school; and indicators for whether or not the teacher was assigned to a number of non-teaching activities such as coaching or advising. (Because all of the teachers under analysis were, by definition, assigned to the teaching activity full time, there is no need for an indicator for teaching.). Broadening the set of teacher and job characteristics included in the model strengthens the argument that the resulting regional cost index reflects only factors that are outside of school district control, and improves the quality of the HWI.

[5] The three exceptions are leave payouts for accrued vacation time and sick leave for those retiring or resigning staff; retiring incentives (a salary bonus given by the district to employees to announce retirement by a certain date) and stipends for coaching. Leave payouts and retiring incentives have been excluded because they provide no information about the salaries needed to recruit or retain teachers. Coaching stipends in Wyoming vary a lot from district to district. Because there is little reason to believe that this variation in coaching stipends reflects regional differences in labor cost (and there is no way of controlling for differences in coaching quality that might successfully explain the differences in salary) all supplemental pay for coaches has been excluded from the measure of total salary.

Table 1: Discretionary Factors from the 2020 Hedonic Wage Model

Years of experience in the school district	Teaching assignment indicators
Years of experience, total	English
Highest degree held	Social science
Wyoming BA indicator	Math
Education degree indicator	Health and P.E.
Non-teaching assignment indicators	Foreign language
Advisor/sponsor	Vocational education
Assistant coach	Bilingual/ESL
Coach	Fine arts
Classified staff position	Science
Head teacher	Special education
Principal	Large school (enrollment > 1,000)
Support staff position	School type (elementary, middle, etc.)
Tutor	Sex and race
Other administrator	Length of typical teacher contract

4. The 2020 hedonic wage model relies on an improved set of uncontrollable cost factors (see Table 2). As with the construction of the 2005 Wyoming HWI, the uncontrollable cost factors include the WCLI, multiple measures of geographic isolation and multiple measures of student need. However, the 2020 hedonic wage model replaces the somewhat problematic metric of the distance to Yellowstone National Park with an indicator for whether or not the nearest hospital is more than 25 miles away. The latter is a measure of geographic isolation that is more relevant to the everyday lives of Wyoming's teachers.[6]

[6] Distance to the nearest hospital was determined as the crow flies using data from the National Center for Education Statistics on the latitude and longitude of each Wyoming school building, and data from the Wyoming Hospital Association on the street address of each Wyoming Hospital. The Wyoming State Hospital was not included in this calculation.

Table 2: Uncontrollable Cost Factors from the 2020 Hedonic Wage Model, with Comparison to the Factors Used in Construction of the 2005 Wyoming HWI

Uncontrollable Cost Factors	Used in the 2020 HWI?	Used in the 2005 HWI?	Impact of the Cost Factor on the 2005 HWI
WCLI	Yes	Yes	Positive
County Wage Index	Yes	No	
Geographic isolation			
Miles to nearest city of 50,000	Yes	Yes	Positive
Miles to nearest city of 15,000	Yes	Yes	Negative
Miles to Yellowstone National Park	No	Yes	Negative
Population density (county)	Yes	No	
Population density (10-mile radius)	No	Yes	Positive
Student demographics			
Percent Free Lunch	Yes	No	
Percent Special Ed.	Yes	Yes	Positive
Percent English language learners	Yes	No	
Percent unduplicated at risk	No	Yes	Negative
Percent mobile	No	Yes	Negative
District average supplemental salary	No	Yes	Negative

For the 2020 HWI analysis, the distance to the nearest city with a population of 50,000 and the nearest city with a population of 15,000 were calculated as-the-crow-flies at the school level using the U.S. Census Bureau's 2019 population estimates and latitude and longitude files for places. For both measures, the nearest city need not be within the state of Wyoming. Indeed, more than half of the school districts in Wyoming have at least one campus that is closer to a city of 50,000 in another state than it is to a city of that size within Wyoming.

In addition, the 2020 analysis replaces the unduplicated-at-risk percent and the percent mobile students with two alternative measures of student need—the percent of students who are English language learners and the percentage of students who qualify to receive free school lunches. Taylor (2011) found that these two variables better explained salaries than did the student demographic indicators used in Baker's 2005 analysis.

The set of uncontrollable cost factors also includes a county-level estimate of the prevailing wage for workerss who are not teachers. Including this county wage index as a cost factor strengthens the model by reflecting not only the labor market alternatives available to Wyoming school teachers but also the wage premiums other workers command in each county. As such, it controls for regional differences in amenities that could make workers willing to accept a wage that was not commensurate with the housing costs if the location offered natural amenities (like scenic beauty) or cultural amenities (like access to sporting events).

The county wage index was estimated from annual data provided by the Wyoming Department of Workforce Services and the U.S. Bureau of Labor Statistics, following the Occupational Employment Statistics methodology described in Taylor and Fowler (2006) and Taylor (2015).[7] The county wage index is the average wage level for each county adjusted for differences in the occupational mix, divided by the state average wage level and then multiplied by 100.

Including the county wage index as a cost factor strengthens the model by reflecting not only the labor market alternatives available to Wyoming school teachers but also the wage premiums other workers command in each county. As such, it controls for regional differences in amenities that could make workers willing to accept a wage that was not commensurate with the housing costs if the location offered natural amenities (like scenic beauty) or cultural amenities (like access to sporting events).

The Estimation

Table 3 presents selected results from the regression analysis of full-time-equivalent total teacher salaries in Wyoming. (The full set of regression coefficients and standard errors is presented in Appendix A.) Following Taylor (2015 and 2018), the model was estimated using an AR random effects specification.[8] An AR random effects model incorporates all of the available information about the distribution of teacher salaries and some of the information about unmeasured teacher characteristics without losing the ability to capture the impact of the time-invariant locational cost factors (as could be the case with other statistical approaches, such as a fixed effects specification). Including the random effects, the AR specification explains 97 percent of the variation in Wyoming teacher salaries.

[7] The wage predictions used to construct the wage index are the least squares means or population marginal means from a regression of the average annual earnings (in logs) on indicator variables for occupation and location, weighted by total employment in the occupation/location cell. Here, the data come from all Wyoming counties and all metropolitan areas and non-metropolitan areas elsewhere in the country. Including data from other states has the effect of estimating Wyoming wage levels as deviations from the national average, by occupation, and ensures that occupations observed in only one or two Wyoming counties are not dropped from the analysis. Because some Wyoming counties lack occupational detail, the estimation includes major occupation groups as well as detailed occupations. Including major occupation groups means that the analysis cannot fully control for differences in occupational mix because it cannot control for differences in the mix within those major occupation groups. However, restricting the analysis only to major occupation groups yielded very similar point estimates for the prevailing wage in Wyoming counties so any bias is likely to be small.

[8] The Hausman test for autocorrelation generated an F-statistic of 285.338 and a probability of a greater F-statistic less than 0.0001.

Table 3: The 2020 Hedonic Wage Model

	2020 Hedonic Wage Model
WCLI	0.0033
	(0.0001)**
County Nonteaching Wage Index	0.0014
	(0.0001)**
County pop. density (log)	0.0468
	(0.0010)**
Distance to a 50,000 city	0.0004
	(0.0000)**
Distance to a 15,000 city	0.0004
	(0.0000)**
Nearest hospital > 25 miles	-0.0410
	(0.0021)**
Percent free lunch	0.0028
	(0.0002)**
Percent free lunch * WCLI	-0.0000
	(0.0000)**
Percent English language learners	0.0000
	(0.0001)
Percent special education	-0.0000
	(0.0001)
Includes year indicators?	Yes
Includes discretionary factors?	Yes
Wooldridge test for autocorrelation in panel data, F(1, 7757)	285.338
Number of observations	49,432
Number of individual teachers	10,679

*Note: The dependent variable is the log of full-time-equivalent total annual salary. Standard errors are in parentheses. The model was estimated using an AR random effects specification. The asterisks indicate a coefficient that is * significant at 5%; ** significant at 1%.*

In contrast, Baker (2005) used a between-teachers model to estimate the 2005 Wyoming HWI. The between-teachers model uses only information about differences between teachers, and largely ignores information about the changing experiences and earnings of individual teachers over time. A between-effects model can be desirable when there is little variation across time, as is the case when the analysis is based on only two years of data. In such situations, the cross-time variation is as likely to be noise as information. The between-effects estimation strategy is not desirable for analyses—like this one—that incorporate many years of data because it fails to exploit much of the available information about salaries.

The 2020 Wyoming HWI

The 2020 Wyoming HWI was constructed by using the AR random effects model to predict the salary a teacher with state average characteristics would earn in each Wyoming school district. This approach treats the specified cost factors as uncontrollable and all other factors that influence salaries—including any relevant omitted factors—as discretionary. A district's index value is the district's predicted salary in 2019-20 divided by the state average predicted salary and then multiplied by 100. Table 4 provides descriptive statistics for the 2020 Wyoming HWI and the 2005 Wyoming HWI. Appendix C presents the 2020 Wyoming HWI and 2005 Wyoming HWI for each Wyoming school district.

Table 4: Comparing the 2020 Wyoming HWI with the Current Components of the RCA

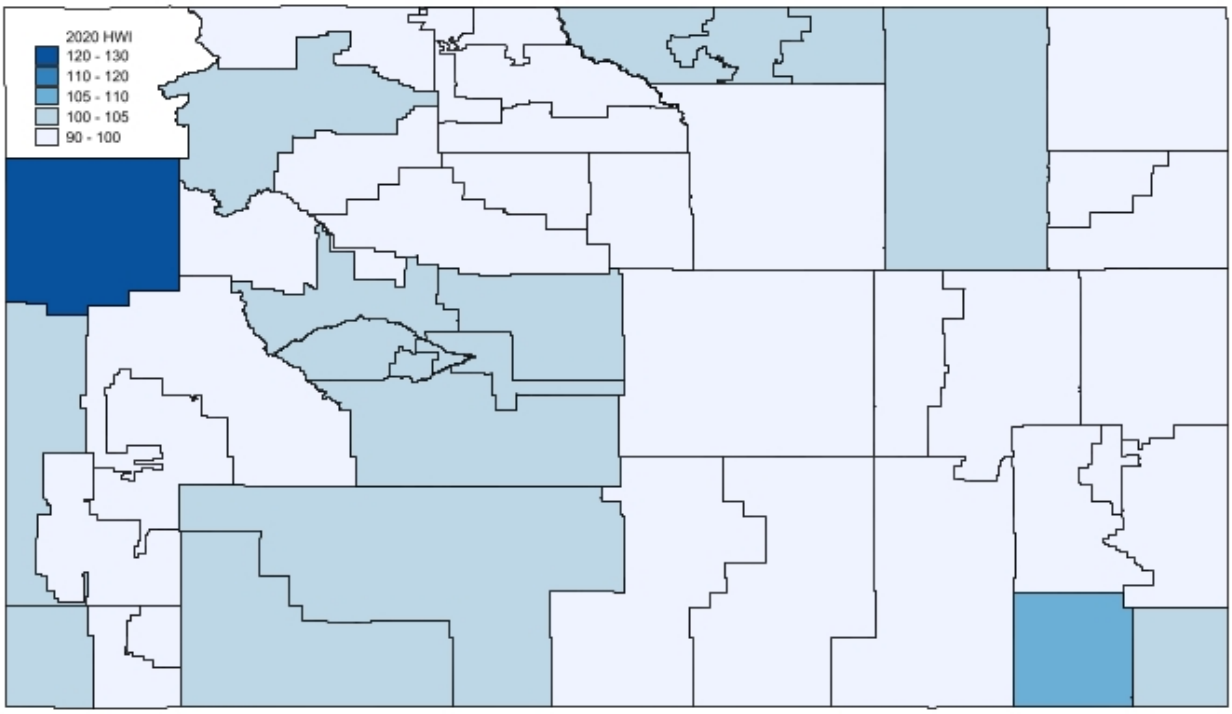
	Mean	Std. Deviation	Minimum	Maximum	Maximum Excluding Teton County
2020 Wyoming HWI	100.0	4.5	93	122	106
2005 Wyoming HWI	100.3	4.6	93	118	107
2020 Averaged WCLI	97.1	9.9	90	157	107

Source: Baker (2005), Wyoming Legislative Service Office, and author's calculations

As the table illustrates, the 2020 Wyoming HWI indicates that there are substantial regional cost differences in Wyoming. By this measure, labor cost is 32 percent higher in the highest-cost district (Teton County School District #1) than it is in the lowest-cost districts (Niobrara County School District #1 and Weston County School District #1). The 2020 Wyoming HWI has a larger range than the 2005 Wyoming HWI, which indicated that labor cost was 27 percent higher in the highest-cost district than in the lowest-cost district, but a much smaller range than the averaged WCLI, which indicated that labor cost was 74 percent higher in the highest-cost district than in the lowest cost district.

Figure 5 illustrates the 2020 Wyoming HWI. Again, darker colors indicate higher index values. As the figure indicates, even though distance to Yellowstone National Park was not included in the estimation, index values were generally lowest along the state's eastern border. They were highest in Teton County.

Figure 5: The 2020 Wyoming Hedonic Wage Index



Source: Author's calculations.

Alternative Specifications

Researchers frequently worry that an outlier of the magnitude of Teton County might bias the estimation of the hedonic wage model and therefore have undue influence on the resulting HWI (Baker 2005, Taylor 2015, 2018). However, that is not the case with the 2020 Wyoming HWI. As a check, the AR-random effects model was re-estimated excluding the teachers in Teton County School District #1 and an alternative HWI was constructed. (For model specification, see Appendix A.) The index values were largely unaffected, suggesting that Teton County does not have undue influence on the model. Excluding Teton County School District #1 teachers from the estimation reduces the influence of the WCLI, which lowers the HWI for Teton County School District #1 from 122 to 112, but has very little effect on the index values for the rest of the districts in Wyoming. The correlation between the HWI estimated with Teton County and the HWI estimated without Teton County was 0.984 for the districts other than Teton County School District #1. Given the similarity between the two indices, either the 2020 Wyoming HWI or the alternative HWI would be a viable regional cost index for Wyoming.

Previously, legislators have expressed concern that the County Wage Index could have undue influence on wage model like the one presented in Table 3. Therefore, the AR random effects model was re-estimated excluding the County Wage Index. The correlation between the HWI estimated with the County Wage Index and the HWI estimated without the index was 0.986. Removing the County Wage Index from the estimation would reduce the HWI by one or two percentage points in 15 Wyoming school districts, and increase the HWI by a single percentage

point in nine districts. Removing the County Wage Index would reduce the HWI in both of the largest districts in the state (Natrona County School District #1 and Laramie County School District #1).

Recently, the National Center for Education Statistics (NCES) published a Comparable Wage Index for Teachers (CWIFT) that was based on the pattern of earnings reported in the American Community Survey (ACS). The ACS-CWIFT measures geographic variation in the prevailing wage for college-educated workers who are not educators. The basic premise of any Comparable Wage Index is that all types of workers—including teachers and other educators—demand higher wages in areas where the cost of living is high or there is a lack of desirable local amenities (such as good climate, low crime rates, or access to beaches, museums, or fine dining). As a result, it should be possible to measure most of the uncontrollable variation in educator pay by observing systematic, regional variations in the earnings of comparably educated workers who are not educators. Intuitively, if accountants in Cheyenne are paid 5 percent more than the national average accounting wage; Cheyenne engineers are paid 5 percent more than the national average engineering wage; Cheyenne nurses are paid 5 percent more than the national average nursing wage; and so on, then a comparable wage index would predict that the wage level for Cheyenne teachers is also 5 percent more than the national average teacher wage.

The Census Bureau and NCES estimated the ACS-CWIFT using data from three consecutive years of the ACS. The most recent index was estimated from over one-million survey responses and covers the three-year period from 2015 through 2017.

Wherever possible, the ACS-CWIFT was estimated at the county level. However, if there were too few survey respondents in a county then the Census Bureau combined data from neighboring counties to ensure that every index value was based on survey responses from at least 50 college-educated non-teachers. Even though the Census Bureau's analysis combine responses from three years of surveys, most Wyoming counties did not have enough college-educated respondents to produce a single-county estimate for the ACS-CWIFT. Instead, most counties were combined with at least one neighbor. Only five counties (Albany, Laramie, Natrona, Sweetwater and Teton) had truly county-level estimates.

The ACS-CWIFT provides further evidence that the WCLI overstates the cost of hiring. Where the WCLI for 2017 indicated that the cost-of-living in Teton County was 37 percent higher than the cost of living in Natrona County, the ACS-CWIFT for 2017 indicated that the prevailing wage for college graduates in Teton County was only 4 percent higher than the prevailing wage for college graduates in Natrona County.

As a final check on the 2020 Wyoming HWI, the AR random effects model was re-estimated using the ACS-CWIFT rather than the County Wage Index. Unfortunately, the ACS-CWIFT was only available for three of the seven years used in the estimation of the 2020 Wyoming HWI. The growth rate for the County Wage Index was used to impute the missing values of the ACS-

CWIFT. Intuitively, if the county wage level grew by 4 percent between 2017 and 2018, then the wages underlying the ACS-CWIFT for districts in that county were presumed to have grown by 4 percent as well. The imputed CWIFT data were then used to re-estimate the hedonic wage model and recalculate the corresponding HWI. The correlation between the HWI estimated with the ACS-CWIFT and the 2020 Wyoming HWI was 0.981, suggesting that the County Wage Index is a highly credible alternative to the ACS-CWIFT for the estimation of a hedonic wage index.

Exploring the Implications

Updating the 2005 Wyoming HWI could substantially alter the distribution of state aid to Wyoming school districts, depending on implementation. Arguably, the two most likely scenarios are that either:

1. The 2020 Wyoming HWI would replace the 2005 HWI in the calculation of the RCA, or
2. The 2020 Wyoming HWI would replace the RCA.

Appendix B lists the current and updated RCA under each scenario for each Wyoming district.

Under the first scenario, updating the Wyoming HWI would impact 25 districts. As Table 5 illustrates, the RCA would increase for 10 districts and decrease for 15 districts. Most of the changes would be modest, but a few would be substantial. The RCA for Fremont County School District #6 would increase from the current level of 100 to a revised 104, largely on the basis of the greater weight placed on geographic isolation in the 2020 HWI. (No district is farther from a city with a population of 15,000 than Fremont County School District #6.) The RCA for Sheridan County #1 would become equal to the RCA for Sheridan County #2, whereas they currently differ by 7 percentage points. The district with the largest downward revision to the RCA would be Natrona County School District #1, which would see its RCA slide from 106 to 100 if the 2005 Wyoming HWI were replaced with the 2020 Wyoming HWI.

After updating, 20 of the 48 school districts in Wyoming would have their RCA based on the 2020 Wyoming HWI. Twenty-five districts would have their RCA set to 100 despite below-average labor costs. Only three districts—Teton County School District #1 and the two districts in Sublette County—would have their RCAs based on the WCLI.

Table 5: Comparing the Current RCA with the RCA Calculated Using the 2020 Wyoming HWI, for Districts Where the RCA Would Change

District Name	Current RCA	RCA using 2020 HWI	Difference
Albany County School District 01	101	100	-1
Campbell County School District 01	106	105	-1
Carbon County School District 01	101	100	-1
Fremont County School District 01	103	102	-1
Fremont County School District 02	102	100	-2
Fremont County School District 06	100	104	4
Fremont County School District 14	104	103	-1
Fremont County School District 21	103	104	1
Fremont County School District 24	100	101	1
Fremont County School District 25	100	102	2
Fremont County School District 38	102	103	1
Johnson County School District 01	102	100	-2
Laramie County School District 02	103	104	1
Lincoln County School District 02	100	101	1
Natrona County School District 01	106	100	-6
Park County School District 01	103	100	-3
Park County School District 06	104	102	-2
Park County School District 16	101	100	-1
Sheridan County School District 01	100	104	4
Sheridan County School District 02	107	104	-3
Sheridan County School District 03	100	102	2
Sweetwater County School District 01	105	101	-4
Sweetwater County School District 02	104	101	-3
Uinta County School District 01	100	101	1
Washakie County School District 01	101	100	-1
Washakie County School District #1	101	100	-1

Note: The Current RCA and the RCA using the 2020 Wyoming HWI are identical for all districts not shown.
Source: Author's calculations.

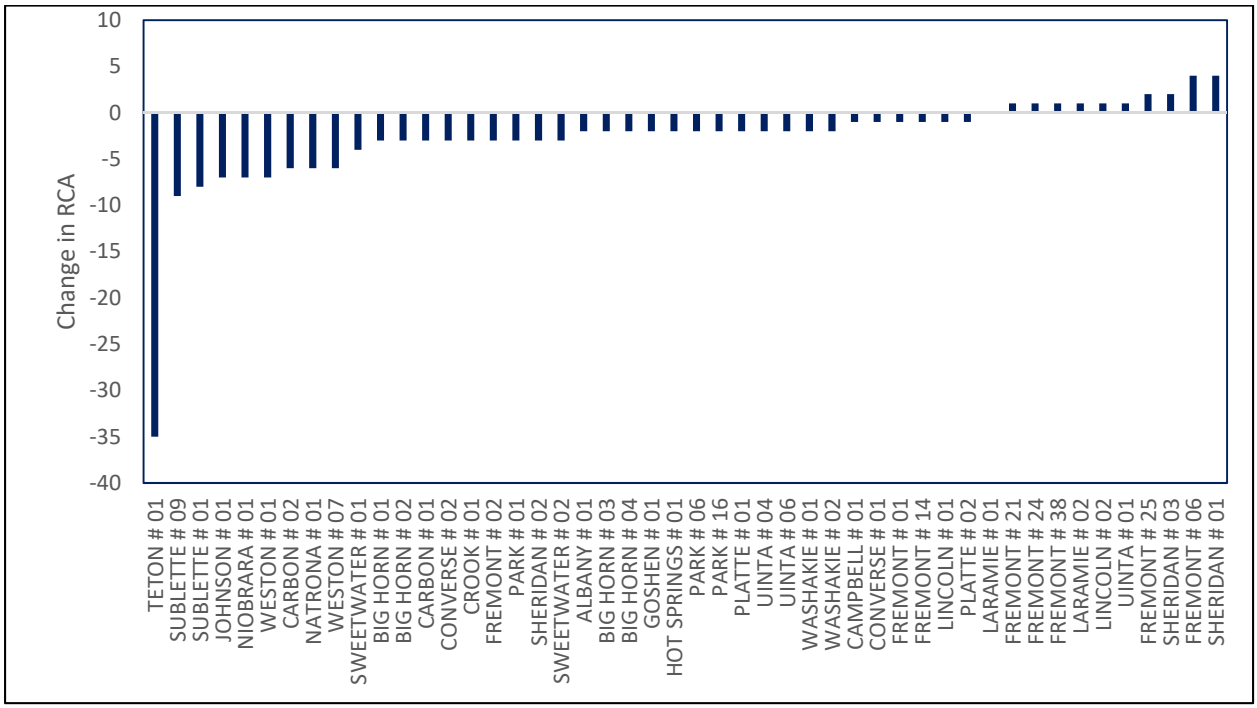
The second scenario uses the 2020 Wyoming HWI as the sole source of regional cost adjustment. The 2020 Wyoming HWI is a direct measure of regional variations in the cost of educator labor and as such would be an appropriate, stand-alone index for regional cost adjustment.

If the Legislature were to adopt the 2020 Wyoming HWI as the RCA, it would not be desirable to apply the regional cost adjustment only to districts with above average costs. Regional cost adjustments exist to equalize the purchasing power of school districts. If one district has labor costs that are 5 percent higher than another, then real resource equity requires that it receive 5 percent more funding than the other, even if both have below average costs. Rounding all the

districts up to the state average ignores important differences in labor cost and therefore undermines the equity goals of the funding model.

Figure 6 illustrates the changes that would occur if the 2020 Wyoming HWI were adopted as the RCA for all Wyoming school districts. Not surprisingly, allowing RCA values below 100 would lower the RCA for many school districts. However, the biggest declines in the RCA would be for districts where the WCLI is particularly high. The school districts benefiting the most by replacing the RCA with the 2020 Wyoming HWI would be Fremont County School District #6, Fremont County School District #25 and two of the three districts in Sheridan County.

Figure 6: The Changes in the RCA Implied by Using the 2020 Wyoming HWI as the RCA for All Districts



Source: Author's calculations.

Importantly, the reference wage for construction of an HWI is purely arbitrary. It would be equally legitimate to set the baseline value of 100 at the state minimum predicted wage, or at some other arbitrary point such as the fifth percentile, or at the wage level in a specific school district. What matters for purchasing power equity is that the relative positions of the districts remain unchanged.

Of course, if the baseline value for the HWI were pegged to something other than the state average, then it would also be necessary to apply the RCA to something other than the state average salary. It would be problematic to take an RCA based on the state minimum predicted wage, and apply it to an estimate of the state average salary. Conceptually, there should be a match between the baseline used to construct a cost adjustment, and the funding element being adjusted.

Conclusions

Wyoming is one of the few states in the nation to adjust its school finance formula to reflect regional variations in the cost of education. This analysis suggests that the cost of education varies widely within the state, offering strong support for continuing such adjustments.

Unfortunately, the Wyoming HWI has not been updated in more than fifteen years. As such, a key component of the Wyoming RCA has become sadly outdated and increasingly inadequate to the task of ensuring the equity of the Wyoming school finance system.

This analysis provides an up-to-date alternative to the 2005 HWI. The 2020 HWI improves upon the 2005 HWI in a number of important ways, not the least of which is the improved timeliness of the index values.

Replacing the 2005 Wyoming HWI with the 2020 version in the calculations of the RCA would lead to little or no change in index values for most Wyoming school districts, but substantial changes for a few. The districts most affected by such a move would be Fremont County School District #6 and Sheridan County School District #1 (where the RCAs would all be revised upward) and Natrona County School District #1 and Sweetwater County School District #1 (where the RCAs would all be revised downward).

As a general rule, larger districts would not benefit from updating the HWI. The RCA would be 6 points lower for Natrona County School District #1 and unchanged in Laramie County #1 if the 2020 Wyoming HWI simply replaced the 2005 Wyoming HWI in the calculation of the RCA. The largest district to benefit from updating the 2005 Wyoming HWI would be Lincoln County School District #2, where the RCA would be revised upward from 100 to 101. On the other hand, the state as a whole would clearly benefit from a decision to update the Wyoming HWI because of the positive influence on equity.

As an alternative, the Legislature could choose to eliminate the best-of-three approach to index construction and simply replace the RCA with the 2020 HWI, rebased as the Legislature sees fit. Such change could be calibrated to be revenue-neutral to the state or to any specific district.

Whichever option the Legislature chooses, I recommend that it put in place a mechanism for regular updates to the RCA. The Wyoming economy is dynamic and labor market conditions in Wyoming are constantly changing. For the RCA to work as intended, it must accurately reflect current differences in labor cost, not differences in labor cost that are more than fifteen years out of date. Making small adjustments to the index values as you go would also be much less disruptive than large, wrenching changes after extended periods of time.

One way to enable incremental change would be to think of the 2020 HWI as a formula rather than a number. The wage predictions for a district depend on some characteristics that do not change over time (such as geographic location) and other factors that most definitely do change (such as the WCLI, the county wage index and the share of low income students). A state agency

such as the Legislative Service Office or the Economic Analysis Division could be tasked with generating new wage predictions each year, based on the coefficient estimates in Appendix C and the most recent data. Such an approach would keep the Wyoming HWI from drifting out of alignment with the real cost differences facing Wyoming school districts.

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Appendix A: The Hedonic Wage Models

Table A presents coefficient estimates and robust standard errors for three alternative hedonic wage models. The first model (i.e. the main specification) incorporated random effects for teachers, assuming an auto regressive (AR1) error structure. The second model replicated the first but was estimated excluding data from Teton County School District #1. The third replicated the first model, excluding the County Wage Index.

Table A: Regression Coefficients and Standard Errors from Alternative Model Specifications

	AR Random Effects Model	AR RE Model Excluding Teton	AR Random Effects Model Excluding County Wage Index	AR Random Effects Model Including CWIFT
MA	0.0683	0.0672	0.0682	0.0688
	(0.0008)**	(0.0008)**	(0.0008)**	(0.0008)**
PhD	0.1002	0.0985	0.1002	0.1013
	(0.0063)**	(0.0064)**	(0.0063)**	(0.0063)**
District experience (log)	-0.0297	-0.0293	-0.0294	-0.0295
	(0.0009)**	(0.0009)**	(0.0009)**	(0.0009)**
District experience (log), sq.	0.0171	0.0168	0.0172	0.0173
	(0.0003)**	(0.0003)**	(0.0003)**	(0.0003)**
Total experience (log)	0.0819	0.0832	0.0812	0.0814
	(0.0008)**	(0.0009)**	(0.0009)**	(0.0009)**
New teacher	0.0381	0.0390	0.0376	0.0379
	(0.0012)**	(0.0012)**	(0.0012)**	(0.0012)**
Non-teaching assignments				
Administration	0.0279	0.0282	0.0275	0.0274
	(0.0016)**	(0.0016)**	(0.0016)**	(0.0016)**
Advisor/sponsor	0.0264	0.0263	0.0265	0.0265
	(0.0006)**	(0.0006)**	(0.0006)**	(0.0006)**
Assistant coach	-0.0021	-0.0020	-0.0022	-0.0022
	(0.0008)*	(0.0008)*	(0.0008)**	(0.0008)**
Classified	0.0359	0.0363	0.0346	0.0343
	(0.0041)**	(0.0041)**	(0.0041)**	(0.0041)**
Coach	-0.0029	-0.0032	-0.0035	-0.0038
	(0.0012)*	(0.0012)**	(0.0012)**	(0.0012)**

	AR Random Effects Model	AR RE Model Excluding Teton	AR Random Effects Model Excluding County Wage Index	AR Random Effects Model Including CWIFT
Head teacher	0.0167	0.0146	0.0153	0.0153
	(0.0026)**	(0.0026)**	(0.0026)**	(0.0026)**
Principal	0.1201	0.1185	0.1185	0.1183
	(0.0313)**	(0.0310)**	(0.0314)**	(0.0315)**
Support	0.0214	0.0241	0.0199	0.0184
	(0.0027)**	(0.0027)**	(0.0027)**	(0.0027)**
Tutor	0.0396	0.0394	0.0408	0.0406
	(0.0047)**	(0.0047)**	(0.0048)**	(0.0048)**
Teaching assignments				
Arts	0.0038	0.0048	0.0028	0.0025
	(0.0028)	(0.0028)	(0.0028)	(0.0028)
Elementary grades	-0.0038	-0.0036	-0.0048	-0.0055
	(0.0020)	(0.0020)	(0.0020)*	(0.0021)**
English/language arts	0.0038	0.0047	0.0030	0.0024
	(0.0022)	(0.0022)*	(0.0022)	(0.0022)
Bilingual/ ESL	-0.0026	-0.0015	-0.0025	-0.0034
	(0.0039)	(0.0043)	(0.0039)	(0.0040)
Foreign Language	-0.0035	-0.0021	-0.0044	-0.0043
	(0.0035)	(0.0037)	(0.0035)	(0.0035)
Health & P.E.	-0.0030	-0.0032	-0.0034	-0.0038
	(0.0026)	(0.0027)	(0.0027)	(0.0027)
Math	0.0012	0.0018	0.0005	0.0000
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Science	0.0040	0.0038	0.0029	0.0021
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
Special Education	0.0044	0.0048	0.0037	0.0032
	(0.0022)*	(0.0022)*	(0.0022)	(0.0022)
Social science	-0.0050	-0.0056	-0.0054	-0.0062
	(0.0025)*	(0.0026)*	(0.0026)*	(0.0025)*
Vo-tech	0.0116	0.0134	0.0104	0.0102
	(0.0027)**	(0.0027)**	(0.0027)**	(0.0027)**
Contract days	0.2739	0.2402	0.2815	0.2911
	(0.0142)**	(0.0142)**	(0.0143)**	(0.0143)**

	AR Random Effects Model	AR RE Model Excluding Teton	AR Random Effects Model Excluding County Wage Index	AR Random Effects Model Including CWIFT
Elementary school	0.0000	0.0000	0.0000	0.0000
High school	0.0080	0.0067	0.0069	0.0062
	(0.0014)**	(0.0014)**	(0.0014)**	(0.0014)**
K-12 school	-0.0252	-0.0257	-0.0284	-0.0288
	(0.0029)**	(0.0029)**	(0.0029)**	(0.0030)**
Middle school	0.0049	0.0039	0.0042	0.0035
	(0.0013)**	(0.0013)**	(0.0013)**	(0.0013)**
Other school type	-0.0030	-0.0035	-0.0036	-0.0040
	(0.0014)*	(0.0014)*	(0.0014)*	(0.0015)**
Large school	0.0021	0.0039	0.0034	0.0042
	(0.0015)	(0.0015)**	(0.0015)*	(0.0015)**
Black	0.0057	0.0078	0.0064	0.0061
	(0.0110)	(0.0110)	(0.0111)	(0.0108)
Hispanic	0.0048	0.0037	0.0051	0.0048
	(0.0038)	(0.0039)	(0.0038)	(0.0038)
Indian	-0.0191	-0.0154	-0.0204	-0.0198
	(0.0068)**	(0.0068)*	(0.0069)**	(0.0067)**
Female	-0.0027	-0.0032	-0.0027	-0.0027
	(0.0015)	(0.0015)*	(0.0015)	(0.0015)
Wyoming university grad	-0.0051	-0.0033	-0.0062	-0.0063
	(0.0013)**	(0.0013)*	(0.0013)**	(0.0013)**
Degree in education	-0.0086	-0.0074	-0.0088	-0.0089
	(0.0014)**	(0.0014)**	(0.0014)**	(0.0014)**
WCLI	0.0033	0.0017	0.0035	0.0036
	(0.0001)**	(0.0002)**	(0.0001)**	(0.0001)**
County Wage Index	0.0014	0.0014		
	(0.0001)**	(0.0001)**		
County pop. density (log)	0.0468	0.0477	0.0449	0.0447
	(0.0010)**	(0.0010)**	(0.0010)**	(0.0010)**
Distance to a 50,000 city	0.0004	0.0005	0.0005	0.0005
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**
Distance to a 15,000 city	0.0004	0.0003	0.0003	0.0003

	AR Random Effects Model	AR RE Model Excluding Teton	AR Random Effects Model Excluding County Wage Index	AR Random Effects Model Including CWIFT
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**
Nearest hospital > 25 miles	-0.0410	-0.0383	-0.0370	-0.0387
	(0.0021)**	(0.0021)**	(0.0021)**	(0.0021)**
Percent free lunch	0.0028	0.0005	0.0027	0.0027
	(0.0002)**	(0.0004)	(0.0002)**	(0.0002)**
Percent free lunch * WCLI	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0000)**	(0.0000)	(0.0000)**	(0.0000)**
Percent ELL	0.0000	-0.0006	0.0001	-0.0000
	(0.0001)	(0.0001)**	(0.0001)	(0.0001)
Percent special education	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
NCES CWIFT				-0.0005
				(0.0001)**
School year 2013-14	-0.0558	-0.0540	-0.0564	-0.0553
	(0.0007)**	(0.0007)**	(0.0007)**	(0.0007)**
School year 2014-15	-0.0381	-0.0361	-0.0389	-0.0382
	(0.0007)**	(0.0007)**	(0.0007)**	(0.0007)**
School year 2015-16	-0.0241	-0.0225	-0.0249	-0.0245
	(0.0006)**	(0.0006)**	(0.0006)**	(0.0006)**
School year 2016-17	-0.0257	-0.0237	-0.0267	-0.0265
	(0.0006)**	(0.0006)**	(0.0006)**	(0.0006)**
School year 2017-18	-0.0271	-0.0262	-0.0276	-0.0276
	(0.0005)**	(0.0005)**	(0.0005)**	(0.0005)**
School year 2018-19	-0.0178	-0.0171	-0.0183	-0.0183
	(0.0004)**	(0.0004)**	(0.0004)**	(0.0004)**
School year 2019-20	0.0000	0.0000	0.0000	0.0000
Constant	8.7209	9.0518	8.8058	8.7994
	(0.0752)**	(0.0761)**	(0.0754)**	(0.0757)**
Number of observations	49,432	47,883	49,432	49,124

*Note: The dependent variable for all models is the log of total annual salary. Robust standard errors are in parentheses. The AR random effects models were estimated using an AR1 error structure. The asterisks indicate a coefficient that is * significant at 5%; ** significant at 1%.*

Appendix B: Index Values for Regional Cost Adjustment

District Name	RCA 2020-21	New RCA	2005 HWI	2020 HWI	Averaged WCLI	County Wage Index	Salary Step Index
Albany County School District 01	101	100	101	99	99	90	95
Big Horn County School District 01	100	100	98	97	90	93	107
Big Horn County School District 02	100	100	100	97	90	93	108
Big Horn County School District 03	100	100	99	98	90	93	98
Big Horn County School District 04	100	100	99	98	90	93	97
Campbell County School District 01	106	105	106	105	100	110	105
Carbon County School District 01	101	100	101	98	99	103	95
Carbon County School District 02	100	100	98	94	99	103	87
Converse County School District 01	100	100	96	99	98	106	100
Converse County School District 02	100	100	94	97	98	106	100
Crook County School District 01	100	100	97	97	97	102	93
Fremont County School District 01	103	102	103	102	96	96	97
Fremont County School District 02	102	100	102	99	96	96	93
Fremont County School District 06	100	104	100	104	96	96	104
Fremont County School District 14	104	103	104	103	96	96	107
Fremont County School District 21	103	104	103	104	96	96	114
Fremont County School District 24	100	101	99	101	96	96	97
Fremont County School District 25	100	102	100	102	96	96	100
Fremont County School District 38	102	103	102	103	96	96	100
Goshen County School District 01	100	100	95	98	90	87	98
Hot Springs County School District 01	100	100	100	98	93	89	96
Johnson County School District 01	102	100	102	95	96	89	96
Laramie County School District 01	106	106	106	106	103	97	104
Laramie County School District 02	103	104	95	104	103	97	101
Lincoln County School District 01	100	100	97	99	90	103	107
Lincoln County School District 02	100	101	98	101	98	103	116
Natrona County School District 01	106	100	106	100	95	101	96
Niobrara County School District 01	100	100	94	93	90	92	99
Park County School District 01	103	100	103	100	99	96	104

District Name	RCA 2020-21	New RCA	2005 HWI	2020 HWI	Averaged WCLI	County Wage Index	Salary Step Index
Park County School District 06	104	102	104	102	99	96	101
Park County School District 16	101	100	101	99	99	96	92
Platte County School District 01	100	100	95	98	93	95	90
Platte County School District 02	100	100	93	99	93	95	95
Sheridan County School District 01	100	104	98	104	100	95	92
Sheridan County School District 02	107	104	107	104	100	95	102
Sheridan County School District 03	100	102	99	102	100	95	89
Sublette County School District 01	107	107	106	99	107	108	107
Sublette County School District 09	107	107	103	98	107	108	91
Sweetwater County School District 01	105	101	105	101	97	109	108
Sweetwater County School District 02	104	101	104	101	97	109	104
Teton County School District 01	157	157	118	122	157	109	132
Uinta County School District 01	100	101	99	101	92	97	99
Uinta County School District 04	100	100	99	98	92	97	107
Uinta County School District 06	100	100	100	98	92	97	99
Washakie County School District 01	101	100	101	99	90	96	95
Washakie County School District 02	100	100	96	98	90	96	89
Weston County School District 01	100	100	94	93	91	84	99
Weston County School District 07	100	100	94	94	91	84	96

Appendix C: The Formula for Calculating the 2020 HWI

Variables	Weight	Mean 2020	Minimum	Maximum
WCLI (Second Quarter)	0.373	96.9	88	161
County Wage Index	0.113	97.4	84	110
Population Density	4.546	1.5	-0.11	3.61
Miles to a City of 50,000	0.0403	32.2	2.5	134.3
Miles to a City of 15,000	0.0393	33.4	1.4	117.5
Nearest Hospital is More than 25 Miles	-4.179	0.2	0	1
Percent Free or Reduced Lunch	0.320	37.8	9.6	100
FRL * WCLI	-0.00327	3618.1	862.6	9500.0
Percent ELL	-0.00922	2.1	0	14.3
Percent Special Education	0.0353	15,1	9.6	23.9
Constant	82.58			