Monopoly Rent:
Measuring the Effects of Residency Requirements on University Profits

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Abstract: To qualify for an undergraduate degree from a university with an on-campus residency requirement, incoming students must pay a sticker price for university housing. Residency requirements are mechanisms for monopolies but are also justifiable by research that shows that students who live on campus have better educational outcomes. Economists have not researched residency requirements and specifically whether they result in monopolistic price-making by universities. We construct a novel dataset with the on-campus housing rents set by 319 universities for three product types and the off-camups rents for three substitute product types within a 1-mile radius of each university. The rent that universities would be able to achieve in the free market is derived by constructing a hedonic pricing model and fitting on assumptions for square footage and amenities on-campus. We then find the profit universities would receive from charging this rent by including the income and expense items from the free market relevant to universities. The average university with a residency requirement will use its monopoly power to set a higher price than schools that do not adopt this requirement. The monopoly rent charged by universities for doubles is $192/month over studios of the same size. We also find that the average student not subject to a residency requirement would move into a shared single-family home from their shared on-campus suite if they are willing to accept a payment of $453/month. A case study for University of Rochester and University of Wisonsin - Madison is prepared to show that universities rely on monopoly rents to keept their endowments and budgets healthy.

Part I: Introduction

A residency requirement is when a school requires living in on-campus housing for a certain number of years. The basis for this requirement is the research showing the positive impact of living on campus on academic outcomes (de Araujo & Murray, 2010). Schools with residency requirements intend to capture this effect for every student, not just those who choose to live on-campus.

When schools have a residency requirement in play, they remove the freedom of choice for their students over where they live. Their students cannot compare the price of housing offered by the university to off-campus substitutes. As we see in the study, there are over 8,000 substitutes in proximity to the average university. Students of lower-income families who go to a university with a residency requirement may have been willing to sacrifice the benefits of living on-campus and save money by living off-campus. Residency requirements have a real effect on where students live.

A basic way to frame the research question would be a hypothetical situation where two schools are right next to each other, and one has a residency requirement while the other does not. Are they going to charge the same amount to live on-campus for the same room? If the school with the residency requirement charges more, the requirement is a mechanism used to achieve monopoly rent.

Financial aid packages do not always cover housing. Students must pay a portion out-of-pocket to experience on-campus living in most cases. Because financial aid is limited for

housing, residency requirements can be inequitable. They can also be unethical because they exploit a basic need, shelter, by using a student's desire for education as leverage.

There are two components to the research portion of this paper. The first is from the student's point of view: rent. The second is from the university's point of view: profit. Take the example of the lower-income student with the option to live on-campus or off-campus. They will compare prices on-campus versus off-campus and have a maximum willingness to pay for on-campus benefits that will drive their decision. Determining the free-market rent for university housing, given the smaller size of university dorms and the amenities they offer, is done in Part 4 of the study. The second component estimates actual profits made by universities to profits made if they charged the free-market rent found in Part 4. We find the required willingness to pay to live on campus in the process.

Residency requirements are, in effect, a temporary monopoly that universities create. In the age of schools charging record-high tuition, I believe there may be a profit-seeking motivation for instituting and maintaining a residency requirement. The same is true for meal plan requirements, but that is not the focus of this paper. This paper does not seek to diminish any benefits of on-campus living or having a residency requirement. After all, a firm can have a monopoly and not behave monopolistically.

Studentification

In many college towns and college neighborhoods, students living off-campus cause the same economic effect as gentrification. Studentification was coined by Smith (2002) and defined as "contradictory social, cultural, economic and physical changes resulting from an influx of students within privately-rented accommodation in particular neighbourhoods." An alternative definition by Garmendia, Coronado, & Urena (2011) is "a concentration of students in some defined neighbourhoods of a city, displacing the indigenous residents and creating what the press calls 'student ghettos'." A few papers attribute studentification to the increasing commodification of the student housing experience. (Kinton, Smith, & Harrison, 2016; Mulhearn and Franco, 2018.) Many markets already have completely commodified student housing, and as admitted classes grow year over year, more schools are likely to follow suit.

Studentification occurs in rental markets and single-family home (SFH) markets near universities. Signs of rental market studentification are above-average quality apartments with rents and amenities that are not typical of that market. This asset class is known as purpose-built student accommodation (PBSA), and it is rapidly growing within real estate. The second form of studentification is the conversion of single-family homes (SFHs) into multiple-occupancy homes (known as HMOs in the UK). These homes are rented out to students where each student has their own room but shares common facilities (kitchen, bathroom, garden, etc.).

Studentification is happening around the globe and is well-researched. Duke-Williams (2009) looked into the age profiles of in-migrants and out-migrants of wards in the UK with high densities of students and confirmed that many wards in the UK are mostly full of students who only come there to live for a few years and then leave. The UK has very high rates of

studentification through PBSA. The value of the UK PBSA sector is €60B, and universities solely own and operate just under 41% of total student housing beds in the UK. Also, university-owned stock in the UK has grown 4% since 2013/2014, while the private stock of student housing has grown by 119% (Cushman & Wakefield, 2020).

Not all studentification looks the same, and not all students contribute to studentification. "Studentification in China is better interpreted as the spatial result of students' conscious residential, entrepreneurial and consumption choices to escape from the rigid control of university dorms, to accumulate cultural and economic capital, as well as to actualise their cultural identity" (He, 2015). In a Lisbon study, Malet Calvo (2018) has found that international students deviate from traditional studentification concentration and segregation patterns because they want to explore the entire city they live in. In Spain, cities are compact, so there are more high-rises than HMOs, and students go to universities close to their homes, making what Malet Calvo calls "part-time studentification." Garmendia, Coronado, & Urena (2011) presented an argument for "vertical studentification" in Spanish high rises because the studentification is "less perceptible in the streets or in the neighbourhoods and more perceptible in the common spaces of the building, such as staircases, lifts and halls."

The principal reason students leave on-campus housing is to get the freedom to choose where and with who they live and share their common space with, if they want to live with anyone. Off-campus living also allows students not to have to abide by school policies regarding pets, fire, noise, drugs, and room checks. Another common inconvenience for students is moving. They cannot stay in their rooms year after year, and sometimes they cannot stay in the same room over summer or even winter break (University of Central Florida, for example).

Living off-campus will likely require paying an application fee and a security deposit, and leases may not be able to be prorated to the academic year. Getting to classes and the school gym or pool will typically take longer, and campus security may also take longer to respond. Sirmans & Benjamin (1991) calculated that the average distance to campus from residence halls is 0.83 miles, compared to 1.4 miles for off-campus housing.

Despite these drawbacks, large real estate firms recognize that students who are not mandated to live on-campus ultimately want off-campus housing accommodations. Student housing is a favorable sector in real estate because "bad debt is typically less than 1% and students are accepting of annual price increases" (Hubbard, 2009). It has also outperformed other product types (such as traditional multifamily) (Bergerson, 2021). For these reasons, if a city or county General Plan zones the area near a university favorably for multifamily designations, and the university either has low residency requirements or an inability to accommodate most students, it will likely attract development. This month, large student housing owner, developer, and management company American Campus Communities, which owns student housing near 71 universities, sold for $12.8B.

COVID-19 and the Rental Market

This section discusses the context of current rental market rates and specifically how the rental market is impacted by COVID-19. COVID-19 impacted the distribution of people worldwide. Key demand drivers in rental markets are proximity to retail, employment, entertainment, and dining. These demand drivers no longer attracted tenants following COVID-19 due to restrictions on both governmental and private levels. When the need to live in a central business district disappears, tenants wait for their lease to expire and move somewhere else, causing landlords and property management companies to lower their rents to attract the smaller pool of prospective tenants. Government restrictions limited retail, entertainment, and dining activity. Most companies shifted to a hybrid or completely work-from-home model, eliminating the need to live near employment hubs with higher rents.

Real estate property values and rents follow a four-stage cycle: recovery, expansion, hyper supply, and recession. Housing options near universities are slightly more immune to this cycle because education is more recession-proof. Kim, Lee, & Tran (2014) found that, through the 2008 recession, housing prices in cities with either a California State University or a University of California campus "suffered a lower housing price decrease than the rest of the state." I would consider the American rental housing market as of Spring 2022 to be in a recovery period. As of April 24th, 2022, it is 75% more expensive to buy a home than four months ago (30Y mortgage). In Silicon Valley, companies are investing billions of dollars into new office campuses, signaling that they expect to shift away from the work-from-home model soon if they have not already. This month Google announced a $3.5B investment into Downtown San Jose for their South Bay campus. Facebook's parent company Meta signed the biggest U.S. office lease of 2021, taking 719,037 square feet of space in Sunnyvale and separately leased 520,000 square feet in Burlingame.

Part 2: Literature Review

Real Estate Pricing Models

In real estate pricing models, rent or home price is the dependent variable. Some researchers are interested in one independent variable: "Floor-level premiums in private housing: the case of condominiums in Singapore" (Khiew & Lee, 2019). Others are interested in multiple independent variables: "What Drives the Premium for Energy-Efficient Apartments – Green Awareness or Purchasing Power?" (Pommeranz & Steininger, 2021). Hedonic real estate pricing models will have a host of control variables to strengthen the price effect of the independent variables the researcher targets, such as different amenities, services, or external factors.

An important group of independent variables found in pricing models is amenities. Amenity research is an interesting topic because it allows tenants to break down their monthly rent bills into line items like receipts. Sirmans et al. (1989) describe the coefficient on an amenity as the value of that amenity at the margin. They recommend using these coefficients to calculate whether providing a certain amenity is worthwhile by determining the market premium for a given amenity, finding the present value of that amenity over its useful life, and comparing it to

the fixed costs, variable costs, and economic depreciation of that amenity over the amenity's useful life. Amenity research can also be useful for developers and appraisers.

Items that have been shown to have a positive effect on apartment rents are: apartment complex size (Sirmans et al., 1990), concessions (Sirmans et al., 1990), covered parking (Sirmans et al., 1989; Sirmans et al., 1990), fireplaces (Guntermann & Norrbin, 1987; Sirmans et al., 1990), fitness centers (Guntermann & Norrbin, 1987; Frew et al., 1990), furnishings (Marks, 1984), hardwood floors (Frew et al., 1990), incomes in the area (Ogur, 1973; Frew et al., 1990), median cost of homes in the area (Gilderbloom & Appelbaum, 1987), modern kitchens (Sirmans et al., 1990), pet-friendliness (Sirmans et al., 1990), pools (Guntermann & Norrbin, 1987; Frew et al., 1990), saunas (Sirmans et al., 1989; Sirmans et al., 1990), security on-staff (Sirmans et al., 1990), share of the population in college (Ogur, 1973), square footage (Guntermann & Norrbin, 1987; Sirmans et al., 1990), and utilities coming included (Malpezzi et al., 1987; Sirmans et al., 1989; Frew et al., 1990; Sirmans et al., 1990).

Items that have been shown to have a negative effect on apartment rents are: age (Marks, 1984; Sirmans et al., 1990), distance from a bus stop (Sirmans et al., 1989; Sirmans et al., 1990), distance from a central business district (Sirmans et al., 1990), number of bus lines (Sirmans et al., 1989; Sirmans et al., 1990), and traffic congestion (Sirmans et al., 1989; Sirmans et al., 1990).

These results can hold true across time, and many of these relationships are applicable to SFHs. In a meta-analysis of 125 studies and their SFH characteristics, Sirmans, MacDonald, & Macpherson (2006) found that age commonly had a negative coefficient, and square footage had a positive coefficient. They also controlled for time and found that the value of characteristics of house prices has not changed over time. Although this study was conducted on SFHs, knowing that real estate characteristics do not change in value gives me confidence in the signs of the coefficients in the older studies above.

Many papers also show that vacancy significantly affects rent, but the effect depends on product type (Rosen & Smith, 1982; Shilling et al., 1987; Des Rosiers & The´riault, 1995). Smith & Kroll (1989) found that older, higher-income groups will pay more for jacuzzis, covered parking, and covered patios, as opposed to other groups such as full-time college students. They also found that tenant age and income yield different price elasticities for rent.

Impacts of Universities on Real Estate Markets

Kenyon (1997) found that local residents who have to live out their everyday lives in areas where students settle perceive student in-migration as having a "negative impact on their social and physical neighborhoods." Despite these perceptions of universities creating a negative externality, many economists have shown that universities create positive externalities to cities and real estate markets. The proximity of houses to universities is associated with an increase in property values, but this effect decays rapidly the farther away they are (Wadell et al., 1993; Kashian & Rockwell, 2013). This effect is also seen in the rental market. Park (2009) found that the value of an apartment increases by 24% for each mile that the property is closer to a

university campus, all else equal. Des Rosiers and The´riault (1995) found that rents increase by 16% for the first 500-meter distance from a university, and then it drops to 3% and 1.7% for the second and third 500-meters.

Research shows what happens to the housing market when a school opens and when a city or county decides to change the zoning around a school. When the small college town of Whitewater, WI approved a neighborhood rezoning near the University of Wisconsin-Whitewater to allow for more than three unrelated individuals to reside in a single household, home values increased by 12%, and in 2019 were valued at 19% more. (Kashian et al., 2020.) When the University of California at Merced opened, local employment increased by 13%, mostly in nontraded industries (Lee, 2019).

University students do not have as many cars as graduates. Their lower mobility rates are one of the reasons they choose to stay closer to campus. This phenomenon lowers students' price elasticities of demand for housing. As mentioned earlier, student housing is a desirable industry because students are less receptive to changes in rent. This is likely not because they are so rich that price changes do not affect them, but due to necessity from their lack of mobility. Des Rosiers and The´riault (1995) suggest that landlords may use this to their advantage when deciding the rents "in as much as the legal constraints allow it." They also say that landlords could drive up rents to make up for high summertime vacancies.

Part 3: Description of the Data

Amenities in Apartments and SFHs

Costar is a real estate information database that sources its intelligence through its other companies, Apartments.com and Loopnet. Property managers and SFH owners use Apartments.com to list their properties in detail to attract prospective tenants. Loopnet is for posting sales and leases in commercial sectors, such as industrial, land, multifamily (complexes, not units), office, and retail.

Costar does not have the amenities from Apartments.com easily accessible. I manually drew the same radius on Apartments.com as Costar to make sure that the same market is being addressed. Apartments.com shows the total number of units on the market in a radius, and the amount of units in that radius that have a specific amenity. This allowed me to find the ratio of units on the market with a specific amenity. These ratios were then multiplied by 100 to give them a value between 0 to 100 to ease regression interpretation.

The amenity ratio for listed apartments and SFHs was assumed to be the same as the real ratio of amenities offered in that radius. Costar provides information for both listed and occupied apartments in this same radius for all items except the operating income and expenses, which are provided on a per-market basis.

The radius size used was one mile by default, but some intuition went into setting the radius. If the radius included both sides of a large freeway that separated an area into two, then only the university side of the freeway was used. This was not replicated for rivers (which have

bridges), but it was replicated for large bodies of water and parks. Many universities are right next to a large park, so a 1.5-2 mile radius was drawn to account for housing spillover.

The amenities of interest include the ability to have pets, washers and dryers in-unit, paid-for utilities, a pool, furnishings, and a fitness center. Apartments.com breaks down pet-friendly to cat-friendly and dog-friendly. I found that there is variation between the two, with cats being generally more allowed than dogs. The highest number of the two was used in this paper, so the definition of pet-friendly is "accepting of some kind of pet."

Laundry facilities are an amenity that could have been included. Laundry facilities are paid for by residents, while in-unit washer and dryers are not paid for. Laundry facilities were not included in this study because in-unit washer and dryers are closer substitutes for laundry facilities included in on-campus rent. Laundry income is an expense exclusive to off-campus apartments, so it is counted as an income item for apartments off-campus and not for SFHs. It is also true that in-unit washer and dryers are paid for by residents through utility billbacks. This is accounted for in two ways. First, one of the amenities of interest was whether utilities are included. Second, the average income that comes from utility billbacks in a certain market is counted in the line item Other Income in Costar's profit and loss statement for that market.

There were other amenities available on Apartments.com to chose from. The chosen amenities represent offerings (or lack thereof) by a vast majority of universities. It cannot be said with certainty that most universities offer other offerings, such as air conditioning. Universities don't allow pets (with the exception of service animals), don't charge for laundry facilities, don't charge for utilities, have a pool and fitness center (though it may be farther away), and all units come furnished. Unfortunately, there were no disamenities from the literature review available on Apartments.com.

Crime Index

USA.com uses its algorithms to generate a city-level crime index. A higher crime index means more crime. There are 292 observations for crime index data because some city names were not able to be matched to the crime index, both automatically and after manually trying similar names.

A variable for student crime levels (as published by school public safety reports) was considered, but that would make the pricing model less general.

Debt Service On-Campus

State universities and universities with wealth have deep access to capital markets. Universities able to raise money for their projects do so by raising bonds. These bonds are public information and accessible on the Electronic Municipal Market Access database, or EMMA. Univesities issue revenue bonds as separate entities created for that project alone and only backed by the project's future revenue (rents). These bonds are not backed by a stronger source of capital, such as the tuition a university brings in.

Universities that do not have the same access to capital markets but want to build on-campus housing will reach agreements with private companies specializing in constructing and managing on-campus housing, such as Provident. The university will guarantee a certain occupancy level in Provident's on-campus building for ground lease payments each year.

To find student housing bonds, I searched EMMA for the university name, which is always included in the name or description of the bond. There are many other bonds universities issue, so the search was further narrowed to the keywords that make student housing identifiable. Each school was searched for three keywords: "student", "housing", and "HSG" (a common shortening for housing in bond titling).

Three components of a bond determine the per-student debt service payments: the face value of the bond, the coupon rate, and the number of additional beds that issuing the bond will bring to a school. If a school has a student housing bond, the most recent project was identified and the offering memorandum for that project was looked into. The introduction of the offering memorandum will include the number of additional beds that issuing the bond will bring to a school. If the bond is not for a one-off student housing project, then somewhere further in the offering memorandum is the price of the student housing portion of the bond.

There are many reasons a school could have issued a bond for a student housing project, but that bond did not make it into this study. First, it is a refunding bond issued to refund a portion of a previously issued student housing revenue bond. Second, the bond issue date is so long ago that the debt service payments would likely not apply to today's market. Third, the bond is not for a one-off student housing development or acquisition with a breakdown provided. This happens when student housing is one component of a large bond that will finance many separate development projects on-campus. For example, in 2020, MIT issued a $136,055,000 bond to construct a 450-bed residence hall, renovate and reconstruct an existing residence hall, and finance routine renovations and equipment purchases for campus facilities. These could have been three separate bonds, but that would cost more to issue. After lumping the three projects together, MIT does not voluntarily disclose how much each project costs. Fourth, the bond could have a variable coupon rate, making debt service payments hard to value.

Table 2.1: Summary Statistics for Student Housing Bonds

	Obs.	Mean	Std. Dev.	Min	Max
Face Value	35	$67,105,515	$65,689,489	$8,255,000	$360,975,000
Coupon Rate	35	4.68%	.99%	2%	7.55%
Number of Beds	35	804	635	100	3,402
Issuance Year	35	2014	5	2002	2022
Difference to off-campus debt service	35	-$287	$2,962	-$9,758	$7,218

MHI, Occupancy, Population Growth, Sale Price/Unit

As discussed, the current real estate market is recovering as people return to areas where they have moved out of. A variable for the radius' predicted future population growth is used as a control for the different speeds that markets will recover from COVID-19.

From the literature review, median household income (MHI) and vacancy are found to have a significant impact on rent levels. The variable for occupancy is Costar's average occupancy for the radius over the previous ten years. Costar also tracks sale prices per unit in a radius. Costar calls brokers to verify these prices and unit counts are accurate.

Median household income and sale price per unit are expressed in thousands. Occupancy rate and population growth are multiplied by 100 to ease regression interpretation.

The collection method for these inputs was found by drawing a one mile (or adjusted one mile) radius and clicking on Analytics. On this tab, these values and the apartment rents are laid out for the radius.

On-Campus Rent

The types of on-campus housing we are interested in are double-occupancy, singles without a bath, and singles with a bath. These are the first-year dorms, suites, and apartments, which are the three typical on-campus housing styles. First-years typically share a dorm room with a roommate and have a shared kitchen, living room, and bathroom. Students in suites typically have their own room and members of the suite share the kitchen, common space, and bathroom. On-campus apartments are typically studios, two-bedroom two-bath, three-bedroom three-bath, or four-bedroom four-bath. In most cases, apartments for more than one student will have a private bathroom with a shared kitchen and living room.

On-campus rents are available on each school's housing website. If the website showed the 2021-2022 rate, I inflated the rate by 3% to account for rent growth. Many universities show the current and prior year rates. For the first few schools I looked into, I noticed an average price hike of 3%. Some schools had price hikes of over 3%. In very few cases was there no price hike.

Finding the on-campus rent was the most time-intensive portion of this study because the rate published had to be for the exact product type. Universities will often publish rates by the name of the residence hall, in which case I had to look up that residence hall and try to find the information I need. This process involves finding descriptions, floor plans, virtual tours, or anything else I can use to verify that the product type is the same across all universities. Universities do sometimes publish rates through keywords such as "suite" and "apartment" but do not specify whether the room includes a private bathroom. I repeated the process of finding out bathroom information often, and double-checked every value that my research assistant filled in using the housing links they saved.

There were many cases where there were multiple rates I could use for the same product type. I could have been very conservative and selected the lowest rates offered on-campus, but that would not be good for the context of this study, which is centered around the required payments that students have to make to get a degree from their university. Using the lower end of these payments gives universities slack which goes against the intention of this study. This is not

to say that I inputted the highest academic year rate whenever possible. I could have used doubles with a bathroom shared by the two people, suites with two bedrooms and one bathroom, or one-bedroom one-bath apartments instead of studios. I did not use these or I skipped over them if there were no alternatives.

There was a strategy in choosing which rent to use for each type of housing. First-year housing sometimes had different rates for older and newer construction halls (which typically have air conditioning). I use the newer construction in these cases. I typically used the highest rent I saw, but if a certain rate jumped out at me, then I looked into the residence hall for specifics. I noticed that honors housing will had higher rents, for doubles or otherwise. I did not input honors housing rates because I assumed that was inclusive of some benefits that are not present in standard rooms.

Suites vary in how many people share common spaces, most importantly the suite bathroom. They typically range from three to six, and I saw a few eight-person suites. When there were multiple options available, I went with four as the first choice and three as the second choice because these align best with how many occupants are in SFHs, the substitute for suites. The typical process for choosing which suite to use involved finding the highest rent for the product most likely to have a shared common bathroom, checking the website for that building to verify the bathroom is shared, and if isn't then repeating for the second-highest rent.

Studios were the first option used for on-campus apartments because they are direct substitutes for studios off-campus. I selected apartments in the following order of preference: four-bedroom four-baths, three-bedroom three-baths, two-bedroom two-baths. Note that rents will escalate as less people share the common space, so there will be more monopoly rent the lower the bedroom count.

Operating Income and Expenses Off-Campus

Costar provides market-level operating income, expenses, and debt service per unit for 2021. Costar has access to real operating statements for many properties, so their figures are good approximations of true average values in a market. There is likely little variation between the income, expenses, and debt service in the one mile radius of interest and the overall market, so it was assumed that they were the same.

Costar's income, expense, and debt service items are provided on a per-unit per-year basis. This becomes a concern when looking at units with more than one bedrooms. This paper does not look at two-bedroom or three-bedroom apartments for the parts of the study when operating income and expenses off-campus are included, so this is not an issue.

Debt service is given in terms of NOI DSCR and NCF DSCR. Costar has annual NOI and NCF per unit, so debt service was easily derived.

Costar's available income items are base rent, laundry income, parking income, and other income. Costar's available expense items are insurance, utilities, repairs and maintenance, payroll, taxes, management fees, marketing, legal and professional fees, general and administrative, other expenses, janitorial, ground rent, leasing commissions, tenant

improvements, capital expenditures, and extraordinary capital expenditures. Later, I discuss which items are applicable to on-campus versus off-campus.

Rent and Square Footage Off-Campus

Through Costar, average rent and average square footage were compiled for studios, one-bedroom, two-bedroom, and three-bedroom apartments within one mile from the 319 universities we are interested in.

The literature review pointed out that housing and rental markets near educational institutions are different from those over one mile away. Using a one mile radius for rents and amenities captures this effect. The starting point for "one mile" was the outer edge of the university. The actual radius that is drawn is from the center of the university, so 1.3 to 1.5 is the actual radius inputed into Costar (and replicated on Apartments.com). The exact radius input depended on the size of the university.

Average rents are on the Analytics tab with many other variables of interest. The average square footage for apartments off-campus by product type is also on the Analytics tab. Within Analytics, there is a Data tab and the data can be narrowed by studio, one bedroom, two bedroom, three bedroom, or four bedrooms and up.

SFH rents are the asking rents on Apartments.com within the same radius used to find amenities. Three houses in a very close range to a campus were selected randomly, and the average price per bed was used. The average radius for SFH rents is probably around .5 miles, but it wasn't measured.

SFH square footage information is available on Apartments.com, but there is likely variability in what a landlord considers square footage. They may list a property with the gross square footage that involves the porch, driveway, and backyard, or they may list only the net rentable area square footage of the entire house. For this reason, SFH square footage was not collected.

Two-beds and three-beds were included in the first pricing regression to show the rental environment holistically but they are not used in the monopoly portion of this paper for two reasons. First, they are not close substitutes to any on-campus housing. Second, the number of bathrooms is not always the same as the number of bedrooms. Costar has no information about the average number of bathrooms in two-bedroom and three-bedroom apartments in a certain radius.

Residency Requirement

Whether or not a school has a residency requirement, and the duration of the requirement, was found through search. Only the official school housing website was used to find this data because many third-party sources turned out to be wrong.

In some cases, this information was hard to come by because the university does not specify it explicitly. Schools that do not have a residency requirement signaled this by strongly encouraging living on-campus to first-years and emphasizing it when they reserve space for

incoming students. If there was no way to tell whether there was a requirement, it was assumed that the school did not have a mandate. I assumed this because, more likely than not, if a school did have a residency requirement they would publicize it.. This specific assumption was made for 56 schools.

Square Footage On-Campus

The on-campus square footage is generalized from offerings at University of Rochester. At University of Rochester, single rooms range from 80 to 152sqft (Riverview: 80sqft; Anderson and Wilder: 120sqft; Brooks: 132sqft; Hill Court: 152sqft). The higher-end, 150sqft, was assumed to be the size of all singles and doubles for all universities to stay conservative. Suites were not sized because they were compared to SFHs, which were also not sized.

Supply and Demand

Supply and demand are used as controls because they are known drivers of real estate prices. Adding these variables will level the playing field across schools regarding how well the market can absorb students in need of housing. For example, a school would be able to charge more in a competitive off-campus market with little supply or a competitive on-campus market with more demand than it can provide.

Supply inputs are obtained from Costar's Analytics tab and demand inputs are obtained from IPEDS. "Supply" is the number of apartments and SFH inventory units within a one mile range of the university. "New supply" is the number of units in the radius under construction. "Demand" for off-campus housing is equal to: the number of undergraduate students + the number of graduate students - beds on-campus. This assumes that universities will have 100% occupancy, which is common. Some schools are at well over 100% occupancy, such as UC Berkeley, which is in a court-ordered enrollment freeze because they "have not built sufficient housing for its new students, exacerbating the city's housing crisis and increasing homelessness." "New demand" is the number of new admissions into the university 2019 versus 2018. These years are assumed to represent the increased amount of incoming student demand in 2023 over 2022 because they remove any effects of enrollment changes due to COVID-19. While "New supply and "New demand" have not actualized in the real estate market yet, they are publicly known to be true and to change the real estate market in the near future.

Universities and University Characteristics

The Integrated Postsecondary Education Data System (IPEDS) was used to decide which schools to select for this study and to get variables on characteristics of these schools.

For this study, IPEDS was used to narrow down postsecondary institutions that meet the following criteria: in the U.S., not-for-profit four-year or above, the highest degree offered is at least a bachelor's, a size of at least 5,000 students, has full-time first-time undergraduates, not in "towns" or "rural" areas (exact definitions provided by NCES Locale Classifications and Criteria), do not have more than 50% of their degrees conferred at the associate's level, and do

not have a religious affiliation. The student body size is set to over 5,000 students to exclude liberal arts colleges. Including liberal arts colleges would make the data collection take much longer, so this study focused on universities. A future study could examine whether liberal arts schools charge more monopoly rents than universities.

The school characteristics of interest pulled from IPEDS were the institutional control or affiliation (public or private not-for-profit), the acceptance rate, the SAT score (I summed the reading and math scores to get the total score), the out-of-state tuition and fees for full-time, first-time undergraduate students, the endowment and the number of students (I divided the two to get endowment per student), the percent of undergraduate students awarded federal, state, local, institutional or other sources of grant aid, the tuition and fees as a percent of core revenues (using FASB), and the four-year graduation rate (getting a bachelor's degree within 100% of normal time). All of these variables were for the 2020-2021 academic year with the exception of aid, which was for 2019-2020.

The only university characteristic not obtained from IPEDS was rank. The rank for a university was obtained from the US News Best National Universities List for 2022. US News stops assigning a ranking after school 298, and the remainder of the ranked schools are grouped into the rank 299-391. A lot of the schools from this study fell into this bucket, but since there was no rank inputted for these schools, only 155 schools have an observed rank.

Part 4: Rent Pricing Model

Model Specifications

Table 4.1: Summary Statistics for the Rent Pricing Model

	Obs.	Mean	Std. Dev.	Min	Max
Studio Rent	274	$1,190	$563	$339	$3,095
1 Bed Rent	315	$1,383	$674	$343	$3,846
2 Bed Rent	319	$1,757	$958	$566	$5,710
3 Bed Rent	307	$2,325	$1,537	$607	$13,309
SFH Rent	300	$762	$410	$250	$3,000
Studio sqft	319	498	89	228	1105
1 Bed sqft	319	697	65	520	964
2 Bed sqft	319	988	103	680	1557
3 Bed sqft	316	1301	227	800	2901
MHI (thousands)	318	$82	$29	$11	$183
SP/unit (thousands)	319	$219	$161	$34	$842
Pop. Growth (5Y future)	319	2	3	-4	17
Vacancy (10Y Past)	319	7	6	1	94

Crime Rating	292	2441	1208	293	6169
Pets Allowed	319	55	38	0	100
Washer/Dryer in unit	319	35	28	0	100
Utilities Included	319	33	30	0	100
Pool	319	36	34	0	100
Fitness Center	319	40	33	0	100
Furnished	318	24	22	0	94

Mean rent and square footage increase with product type, which is expected. There were more markets without a studio than any other product type, followed by SFHs.

MHI and sale price per unit have high ranges, because universities in this dataset are located in many different places, including the Bay Area and NYC where MHI and sales prices are the highest. Population growth, on average, is expected to rise 2% in the area around universities. The area around universities has had a ten year historical vacancy rate of 7%. Both of these variables have high standard deviations, so they are specific to those markets and do not follow a larger overall trend. Crime rating is hard to interpret because it's an index, but it's good to know the range for context to the regression results.

Every amenity has high standard deviation, so there is variability in whether an amenity is offered in a market. In other words, there is no amenity set that is common. The most common amenity amenity, on average, is pets. It's the only amenity that is offered in most of the listed properties in a given market, on average. The second most provided amenity is a fitness center, which is in 40% of listings in a given market, on average. The least provided amenity is furnishings, which are only offered at 24% of listings in a given market, on average. They are also the only amenity that doesn't have at least one market offering the amenity in all listings. Every amenity has at least one market that doesn't offer the amenity in any listing.

Table 4.2: Correlations between the Independent Variables in the Rent Pricing Model

	1	2	3	4	5	6	7	8	9	10	11
1. MHI	1										
2. SP/unit	.77	1									
3. PG 5Y	.00	-.01	1								
4. Vacancy 10Y	-.02	-.07	.00	1							
5. Crime	-.32	-.26	-.05	.14	1						
6. Pets	.14	.11	.18	.09	-.10	1					
7. Wash/Dry	.16	.14	.12	.08	-.17	.71	1				

8.	Utilities	-.18	-.07	-.16	.05	-.02	.53	.48	1			
9.	Pool	.05	-.01	.18	.07	-.13	.74	.65	.25	1		
10.	Fitness	.12	.11	.18	.11	-.04	.81	.76	.37	.77	1	
11.	Furnishings	-.26	-.17	.02	-.05	-.03	-.08	.09	.12	-.05	.05	1

SP/unit: Sales Price per unit; PG 5Y: Projected 5 Year Population Growth; Vacancy 10Y: Historic Average 10 Year Vacancy

A rental market with a high proportion of fitness centers is highly likely to be pet-friendly, have washers and dryers in units, and have pools. To avoid multi-collinearity, the variable for fitness center was removed from the pricing model. No other variables have a correlation of more than 0.8 with another variable, which is the rule of thumb threshold to detect the presence of multi-collinearity.

Other than fitness centers and washer and dryers, amenities had low correlations with each outer. Washer and dryers have a positive correlation with every other amenity. This means the more amenities are present, the more likely washers and dryers will be in the unit.

Interestingly, areas with higher incomes are moderately less likely to be in a market where apartments come furnished. Areas with higher incomes are also more likely to be in markets that allow pets, have washer and dryers included, have pools, have fitness centers, and don't include utilities.

There is a high correlation between the sale price per unit and the MHI, which makes sense because high incomes have been shown to have a positive effect on rent, and higher rents directly increase the sale price per unit. Crime has moderate negative correlations with incomes and sale prices, which also makes sense because many studies show that areas with higher poverty rates have higher rates of violent crime.

The models I estimate in functional form are as follows:

$$Y_{Studio} = B_0 + B_1X_{Studio} + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9 + B_{10}X_{10}$$

$$Y_{1BR} = B_0 + B_1X_{1BR} + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9 + B_{10}X_{10}$$

$$Y_{2BR} = B_0 + B_1X_{2BR} + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9 + B_{10}X_{10}$$

$$Y_{3BR} = B_0 + B_1X_{3BR} + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9 + B_{10}X_{10}$$

$$Y_{SFH} = B_0 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9 + B_{10}X_{10}$$

Y_i = Monthly rent off-campus for the product type of interest in a 1 mile radius from a university

X_{Studio} = Square footage of the average studio apartment in a 1 mile radius from a university

X_{1BR} = Square footage of the average 1 bedroom apartment in a 1 mile radius from a university
X_{2BR} = Square footage of the average 2 bedroom apartment in a 1 mile radius from a university
X_{3BR} = Square footage of the average 3 bedroom apartment in a 1 mile radius from a university
X_2 = MHI (thousands) in a 1 mile radius from a university
X_3 = Sale price per unit (thousands) in a 1 mile radius from a university
X_4 = Population growth predicted for the next five years in a 1 mile radius from a university with 1 representing every 1% average annual predicted change
X_5 = Crime Index in the city of a university
X_6 = Number of apartments and SFHs out of 100 in the 1 mile radius that allow pets
X_7 = Number of apartments and SFHs out of 100 in the 1 mile radius that include washers and dryers in the unit
X_8 = Number of apartments and SFHs out of 100 in the 1 mile radius that include utilities
X_9 = Number of apartments and SFHs out of 100 in the 1 mile radius that have a pool
X_{10} = Number of apartments and SFHs out of 100 in the 1 mile radius that come furnished

Results

Table 4.3: Monthly Rent Pricing Regression Results

	Studio	1 Bed	2 Bed	3 Bed	SFH
Constant	39.86 (128.4)	-203.4 (143.1)	-540.9** (184.7)	-1839.9*** (245.0)	170.9 (89.34)
Studio sqft	0.988*** (0.181)				
1 Bed sqft		0.839*** (0.199)			
2 Bed sqft			0.800*** (0.192)		
3 Bed sqft				1.351*** (0.158)	
MHI (thousands)	2.232* (0.990)	3.214*** (0.763)	4.611*** (1.070)	9.847*** (2.151)	2.773** (0.939)
Sale Price per Unit	2.480*** (0.161)	3.478*** (0.121)	4.932*** (0.169)	6.305*** (0.338)	1.761*** (0.159)
Population Growth (Next 5Y)	-4.093 (5.540)	-8.654* (4.163)	-8.803 (5.849)	-1.927 (11.36)	-1.563 (5.154)
Vacancy	-0.742	-1.747	0.147	1.878	-3.247

(Past 10Y)	(2.630)	(2.066)	(2.913)	(5.650)	(2.526)
Crime Rating	-0.0253	0.00207	0.0243	0.0407	-0.00966
	(0.0150)	(0.0110)	(0.0157)	(0.0308)	(0.0136)
Pets Allowed	-0.104	0.155	0.654	-0.767	0.619
	(1.026)	(0.646)	(0.899)	(1.920)	(0.792)
Washer/Dryer Included	-0.331	-0.291	-0.115	0.993	-0.477
	(1.062)	(0.700)	(0.966)	(2.067)	(0.848)
Utilities Included	0.581	-0.0180	-0.268	0.798	0.252
	(0.850)	(0.601)	(0.830)	(1.655)	(0.737)
Pool	0.258	0.230	-0.628	-0.776	0.682
	(0.884)	(0.612)	(0.849)	(1.706)	(0.751)
Furnished	-0.985	-0.350	0.276	3.858*	-0.0448
	(0.842)	(0.603)	(0.845)	(1.682)	(0.759)
N	252	287	290	279	274
Adjusted R^2	0.793	0.909	0.910	0.847	0.613

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Discussion

This model has three statistically significant variables: square footage, MHI, and sale price per unit. Square footage and MHI are known from the literature review to be statistically significant rent-increasing variables. Sale price per unit makes sense to be positive and statistically significant because markets with higher sales prices per unit are the markets where the rent is higher. The other variables are not statistically significant, which can either mean that they do not have an impact on rent (which is not the case given the literature review) or there is one or more confounding variables excluded from this model whose effect is being absorbed by other variables and the residuals. Despite some coefficients having unexpected signs and no statistical significance, the regressions have strong adjusted R^2 values. Econometricians classify a cross-sectional model as having a "good" fit when R^2 is at least 0.4, which all of these have. The residuals were also plotted against the fitted values of the dependent variable to look for any sign of heteroskedasticity, and no pattern or complete outliers were found.

The adjusted R^2 is lowest for SFHs, likely because there is no control for square footage. There is also a smaller income coming from sale price per unit, which is understandable because this metric does not apply to SFHs.

There is a negative coefficient on the constant value for one-bedroom, two-bedroom, and three-bedroom apartments. This is not an issue because it is to offset the higher square footages of these product types. For example, applying the mean square footage of a one-bedroom

apartment, 697, to the square footage coefficient, .839, will result in a rent of $550 after being summed with the constant.

Higher population growth predicted for an area harms rent. This does not go against the law of demand because the variable measures expected and not current demand, but it is strange. I expected markets with a faster-projected recovery from COVID to be already charging higher rents. Vacancy has mixed effects on rent, but for the product types used in the next portion of this study, higher vacancy hurts rent, signaling that properties with more rooms to fill will try to lower the price to attract tenants. Vacancy and population growth both have high standard errors. These two variables were included as controls, but it looks like they are not strong control variables for a university radius.

The crime coefficient should be negative because more crime harms rent, but it has mixed results. It doesn't make sense for crime to have a negative coefficient for studio but a positive coefficient for one bedroom. Crime was also supposed to be a strong control variable, but it seems like it does not have an effect on university markets.

Every amenity should have a positive sign, in theory. In this model, two to three of five amenities will hurt rent for each product type, and the exact amenities that have a negative impact on rent change across product type. Allowing pets is not an amenity that is necessarily priced into rent because tenants also have to pay one-time and recurring pet fees. Getting mixed results for pets is more understandable than for other amenities, which should be priced into rent. Markets that have a high prevalence of providing washers and dryers, for example, charge lower rent for all product types except for three-bedroom apartments. Neither the sign nor the exception makes sense.

Before fitting on-campus housing square footage and amenities onto this model in Part 5, it's important to discuss what this regressions mean high-level. One way to explain the significance of these regressions is through example. Suppose a developer was building an apartment and it had one of each of these product types. They need to decide what rent to charge based on the amenities that are provided and square footage of each product. Depending on the market they are developing in, they could use these regressions and that market's residuals to determine a price. All the developer needs to do is match their product type with the regression, and input their square footage, that market's MHI, sales price per unit, 5Y projected growth, 10Y historic vacancy, 100 for any amenity they provide, 0 for any amenity they don't provide, and add in the residuals for that product type in that market to account for any market-level differences. The result would be the free-market rent that they could charge given where rents are right now. They could be more aggressive as they so choose, but they should understand that this is how the free market values their units.

Key on-campus amenities are assumed to be included in 100% of universities. This is a safe assumption because student housing has a standardized business model that few universities deviate from. Amenities assumed to be available at 100% of university on-campus housing are washers and dryers, utilities included in rent, and furnishings. The amenities offered at 0% of

on-campus university housing are the ability to have pets and pools. All other variables in the pricing model are going to remain when constructing the free-market rent.

Part 5: Measuring the Effects of Residency Requirements

If schools opened their doors to the public, they would have an advantage over off-campus apartment managers because they have far fewer expenses. One of the largest expense benefits for universities is not having to pay taxes. All the universities considered in this paper are non-profits, so they do not need to pay property taxes.

Universities have a centralized system of collecting payments. Having a Bursar's office that collects rent payments with tuition eliminates most of the general and administrative expenses that off-campus managers incur.

Universities do not need to incur the costs associated with leasing, including marketing, screening tenants, showing tours (RAs do that), working with contracts, and hiring leasing professionals who get commissions. Universities do hire RAs, but they also never give out concessions (such as "first month free"). Concessions are typical off-campus. In aggregate, the foregone rents from RAs on-campus are likely in range of the foregone rents from concessions off-campus. Costar doesn't have information about concessions in their per-unit market profit and loss statements. The two effects are assumed to be equal in this paper.

Universities can achieve economies of scale in payroll and management. While off-campus properties have to keep mechanics and other repair workers on staff or on contract, universities handle repair work through their facilities staff. On campus, those on payroll (typically an area secretary, an area coordinator, and an assistant) mostly do property management work. These three staff members are able to manage far more units per staff member because university residential buildings are in groups called "areas." If off-campus apartment managers want to achieve this scale effect, they need to have multiple properties next to one other. There is also a smaller workforce because there is less pressure to constantly monitor occupancy and competitors to find the best rent to charge and the market concessions to give out at a certain time. Payroll and management fees are likely far lower on-campus for all these reasons. Management is the function of workers in residence buildings, so they are the fee I deemed applicable to on-campus.

A hypothetical example will show which variables are relevant to finding excess profits over the free market and which are not. Say there is a market and the off-campus properties charge $4/month for rent to make $20/year in profit. They can charge $2/month and break even, but they can charge more and make profits. The university less than one mile away from this market charges $5/month (dividing the academic year rate by 9) and makes $30/year in profit. The excess rent seen by students that have the option to live on-campus or off-campus is $1/month. Say we find in Part 4 that the free-market rent for the university is $3/month, given their square footage and amenities, and that the profit that universities would make over off-campus properties if they both charged $3/month is $3/year, which shows that doing business on-campus is more profitable than off-campus.

Universities are charging \$5/month, which translates to \$30/year in profit, while the rent that would be set in the free market is \$3/month, which translates to \$18/year in profit. Universities make \$12/year in *excess* profit by setting a price more aggressive than their market. Universities should be naturally making \$3/year more than off-campus properties, but their excess profit is not \$9/year because the \$18/year profit already captures the additional profitability of doing business on campus.

Excess $\text{Profit}_{c,f}$ between on-campus product type *c* at university *u* and off-campus product type *f* in market *m* is:

$$\text{Excess Profit}_{c,f} = \text{On-Campus Profit}_{c,u} - \text{Fitted Profit}_{c,m} \quad (1)$$

where

$$\text{On-Campus Profit}_{c,u} = \text{Rent Income}_{c,u} + \text{Other Income}_{u,m} - \text{Expenses}_{u,m} - \text{Debt Service}_{u}$$

$$\text{Fitted Profit}_{c,m} = \text{Fitted Rent Income}_{c,f} + e_{f,m} + \text{Other Income}_{u,m} - \text{Expenses}_{u,m} - \text{Debt Service}_{u}$$

$$\text{Fitted Rent Income}_{\text{double,f}} = [B_0 + B_1*150 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6*0 + B_7*100 + B_8*100 + B_9*0 + B_{10}*100]*12$$

$$\text{Fitted Rent Income}_{\text{1bed with private bathroom,f}} = [B_0 + B_1*150 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6*0 + B_7*100 + B_8*100 + B_9*0 + B_{10}*100]*12$$

$$\text{Fitted Rent Income}_{\text{1bed without private bathroom,f}} = [B_0 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6*0 + B_7*100 + B_8*100 + B_9*0 + B_{10}*100]*12$$

$$\text{Off-Campus Profit}_{f,m} = \text{Rent Income}_{f,m} + e_{f,m} + \text{Other Income}_{m} - \text{Expenses}_{m} - \text{Debt Service}_{m}$$

Since the fitted profit already captures the benefit of doing business on-campus, all other income, expense, and debt service items cancel out.

This study only looks at the Excess $\text{Profit}_{c,f}$ as defined in (1). Alternative regression results for Excess $\text{Profit}_{c,f}$ = On-Campus $\text{Profit}_{c,u}$ - Fitted $\text{Profit}_{c,m}$ - Off-Campus $\text{Profit}_{f,m}$ are presented in the appendix but not discussed because they cover a different hypothesis. Using this definition, a positive value for excess profit means the profit made over the free-market is so large that it is greater than the actual profits made off-campus. Going back to the hypothetical example, this alternative definition of Excess $\text{Profit}_{c,f}$ would result in a value of -\$8. Note that positive profit can be made in the short run off-campus because the housing market is best described as monopolistic competition. (Yang et. al, 2014.)

We define Monopoly $\text{Rent}_{c,f}$ as the difference in Excess $\text{Profit}_{c,f}$ between schools with a residency requirement and schools without a residency requirement.

Rent Income$_{f,m}$ is the annualized average rent charged for property type *f* in market *m*. Rent Income$_{c,u}$ is the annualized academic-year rate for product type *c* at university *u*.

Fitted Rent Income$_{c,f}$ is the annualized average rent that comes from fitting on-campus housing assumptions onto the model for the corresponding product type of interest *f*. This is the achievable rent that could be charged for *c* if it opened its doors for the public. After adding in residuals, the derived rent uses the same valuation method for its substitute of interest, *f*.

Other Income$_{m}$ is the average annual income per unit in market *m* from parking, laundry, vending, utility billbacks, damages, month-to-month premiums, and other miscellaneous income. For SFHs, there is no other income. Other Income$_{u,m}$ is the average annual income per unit on-campus, which is only parking. Though a separate department handles parking income, it is still auxiliary income for universities and needs to be included because it is a direct income item in the free market.

Expenses$_{m}$ is the average annual expenses per unit in market *m* for insurance, utilities, repairs and maintenance, payroll, taxes, management fees, marketing, legal and professional fees, general administrative fees, and other miscellaneous expenses. This applies to for both apartments and SFHs. Expenses$_{u,m}$ is the average annual expenses in market *m* applicable to on-campus housing, which include only insurance, utilities, repairs and maintenance, and payroll.

$e_{f,m}$ is the residual difference between actual rent for product type *f* in market *m* and the predicted rent from the general rent pricing model.

Debt Service$_{m}$ is the average annual debt service per unit in market *m*. Debt Service$_{u}$ is the actual annual debt service per unit for university *u*. Debt Service$_{u}$ only has a unique value for the 35 schools that have EMMA data, otherwise Debt Service$_{m}$ was used. Using the average difference between on-campus and off-campus debt service was considered but not done because 35 observations are not easily generalizable to 319.

Table 5.1: Summary Statistics for Residency Requirement Impact Model

	Obs.	Mean	Std. Dev.	Min	Max
ExcessProfit_double,studio	258	$1,261	$4,944	-$14,988	$14,043
ExcessProfit_double,1bed	297	$375	$5,917	-$19,420	$12,419
ExcessProfit_double,SFH	283	$1,594	$4,138	-$18,336	$9,799
ExcessProfit_singleprivatebath,studio	245	$774	$5,331	-$18,360	$17,511
Excess Profit_singlesharedbath,SFH	196	$5,830	$4,866	-$14,734	$17,166
mandate?	263	0.55	0.50	0	1
mandate_years	304	0.87	0.92	0	4
supply	319	8,437	22,488	67	226,099
new_supply	319	348	818	0	5662
demand	318	15,421	13307	926	132,411

new_demand	319	7	294	-810	2393
public?	316	0.78	0.41	0	1
acceptance_rate	309	68.7	22.7	5	100
sat	264	1,278	141	900	1580
tution_thousands	319	$28.83	$12.76	$7.51	$61.79
endowment_perstudent	72	$241.80	$513.73	$4.30	$3,073.60
aid_rate	319	42	15.1	2	90
sf_ratio	319	16.7	4.6	3	31
tuition_corerev	74	60.5	28.8	6	97
gradrate	318	39.5	22.4	0	89
usnews	155	122	85.8	1	288
FittedRentIncome(c,studio)_residuals	274	$9,801	$6,354	-$3,795	$32,331
FittedRentIncome(c,1bed)_residuals	315	$10,577	$7,937	-$2,223	$40,301
FittedRentIncome(c,SFH)_residuals	300	$9,804	$4,748	$3,461	$36,012
RentIncome(double,u)	300	$10,781	$3,816	$2,737	$26,333
RentIncome(single_sharedbath,u)	207	$14,602	$4,642	$3,851	$28,634
RentIncome(single_privatebath,u)	285	$13,020	$4,378	$3,189	$36,733
RentIncome(studio,m)_residuals	274	$14,285	$6,860	$3,687	$37,528
RentIncome(1bed,u)_residuals	315	$16,599	$8,150	$3,728	$46,533
RentIncome(SFH,u)_residuals	300	$20,422	$10,271	$6,702	$69,105
On-CampusProfit(double,u)	300	$3,760	$3,229	-$3,365	$13,763
On-CampusProfit(single_sharedbath,u)	207	$7,862	$4,030	-$7,383	$23,864
On-CampusProfit(single_privatebath,u)	285	$6,018	$3,724	-$2,913	$23,233
FittedProfit(c,studio)	274	$2,730	$5,135	-$10,564	$19,263
FittedProfit(c,1bed)	315	$3,518	$6,386	-$9,084	$26,802
FittedProfit(c,SFH)	300	$2,181	$4,107	-$6,643	$25,487
Off-CampusProfit(studio,m)_residuals	274	$5,657	$5,280	-$6,796	$25,624
Off-CampusProfit(1bed,m)_residuals	315	$8,007	$6,060	-$5,106	$28,933
Off-CampusProfit(SFH,m)_residuals	300	-$380	$4,453	-$12,327	$22,571

From the positive mean for every excess profit item, there is already evidence that schools make more profit over their free market. The lowest mean excess profit is doubles over one bedrooms at $375/year or $31/month and the highest excess profit is for suites over SFHs at $5,830/year or $486/month. This result means that a double room is going to be slightly more expensive on-campus than if it were offered without the roommate and with a separated kitchen and living room off-campus. Rent for a suite room on-campus is going to be significantly more

expensive than rent for that same room in a SFH. Paying an average $486/month premium over the market, students in suites might want to look into just renting out a house together.

There is a high standard deviation for every excess profit comparison. High variability is important to notice, but not a primary concern because we we are going to isolate the variables that contribute to the variability.

The reason that there are different amounts of observations for excess profits, and every other incomes, expense, and profit item, is because not every university had every product type *c* and not every market had every product type *f*. Excess $\text{Profit}_{\text{double,studio}}$, for example, has 258 observations because that is how many universities offer doubles in markets with studios.

The dataset is ideal for exploring whether more excess profits is attributable to monopoly power because around half, 55%, of the schools have a residency requirement. The average duration of the residency requirement is . 87 academic years.

There is more demand than supply for off-campus housing on average, which is why the real estate in proximity to universities has been shown to be valuable. This is also why some students live outside of the one mile radius. Supply is also undervalued because it's on a per-unit rather than a per-bed basis like demand. There is a large range for supply and demand because so many markets were covered, and each market has a different density, with the highest values coming from NYC.

78% of universities in the dataset are public. This is because state universities often have more than one university, while private schools do not typically have other universities.

Because there are 319 universities in this study, it is understandable that there are large ranges and standard deviations across university characteristics. The characteristic with the most variation was the endowment per student, which ranged from $4,300 to $3M per student, and averaged at $241,300. There's a sparse amount of information on endowment and tuition as a percent of core revenue on IPEDS, hence the low observation count.

The average ranking of a university was 122 for 298 ranking slots available. The average university in the dataset has a high acceptance rate of 68.7%. The average SAT score is low at 1,278. The student faculty ratio averaged 16.7 with a large range between 3 and 31. Tuition costs an average of $28,830 for out-of-state students, when applicable. Tuition averages 60.5% of core revenue, but it can range from 6% to 97%. 42% of students are on financial aid, but it could be as low as 2% or as high as 90%. The average student will graduate on time 39.5% of the time, but it can be as low as 0% or as high as 90%. Surprisingly, there was more than one school with a graduation rate of 0% for 2020-2021, and a large amount in the 1-10% range, all of which are public universities. This may be an IPEDS error.

Income, expenses, and profits are expressed in years. There are definitely some outliers on the high and low end, for example the highest rent income value came from SFH at the New York Institute of Technology in NYC at $69,015/year or $5,759/month. It's evident that average rent income on-campus is greater than fitted rent. Average on-campus profit is strictly greater than fitted profit. The average off-campus studios and SFHs make as much or more than

on-campus properties. Despite lower rent income, profit on-campus is higher on average than off-campus due to the cost savings of doing business on-campus as a non-profit.

Interestingly, more rent income is brought in from singles with shared baths than singles with private baths. This is not a data collection error, but something that I noticed early on and still don't understand.

Rent Income is always positive but calculated profit could take on negative values. The universities that have negative values for on-campus profit are likely charging too little or their market is so saturated they cannot offer competitive rates. The same goes for negative profits off-campus. Real estate is a competitive market which could drive profits close to zero, as seen for the average profit for SFHs, a market with even less barriers to entry. With the exception of SFHs, all income and profits are positive.

Table 5.2: Correlation Table between Outcome Variables and all Dependent Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. DB-Studio	1																				
2. DB-1bed	.82	1																			
3. DB-SFH	.64	.64	1																		
4. SB-Studio	.85	.60	.54	1																	
5. SNB-SFH	.48	.46	.83	.49	1																
6. RR?	.23	.27	.15	.10	.07	1															
7. Yrs of RR	.21	.19	.20	.12	.06	.80	1														
8. Supply	-.34	-.49	.00	-.10	-.08	-.11	-.06	1													
9. New S.	-.30	-.41	-.07	-.17	-.05	-.11	-.03	.52	1												
10. Demand	-.04	-.07	-.06	.02	.03	-.15	-.23	.06	.04	1											
11. New D.	-.07	-.03	-.09	-.09	-.12	.03	-.03	-.05	-.04	.17	1										
12. Public?	.07	.25	-.04	-.05	.01	-.13	-.31	-.27	-.28	.22	.07	1									
13. AR	.17	.29	.10	.13	.01	-.09	-.11	-.22	-.26	-.06	-.01	.41	1								
14. SAT	-.09	-.23	-.05	-.06	.02	.14	.16	.19	.25	.24	.02	-.46	-.73	1							
15. Tuition	-.12	-.26	-.02	-.06	.06	.13	.23	.16	.23	.02	-.07	-.68	-.62	.79	1						
16. End./stu.	-.12	-.16	-.16	-.38	-.08	.23	.09	-.08	-.03	-.08	.08	-.10	-.59	.53	.31	1					
17. Aid	.12	.22	.13	.05	-.03	.00	.01	-.19	-.10	-.29	-.07	.06	.55	-.60	-.30	-.61	1				
18. SF	.07	.13	-.09	.05	-.12	-.22	-.30	-.21	-.25	.34	.12	.61	.47	-.49	-.61	-.65	.09	1			
19. TCR	.05	.08	.11	.26	-.17	-.42	-.15	-.03	-.14	-.05	-.08	-.18	.78	-.74	-.52	-.61	.63	.70	1		
20. Grad	-.04	-.12	.06	-.07	.04	.15	.23	.07	.12	.09	-.05	-.49	-.65	.82	.80	.43	-.30	-.53	-.56	1	
21. Rank	.03	.10	-.11	.00	-.11	-.13	-.18	-.07	-.08	-.06	.08	.36	.76	-.83	-.69	-.48	.52	.50	.68	-.81	1

DB-Studio: Excess Rents (double occupancy,studio); DB-Studio: Excess Rents (double occupancy,1bed); DB-Studio: Excess Rents (single with private bath,studio); DB-Studio: Excess Rents (single with shared bath,SFH); RR?: Binary variable for whether a residency requirement is in-place; New S.: New Supply; New D.: New Demand; AR: Acceptance Rate; End./stu.:

Endowment per student; Aid: Percent of students on financial aid; SF: Student to Faculty Ratio; TCR: Tuition as a percent of core revenue; Grad: Graduation rate; Rank: US News University Ranking.

There are high correlations between the excess rents, so universities that charge high excess rents over a certain off-campus product type are likely to have high excess rents over other product types as well.

Residency requirements have a positive correlation with all exces profits, signaling that monopoly rent does exist. The number of years in the residency requirement also has a positive correlation with all excess profits, signaling that monopoly rents increase over requirement length. Both of these hypotheses will be checked and quantified in the regression.

Supply and new supply have a negative correlation with excess profits, so higher excess profits are able to be made when there's less availability off-campus, which follows the law of supply. Compared to supply effects, demand has mixed and weaker effects. The correlation is mostly negative, which goes against the law of demand because more demand for on-campus housing should increase rents.

Three independent variables have high correlations with other variables, so they were removed: acceptance rate, SAT score, and graduation rate. Rank is an endogenous variable that captures the effects of these removed variables. However, US News stops assigning rank at school 298, so there are only observations for about half of the universities. There are between 41 to 65 observations for universities with every independent variable and both product types *c* and *f*. The results of regressing all independent variables would hence be far less generalizable than the other regressions, so it was decided that all independent variables 13 to 21 would not used. Still, some insights can be seen by looking at the correlations between the five outcome variables and independent variables 13 to 21.

The only university characteristics that have the same direction of correlation with every excess profit comparison is acceptance rate and endowment per student. Acceptance rate has a positive correlation with excess profits, so more selective schools will charge less and make less excess profits. An explanation for this is that schools that are more picky will have the best interest of the students they picked at heart. Endowment per student has a negative correlation with excess profits, so wealthier schools will charge less and make less excess profits. This could be because they don't need the extra money as desperately.

Frame (2008) found that population growth and housing demand are jointly determined. To avoid multicollinearity, the demand variables were tested for correlation with population growth. Demand had a low correlation with population growth (.14), and so did new demand (.03), likely because population growth is a market-specific variable while demand is only involves university-specific inputs.

Before looking at the regression results, I encourage the reader to think about how they individually value double-occupancy rooms, suite rooms, and apartments on-campus compared

to studios, one-bedrooms, and rooms in SFHs off-campus. Then, the regression coefficients can be interpreted compared to an individual willingness to pay.

Results

Table 5.3: Parsimonious Model Measuring the Annual Effects of Residency Requirements on University Profits

	Excess Profit: Double, Studio	Excess Profit: Double, 1 Bed	Excess Profit: Double, SFH	Excess Profit: Single w Bath, Studio	Excess Profit: Single w/o Bath, SFH
Constant	3.261	-1411.1**	886.4*	166.8	5431.2***
	(445.4)	(501.0)	(366.5)	(506.7)	(537.5)
Mandate?	2300.8***	3175.8***	1267.1*	1101.8	686.0
	(602.6)	(668.1)	(490.5)	(682.6)	(704.7)
N	258	297	283	245	196
Adj. R^2	0.050	0.068	0.020	0.007	0.000

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.4: Measuring the Annual Effects of Residency Requirements on University Profits with Supply and Demand Controls

	Excess Profit: Double, Studio	Excess Profit: Double, 1 Bed	Excess Profit: Double, SFH	Excess Profit: Single w Bath, Studio	Excess Profit: Single w/o Bath, SFH
Constant	888.1	396.3	1075.7*	137.6	5169.3***
	(623.1)	(635.8)	(541.1)	(763.4)	(830.5)
Mandate?	812.8	2237.3*	134.3	35.13	281.0
	(982.0)	(993.8)	(848.0)	(1168.5)	(1209.4)
Years of Mandate	725.2	85.91	824.1	708.6	368.4
	(536.4)	(533.7)	(462.7)	(641.9)	(649.7)
Supply	-0.0525***	-0.0976***	-0.0880	-0.00625	-0.0700
	(0.0144)	(0.0156)	(0.0465)	(0.0258)	(0.0587)
New Supply	-0.990*	-1.498***	0.0437	-1.071*	0.0402
	(0.382)	(0.410)	(0.432)	(0.494)	(0.561)
Demand	0.0157	0.00357	0.0106	0.0269	0.0368
	(0.0218)	(0.0224)	(0.0188)	(0.0262)	(0.0264)
New	-1.949	-1.436	-1.589	-2.286	-2.841*

Demand	(1.109)	(0.985)	(0.818)	(1.322)	(1.240)
N	246	282	270	233	186
Adj. R^2	0.168	0.303	0.051	0.039	0.012

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.5: Measuring the Annual Effects of Residency Requirements on University Profits with Supply, Demand, and Public Status as Controls

	Excess Profit: Double, Studio	Excess Profit: Double, 1 Bed	Excess Profit: Double, SFH	Excess Profit: Single w Bath, Studio	Excess Profit: Single w/o Bath, SFH
Constant	610.6	-1762.9	931.7	1288.1	4826.8***
	(898.4)	(913.5)	(815.3)	(1153.1)	(1241.3)
Mandate?	737.5	1745.4	96.43	235.1	246.4
	(996.8)	(988.4)	(869.8)	(1178.5)	(1235.4)
Years of Mandate	820.6	648.2	858.1	421.1	441.4
	(567.7)	(550.0)	(495.3)	(677.1)	(696.1)
Supply	-0.0514***	-0.0891***	-0.0861	-0.0170	-0.0656
	(0.0146)	(0.0155)	(0.0478)	(0.0271)	(0.0605)
New Supply	-0.958*	-1.261**	0.0456	-1.111*	0.0472
	(0.388)	(0.409)	(0.434)	(0.495)	(0.564)
Demand	0.0130	-0.0117	0.0108	0.0324	0.0348
	(0.0223)	(0.0226)	(0.0195)	(0.0266)	(0.0268)
New Demand	-1.939	-1.330	-1.738	-2.279	-2.843*
	(1.113)	(1.101)	(0.938)	(1.323)	(1.246)
Public?	357.1	2651.1**	144.5	-1313.5	399.9
	(794.0)	(801.2)	(710.4)	(982.7)	(1023.4)
N	245	280	268	232	185
Adj. R^2	0.166	0.329	0.047	0.042	0.007

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Discussion

Formula (1) simplifies to

$$\text{Excess Profit}_{c,f} = \text{Rent Income}_{c,u} - (\text{Fitted Rent Income}_{c,f} + e_{f,}) \quad (2)$$

Therefore, higher excess profits are the direct result of higher on-campus rents. The constant coefficient in each regressions can be interpreted as not only the the average annual profit over market for a university without a mandate requirement, but also the annual rent over the market that is charged to students. We see that in almost every instance, the constant coefficient is positive, so schools without residency requirements know that students are willing to pay more than the rents they would be able to achievable in the free market.

Another interpretation of the constant coefficient is the minimum willingness to accept (if positive) or pay (if negative) needed for a student to have for them to forgo the benefits of living on-campus to move into product type *f*, which has the same amenities and square footage as *c*, as well as other benefits, when they have no residency requirement. The additional benefits that come with a studio are a private bathroom, kitchen, and bedroom (all compact). The additional benefits of a one-bedroom apartment is the same as the studio, with the addition of a living room and a separated kitchen and bedroom. Obviously, this can't all be fit into 150sqft, but the idea is there. A premium would be paid for the additional square footage off-campus, and this premium should be compared to the willingness to pay or accept. The benefits between a SFH and suite are very similar to one another, so when given a choice, students will likely choose to live in the suite to reap the benefits of on-campus living.

Double,onebed and double,SFH are not very comparable to one another, but were included in each regression as reference points for double,studio and singlenobath,SFH.

Monopoly rent exists if there is economic profit and deadweight loss from setting the price higher than the free-market rent. Positive excess rent is not monopoly rent because it is not the direct result of monopoly power. If there is a positive difference between excess profit made by universities that have a residency requirement and universities that don't, then that is economic profit exclusive to monopolies and is considered monopoly rent. Monopoly rent is the value on the coefficient for "Mandate?".

Table 5.3: Parsimonious Model Measuring the Annual Effects of Residency Requirements on University Profits

Lets start by looking into the results for Excess $\text{Profit}_{\text{double, studio}}$. Doubles are objectively a worse product type than a studio from a strictly real estate perspective. Double occupants have to share their room with another person and all common spaces, including bathrooms, with a large community. From (2), we know that Excess $\text{Profit}_{\text{double, studio}}$ directly results from how the university chooses to set their double room rents. In the first regression, the Excess $\text{Profit}_{\text{double, studio}}$ constant has a coefficient of close to zero, so a student that goes to a university without a residency requirement does not have to pay a premium to live on campus. Many students, including myself, believe that the benefits of a private kitchen, bedroom, and bathroom outweigh the forgone benefits of not living on-campus, which is why students repeatedly choose to live off-campus. This is another example of the statement I made in the introduction, "residency

requirements have a real impact on where students live." Even though there is probably a correct value for private kitchens, bedrooms, and bathrooms, we know from behavioral economics that students will act as if they are utility-maximizing and chose an option based on how they individually value each item.

Students not under a residency requirement can freely compare their willingness to pay for the on-campus experience to the costs and benefits of a private studio space off-campus. Let's say this student has a tough time making the choice between a double on-campus and a studio off-campus. This would mean that their willingness to accept to forego on-campus benefits is about the same as how they value the costs and benefits of a studio off-campus. When this student is under a residency requirement, they have to pay a monopoly rent of $2,300/year or $192/month for the double (significant at the .1% level). Since they would move off campus if they weren't tied to the residency requirement, this $192/month is producer surplus taken directly from the student's consumer surplus. Interestingly, because occupancy rates are so high across universities, residency requirements create a monopoly that doesn't influence the quantity of beds unused, so the deadweight loss from residency requirements is low.

There is a negative constant coefficient for Excess $Profit_{double,\ 1bed}$, so universities without a residency requirement understand their doubles cannot compete with one-bedrooms, so they charge lower free-market rents. Students would need to be willing to pay $118/month more to forgo the benefits of a double and experience a one-bedroom apartment, which is arguably low (significant at the 1% level). However, the average university with a mandate will charge $147/month more for the double than a one-bedroom apartment, despite having a far worse product type from a strictly real estate perspective (significant at the .1% level). I would move to a one-bedroom apartment off-campus in a heartbeat if I knew that I would not have to deal with my roommate, I would get more space to myself than I have ever had before, and I would have $147/month to help pay for a part of the premium that gets me more square footage.

A student who wants to move out of their double and move into an off-campus house would need to be willing to accept just $74/month to make this switch (significant at the 5% level). If a student lives in a double room because they are required to, they are paying $106 in monopoly rent when that double room is valued the same as a SFH.

The average school is overcharging students by $14 for a single with a bath compared to the same studio off-campus. A student would need to only have a willingness to accept of $14/month to move, which is reasonable for a student with a car given that the amenity value of a personal kitchen plus $14/month is likely comparable to the value of living on campus. If they live in a single with a private bathroom because their school mandates them to (far less likely, but still happens), they are paying $92/month more than their friends who live in a studio off-campus because their university has no residency requirement. Clearly, there is a few ways to interpret these coefficients.

A student would likely accept $453/month to live in a SFH over a suite (significant at the .1% level). Given that the two product types are similar, the major cost-benefit analysis here is the cost of living further away from academic buildings to the social benefits of on-campus

living (although there isn't much socializing in suite-style and apartment-style university housing). When a student has no choice, they can expect $57/month of their bill to be attributable to monopoly rent.

Table 5.4: Measuring the Annual Effects of Residency Requirements on University Profits with Supply and Demand Controls

In this set of regressions, we control for supply and demand and separate the mandate into binary and non-binary variables to see the impact of longer-term mandates.

Compared to the first regression, the results for the second are numerically similar except for the constant coefficient for Excess $\text{Profit}_{\text{double, 1bed}}$. This coefficient lost its significance, as many others did, and became positive. When defining rent as a function of the demand on-campus and supply off-campus, the average school without a residency requirement will charge a positive premium for doubles over one-bedrooms. The student no longer has to be willing to pay to live in a one-bedroom off-campus, but now has to be willing to accept $33/month.

The second and third models should be interpreted with caution. The "Years of Mandate" variable is not the number of years of the mandate over one, but the exact number of years the mandate is for, while the "Mandate?" variable is still binary, representing whether there is a mandate. The impact of a one year mandate, for example, is the sum of the "Mandate?" and "Years of Mandate" coefficients.

We find that more beds off-campus harm excess profit. In other words, schools in markets with more inventory within a one mile radius will not be able to charge as much as schools in markets with less off-campus inventory. For every additional 1,000 beds that its market has, a university will charge $53/month less for their doubles when the doubles are valued as studios and $98/month less when their doubles are valued as one-bedroom apartments. This impact is significant at the .1% level and follows the law of supply.

The new supply variables which are significant have a stronger negative effect than existing supply. For every 1,000 units under construction in its market, a university will charge $80/month less for their doubles when the doubles are valued the same as studios (significant at the 5% level), $105/month less for their doubles when the doubles are valued the same as one-bedroom apartments (significant at the .1% level), and $89/month less for their singles with bathrooms when they are valued the same as studios (significant at the 5% level).

On-campus demand is an interesting variable because the number of beds on campus is a university decision. The university's own supply decision can be used to raise rents for students who have no say in the supply decision. I doubt universities are deliberately not constructing new housing to keep their rents higher, but that is one interpretation of the demand coefficient. Regardless of residency requirements, for every 1,000 students that go unhoused, schools will raise rents for housed students by $4 to $37 per month.

New demand is a variable representing anticipated growth in demand. Once new students arrive, they become part of the demand bucket. This variable was predicted to have a positive coefficient but it does not, likely because this demand has not actualized yet.

Table 5.5: Measuring the Annual Effects of Residency Requirements on University Profits with Supply, Demand, and Public Status as Controls

Moving on to the third regression, we see that public control of an institution will increase excess profit for every *c,f* except Excess $\text{Profit}_{\text{singlewithbath,studio}}$. I hypothesized that private universities would charge more than public universities considering they charge higher tuition and fees also, but this reasoning must go in the other direction. Because private universities can get their revenue from tuition more so than public universities (Table 5.2 shows that the correlation between Public and Tuition as a Percentage of Core Revenue is -.18), public universities may be raising their housing rates to bring in the needed revenue to stay competitive to private universities.

The "Public?" coefficient can be defined as the additional excess rent that a public school charges over a private school, on top of the excess the two of them already charge.

An outlying but statistically significant coefficient is the "Public?" coefficient on Excess $\text{Profit}_{\text{double,1bed}}$. The constant coefficient changed signs from the second regression, and the public coefficient is unusually high, but is significant at the 1% level. Public universities will charge $221/month more for their double rooms than one-bedroom apartments of the same square footage and amenities. If the public school has a one year residency requirement, they will charge $273/month in monopoly rent for the same substitute.

Because suites and SFHs are similar, the coefficient on the constant must be at least the student's willingness to accept to forgo on-campus benefits. Valuing suites the same way as SFHs consistently yields the highest excess rents pre-mandate. The excess rent ranges from $402 to $453 per month and is always significant at the .1% level, which many students would accept.

The adjusted R^2 values are low for every regression. The rent pricing model had high R^2 values, which were one-half of the inputs for the $\text{ExcessProfit}_{c,f}$ equation. The variables I chose may not be the variables that best explain the fit of $\text{ExcessProfit}_{c,f}$, but creating a good fit model was not the primary goal of Part 5. My goal was to create a simple model to see how the mandate independent variable impacts $\text{ExcessProfit}_{c,f}$ in a few different situations. The most important takeaway from these regression results is that the coefficients for "Mandate?" and "Years of Mandate" are always positive, confirming that there are monopoly rents that increase with the length of the monopoly.

Part 6: Case Study for University of Rochester and University of Wisconsin - Madison

A case study is prepared for University of Rochester (UR) and University of Wisconsin - Madison (UWM) to compare two specific cases of monopoly rent and their relation to school

budgets and endowments. These two schools were selected for comparison because they have average fitted profits in close range of one another, but they have different university-level characteristics. UR has a two year residency requirement while UWM has no residency requirement. UWM is a large public university with about 10,000 beds on campus while UR is a smaller and private university with about 5,600 beds on campus. They have endowments in close range of one another, but UR has a greater endowment per student.

Table 6.1: Summary Statistics for University of Rochester and University of Wisconsin - Madison

	University of Rochester	University of Wisconsin - Madison
ExcessProfit_double,studio	$8,374	$3,911
ExcessProfit_double,1bed	$7,972	$2,607
ExcessProfit_double,SFH	$7,274	$3,151
ExcessProfit_singleprivatebath,studio	$6,993	$2,743
Excess Profit_singlesharedbath,SFH	$10,146	$4,351
mandate?	1	0
mandate_years	2	0
acceptance_rate	35	57
sat	1,510	1,460
tution_thousands	56	38
endowment_perstudent	193.77	83.45
usnews	34	42
studiorent	$866	$906
onebedrent	$1,030	$1,209
sfhrent	$572	$618
mhi	56.4	89.6
saleprice_unit	94.5	150
FittedRentIncome(c,studio)_residuals	$6,296	$7,156
FittedRentIncome(c,1bed)_residuals	$6,697	$8,459
FittedRentIncome(c,SFH)_residuals	$7,395	$7,916
RentIncome(double,u)	$14,669	$11,067
RentIncome(single_sharedbath,u)	$17,541	$12,267
RentIncome(single_privatebath,u)	$15,955	$11,867

RentIncome(studio,m)_residuals	$10,508	$10,815
RentIncome(1bed,u)_residuals	$12,526	$14,557
RentIncome(SFH,u)_residuals	$15,426	$18,351
On-CampusProfit(double,u)	$8,679	$4,413
On-CampusProfit(single_sharedbath,u)	$11,551	$5,613
On-CampusProfit(single_privatebath,u)	$9,964	$5,213
FittedProfit(c,studio)	$305	$502
FittedProfit(c,1bed)	$707	$1,806
FittedProfit(c,SFH)	$1,405	$1,262
Off-CampusProfit(studio,m)_residuals	$2,971	$2,470
Off-CampusProfit(1bed,m)_residuals	$4,989	$6,211
Off-CampusProfit(SFH,m)_residuals	-$1,340	-$1,963
Endowment (billions)	$3.19	$4
Number of Beds	5,600	10,000
Auxiliary Revenue (2020) (millions)	$95.8	$528.5
Total Budget (billions)	$4.8	$6.56
Auxiliary Revenue as a % of Budget	2%	8%
Average Annual Rent Income	$16,055	$11,734
Total Annual Rent Income	$89,908,000	$104,089,357
Total Annual Rent Income as a % of Annual Budget	1.87%	1.59%
Average Annual Excess Profit	$8,151	$3,353
Total Excess Annual Profit	$45,645,600	$33,526,000
Total Excess Annual Profit as a % of Endowment	1.43%	.84%
Total Excess Annual Profit as a % of Annual Budget	.95%	.51%

Even though off-campus apartments and SFH units cost more near UWM than UR, and fitted rent is higher at UWM than UR, UR makes much higher excess profit. UR has 2.43x more excess profit than UWM, when UWM has an average fitted profit of 1.48x more than UR. The residency requirement is most likely the reason that UR charges, on average, $4,321 more than UWM, in what is explained in this paper as monopoly rent.

There may be a combination of characteristics that could contribute to the level of excess rent charged. The two schools have different characteristics other than one having a residency requirement and the other one not. As discussed, all characteristics were not regressed because the result would not be generalizable to all universities and there was multicollinearity between variables. Public control of a university was shown to have a rent-increasing effect, but this effect is not strong enough at UWM to bring their express profit close to UR's.

If public control is not the explanatory variable, we can look if higher excess profits are related to how "good" the school is. UR is only marginally better than UWM in terms of acceptance rate, SAT scores, and rank. Rank is endogenous and captures a large group of variables, but UR only has a rank of 8 points more than UWM, which is so marginal that it cannot explain the large difference in excess profits. Indeed, rank is shown to have a weak and not a strictly one-way correlation with the five measures of excess profits in Table 5.2.

Stepping back, excess annual profits make up between 84 to 143 basis points of the total endowment every year for thse universities. Monopoly rent at UR of $4,321 generates 59 more basis points to UR's endowment annually over UWM's. If the results of this case study are generalized to all universities, it could be said that the average university relies on excess profits to keep their endowments healthy, and universities with residency requirements rely on excess profits even more heavily so they can achieve an annual 1%+ endowment lift. Similarly, excess annual profit makes up between 51 to 95 basis points of the budget for these two universities. Monopoly rent at UR generates 44 more basis points to budget over UWM.There is clearly a lucrative monetary incentive to universities for taking advantage of the housing monopoly power they created through their residency requirement.

Part 7: Conclusion

This paper has determined that schools with residency requirements will profit more than schools without a residency requirement. We construct an achievable free-market rent for on-campus housing by using a pricing model with close substitutes as the dependent variables. We find that a student would need to be willing to accept a payment of $453/month to move out of their suite and into a single-family home. The monopoly rent charged by universities for doubles is $192/month over studios of the same size. A case study for University of Rochester and University of Wisonsin - Madison is prepared to show that universities rely on monopoly rents to keept their endowments and budgets healthy.

Excess profit follows the simple formula Excess $\text{Profit}_{c,f}$ = On-Campus $\text{Profit}_{c,u}$ - Fitted $\text{Profit}_{c,m}$, which can be simplified to Excess $\text{Profit}_{c,f}$ = Rent $\text{Income}_{c,u}$ - (Fitted Rent $\text{Income}_{c,f}$ + $e_{f,}$). This removed the relevance for a lot of the constructed dataset, but an alternative set of regressions is provided in the appendix that shows whether there is a monopoly effect for how well the excess profit outperforms off-campus profit. The simplified formula shows that any increase in on-campus rent will directly increase excess profit, which allow the regression results to be interpreted on a monthly rent basis.

There's a lot of data that went into this study, so naturally there are things that could have been improved. First, an updated pricing model could be created and applied to this study. The rent pricing model in this study has a few independent variables that were either not significant or had a sign inconsistent with previous literature. I also made assumptions along the way, such as the cost of housing an RA being the same as market concessions, which could have been handled differently. Debt service was generalized from apartments onto SFHs, which are financed in separate ways. Even though the debt service ended up not being part of the study directly, it impacts the regression in the appendix. For the EMMA dataset, the year of issuance could have been higher to capture current market coupon rates.

A different approach to this study altogether would be creating a smaller sample of universities and finding in-depth information about them and their substitutes. I assumed that all on-campus housing provides the same amenities, and further research into a small pool of universities could confirm or deny this. How many students share the common spaces in a suite could be identified and controlled for in a small study. Also, vintage effects were assumed away but could have been included. The vintages of university-owned housing is sparsely available on Costar, but is available for apartments and SFHs. Vintage was assumed away in alignment with the study. On-campus housing is likely older than off-campus options, so controlling for this variable in the rent pricing model would only increase excess rents.

A study into the value of an RA could be compared against the excess rent that the average university is found to be charging. This study should net off-campus rents to make them post-concessions. In a world without on-campus housing, private companies would construct student housing off-campus, and the same "intellectual and social growth" that is marketed as occurring on-campus would occur in these complexes. Students would have to build communities themselves, and maybe not having an RA would ironically alleviate some of the pressure to do so. If RAs are a justification for residency requirements, then the cost of providing free housing for one RA has a huge return on investment when it means all their residents have to pay monopoly rent.

I've scattered my recommendations for future research throughout the paper, but there's a few other uses for this dataset that I want to highlight. Further study could look into the wealth of the students in each school to see how equitable the distribution of excess rents across universities is. I would have included this data had I found it. Another study could look into excess rents compared to endowment sizes through a process similar to the case study. The outcome of such study would be the average amount of basis points that monopoly rents lift endowments by. This study can also be replicated in other countries to see how monopoly rents change with GDP and national opinion towards monopolistic behavior. Lastly, this study could be replicated for meal plans, which are commonly required when living on-campus.

References

Bergeron, P. (2021). *Harrison Street sells nearly $2B in Student Housing Assets*. GlobeSt.

de Araujo, P., & Murray, J. (2010). Estimating the Effects of Dormitory Living on Student Performance. *Economics Bulletin*, 30(1), 866–878.

Des Rosiers, F., & Theriault, M. (1996). Rental Amenities and the Stability of Hedonic Prices: A Comparative Analysis of Five Market Segments. *Journal of Real Estate Research,* 12(1), 17–36.

Dinkelspiel, F. (2022). *UC Berkeley must slash new enrollment by a third unless High Court intervenes.* Berkeleyside.

Dorsey, D. (2022). *Google invests $3.5B in CA projects including plan to revamp downtown San Jose.* ABC7 .

Duke-Williams, O. (2009). The Geographies of Student Migration in the UK. *Environment and Planning A: Economy and Space*, 41(8), 1826–1848.

Frame, D. E. (2008). Regional Migration and House Price Appreciation . *International Real Estate Review*, *11*(1), 96–112.

Frew, J. R., Jud, G. D., & Winkler, D. T. (1990). Atypicalities and Apartment Rent Concessions. *The Journal of Real Estate Research*, 5(2), 195–201.

Garmendia, M., Coronado, J. M., & Ureña, J. M. (2012). University Students Sharing Flats: When Studentification Becomes Vertical. *Urban Studies*, 49(12), 2651–2668.

Gilderbloom, J. I., & Appelbaum, R. P. (1987). Toward a Sociology of Rent: Are Rental Housing Markets Competitive? *Social Problems*, 34(3), 261–276.

Guntermann, K. L., & Norrbin, S. (1987). Explaining the Variability of Apartment Rents. *American Real Estate and Urban Economics Association Journal*, 15(4), 321–340.

He, S. (2015). Consuming urban living in ‘villages in the city’: Studentification in Guangzhou, China. *Urban Studies*, 52(15), 2849–2873.

Hubbard, P. (2009). Geographies of Studentification and Purpose-Built Student Accommodation: Leading Separate Lives? *Environment and Planning A: Economy and Space*, 41(8), 1903–1923.

Kashian, R., & Rockwell, S. J. (2013). Town and Gown: The Negative Externality of a University on Housing Prices. *Journal of Real Estate Practice and Education*, 16(1), 1–12.

Kashian, R., Tittle, R., & Cliff, S. (2020). The Impact of Density Rezoning in a Small College Town. *Journal of Real Estate Finance and Economic*s, 61(2), 275–287.

Khiew, D. N. C., & Lee, C. G. (2019). Floor-Level Premiums in Private Housing: The Case of Condominiums in Singapore. *Applied Economics Letters,* 26(6), 436–439.

Kim, T., Lee, D., & Tran, D. (2014). The Effect of the Presence of Educational Sectors on Housing Prices: The Case of California. *International Research Journal of Applied Finance,* 5(3), 277–280.

Lee, J. (2019). The Local Economic Impact of a Large Research University: Evidence from UC Merced. *Economic Inquiry,* 57(1), 316–332.

Li, R. (2021). *Facebook parent meta signs biggest U.S. office lease of 2021 in Sunnyvale, huge expansion in Burlingame*. San Francisco Chronicle.

Lim, D. (2022). *Blackstone adds to bet on student housing with $13 billion deal*. Yahoo! Finance.

Malet Calvo, D. (2018). Understanding international students beyond studentification: A new class of transnational urban consumers. The example of Erasmus students in Lisbon (Portugal). *Urban Studies,* 55(10), 2142–2158.

Malpezzi, S., Ozanne, L., & Thibodeau, T. G. (1987). Microeconomic Estimates of Housing Depreciation. *Land Economics*, 63(4), 372–385.

Marks, D. (1984). The Effect of Rent Control on the Price of Rental Housing: An Hedonic Approach. *Land Economics*, 60(1), 81–94.

Mulhearn, C., & Franco, M. (2018). If you build it will they come? The boom in purpose-built student accommodation in central Liverpool: Destudentification, studentification and the future of the city. *Local Economy*, 33(5), 477–495.

Ogur, J. D. (1973). Higher Education and Housing: The Impact of Colleges and Universities on Local Rental Housing Markets. *American Journal of Economics and Sociology*, 32(4), 387–394.

Park, D.-Y. (2009). Determinants of Market Performance for Local Rental Housing Markets: Theory and Evidence [Ph.D., Purdue University].

Pommeranz, C., & Steininger, B. I. (2021). What Drives the Premium for Energy-Efficient Apartments--Green Awareness or Purchasing Power? *Journal of Real Estate Finance and Economics,* 62(2), 220–241.

Rosen, K. T, & Smith, L. B. (1982). The Price Adjustment Process for Rental Housing and the Natural Vacancy Rate. UC Berkeley: Fisher Center for Real Estate and Urban Economics.

Shilling, J. D., Sirmans, C. F., & Corgel, J. B. (1987). Price Adjustment Process for Rental Office Space. *Journal of Urban Economics*, 22(1), 90–100.

Sirmans, G. S., MacDonald, L., Macpherson, D. A., & Zietz, E. N. (2006). The Value of Housing Characteristics: A Meta Analysis. *Journal of Real Estate Finance and Economics*, 33(3), 215–240.

Sirmans, G. S., Sirmans, C. F., & Benjamin, J. D. (1989). Determining Apartment Rent: The Value of Amenities, Services and External Factors. *The Journal of Real Estate Research,* 4(2), 33–43.

Sirmans, G. S., Sirmans, C. F., & Benjamin, J. D. (1990). Examining the Variability of Apartment Rent. *Real Estate Appraiser and Analyst*, Vol. 56, No. 2, pp. 43–48.

Sirmans, G. S., Sirmans, C. F., & Benjamin, J. D. (1990). Rental Concessions and Property Values. *The Journal of Real Estate Research*, 5(1), 141–151.

Smith, C. A., & Kroll, M. J. (1989). Utility Theory and Rent Optimization: Utilizing Cluster Analysis to Segment Rental Markets. The Journal of Real Estate Research, 4(1), 61–71.
Smith, D. (2005). Patterns and processes of 'studentification' in Leeds. *The Regional Review,* 12, 14-16.

UK student accommodation report: United Kingdom. Cushman & Wakefield. (2020).

Waddell, P., Berry, B. J. L., & Hoch, I. (1993). Residential Property Values in a Multinodal Urban Area: New Evidence on the Implicit Price of Location. *Journal of Real Estate Finance and Economics*, 7(2), 117–141.

Yang, Fan & Liu, Hongyu. (2014). Measurement and Impact of the Real Estate Developers' Monopoly Power: Evidence from the Major Cities in China. Proceedings of the 18th International Symposium on Advancement of Construction Management and Real Estate.

Appendix

Appendix 1: Parsimonious Model Measuring the Annual Effects of Residency Requirements on University Profits using Excess $Profit_{c,f}$ = On-Campus $Profit_{c,u}$ - Fitted $Profit_{c,m}$ - Off-Campus $Profit_{f,m}$

	Excess Profit: Double, Studio	Excess Profit: Double, 1 Bed	Excess Profit: Double, SFH	Excess Profit: Single w Bath, Studio	Excess Profit: Single w/o Bath, SFH
Constant	-6076.2***	-10436.9***	1379.0*	-5624.0***	5839.4***
	(875.8)	(974.2)	(690.1)	(927.6)	(922.9)
Mandate?	3215.5**	5217.8***	1193.9	1715.8	518.5
	(1184.6)	(1299.2)	(923.6)	(1249.6)	(1210.1)
N	258	297	283	245	196
Adj. R^2	0.024	0.049	0.002	0.004	-0.004

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 2: Measuring the Annual Effects of Residency Requirements on University Profits using Excess $Profit_{c,f}$ = On-Campus $Profit_{c,u}$ - Fitted $Profit_{c,m}$ - Off-Campus $Profit_{f,m}$ with Supply and Demand Controls

	Excess Profit: Double, Studio	Excess Profit: Double, 1 Bed	Excess Profit: Double, SFH	Excess Profit: Single w Bath, Studio	Excess Profit: Single w/o Bath, SFH
Constant	-4308.0***	-6975.7***	1785.1	-4688.3***	5781.7***
	(1205.3)	(1188.0)	(1023.4)	(1368.1)	(1429.4)
Mandate?	2059.1	4665.4*	267.6	727.6	756.0
	(1899.7)	(1856.7)	(1603.9)	(2094.0)	(2081.7)
Years of Mandate	291.8	-602.1	825.7	469.7	123.0
	(1037.6)	(997.2)	(875.1)	(1150.4)	(1118.2)
Supply	-0.113***	-0.194***	-0.146	-0.0875	-0.159
	(0.0278)	(0.0291)	(0.0880)	(0.0462)	(0.101)
New Supply	-2.325**	-3.417***	-0.194	-2.215*	-0.331
	(0.738)	(0.766)	(0.817)	(0.886)	(0.966)
Demand	0.0330	0.00907	0.00325	0.0351	0.0458

	(0.0422)	(0.0419)	(0.0356)	(0.0469)	(0.0454)
New Demand	-2.232	-1.366	-1.451	-2.690	-2.939
	(2.146)	(1.840)	(1.547)	(2.370)	(2.134)
N	246	282	270	233	186
Adj. R2	0.180	0.339	0.018	0.087	0.009

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 3: Measuring the Annual Effects of Residency Requirements on University Profits using Excess $Profit_{c,f}$ = On-Campus $Profit_{c,u}$ - Fitted $Profit_{c,m}$ - Off-Campus $Profit_{f,m}$ with Supply, Demand, and Public Status as Controls

	Excess Profit: Double, Studio	Excess Profit: Double, 1 Bed	Excess Profit: Double, SFH	Excess Profit: Single w Bath, Studio	Excess Profit: Single w/o Bath, SFH
Constant	-5689.3**	-12203.3***	791.7	-4001.3	4128.1
	(1734.7)	(1682.3)	(1540.0)	(2073.9)	(2131.6)
Mandate?	1723.6	3486.2	-7.650	846.1	424.2
	(1924.8)	(1820.2)	(1643.1)	(2119.4)	(2121.6)
Years of Mandate	695.2	740.7	1090.6	299.7	540.0
	(1096.2)	(1012.9)	(935.6)	(1217.8)	(1195.3)
Supply	-0.107***	-0.173***	-0.129	-0.0939	-0.135
	(0.0283)	(0.0286)	(0.0903)	(0.0487)	(0.104)
New Supply	-2.181**	-2.849***	-0.182	-2.239*	-0.306
	(0.750)	(0.754)	(0.821)	(0.891)	(0.969)
Demand	0.0227	-0.0292	-0.00296	0.0384	0.0385
	(0.0432)	(0.0416)	(0.0368)	(0.0478)	(0.0460)
New Demand	-2.220	-0.740	-1.353	-2.684	-2.931
	(2.149)	(2.027)	(1.771)	(2.380)	(2.139)
Public?	1717.8	6449.0***	1165.6	-782.9	1855.3
	(1533.2)	(1475.5)	(1341.9)	(1767.4)	(1757.5)
N	245	280	268	232	185
Adj. R^2	0.181	0.382	0.016	0.083	0.010

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$