

RESEARCH NOTE

University of California PhD Pay is Among the Lowest in the U.S. After Accounting for Cost of Living

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Abstract

How much do PhD students earn in university pay and how far does this income go toward basic cost of living? In this paper, we describe the PhD workforce, focusing on their wages and cost-of-living adjustments. We present nationwide data and a focused comparison to University of California wages. We find that after adjusting for cost-of-living in the county where a school is located, the UC's wages are among the lowest at top institutions in the country. This trend holds when the UCs are compared against both public and private peer institutions. We find that even if UC PhD pay were 7% higher, it would still fall near the bottom of the pay distribution for peer institutions. We also examine the cost of housing alone, and we find that at most of the UCs, a fair-market rent in the school's county is roughly 100% of the average total PhD income.

Keywords: Higher education, academic worker and student employment, salaries and compensations, cost of living, California

JEL classification: I23,I31,J30

On November 14, 2022, 48,000 university employees in the University of California system went on strike. These graduate student workers, postdoctoral fellows, and academic workers called for higher wages and increased benefits and protections. One of the core claims behind the movement is that the economy around them has changed, with rising inflation and housing scarcity, and university compensation has not kept pace.¹ The University of California (UC), in contrast, claims that after a proposed 7% pay raise “[UC] academic student employees would be among the highest compensated among public universities in the Association of American Universities (AAU), with compensation similar to what top private institutions offer.”² These are ultimately empirical claims, and although specific to the University of California system, they resonate with broader debates about university compensation. In this paper we explore these assertions with nationwide data on PhD student compensation and cost of living, with special attention to PhD compensation at the UC.

First, looking at PhD salaries we find that after adjusting for the high cost of living, the UC pays among the lowest adjusted PhD salaries in the nation. The only schools with lower adjusted PhD pay are those in the nation's most expensive area, Manhattan. These extremely low rates of relative pay obtain when the UC is compared to top 20 schools in the US, top 50 schools, to top private institutions, and even to top public institutions.

Second, we find that if UC wages were increased by 7%, they would still fall near the bottom of the distribution of nationwide adjusted PhD pay at top schools. Average adjusted UC PhD incomes sit

1. <http://tinyurl.com/uaw-statement-nov22>

2. November 15, 2022, letter from Michael T. Brown, UC Provost and Executive Vice President for Academic Affairs. <https://tinyurl.com/evc-letter-nov15>

at the 9th percentile for adjusted PhD pay at top US universities. If a 7% pay raise were implemented the UC would shift to the 19th percentile in the nationwide distribution of adjusted PhD pay.

Third, looking at the nationwide data on cost-of-living, we find that counties with universities are much more expensive than the average county. This differential increases in counties with top universities, and is even higher in counties with a UC campus.

Last, we find that in order to afford a “fair-rate” (according to HUD) one-bedroom apartment, most UC PhD students would need to pay roughly their entire monthly university income. That is, at most of the UCs, the average total PhD income is roughly equal to a fair-market rent in the school’s county.

1. Salaries for PhD-program Academic Student Workers

Many different arrangements exist across the US for funding of PhD students during their studies and research, and the nature of a student’s funding may change over time as well. Many graduate students earn their salary from the university from a combination of fellowships, teaching, and research work.³ Fellowships and teaching salaries are often paid by the school, and research work is often paid from faculty or departmental grants.

Departments may have flexibility to pay graduate students above a base rate. For example, if a student were on a fellowship or a TAship that pays approximately \$24,000, faculty or the department could provide additional pay from grants directly to the student. Some students in some disciplines may also be able to take on research work to earn additional income beyond the fellowship or TAship pay.

In general, the data for this research note is reported by PhD students and represents the total amount of income that they received from their school, without disaggregating the funding source. In the interest of parsimony and as a function of the aggregation of the available data, describing the details of PhD funding is beyond the scope of this paper.

2. Data

In this research note, we analyze data on PhD university income by school and consider cost-of-living in the county where a school is located. Data on PhD pay comes from <https://phdstipends.com>, including 11,678 observations of PhD student pay, based on crowd-sourced reporting of PhD income submitted by students at universities around the world. The vast majority are at US institutions and we focus our analysis on these observations.⁴ We analyze data for reported PhD pay from academic year 2014–2015 to academic year 2022–2023. The distribution of the data’s time coverage is presented in the Appendix.⁵

After data cleaning, we aggregate the data to obtain school-level mean pay, producing average graduate student pay for 183 universities in the US. Details of data processing are presented in the Appendix. We focus our analysis on top US universities according to the 2022 US News ranking. We compare the top 20 (and top 50) non-UC schools to UC schools. This results in 60 schools in the US, including 10 UC campuses. 57 for which we have sufficient data.⁶

These schools include both public and private institutions, such as Harvard University, University of Michigan, and University of Wisconsin. The full list of comparison schools is presented in the Appendix, as well as links to the methodology and raw data.

3. Within the UC system, these three categories are referred to as Fellowships, Teaching Assistantships (TAships), and Graduate Student Researcher positions (GSR).

4. We discuss the reliability and limits on interpretation in Appendix 3.

5. The data includes 13,827 observations in total, including international universities and funding packages ranging from 2002 to 2025. For comparability, in this paper we focus on top-rated American universities from 2014–2022.

6. The College of William and Mary, Villanova University, and Pepperdine University drop out of the data due to having fewer than 10 reported salaries.

We use data on cost-of-living by county from the Council for Community and Economic Research (C2ER). This data has an index of the cost-of-living by county where 100 represents the national average, and values above (below) 100, represent counties that are more (less) expensive than the national average. The data includes a cost-of-living index for 3,111 of the country's 3,143 counties and county-equivalents. More discussion of this data is presented in the Appendix, including discussion of the index's inputs and weights.

We use data on the price of a fair-rate one-bedroom apartment from the U.S. Department of Housing and Urban Development (HUD).

Our key data sources are presented below in Table 1. Replication code and data are posted online at Daniel Masterson's Dataverse: <https://dataverse.harvard.edu/dataverse/danielmasterson>. The county-level cost-of-living data is proprietary, and requires purchase from C2ER, and therefore that column is excluded from replication data.

Table 1. Data sources description

Data	Source	Level	N
Stipend data	https://phdstipends.com . Crowd-sourced PhD student reports of PhD stipends. 2014–2022.	Student report	12,484
Cost of living data	https://C2ER.org . Cost-of-living index calculated by the Council for Community and Economic Research. 2022.	County	3,111
Apartment cost data	HUD. Fair Market Rents, estimates of 40th percentile gross rents for standard quality units. 2022.	County and metro area	4,765 counties, county-level equivalents, and metro areas
Top schools data	US News. School ratings based on evaluation of universities and colleges on multiple measures: Graduation and retention rates, metrics of social mobility, graduation rate performance, undergraduate academic reputation, faculty resources, student selectivity, financial resources for students, average alumni giving rate, and graduate indebtedness.	University	50

2.1 Results

2.1.1 Cost of living by county in the US

We begin by presenting descriptives on cost-of-living data in the US. Figure 1 shows a heat map of the cost of living across US counties based on C2ER's county-level cost-of-living index (COLI). Darker shades of blue represent less expensive counties (below-average cost of living). Darker shades of red indicate more expensive counties (above-average cost of living). Counties in white (with COLI=100) have an average cost of living. The map reveals that the cost of living distribution is right-skewed, with many light blue counties with slightly lower than average COLI, and a small number of counties—notably around Boston, New York City, Washington DC, San Francisco, and Los Angeles—with COLI far above the average.

Figure 2 presents the cost of living in counties with universities. We see that counties with universities tend to be more expensive places to live. The cost of living burden is higher when we consider top schools, and higher yet when we look at UC schools. We see that UC schools are, on average, in counties 1.5 times as expensive as the average US county. Overall, Figure 2 shows

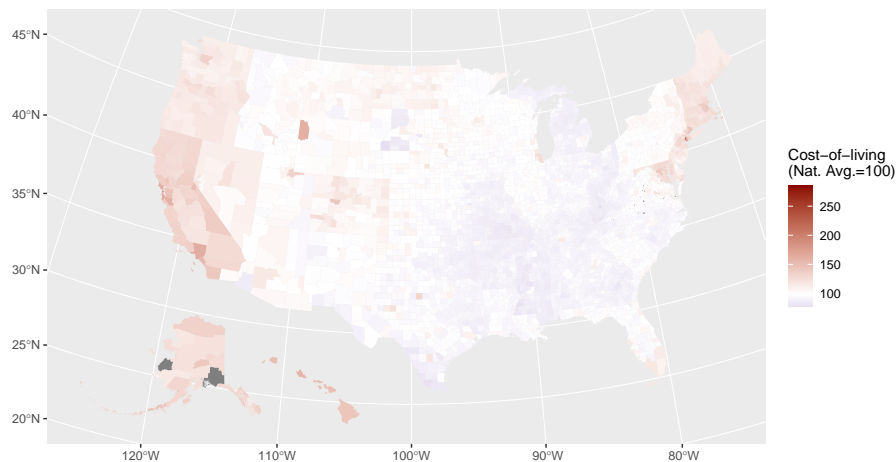


Figure 1. Cost of living by US county

that cost of living is higher in university areas, and particularly so in areas with top schools and UC schools.

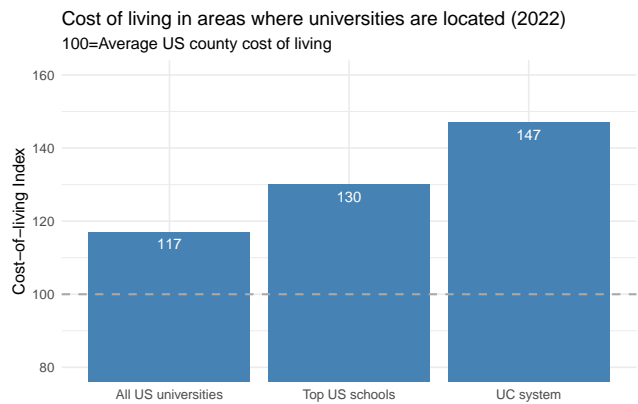


Figure 2. Cost of living in university counties

2.1.2 PhD Student Salaries in the US

Figure 3 shows a rank ordering of universities in terms of average PhD student salary. The left panel presents unadjusted PhD pay and the right panel presents the data after adjusting for the cost-of-living index (henceforth CLA mean salaries, for cost-of-living adjusted). In this plot we

examine where the UC schools fall against the top 20 non-UC schools in the US.

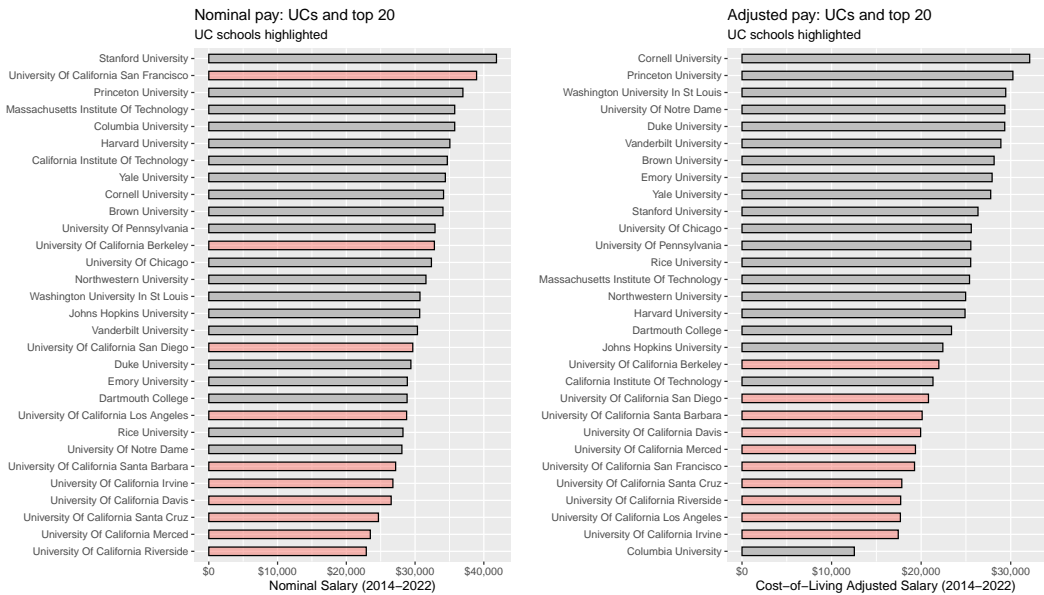


Figure 3. Comparison of UC PhD Pay Against Top 20 non-UC Universities in the US in Unadjusted Pay (Left) and After Cost-of-living Adjustment (Right)

Mean salaries are presented on the x axis. Gray bars show the mean CLA salary at non-UC top schools. The highlighted bars represent the mean CLA salary at each of the UCs for which we had sufficient data. The UCs occupy much of the lower end of the distribution in both metrics, particularly so when considering adjusted pay. Overall, we see that in this distribution of the UCs and the top 20 non-UC schools in the US, the UCs nearly exclusively constitute the bottom third of the CLA distribution. This result is not a function of comparison to the top 20 universities in the US. Appendix 2.1 shows that the pattern obtains when comparing to pay at the top 50 universities in the US. The overall takeaway changes little if we expand the comparison group to the top 50 schools in the US, as shown in Appendix 2.1. Most UCs are in the bottom half of the distribution compared to the top 50 schools in the US in nominal terms, and the UCs again are the lowest paid schools after the cost of living adjustment.

We can also examine the mean UC pay compared to the distribution of pay in top 50 non-UC schools. Figure 4 shows the mean adjusted pay at the UCs and the top 50 non-UC universities in the US.⁷ Cost-of-living adjusted salaries are presented on the x axis. The density on the y axis represents how common the salaries on the x axis are. The salaries with higher bars (and higher points on the density curve) correspond to CLA PhD salaries paid more frequently by top US universities. The blue line indicates the current mean UC PhD wage in the data. The gray dashed lines each represent one UC campus's CLA average PhD pay. The solid red line represents where the UC system's CLA average PhD pay would fall in the distribution of top university pay if the 7% pay raise proposed by UC administration during the week of November 14, 2022, were implemented.

Figure 3 shows clearly that after adjusting for local county cost of living, UC stipends are among the lowest offered at top universities. Figure 4 shows that mean adjusted UC PhD pay falls at only the 9th percentile for adjusted PhD pay at top US universities. Furthermore, if a 7% pay raise were implemented the UC would shift to the 19th percentile in the nationwide distribution of adjusted

7. A parallel histogram is presented for unadjusted pay in Appendix 4.

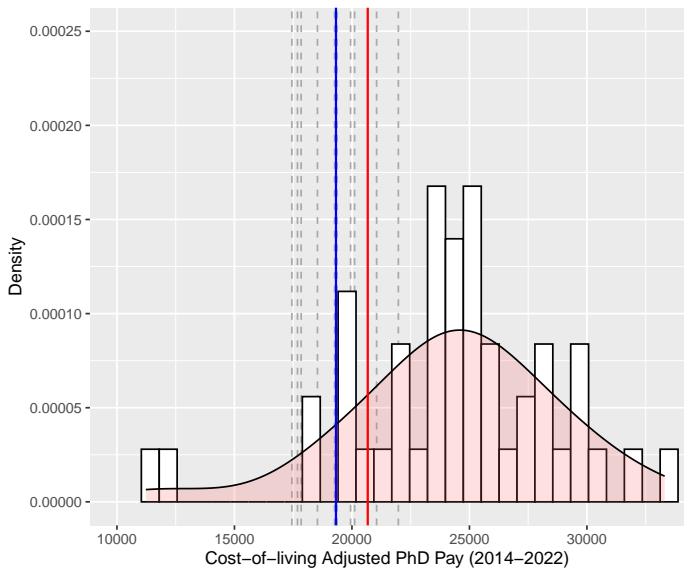


Figure 4. Comparison of UC PhD Pay Against Top 50 non-UC Universities in the US

PhD pay.

In Appendix 3.5 we run simple regression models adjusting for observable differences between schools to test for the robustness of the observed differences. The regression models reveal two consistent results. First, unadjusted salaries do not reveal a meaningful pay differential for UCs. Second, adjusted salaries show a very large and consistent negative pay differential for UCs. The regression results support the conclusion that the observed difference in Figure 4 between UC schools and non-UC schools is not attributable to observable differences between the observations in the data from the UCs and those from non-UC top schools.

To clarify how cost-of-living adjustments look in practice, Table 2 presents the unadjusted and adjusted average PhD pay and the COLI for a number of schools.

Table 2. Example of Cost-of-living Adjustment

School	Unadjusted Mean PhD Pay	COL index	Adjusted PhD Pay
University of California, Santa Barbara	\$27,261	135.1	\$20,178
University of California, Los Angeles	\$28,808	162.7	\$17,706
University of Michigan, Ann Arbor	\$28,044	99.9	\$28,072
University of Wisconsin, Madison	\$24,213	104.7	\$23,126
Harvard University	\$34,947	140.8	\$24,820
Yale University	\$34,401	123.9	\$27,766

Table note: See Appendix for more on calculation

2.1.3 Public universities

How does the UC compare against public universities? Figure 5 shows results when we disaggregate the data to top public institutions (left panel) and top private institutions (right panel).

The left panel of Figure 5 reveals that CLA pay for PhD students at some UCs (leftmost dashed gray lines) are the lowest in the nation among top public school universities. The average adjusted

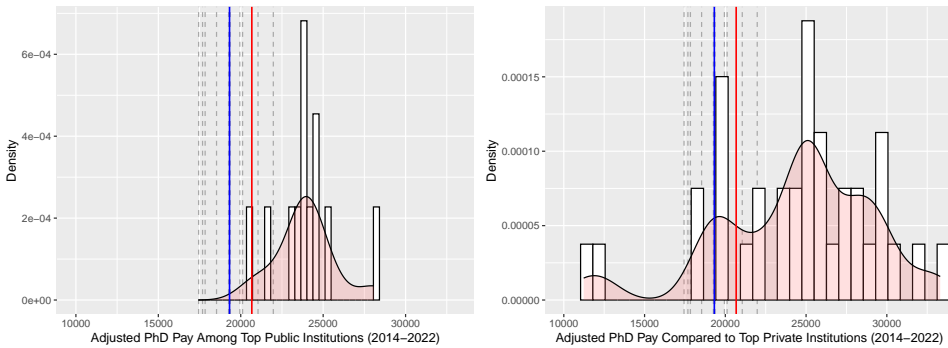


Figure 5. Comparison of UC PhD Pay Against Top Public and Private Universities

UC PhD pay (solid blue line) is lower than adjusted pay at all 12 top non-UC public schools. In other words, the nation’s top 12 non-UC public universities all have a higher average adjusted PhD pay than the average UC salary. Even if a 7% pay raise were implemented, the adjusted UC pay (solid red line) would still be well below the mean adjusted pay at peer public institutions, falling at the 8th percentile among top public institutions after the raise.

In the right panel, we see that UC PhD pay does not look meaningfully better when compared to private institutions. A number of private institutions in Manhattan have lower adjusted PhD pay than any UC. Without the raise, average UC pay falls at the 11th percentile when compared against top private institutions, and at the 23rd percentile with the raise.

2.1.4 Housing prices

We compare unadjusted PhD pay data against housing price data. The cost-of-living adjustment data sets the weight of housing prices on the index at 0.2815 (with weights summing to 1). This may underweight the effective cost of rent for people who spend more than that share of their income on rent. This may apply to many PhD students paying more than half of their salary on rent.⁸ Therefore, we next present a more direct assessment of how far PhD students go toward paying for rent across the US.

We use data from HUD presenting HUD’s determination of a ‘fair-market’ rent for a one-bedroom apartment in each US county. According to HUD, a county’s fair-market rent is the 40th percentile gross rent for standard quality units in that county.⁹ We then calculate a ratio of the fair-market rent in each school’s county to the average PhD pay at the school. The results for UCs and the top 50 non-UC schools are shown in Figure 6.¹⁰ We see that at most of the UCs, the average total PhD income is roughly equal to a fair-market rent in the school’s county—that is, a value of 1 on the x axis.

Some schools provide below-market rate housing. We do not have data on which schools provide this and at what rates, however we can easily assess what housing would cost if a school provided below-market rate housing at a given share of the market price. For example, if campus housing cost 50% of fair-market housing, we would divide the values on the x axis by this percentage (i.e., for 50%, that would mean multiplying by 2). For example, consider a UC that provides below-market rate housing at 50% of HUD’s fair-market rate for that county. In this case, most UC pay would cluster around a value of 2 on the x axis, meaning that average PhD income is roughly equal to 50%

8. UAW 2865 member survey. <https://tinyurl.com/bargaining-results-survey>

9. Data and documentation available here: https://www.huduser.gov/portal/datasets/fmr.html#2022_data

10. The results are not meaningfully different when examining all schools in the PhD pay data. This plot is presented in Appendix 5

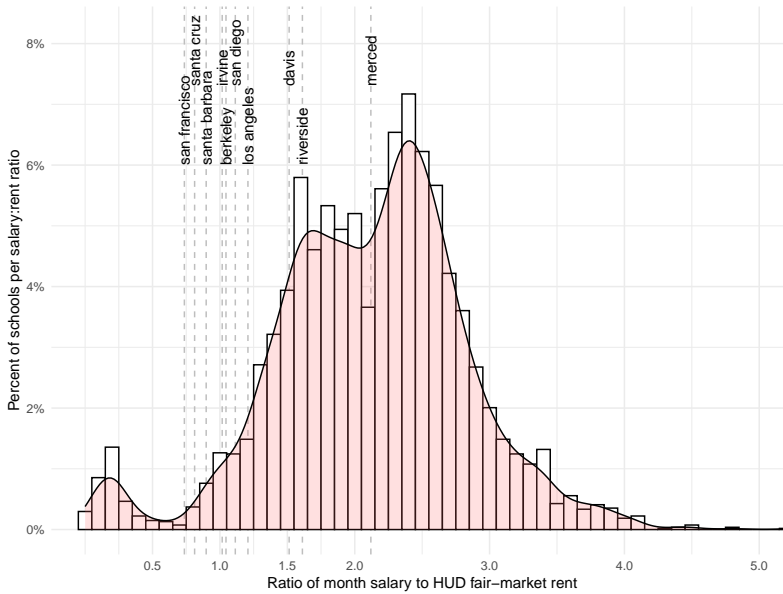


Figure 6. Ratio of PhD salary to fair-market rent for one-bedroom apartment in county. UCs and top 50 US schools.

of a fair-market rent in the school's county.

Although this paper focuses on UC pay, the findings in Figure 6 present a fairly dire picture of PhD pay for a sizeable fraction of the distribution. This suggests serious concerns about the aggregate housing insecurity for PhD students at top PhD programs. The data presented here should raise concerns that housing insecurity may be rampant across the sector. Further attention would be needed to explore this in more depth.

3. Discussion & Conclusion

The data reveal that after accounting for local cost of living, the UCs pay among the lowest salaries of top schools in the US. The data also show that average student pay for UC PhD students compares poorly against HUD-determined fair-market rate for rentals in their county.

More broadly, the data reveal that PhD pay is low at almost all schools. Few PhD students earn more than \$35,000 from their university. Our findings show that this burden is higher than it may immediately appear because universities tend to be located in the nation's more expensive areas, especially top schools and UC campuses.

Due to data limitations, this research note focuses on county-level cost-of-living data, rather than lower levels of geographic aggregation. It is worth noting that if universities tend to be in pricier communities within counties (some of which are quite large in area), county-wide analysis will underestimate the actual cost of living for PhD students.

Low pay for PhD students has long been justified under the logic that training may lead to lucrative careers, making the cost and risk worth it. Like medical training, students take on debt as a matter of course in order to obtain higher earnings and higher job satisfaction down the road. Recent unionization campaigns push back on the consumption smoothing logic. This trend may be due to inflation and housing availability, as well as changes in general expectations about the chances of securing stable academic employment.

An indirect finding from our research is that a scarcity of reliable data exists on pay and living conditions for graduate students and postdoctoral researchers. Such information would be highly

valuable given the concerns raised in this research note about academic pay for some of the university system's essential workers. We call for future research to run a high-quality survey of pay and living conditions for PhD students and postdoctoral researchers.

Acknowledgement

We thank Youssef Benzarti, Graeme Blair, Sarah Brosio, Mark Buntaine, Charmaine Chua, Saad Gulzar, Hakeem Jefferson, Amelia Reese Masterson, Matto Mildenberger, Emily Roberts, Ingmar Sturm, and Gonzalo Vazquez-Bare.

Appendix 1. Data sources

All replication code and data (except proprietary cost-of-living data) will be posted at Daniel Masterson's Dataverse: <https://dataverse.harvard.edu/dataverse/danielmasterson>

PhD pay data: <https://phdstipends.com/csv>

Cost-of-living data: <https://www.coli.org/products/>

HUD fair-market rent data: https://www.huduser.gov/portal/datasets/fmr.html#2022_data

University ranking data: <https://usnews.com>

Appendix 2. Comparison schools

Using the ranking of top schools noted in Appendix 1, we include the following schools as our comparison group of non-UC top 50 schools the US, in alphabetical order: Brown University, California Institute of Technology, Carnegie Mellon University, Case Western Reserve University, College of William and Mary, Columbia University, Cornell University, Dartmouth College, Duke University, Emory University, Florida State University, Georgetown University, Georgia Institute of Technology, Harvard University, Johns Hopkins University, Lehigh University, Massachusetts Institute of Technology, New York University, Northeastern University, Northwestern University, Ohio State University-Columbus, Pepperdine University, Princeton University, Purdue University, Rensselaer Polytechnic Institute, Rice University, Stanford University, Tufts University, Tulane University, University of Chicago, University of Florida, University of Georgia, University of Illinois-Urbana-Champaign, University of Michigan-Ann Arbor, University of North Carolina-Chapel Hill, University of Notre Dame, University of Pennsylvania, University of Rochester, University of Southern California, University of Texas-Austin, University of Virginia, University of Wisconsin-Madison, Vanderbilt University, Villanova University, Wake Forest University, Washington University in St. Louis, and Yale University.

The top 20 group is: Brown University, California Institute of Technology, Columbia University, Cornell University, Dartmouth College, Duke University, Emory University, Harvard University, Johns Hopkins University, Massachusetts Institute of Technology, Northwestern University, Princeton University, Rice University, Stanford University, University of Chicago, University of Notre Dame, University of Pennsylvania, Vanderbilt University, Washington University in St. Louis, and Yale University.

Appendix 2.1 Comparison to top 50 universities in the US

Figure 7 shows the mean adjusted pay at the UCs and the top 50 non-UC universities in the US. Cost-of-living adjusted (CLA) mean salaries are presented on the x axis. Gray bars show the mean CLA salary at non-UC top schools. The highlighted bars represent the mean CLA salary at each of the UCs.

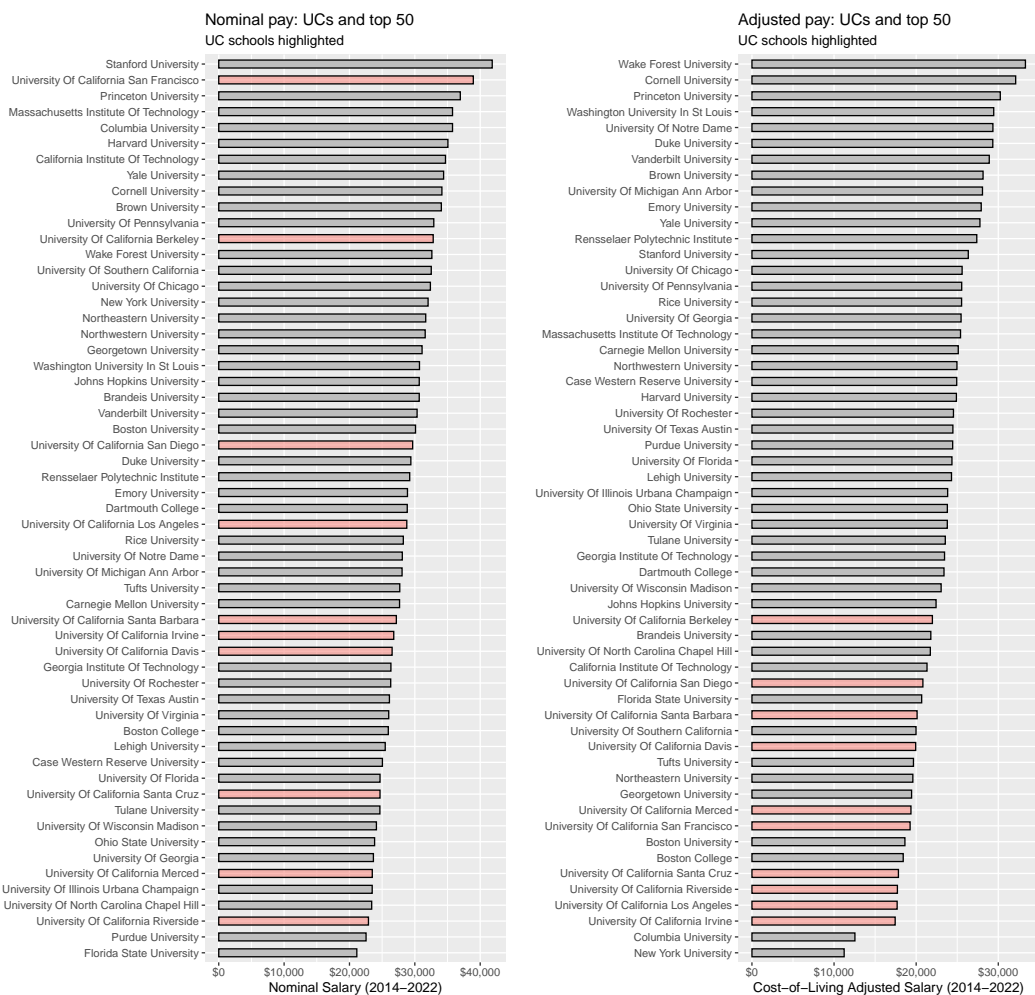


Figure 7. Comparison of UC PhD Pay Against Top 50 non-UC Universities in the US in Nominal Pay (Left) and Adjusted Pay (Right)

Appendix 3. Stipend data

Appendix 3.1 Definition of pay

Here is the information provided to respondents on phdstipend.com: “When you enter your pay, please use your gross (before withholdings/taxes) income from any/all sources relevant to your role as a grad student—stipend, RA or TA pay, fellowship, scholarship, summer pay, internship. If your pay is different during the summer than from the school year, please enter the two amounts separately and consider explaining in the Additional Comments section. Please do not include scholarships that were used to pay for your tuition and other qualified fees.”

The data-entry form is available here: <https://www.phdstipends.com/survey>

Appendix 3.2 Variation in PhD pay

Why would PhD pay from the stipend database vary across individuals within a given school? Why would the numbers reported in the data not be consistent with officially stated standard PhD package pay? Consider this document reporting that the standard pay rate for a graduate student instructor at

University of Michigan, Ann Arbor, is \$23,196 per academic year.¹¹ In our data, the mean nominal salary for a University of Michigan, Ann Arbor, PhD student is \$28,047.87 and the median pay is \$30,000. These differences are likely driven by supplementary university work such as paid research positions. As discussed briefly in Section 1 of the paper, most PhD students draw on multiple sources of funding over the course of their degree, and sometimes draw on multiple sources at a given time. We do not, however, explore these distinctions in greater detail in this research note since our data do not include this level of disaggregation.

Sub-group analysis by academic disciplines (e.g., humanities, sciences, and social sciences) may reveal important variation in PhD pay. We leave this analysis for future work. The data for this paper's analysis, calculates the mean of responses across every response from each institution, irrespective of academic discipline.

Appendix 3.3 Observations per school

Figure 8 presents the number of income reports (student report observations) per school.

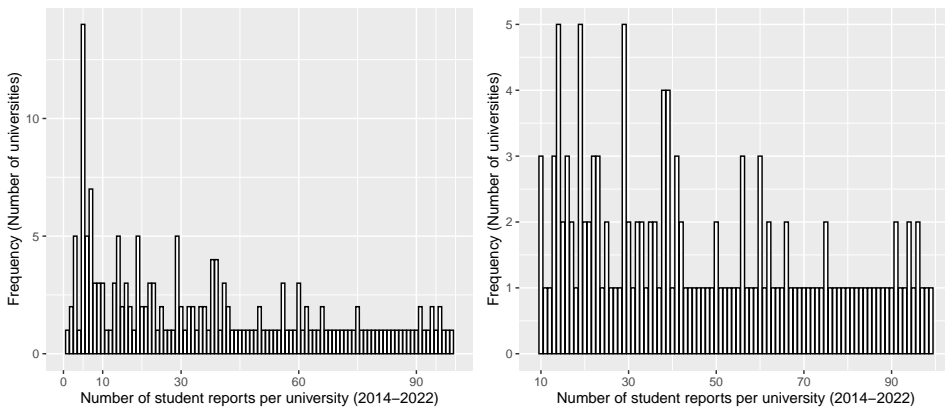


Figure 8. Frequency count of PhD pay reports per university. (Left: Untrimmed. Right: Trimmed, obs. ≥ 10 .)

Appendix 3.4 Observations per year

Figure 9 presents the number of PhD student income reports per year. The years on the x axis correspond to the starting year of the academic year (e.g., 2022, indicates the 2022–2023 AY).

Appendix 3.5 Data quality and bias

The data on PhD stipends has important limits. Students self select into this sample, and the selection process is unobservable and may correlate with determinants of student pay. We now evaluate whether the students in the stipend data from the UCs systematically differ from those in the data from non-UC top schools. If this were the case, then the observed difference in stipend between the UCs and non-UC top schools could be driven by differences in the reporting students rather than underlying differences in pay. For example if students at certain schools or certain types of schools who report were more likely to come from STEM fields (or be more senior in their programs or report data in later calendar years) simple comparisons across groups (e.g., UC/non-UC) may lead to misleading results. For example, the lower average pay that we find at the UCs could be attributable to more students in the humanities reporting their income at the UCs and more students in (possibly)

11. <https://hr.umich.edu/sites/default/files/2021-2022-gsa-salary-memo.pdf>

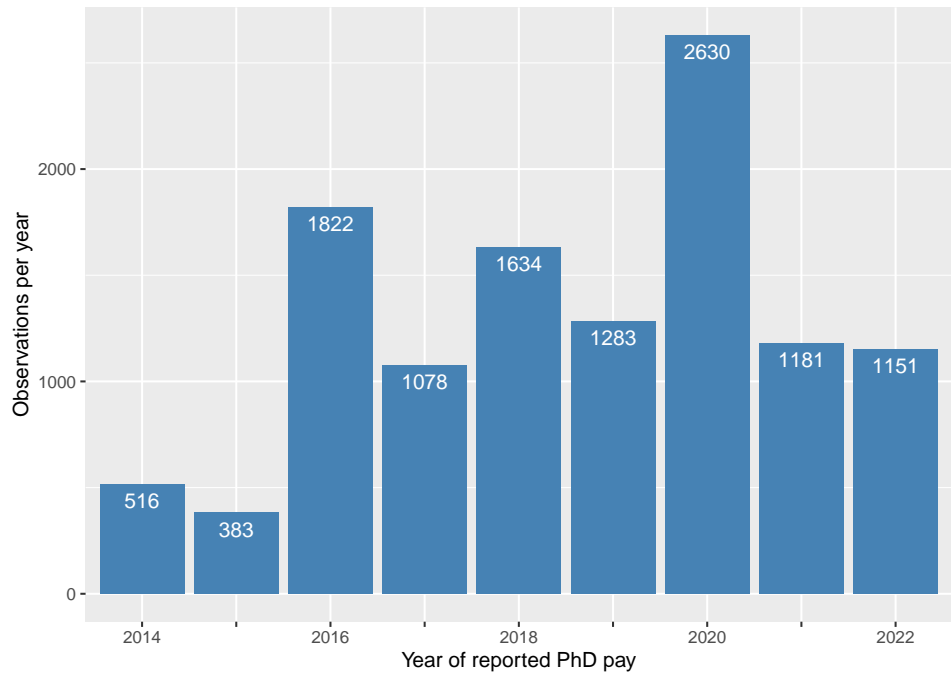


Figure 9. Number of student reports of pay per par period (starting year of academic year).

higher-paid STEM fields reporting at non-UC top schools. Or the data for the UC schools could come from further in the past than observations from non-UC top schools.

We begin by exploring these possibilities visually. We see in Figures 10, 11, and 12 that there is no clear differences in the distribution of disciplines, program year, or calendar year between the UCs and non-UC top 50 schools. Although the number of observations in non-UC top 50 schools is higher in absolute terms than in the UCs, the relative distributions appears similar.

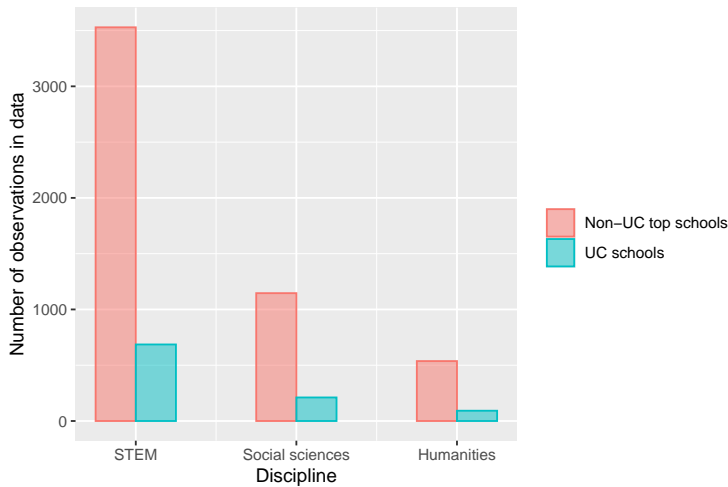


Figure 10. Number of responses by discipline, non-UC vs UC.

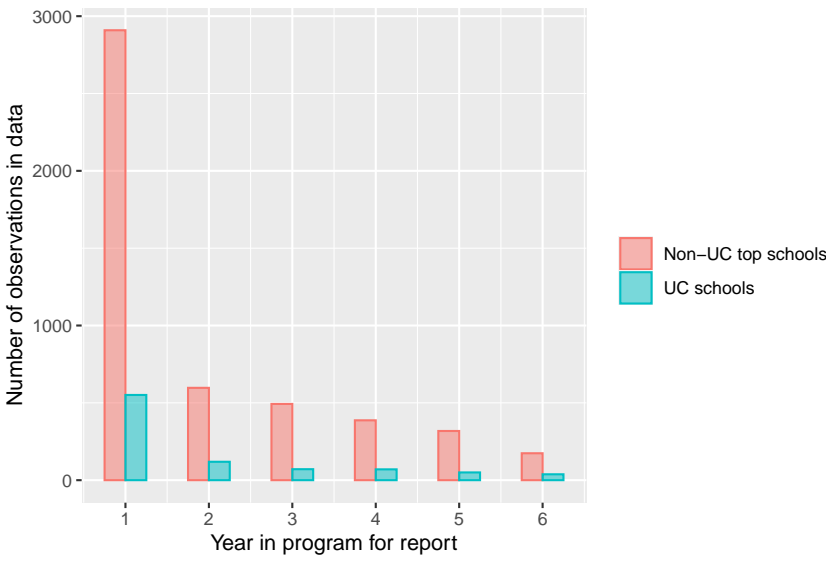


Figure 11. Number of responses by year in program, non-UC vs UC.

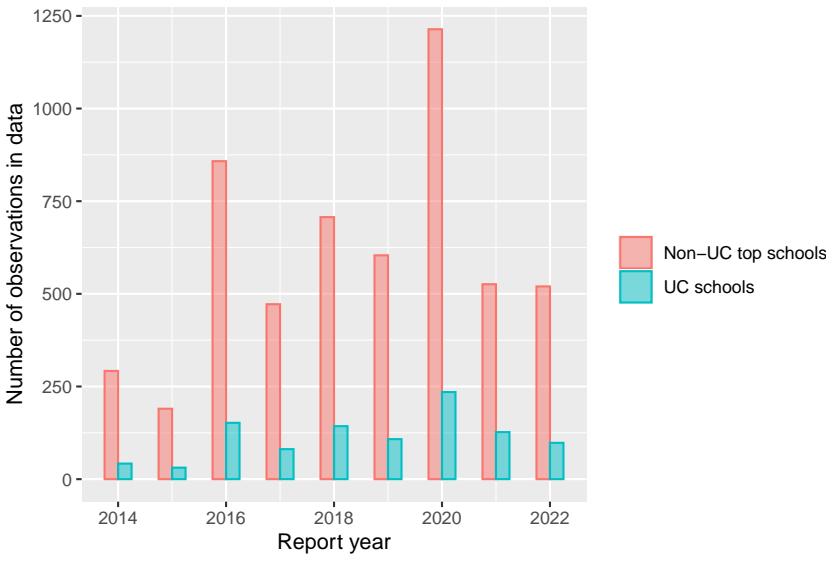


Figure 12. Number of responses by calendar year, non-UC vs UC.

To explore these possibilities we run simple regression models to adjust for observable characteristics that may correlate with income and vary across our sample. In the models below, S_i (S_i^{Adj}) indicates the nominal (adjusted) salary for student i , and S_j (S_j^{Adj}) indicates the mean nominal (adjusted) salary for students in our data from university j . UC indicates whether a student or university is a University of California student or school. X indicates a battery of covariates including the following:

For student-level data:

1. Report-year fixed effects
2. Program-year fixed effects
3. Report-year trend
4. Program-year trend

For school-level data:

1. Average report year
2. Average program year
3. % of reports from STEM fields
4. % of reports from social science fields

ϵ denotes a mean-zero error term.

$$S_i = \alpha + \beta \times UC_i + X_i + \epsilon_i \quad (1)$$

$$S_j = \alpha + \beta \times UC_j + X_j + \epsilon_j \quad (2)$$

$$S_i^{Adj} = \alpha + \beta \times UC_i + X_i + \epsilon_i \quad (3)$$

$$S_j^{Adj} = \alpha + \beta \times UC_j + X_j + \epsilon_j \quad (4)$$

Table 3. Nominal report-level pay

	OLS, no covariates	OLS, w covariates	OLS, covariates & interactions
UC school	-372.218 (323.346)	-424.444 (338.013)	-235.059 (735.688)
STEM		2859.347*** (314.663)	2829.736*** (353.133)
Social science		-446.851 (330.632)	-222.956 (375.079)
UC school x STEM			295.097 (761.412)
UC school x Soc. science			-1356.442 (755.251)
N	6571	5795	5795
Level of analysis	Student	Student	Student
Cost-of-living adjusted	No	No	No
Report-year trend	No	Yes	Yes
Program-year trend	No	Yes	Yes
Report-year FE	No	Yes	Yes
Program-year FE	No	Yes	Yes
Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two tailed). Standard errors in parentheses. Drop in observations is primarily driven by respondents who did not report program year.			

Table 4. Nominal school-level pay

	OLS, no covariates	OLS, w covariates	OLS, covariates & interactions
UC school	-983.350 (1638.940)	-886.796 (1631.970)	-2897.592 (29352.129)
Share STEM		2583.619 (5279.169)	607.607 (5466.676)
Share social science		7461.666 (6601.738)	8563.055 (6466.526)
UC school x Share STEM			6801.719 (27936.649)
UC school x Share soc. science			-11033.142 (42755.645)
N	59	59	59
Level of analysis	School	School	School
Cost-of-living adjusted	No	No	No
Mean report-year	No	Yes	Yes
Mean program-year	No	Yes	Yes
Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two tailed). Standard errors in parentheses.			

Table 5. Adjusted report-level pay

	OLS, no covariates	OLS, w covariates	OLS, covariates & interactions
UC school	-4788.292*** (229.027)	-4894.237*** (239.744)	-4058.021*** (521.794)
STEM		2858.336*** (248.097)	3028.071*** (283.180)
Social science		-701.225** (259.234)	-636.401* (298.989)
UC school x STEM			-1057.171 (539.832)
UC school x Soc. science			-346.125 (534.154)
N	6562	5788	5788
Level of analysis	Student	Student	Student
Cost-of-living adjusted	Yes	Yes	Yes
Report-year trend	No	Yes	Yes
Program-year trend	No	Yes	Yes
Report-year FE	No	Yes	Yes
Program-year FE	No	Yes	Yes
Note: * p < 0.05, ** p < 0.01, *** p < 0.001 (two tailed). Standard errors in parentheses. Drop in observations is primarily driven by respondents who did not report program year.			

Table 6. Adjusted school-level pay

	OLS, no covariates	OLS, w covariates	OLS, covariates & interactions
UC school	-4773.115*** (840.512)	-5361.938*** (895.355)	-5624.821 (9527.187)
Share STEM		9975.037* (4057.134)	11147.946* (4704.348)
Share social science		-569.613 (5474.674)	-1431.852 (5974.172)
UC school x Share STEM			-2963.453 (8954.998)
UC school x Share soc. science			9188.758 (13946.319)
N	58	58	58
Level of analysis	School	School	School
Cost-of-living adjusted	Yes	Yes	Yes
Mean report-year	No	Yes	Yes
Mean program-year	No	Yes	Yes
Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two tailed). Standard errors in parentheses.			

The regression models reveal two consistent results. First, the unadjusted data do not reveal a meaningful pay differential for UCs. Second, the adjusted data show a very large and consistent negative pay differential for UCs.

Of course, we are only able to observe and adjust for a narrow range of background characteristics. We emphasize that a number of unobserved characteristics still may exist in ways that confound our results. Future work could offer more credible estimates by ensuring representative student populations are included in the data through a well-designed sampling process.

Appendix 4. Unadjusted pay histogram

Figure 13 shows a density plot of unadjusted PhD student salaries at the top 50 schools in the US, excluding the UCs. Unadjusted university incomes are presented on the x axis. The density on the y axis represents how common each salary range on the x axis is. Salaries with higher bars (and higher points on the density curve) correspond to unadjusted PhD income received more frequently by PhD students at top US universities. The average university income for PhD students at the UCs is indicated in the plot in the blue solid line for comparison. The dotted light red and light blue vertical lines represent the mean and median (respectively) of unadjusted PhD student salaries at the top 50 schools in the US, excluding the UCs. The UC's average unadjusted PhD pay falls at the 40th percentile of adjusted PhD income at top US universities.

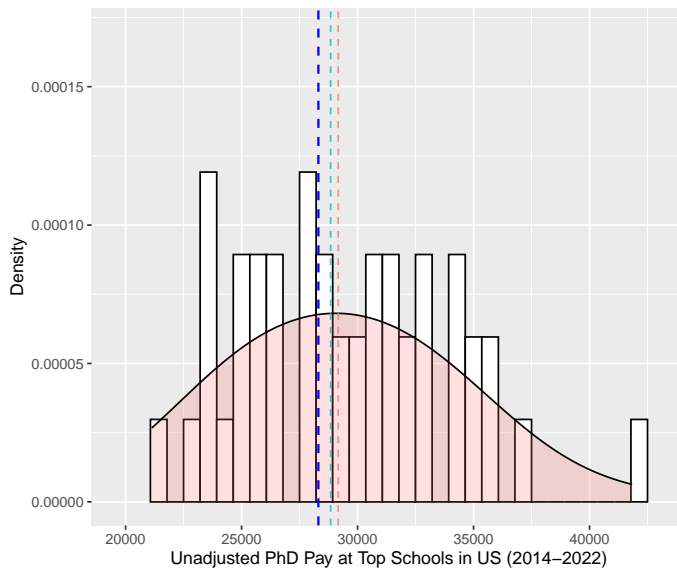


Figure 13. PhD pay in the US at top universities (2014–2022)

Appendix 5. Rent Ratio Plot for All Schools

Figure Appendix 5 presents the share of a monthly PhD salary for a HUD 'fair-market' rent one-bedroom apartment considering all 50 top non-UC universities.

Appendix 6. Data processing

Data processing involved the following steps. We subset PhD income data to the United States. First, school stipend data was merged with school location data through exact string matching by school name. Data cleaning of school names, and manual review of the (non-)matches after merge, leads to

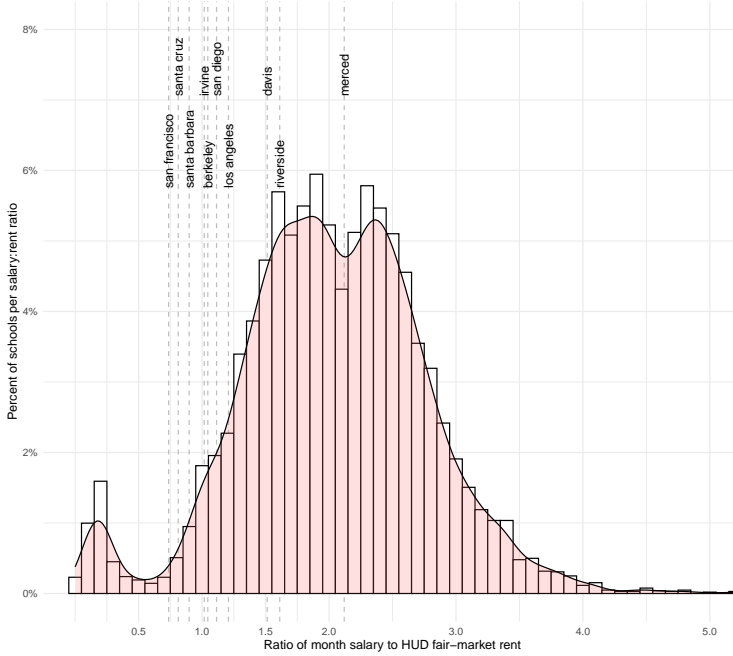


Figure 14. Ratio of PhD salary to fair-market rent for one-bedroom apartment in county. All schools in PhD pay data.

near universal matches (99%). Second, this was merged with cost of living data (at the county level) acquired from COLI (C2ER), matching on county FIPS code. The C2ER data needed to be purchased. C2ER's methodology for calculating the county-level cost-of-living index is available here: <https://www.dropbox.com/s/czuc20ymnyy4my4/CountyLevelCostofLivingIndexMethodology.docx?raw=1>.

We subset stipends data to schools with more than 10 observations for reliability. We make an exception to this rule for UC Merced, which had 9 observations, in order to include the full set of UC campuses. The average number of responses per UC campus was 101.7. 183 universities had more than 10 PhD student reports. We also eliminate observations that report earning more than \$80,000, which we picked as our cut-off for pay rates that are unlikely to accurately reflect university pay. This constitutes less than 0.2% of the full 12,484 observations.

When we subset stipends to the 10 UCs and the top 50 non-UC schools according to US News, we have 6,400 89 students reports remaining (from an original 12,484). When subsetting to top universities with more than 10 students pay reports, we are left with 57 top US universities and UCs. Among these 57 top US universities with sufficient data, we have 10 UC campuses. With this, our comparison group for UC salaries in our data comprises 47 non-UC top US universities with sufficient data. The three schools that drop out for lack of salary data are the College of William and Mary, Villanova University, and Pepperdine University.

The cost-of-living adjusted stipend estimates, \hat{P}_j , are calculated as follows:

$$\hat{P}_j = \bar{P}_j / C_k \times 100 \quad (5)$$

Where \bar{P}_j denotes the average reported student pay at university j . C_k denotes the cost-of-living index for county k . \bar{P}_j is calculated as follows:

$$\bar{P}_j = \frac{1}{N_j} \sum_{i=1}^{N_j} P_{ij} \quad (6)$$

Where P_{ij} is pay for student i and university j , and N_j denotes the number of student respondents from university j .