Beyond tuition: College cost accuracy and student outcomes*

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Abstract

This paper goes beyond the focus of the college affordability debate on tuition and studies how living expenses affect the human capital accumulation of US college students. Cost of living (COL) allowances reported by colleges are a substantial part of cost of attendance, which limits federal loan and grant amounts. Without regulation or oversight, self-reported college COL estimates considerably differ from local cost benchmarks, with under-reporting particularly pervasive in 4-year for-profits. Exploiting within-university variation in levels of reported living costs, I show that under-reporting in 4-year for-profits increases dropout rates and enrollment, and lowers student aid received by students. By having all universities follow standardized COL estimates and making the average under-estimating 4 year for-profit university perfectly accurate, dropout rates would decrease by 15%.

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1 Introduction

Recent public debate about college affordability has focused on rising tuition, which has increased 50% in nominal terms in the last decade. However, another substantial component of cost of attendance (COA) experienced accelerated growth (Figure (I)). Cost of living (COL) comprises over half of cost of attendance on average.[1] Although universities have no direct control over off-campus housing and food expenditure, they set the amount of aid students may use to cover expenses while in college. Individual student aid figures are capped by the COA amount universities are required to report annually. Colleges are in charge of estimating cost-of-living allowances, without any oversight or official methodology. This raises the question of whether these estimates are correctly measured and how they affect the US higher education sector.

In this paper, I show for the first time how cost of living estimates reported by universities affect student outcomes. Using within-university variation, I find that 4-year for-profit universities consistently reporting lower relative cost-of-living allowances over time increase freshmen dropout rates by 0.25 percentage points for each COL estimate understated by 1 percentage point. These are sizable estimates, particularly for an outcome reflecting only short-run effects. Making the average under-reporting 4-year for-profit college *perfectly* accurate would decrease freshmen dropout rates by 15% (for a mean dropout rate of 48%).

There are two parts to my analysis. First, I derive local cost-of-living measures that reflect the categories considered by universities when publishing room and board allowances. These student-based estimates are new and measure local housing and food costs based on a national representative student, with locally adjusted multipliers. I consider only housing and food since these make up 80% of student living allowances and can be objectively defined. In my main analysis, I take counties to be the geographic level, but also generate indices covering neighborhoods close to universities, and broader geographic areas for which all my findings are robust. I use these indices to benchmark how the accuracy of living expenses reported by U.S. universities behaves over time and across space with respect to county-wide student costs.

Several patterns of universities' living allowances emerge. Half of all 2- and 4-year universities provide housing and food allowances that deviate by at least 20% ($2,000) from county-level student cost of living. For most university selectivity groups, overstated estimates are common. In contrast, 4-year for-profit institutions are disproportionately more likely to report living expenses below my cost-of-living benchmark. Over 50% of these colleges under-report by at least 20%, being consistently below student housing and food costs over time.

[1] The rise in tuition in higher education institutions has been extensively documented. For examples, see Hoxby (1997) and Jones and Yang (2016).

The second part of the paper is devoted to quantifying the determinants and consequences of imprecise student living allowances. The identification I explore in the main empirical design on the impact on students comes from temporal variation in levels of living expenses provided by colleges relative to my estimated county-level student cost-of-living. By using college fixed-effects and a series of institution, student, and county controls, my empirical design is robust to composition effects across universities and attenuates potential measurement error in the student COL measure I derive. Under the validity of the assumption of no significant unaccounted changes in student composition over cohorts, my results have causal interpretation.

To ground the empirical analysis, I present a simple framework that describes how students' time allocation choices and colleges' reported living allowances determine student attainment. The model underscores two different channels through which college-provided cost-of-living estimates impact students based on their place of residence: an information and a credit channel. These channels play a larger role in the decision of students of staying enrolled in colleges with lower value-added.

I consider prospective financially constrained students who already live in the college's county to be informed about the actual cost-of-living associated with the location. Unlike informed students, out-of-district individuals are uninformed about these costs and therefore evaluate the value-added from college attendance based on the belief that the university-reported cost-of-living allowance is accurate. While only uninformed individuals are subject to an *information channel* from noisy value-added expectations, both student types face a *credit channel*. Living allowances below the county average limit the ability of students to finance actual living expenses, which students compensate by supplying more labor and decreasing study hours. This in turn affects expected returns to human capital accumulation and decreases college value-added, contributing to dropout.

I find significant effects of understated student COL on dropout rates only in 4-year for-profits (FP) and in 2-year for profits (with smaller magnitudes). These two selectivity types encompass most low value-added higher education institutions. My estimates indicate that 4-year FPs reporting lower housing and food estimates relative to the county-level student COL over time enroll more students, larger contingents of women and students receiving preferential low-income grants and taking federal loans. Supporting the credit channel, I show that students take smaller amounts of federal loan and grants. Taken together, these findings suggest that colleges that appear more affordable both attract individuals potentially closer to the margin of indifference between maintaining enrollment or dropping out and constrain students' borrowing.

I consider several potential explanations for universities reporting inaccurate local living expenses. My results suggest that costly COL estimation and low college selectivity are in general related to more imprecisely estimated living expenses, especially in for-profit institutions. Exploit-

ing a policy that decreased student information costs to observe colleges' reported cost-of-living, I find that schools improved COL reporting accuracy, in particular selective colleges, but not for-profits, which might be attributed to reputation concerns.

This paper relates and contributes to the urban and education economics literatures. Its main novel contribution is to show how changes in living costs affect the supply of high-skill individuals by exploiting college-reported living allowances.[2] Going to college imposes a financial burden of tuition and supplies, but also offers individuals a way of financing or covering costs of attendance with federal loans and grants. As long as colleges are able to keep up with rising housing and food costs, students' expanded credit partially alleviates unaffordability. Thus, shocks to cost of living influence students along two dimensions: traditional labor channels and borrowing limit, which is *de facto* controlled by universities.

This study directly relates to papers on the determinants of college completion and the effects of student aid. In particular, I expand on previous work analyzing the effects of student aid on student outcomes (Dynarski (2003), Denning (2018), Denning et al. (2017)). This paper deviates from the standard setting in the literature which considers the effects of financial aid *access*. Rather than analyzing how the marginal student responds to aid eligibility, additional or removal of financial resources, I consider how *sufficient* borrowing affects the marginal constrained student. With this design, even with a fixed credit supply and unchanged aid policy, students may lack sufficient credit if cost of living allowances reported by universities progressively fall short of county-wide actual living expenses. This important determinant of college dropout contributes to the body of literature focused on broader factors that influence college completion (Dynarski (2008) and Bound et al. (2010)) and the consequences of credit constraint (Sun and Yannelis (2016) and Stinebrickner and Stinebrickner (2008)).

The concentrated effects in for-profits institutions I document contribute to recent work that stresses how these institutions engage in questionable behavior, inducing worse outcomes for their students (Deming et al. (2012), Cellini and Goldin (2014), Deming et al. (2016), Armona et al. (2019)). I show that 4-year for-profits fail to keep up with rising housing costs because of latency in updating estimates, and that under-reporting is explained by low selectivity and investment in student resources and administrative personnel, particularly in these institutions.

This paper also contributes to the housing literature more broadly by providing for the first time a rich characterization of student housing for the entire US. The average student attending an U.S. university lives off-campus without parents, is older than 25 years and likely to live with a spouse, children, or a roommate. Student homeownership is lower than the rest of the population and they also rent smaller dwellings, although pay *higher* rents. Interestingly, this student rental

[2]Cross-sectional patterns of living allowances estimates by universities have recently been described in Kelchen et al. (2017).

premium is invariant to the city size and generalizes the findings for college towns from Mocanu and Tremacoldi-Rossi (2018).

This paper proceeds as follows. Section 2 introduces the background on the higher education aid regulation and student aid dynamics. Section 3 contains the data used in the paper. I derive student cost-of-living estimates in Section 4, followed by a conceptual framework in Section 5. The main empirical analysis is contained in Section 6. Section 7 discusses university incentives to report living allowances below or above county averages. Section 8 concludes.

2 Background

Universities are required to report annual figures for cost of attendance (COA) to the federal government. The definition of cost of attendance is determined by law, according to the Higher Education Act, Sec. 472, and is not subject to change by the universities. The law specifies the types of costs that must be included in the COA institutions report: tuition and fees, room and board, books, supplies, transportation, miscellaneous personal expenses. However, it is the university's responsibility to estimate and determine "appropriate and reasonable amounts" for each category. There is no regulation as to how living costs should be determined, and no oversight of the methodology used and costs reported by universities.

Cost of living allowances vary depending on where students reside during college. Universities must report estimates for room and board for groups of students facing similar types of costs: 1) students residing at home with parents, 2) students in institutionally owned housing (dorms), 3) students living off campus, without parents. Students living on campus, and those living with their family are not subject to potential erroneous estimation by the financial aid administrators. Students living off campus, away from their family are the only group who incur the living costs and will be affected by the estimates provided by the university. There is no distinction for room and board costs for full-time, part-time, less than part-time (for three semesters), and online students.

The federal definition of cost of attendance has included living expenses since the beginning of the federal financial aid system in 1965. In spite of the fact that at least some part of the living costs would be incurred regardless of whether a student is attending college, student have access to federal, state, and institutional aid to cover those costs. Since universities have full discretion as to the costs they report, thus, controlling federal aid, it is important to establish their accuracy. Inaccurate cost of living allowances will matter most for students with fewer resources, who rely on grants and loans to cover their college expenses and who already are at risk of not completing

their degree. Unanticipated financial expenses can derail college performance, particularly for credit constrained students from low income families.

Federal student aid consists mainly of Pell Grants and loans. Federal loans come in two forms: subsidized and unsubsidized, with the federal government paying the interest on subsidized loans while the student is in college. Pell Grants and subsidized loans are considered need-based aid, while unsubsidized loans are given on non-need-based basis. The amounts of student aid are determined by individual maximum, which depend on the particular cost of attendance and expected family contribution, and by overall policy maximum that apply to all students. The individual maximum for need-based and non-need-based aid is determined in the following way:

$$\text{Need-based aid} = \text{COA} \; - \; \text{Expected Family Contribution (EFC)}$$
$$\text{Non-need-based aid} = \text{COA} \; - \; \text{Total Aid}$$

Need-based aid is received by students who have financial need, as calculated from COA and the expected family contribution (EFC). The EFC represents the costs that students and their families are expected to contribute, and is calculated according to a formula established by law. Need-based aid includes Pell Grants, subsidized loans, Federal Supplemental Educational Opportunity Grants (FSEOG), federal work-study, and federal Perkins loans. Non-need-based aid is financial aid that is not based on the EFC, only the COA of the college and how much aid from all sources students have been awarded, such as from the school, or private scholarships matter. Non-need-based types of aid includes unsubsidized loans, federal PLUS loans for parents, and Teacher Education Access for College and Higher Education (TEACH) grants.

3 Data

I construct primarily two main datasets. The first is a consistent panel of 4- and 2-year Title IV participating universities using the Integrated Postsecondary Education data System (IPEDS). These are institutions eligible to federal aid programs, hence required to report statistics to IPEDS. I gather a number of student and college characteristics for the 2010, 2013, and 2016 cohorts. Most student-related variables I retrieve are for first-time full-time degree-seeking undergraduate students. The raw sample includes 4,141 colleges of which 3,594 constitute my final sample. I drop colleges only offering online programs and highly selective institutions where all first-year students reside on campus. Table (I) displays summary statistics for Fall 2016. There are visible differences across sectors. Students in 4-year for-profits take larger and more often federal loans, are more

likely to dropout within 150% of normal completion time, receive more federal aid targeted to low-income students and to be women, minorities, and older.

The second source of data are 3% American Community Survey (ACS) samples from the US Census Bureau available at the Integrated Public-Use Microdata Series (IPUMS) (Ruggles et al. (2017)). These data come at the public-use microdata area (PUMA) level which I map onto counties using the allocation adjustment provided in Albouy (2016). I consider only households where the household head is currently enrolled as an undergraduate or professional/graduate student, not living in group quarters (including college-provided housing), and excluding older than 54 and individuals living without paying rent. In robustness results, I map PUMAs onto commuting zones (CZs) (Autor and Dorn (2013)) and use households headed by undergraduate students.[3]

4 Student cost of living (COL)

In this section, I derive local cost of living measures that correspond to housing and food categories used by universities to calculate non-institutional cost of attendance. First, I provide a comprehensive description of undergraduate and graduate students in U.S. universities using census data. These patterns shed light into how individuals accumulating human capital live. I then estimate county-level student cost-of-living benchmarks to evaluate how each institution compares to county costs over time. This is the main variable of interest for my empirical analysis.

4.1 How do students live?

Table (II) compiles data for student household heads for a number of census years. Households headed only by undergraduate students display very similar average and median values. I highlight some key statistics below.

Households. Off-campus students attending a U.S. university are older than 25, many live with spouse or children and the majority rents. While about a third of students lives in university-provided housing or with parents, a larger number lives in off-campus housing.[4] With a median age of 29, these students reflect the fact that less selective schools tend to concentrate in larger urban areas, and these colleges cater to a student body that closely matches the average profile shown in Table (I). In contrast, only about 20% of students were sharing housing with a

[3]David Dorn kindly makes commuting zone crosswalk files available on his webpage.

[4]I consider university-provided housing, or dorms, to match the description of non-institutional quarter groups the US Census had until 2000. For more recent years, it is not possible to distinguish this category.

non-family member (which I consider to be a lower-bound for roommates). There is also a positive association between county size and number of roommates (Figure (A.1)).

Housing. As a consequence of living with either spouse, children or roommates, students who rent tend to occupy dwellings with two bedrooms, for which the average nominal rent paid increased almost 2-fold from 2000 to 2015. Interestingly, students pay higher rents than the county's average for all households by almost the same proportion *regardless of county size* (Figure (A.3)). This student rental premium is also persistent over time. Finally, students occupy dwellings with fewer bedrooms in more expensive areas (Figure (A.2)).

Work. Most students living off-campus work. Of those employed, 77% worked over 27 weeks in 2000 (and 72% in 2015). The median hours worked per week is 40, remaining constant since 2000.

4.2 Estimation of student cost-of-living

For each ACS year, I estimate predicted rents from student households by running the following regression:

$$\ln \text{Rent}_h = \beta X_h + \mu_c + \varepsilon_{hc} \tag{1}$$

where household h's gross rents are regressed on a number of extensive housing characteristics and county dummies. After collapsing predicted housing expenditures into a national representative student, $\overline{X}\widehat{\beta}$, I locally adjust this US average estimate with county effects from (1). This process gives estimated rents at county c, $\widehat{\text{Rent}_c}$, which are retrieved from $\exp\left(\overline{X}\widehat{\beta} + \mu_c\right)$. Further details on the estimation are available in the Appendix.

I use county-adjusted food consumption expenses from Waxman et al. (2018). The authors retrieve weekly expenditures on food from low-income, food-secure households using the 2015 Current Population Survey (CPS). These are households below 130% of the federal poverty level, or roughly SNAP-eligible households. Then, a national representative cost per meal (equivalent to $2.36) is adjusted to US counties by using local food price indices. I convert monthly food and housing costs to a nine-month academic calendar period, where I adjust food prices in 2015 with the CPI-U. It should be pointed out that although not directly including students, this food expenditure represents a lower bound for costs with meals.

4.3 Benchmarking reported COL allowances

I aggregate housing and food cost estimates into a county-level student cost-of-living estimate $\widehat{COL}_{ct}$. Given the reported room and board allowance provided by each university, COL_{ict}, I construct a deviation variable that measures the degree to which universities' reported COL estimates is above or below my student benchmark as:

$$\widetilde{COL}_{ict} = \frac{COL_{ict}}{\widehat{COL}_{ct}} - 1 \tag{2}$$

Figure (II) shows the distribution of $\widetilde{COL}_{ict}$ by university sector-type in 2016.[5] Several patterns emerge. First, while most 4-year public and nonprofit colleges report living expenses above the county benchmark, 4-year for-profits are disproportionately more likely to provide allowances below the county student COL. Under-reporting is also common in community colleges, although it occurs with less intensity than in 4-year for-profits. In the aggregate, half of all 2- and 4-year universities provide housing and food allowances that deviate by more than 20% ($2,000) from county-level student cost of living. Moreover, at least 50% of 4-year FPs under-report by 20%, being consistently below student housing and food costs over time. I later show that 4-year FPs are not more likely to face rising housing costs, as predicted rents experienced comparable growth rates between large and small cities.

The constructed benchmark in (2) closely matches the county average COL reported by universities. In Figure (III), I compare the overall performance of $COL_{ic} - \widehat{COL}_c$ to deviations of universities' reported living allowances with respect to the mean allowance of all universities in a county. The correlation between my estimate and the measurement-free benchmark is particularly high for 4-year for-profit colleges (blue dots in the figure).

5 Conceptual framework

I introduce a simple model to guide my empirical analysis below. The setup considers students that differ along their knowledge θ at $t = 0$ about the accurate local cost-of-living: θ_I for *informed* students and θ_U for *uninformed* students. Informed students are residents of university's i county c and know the true COL_c, while uninformed individuals move into the county to attend college with the belief that $\mathbb{E}_0(COL_c)$ is correct. I consider moving costs are negligible. Let $\mathcal{J}(i)$ represent the population of students accepted by college i, which is segmented into financially unconstrained and constrained individuals. My interest is in the subset of constrained students $\mathcal{C}(i) \subset \mathcal{J}(i)$. These individuals are offered a federal loan of balance B, which I consider to cover

[5] Densities for 2010 and 2013 are very close to those in Figure (II).

the residual from the cost of attendance net of family contribution, which is exhausted.[6] I also allow students to work *while* in college to match the descriptive evidence presented in Section (4).

After matriculation, student j attending university i living in county c consumes two final consumption bundles from a set $\mathbb{S}$. The first is a student cost-of-living vector l_{ijc} that depends on official consumption items considered when calculating the COA (housing and food). The second is a freely traded numeraire good x_{ijc} that is disjoint to l_{ijc}. Students' preferences also depend on the amount of time devoted to school-related work, s_{ijc}. I assume students have Stone-Geary preferences so that they need a minimum amount of school hours $\overline{s}$ and a subsistence consumption level $\overline{l}$: $u_{ijc} = (x_{ijc})^{\alpha} \left(l_{ijc} - \overline{l}\right)^{\beta} (s_{ijc} - \overline{s})^{\gamma}$, where expenditure shares add-up to 1.

The minimum work-load at college $\overline{s}$ captures the amount of study hours that induce school dropout with *certainty*. This can be seen as time spent watching lectures and for simplicity I assume that $\overline{s}$ is invariant with student and college quality.[7] The threshold for maintaining enrollment represents a known college-side requirement and therefore independent of students' assessment of whether continuing enrollment is rational. Students derive utility from s_{ijc}, because more effort into studying increases the odds of better future economic gains, conditional on university's i overall expected income after graduation. Students have a (net) time endowment T which they allocate between study hours and labor supply, L_{ijc}.

The utility of a student choosing (x, l, s) is determined by the problem

$$\begin{aligned} &\max_{x_{ijc}, l_{ijc}, s_{ijc}} (x_{ijc})^{\alpha} \left(l_{ijc} - \overline{l}\right)^{\beta} (s_{ijc} - \overline{s})^{\gamma} \\ &\text{s.t.} \quad x_{ijc} + p_c l_{ijc} + t_i + \overline{w}_c s_{ijc} = F + \overline{w}_c T + B\left(t_i + COL_c\right) \end{aligned} \tag{3}$$

where F represents unearned household income and $p_c l_{ijc}$ gives the student's cost of living in county c. Solving for the optimal demand for study time yields s^*, which regulates whether students may choose to maintain enrollment or are forced to drop out. In this simplified county, I assume my cost-of-living estimate from Section (4), $\widehat{COL}_c$, to be a noisy measure as in

$$\widehat{COL}_c = \sum_i \mathcal{C}(i)^{-1} p_c \sum_j \sum_i l^*_{ijc}$$

since constrained and unconstrained students are indistinguishable from the data. Note that because constrained informed and uninformed students differ only along θ, both face the same intra-county price p_c.

[6] Here, I do not model a complete student-college equilibrium so that I take tuition offers as exogenous. Fore more on it, see Epple et al. (2006)

[7] This assumption can easily be relaxed by accommodating heterogeneity in minimum study requirements based on the student's own ability, q_j, and university's quality, q_i, so that $s_{ijc} > S - q_j + q_i$, for some $S > 0$.

For simplicity, I assume that students solving problem (3) were offered a sticker price tuition t from university i and matriculated following the simple decision rule as in Stinebrickner and Stinebrickner (2008):

$$\underbrace{\mathbb{E}_0\left(V_{C(i)}\right) - \mathbb{E}_0\left(V_N\right)}_{\text{Value-added}} > 0 \tag{4}$$

where $\mathbb{E}\left(V_{C(i)}\right)$ is the ex-ante expected present value of lifetime utility of entering and finishing college, and $\mathbb{E}\left(V_N\right)$ is the lifetime utility from the outside option of never matriculating.

I further decompose the participation constraint (4) into:

$$\mathbb{E}_0\left(L_j w^{skilled} | s^*_{ji}\right) - \mathbb{E}_0 \underbrace{\left(t_i + COL_c\right)}_{COA_{ic}} > \mathbb{E}_0\left(L_j w^{unskilled}\right) - \mathbb{E}_0\left(COL_q\right). \tag{5}$$

In the the expression above, the value of going to college is given by the expected lifelong earnings from being employed in skilled jobs minus the cost of accumulating human capital while in college.[8] The opportunity cost of not going to college is given by earnings from working in unskilled jobs and the cost the student would incur had she stayed in county q. While informed students evaluate the cost of living at $q = c$, i.e. they face the cost in county c independent of enrollment, attending college decreases the labor supply ex-post $t = 0$. Students offered a balance B finance the cost of attendance and partially offset COL_c.

After matriculating, uninformed students are subject to both information and credit shocks, while informed students are only exposed to the credit channel. The intuition behind the differential information effects along student types is straightforward. Consider students attending a college that underestimates the true cost of living in county c. Prior to enrollment, uninformed students evaluate the direct cost component of $\mathbb{E}\left(V_{C(i)}\right)$ at COL_c, which they assume to be correct. Learning that living expenses associated with college are *higher* than anticipated lowers the benefit of going to college to $\mathbb{E}_1\left(V_{C(i)}\right) < \mathbb{E}_0\left(V_{C(i)}\right)$. In contrast, informed students formed correct beliefs on COL_c, accepting college's i offer even though $COL_c < \widehat{COL}_c$.

The credit channel is relevant to both informed and uninformed students. By under-reporting living expenses, universities make students eligible to $B(t_i + COL_c) < B(t_i + \widehat{COL}_c)$, making it more difficult to students of both types to afford the cost of attendance. This credit channel also impacts informed students because they need to give up some amount of hours worked upon matriculating in order to attain $\overline{s} > 0$. From (3), the demand for study hours is given by

$$s^* = \overline{s} + \frac{\gamma}{\overline{w}}\left(F - t + \overline{w}T - \bar{l}p - \overline{ws} + B\right) \tag{6}$$

[8] As specified by the U.S. Department of Education, "*COA is the amount it will cost you to go to school.*" See https://studentaid.ed.gov/sa/fafsa/next-steps/how-calculated#non-need-based.

which implies that a lower loan balance induces fewer study hours, as students compensate the negative income shock by expanding labor supply. This worsens student performance toward $\overline{s}$. From (4), it follows that decreasing s^* *also* impacts negatively future earnings conditional on completion.

In colleges with low value-added, the surplus in (4) is small and therefore larger portions of living expenses uncovered by credit and grants are more important in determining dropout decisions. Therefore, one should expect under-reporting to influence attainment decisions disproportionately in schools such as for-profit colleges than more selective universities.[9]

6 Impact of COL Estimates on Students

This section focuses on the consequences of inaccurate cost-of-living estimates provided by universities on student outcomes. Because the degree of accuracy in reported COL changes relative prices between colleges and affects enrollment continuation decisions of students, I start the empirical analysis by testing how dropout rates and student type selection react to varying levels of within-institution COL inaccuracy.

6.1 Empirical strategy

I analyze how inaccurate COL estimates reported by college i impact freshmen dropout rates using the following baseline regression:

$$Dropout_{ict} = \sum_{j \in J} \delta_j \left(\widetilde{COL}_{ict} \times S(i)_j \right) + \alpha \boldsymbol{X}_{ict} + \gamma_i + \lambda_t + \varepsilon_{ict} \tag{7}$$

where the variable of interest, $\widetilde{COL}_{ict}$, measures the degree of accuracy of university i's reported cost-of-living benchmarked by county c's COL derived in Section (4). I partition universities according to their selectivity using the standard Barron's (2006) selectivity index.[10] The interaction term $S(i)$ maps each college onto a selectivity type from {4-year for-profit, 2-year for-profit, 2-year public & nonprofit, 4-year non-selective, 4-year somewhat selective, 4-year selective}.

[9] If low value-added schools are also less likely to have concerns over reputation, they might allocate fewer resources to correctly estimating COL_c, or engage in strategic pricing of living expenses. For a model of school reputation, see MacLeod and Urquiola (2015). In **Section X**, I analyze the determinants of inaccurate COL reporting

[10] For examples, see Dale and Krueger (2002), Looney and Yannelis (2015), and Jacob et al. (2018). Barron's classification only includes 5 categories. I split "for-profits" into 4- and 2-year institutions for more precision.

In this college-level specification, I expect institutions with large shares of financially constrained off-campus students at a point in time to be disproportionately affected by inaccurate cost-of-living estimates. I capture the joint level of exposure to cost-of-living shocks and relative access to borrowing by interacting the main variable with the intensity term Int_{ict} in the modified baseline regression below. This term gives the fraction of students living off-campus without parents of those receiving grant or scholarship aid.

$$Dropout_{ict} = \sum_{j \in J} \delta_j \left(\widetilde{COL}_{ict} \times Int_{ict} \times S(i)_j \right) + \alpha \boldsymbol{X}_{ict} + \gamma_i + \lambda_t + \varepsilon_{ict}$$

My empirical setting relies on fixed effects and a variety of observed controls. Colleges display remarkable differences in their student body characteristics and the quality of educational services they provide. The validity of conclusions drawn from comparisons between a highly selective 4-year nonprofit and a 4-year for-profit, or within sector-type, would certainly be challenged by composition effects. Students at for-profit schools are more likely to be minority, disadvantaged, and older students (Deming et al. (2012)). Taken together, these are important predictors of college completion, which reflects into high dropout rates at for-profits. I use college effects γ_i to absorb important sources of (time-invariant) college heterogeneity that might drive dropout rates and also the ability of producing accurate COL estimates over time. Thus, (7) is identified by using the temporal variation in levels of relative reported COL estimates *within* universities.[11]

Under this empirical design, the potential influence of my estimated living costs $\widehat{COL}_c$ in driving my estimates is attenuated, since variation only comes from different degrees of reported living allowances over time and not from absolute deviations of $\widehat{COL}_c$. To illustrate this point, assume that students at college i happen to occupy cheaper dwellings than the average student in the county aggregated by my measurement of $\widehat{COL}_c$. For a single t, I might qualify college i as "under-reporting" when its COL_{ic} accurately reflects its student population. In the cross-section, $\widehat{\delta}_j$ would suffer both from composition effects and potential measurement error in $\widetilde{COL}_c$. By exploiting only time variation, if the student composition within college relative to the county remained unaltered from t to $t+1$, COL_{it} should grow at the same rate of $\widetilde{COL}_{it}$. Hence, $\widetilde{COL}_{c(t+1)} < \widetilde{COL}_{ct}$ is free of measurement error.

College-level and county controls in $\boldsymbol{X}_{ict}$ include time-varying student demographic characteristics, university quality measures, and local economic drivers. Finally, year effects λ_t control for aggregate shocks to the economy over $t = 2010, 2013, 2016$.[12] To homogenize student variables, all student-related variables in the baseline model are with respect to full-time first-time degree

[11] The use of an institution fixed-effect shares the spirit of Cellini and Goldin (2014).

[12] I limit t to these cohorts because of pooled tri-annual census housing estimates. For a complete list of covariates included in (7), see the Appendix.

undergraduate students, since some IPEDS variables are only available for this subgroup. Moreover, the intuition is that these students enroll and are potentially affected by large absolute values of $\widetilde{COL}_{ict}$. The outcome in (7) measures only the short-term impact of a one-time cost-of-living shock upon matriculation, capturing the dropout rates of first-year students.

Over time, $\widetilde{COL}_{ict}$ might take up any value for a given college (e.g. college is below the county average by 30% in 2010, then above by 5% in 2013). As a consequence, if a college's allowance induces annual changes of the sign of $\widetilde{COL}_{ic}$, the effects of the credit and information channel would be likely nil.[13] I exploit the high persistence in reporting direction in the sample to run separate baseline regressions for colleges *always* reporting below the county student COL and those that only report above. Were inaccurate reporting to be random within universities, this stratification would be unfeasible. Colleges consistently below the county average or above correspond to two thirds of all institutions. This design intends to capture how different levels of living allowances provided by a college impact its 2010, 2013, and 2016 student cohorts outcomes. In additional specifications, I also include county fixed-effects ϕ_c to accommodate potential competition among colleges in the same area.

6.2 Baseline results

The base results are summarized in Table (III). Columns (1) and (3) implement the baseline model without the intensity variable for under-reporting-only and over-reporting-only universities, respectively. The estimate for 4-year for-profit colleges implies that a 10 percentage point increase in under-reporting raises freshmen dropout rates by 2.5 percentage points. Making the average under-reporting 4-year for-profit college *perfectly accurate* would decrease freshmen dropout rates by 15% (for a mean dropout of 48%). These are large effects given that the representative 4-year FP understates living expenses by $1,000 for a 9-month academic term.

The impact for 4-year FPs is intensified when interacting the main variable with the share of financially constrained students living off-campus (column (2)), and robust to county-fixed effects. Other selectivity groups display no consistent effects. The exception are 2-year for-profit colleges with a point estimate of 70% the magnitude of 4 year for-profits. The lack of effects of under- or over-reporting in other sectors might be partially associated with better quality and resources allocated to students. I discuss these determinants in detail in the next section. To conclude, over-reporting effects on dropout rates are also inexistent. This is also consistent with the lack of credit channel for over-reporting, shown below.

[13] In unreported results, I find no effects on dropout rates for schools with time-varying signs of $\widetilde{COL}_{ic}$.

6.3 Credit channel

I examine whether the amount of federal aid students receive decreases as colleges under-report cost of living estimates by higher proportions. This directly tests the necessary condition for credit effects to account for dropout rates. If college reported COA were to exceed the policy maximum, different degrees of under-reporting without the individual maximum binding would exert no effect on the amount of federal loans and aid students receive. Thus, the credit channel would be ruled out as an explanation to college completion.

Estimates in Table (IV) show that increasing the degree of under-reporting in 4-year for-profit leads to students financing a smaller portion of tuition using federal loans (column (1)) and to hold smaller balances (column (2)). The economic magnitude of these estimates is sizable: a one percentage point increase in under-reporting leads to a drop of 0.6 percentage point in the tuition share and a 1.6% decrease in the amount of loan held by first-time students. These effects are similar for 2-year for-profit institutions and under-reporting appears to be innocuous to credit dynamics in other selectivity categories.

Comparable results emerge for Pell grants (columns (3) and (4)). Since lower cost-of-living estimates limit both the amount of credit students might borrow and grant eligibility, any type of federal aid should be affected to some extent by under-reporting. Regressions with the intensity term Int yield estimates of similar magnitude and identical sign, but with slightly larger standard errors for 4-year for-profits.

6.4 Student selection

In Table (V), I analyze how reporting living allowances below $\widehat{COL}_c$ affects a series of student selection characteristics. There is some evidence that 4-year FPs under-reporting by more enroll more students and do so at increasing rates. These colleges also enroll larger contingents of women, Pell grant and federal loan receiving students. Taken together, these composition effects suggest that under-reporting 4-year for-profits appear cheaper and successfully attract poorer and more vulnerable students, who are at greater risk of dropping out.

6.5 Robustness

I now present a battery of additional tests to assess the robustness of my baseline results.

Measurement-free COL benchmark. One potential issue with estimates in Table (III) is that $\widehat{COL}_c$ might suffer from measurement error. I address this concern in two ways. First, by constructing an alternative deviation variable that is *independent* of any estimated cost-of-living measure:

$$\widetilde{\widetilde{COL}}_{izt} = \frac{COL_{izt}}{i\,(z)^{-1}\sum_{i\in z} COL_{izt}} - 1 \tag{8}$$

where $i\,(z)^{-1}\sum_{i\in z} COL_{izt}$ is the average room and board allowance reported by all universities in commuting zone (CZ) z. Thus, $\widetilde{\widetilde{COL}}_{izt}$ measures the deviation of college i's allowance from the area benchmark given by other universities' reported allowances. I map counties onto CZs for two reasons. First, commuting zones reflect local labor markets which might be a more relevant geographic dimension than political boundaries from counties. Second and related, these areas usually group multiple counties, which circumvents the frequent issue of estimating a version of (8) for counties that only host one college. Results of model (7) using CZ-derived deviations of living expenses are reported in Table (VI). Parameter estimates for under-reporting 4-year FP colleges are similar to the baseline results, even when using temporal variation within commuting zones.

Undergraduate $\widehat{COL}$. A second concern with $\widehat{COL}_c$ is that the estimate pools rental costs from both undergraduate and graduate students, while in effect the outcomes I study are relevant only to undergraduates. To correct for potential distortions to my cost-of-living estimate arising from graduate student households, I estimate county-level residual rents only for households headed by undergraduate students. Replication of the baseline model using this version of $\widehat{COL}_c$ is reported in column (1) of Table (VII).

Unaffected Students. Next, I conduct a falsification test of the importance of living expenses effects. Shocks to local cost of living not covered by proportional changes in reported room and board should only affect students facing actual living expenses, which is captured in the augmented baseline model by the exposure term Int. A simple test to the relevance of $\widehat{COL}_{ict}$ over time rests on the opposite interaction: $1 - Int_{ict}$, or the share of students in each cohort *plausibly unaffected* by changes in housing and food costs. I report this regression in column (2), which shows an insignificant parameter estimate for 4-year FPs.

Additional tests. In column (3), I create a different version of Int using the share of students living off-campus without family from those receiving any type of federal aid, including grants, scholarships, and loans. In columns (4) and (5), the baseline model is reproduced with trimmed samples to purge potential outlier effects. Discarding the top and bottom 5% and 10% of the under-reporting college samples have no impact on the main estimates. In unreported regressions, dropping counties with less than one or half million people also leaves main estimates unchanged.

6.6 Additional results

Effects on dropout rates in 4-year for-profit institutions are higher when selectivity decreases over time. In column (6) of Table (VII), I add an interaction term to the baseline model to include colleges' lagged acceptance ratio. The parameter estimate indicates the importance of college quality, which I address in more detail in the next section. I conclude the table showing that deviations from the county-average interacted with the level of living expenses also affects dropout rates in for-profit colleges.

To finish, Tables (VIII) and (IX) show that dropout rates are higher for under-reporting 4-year FPs in counties with housing costs rising faster, which provides additional support to the importance of gradually larger portions of living expenses uncovered by universities' reported COL. I also show that in counties with faster rental growth, students supply more labor, consistent with the framework from Section (3).

7 Accounting for inaccurate COL estimates

I now take a closer look at the potential determinants of variation in $\widetilde{COL}_{ict}$ estimates provided by higher education institutions. First, colleges might provide inaccurate living allowances because estimating and updating these benchmarks is costly. Second, under-reported cost-of-living figures effectively lowers the cost of attendance and therefore make a college appear more affordable. Under-reporting could also be driven by colleges interested in having students taking out smaller amounts of federal loans, possibly reducing default rates and federal sanctions. On the other hand, institutions over-stating living expenses raise the amount of federal aid to students, easing college financing.

7.1 Resources and selectivity

To start, it is important to distinguish between static and dynamic behavior regarding living allowances reporting. In the cross-section, large absolute values of $\widetilde{COL}_{ict}$ might simply reflect colleges correctly estimating living expenditures for their own student population. Thus, if a college caters to high income students, the group-based estimate COL_{ic} would be higher than my local area benchmark. In contrast, well-defined time variation of $\widetilde{COL}_{ict}$ according to some observable characteristic indicates that, unless living expenditures for this particular group grow differentially from local costs in all cities, colleges are necessarily updating living allowances incorrectly over

time. This source of variation is the key identification I explore in my empirical analysis, in Section (7).

Inaccurate living expenses estimates and adjustments by universities may arise due to several factors. First, providing annual accurate estimates of cost-of-living could be costly. Even if colleges were able to properly measure student local living expenses for a given year, correct annual revisions of the estimate are needed to maintain accuracy in reporting. Colleges with low resources allocated to student services might find particularly difficult to measure and keep up with housing and food costs. In Table (X), I run panel regressions of cost-deviations $\widetilde{COL}_{ict}$ on lagged expenditure measures of financial planning and institutional services. Columns (1)-(4) suggest that for all selectivity groups, lower resources dedicated to administrative structure imply greater deviations from the county average for both under-reporting institutions and in absolute terms, although most estimates are non-significant.

A second possibility is that providing living allowances below the county average makes a school appear more affordable and therefore some colleges might have an incentive to under-report. However, since lowering COL estimates also decreases the amount of federal aid students receive and impacts college attainment, one expects different school types to favor these countervailing factors distinctively. More selective schools are more likely to favor student quality and maintain academic prestige and reputation. By the same token, low value-added colleges have greater incentive to maximize revenues on the extensive margin (i.e. by enrolling more students) even if these students fail to complete the degree.[14] In column (5), I show that lower selectivity is associated with under-reporting living expenses by more. The positive effects for 4 FPs in column (6) on absolute values of $\widetilde{COL}$ are mainly driven by under-reporting. As expected, these effects are stronger and more robust in 4 year FPs, where selectivity is already low and reputation is arguably a secondary firm's objective.

While I do not claim these results reveal *intent*, they do indicate that allocating fewer resources to institutional support and lower college quality meaningfully account for under-reporting and to some extent overall imprecise reporting over time. I conclude by showing that under-reporting is also driven by the absolute value of COL in column (7). Thus, higher student housing and food costs also lead to higher deviations from the county benchmark. This is not necessarily trivial, since large absolute values of $\widetilde{COL}_{ict}$ could be noisy.

7.2 Strategic COL reporting

[14] Of course, low-valued added colleges might also allocate fewer resources to financial personnel in charge of estimating local living expenses.

To gain some insight into whether universities have strategic considerations when setting living allowances, I exploit an exogenous policy change that "revealed" institutions with inaccurate COL estimates. The 2008 Higher Education Opportunity Act introduced a tool where students would be able to observe the individual components of each institution's cost of attendance, therefore allowing for informed and uninformed students to observe reported living allowances. If colleges care about reputation, the policy might have changed conduct and caused institutions to provide more accurate cost-of-living estimates.

Policy background. The 2008 Higher Education Opportunity Act (HEOA) amends the Higher Education Act of 1965 requiring institutions to post on their website a net price calculator. A net price calculator breaks down every component of the total cost of attendance, where a student can insert her expected family contribution and other financial information and obtain a personalized net COA. The policy was largely acknowledged as an improvement in information transparency and enabled students to more easily compare cost of attendance between colleges and individual reported components.

Adoption timing. The HEOA first mandated the Secretary of Education to create an individual net price calculator methodology and have it released to universities by 2009. The calculator was posted on October 29, 2009. Starting on this day, universities had up to two years to comply with the policy by then posting on their own websites an individual net calculator (the same as the federal template or some comparable version). Figure (IV) shows the take-up by colleges using the existence of a financial aid webpage as proxy for the net price calculator.

Before the introduction of the individual net calculator, students faced much higher information costs to learn the structure of costs comprising the cost of attending a particular college:

$$\text{Before HEOA: } \text{COA}_{ist} = \mathbb{E}_0 \left[g \left(t_i, COL_{ict} \right) \right]$$

where prospective students' uncertainty over the functional form of g allowed colleges to shroud individual COA components similar to surcharges (Brown et al. (2010)). The requirement of displaying a net price calculator (i.e. revealing g) imposed by the HEOA exogenously reduced the ability of universities to obfuscate COA components:

$$\text{Post-HEOA: } \text{COA}_{ist} = t_i + \mathbb{E}_0 \left[COL_{ict} \right]$$

where post-policy informed students might correctly evaluate the precision of reported living allowances and uninformed students remain subject to an information channel. Because the HEOA was a federal policy targeting all relevant higher education institutions, I exploit variation in the degree of an institution's student body comprised by financially constrained off-campus students

to estimate the effects of the HEOA on COL reporting. These institutions are more exposed to being "revelead" by the policy to larger share of its student demand.

I therefore use the pre-policy level of financially constrained students living off-campus, Int_{ic}^{2006}, to assign treatment intensity to colleges and study how the introduction of the net price calculator changed the accuracy of COL reporting. The estimating equation is given by:

$$\widetilde{COL}_{ict} = \beta_0 + \beta_1 \left(Int_{ic}^{2006} \times \mathbb{1}_{t \geq 2010} \right) + \alpha \boldsymbol{X}_{ict} + \gamma_i + \lambda_t + \varphi_{ict} \tag{9}$$

where now data for the year $t = 2007$ is included to represent the pre-policy period. The difference-in-differences parameter of interest β_1 captures change in conduct due to greater pricing transparency, under the identifying assumption that the trend in COL reporting accuracy would have remained the same regardless of Int_{ic}^{2006} without the HEOA.

Difference-in-Differences estimates in Table (XI) show that the greater transparency in the components of cost of attendance led universities to increase the accuracy of reported living allowances (in absolute value).[15] Not surprisingly, this correction occurred more strongly in selective institutions (column (3)), which are more likely to have preferences to maintain reputation, while low-value added for-profit institutions did not improve COL reporting accuracy. Although these estimates do not directly speak to dynamic strategic COL setting in the study period, they do suggest that most colleges react to exogenous changes in the ability to obfuscate

7.3 Heterogeneous adjustments to housing costs

The lack of effect on dropout rates from under-reported COL estimates in all selectivity categories except for 4-year for-profits (and somewhat for 2-year for-profits) is consistent with the reasoning in Section (3) that students in low value-added universities are closer to the margin of indifference between maintaining enrollment or dropping out. Having discussed the potential reasons behind inaccurate living allowances, I now show that 4-year FPs actually face similar rising costs than other institution groups, and yet fail to keep up with cost growth.

Predicted rents (i.e. controlling for housing stock characteristics) in my sample counties grew 8% from 2009 to 2015. While average rental growth has been relatively uniform across counties, housing costs in urban areas with more than 1 million people are 60% higher than in smaller counties. Not surprisingly, 4-year for-profit universities were not more likely to experience higher

[15] Both under- and over-reporting institutions became more accurate after the introduction of the net price calculator.

rents over 2009-2015 than other selectivity types, even though they locate in counties with a mean population three times larger.[16]

In spite of being exposed to the same average housing cost shocks, 4-year for-profit institutions had different adjustment patterns of reported COL. In Table (XII), I regress $\widetilde{COL}_i$ on rental costs interacted with selectivity to assess the heterogeneity in variations of reporting given housing cost changes. Estimates for both predicted rents and rent growth indicate that a 4-year for-profit institution under-reports by *more* when housing costs rise over time. The response from other selectivity categories shows an opposite direction in general, and most times these estimates are non-significant. When breaking down the combined category "Others" into all selectivity criteria, under-reporting community colleges show similar effects to 4-year for-profits, but with smaller magnitudes.

Are 4-year for-profit colleges failing to keep up with rising housing costs because of inaction, decreases in reported COL, or insufficient positive adjustments? I test for the possibility that 4-year for-profits are simply reporting constant off-campus room and board values over time. In Figure (V), I select all consistent under-reporters and measure the number of changes in annual reported COL amounts from 2007 to 2016. Most under-reporting colleges update their estimates with some periodicity, with larger concentrations in 4-6 annual changes in the period. 4-year for-profits tend to experience greater latency, with the majority updating COL estimates only three to four times. Thus, 4-year FPs are worse at keeping up with rising costs relative to other selectivity groups because they update COL estimates less frequently. A cross-sectional illustration of these two distinctive patterns is given in Figure (VI).

8 Conclusion

In this paper, I document that inaccurate COL estimates provided by higher education institutions are pervasive and show how imprecise reporting affects student outcomes. I find large effects on dropout rates for that 4-year for-profit universities. Making the average under-reporting 4-year for-profit college *perfectly* accurate would decrease freshmen dropout rates by 15% (for a mean dropout rate of 48%).

The findings that colleges' living allowances affect student outcomes have important policy implications. First, following a standardized cost of living index would alleviate large economic losses as a consequence of student dropout, debt and default rates. While this change would leave the current availability and access to federal aid unchanged, it would allocate public sources more efficiently. In practice, a policy with the objective of increasing the maximum student

[16]The same holds for 2-year for-profits combined with 4-year FP institutions.

borrowing cap would benefit institutions that over-report living expenses, and not necessarily affect those under-reporting. Furthermore, if colleges with high-income students tend to estimate above county-level living allowances to reflect life-style choices of current students, the induced higher cost of attendance hampers access from low-income individuals to those institutions. Since many of the most selective public and nonprofit colleges do provide living expenses allowances above county-level estimates, this might further widen education inequality.

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TABLE I
Summary Statistics

	4-year			2-year			
	Public	Private nonprofit	Private FP	Public	Private nonprofit	Private FP	All
% Female	56%	56%	65%	57%	65%	73%	61%
% Asian	4%	3%	4%	3%	3%	3%	3%
% Black	14%	14%	26%	14%	21%	23%	17%
% Hispanic	11%	8%	14%	15%	11%	17%	12%
% > 25 years	29%	34%	64%	38%	47%	49%	41%
County pop (1,000)	596	997	1,618	762	1,306	1,230	997
Estimated living cost ($)	10,019	10,970	12,132	9,932	11,129	10,856	10,683
Reported living cost ($)	9,243	9,213	8,575	8,102	11,208	10,971	9,260
COA ($)	22,168	39,066	28,659	16,972	29,144	28,707	27,962
Expend. per student ($)	7,030			4,237			
Student-to-faculty ratio	18	13	14	19	14	18	16
Average federal loans ($)	5,448	6,171	7,201	4,479	6,614	7,470	6,080
% Federal loans	53%	68%	76%	29%	67%	76%	60%
% Private loans	5%	9%	5%	1%	5%	5%	5%
% Pell grant	39%	40%	62%	40%	54%	64%	47%
Dropout rate	40%	39%	65%	52%	41%	38%	45%
Default rate	8%	6%	12%	18%	9%	13%	10%

Notes: Values reported for 2016 Fall enrollment of all students at 3,594 4- and 2-year universities.

TABLE II
STUDENT HOUSING

	2000	2006	2009	2012	2015
% with parents	26%	32%	32%	35%	35%
% in dorms	13%	-	-	-	-
% renting	60%	59%	62%	66%	66%
Students off-campus not living with parents					
Age	31.8 (30)	31.5 (29)	31 (29)	31.8 (30)	31.6 (29)
% with roommate	17%	15%	16%	16%	17%
% with spouse	34%	33%	33%	32%	33%
% with children	37%	39%	40%	42%	40%
Rent	681 (623)	901 (807)	988 (880)	1047 (932)	1140 (1013)
Bedrooms	2.24 (2)	2.41 (2)	2.43 (2)	2.44 (2)	2.45 (2)
Family Size	2.24 (2)	2.28 (2)	2.32 (2)	2.37 (2)	2.34 (2)
Age Building	1970 (1975)	1975 (1975)	1976 (1975)	1977 (1975)	1978 (1985)

Notes: Census mean (median) values for households headed by undergraduate or graduate students not living in group quarters, older than 54 and that pay rent in cash (when renters). Sample construction is detailed in the Appendix.

TABLE III
FIXED EFFECT ESTIMATES: BASELINE MODEL

	Freshmen dropout rates					
	Under-reporting colleges			Over-reporting colleges		
	(1)	(2)	(3)	(4)	(5)	(6)
$\widetilde{COL}\times$						
4-year for-profit	0.252		0.233	-0.237		-0.236
	(0.084)***		(0.091)***	(0.237)		(0.267)
2-year for-profit	0.104		0.098	−0.048		−0.048
	(0.063)		(0.070)	(0.049)		(0.055)
2-year public & nonprofit	−0.010		−0.013	0.039		0.039
	(0.023)		(0.025)	(0.030)		(0.033)
4-year non-selective	−0.037		−0.031	0.064**		0.064**
	(0.037)		(0.040)	(0.026)		(0.029)
4-year somewhat-selective	−0.007		−0.004	0.002		0.001
	(0.012)		(0.014)	(0.030)		(0.033)
4-year selective	−0.004		0.001	−0.011		-0.011
	(0.008)		(0.009)	(0.023)		(0.027)
$\widetilde{COL} \times Int\times$						
4-year for-profit		0.329			−0.140	
		(0.147)**			(0.251)	
2-year for-profit		0.231			−0.048	
		(0.081)***			(0.056)	
2-year public & nonprofit		−0.008			0.077	
		(0.053)			(0.049)	
4-year non-selective		−0.502			0.127	
		(0.347)			(0.092)	
4-year somewhat-selective		−0.207			0.603	
		(0.238)			(0.480)	
4-year selective		−0.119			−0.123	
		(0.099)			(0.222)	
Full set of controls	X	X	X	X	X	X
University and time effects	X	X	X	X	X	X
County effect			X			X
R-squared	0.07	0.07	0.07	0.03	0.03	0.03
Colleges	1,015	1,015	1,015	802	802	802

Notes: Outcomes for first-time full-time undergrads. Controls include % female, % Asian, % Black, % Hispanic, % over 25, % Pell grant, % federal loans, student income, instruction, amount of federal loans and Pell grants, dormitory capacity, tuition value, student service, and institutional support expenditures per FTE student, business, financial, office and administrative staff, student-to-faculty ratio, county population and income. Standard errors clustered at the college level.

TABLE IV
Fixed Effect Estimates: Federal Aid Access

	Federal loan per capita (% of tuition) (1)	Federal loan per capita (2)	Pell grant per capita (% of tuition) (3)	Pell grant per capita (4)
$\widetilde{COL}\times$				
4-year for-profit	−0.655**	−0.016***	−0.421**	−0.015***
	(0.300)	(0.004)	(0.163)	(0.003)
2-year for-profit	−0.793*	−0.014***	−0.251	−0.011**
	(0.414)	(0.005)	(0.284)	(0.005)
2-year public & nonprofit	0.645	−0.0001	0.448	0.001
	(0.565)	(0.002)	(0.358)	(0.001)
4-year non-selective	0.086	0.003	0.015	0.002
	(0.052)	(0.002)	(0.032)	(0.002)
4-year somewhat-selective	0.023	0.003	−0.018	−0.001
	(0.044)	(0.002)	(0.019)	(0.001)
4-year selective	−0.004	−0.00001	−0.009	0.0004
	(0.013)	(0.001)	(0.009)	(0.001)
Full set of controls	*X*	*X*	*X*	*X*
University and time effects	*X*	*X*	*X*	*X*
R-squared	0.13	0.26	0.12	0.33
Colleges	1,062	986	987	986

Notes: Outcomes for first-time full-time undergrads. Controls include % female, % Asian, % Black, % Hispanic, % over 25, % Pell grant, % federal loans, student income, instruction, amount of federal loans and Pell grants, dormitory capacity, tuition value, student service, and institutional support expenditures per FTE student, business, financial, office and administrative staff, student-to-faculty ratio, county population and income. Standard errors clustered at the college level.

TABLE V
Fixed Effect Estimates: Student Selection

	ln enrollment (1)	ln Pell (2)	ln female (3)	ln Black (4)	ln Hispanic (5)	ln 25+ (6)	ln Federal (7)	Δ ln enrollment (8)
$\widetilde{COL} \times Int \times$								
4-year for-profit	0.004*	0.021***	0.028***	0.013	0.011	−0.004	0.020**	0.034***
	(0.003)	(0.007)	(0.010)	(0.022)	(0.008)	(0.008)	(0.009)	(0.012)
2-year for-profit	0.004	−0.005	0.004	0.003	0.010*	0.005	−0.009*	0.004
	(0.004)	(0.005)	(0.005)	(0.008)	(0.005)	(0.006)	(0.005)	(0.005)
2-year public & nonprofit	0.003*	0.004	0.004	0.015***	0.017***	0.005**	0.010*	0.002
	(0.002)	(0.004)	(0.003)	(0.005)	(0.005)	(0.003)	(0.005)	(0.003)
4-year non-selective	−0.030	0.0160	0.0160	−0.013	−0.009	−0.082	0.0047	0.012
	(0.021)	(0.028)	(0.031)	(0.035)	(0.078)	(0.058)	(0.027)	(0.030)
4-year somewhat-selective	0.037	0.012	−0.034	0.036	0.017	0.054	−0.001	−0.032
	(0.027)	(0.029)	(0.037)	(0.073)	(0.034)	(0.049)	(0.025)	(0.040)
4-year selective	−0.012**	−0.003	−0.013	−0.001	−0.052**	-0.017	−0.021	−0.014
	(0.005)	(0.014)	(0.009)	(0.019)	(0.020)	(0.013)	(0.014)	(0.010)
Full set of controls	X	X	X	X	X	X	X	X
University and time effects	X	X	X	X	X	X	X	X
R-squared	0.31	0.22	0.23	0.09	0.16	0.31	0.29	0.22
Colleges	962	962	959	942	931	950	962	962

Notes: Sample of consistent under-reporting colleges. Controls include % female, % Asian, % Black, % Hispanic, % over 25, % Pell grant, % federal loans, student income, instruction, amount of federal loans and Pell grants, dormitory capacity, tuition value, student service, and institutional support expenditures per FTE student, business, financial, office and administrative staff, student-to-faculty ratio, county population and income. Standard errors clustered at the college level. For years 2013 and 2016.

TABLE VI
Fixed Effect Estimates: Robustness

	Freshmen dropout rates					
	Under-reporting colleges			Over-reporting colleges		
	(1)	(2)	(3)	(4)	(5)	(6)
$\widetilde{COL}\times$						
4-year for-profit	0.284		0.274	0.031		0.036
	(0.103)***		(0.108)***	(0.048)		(0.050)
$\widetilde{COL} \times Int\times$						
4-year for-profit		0.448			0.088	
		(0.157)***			(0.050)*	
All selectivity interactions	X	X	X	X	X	X
Full set of controls	X	X	X	X	X	X
University and time effects	X	X	X	X	X	X
Commuting zone effect			X			X
R-squared	0.08	0.10	0.08	0.03	0.03	0.03
Colleges	932	840	886	782	734	732

Notes: Outcomes for first-time full-time undergrads. Controls include % female, % Asian, % Black, % Hispanic, % over 25, % Pell grant, % federal loans, student income, instruction, amount of federal loans and Pell grants, dormitory capacity, tuition value, student service, and institutional support expenditures per FTE student, business, financial, office and administrative staff, student-to-faculty ratio, commuting zone population and income. Standard errors clustered at the college level.

TABLE VII
Fixed Effect Estimates: Additional Tests

	Freshmen dropout rates (under-reporting)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\widetilde{COL}\times$							
4-year for-profit	0.331	0.023	0.311	0.195**	0.197**	0.528**	
	(0.153)**	(0.119)	(0.141)**	(0.081)	(0.091)	(0.254)	
2-year for-profit	0.248	−0.076	0.064	0.060	0.046	0.226	
	(0.099)**	(0.079)	(0.053)	(0.074)	(0.073)	(0.296)	
2-year public & nonprofit	0.004	−0.010	0.011	0.015	0.014	0.390	
	(0.052)	(0.027)	(0.037)	(0.027)	(0.026)	(0.411)	
4-year non-selective	−0.489	0.014	−0.204	−0.028	−0.030	-0.269	
	(0.341)	(0.049)	(0.302)	(0.020)	(0.020)	(0.400)	
4-year somewhat-selective	−0.220	−0.009	−1.408	0.001	−0.0004	-0.361	
	(0.235)	(0.013)	(1.068)	(0.012)	(0.012)	(0.383)	
4-year selective	−0.091	−0.002	−0.097	−0.005	−0.007	-0.200	
	(0.101)	(0.008)	(0.129)	(0.008)	(0.008)	(0.144)	
$\widetilde{COL} \times \ln \widehat{COL}\times$							
4-year for-profit							0.035
							(0.016)**
Full set of controls	*X*	*X*	*X*	*X*	*X*	*X*	*X*
All selectivity interactions							*X*
University and time effects	*X*	*X*	*X*	*X*	*X*	*X*	*X*
R-squared	0.08	0.05	0.07	0.06	0.06	0.11	0.08
Colleges	975	1,184	1,184	942	899	487	978

Notes: (1) only undergraduate household estimated rents. (2) $\widetilde{COL}$ interacted with the share of financially constrained students not living off-campus without parents. (3) intensity using all off-campus students living without parents of those receiving any aid. (4) Sample of under-reporting universities without top and bottom 5%. (5) Sample of under-reporting universities without top and bottom 10%. (6) $\widetilde{COL} \times Int$ interacted with acceptance ratio (selectivity level). (7) Reported COL levels interacted with selectivity groups. Outcomes for first-time full-time undergrads. Controls include % female, % Asian, % Black, % Hispanic, % over 25, % Pell grant, % federal loans, student income, instruction, amount of federal loans and Pell grants, dormitory capacity, tuition value, student service, and institutional support expenditures per FTE student, business, financial, office and administrative staff, student-to-faculty ratio, county population and income. Standard errors clustered at the college level.

TABLE VIII
Housing Costs and Dropout Rates

	Freshmen dropout rate		
	All institutions	Under-reporting institutions	Over-reporting institutions
Δ ln Rent×4-year for-profit	0.765**	0.945**	1.310
	(0.370)	(0.443)	(0.903)
Δ ln Rent×2-year for-profit	−0.257*	−0.443	−0.067
	(0.148)	(0.305)	(0.208)
Δ ln Rent×2-year public & nonprofit	0.041	−0.018	0.121*
	(0.037)	(0.056)	(0.067)
Δ ln Rent×4-year non-selective	−0.046	0.119	−0.056
	(0.060)	(0.167)	(0.069)
Δ ln Rent×4-year somewhat selective	0.008	0.080	0.031
	(0.048)	(0.060)	(0.058)
Δ ln Rent×4-year selective	−0.015	−0.132*	0.047
	(0.034)	(0.076)	(0.043)
Full set of controls	X	X	X
University and time effects	X	X	X
R-squared	0.77	0.76	0.77
Colleges	2,265	1,107	1,158

Notes: Controls include % female, % Asian, % Black, % Hispanic, % over 25, % Pell grant, % federal loans, student income, average amount of Pell grant and federal loans, instruction, student service, and institutional support expenditures per FTE student, business, financial, office and administrative staff, student-to-faculty ratio, tuition value, county population and income. Cohort years 2013 and 2016.

TABLE IX
Housing Costs and Student Labor Supply

	log hours worked			log weeks worked		
Δ log rents	(2016)	(2013)	(2016)	(2016)	(2013)	(2016)
2012-2015	0.154			0.121		
	(0.06)**			(0.029)***		
2009-2012		0.105			0.004	
		(0.072)*			(0.031)	
2009-2015			0.172			0.071
			(0.045)***			(0.020)***
Full set of controls						
Student	*X*	*X*	*X*	*X*	*X*	*X*
Institution	*X*	*X*	*X*	*X*	*X*	*X*
County	*X*	*X*	*X*	*X*	*X*	*X*
R-squared	0.49	0.53	0.50	0.49	0.42	0.49
Counties	993	898	993	993	898	993

Notes: Controls include % female, % Asian, % Black, % Hispanic, % over 25, % Pell grant, % federal loans, student income, instruction, student service, and institutional support expenditures per FTE student, business, financial, office and administrative staff, student-to-faculty ratio, county population and income.

TABLE X
Fixed Effect Estimates: Explaining Reported COL Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
4-year for-profit	−2.738**	−8.360*	−0.489	−11.10*	21.42***	13.41***	115.7***
	(1.407)	(4.659)	(3.303)	(6.578)	(8.166)	(5.075)	(24.77)
2-year for-profit	3.533	−0.265	−3.316	−6.987***	10.37*	−6.578	70.44***
	(2.556)	(2.825)	(2.121)	(2.498)	(5.725)	(12.52)	(16.33)
2-year public & nonprofit	−1.931	−1.303	9.204	4.528	11.93**	−4.099	75.43***
	(1.248)	(1.127)	(8.165)	(9.573)	(6.018)	(5.721)	(7.259)
4-year non-selective	4.553	3.115	−22.96	−11.98	−0.871	0.279	−2.883
	(3.486)	(2.417)	(15.07)	(7.594)	(6.633)	(4.615)	(34.64)
4-year somewhat-selective	2.748	3.304	−14.35	4.158	15.95**	−4.328	28.68
	(3.471)	(2.032)	(18.77)	(13.33)	(7.460)	(11.13)	(37.55)
4-year selective	1.542	1.135	−15.59	−7.742	−5.138	−1.854	−12.49
	(1.439)	(1.214)	(10.45)	(6.666)	(3.502)	(2.789)	(19.73)
Full set of controls	*X*	*X*	*X*	*X*	*X*	*X*	*X*
University and time effects	*X*	*X*	*X*	*X*	*X*	*X*	*X*
R-squared	0.05	0.06	0.04	0.07	0.14	0.07	0.10
Colleges	891	2,513	980	2,798	498	1,585	994

Notes: (1) regresses $\widetilde{COL}$ for under-reporting colleges on the lagged student-to-business-personnel ratio. (2) regresses absolute values of $\widetilde{COL}$ on the the lagged student-to-business-personnel ratio. (3) regresses $\widetilde{COL}$ for under-reporting colleges on lagged institutional support expenses per student. (4) regresses absolute values of $\widetilde{COL}$ on lagged institutional support expenses per student. (5) regresses $\widetilde{COL}$ for under-reporting colleges on the lagged acceptance ratio. (6) regresses absolute values of $\widetilde{COL}$ on the the lagged acceptance ratio. (7) regresses $\widetilde{COL}$ for under-reporting colleges on the county-wide COL estimate $\widetilde{COL}$. Controls include % female, % Asian, % Black, % Hispanic, % over 25, % Pell grant, % federal loans, student income, instruction, amount of federal loans and Pell grants, dormitory capacity, tuition value, student service, and institutional support expenditures per FTE student, business, financial, office and administrative staff, student-to-faculty ratio, county population and income. Standard errors clustered at the college level.

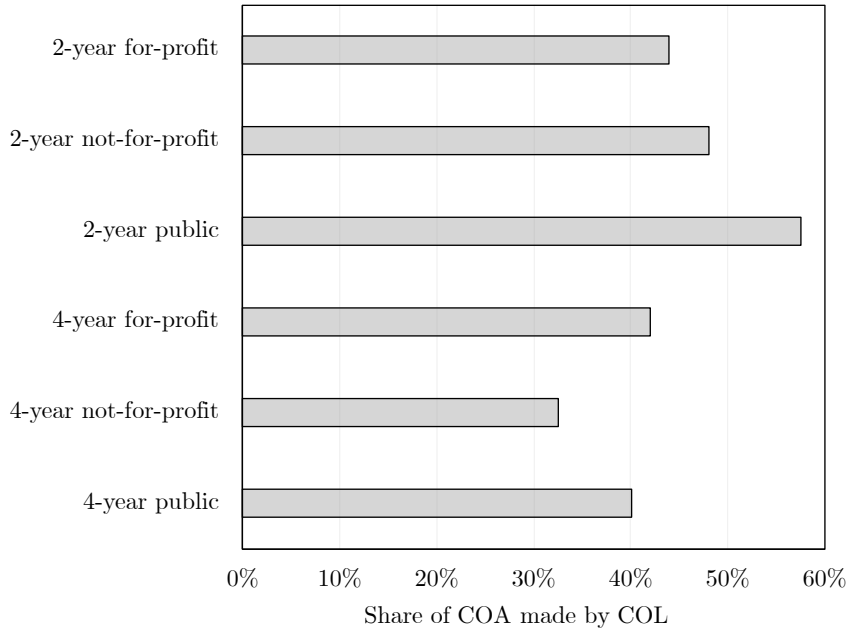
TABLE XI
DIFFERENCE-IN-DIFFERENCES ESTIMATES:
GREATER TRANSPARENCY ON REPORTED COL ACCURACY

	$\lvert\widetilde{COL}_{ict}\rvert$ (1)	$\lvert\widetilde{COL}_{ict}\rvert$ (2)	$\lvert\widetilde{COL}_{ict}\rvert$ (3)
$Int_{ic}^{2006} \times \mathbb{1}_{t\geq 2010}$	−0.049***		
	(0.019)		
For-profit			
$Int_{ic}^{2006} \times \mathbb{1}_{t\geq 2010}$		−0.048	
		(0.046)	
4-year selective			
$Int_{ic}^{2006} \times \mathbb{1}_{t\geq 2010}$			−0.116**
			(0.057)
Full set of controls	X	X	X
University and time effects	X	X	X
R-squared	0.10	0.10	0.12
Observations	2,234	476	533

TABLE XII
FIXED EFFECT ESTIMATES: KEEPING UP WITH HOUSING COSTS

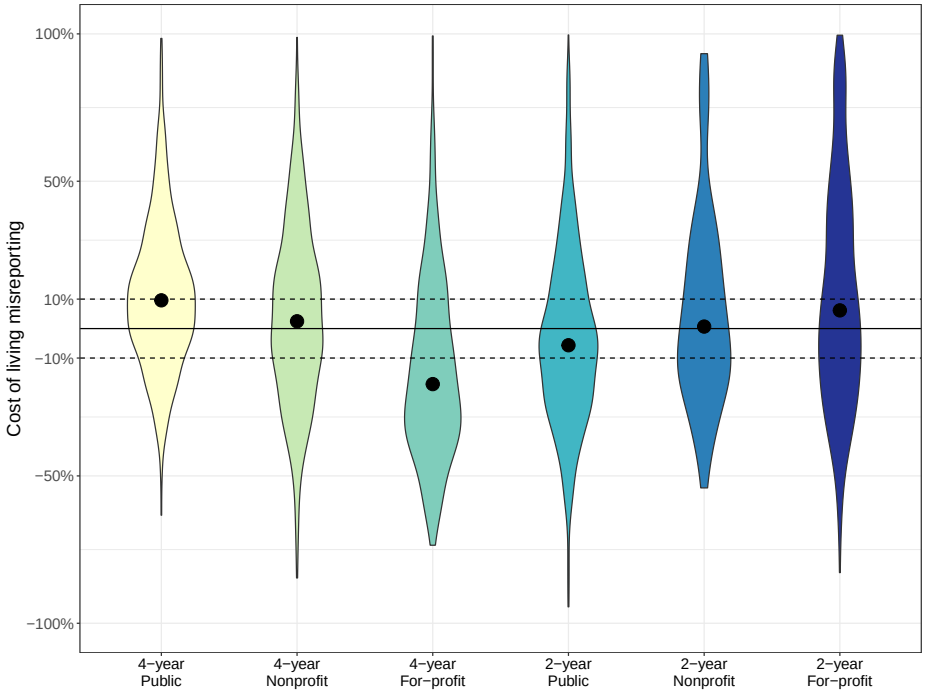
	Cost-of-living reported below county-level student estimate							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln Rent×								
4-year for-profit	1.091***	1.191***						
	(0.241)	(0.285)						
Others	0.091	0.083						
	(0.104)	(0.135)						
Δ ln Rent×								
4-year for-profit			0.386*	0.516**				
			(0.205)	(0.261)				
Others			0.109	0.165**				
			(0.070)	(0.080)				
ln Rent × *Int* ×								
4-year for-profit					0.015*	0.017**		
					(0.008)	(0.008)		
Others					−0.008*	−0.012**		
					(0.005)	(0.006)		
Δ ln Rent × *Int* ×								
4-year for-profit							0.495*	0.705**
							(0.276)	(0.341)
Others							−0.042	0.021
							(0.159)	(0.188)
Full set of controls		*X*		*X*		*X*		*X*
Only intensity	*X*		*X*		*X*		*X*	
University and time effects	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*
R-squared	0.02	0.04	0.01	0.03	0.01	0.04	0.01	0.02
Colleges	1,172	1,084	1,169	1,065	1,172	1,084	1,169	1,065

Notes: Outcomes for first-time full-time undergrads. Controls include % female, % Asian, % Black, % Hispanic, % over 25, % Pell grant, % federal loans, student income, instruction, amount of federal loans and Pell grants, dormitory capacity, tuition value, student service, and institutional support expenditures per FTE student, business, financial, office and administrative staff, student-to-faculty ratio, county population and income. Standard errors clustered at the college level.



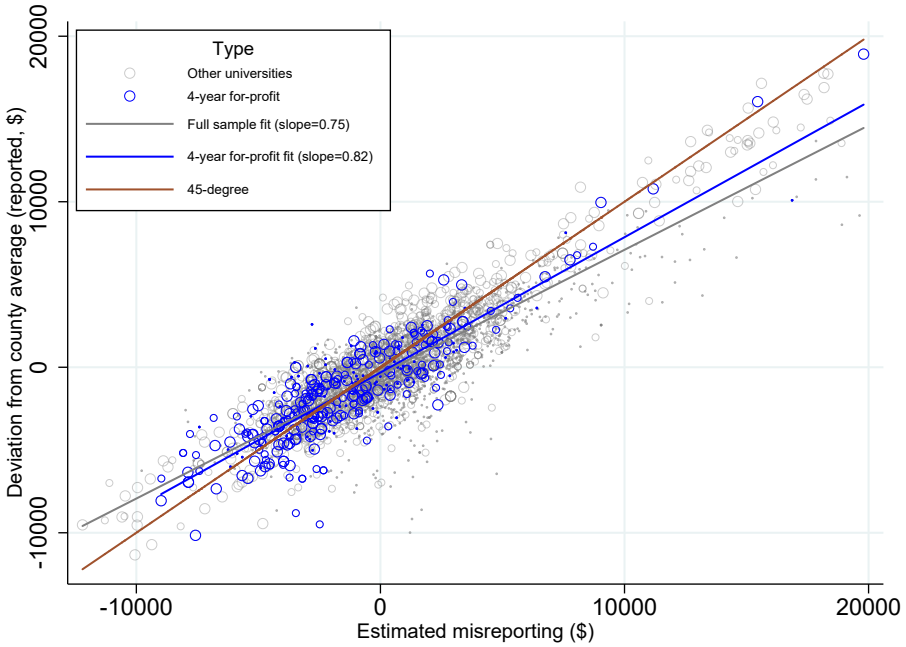
Notes: The figure shows the share of cost of attendance (COA) comprised by cost of living (COL) reported by Title IV universities. The components of the COA are: tuition and fees, book and supplies, room and board (denoted by COL), and other expenses, which include transportation, personal care, entertainment, and miscellaneous expenses. Tuition and fees for public universities refer to out-of-state values. Data for the 2015-2016 academic year from IPEDS.

FIGURE I
Importance of Cost-of-Living on Cost of Attendance, Sector-Type



Notes: Distribution of reported COL deviations from the county benchmark, $\widetilde{COL}$ by university sector-type.

FIGURE II
Distribution of COL Misreporting, Sector-Type



Notes: This figure compares estimated deviations of the county benchmark for each university ($COL_{ic} - \widehat{COL_c}$) to actual deviations based on reported allowances and a county-average benchmark calculated with all universities' reported living expenses.

FIGURE III
ASSESSING THE ACCURACY OF THE STUDENT COL MEASURE

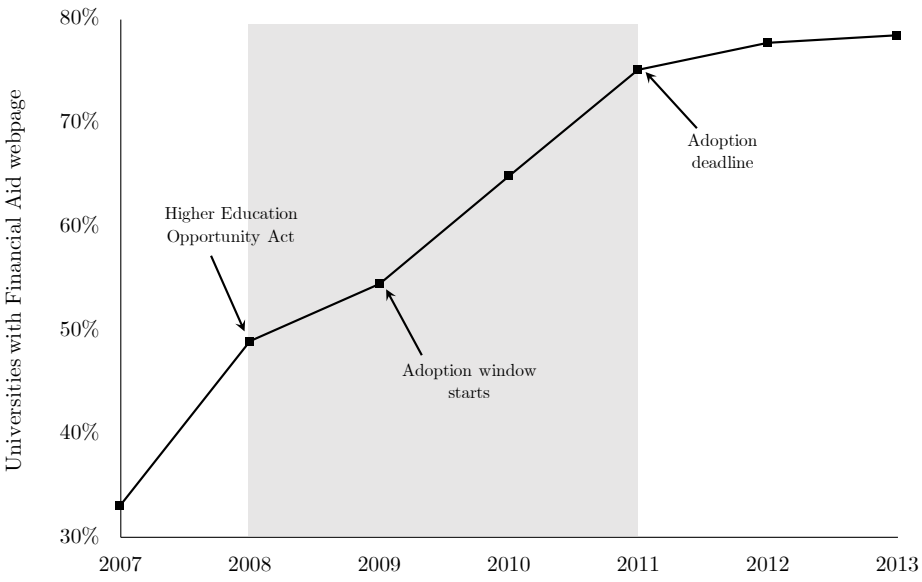


FIGURE IV
Colleges With a Financial Webpage

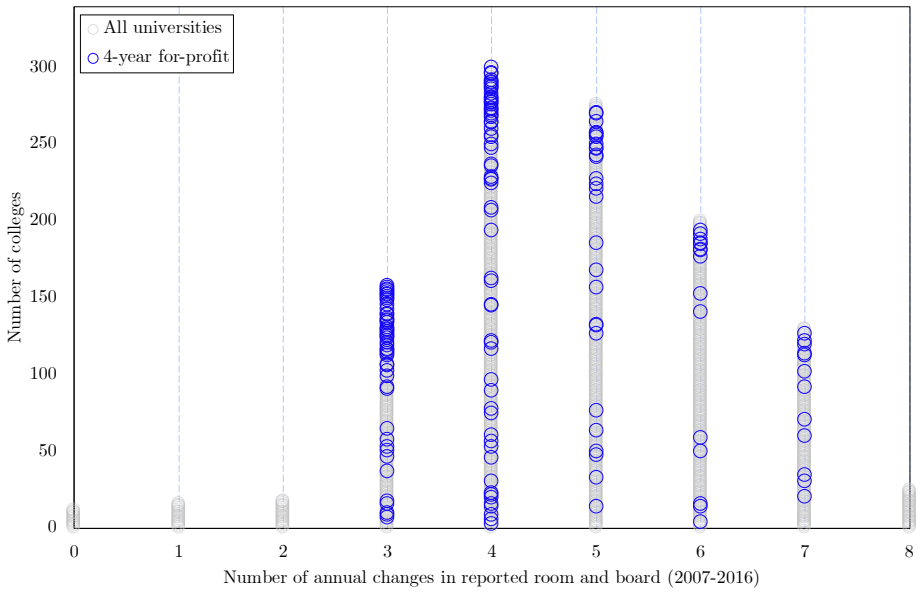


FIGURE V
FREQUENCY OF COL UPDATES: UNDER-REPORTING COLLEGES

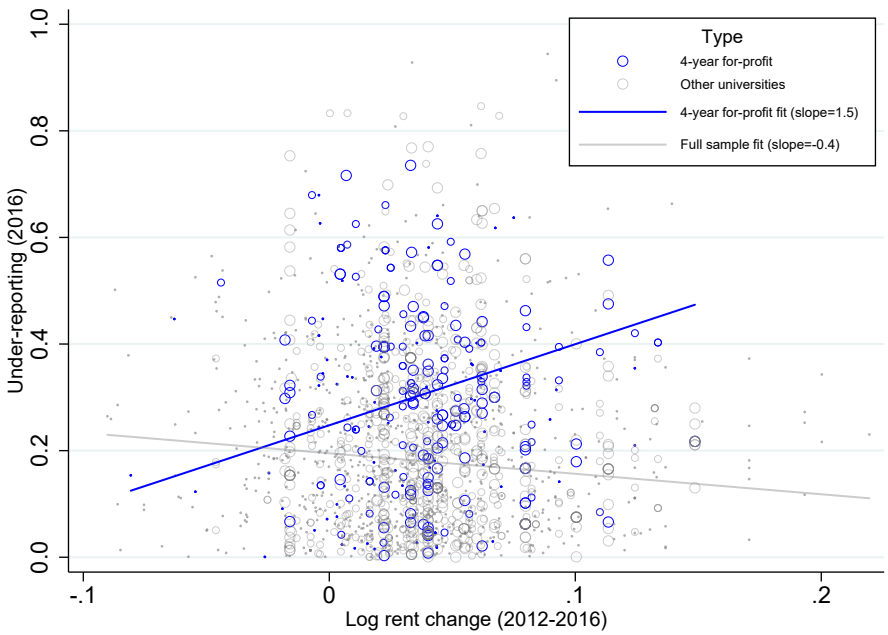


FIGURE VI
Reacting to Rising Housing Costs

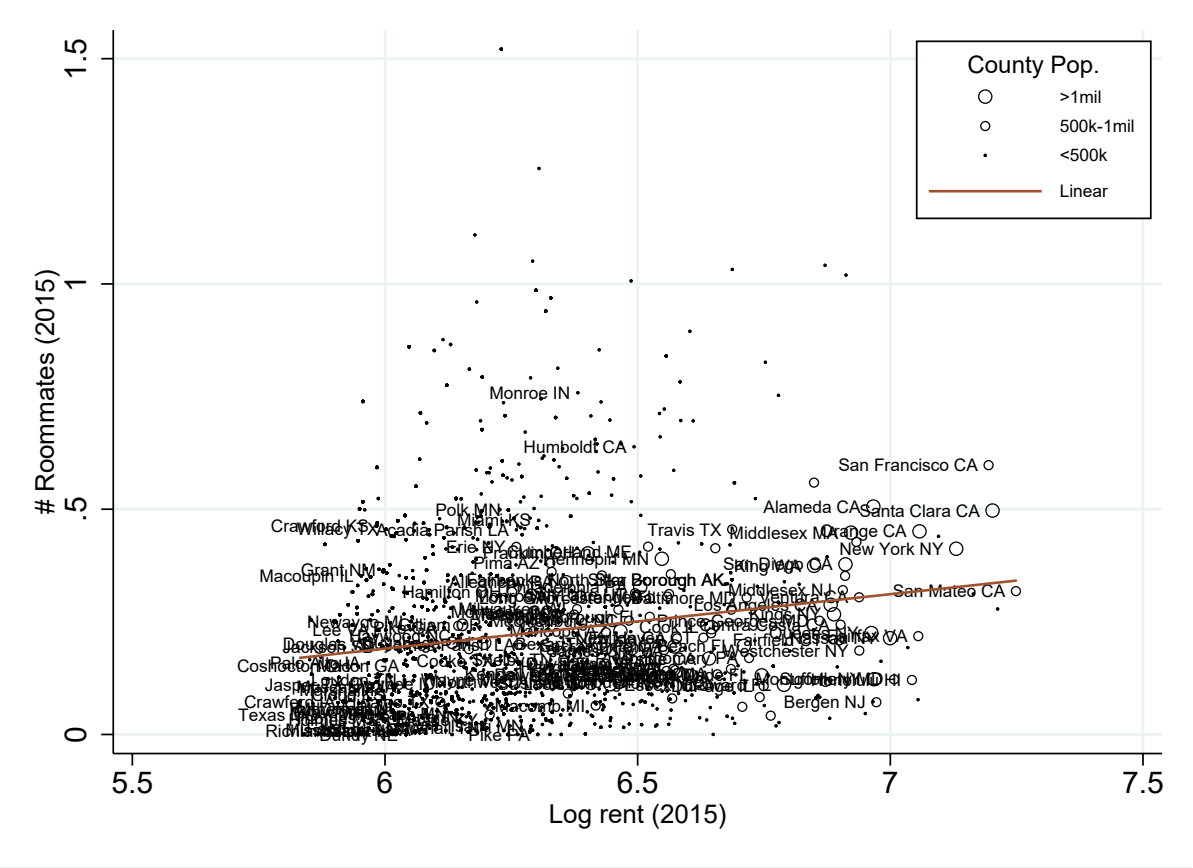


FIGURE A.1
Housing Costs and Number of Roommates

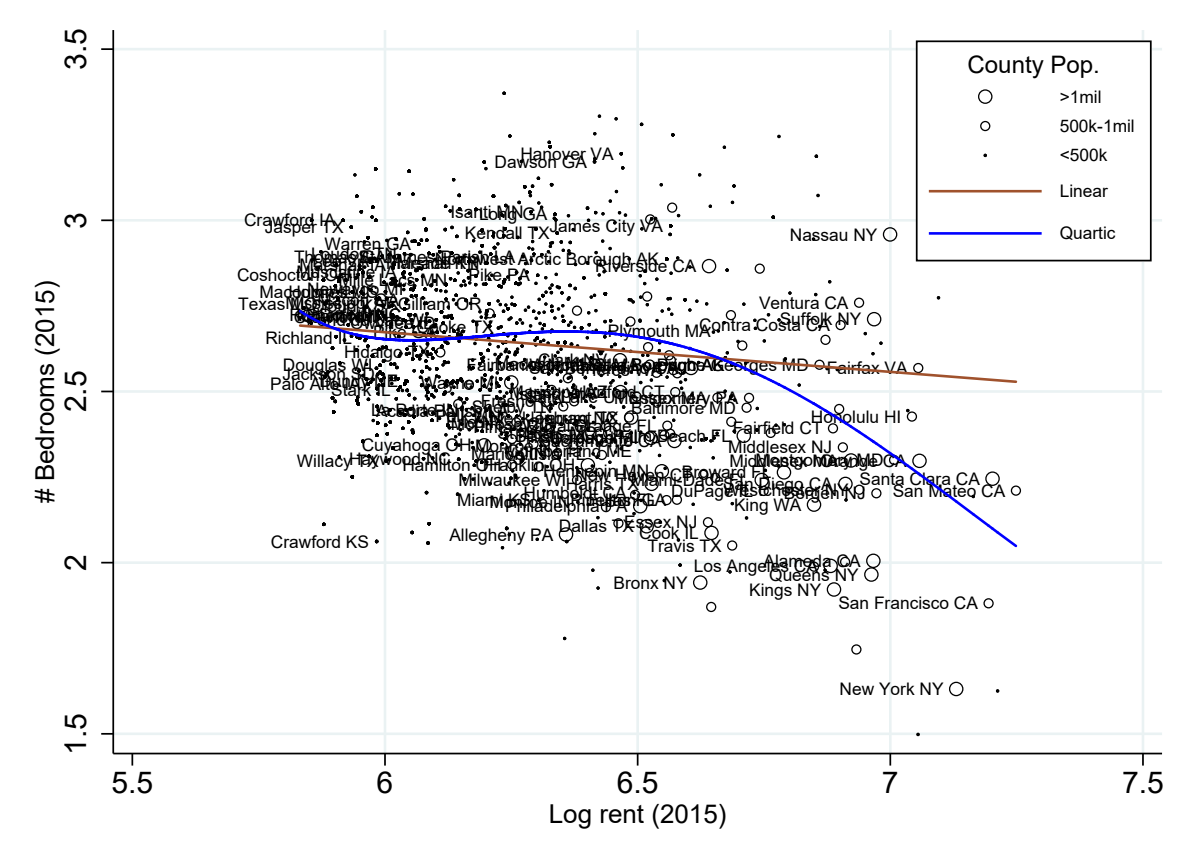


FIGURE A.2
Housing Costs and Number of Bedrooms

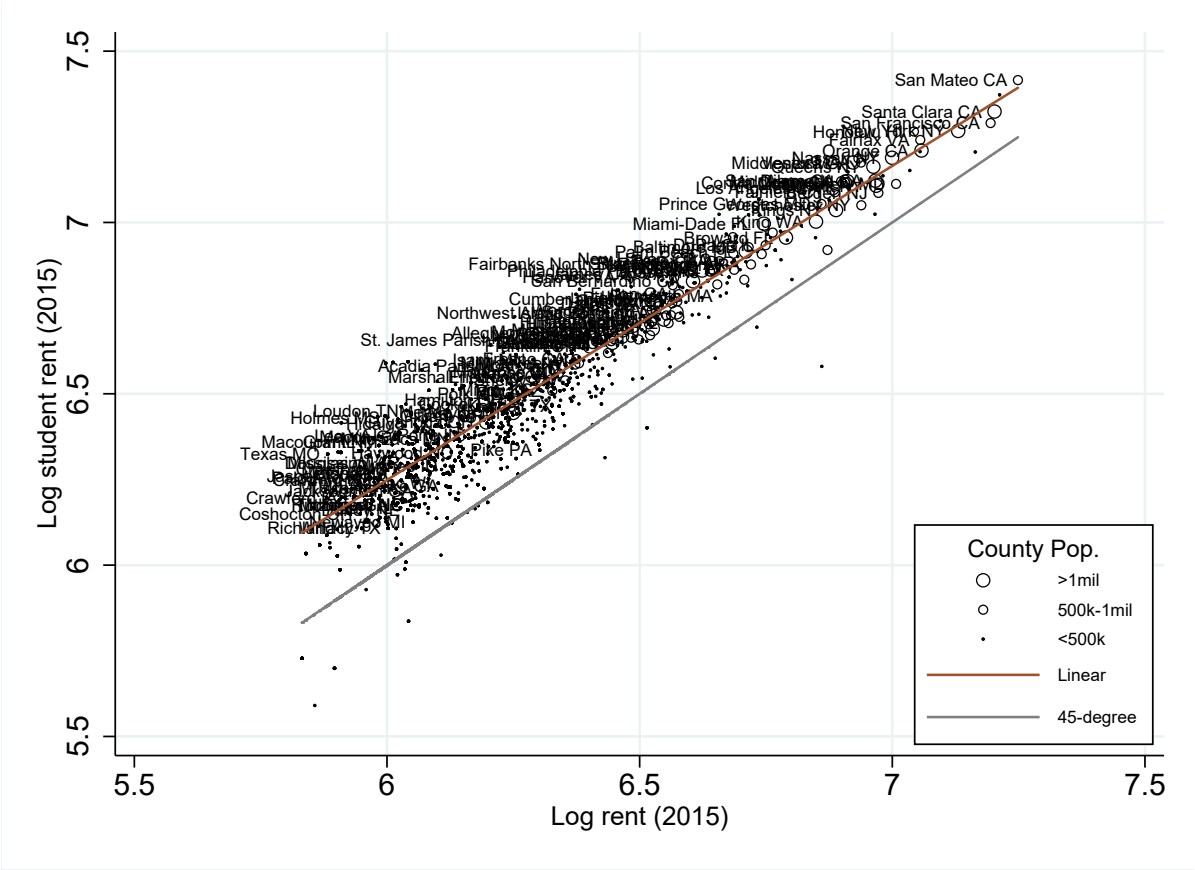


FIGURE A.3
STUDENT RENTAL PREMIUM