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9B17B003

REVENUE MAXIMIZATION: APARTMENT RENTAL UNITS

Karen Shastri and Steven Onaitis wrote this exercise solely to provide material for class discussion. The authors do not intend to illustrate either effective or ineffective handling of a managerial situation. The authors may have disguised certain names and other identifying information to protect confidentiality.

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“It’s the combination of rent and occupancy which produces revenue, so we are maximizing that mix,” stated David Romano, vice-president of pricing and revenue management for Equity Residential.[[1]](#footnote-1) He added that a centralized pricing software system determined the appropriate rent for apartments using a revenue maximizer for given occupancy levels. This tool provided an opportunity for a more objective budget because the number of apartments that rented at the various prices would be based on a model’s forecast. That forecast resulted from identifying the constraint as the number of rooms available, and setting the apartment rental fees based on market conditions instead of simply allowing apartment managers to set prices at arbitrary levels. An apartment manager and his team wanted to determine optimal decisions in a particular rental setting: Pittsburgh, Pennsylvania.

PITTSBURGH APARTMENT RENTALS FOR STUDENTS

The U.S. city of Pittsburgh was atypical: out of a population that totalled approximately 306,000 people, about 65,600 were students at universities or trade and technical schools. Pittsburgh had six major universities, all within seven miles (11.27 kilometres) of each other. This created a notable demand for student apartments in Pittsburgh, which served as an indicator of the minimum number of rental units required in the city.

Pittsburgh Universities

Starting at the northeast corner of the city was Chatham University (Chatham). Chatham had a student body population of 2,224. The school was widely known as a liberal arts college, but was growing its reputation as a business school.

Moving west across Pittsburgh, the next school on the map was Carnegie Mellon University (CMU) with a total of 12,891 students. CMU was best known for its School of Computer Science, one of the best engineering programs in the country, and a well-recognized drama program. The university had been consistently rated as one of the top 50 U.S. universities overall.

The next university, to the west of CMU, was the University of Pittsburgh (Pitt), with a population of 28,649 students. Pitt was recognized for its medical, philosophy, and business programs. In addition, the university was known for athletics—namely, its basketball and football programs.

Slightly southwest of Pitt was Carlow University (Carlow). Carlow had 2,768 students, and while its core offering was liberal arts, it had recently expanded into business and accounting degrees as well.

Still further west was Duquesne University (Duquesne), with 9,956 graduate and undergraduate students. Duquesne was one of the first Catholic universities founded in the state of Pennsylvania, and had prestigious programs in law and business.

The final university to consider was Point Park University (Point Park), with an enrolment of 3,737 students. Point Park had increased its enrolment by approximately 10 per cent from 2011 to 2016. The school was known for its nursing program, as well as for its business and liberal arts programs.

In addition to these six major universities, Pittsburgh also had the following trade and technical schools: UPMC Shadyside School of Nursing, Bidwell Training Center, ITT Technical Institute, Triangle Tech, Rosedale Technical College, Vet Tech Institute, Brightwood Career Institute, Everest College, and Duff’s Business Institute. These examples alone accounted for 5,409 students.

On average, 43 per cent of students lived in campus housing in Pittsburgh, meaning that 57 per cent—or at least 37,411 students—needed to find some form of off-campus housing. This number did not include the number of recent graduates and families also looking for rental properties.

In order to determine the optimal rent to charge, according to Romano, results were generated by an optimization model, Rainmaker LRO.[[2]](#footnote-2) The model took into account the demand as well as comparable market rates where rents were based on the region’s supply and demand for apartments. If a specific apartment was not rented within a few weeks, a rental manager would normally be reluctant to reduce the rate because the set price was a personal decision. But, a rent-maximizing software model was capable of creating operating budgets and determining optimal apartment rates.

THE MODEL AND RENTAL BACKGROUND

As of 2015, occupancy rates for apartments were more stable than they had been in 2000, prior to the use of revenue maximizing software by rental companies. Brock MacLean of Homes.com, a website with sales and rentals for landlords, stated that the fluctuations in apartment rentals declined with the use of rental revenue maximizing software.[[3]](#footnote-3) Further, occupancy rates stabilized at 95 per cent, according to Bryan Pierce, from the Holland Partner Group, a housing management company. Previously, a typical occupancy rate was between 92 and 97 per cent across the country, according to Pierce. This stability facilitated the budgeting process and other management decisions that were part of the rental company’s operations.[[4]](#footnote-4)

Software such as Yield Star Price Optimizer (from Real Page) and Rainmaker LRO (Rainmaker) were created specifically to determine optimal price configurations. For example, Shea Property, a division of J. F. Shea, Co. Inc., located primarily in California, successfully charged US$3,000[[5]](#footnote-5) for a one-month rental of a unit that typically would rent for $1,200 per month.[[6]](#footnote-6) For many rental companies, switching from the earlier model of rental agreements to revenue maximizing software resulted in revenue increases. The software cost to a rental company was based on an initial setup fee, a monthly fixed fee, and the number of units, working out to approximately $2 per unit per month for each complex, according to Steve Gilmore of Shea Properties.[[7]](#footnote-7)

In addition to the software systems already mentioned, standard software was available to solve optimizing problems for apartment rents. Excel’s Solver,[[8]](#footnote-8) for example, was a tool used for this purpose, as well as for other management decisions that focused on optimization.

Homes.com identified its optimal revenue based on calculations for an objective function, and the constraints associated with its objective function. The resulting outcome for Homes.com was a determination of the optimal number of units that could be rented for each apartment during various time periods. Apartment management firms were interested in determining the ideal mix of rental types (yearly, semesterly, or monthly) to optimize their revenues.

THE CASE FOR MANAGING APARTMENT RENTALS AND BUDGETS

An apartment manager needed to identify the best possible mix of units to maximize rental revenues from apartment units in Pittsburgh, where many of the units were rented by students. The manager had the necessary information on yearly, semesterly, and monthly rents, as well as the number of apartments that rented at these rates (see Exhibit 1).

Given that only 200 units were available, if 120 units were rented for the entire year, 80 were available to rent by semester. If 50 of the available 80 units were rented for the entire fall semester, 30 units remained to rent monthly for each month in the fall term. Likewise, the same assumptions applied for the spring and summer terms.

The number of rentals was lower in the summer than it was for the other terms, but this was not a surprise given that most universities had fewer students on campus in the summer, causing demand and occupancy rates to also be lower. The units available on a monthly basis were priced at an amount greater than the rent for an entire semester.

The goal was to determine the optimal number of apartments rented for each time period. A manager could determine the proper allocation of units for this problem using Excel Solver (found on Excel’s Data Toolbar or in the menu under **Tools > Solver**).

First, the objective to maximize needed to be defined—in this case, the total rent revenue from all of the rental time periods:

Where,

NRY = Number of rooms rented for the year

NRS = Number of rooms rented for the semester

NRM = Number of rooms rented for the month

The rates were based on the appropriate amount for each rental type.

Second, a manager had to specify the constraints for the number of units to be rented for each year, semester, and month (see Exhibit 1).

By inputting the objective function and these constraints into the Excel Solver model, a manager arrived at a solution that determined the number of units to rent in each category to optimize revenues. However, input guesses were required for the number of units in each cell, along with the appropriate rent for each time period, to give Excel Solver a starting point for making initial calculations. The process continued with reiterations until the maximization problem was solved. Having completed this process for the current inputs and constraints (see Exhibit 1), a manager next determined the optimal configuration (see Exhibit 2).

The total number of units for each time period (entire year, and fall, spring, and summer semesters) did not exceed 200—the maximum number of units available for rent. The solution (see Exhibit 3) indicated that the optimal revenue generation policy was to rent 110 units yearly; 50 units for each of the fall and spring terms; 40 units for the entire summer term; and 40 units on a monthly basis during the fall and spring terms, and 50 during the summer term. The total amount of revenue based on this scenario would be $310,500.

These results provided a starting point for management in terms of signing lease agreements, and budgeting revenues, directly related costs, and, to a large extent, indirect costs.

USING THE OPTIMIZING (EXCEL SOLVER ADD-In) MODEL AS A MANAGEMENT TOOL: A CHANGE IN MANAGEMENT DECISION

After studying the changes in supply and demand for the local market, the manager concluded that more units than initially assumed would be rented yearly as part of the sales plan for the upcoming year. The adjusted number of potential rentals available for each of the scenarios was 150 for the yearly rental (an increase of 30 units), 50 for each of the entire fall and spring semesters, 35 for the entire summer semester, 40 for monthly rentals in the fall and spring, and 50 for the summer monthly rentals. Even though the demand each semester appeared to exceed the number of available units (e.g., in the fall semester, the demand was 150 yearly rooms, 50 semester rooms, and 40 rooms by the month, or 240 total rooms), the Solver’s constraint limited the total number of units rented each semester to only 200. Solver maximized total revenue by manipulating the number of each type of unit rental, with the limit being 200 units per semester.

Further, the manager assumed that rent revenue earned for certain time periods changed under this new scenario, requiring information for this apartment complex optimization problem to be updated based on the changes in supply and demand in the local market (see Exhibit 4). As noted, the rent for the yearly agreement increased from $1,300 to $1,375; the semesterly rent decreased from $750 to $700 for the fall and spring terms; and the rent for the summer semester did not change. The monthly rent did not change for the fall and spring semesters, but decreased to $500 (from $550) in the summer. This information was based on data for the local rental market.

Based on this model, the manager prepared revised plans for lease contracts and budgets for the next fiscal year. In order to completely evaluate the results for the next year, projections for operating expenses for the rental properties were estimated (see Exhibit 5). One of the manager’s goals was to use the data to prepare a budgeted income statement for the apartment management, which required a revenue schedule derived by Excel Solver, followed by an income statement.

Exhibit 1: Inputs and Constraints for pittsburgh rentals, 2016

|  |  |
| --- | --- |
| **Rental Term** | **Constraint** |
| For the year | ≥ 0 |
| For the semester | ≥ 0 |
| For the month | ≥ 0 |
| For the year | ≤ units available for yearly rental |
| For the semester | ≤ units available for semesterly rental |
| For the month | ≤ units available for monthly rental |
| Units rented by the year + units rented semesterly + units rented monthly | ≤ total units available rented each semester |

Source: Created by the authors, based on Matt Hudgins, “When Apartment Rents Climb, Landlords Can Say ‘The Computer Did It,’” *New York Times*, November 29, 2011, accessed September 10, 2014, www.nytimes.com/2011/11/30/realestate/commercial

/lanlords-use-computers-to-arrive-at-the-right-rental-fees.html.

Exhibit 2: Optimal Configuration for PITTSBURGH RENTALS, 2016

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Units Available** | **Rent (in US$)** | **Rent is for the** |
| Yearly | 120 | 1,300 | Entire year |
| Fall semester | 60 | 600 | Fall semester |
| Spring semester | 60 | 600 | Spring semester |
| Summer semester | 40 | 500 | Summer semester |
| Fall term, by month | 40 | 450 | Month in the fall semester |
| Spring term, by month | 40 | 450 | Month in the spring semester |
| Summer term, by month | 50 | 700 | Month in the summer semester |
| Maximum number of units available per semester | 200 |  |  |

Source: Created by the authors, based on Matt Hudgins, “When Apartment Rents Climb, Landlords Can Say ‘The Computer Did It,’” *New York Times*, November 29, 2011, accessed September 10, 2014, www.nytimes.com/2011/11/30/realestate/commercial

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Exhibit 3: Optimal Revenue Generation for PITTSBURGH RENTALS, 2016

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Number of Units to Rent** | **Rent**  **(in US$)** | **Total Revenue (in US$)** |
| Yearly | 110 | 1,300 | 143,000 |
| Fall term | 50 | 600 | 30,000 |
| Spring term | 50 | 600 | 30,000 |
| Summer term | 40 | 500 | 20,000 |
| Fall term, by month | 40 | 750 | 30,000 |
| Spring term, by month | 40 | 750 | 30,000 |
| Summer term, by month | 50 | 550 | 27,500 |
| Total revenue |  |  | 310,500 |

Source: Created by the authors, based on Matt Hudgins, “When Apartment Rents Climb, Landlords Can Say ‘The Computer Did It,’” *New York Times*, November 29, 2011, accessed September 10, 2014, www.nytimes.com/2011/11/30/realestate/commercial

/lanlords-use-computers-to-arrive-at-the-right-rental-fees.html.

Exhibit 4: Revised Figures for Optimal Revenue Generation for PITTSBURGH RENTALs, 2016

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Number of Units Possibly Available** | **Rent (in US$)** | **Rent is for the** |
| Yearly | 150 | 1,375 | Entire year |
| Fall semester | 50 | 700 | Fall semester |
| Spring semester | 50 | 700 | Spring semester |
| Summer semester | 35 | 500 | Summer semester |
| Fall term, by month | 40 | 750 | Month in the fall semester |
| Spring term, by month | 40 | 750 | Month in the spring semester |
| Summer term, by month | 55 | 500 | Month in the summer semester |
| Maximum number of units available per semester | 200 |  |  |

Source: Created by the authors, based on Matt Hudgins, “When Apartment Rents Climb, Landlords Can Say ‘The Computer Did It,’” *New York Times*, November 29, 2011, accessed September 10, 2014, www.nytimes.com/2011/11/30/realestate/commercial

/lanlords-use-computers-to-arrive-at-the-right-rental-fees.html.

Exhibit 5: Projected Operating Expenses (in US$)

|  |  |
| --- | --- |
| Property maintenance | $4,000 per month plus 20% of yearly revenue |
| Real estate taxes | $250 per unit, all units taxed |
| Property management and other fees | $50,000 yearly |
| Depreciation | 50-year life; cost of $5,000,000; 25 years old; straight-line with no salvage value |
| Other | 2.5% of yearly revenue |

Source: Created by the authors, based on Matt Hudgins, “When Apartment Rents Climb, Landlords Can Say ‘The Computer Did It,’” *New York Times*, November 29, 2011, accessed September 10, 2014, www.nytimes.com/2011/11/30/realestate/commercial

/lanlords-use-computers-to-arrive-at-the-right-rental-fees.html.

1. Matt Hudgins, “When Apartment Rents Climb, Landlords Can Say ‘The Computer Did It,’” *New York Times*, November 29, 2011, accessed September 10, 2014, www.nytimes.com/2011/11/30/realestate/commercial/landlords-use-computers-to-arrive-at-the-right-rental-fee.html. [↑](#footnote-ref-1)
2. Ibid. [↑](#footnote-ref-2)
3. Les Christie, “Priceline for Landlords May Determine Your Next Rent,” CNN Money, February 19, 2014, accessed September 10, 2014, http://money.cnn.com/2014/02/19/real\_estate/apartments-rent/index.html?iid=HP\_LN. [↑](#footnote-ref-3)
4. Ibid. [↑](#footnote-ref-4)
5. All currency amounts are in US$ unless otherwise specified. [↑](#footnote-ref-5)
6. Hudgins, op. cit. [↑](#footnote-ref-6)
7. Ibid. [↑](#footnote-ref-7)
8. For Excel 2007 and 2010 see “Load the Solver Add-In,” Microsoft Corporation, accessed February 15, 2017, https://support.office.com/en-us/article/Load-the-Solver-Add-in-612926fc-d53b-46b4-872c-e24772f078ca; For Excel 2013 and 2016 see “Load the Solver Add-In,” Microsoft Corporation, accessed February 15, 2017, https://support.office.com/en-us/article/Load-the-Solver-Add-in-ec994cd0-a396-4bf3-a5dd-feda369cef37 [↑](#footnote-ref-8)