University of Colorado Boulder
Colorado Equal Pay for Equal Work Act
Instructional Faculty Salary Equity Analysis

2021–22

Methodology and Review Process

Office of Data Analytics and Office of Academic Affairs
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Abstract

The Institutional Research (IR) team in the Office of Data Analytics (ODA) performs an annual faculty salary equity analysis on behalf of the Provost's Office to monitor faculty salaries for racial or ethnic group and gender salary equity. In 2021, IR revised this analysis methodology to address the requirements of the Colorado Equal Pay for Equal Work Act (EPEWA). Unlike the annual faculty salary equity analysis methodology, which analyzes salaries as a campus-wide aggregate, the EPEWA instructional faculty salary equity analysis methodology enables a comparison of salaries within particular faculty ranks and particular academic disciplines. The construction of the EPEWA methodology demonstrated that a number of variables permissible for salary differentiation under the EPEWA have statistically significant predictive value for faculty salaries. In addition, due to the fact that some of these variables had statistically significant predictive value and others did not, depending on different groups of faculty, different versions of the predictive model were created to apply to these different groups of faculty. These different versions of the predictive model were then used to analyze current base salary and to calculate predicted salary for all tenured, tenure-track, instructor-track, and clinical faculty members, according to the model version and criteria applicable to each faculty member's position. If a faculty member who was identified as having an actual salary below the predicted salary was also in a category eligible for a pay adjustment under the EPEWA, they were flagged for further qualitative review to determine whether an additional explanatory factor allowable under the EPEWA accounted for the gap between actual and predicted salary. If no explanatory factor allowable under the EPEWA accounted for that gap, the faculty member was deemed eligible for the identified pay adjustment.

Annual Faculty Salary Equity Analysis: Background and History

CU Boulder began to analyze faculty salary equity in the late 1990s, using methods grounded in influential research by CU Boulder faculty members Jane Lillydahl and Larry Singell.[1] At that time, the Associate Vice Chancellor of Academic Affairs for Budget and Planning engaged in analysis of tenure-track and tenured faculty salaries for racial and ethnic group and gender salary equity. Results

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[1] Jane H. Lillydahl and Larry Singell, "Job Satisfaction, Salaries and Unions: The Determination of University Faculty Compensation," *Economics of Education Review* 12.3 (1993): 233-43; Lillydahl and Singell, "Compression in faculty salaries: An Empirical Evaluation of Merit and Market Based Adjustments," *The Journal of Socio-Economics* 21.3 (1992): 229-43.

from fall 1999 and fall 2000 identified statistically significant salary differences based on gender. The campus invested funds to address these salary differences. Further analysis in fall 2001 did not uncover any statistically significant gender disparity in faculty salaries.

When the tenured and tenure-track (TTT) faculty salary equity analysis was repeated in 2009, it revealed a statistically significant negative salary gap for women. The campus did not have funding to address this gap, due to budget cuts resulting from funding shortfalls from 2009 through 2011. When the campus resumed this salary equity analysis in 2011, the 2009 negative salary gap for women did not reappear. Subsequent IR analyses of TTT faculty salaries have not uncovered a statistically significant salary gap either for women or for racial/ethnic categories.

The Office of Institutional Research (IR) began to conduct the campus-wide equity analysis of tenured and tenure-track faculty salaries for the Provost's Office annually in 2011. In addition, salary equity analysis across all remaining employee categories at CU Boulder is conducted annually in support of the Office of Federal Contract Compliance Programs (OFCCP) compliance. The annual salary equity analyses conducted by IR and by OFCCP assess statistically significant salary differentials by racial or ethnic group and gender across employee groups with similar job roles and responsibilities. Over time, the salary equity analysis methodology for faculty members has been further refined based on publicly disseminated research on analyzing pay gaps in higher education associated with gender or race/ethnicity.[2]

Development of EPEWA Methodology

As described above, CU Boulder's annual salary equity analyses have examined salaries in aggregate instead of assessing pay inequities related to gender and racial or ethnic group at the unit level. For tenure-track and tenured faculty, this annual faculty salary equity analysis has three separate analytical models based on faculty rank (full, associate, and assistant professor). In order to adapt the campus-wide faculty salary equity analysis to the analysis needed to address the EPEWA, IR revised the campus methodology in a way that localizes salary equity analysis within particular faculty ranks and particular academic disciplines. For purposes of the EPEWA salary analysis, IR also extended the revised methodology to analyze the salaries of instructor-track and clinical faculty members along with those of TTT faculty members. (Adjunct/lecturer faculty salaries are not part of the EPEWA methodology.) References to "faculty" throughout the rest of this document are to all tenured, tenure-track, instructor-track, and clinical faculty unless otherwise specified.

As part of developing the EPEWA methodology, IR undertook multiple analyses of current faculty base salaries within the various faculty ranks and within the colleges, schools, and individual disciplines within

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[2] See, for example, Robert K. Toutkoushian, ed., *Conducting Salary Equity Studies*, special issue of *New Directions in Institutional Research*, vol. 2002, issue 115 (Fall 2002); Linda W. Perna, "Studying Faculty Salary Equity: A Review of Theoretical and Methodological Approaches," in John C. Smart, ed., *Higher Education: Handbook of Theory and Research* (Dordrecht: Springer, 2003), 323–88; Andrew L. Luna, "Faculty Salary Equity Cases: Combining Statistics with the Law," *The Journal of Higher Education* 77:2 (2006): 193–224; Joyce J. Chen And Daniel Crown, "The Gender Pay Gap In Academia: Evidence From The Ohio State University," *Amer. J. Agr. Econ.* 101(5) (2019): 1337–52; Lori L. Taylor et al., "How to Do a Salary Equity Study: With an Illustrative Example From Higher Education," *Public Personnel Management* Vol. 49(1) (2020): 57–82; and Peter Choi and Erick Axxe, "Race and Gender Disparities in Academic Pay," Academic Analytics Research Center, 27 Sep. 2021; accessed 13 Jan. 2022.

larger colleges and schools. (A faculty member's base salary is defined later in this document.) The goal was to identify those variables that strongly correlate with a higher salary and that can be confidently viewed as explanatory factors for why one individual faculty member's salary differs from that of another faculty member who is at the same rank. Once those explanatory factors were identified, the task was to determine which of them are permissible under the EPEWA.

Multiple variables were initially considered in order to determine which ones had the greatest explanatory value for individual faculty members' salaries, and to eliminate those that did not have strong explanatory value. The multiple variables initially modeled for consideration were:

- School, college, or (in the case of ENVD) program
- A&S division (if applicable)
- Department (applicable in A&S, CEAS, and CMCI), division (applicable in Leeds), or disciplinary area within a college
- Job title
- Age
- Gender
- Race/ethnicity
- Years since highest degree
- Years in current faculty rank
- Years at CU (employed in any position)
- Years in CU position (i.e., total years at CU in a TTT faculty position, or in an instructor-track or clinical faculty position)
- Years teaching in higher education (applicable in Law)
- Whether the faculty member was a new hire (hired within the past 12 months)
- Whether the faculty member had recently been promoted to a higher rank (within the past 12 months)
- Total number of appointments held by the faculty member in AY 2021-22 (including primary appointment, institute appointment, administrative appointment, overload teaching appointment, etc.)
- Whether the faculty member specifically holds an administrative appointment in AY 2021-22 (chair, associate chair, or faculty director), as separate from the total number of appointments held by that faculty member
- Whether the faculty member specifically holds an institute appointment, as separate from the total number of appointments held by that faculty member
- The faculty member's average merit score, standardized by unit: time spans considered were 2007-2021, 2012-2021, and 2017-2021
- Whether the faculty member accepted a retention offer between March 2011 and August 2021 (a dichotomous "yes" or "no" variable; the amount or structure of the retention offer was not included)

This modeling ultimately demonstrated which of these variables did or did not have significantly significant predictive value for faculty salaries at CU Boulder:

1) Gender and race/ethnicity were among the variables with strongly predictive value for faculty salaries. However, gender and race/ethnicity are *not* variables that are permissible for salary differentiation under the EPEWA.

2) In contrast, the other variables that had strongly predictive value for faculty salaries *are* permissible for salary differentiation under the EPEWA. Across the entire faculty, including both TTT and instructor-track/clinical faculty, the statistically significant variables that are permissible for salary differentiation under the EPEWA were:

   - **Variables related to seniority:**
     - Years since highest degree
     - Years in current faculty rank
     - Years at CU (employed in any position)
     - Years in position (i.e., total years at CU in a TTT faculty position, or in an instructor-track or clinical faculty position)
     - Years teaching in higher education, as separate from years since highest degree (applicable only in Law)
     - For instructor-track and clinical faculty, total years as instructor-track or clinical faculty
     - Whether the faculty member was a new hire (hired within the past 12 months)

   - **Variables related to education, training, or experience:**
     - School, college, or (in the case of ENVD) program
     - A&S division (if applicable)
     - Department (applicable in A&S, CEAS, and CMCI), division (applicable in Leeds), or disciplinary area (applicable only in Libraries and Law)
     - Job title
     - Total number of appointments held by the faculty member in AY 2021-22 (including primary appointment, institute appointment, administrative appointment, overload teaching appointment, etc.)

   - **Variables related to a merit system or a system of measuring quantity or quality of production:**
     - The faculty member's average merit score, standardized by unit, for the five-year span of 2017-2021; longer time spans for merit scores did not prove to have statistically significant predictive value for higher salaries
     - Whether the faculty member accepted a retention offer between March 2011 and August 2021 (a dichotomous "yes" or "no" variable; the amount or structure of the retention offer was not included)

3) The variables that did not prove to have strongly significant predictive value for faculty salaries were discarded from further use in the methodology. These included:

   - Age (as separate from years in current faculty rank, years since highest degree, etc.)
   - Whether the faculty member specifically holds an administrative appointment in AY 2021-22 (chair, associate chair, or faculty director), as distinct from the total number of appointments held by that faculty member

- Whether the faculty member specifically holds an institute appointment, as distinct from the total number of appointments held by that faculty member
- The faculty member's average merit score, standardized by unit, for longer time spans than the previous five years (2017-2021)

In order to apply the predictive model in a manner permissible for analysis under the EPEWA, *race and gender were eliminated as variables that could predict salary*. The variables that remained were those listed above that are permissible under the EPEWA and that proved strongly predictive of faculty salaries.

Furthermore, this process of considering variables revealed that the specific array of variables that had statistically significant predictive value differed among different groups of faculty. As a result, different variations of the predictive model were created to apply to these different groups of faculty. These variations are described below in the sections titled "EPEWA Methodology for Tenured and Tenure-Track Faculty" and "EPEWA Methodology for Instructor-Track and Clinical Faculty." Each variation of the predictive model was then employed to calculate the predicted salary of every individual faculty member within the faculty group covered by that variation of the model.

Once that calculation was complete, those faculty members who were identified as having an actual salary below the predicted salary and who were also in a category eligible for a pay adjustment under the EPEWA (according to gender and/or race/ethnicity) were flagged for further qualitative review to determine whether an additional explanatory factor allowable under the EPEWA accounted for the gap between actual and predicted salary. If no explanatory factor allowable under the EPEWA accounted for that gap, the individual was deemed eligible for the identified pay adjustment. Further information on this qualitative review is included in the section titled "Review Process," below.

EPEWA Methodology for Tenured and Tenure-Track Faculty

For tenured and tenure-track faculty, predicted salary is determined by customized models by school/college/program and rank, using variables that have a statistically significant predictive value for salaries of that particular group of faculty. Customized model specifics by school/college/program and rank are provided in Appendix A.

Model variables that proved strongly predictive for TTT faculty overall and that were included in the customized models insofar as they were strongly related to that particular group of faculty were:

- **Variables related to seniority:**
  - Years since highest degree
  - For Libraries faculty only: years since receipt of the MLS degree, as separate from years since other higher degree earned
  - For Law faculty only: years teaching in higher education, as separate from years since highest degree
  - Years in current faculty rank
  - Years at CU (employed in any position)
  - Years in position (i.e., total years at CU in a TTT faculty position, or in an instructor-track or clinical faculty position)
  - Whether the faculty member was a new hire (hired within the past 12 months)

- **Variables related to education, training, or experience:**

- School, college, or (in the case of ENVD) program
- A&S division (if applicable)
- Department (applicable in A&S, CEAS, and CMCI), division (applicable in Leeds), or disciplinary area (applicable only in Libraries and Law)
- Total number of appointments held by the faculty member in AY 2021-22 (including primary appointment, institute appointment, administrative appointment, overload teaching appointment, etc.)

- **Variables related to a merit system or a system of measuring quantity or quality of production:**
  - The faculty member's average merit score, standardized by unit, for the five-year span of 2017-2021; longer time spans for merit scores did not prove to have statistically significant predictive value for higher salaries
  - Whether the faculty member accepted a retention offer between March 2011 and August 2021 (a dichotomous "yes" or "no" variable; the amount or structure of the retention offer was not included)

EPEWA Methodology for Instructor-Track and Clinical Faculty

For instructor-track and clinical faculty, predicted salary is determined by customized models by school/college/program and (if applicable) A&S division, using variables that have a statistically significant predictive value for salaries of that particular group of faculty. Customized model specifics by school/college/program are provided in Appendix A.

Model variables that proved strongly predictive for instructor-track faculty overall and that were included in the customized models insofar as they were strongly related to that particular group of faculty were:

- **Variables related to seniority:**
  - Years since highest degree
  - For Law faculty only: years teaching in higher education or years of clinical/librarianship experience, as separate from years since highest degree
  - Years in current faculty rank
  - Total years as instructor-track or clinical faculty
  - Years at CU
  - Whether the faculty member was a new hire (hired within the past 12 months)

- **Variables related to education, training, or experience:**
  - Job title
  - School, college, or (in the case of ENVD) program
  - A&S division (if applicable)
  - Department (applicable in A&S, CEAS, and CMCI), division (applicable in Leeds), or disciplinary area (applicable only in Libraries and Law)
  - Total number of appointments held by the faculty member in AY 2021-22 (including primary appointment, institute appointment, administrative appointment, overload teaching appointment, etc.)

- **Variables related to a merit system or a system of measuring quantity or quality of production:** unlike with TTT faculty, annual merit scores were not strongly predictive of salary for instructor-track and clinical faculty, so they were not used in any of the customized models for these faculty groups.

Application of Methodology to Faculty Salaries: Algorithms and Examples

The algorithms used to apply the EPEWA analytic methodology to the determination of predicted salaries for TTT faculty (assistant, associate, and full professors) and instructor-track and clinical faculty in the various schools and colleges are included as Appendix A.

Appendix B provides two examples of how the relevant algorithm calculates predicted salaries:
1) Three different TTT faculty members of the same rank in the same A&S division and same department
2) Four different instructor-track faculty members of different ranks (instructor and senior instructor) in different departments of the College of Engineering & Applied Science (CEAS)[3]

Model Statistical Information

- Model R-Squared values range from mid-60s to mid-90s when gender and race/ethnicity were included as variables. Once those variables were excluded, R-Squared range increased significantly, from mid-20s (for just two different TTT faculty groups) to upper-90s. The increase in range heightened the need for qualitative analysis, especially for those model variations with lower R-Squared values.
- Most variable p-values are statistically significant at or below 0.05 significance level
- The direction of most coefficient estimates aligns with expectations

Review Process

- Each faculty member's current base salary was analyzed according to the model and criteria applicable to their position. Individuals with an actual salary below the predicted salary according to these criteria were identified.
- If an individual identified as having an actual salary below the predicted salary was also in a category eligible for a pay adjustment under the EPEWA, they were flagged for further review by their dean.
- The flagged faculty members' salaries were reviewed by the applicable deans of the schools and colleges, the divisional deans of the College of Arts & Sciences (A&S), the deans of Continuing Education, the Graduate School, and Undergraduate Education (for faculty whose positions are in those areas), and their respective budget/HR teams. The deans identified whether an additional explanatory factor allowable under the EPEWA accounted for the gap between actual and predicted salary.
- Academic Affairs undertook an iterative review and correction process for equity adjustments based on the deans' feedback, consulting further with the deans and their respective budget teams before final determinations were made.
- Salaries of individuals with less than 1.0 FTE appointments were analyzed at the 100% FTE rate for predicted salary, and final equity adjustments were prorated to each individual's actual FTE.

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[3] These examples represent generic members of these faculty groups and do not reflect the actual salaries or other characteristics of actual faculty members.

Additional Information: Data Sources

- <u>Academic Year base salary:</u> AY 2021-22 base salaries were identified as of October 1, 2021, from data supplied by the Provost's Office Budget Office for rostered and budgeted positions and from campus Human Capital Management system (HCM) personnel appointments for all other positions. The base salary excludes any additional appointment payments, such as chair stipends, other administrative stipends, overload payments, and summer research stipends.
- <u>3% increase:</u> AY 2021-22 base salaries were then increased 3% to reflect the January 1, 2022, base-building compensation increase.
- <u>Retention offers:</u> The existence of one or more successful retention offers accepted from January 2011 through June 30, 2021, is included as a data source for its predictive value for faculty salaries and as a factor indicative of EPEWA-allowable factors such as merit and quality and quantity of production. This is a dichotomous variable that does not consider retention offer amount or additional retention offer incentives (e.g., additional research funding, research lines).
- <u>Annual evaluation merit scores for tenured and tenure-track faculty:</u> Merit scores were standardized by unit across all full, associate, and assistant professors. Merit Z-score calculation used the mean and standard deviation with an academic unit to determine variance of an individual's score from peers within the department. Various spans of time were tested for their predictive value for faculty salaries; average merit score over the past 5 years (2017-2021) proved to have the highest predictive value and is used for calculation. Merit scores were removed as a variable for assistant professors because they proved not to have predictive value for salary for this group of faculty.
- <u>Number of appointments:</u> This is the total of additional appointments during the current academic year. This variable is included both for its predictive value and because an additional appointment (e.g., chair, director) may be indicative of training or experience, which are factors contributing to salary that are allowed under the EPEWA.
- <u>Gender and race/ethnicity information:</u>
  - Gender and race/ethnicity information was taken from HCM as of October 1, 2021.
  - For gender, HCM currently has only the binary choice of male or female.
  - For race/ethnicity, individuals are asked two questions to collect ethnicity and race information that result in reporting in one of the following categories:
    - Hispanic/Latino
    - American Indian/Alaska Native
    - Native Hawaiian/Pacific Islander
    - Black/African American
    - Asian
    - White
    - International
    - Unknown
  - For the purpose of the EPEWA analysis, international employees with a H-1B or other visa type were classified based on disclosed race/ethnicity information, if available.
  - For the purpose of the EPEWA analysis, race/ethnicity information was not included for individuals who have not selected an ethnicity and/or race in HCM.
- <u>Calculated variables:</u>

- Years since Highest Degree used Office of Faculty Affairs data as the primary source and HCM data as a secondary source. This variable was calculated based on the latest highest degree obtained by the faculty member when information on multiple degrees is available. Deans were consulted on which degree(s) are considered terminal in particular fields. For example, the MLS degree is considered the terminal degree for library faculty.
- Years as instructor = as of October 1, 2021
- Years as instructor and senior instructor (i.e., total years in instructor-track position[s]) = as of October 1, 2021
- Age = as of October 1, 2021
- Years in position = based on HCM current position
- New faculty status = based on a CU Hire Date on or after October 1, 2020
- Years at CU = based on CU Hire Date
- Years in rank = based on date rank took effect

Additional Information: Faculty Groupings

- Associate deans were included in the analysis with school/college/program determined by tenure-locus or home department and rank assignment using instructional rank, job title, and base pay.
- If an individual received two degrees at the same level (e.g., MA and MS, PhD and EdD), then years since the highest degree was calculated based on the earlier awarded degree.
- Tenured and tenure-track faculty:
  - Separate models were developed for full, associate, and assistant professors since the set of variables that proved to have the most reliable predictive value varied for each rank.
  - Distinguished professors were included with full professors.
  - Institute faculty were included with their tenure-locus departments.
  - The level of analysis was the academic unit by rank for departments in A&S and CEAS. For the Leeds School of Business, the level of analysis was the division, classified as accounting, finance, management OLIA, management SEO, marketing, or general business, by rank. For other schools and colleges and the Program in Environmental Design, the level of analysis was the school, college, or program as a whole.
- Instructor-track and clinical faculty:
  - Senior instructors and instructors with multiple appointments (e.g., appointments in two or more separate units) were categorized according to their higher/highest appointment. This was selected based on job title, percent time, and salary.
  - Senior instructor rank analysis included faculty with a top appointment of senior instructor, associate deans with a senior instructor appointment, and clinical faculty with a full, associate, or assistant clinical faculty appointment.
  - Instructor-rank faculty analysis included individuals with a top appointment of instructor and clinical faculty with a clinical senior instructor or clinical instructor appointment.

- Faculty groups not included in EPEWA analysis of instructional faculty:
  - Because salary adjustments are planned for January 2022 for individuals identified by this analysis, faculty with retirement agreements taking effect on or before January 1, 2022 were removed from the analysis process.
  - Former deans who had returned to the faculty with a substantially higher salary than the next-highest-paid full professors were removed from the analysis process, and their salaries were not part of college/school/program or department/division/area calculations.
  - Research faculty in both the research professor title series and the research associate title series were not included in the analysis of instructional faculty. Salary equity analysis for research faculty is being done separately and will be completed in 2022.
  - Adjunct faculty and lecturers were not included in the analysis of instructional faculty.

Additional Information: Comparison Between the Annual Faculty Salary Equity Analysis and the Current EPEWA Analysis

- The annual salary equity analysis conducted by IR focuses on assessing statistically significant pay differences, whereas the EPEWA analysis includes any dollar amount difference between actual and predicted salary.
- The annual salary equity analysis developed a model for consistency across job titles and disciplines, whereas the EPEWA analysis allows for different models across different job titles and disciplines, as per the EPEWA allowance for salary difference attributable to education, training, or experience.
- The annual salary equity analysis considered tenured and tenure-track faculty ranks only, whereas the EPEWA analysis also includes instructor-track and clinical faculty.
- The annual salary equity analysis included a comparison to the average faculty salary at AAU public peers, whereas the EPEWA analysis uses only CU Boulder data sources. Market comparison is not allowed as a component of analysis for purposes of the EPEWA criteria.
- The EPEWA analysis includes retention offers, because of their predictive value for salaries and because they are an indicator of EPEWA-allowable factors such as experience and quality and quantity of production.
- A longer time frame of merit scores (5 years) is included in the EPEWA analysis than in the annual salary equity analysis. This helps to account for pay disparities that result from the quantity and quality of a faculty member's production, as based on a documented merit system and allowable under the EPEWA.
- Neither the annual salary equity analysis nor the EPEWA analysis addresses pay disparities that reflect salary compression. Salary compression is analyzed by a separate process.

Project Timeline

- Fall 2020 through July 2021: creation of EPEWA analytic methodology
  - CU Boulder working group formed comprising individuals from Human Resources, University Counsel, the Academic Affairs finance and budget office, and Institutional Research, as well as the Executive Vice Provost for Academic Resource Management, the Senior Vice Provost for Academic Planning & Assessment, and the Vice Provost for Faculty Affairs

- ○ Review of existing CU Boulder salary equity analysis
  - ○ External consultant engagement on possible salary equity analysis model
  - ○ Salary equity results comparisons and validation
  - ○ Finalized model for Round 1 review
- ● August 2021 to January 2022: iterative application and refinement of EPEWA methodology; iterative qualitative review; final determinations of salary adjustments
  - ○ Results produced for Round 1 review by deans and their respective budget/HR team
  - ○ Working group meetings with each dean and their leadership team to discuss methodology and preview Round 1 results
  - ○ Round 1 results shared with each dean and their leadership team
  - ○ Round 1 results compared to salary equity analysis performed independently by some schools, colleges, and programs
  - ○ Methodology refined based on deans' feedback from Round 1 results
  - ○ Base salaries in model revised to reflect University of Colorado Board of Regents decision to award a 3% base building salary increase as of Jan. 1, 2022
  - ○ Round 2 results sent to deans for qualitative review and further feedback
  - ○ Review and corrections by working group based on deans' qualitative review and further feedback
  - ○ Round 3 results sent to deans for further qualitative review
  - ○ Individual meetings held with each dean to discuss further qualitative review
  - ○ Review of deans' further qualitative review and final determinations of salary adjustments by the working group
  - ○ Budget review and final fact checking by the Provost's Office Finance and Budget Office
  - ○ Approval of salary adjustments by campus leadership
  - ○ Submission of salary adjustments to Employee Services for Jan. 2022 pay cycle