

## **ONLINE APPENDIX**

Are Professors Worth It? The Value-added and Costs of Tutorial Instructors

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**Appendix A**  
*Additional Tables*

**Table A1**  
Comparison of Sample vs. Nonsample Courses

|                                  | Sample<br>courses<br>(N = 651) | Other courses<br>(N = 628) | Diff. in<br>Means |
|----------------------------------|--------------------------------|----------------------------|-------------------|
|                                  | Mean                           | Mean                       |                   |
|                                  | (1)                            | (2)                        | (2) - (1)         |
| <i>Instructor academic rank:</i> |                                |                            |                   |
| Student                          | 0.18                           | 0.12                       | 0.06              |
| PhD                              | 0.27                           | 0.14                       | 0.13              |
| Postdoc                          | 0.03                           | 0.05                       | -0.02             |
| Lecturer                         | 0.28                           | 0.14                       | 0.14              |
| Assist.                          | 0.14                           | 0.25                       | -0.11             |
| Assoc.                           | 0.05                           | 0.18                       | -0.13             |
| Prof.                            | 0.05                           | 0.12                       | -0.07             |
| <i>Student characteristics:</i>  |                                |                            |                   |
| Grade                            | 6.85                           | 7.1                        | -0.25             |
| Previous GPA                     | 6.11                           | 6.31                       | -0.20             |
| Bachelor                         | 0.65                           | 0.46                       | 0.19              |
| <i>Course characteristics:</i>   |                                |                            |                   |
| Mathematical                     | 0.27                           | 0.42                       | -0.15             |
| First-year                       | 0.18                           | 0.1                        | 0.08              |
| Offered by microeconomics dept.  | 0.12                           | 0.16                       | -0.04             |
| Offered by macroeconomics dept.  | 0.06                           | 0.12                       | -0.06             |
| Offered by finance dept.         | 0.16                           | 0.08                       | 0.08              |
| Offered by other dept.           | 0.66                           | 0.65                       | 0.01              |
| No. instructors                  | 4.01                           | 1.18                       | 2.83              |
| No. students                     | 140.71                         | 31.66                      | 109.05            |
| No. tutorials                    | 10.88                          | 2.71                       | 8.17              |
| No. students per tutorial        | 12.55                          | 11.24                      | 1.31              |

This table is based on data from 111,481 observations from 14,051 students who took 1,279 courses in 160 different subject matters, taught by 2,054 instructors over 24 teaching periods between the academic years 2009-2010 and 2014-2015.

**Table A2**

## Wage Costs and Contractual Time by Instructor Academic Rank

|   | <i>By instructor academic rank:</i> |            |                |                 |                |               |              |
|---|-------------------------------------|------------|----------------|-----------------|----------------|---------------|--------------|
|   | <u>Student</u>                      | <u>PhD</u> | <u>Postdoc</u> | <u>Lecturer</u> | <u>Assist.</u> | <u>Assoc.</u> | <u>Prof.</u> |
| Monthly gross wage                                | €2,251                              | €3,179     | €3,714         | €5,034          | €5,034         | €6,908        | €7,599       |
| FTE teaching and preparation<br>(hours per month) | <i>flexible</i>                     | 32         | 40             | 160             | 80             | 80            | 80           |
| FTE Standard teaching load                        | <i>flexible</i>                     | 0.20       | 0.25           | 1               | 0.50           | 0.50          | 0.50         |
| Hourly wage                                       | €14                                 | €20        | €23            | €31             | €31            | €43           | €47          |
| <i>Hours per tutorial session in:</i>             |                                     |            |                |                 |                |               |              |
| Paid preparation                                  | 2                                   | 2          | 2              | 2               | 2              | 2             | 2            |
| Teaching  | 2                                   | 2          | 2              | 2               | 2              | 2             | 2            |
| Total   | 4                                   | 4          | 4              | 4               | 4              | 4             | 4            |
| Total wage costs per tutorial session             | €56                                 | €79        | €93            | €126            | €126           | €173          | €190         |

Monthly gross wages are assumed to be in the lowest pay scale of the instructor type, which provides a lower bound of the actual costs for more senior instructors. Calculations based on a total of 160 Full Time Equivalent (FTE) hours in a month.

**Table A3**

Dropout, Course Evaluation Response, and Survey Response by Instructor Academic Rank

| Dep. Variable:                              | Course dropout    | First-year dropout | On-time graduation | Course eval. respondent | Survey respondent |
|---|-------------------|--------------------|--------------------|-------------------------|-------------------|
|   | (1)               | (2)                | (3)                | (4)                     | (5)               |
| Instructor academic rank<br>(Base: Student) |                   |                    |                    |                         |                   |
| PhD   | 0.002<br>(0.009)  | 0.010<br>(0.009)   | -0.008<br>(0.022)  | -0.032*<br>(0.019)      | 0.012<br>(0.016)  |
| Postdoc                                     | -0.004<br>(0.011) | -0.005<br>(0.012)  | 0.019<br>(0.036)   | -0.041<br>(0.034)       | -0.012<br>(0.023) |
| Lecturer                                    | -0.003<br>(0.008) | 0.001<br>(0.007)   | 0.002<br>(0.021)   | -0.006<br>(0.017)       | -0.003<br>(0.014) |
| Assist.                                     | -0.000<br>(0.009) | 0.003<br>(0.008)   | 0.003<br>(0.026)   | -0.016<br>(0.020)       | -0.012<br>(0.016) |
| Assoc.                                      | -0.002<br>(0.011) | 0.004<br>(0.010)   | 0.007<br>(0.038)   | -0.025<br>(0.024)       | -0.002<br>(0.019) |
| Prof.                                       | -0.002<br>(0.012) | 0.001<br>(0.009)   | 0.002<br>(0.042)   | -0.061**<br>(0.027)     | -0.016<br>(0.023) |
| Instructor gender, nationality, experience: | ✓                 | ✓                  | ✓                  | ✓                       | ✓                 |
| Tutorial schedule FE:                       | ✓                 | ✓                  | ✓                  | ✓                       | ✓                 |
| Course FE:                                  | ✓                 | ✓                  | ✓                  | ✓                       | ✓                 |
| F-test inst. academic rank [p-value]        | [0.987]           | [0.754]            | [0.987]            | [0.171]                 | [0.466]           |
| R-squared                                   | 0.07              | 0.67               | 0.08               | 0.09                    | 0.12              |
| Instructors-by-time                         | 1,490             | 1,015              | 907                | 1,490                   | 1,433             |
| Observations                                | 48,842            | 34,350             | 24,236             | 48,842                  | 41,390            |

This table reports OLS coefficients of regressing student dropout and survey response dummies on instructor observable characteristics. All regressions condition time-of-day and day-of-week fixed effects, a dummy for students who registered late for the courses, and course fixed effects. Standard errors based on 500 pair bootstrap redraws clustered at the instructor-by-time level are in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table A4**

Comparison of Student Characteristics for the Population and the Different Estimation Samples

|                     | <i>Student population:</i> |   | <i>Student sample:</i>          |  |  |
|---------------------|----------------------------|---|---------------------------------|--|--|
|                     | All<br>N = 14,051<br>(1)   | Graduate<br>Survey<br>N = 10,566<br>(2) | Estimation<br>N = 12,257<br>(3) | Course<br>evaluation<br>N = 7,574<br>(4) | Graduate<br>Survey<br>N = 1,737<br>(5) |
| Female              | 0.40                       | 0.40                                    | 0.40                            | 0.44                                     | 0.38                                   |
| Age                 | 20.71                      | 21.00                                   | 20.67                           | 20.72                                    | 19.92                                  |
| Dutch               | 0.25                       | 0.26                                    | 0.26                            | 0.25                                     | 0.32                                   |
| German              | 0.36                       | 0.37                                    | 0.38                            | 0.41                                     | 0.57                                   |
| Course grade        | 6.76                       | 6.77                                    | 6.72                            | 6.86                                     | 7.04                                   |
| Total courses taken | 7.93                       | 9.29                                    | 3.98                            | 2.48                                     | 7.71                                   |

This table reports means of student characteristics for the population of students in our data (comprising 111,481 observations from 14,051 students who took 1,271 different courses in 274 subject matters, taught by 2,054 instructors over 24 teaching periods between 2009 and 2014), the population of students eligible to answer the graduate survey, and all the estimation sub-samples used in the paper.

**Table A5**

Value-added and Instructor Academic Rank with Inverse Probability Weighting Corrections

| Dep. Variable:                              | <i>Inverse Probability Weighted VA on:</i> |                          |                   |
|---|--|--------------------------|-------------------|
|   | Std. Course<br>evaluation                  | Std. Job<br>satisfaction | Log earnings      |
|   | (1)  | (2)                      | (3)               |
| Instructor academic rank<br>(Base: Student) |  |                          |                   |
| PhD   | -0.017**<br>(0.008)                        | 0.003<br>(0.008)         | 0.003<br>(0.008)  |
| Postdoc                                     | 0.046***<br>(0.015)                        | -0.014<br>(0.012)        | 0.007<br>(0.014)  |
| Lecturer                                    | 0.005<br>(0.008)                           | 0.011<br>(0.008)         | -0.004<br>(0.010) |
| Assist.                                     | 0.032***<br>(0.009)                        | 0.020**<br>(0.008)       | 0.013<br>(0.008)  |
| Assoc.                                      | 0.044***<br>(0.010)                        | 0.006<br>(0.010)         | -0.008<br>(0.011) |
| Prof.                                       | 0.036***<br>(0.011)                        | 0.011<br>(0.009)         | 0.014<br>(0.009)  |
| F-test inst. academic rank [p-value]        | [<0.000]                                   | [0.004]                  | [0.086]           |
| R-squared                                   | 0.06                                       | 0.01                     | 0.00              |
| Instructors                                 | 499  | 478                      | 481               |
| Observations                                | 1,417                                      | 1,299                    | 1,307             |

This table reports WLS coefficients of regressing measures of value-added on several student outcomes on instructor academic rank, weighting by the square root of the number of students identifying each value-added estimate. Value-added measures were calculated using the inverse of the predicted response probabilities to each question as weights (Wooldridge, 2007). Predicted response probabilities were calculated from the estimates in columns 4 and 5 of Table A3 and windosorized at the 5th and 95th percentiles of their values. Heteroscedasticity-robust standard errors are in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## **Appendix B**

### *Survey of Tutorial Teaching in OECD Countries*

In this section, we describe the sampling procedure and show some summary statistics of the survey discussed in Section II.A. We used the Universities Worldwide Database available at <https://univ.cc>. to obtain a list of the population of universities in OECD countries. This database is based on the “World List of Universities 1997,” which is published by the International Association of Universities and it is updated and maintained by Klaus Förster. From this database, we drew a stratified random sample without replacement from universities in OECD countries. In particular, we randomly selected three universities without replacement from each OECD country to obtain a representative picture of tutorial teaching practices in different countries. There are three exceptions to this sampling procedure. For two small countries, we could only identify contact details for fewer than three universities: two in Latvia and one in Luxembourg. Additionally, we oversampled the United States with 30 universities because they represent a 40 percent share of OECD universities. In total, our sampling population covers 4,938 universities from all OECD countries; through our survey, we contacted 139 of them. Our statistical analyses account for this complex survey design by: 1) stratifying by country, 2) including finite population corrections through stratum sampling rates, and 3) including poststratification weights constructed as the ratio of the population and the sample share of universities in the country.

We sent the survey by email to academic staff in economics, commerce, and business administration departments of the sampled universities. The email addresses were collected by a research assistant who chose academic staff who, according to their CV, are likely to speak English and have at least two years of teaching experience. To increase the response rate, we sent

the survey sequentially to up to four academics per institutions. More specifically, we first sent the survey to one academic per institution and followed up with one reminder. If the academic did not respond after the first reminder, we sent the survey to another academic in the same institution. After repeating this procedure up to four times, we got survey responses from 69 out of 139 universities, covering 31 out of 35 OECD countries.

The survey consisted of up to 18 questions and took about 5 minutes to complete. All survey questions and the survey data stripped from university identifiers is available at <http://ulfzoelitz.com/research/material>.



## **Appendix C**

### *Data Restrictions*

Our sample period covers the academic years of 2009–10 through 2014–15. We derive our estimation sample in two steps. First, we exclude a number of observations from our estimation sample because they represent exceptions from the standard tutorial group assignment procedure at the business school. Second, we limit our estimation sample following Chetty, Friedman, and Rockoff (2014a) so that we are able to estimate instructor value-added.

Because they represent an exception to the standard tutorial group assignment procedure at the business school, we exclude the following observations:

- eight courses in which the course coordinator or other education staff actively influenced the tutorial group composition. One course coordinator, for example, requested to balance student gender across tutorial groups. The business school’s scheduling department informed us about these courses.
- 21 tutorial groups that consisted mainly of students who registered late for the course. Before April 2014, the business school reserved one or two slots per tutorial group for students who registered late. In exceptional cases in which the number of late registration students substantially exceeded the number of empty spots, new tutorial groups were created that mainly consisted of late-registering students. The business school abolished the late registration policy in April 2014.
- 46 repeater tutorial groups. One course coordinator explicitly requested to assign repeater students who failed his/her courses in the previous year to special repeater tutorial groups.

- 17 tutorial groups that mainly consisted of students from a special research-based program. For some courses, students in this program were assigned together to separate tutorial groups with a more-experienced teacher.
- 95 part-time MBA students, because these students are typically scheduled for special evening classes with only part-time students

Following Chetty, Friedman, and Rockoff (2014a), and due to our own requirements for the identification of our estimates (see Section III), we exclude from our estimation sample:

- 93 tutorials with fewer than seven students, because these tutorials are considered to have too little useful variation to contribute to instructor VA estimates
- 1,410 instructor-subject observations that we did not observe for at least two periods, because we required at least two periods for each instructor-subject to construct our VA estimates
- 649 courses taught by only one instructor, because we could not identify the VA of these instructors solely using within-course variation
- 2,147 student-period observations for students who were taking more than two courses at the same time, because these students might have had to make special scheduling arrangements outside the usual system
- 71 student-year observations for which we neither observed nor could reasonably impute age

