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January 2016

Options for Higher Education Tuition Growth Factors

Revised April 2016 to correct community and technical college tuition data.

The 2015 Washington State Legislature reduced college tuition by 5% in the 2015-16 academic year for public resident undergraduate students.[1] The legislature reduced tuition further for the following academic year by 20% at public regional four-year institutions and 15% at the state's two research universities.

The new law also limited future tuition increases for public resident undergraduate students to no more than the average annual growth in median hourly wages in Washington State. The legislature directed the Washington State Institute for Public Policy (WSIPP) to examine how this median hourly wage "growth factor" will affect tuition and to study alternative metrics for determining changes in tuition levels.[2]

This report describes the following types of metrics and estimates future tuition growth using each:

- Hourly wages,
- Total income,
- Inflation indices, and
- Higher education-specific indices.

We also discuss a potential growth factor related to "student affordability" as directed in legislation.

Summary

The 2015 Washington State Legislature reduced public resident undergraduate tuition in 2015 and limited future tuition increases to no more than the average annual percentage growth in Washington's median hourly wage.

The legislature also directed WSIPP to examine how this median hourly wage "growth factor" will affect tuition at the state's public colleges and universities and to study alternative metrics for limiting tuition increases.

This report focuses on published tuition prices, not the net cost of college after other resources—such as financial aid and state appropriations to institutions—are taken into account. A comprehensive analysis of net costs and overall college affordability is beyond the scope of this assignment.

The median hourly wage in Washington State has grown by an annual average of 2.1% since 2001. This measure captures how much workers are paid, but does not directly take unemployment or inflation into account.

The alternative higher education tuition growth factors examined in this report increased annually by 2.1% to 3.0% over the past 14 years. Income-based metrics take unemployment into account because income is averaged across wage earners and non-workers, but they fluctuate more than wage- and general inflation-based measures.

Suggested citation: Pennucci, A. (2016) *Options for higher education tuition growth factors* (Document Number 16-01-2301). Olympia: Washington State Institute for Public Policy.

[1] Second Engrossed Substitute Senate Bill 5954, Chapter 36, Laws of 2015, 3rd Special Session. The base year for the tuition reduction is the 2014-15 academic year.
[2] Ibid, Sec. 10.

I. Background

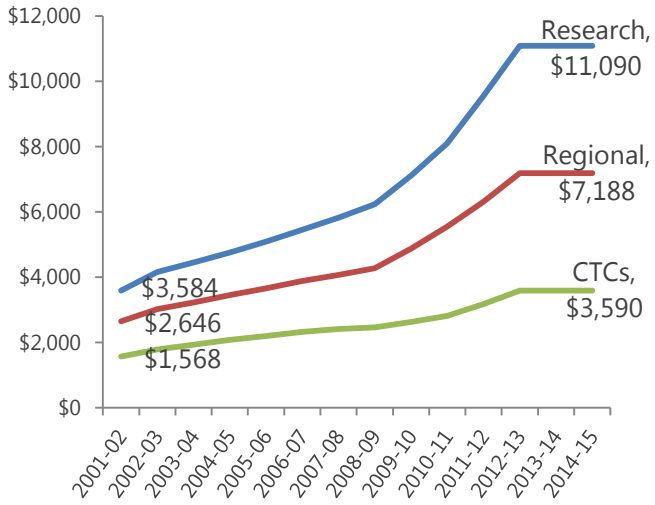
Tuition fees for resident undergraduate students at Washington State public colleges and universities more than doubled between 2001 and 2012.

Exhibit 1 displays tuition rates for Washington's public research and regional postsecondary institutions as well as community and technical colleges (CTCs).[3]

Average tuition at the state's two research universities increased from $3,584 in the 2001-02 academic year to $11,090 in 2012-13 (in unadjusted dollars).[4] Tuition at the state's regional institutions increased from an average of $2,646 to $7,188[5] and, at CTCs, from $1,568 to $3,590.[6] The legislature placed a freeze on tuition levels in 2012, so tuition remained the same through the 2014-15 school year.

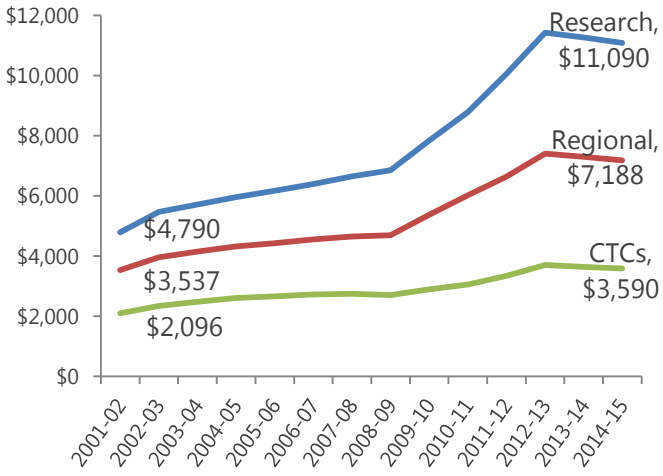
After adjusting for inflation,[7] tuition levels more than doubled at the four-year institutions and increased by over 70% at Washington CTCs (see Exhibit 2).

Exhibit 1
Public Resident Undergraduate Tuition,
Washington State 2001-2014



Data source: WSAC, in unadjusted dollars.

Exhibit 2
Inflation-Adjusted
Public Resident Undergraduate Tuition,
Washington State 2001-2014



Data source: WSAC, in 2014 dollars.

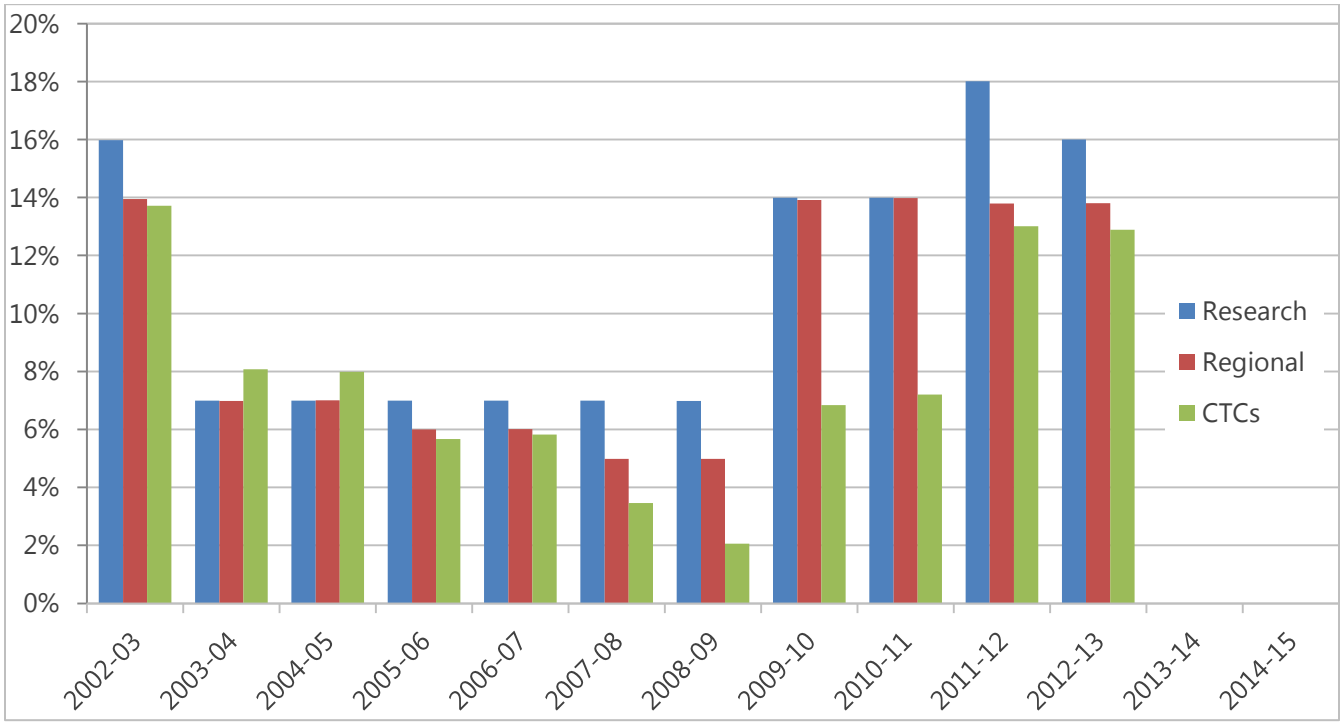
[3] Resident undergraduate tuition rates include operating and building fees. Estimates are from the Washington Student Achievement Council (WSAC) Annual Tuition and Fees Distribution of Academic Year Student Charges reports.
[4] The two research universities are the University of Washington and Washington State University.
[5] The four regional institutions are Central Washington University, Eastern Washington University, The Evergreen State College, and Western Washington University.
[6] Washington has 34 community and technical colleges, overseen by the Washington State Board of Community and Technical Colleges. For more information visit: http://www.sbctc.edu/
[7] Based on the CPI-U, described later in this report.

Exhibit 3 displays the recent annual percentage change in resident undergraduate tuition at Washington public higher education institutions. Between 2001 and 2014, tuition grew by an annual average of 9.2% at the research universities, 8.1% at regional institutions, and 6.7% at CTCs.

Washington's recent college tuition increases are not unique. Public tuition rates have risen in all but one state (Maine). Washington's recent tuition increases have been above the national average in the past five years (see Appendix, Exhibit A1).

Exhibit 3

Annual Percentage Change in Public Resident Undergraduate Tuition in Washington State



Data source: WSAC (WSIPP calculated percentage change from previous year).

II. Median Hourly Wage as a Tuition Growth Factor

A noted earlier, the 2015 Washington State Legislature reduced 2015-16 public resident undergraduate tuition fees by 5%, with additional reductions stipulated for 2016-17 for four-year institutions (15% for research universities and 20% for regional institutions).

The legislature also limited future public resident undergraduate tuition increases to "no more than the average annual percentage growth rate in the median hourly wage for Washington for the previous fourteen years as the wage is determined by the federal bureau of labor statistics" (BLS).[8] In the same legislation, WSIPP was directed to study median hourly wages and possible alternatives to this tuition "growth factor."

In this section, we describe the median hourly wage metric as it relates to public resident undergraduate tuition fees.

It is important to note that this report focuses on published tuition prices, not the net cost of college after other policies and funding sources—such as financial aid and state appropriations to institutions—are taken into account. A comprehensive analysis of college affordability is beyond the scope of this assignment.

Legislative Study Direction

The Washington state institute for public policy shall conduct a study on alternative resident undergraduate tuition growth factors such as median wage, average wage, consumer price index, student affordability metrics, and others. The analysis should indicate how tuition is likely to change under each metric over an extended period of time. The report should also consider the relative ease of calculating or obtaining the metric for budget development purposes. The legislature intends to use this analysis to evaluate the median wage metric [...]

2ESSB 5954 Sec. 10, Laws of 2015

Median Hourly Wages

The median hourly wage metric was first published by the BLS at the statewide level for surveyed occupations in 2001.

"Hourly wages" are the dollar amount paid to non-farm workers per hour, excluding benefits.[9] The "median" falls in the middle of the distribution of all hourly wages; that is, half of Washington workers make less than that amount per hour, and half make more.

For this growth factor and those summarized later in this report, we use data series that are not seasonally adjusted, because seasonal adjustments are made to monthly or quarterly (not annual) data. The Appendix to this report provides additional detail about how Washington's median hourly wage is calculated.

[8] Second Engrossed Substitute Senate Bill 5954, Chapter 36, Laws of 2015, 3rd Special Session.

[9] The Appendix provides detail about the specific wages and occupations included in the measure.

Trends in Median Hourly Wages

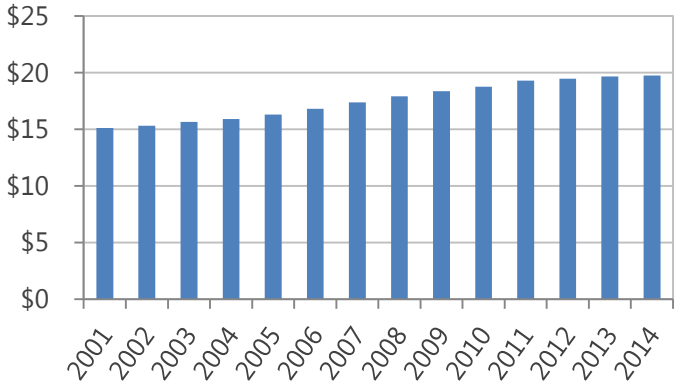
In 2014, the median hourly wage in Washington State was $19.76, up from $15.12 in 2001 (in current dollars; see Exhibit 4).

Since 2001, the annual percentage change in Washington's median hourly wages has varied from 0.5% to 3.5%, with an average of 2.1% (see Exhibit 5).

In real terms (after adjusting for inflation), Washington's median hourly wage has remained relatively flat. In 2014 dollars, the median wage was $20.21 in 2001 and $19.76 in 2014.

Exhibit 4

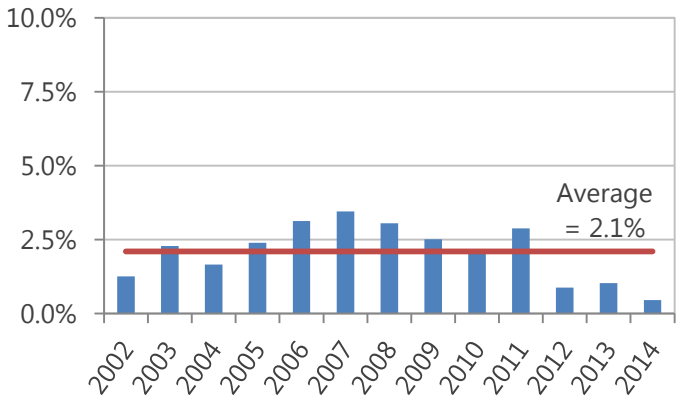
Washington's Median Hourly Wage



Data source: BLS, in unadjusted dollars.

Exhibit 5

Annual Percentage Change in Washington's Median Hourly Wage



Data source: BLS, in unadjusted dollars.

Projecting Tuition Growth Using the Median Hourly Wage Metric

To project future tuition levels, we use the median hourly wage in unadjusted dollars, because tuition amounts are set in unadjusted dollars.

Under current policy, tuition at Washington's public higher education institutions would grow by 2.1% in the 2017-19 biennium. Exhibit 6 displays the estimated tuition for those years.

Exhibit 7 illustrates projected future tuition levels assuming a 2.1% average annual increase out to the 2024-25 academic year.

Exhibit 6

Current and Future Estimated
Resident Undergraduate Public Tuition
Based on the 2001-14 Average Annual Change
in Washington's Median Hourly Wage

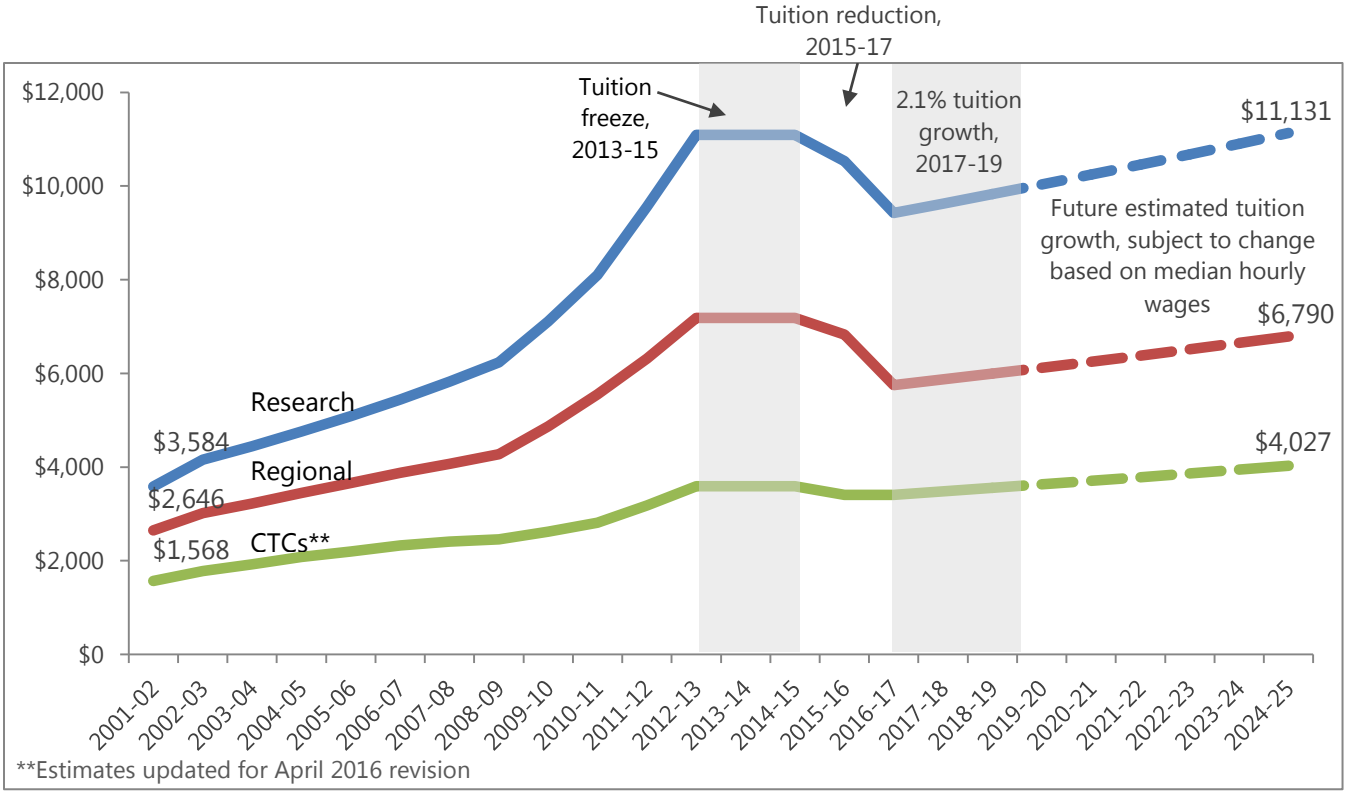
Academic year	Research	Regional	CTCs**
2014-15	$11,090	$7,188	$3,590
2015-16 (5% decrease)	$10,535	$6,828	$3,411
2016-17 (15-20% decrease except for CTCs)	$9,426	$5,750	$3,411
2017-18 (2.1% increase)	$9,624	$5,871	$3,482
2018-19 (2.1% increase)*	$9,826	$5,994	$3,555

*Subject to change based on May 2016 BLS data release

**Estimates updated for April 2016 revision

Exhibit 7

Current and Future Estimated Public Resident Undergraduate Tuition Levels
Based on Average Annual Percentage Change in Washington's Median Hourly Wage



**Estimates updated for April 2016 revision

The legislative direction for this study requires WSIPP to "consider the relative ease of calculating or obtaining the metric for budget development purposes."[10]

Each May, the federal Bureau of Labor Statistics (BLS) releases a new year of data on its website.[11] Updating the median hourly wage tuition growth metric involves two steps:

1) Calculate the most recent annual percentage change: divide the difference between the new median hourly wage and the previous year's median by the previous year's median.

$$\textit{Annual \% change} = \frac{\textit{(New – Previous)}}{\textit{Previous}}$$

2) Calculate the 14-year average (known as a "moving average"): add the newest percentage change and drop the oldest (from over 14 years ago) from the data series. Then compute a simple average (sum of the data series divided by 14).[12]

Limitations of the Median Hourly Wage Metric

This "growth factor" is tied to the wages earned by full- and part-time workers. Other aspects of the state economy—such as unemployment rates, public assistance, fringe benefits, and other non-wage income that can affect students' ability to pay tuition fees—are not captured in the metric.

Other limitations include the following:

- The BLS wage survey covers only 57% of occupations in Washington State, based on businesses that report to the state for unemployment insurance purposes.[13]
- Not all businesses are included in every survey administration; the metric itself is a three-year moving average.
- Economic downturns that increase unemployment rates are not reflected in this measure, because wages that equal zero are excluded from the calculation.
- Because only 14 years of data are presently available, the stability of the moving average is unknown.

Detailed information about the median hourly wage metric is included in the Appendix.

The following section compares alternative tuition growth factors that could be used in lieu of this metric.

[10] Second Engrossed Substitute Senate Bill 5954, Chapter 36, Laws of 2015, 3rd Special Session, Sec. 10

[11] http://www.bls.gov/oes/tables.htm

[12] Because the current series includes only 13 years (2002-14), for the first update with 2015 median hourly wages, the oldest year would be kept in the calculation.

[13] Excluded occupations include: crop and animal production; timber and forestry; fishing, hunting, and trapping; private households; household workers or unpaid family workers; self-employed; and owners and partners in unincorporated firms.

III. Alternative Growth Factors

The legislative direction for this study requires WSIPP to "conduct a study on alternative resident undergraduate tuition growth factors such as median wage, average wage, consumer price index, student affordability metrics, and others."[14] We consulted with legislative, executive agency, and higher education budget staff to identify other growth factors to consider.

This section reviews and compares potential tuition growth factors including measures of:

- Wages and income: median and average hourly wages, median household and family income, and per capita income;
- Inflation: the Consumer Price Index and Implicit Price Deflator; and
- Higher education-specific inflation: the Higher Education Price Index and Higher Education Cost Adjustment.

Exhibit 8 displays the 14-year average annual percentage change for each metric. These options for alternative tuition growth factors range from 2.1% to 3.0%.

Details on how each metric is calculated and data covering the past 14 years are in the Appendix to this report.

Exhibit 9 presents data on projected tuition levels based on these alternative tuition growth factors.

Exhibit 8

Average Annual Percentage Change among Potential Tuition Growth Factors

14-year average, 2001-2014

Metric	Annual change
Median hourly wages	2.1%
Average hourly wages	2.6%
Median household income	2.5%
Median family income*	2.4%
Per capita income	3.0%
Consumer Price Index (CPI)	2.3%
Chained CPI	2.1%
Implicit Price Deflator (IPD)	2.1%
Higher Education Price Index (HEPI)	3.0%
Higher Education Cost Adjustment (HECA)	2.7%

*Limited to nine years of data

[14] Second Engrossed Substitute Senate Bill 5954, Chapter 36, Laws of 2015, 3rd Special Session, Sec. 10

Exhibit 9

Projected Tuition Levels Based on Alternative Tuition Growth Factors

Washington State Public Research Universities

Academic year	Med. hourly wage, chained CPI, or IPD (2.1%)	CPI (2.3%)	Median family income (2.4%)	Median household income (2.5%)	Average hourly wage (2.6%)	HECA (2.7%)	HEPI or per capita income (3.0%)
2013-14*	$11,090*	$11,090	$11,090	$11,090	$11,090	$11,090	$11,090
2014-15*	$11,090*	$11,090	$11,090	$11,090	$11,090	$11,090	$11,090
2015-16*	$10,535*	$10,535	$10,535	$10,535	$10,535	$10,535	$10,535
2016-17*	$9,426*	$9,426	$9,426	$9,426	$9,426	$9,426	$9,426
2017-18	$9,624*	$9,643	$9,652	$9,662	$9,671	$9,681	$9,709
2018-19	$9,826*	$9,865	$9,884	$9,903	$9,923	$9,942	$10,000
2019-20	$10,032*	$10,092	$10,121	$10,151	$10,181	$10,210	$10,300
2020-21	$10,243*	$10,324	$10,364	$10,405	$10,445	$10,486	$10,609
2021-22	$10,458*	$10,561	$10,613	$10,665	$10,717	$10,769	$10,927
2022-23	$10,678*	$10,804	$10,868	$10,931	$10,996	$11,060	$11,255
2023-24	$10,902*	$11,052	$11,128	$11,205	$11,281	$11,359	$11,593
2024-25	$11,131*	$11,307	$11,395	$11,485	$11,575	$11,665	$11,941

Washington State Public Regional Higher Education Institutions

Academic year	Med. hourly wage, chained CPI, or IPD (2.1%)	CPI (2.3%)	Median family income (2.4%)	Median household income (2.5%)	Average hourly wage (2.6%)	HECA (2.7%)	HEPI or per capita income (3.0%)
2013-14*	$7,188*	$7,188	$7,188	$7,188	$7,188	$7,188	$7,188
2014-15*	$7,188*	$7,188	$7,188	$7,188	$7,188	$7,188	$7,188
2015-16*	$6,828*	$6,828	$6,828	$6,828	$6,828	$6,828	$6,828
2016-17*	$5,750*	$5,750	$5,750	$5,750	$5,750	$5,750	$5,750
2017-18	$5,871*	$5,882	$5,888	$5,894	$5,900	$5,923	$5,923
2018-19	$5,994*	$6,018	$6,030	$6,041	$6,053	$6,100	$6,100
2019-20	$6,120*	$6,156	$6,174	$6,192	$6,210	$6,283	$6,283
2020-21	$6,249*	$6,298	$6,322	$6,347	$6,372	$6,472	$6,472
2021-22	$6,380*	$6,443	$6,474	$6,506	$6,538	$6,666	$6,666
2022-23	$6,514*	$6,591	$6,630	$6,668	$6,708	$6,866	$6,866
2023-24	$6,651*	$6,742	$6,789	$6,835	$6,882	$7,072	$7,072
2024-25	$6,790*	$6,897	$6,952	$7,006	$7,061	$7,284	$7,284

*Current policy

Estimates are subject to change as each data series' rolling average is updated.

Exhibit 9, (Continued)

Projected Tuition Levels Based on Alternative Tuition Growth Factors

Washington State Public Community and Technical Colleges**							
Academic Year	Med. hourly wage, chained CPI, or IPD (2.1%)	CPI (2.3%)	Median family income (2.4%)	Median household income (2.5%)	Average hourly wage (2.6%)	HECA (2.7%)	HEPI or per capita income (3.0%)
2013-14*	$3,590*	$3,590	$3,590	$3,499	$3,590	$3,590	$3,590
2014-15*	$3,590*	$3,590	$3,590	$3,590	$3,590	$3,590	$3,590
2015-16*	$3,411*	$3,411	$3,411	$3,411	$3,411	$3,411	$3,411
2016-17*	$3,411*	$3,411	$3,411	$3,411	$3,411	$3,411	$3,411
2017-18	$3,482*	$3,489	$3,492	$3,496	$3,499	$3,503	$3,513
2018-19	$3,555*	$3,569	$3,576	$3,583	$3,590	$3,567	$3,618
2019-20	$3,630*	$3,651	$3,662	$3,673	$3,683	$3,694	$3,727
2020-21	$3,706*	$3,735	$3,750	$3,765	$3,779	$3,794	$3,839
2021-22	$3,784*	$3,821	$3,840	$3,859	$3,878	$3,896	$3,954
2022-23	$3,863*	$3,909	$3,932	$3,955	$3,978	$4,002	$4,072
2023-24	$3,945*	$3,999	$4,026	$4,054	$4,082	$4,110	$4,194
2024-25	$4,027*	$4,091	$4,123	$4,155	$4,188	$4,221	$4,320

*Current policy

**Estimates updated for April 2016 revision

Estimates are subject to change as each data series' rolling average is updated.

The following section compares the options for higher education tuition growth factors on a variety of characteristics.

Exhibit 10 summarizes whether the growth factors are:

- Calculated using Washington State data (rather than data for the US);
- Based on wages/income or prices;
- Affected by unemployment rates;
- Sensitive to "outliers" (very high, rare values that pull up averages and may not reflect typical earnings);
- Sensitive to the base population (total population, household or family size);
- Relatively easy to update (as a "moving average" similar to updating the median hourly wage);
- Calculated prior to 2001; and
- Forecast by the Washington State Economic and Revenue Forecast Council (ERFC).

Hourly Wages

The two measures of hourly wages—the median and the average—are calculated by the federal Bureau of Labor Statistics (BLS) from the same data source. The BLS computes these metrics for every state, as well as for the nation overall.

The median hourly wage growth factor was described in the previous section. The average hourly wage is the sum of all wages divided by the number of wage earners. This metric is more sensitive to outliers and tends to be higher than the median, in terms of dollars as well as annual percentage change.

Exhibit 10
Summary of Alternative Tuition Growth Factors

	Median hourly wage	Average hourly wage	Median family income	Median household income	Per capita income	Inflation Indices (CPI & IPD)	Higher education cost indices
Specific to WA	✓	✓	✓	✓	✓		
Based on wages or income	✓	✓	✓	✓	✓		
Based on prices						✓	✓
Accounts for unemployment			✓	✓	✓		
Sensitive to "outliers"		✓			✓		
Sensitive to size of population			✓	✓	✓		
Simple "moving average" update	✓	✓	✓	✓	✓	✓	✓
Pre-2001 data available				✓	✓	✓	
Forecast by ERFC					✓	✓	

As noted earlier, median and average hourly wages do not account for unemployment, because they represent earnings only of employed people.

Both growth factors are relatively easy to update annually by adding the newest year, and dropping the oldest year, of BLS data to the moving average. Long-term trends in these metrics are unknown, because state overall median and average hourly wage were not regularly calculated prior to 2001. The ERFC does not forecast either metric.

Income

Measures of income—median household or family income and per capita income—capture more of the resources that may be available to students because they take into account other, non-wage earnings (such as farm production income, interest from ownership of financial assets, and public assistance).

Each of these state-specific metrics is calculated by the federal Bureau of Economic Analysis (BEA). The growth factors take into account both income and unemployment, because total income is spread across a family or household or the total population—including people who do not earn income.

The average annual percentage change for income-based growth factors fluctuates more widely than for wages (see Appendix exhibits). While all of the economic measures reviewed in this report tend to decline during periods of recession, the income-based metrics are more likely to have negative annual percentage change (see Appendix Exhibit A2).

Per capita income, which is an average of personal income spread across the total state population age 15 or older, is more sensitive to outliers than median family or household income. The ERFC forecasts per capita income in its regular economic forecast for Washington State.

The primary difference between median household and median family income is the base population: household income divides income by the number of individuals in a household (whether related or not), whereas family income includes only those considered to be family (and thus possibly expected to contribute to college expenses). Median family income is used in determining financial aid eligibility and amounts for programs such as Washington's State Need Grant and College Bound Scholarship.

Like median and average wages, all three of the income metrics can be easily updated by adding the newest year, and dropping the oldest year, of data to a moving average. Long-term data are available for median household income and per capita income, which allows analysts to examine how the moving average has changed over time. Additional information about long-term trends is presented following the next sub-section of this report.

Thus far, the alternative growth factors we have discussed focus on resources available to students and families via wages and income. The following metrics focus on prices—how much it costs to purchase certain economic goods and services—as a way to gauge changes in the economy.

Inflation Indices

The Consumer Price Index for urban consumers (CPI-U) and Implicit Price Deflator for personal consumption (IPD) are both general measures of inflation that track changes over time in prices for the same goods and services. Both metrics are national (not state-level).[15] The Washington State ERFC forecasts both measures.

The CPI-U tracks daily expenses of US consumers based on a fixed "market basket" of specific goods and services that do not change over time. An alternative "chained" CPI-U updates both the prices as well as the specific items included in the "basket"—items are substituted over time as consumption patterns change. The annual percentage change for the chained CPI-U tends to be lower than the "unchained" index.

The IPD for personal consumption measures the prices of a broader group of goods and services than the CPI-U (see Appendix for more detail). Both metrics are commonly used to make inflation adjustments. Washington State's expenditure limit is based on the IPD. Similar to the hourly wage metrics, neither the CPI-U nor the IPD are as sensitive to population size and unemployment as income-based growth factors are.

Like the wage and income metrics, inflation-index-based tuition growth factors can be easily updated by adding the newest year, and dropping the oldest year, of data to a moving average.

Long-Term Trends

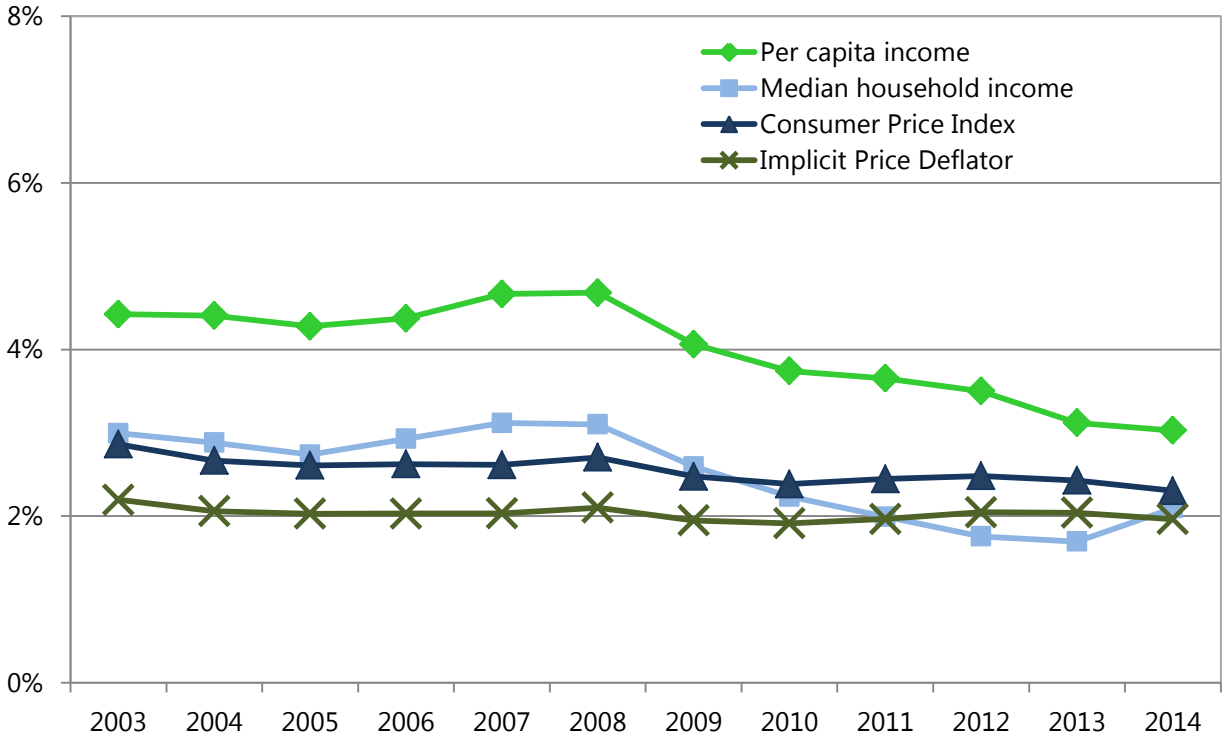
Long-term data are available for the CPI-U and IPD as well as for per capita and median household income. Exhibit 11, next page, displays the 14-year moving average annual percentage change for these four alternative tuition growth factors.

The two resource-related income metrics are more sensitive to population size and unemployment and tend to fluctuate more than the price-related inflation indices.

[15] The CPI has multiple series available at different levels of aggregation (national, local). This report focuses on the CPI-U, a national measure that is based on prices in urban areas and thus does not reflect changes in prices in rural areas (none of the series include rural areas). The BLS calculates a CPI-U for the Seattle-Tacoma-Bremerton area but not for the state of Washington. The most recent 14-year annual average percentage change in the Seattle CPI-U is the same as for the national CPI-U.

Exhibit 11

14-Year Moving Average Annual Percentage Change
for Four Alternative Growth Factors with Long-Term Data Available



Higher Education Indices

Two higher education-specific measures are the Higher Education Cost Index (HECI), calculated by a private investment firm, and the Higher Education Cost Adjustment (HECA), published by the State Higher Education Executive Officers (SHEEO) organization.

These two inflation indices track changes in higher education institutional spending on operations (primarily salaries, as well as utilities, library acquisitions, and other services). Both indices reflect higher increases in spending over time than more general measures of inflation (such as the CPI-U and IPD).

These indices are considered to be useful for internal budgeting processes in colleges and universities. The indices do not, however, take into account the ability of students to pay for the estimated total cost of providing higher education or the non-tuition resources that help pay for those costs (e.g., financial aid and state appropriations).[16]

More information about the indices is provided in the Appendix.

[16] See: https://www.commonfund.org/CommonfundInstitute/HEPI/Pages/HEPIvsCPI.aspx; and Gillian, A., & Robe, J. (2011). Stop misusing higher education price indices. Center for College Affordability and Productivity. http://files.eric.ed.gov/fulltext/ED536149.pdf

IV. Student Affordability

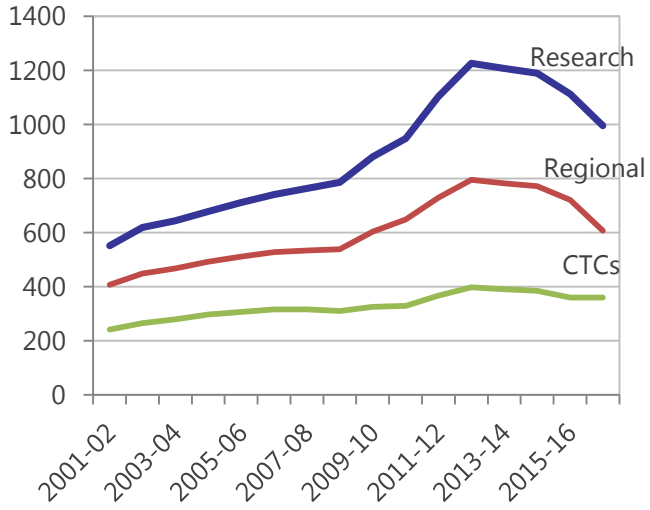
In addition to wages, income, and inflation, the legislative assignment for this study directed WSIPP to examine alternative tuition growth factors that more directly address student "affordability," or the ability of Washington residents to pay for college.

As noted earlier, for individuals, the decision about whether higher education is affordable depends on more than the "sticker price" of published tuition fees—students' actual out-of-pocket expenses and debt accumulation depends on the net price of tuition, after financial aid and other resources are considered.[17] There is, however, a literature on "student price response" that suggests published tuition prices can have an impact on their own.[18]

A University of Washington student working group developed a proposal to compare tuition to the state's minimum wage.[19] The specific metric proposed is the number of minimum-wage-paid hours needed to equal tuition at public colleges and universities.[20] As the student group noted, minimum wage earnings would not solely be used to cover tuition. To fully examine affordability, a more comprehensive analysis that includes financial aid and other information is needed.

Nonetheless, Exhibit 12 displays the number of working hours at minimum wage needed to earn enough to pay for tuition (and nothing else). The hours needed increased between 2001 and 2012 and have since declined, similar to tuition levels.

Exhibit 12
Estimated Number of Working Hours at Minimum Wage for Total Earnings to Equal Resident Undergraduate Public Tuition



[17] For a more detailed discussion of affordability, see, for example: Baum, S., & Ma, J. (2014). *College affordability: What is it and how can we measure it?* Lumina Foundation; Heller, D. (2001).*The states and public higher education policy: Affordability, access, and accountability*. JHU Press. Baltimore: Maryland.

[18] WSIPP has not yet systematically reviewed this research literature. See, e.g., Garibaldi, P., Giavazzi, F., Ichino, A., & Rettore, E. (2007). *College cost and time to complete a degree: Evidence from tuition discontinuities.* National Bureau of Economic Research Working Paper 12863; Rizzo, M., & Ehrenberg, R. (2003). *Resident and nonresident tuition and enrollment at flagship state universities.* National Bureau of Economic Research Working Paper 9516; Kane, T. (1995). *Rising public college tuition and college entry: How well do public subsidies promote access to college?* National Bureau of Economic Research Working Paper 5164; and Leslie, L., & Brinkman, P. (1987). Student price response in higher education: The student demand studies. *Journal of Higher Education, 58*(2), 181-204.

[19] Association of Students of the University of Washington, (2014). Meet us in the middle: Affordability for the working student. http://www.asuw.org/files/2014/06/MeetInTheMiddle1.pdf

[20] Assuming working full-time over the summer (40 hours per week for three months) and half-time during the school year (20 hours per week for nine months).

V. Upcoming Research

In 2015, the Washington State Legislature[21] and WSIPP's Board of Directors[22] assigned WSIPP additional research projects related to higher education. The legislature directed WSIPP to conduct an outcome evaluation of the College Bound Scholarship Program. The Board of Directors approved a project supported by the Pew-MacArthur Results First Initiative that includes a review of research evidence on:

- The monetary benefits of improving outcomes such as college attendance, persistence, and completion;
- Programs targeting middle and high school students that aim to increase college attendance and reduce the need for remedial courses once in college;
- Financial aid and tuition policy; and
- College programs that assist students in persisting in and completing degree programs in a timely fashion.

These studies will be completed in 2017 (the research reviews) and 2018 (the College Bound evaluation).

[21] Second Substitute Senate Bill 5851, Chapter 244, Laws of 2015.
[22] http://www.wsipp.wa.gov/About/Board

Appendix

Options for Higher Education Tuition Growth Factors

A. I. Public Resident Undergraduate Tuition in the United States

For this report, we collected information from other states' websites, laws, and regulations about tuition setting authority. In most states, tuition setting authority is "distributed"—that is, rather than being a centralized decision by the legislative or executive branch, tuition policy is guided by the legislature and specific amounts are determined by college system governing boards or individual postsecondary institutions.[23] Some states, like Washington, set limits on tuition increases using a measure of inflation or income. For example:

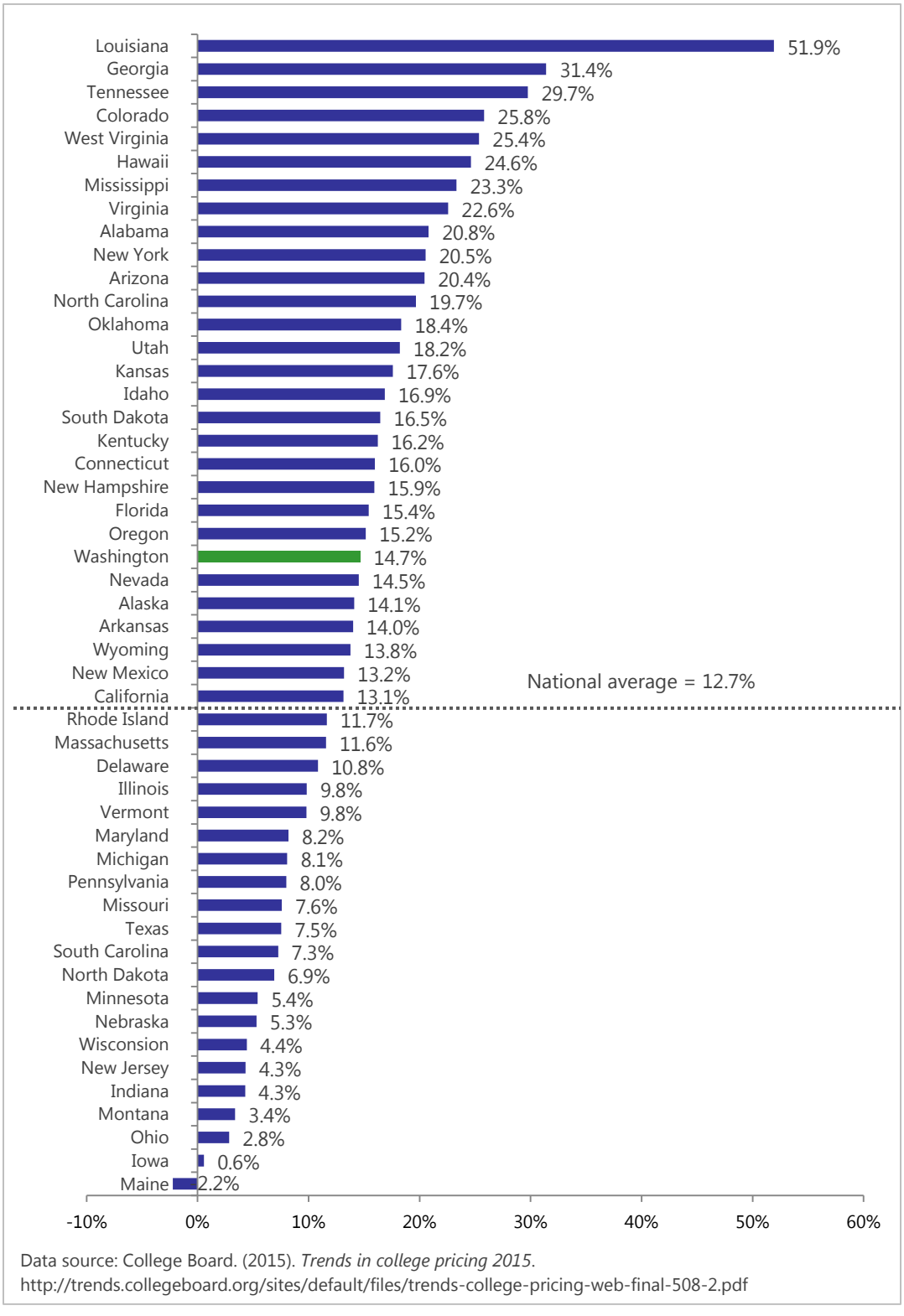
- **Alaska's** University of Alaska Board of Regents sets tuition rates. The policy established in 2001 states that "[t]uition rates for each academic year, fall through summer, will be adjusted for inflation based on a moving average of inflation for the most recent three-year period, as determined by the university's chief finance officer."[24]
- **Colorado** law directs the Colorado Commission on Higher Education to set resident undergraduate tuition rates between fiscal years 2011-12 and 2015-16. The Commission's policy limits tuition growth to no more than 9% annually.[25]
- **Iowa** law requires the Board of Regents to adopt a policy for establishing tuition rates that will provide predictability for assessing and anticipating changes. The Board of Regents policy requires that university tuition proposals are reviewed using the Higher Education Price Index (HEPI) as a guideline to limit tuition increases.[26]
- **Maryland** limits tuition growth by "a percent not to exceed the increase in the three–year rolling average of the State's median family income."[27] Maryland also has a "Tuition Stabilization Account" which is used to offset declines in appropriations and limit tuition increases.[28]
- **Missouri's** Coordinating Board for Higher Education is directed in statute to ensure that tuition growth for institutions with above-average tuition levels is limited as follows: "the percentage change in tuition shall not exceed the percentage change of the consumer price index or zero, whichever is greater." The CPI-U for the previous year is used as the growth factor.[29]

[23] We identified only Florida and Louisiana as having primarily state-level tuition setting authority for public two- and four-year colleges and universities.
[24] https://www.alaska.edu/bor/policy/05-10.pdf
[25] http://highered.colorado.gov/Publications/Policies/Current/vi-partc.pdf
[26] http://www.regents.iowa.gov/Policies/Chapter%208/Chapter%208.pdf
[27] http://mgaleg.maryland.gov/webmga/frmStatutesText.aspx?article=ged&section=15-106.6&ext=html&session=2016RS&tab=subject5
[28] http://www.ncsl.org/research/education/tuition-policy.aspx#Policy Options
[29] http://dhe.mo.gov/documents/HESFA.pdf

Exhibit A1 displays recent five-year percentage tuition change among four-year public intuitions. Washington State's average increase (14.7%) is above the national average (12.7%).

Exhibit A1

Five-Year Percentage Change in Resident Undergraduate Tuition Fees
at Public Four-Year Institutions



Data source: College Board. (2015). *Trends in college pricing 2015*.
http://trends.collegeboard.org/sites/default/files/trends-college-pricing-web-final-508-2.pdf

A. 2. Detailed information about alternative tuition growth factors

This section provides detail on the following potential tuition growth factors, including the most recent 14-year annual average percentage change for each. The metrics include:

- Wage and income measures: median and average hourly wages, median household and family income, and per capita income;
- Inflation measures: the Consumer Price Index and Implicit Price Deflator; and
- Higher education-specific inflation: the Higher Education Price Index and Higher Education Cost Adjustment.

Details about each alternative growth factor follow the summary data table (Exhibit A2).

Exhibit A2

14-Year Annual Data for Potential Tuition Growth Factors: State-Specific Wages and Income

	Median hourly wage		Average hourly wage		Median household income		Median family income		Per capita income	
Year	Estimate	% change	Estimate	% change	Estimate	% change	Estimate	% change	Estimate	% change
2001	$15.12		$18.11		$42,490	-0.1%			$33,241	1.1%
2002	$15.31	1.3%	$18.64	2.9%	$45,183	6.3%			$33,629	1.2%
2003	$15.66	2.3%	$19.04	2.1%	$47,508	5.1%			$34,663	3.1%
2004	$15.92	1.7%	$19.44	2.1%	$49,922	5.1%			$36,787	6.1%
2005	$16.30	2.4%	$19.93	2.5%	$50,646	1.5%	$60,077		$37,754	2.6%
2006	$16.81	3.1%	$20.63	3.5%	$54,723	8.0%	$63,705	6.0%	$40,204	6.5%
2007	$17.39	3.5%	$21.50	4.2%	$58,080	-6.1%	$66,642	4.6%	$42,954	6.8%
2008	$17.92	3.0%	$22.32	3.8%	$56,631	-2.5%	$70,498	5.8%	$44,460	3.5%
2009	$18.37	2.5%	$22.97	2.9%	$60,392	6.6%	$68,360	-3.0%	$42,248	-5.0%
2010	$18.76	2.1%	$23.53	2.4%	$56,163	-7.0%	$67,328	-1.5%	$42,821	1.4%
2011	$19.30	2.9%	$24.17	2.7%	$56,850	1.2%	$68,628	1.9%	$44,800	4.6%
2012	$19.47	0.9%	$24.59	1.7%	$62,187	9.4%	$69,937	1.9%	$47,344	5.7%
2013	$19.67	1.0%	$25.04	1.8%	$63,922	2.8%	$71,371	2.1%	$47,468	0.3%
2014	$19.76	0.5%	$25.26	0.9%	$59,068	-7.6%	$74,193	4.0%	$49,610	4.5%
14-year percentage change statistics:										
Average annual		**2.1%**		**2.6%**		**2.5%**		**2.4%**		**3.0%**
Minimum annual		0.5%		0.9%		-7.6%		-3.0%		-5.0%
Maximum annual		3.5%		4.2%		9.4%		6.0%		6.8%
Overall		29.1%		35.5%		39.0%		23.5%		49.2%

Wage and income estimates are in unadjusted dollars.

Exhibit A2, (Continued)

14-Year Annual Data for Potential Tuition Growth Factors: National Inflation Indices

Year	Consumer Price Index		Chained CPI		Implicit Price Deflator		Higher Education Price Index		Higher Education Cost Adjustment	
Year	Estimate	% change	Estimate	% change	Estimate	% change	Estimate	% change	Estimate	% change
2001	177.10	2.8%	104.30	2.3%	84.74	1.9%			71.89	4.0%
2002	179.90	1.6%	105.60	1.2%	85.87	1.3%	212.70	1.9%	74.06	3.0%
2003	184.00	2.3%	107.80	2.1%	87.57	2.0%	223.50	5.1%	76.47	3.3%
2004	188.90	2.7%	110.50	2.5%	89.70	2.4%	231.70	3.7%	79.05	3.4%
2005	195.30	3.4%	113.70	2.9%	92.26	2.9%	240.80	3.9%	81.70	3.4%
2006	201.60	3.2%	117.00	2.9%	94.73	2.7%	253.10	5.1%	84.31	3.2%
2007	207.34	2.8%	119.96	2.5%	97.10	2.5%	260.30	2.8%	87.31	3.6%
2008	215.30	3.8%	124.43	3.7%	100.07	3.1%	273.20	5.0%	89.87	2.9%
2009	214.54	-0.4%	123.85	-0.5%	100.00	-0.1%	279.30	2.2%	91.31	1.6%
2010	218.06	1.6%	125.62	1.4%	101.65	1.7%	281.80	0.9%	92.67	1.5%
2011	224.94	3.2%	129.45	3.1%	104.15	2.5%	288.40	2.3%	94.64	2.1%
2012	229.59	2.1%	131.98	1.9%	106.12	1.9%	293.20	1.7%	96.35	1.8%
2013	232.96	1.5%	133.62	1.2%	107.57	1.4%	297.80	1.6%	98.06	1.8%
2014	236.74	1.6%	135.57	1.5%	109.11	1.4%	306.70	3.0%	100.00	2.0%
14-year percentage change statistics:										
Average annual		**2.3%**		**2.1%**		**2.0%**		**3.0%**		**2.7%**
Minimum annual		-0.4%		-0.5%		-0.1%		0.9%		1.5%
Maximum annual		3.8%		3.7%		3.1%		5.1%		3.6%
Overall		31.6%		28.4%		27.1%		44.2%		35.0%

Index estimates are relative to a certain base year (see details for each measure in the following pages).

Median and Average Hourly Wages

Washington-specific

As noted in the main body of this report, the median hourly wage metric was first published by the federal Bureau of Labor Statistics (BLS) at the statewide level for all surveyed occupations in 2001. The BLS computes wage estimates separately for each of the 50 states.

"Hourly wages" are the dollar amount paid to non-farm workers per hour, excluding benefits. The "median" falls in the middle of the distribution of all hourly wages; that is, half of Washington workers make less than that amount and half make more per hour.

The BLS estimates Washington's average hourly wage from the same data source. The average is the sum of all wages divided by the number of wage earners. This metric is more sensitive to "outliers"—especially very high hourly wages earned by a small percentage of workers—and tends to be larger than the median.

Exhibit A3 presents detail regarding how these metrics are calculated and the wage earnings and occupations are included.

Exhibits 3-5 in the main body of this report depict trends in Washington's median hourly wage. Annual change in the median wage has averaged 2.1% since 2001.

Washington's average hourly wage has followed a similar growth pattern (see Exhibits A4 and A5), although its annual average percentage is higher (2.6%). Like the median, in real terms, average wages have remained relatively flat: $24.21 in 2001 and $25.45 in 2014 (in 2014 dollars).

For both median and average hourly wages, longer term trends in the 14-year average annual percentage change cannot be estimated, because these metrics have only been reported by the BLS since 2001.

Exhibit A3

Median and Average Hourly Wages: Details

Name	Median hourly wage Average hourly wage
Brief definition	*Hourly wage*: the dollar amount paid to employees per hour (excluding benefits). The *median hourly wage* is in the middle of the distribution of all hourly wages paid to workers in Washington State; that is, half of workers make less than that amount and half make more. The *average hourly wage* is the average of wages: the sum of all wages, divided by the number of people. This metric is more sensitive to "outliers," especially very high values, and tends to be larger than the median.
Data source name	Bureau of Labor Statistics (federal) Occupational Employment Statistics (OES)
Data source link	http://www.bls.gov/oes/tables.htm
Data availability	2001-present
Data source details	A nationally collected, state-specific semi-annual mail survey of non-farm employment (about 57% of occupations). Businesses are selected for the survey if they report to the state for unemployment insurance. The annual hourly wage is calculated as a moving average from the three most recent surveys. The BLS has reported overall hourly wages by state since 2001 (in prior years, hourly wages were reported separately by occupation and industry). The metric includes all part-time and full-time workers that are paid a wage or salary. In 2002, the data collection schedule changed from October, November, and December to May and November in order to reduce seasonal influences. (Both metrics are not seasonally adjusted, as the seasonal adjustments are made to "smooth out" variation in monthly, not annual, estimates). Also in 2002, the average wage methodology changed for occupations with workers earning more than $70 per hour to remove a downward bias in the mean estimates. This change did not affect the median. See http://www.bls.gov/respondents/gtp/glossary.htm for definitions of pay categories listed below.
Included	• Full- and part-time wages • Commissions, production bonuses, mileage, and tips • Cost-of-living adjustments • Deadheading, guaranteed, hazard, incentive, and longevity pay • Piece rates

Name	Median hourly wage Average hourly wage

Excluded	• Benefits (such as health insurance, contributions to retirement plans, perquisites, discounts, profit-sharing, tuition reimbursement)
	• Weekend, shift, on-call, weekend, overtime, and other premium pay
	• Stock, holiday, year-end and attendance bonuses
	• Tool/equipment, uniform, clothing, relocation, meal, and lodging allowances
	• Severance pay
	• Types of businesses/people excluded:
	  ○ Crop and animal production
	  ○ Timber tract operations
	  ○ Forest nurseries, gathering of forest products, and forestry support
	  ○ Fishing, hunting, and trapping
	  ○ Private households
	  ○ Household workers or unpaid family workers
	  ○ Self-employed
	  ○ Owners and partners in unincorporated firms
	  ○ Unemployed individuals

Exhibit A4

Washington's Average Hourly Wage
(in unadjusted dollars)

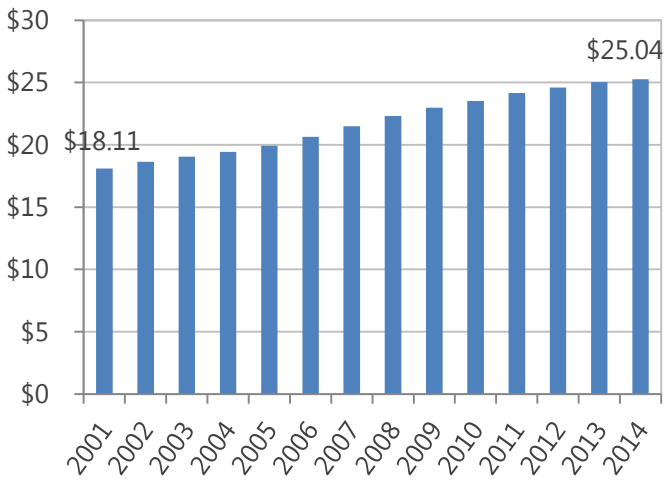
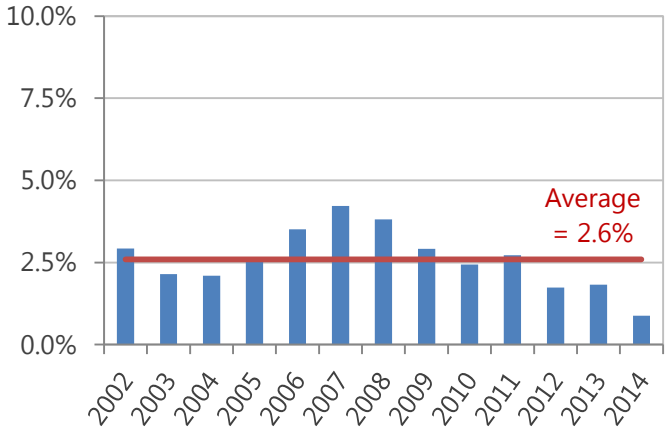


Exhibit A5

Annual Percentage Change in Washington's Average Hourly Wage



Median Household Income

Washington-specific

Median household income information is produced by the US Census Bureau Annual Social and Economic Supplement. A consistent data series is available since 1989.

Household income represents total income for all individuals living in a household, regardless of their relationship to one another. This income measures excludes one-time, lump sum payments and only including ongoing or regular payments. Median family income, presented next, is more typically used in higher education because the number of people for each income level is considered family and therefore potentially responsible for education costs.

Exhibit A6 presents detail regarding the median household income. Exhibits A7 and A8 depict trends in Washington's median household income. Annual change in this metric has averaged 2.5% over the last 14 years.

Exhibit A6

Median Household Income: Details

Name	Median household income
Brief definition	*Household income*: total monetary income (not just wages) for all residents of a household (regardless of relationship to one another). *Median household income:* The middle of the distribution of all households' income in Washington State; that is, half of households have lower income, and half, higher income.
Data source name	Census Bureau (federal), Annual Social and Economic Supplement (formerly the March Current Population Survey)
Data source link	https://www.census.gov/hhes/www/poverty/publications/pubs-cps.html
Data availability	1989-present (as a consistent series)
Data source details	Computed by the Census Bureau using the monthly Current Population Survey (CPS). . The "survey" is conducted as an interview of a sample of households through the US. Income is self-reported by households and may be under-reported. State-level estimates are published annually in March.
Included	• Wage earnings • Unemployment and workers' compensation • Social Security, Supplemental security, other public assistance • Veterans' payments • Survivor and disability benefits • Pension or retirement income • Interest, dividends, rents, royalties, and estates and trusts • Educational assistance • Alimony, child support • Non-farm income
Excluded	• Capital gains • Lump-sum payments (e.g., from inheritance or sale of a home)

Exhibit A7

Washington's Median Household Income
(in unadjusted dollars)

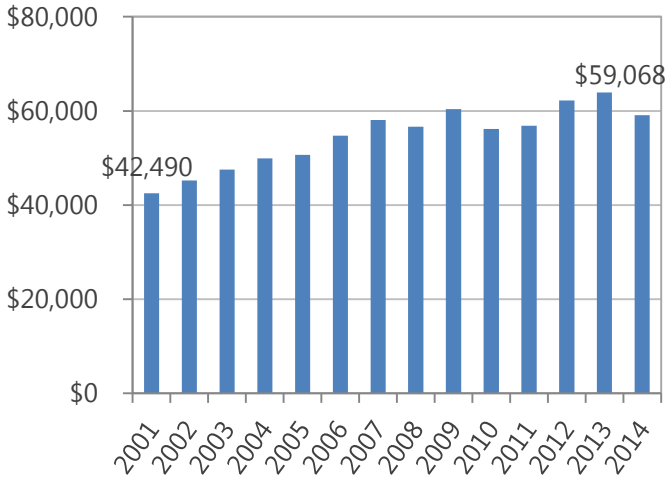
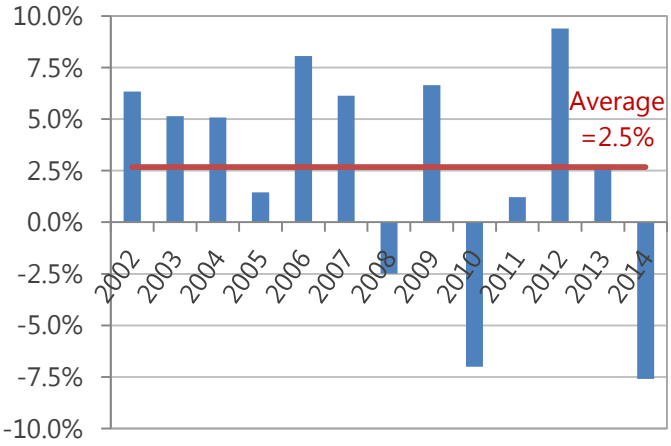


Exhibit A8

Annual Percentage Change in Washington's Median Household Income



Median Family Income
Washington-specific

Median family income information is produced by the US Census Bureau American Community Survey. A consistent data series is available since 2005.

Median family income is total monetary income (not just wages) for members of a family. A "family" is two or more people related by birth, marriage, or adoption who live together. Median family income is typically used by higher education institutions to calculate financial aid awards for individual students. A statewide consistent data series has only been available since 2005 (longer data series focus on households rather than families).

Exhibit A9 presents detail regarding about median household income. Exhibits A10 and A11 depict trends in Washington's median household income. Annual change in this metric has averaged 2.4% over the last nine years.

Exhibit A9
Median Family Income: Details

Name	Median family income
Brief definition	*Family income*: total monetary income (not just wages) for members of a family. A "family" is two or more people related by birth, marriage, or adoption who live together. *Median family income:* The middle of the distribution of all families' income in Washington State; that is, half of families have lower income, and half, higher income.
Data source name	Census Bureau (federal), American Community Survey
Data source link	https://www.census.gov/history/pdf/acsdesign-methodology2014.pdf
Data availability	2005-present (2005 was the first year of ACS implementation)
Data source details	Computed by the Census Bureau using survey data collected from the American Community Survey (ACS) program. The survey is mailed to a small sample of the US population each month. The ACS collects information about individuals and families similar to the decennial Census (such as demographics, housing, education, employment, and income). Family income is self-reported by survey respondents and may be under-reported. State-level one-year survey estimates are published annually in September.
Included	• Wages, salary, commissions, bonuses, and tips • Income from self-employment (including farm businesses) • Interest, dividends, net rental income, royalties, estates and trusts • Social Security, Supplemental Security Income, other public assistance • Retirement, survivor, or disability pensions
Excluded	• Lump-sum payments (e.g., from inheritance or sale of a home)

Exhibit A10

Washington's Median Family Income
(in unadjusted dollars)

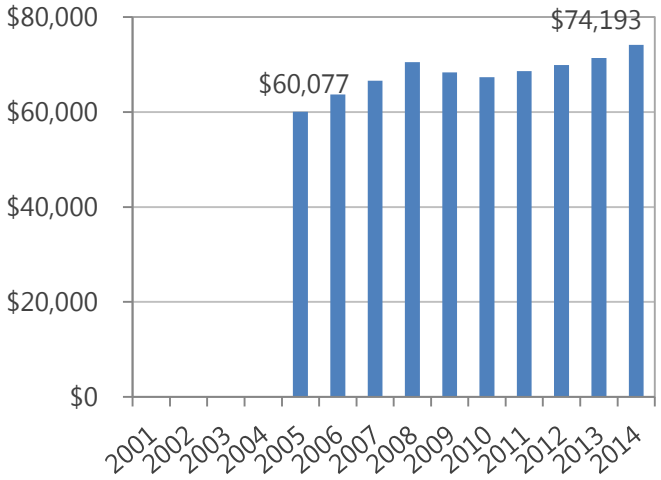
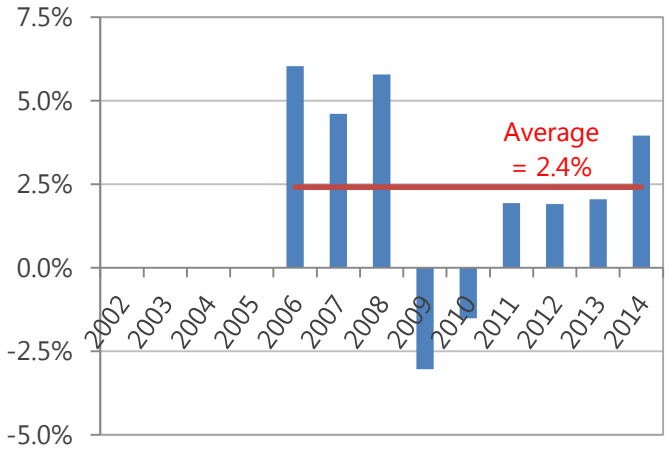


Exhibit A11

Annual Percentage Change in Washington's Median Family Income



Per Capita Income
Washington-specific

Per capita income is the average amount of income received in a given year for all people age 15 or older in a geographic area. The total income for a state is divided by the population. The measure is published by the Federal Bureau of Economic Analysis using a variety of federal and state data sources (see Exhibit A12).

Exhibits A13 and A14 display the annual estimates for per capita income and the percentage change over time. Over the last 14 years, the average annual percentage change was 3.0%.

Exhibit A12
Per Capita Income: Details

Name	Per capita income
Brief definition	*Personal income*: total monetary income (not just wages) for residents in a state. *Per capita income:* Total personal income divided by the number of residents in the state.
Data source name	Bureau of Economic Analysis (federal) Regional Data, GDP & Personal Income
Data source link	http://www.bea.gov/iTable/index_regional.cfm
Data availability	1929-present
Data source details	Computed by the BEA using administrative data sources on income, including: State unemployment insurance programs (Bureau of Labor Statistics, US Department of Labor) • State Medicaid programs and the federal Medicare program (Centers for Medicare and Medicaid Services, US Department of Health and Human Services) • Social Security (Social Security Administration) • Federal veterans' programs (US Department of Veterans Affairs) • State and federal income tax codes (Internal Revenue Service, US Department of the Treasury and Bureau of the Census, US Department of Commerce) Total income is divided by total population (using Census Bureau annual mid-year (July 1) population estimates). http://www.bea.gov/regional/pdf/spi2014.pdf Annual state-level estimates are published annually in November. Updated and revised estimates are published in September (in subsequent years).
Included	• Full- and part-time wage earnings from participation as laborers in production, from owning a home or business • Farm production earnings and other occupations not covered by median and average wages • Income from ownership of financial assets • Government transfers • Domestic and foreign income • Persons include individuals, nonprofit institutions that primarily serve individuals, private noninsured welfare funds, and private trust funds
Excluded	• Realized or unrealized capital gains or losses • Corporate profits • Taxes on production and imports

Name	Per capita income
	• Contributions for government social insurance • Interest and miscellaneous payments on asses • Business current transfer payments • Current surplus of government enterprises

Exhibit A13

Washington State Per Capita Income
(in unadjusted dollars)

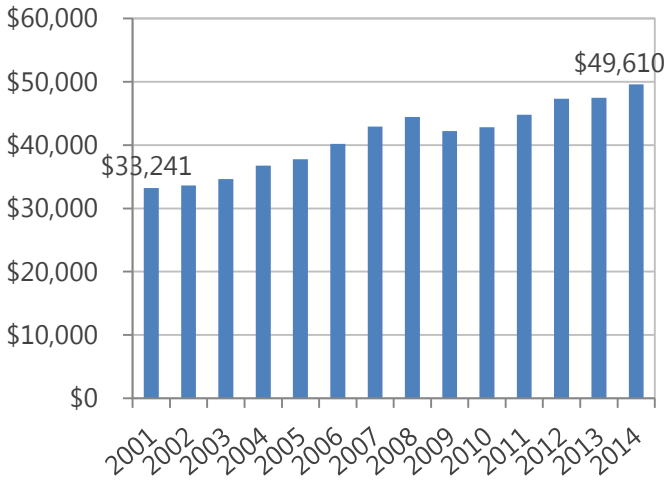
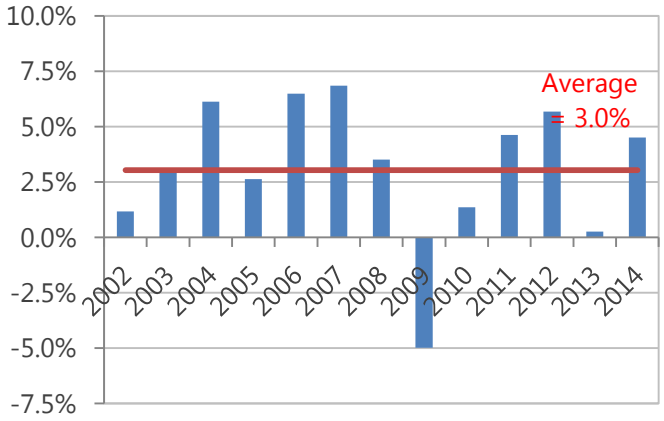


Exhibit A14

Annual Percentage Change in Washington's Per Capita Income



Consumer Price Index (CPI-U)
National estimate

The national Consumer Price Index for urban consumers (CPI-U) is a commonly used measure for adjusting today's dollar amounts of a "market basket of goods and services" equivalent to one that urban consumers could purchase in an earlier period. The CPI-Uis based on an ongoing survey of prices of typically purchased items in the urban economy and does not reflect changes in prices in rural areas (thus it is often referred to as the CPI-U). The CPI-U is frequently used to compare wages, benefits, taxes, other dollar amounts between different years. The CPI-U is an index—a numerical value that represents changes in relative prices—not a dollar amount.

In this Appendix, we present the CPI-U based on all non-farm urban consumers (not limited to wage earners and clerical workers, thus, 89% rather than of 28% of workers are represented). The annual value is not seasonally adjusted.

The most recent 14-year average annual percentage change in the national CPI-U is 2.3%.

The BLS also calculates a local CPI-U for the Seattle-Tacoma-Bremerton area.[30] The most recent 14-year average is the same as for the national CPI-U.

Exhibit A15 summarizes details about the CPI-U and trend data are in Exhibits A16 and A17.

[30] http://www.bls.gov/regions/west/news-release/ConsumerPriceIndex_Seattle.htm

Exhibit A15

Consumer Price Index: Details

Name	Consumer Price Index
Brief definition	A measurement of how prices change relative to a base year (also known as a measurement of monetary inflation).
Data source name	Bureau of Labor Statistics
Data source link	http://www.bls.gov/cpi/home.htm
Data availability	The CPI has multiple series available, some dating back to 1913
Data source details	Based on a monthly survey of price data collected by the Bureau of Labor Statistics for a representative basket of goods and services purchased by US families in urban areas. The index focuses on the price of day-to-day purchased goods and services (not long-term investments). Price data on items in over 200 categories are collected through surveys and interviews with retail and service businesses and families. Most CPI indices use 1982-84 as a base year of 100, with numbers higher or lower reflecting how prices numerically compare to that year.

Included	• Spending patterns of people living in rural nonmetropolitan areas, on farms, in the armed forces, and in institutions such as prisons and mental hospitals;
	• Prices for the following goods and services:
	  ○ Food and beverages (breakfast cereal, milk, coffee, chicken, wine, full service meals, snacks)
	  ○ Housing (rent of primary residence, owners' equivalent rent, fuel oil, bedroom furniture)
	  ○ Clothing
	  ○ Transportation (new vehicles, airline fares, gasoline, motor vehicle insurance)
	  ○ Health care (prescription drugs and medical supplies, physicians' services, eyeglasses and eye care, hospital services)
	  ○ Recreation (televisions, toys, pets and pet products, sports equipment, admissions)
	  ○ Education and communication (college tuition, postage, telephone services, computer software and accessories)
	  ○ Other (tobacco and smoking products, haircuts and other personal services, funeral expenses)
	  ○ Government-charged user fees (water and sewage costs, auto registration fees, and vehicle tolls)
	• Sales and excise taxes

Excluded	• Wage earnings and income • Unemployment rates • Taxes not associated with purchases (such as income and Social Security taxes) • Investment items (such as stocks, bonds, real estate, and life insurance)

Exhibit A16

Consumer Price Index for urban consumers)

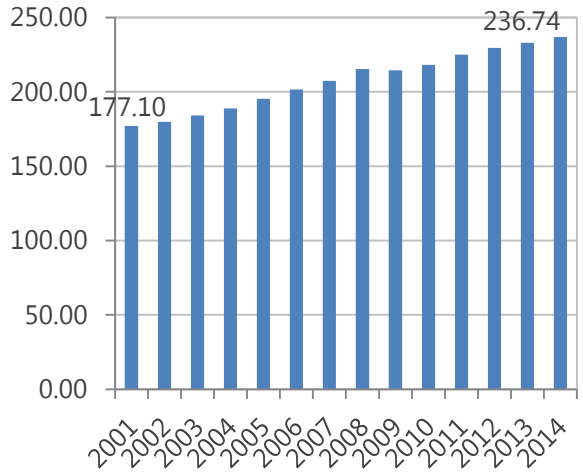
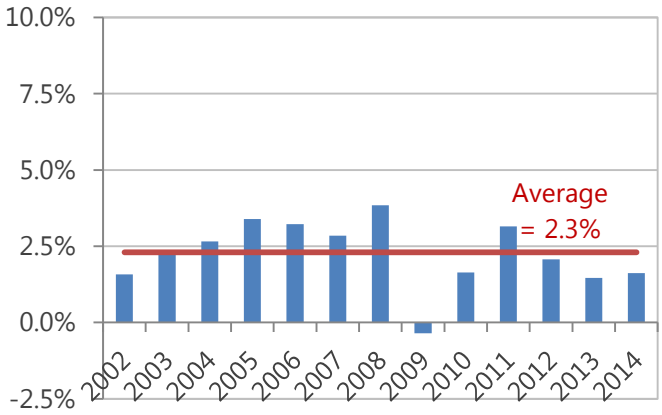


Exhibit A17

Annual Percentage Change in the CPI-U



Chained Consumer Price Index (C-CPI-U)
National estimate

The "chained" CPI is computed by the same agency and data sources as the CPI-U. The difference is that the chained CPI –U includes "substitutes"—specific purchase items that change over time as consumer preferences change and respond to access and price changes. The traditional CPI-U is viewed as an "upper bound" of inflation—the C-CPI-U annual percentage change is usually lower as people substitute lower-priced goods for higher-priced. Both inflation measures are based on consumption, and neither accounts for other changes to environmental changes such as crime, overall education levels, and other factors that affect income and costs.

Exhibits A18 and A19 display trend data for the C-CPI-U.

Exhibit A18
Chained Consumer Price Index-Urban (National)

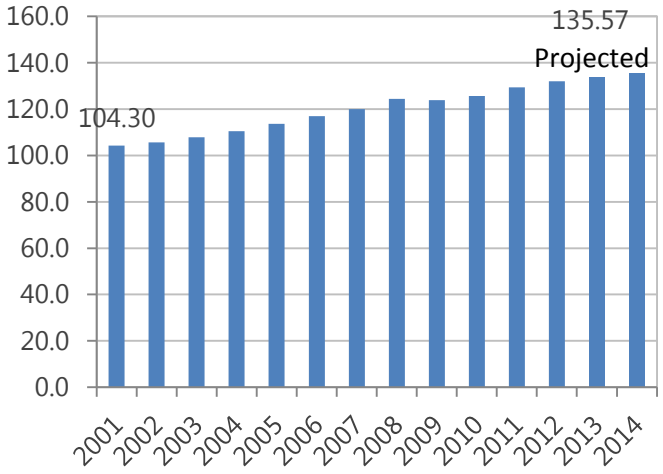
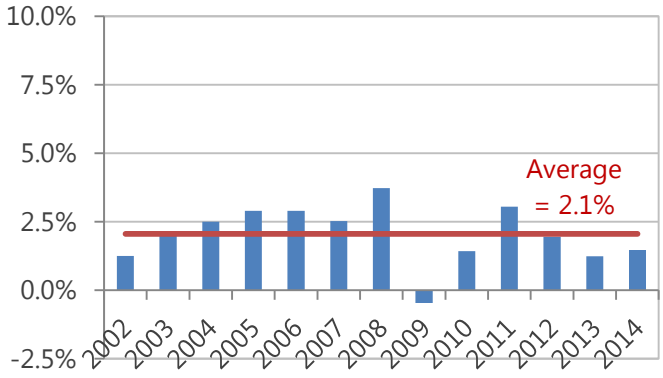


Exhibit A19
Annual Percentage Change in the CCPI-U



Implicit Price Deflator (IPD)
National estimate

The national Implicit Price Deflator (IPD) is another commonly used index for comparing prices of personal consumption expenditures over time and measuring inflation. The IPD for personal consumption is a weighted average of the prices of a wider group of goods and services than the CPI. For example, the IPD includes all consumption of health care rather than out-of-pocket expenses and consumer-purchased insurance measured in the CPI.[31]

The IPD is based on current economic conditions and consumer expenditures, tastes and preferences; it is "chained" like the C-CPI-U. It is frequently used to adjust state economic and revenue data. The state expenditure limit is based on the IPD as well as inflation adjustments in the state's biennial budget The IPD has grown by an average of 2.0% in the past 14 years.

Exhibit A20 briefly summarizes details about the IPD and trend data are in Exhibits A21 and A22.

Exhibit A20
Implicit Price Deflator: Details

Name	Implicit price deflator
Brief definition	A measurement of how prices change relative to a base year (also known as a measurement of monetary inflation).
Data source name	US Department of Commerce, Bureau of Economic Analysis
Data source link	https://research.stlouisfed.org/fred2/series/DPCERD3Q086SBEA
Data availability	1947-present
Data source details	Based on a monthly survey of price data collected by the Bureau of Economic Analysis. The current base year for the IDP is 2009; the base number is 100, with index numbers higher or lower reflecting how prices numerically compare to that year.
Included/Excluded	• See CPI-U table for example of types of expenditures that are measured in price indices. The measures are very similar but use different formulas and weights. • For more information about differences between the two measures see: http://bea.gov/faq/index.cfm?faq_id=555

[31] For more information about how the CPI and IPD compare, see: https://www.bea.gov/scb/pdf/2007/11%20November/1107_cpipce.pdf

Exhibit A21

Implicit Price Deflator for personal consumption

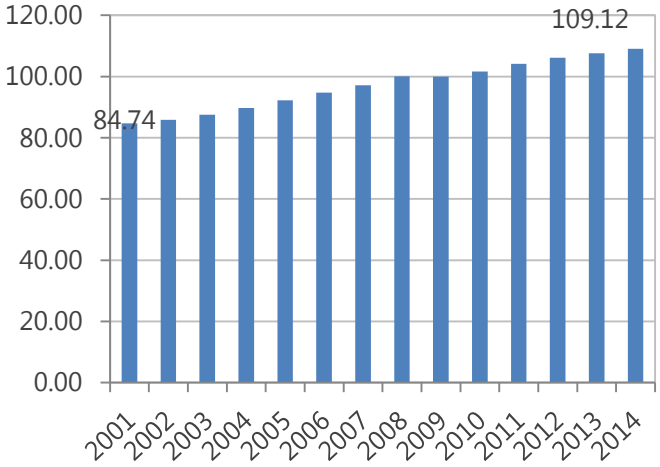
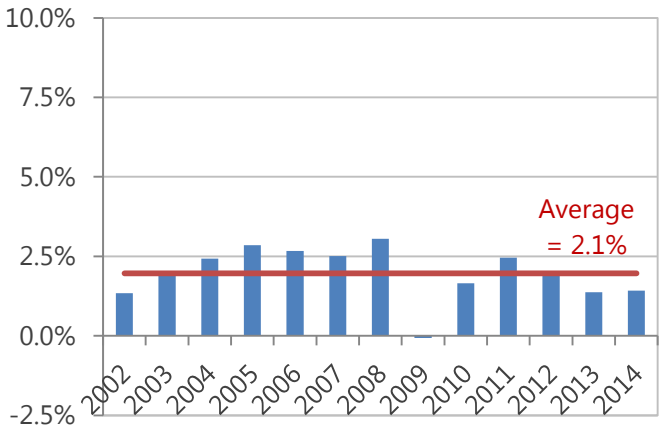


Exhibit A22

Annual Percentage Change in the IPD



Higher Education Price Index (HEPI)
National estimate

The Higher Education Price Index (HEPI) is an index of the prices of goods and services purchased in the higher education sector. The metric is calculated by a private investment firm and is distributed to higher education institutions for free. The index is typically used for internal budgeting processes; the HEPI captures college costs without making assumptions about which portion of those costs would be covered by tuition, financial aid, or other sources. Exhibit A23 presents additional detail about the HEPI, and Exhibits A24 and A25 display trend data. The HEPI has increased by an annual average of 3%.

Exhibit A23

Higher Education Price Index: Details

Name	Higher education price index
Brief definition	An inflation index that tracks prices of the main cost drivers in higher education.
Data source name	Commonfund Institute (a private investment firm)
Data source link	https://www.commonfund.org/CommonfundInstitute/HEPI/Pages/default.aspx
Data availability	1983-present (consistent series available since 2002)
Data source details	Compiled from data reported and published by government and economic agencies covering the current operational costs of colleges and universities. Prices for the cost categories listed below in the "included" row of this table are obtained from salary surveys conducted by the American Association of University Professors, the College and University Personnel Association, and the US Department of Labor's Bureau of Labor Statistics; and from price series for components of the Consumer Price Index (CPI) and the Producer Price Index (PPI) published by the Bureau of Labor Statistics. Prior to 2002, HEPI was based on the price data for 25 budget components organized into eight categories. Since 2002, HEPI has been calculated using a statistical regression formula. Beginning in 2009, the estimates were re-aligned with the July-June academic fiscal year. Prior to that, the index had been calculated using data drawn from data series with various monthly endpoints. This change in methodology led to a recasting of values between 2002 and 2008. HEPI annual estimates are published each November. The base year (with a value of 100) is 1983.
Included	• Primary factor: salaries and benefits for faculty, administrators, and other professional service personnel • Non-professional wages, salaries and fringe benefits for clerical, technical, service and other non-professional personnel • Contracted services such as data processing, communication, transportation, supplies and materials, and equipment • Library acquisitions • Utilities
Excluded	• General economic measures of wages, income, employment, prices, and inflation

Exhibit A24

Higher Education Price Index

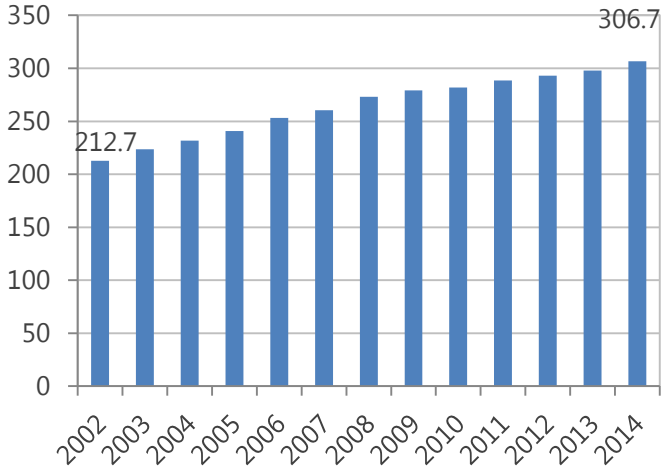
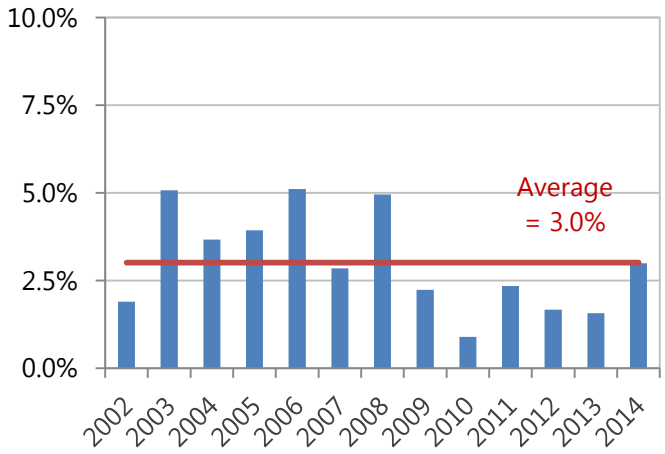


Exhibit A25

Annual Percentage Change in the HEPI



Higher Education Cost Adjustment (HECA)
National estimate

The Higher Education Cost Adjustment (HECA) is a price index produced by the State Higher Education Executive Officers Association (SHEEO). It is a combination two other price indices and primarily reflects faculty and other higher education salaries.

Exhibit A26 presents additional detail about the HEPI, and Exhibits A27 and A29 display trend data. The HEPI has increased by an annual average of 2.7%.

Exhibit A23
Higher Education Price Index: Details

Name	Higher education cost adjustment
Brief definition	An inflation index that tracks prices of the main cost drivers in higher education.
Data source name	State Higher Education Executive Officers Association (SHEEO)
Data source link	http://www.sheeo.org/sites/default/files/SHEEO002_2014AdtlDocs_TechA_Rd1.pdf
Data availability	1983-present (consistent series available since 2002)
Data source details	The index is calculated based on two federal price indices: the Employment Cost Index (ECI, which accounts for 75% of the HECA) and the Gross Domestic Product Implicit Price Deflator (GDP IPD, which accounts for 25% of the HECA) The base year for HECA (with a value of 100) is currently 2014.
Included	• General economic measures of employment, prices, and inflation • Similar to HEPI, is primary driven by faculty salaries
Excluded	• Costs and prices not related to higher education operations

Exhibit A27

Higher Education Cost Adjustment

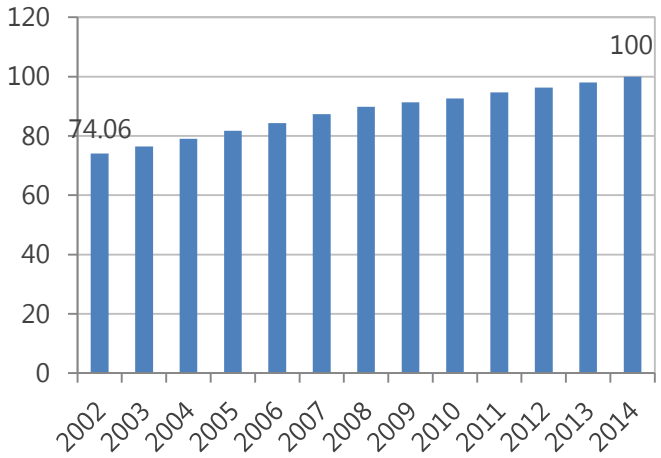
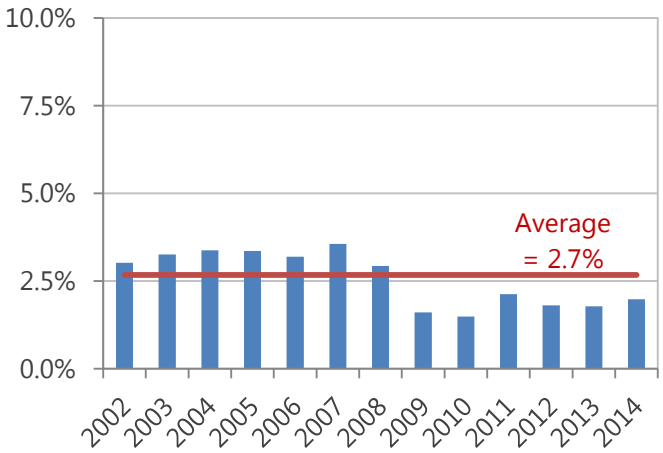


Exhibit A28

Annual Percentage Change in the HECA



A Student Affordability Metric

A University of Washington student working group developed a proposal, frequently mentioned to the author during this study, about tracking tuition relative and college affordability more generally to the state's minimum wage.[32] The specific metric proposed is the number of minimum-wage-paid hours to pay for tuition at public colleges and universities.[33] As the student group noted, minimum wage earnings would not solely cover tuition; as noted earlier, more information would need to be taken into account for a full analysis of affordability. Exhibit A29 displays the number of hours needed to work at minimum wage to earn enough to pay for tuition (and nothing else). The hours needed to cover tuition increased steadily between 2001 and 2012, and have since declined, similar to tuition levels and measures of economic production.

Exhibit A29

Estimated Number of Working Hours at Minimum Wage
for Total Earnings to Equal Resident Undergraduate Public Tuition Amounts

	Tuition			Minimum wage		Working hours to earn tuition		
Year	Research	Regional	CTCs**	Amount	% change	Research	Regional	CTCs**
2001-02	$3,584	$2,646	$1,568	$6.50		**551**	**407**	**241**
2002-03	$4,156	$3,015	$1,783	$6.72	3.4%	**618**	**449**	**265**
2003-04	$4,447	$3,225	$1,927	$6.90	2.7%	**644**	**467**	**279**
2004-05	$4,758	$3,451	$2,081	$7.01	1.6%	**679**	**492**	**297**
2005-06	$5,090	$3,658	$2,199	$7.16	2.1%	**711**	**511**	**307**
2006-07	$5,446	$3,878	$2,327	$7.35	2.7%	**741**	**528**	**317**
2007-08	$5,827	$4,071	$2,408	$7.63	3.8%	**764**	**534**	**316**
2008-09	$6,234	$4,274	$2,457	$7.93	3.9%	**786**	**539**	**310**
2009-10	$7,107	$4,869	$2,625	$8.07	1.8%	**881**	**603**	**325**
2010-11	$8,101	$5,550	$2,814	$8.55	5.9%	**947**	**649**	**329**
2011-12	$9,560	$6,316	$3,180	$8.67	1.4%	**1103**	**728**	**367**
2012-13	$11,090	$7,188	$3,590	$9.04	4.3%	**1227**	**795**	**397**
2013-14	$11,090	$7,188	$3,590	$9.19	1.7%	**1207**	**782**	**391**
2014-15	$11,090	$7,188	$3,590	$9.32	1.4%	**1190**	**771**	**385**
2015-16	$10,535	$6,828	$3,411	$9.47	1.6%	**1112**	**721**	**360**
2016-17	$9,426	$5,750	$3,411	$9.47	0.0%	**995**	**607**	**360**

*Tuition divided by minimum wage
**Estimates updated for April 2016 revision
Total possible working hours (full-time summers, half-time school year): 1280

[32] Association of Students of the University of Washington, (2014). Meet us in the middle: Affordability for the working student. http://www.asuw.org/files/2014/06/MeetInTheMiddle1.pdf

[33] Assuming working full-time over the summer (40 hours per week for three months) and half-time during the school year (20 hours per week for nine months).

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