Rent Growth Expectations and the Amazon Effect in Seattle

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Introduction:

The main goal of this project is to determine if the expansion of Amazon's offices in downtown Seattle has overinflated future rent expectations for building owners. When an office building is sold, the sale price is determined from projections of future cash flows generated from renting office space to future tenants. However, there is considerable uncertainty when projecting the future cash flows: tenants could choose to not renew a lease, economic conditions could decrease demand for office, or newer, nicer buildings could enter the market, increasing the competition for tenants. As a result of this uncertainty, owners will look at current market trends, tenant leases, and other factors to determine their willingness to pay for a new building. Since office buildings vary in their layouts, amenities, and available square footage, future landlords must weigh their expectations for future rents for their buildings based on comparable spaces ("comps") in other buildings. Amazon, a single tenant with voracious demand in a small geographic location, has skewed the market, disrupted comps, and caused building owners to overestimate their cash flows and an overinflated price for office buildings in the Seattle market.

Over the past ten years, rapid corporate growth required Amazon to rent a substantial amount of office space in a short period of time. In 2007, Amazon leased space in only five buildings outside of Seattle's city center (Pyrne 2007). As of 2018, Amazon's offices are spread across 45 buildings in downtown Seattle. In August 2017, Amazon's office space occupied 8 million square feet of premium office space totaling 19 percent of total space in the city. Compared to other tenants in Seattle; Amazon leases or owns as much office space as the next 43 companies. Over the same ten years, the rent for premium office space in Seattle has grown alongside Amazon's expansion. According to CoStar, a real estate analytics firm, the average price for premium office space in 2009 was approximately $30 per square foot. By the end of 2017, the price for premium office space had increased to approximately $45 per square foot (CoStar). The two important results of increasing office rent are that it is more expensive for tenants and more lucrative for landlords.

This project addresses two questions that relate Amazon's demand for office space to the rise in premium office rents in Seattle. First, do building owners value Amazon occupied buildings more than other buildings? Second, does the valuation of Amazon occupied buildings cause other buildings to be overpriced in the Seattle market? To answer these two questions, this project will primarily explore Smith and Smith's (2003) concept of fundamental value and Marcato and Tong's (2016) concept equilibrium vacancy. Fundamental value refers to the present value of an asset's future cash flows. Smith and Smith (2003) has used fundamental value to value residential real estate properties and I consulted their methodology to apply fundamental value to commercial real estate in Seattle. To describe market dynamics of the tenant leasing market, Marcato and Tong (2016) describe equilibrium vacancy as a combination of structural, frictional, and cyclical vacancy that influences how landlords set rents for office space (Marcato 2016). As Amazon has grown, developers and brokers have started to overprice the leases and buildings in the Seattle market, causing the purchase price of buildings to increase against their fundamental market value. From these two concepts and an understanding of a building's capitalization ("cap") rate, I derive rent growth expectations for each building in the data set. Rent growth expectations provide a proxy for determining an investor's future cash flow expectations when they purchase a building. Then, I used permutation tests to determine if Amazon occupied buildings are valued more than others and if other buildings have become overpriced in the Seattle market.

Literature Review:

The purpose of the literature review is to explore how the fundamental value of stock prices relates to real estate and how different types of vacancy affect the market dynamics of tenant leasing.

Smith and Smith’s (2003) analysis of fundamental value in real estate provides the basis for creating the rent growth expectations metric that I used to measure investor confidence in future cash flows. The work by Edelstein and Liu, Marcato and Tong, and Mourouzi-Sivatandou, gives insight for understanding the tenant leasing market and possible ways for Amazon to inflate future cash flow projections.

Fundamental Value of Real Estate:

In the residential housing market, the market price of a home is estimated using comps of similar homes. For example, a useful comp would be two houses with similar characteristics such as neighborhood quality, square footage, number of bed and baths, etc. These comps are analyzed informally by realtors to determine prices or analyzed systematically with multiple regression models and other statistical techniques. While comps can help determine if the price of a house is high or low compared to other houses, it cannot determine whether the value of the house is high or low in an absolute sense. To address this problem Smith and Smith (2003) developed a rent alternative for analyzing the fundamental value of a house (Smith 2003).

The fundamental value of an asset is designed to differentiate the price of an asset from the present value of future cash flows. For example, a stock’s market price is the agreed dollar amount where ownership of a stock transfers from seller to buyer. The buyer can make money by selling at a higher price in the future, but between now and the sell date, this investment strategy has no income. But, an investor can receive income from a stock’s dividends. The fundamental value of a stock is the present value of the cash flows from anticipated future dividends. A stock is considered overpriced when a market price is higher than the fundamental value because the income an investor receives from cash flows does not recoup what the investor paid to own the stock (Smith 2015). For a residential property, the dividend can be thought of the difference between the rent a homeowner would have to pay minus the mortgage payment on the home, property taxes, and maintenance costs. From rent data and mortgage information, it is possible to determine the fundamental value of a home. If the price is higher than the fundamental value, homeowners should rent as opposed to buying a home (Smith 2003).

In the commercial real estate market, it is more difficult to determine the difference between fundamental value and market price. Like a stock or a home, the dividend for an office building is the yearly Net Operating Income (“NOI”), which is equal to revenue minus expenses. Revenues are collected from renting out office space to tenants like Amazon and, like the residential real estate market, the commercial real estate market uses comps. Similar office buildings can suggest to an investor how much they can charge for rent today and what they may be able to charge for rent in the future. Overestimating future rent growth by misreading the local market or choosing poor comps may cause an owner to have overinflated expectations of future cash flows and overpay for an office building. Much like the housing market, rents and revenues are influenced by comps and that the commercial market may be susceptible to overpriced assets.

Ideal Tenants and Structural Vacancy:

The cash flow from an office building is different from the cash flow from a stock or a home, because the owner, as the landlord, has agency when determining their cash flow. For example, few individual stockholders can control how much a company pays in dividends. But, the owner of a building can set the rental rate for their office space. This fact is explored by Marcato and Tong’s (2016) model of search equilibrium in a commercial real estate markets. Marcato and Tong use terminology similar to the terminology of labor markets to describe vacancy in a commercial real estate market. Specifically, structural, frictional, and cyclical vacancy in a commercial real estate market mimics how economists understand structural, frictional, and cyclical unemployment in the labor market. One important similarity between tenant markets and unemployment markets is that a “lag” occurs when landlords look for new tenants while buildings are empty and when people look for new jobs while they are unemployed. Contracts are typically negotiated in advance, reducing the lag between an old tenant and a new tenant, which may cause the tenant markets sometime act differently than unemployment markets. But, defining different types of vacancy can be used to understand the dynamics of tenant markets. First, structural vacancy is caused by landlords holding office space empty for higher future rents. Next, frictional vacancy occurs when current buildings do not have the amenities to attract tenants. Finally, cyclical vacancy is created by short term fluctuations in economic or business conditions (Marcato 2016). Each of these different types of vacancy affect the landlord's rental rate decision, which drives changes in the fundamental value of a building.

Frictional and cyclical vacancy are not the main focuses for this project because Amazon's expansion cannot directly affect these types of vacancy, but the definitions are important to understand how the market functions. Frictional vacancy occurs when there is a physical mismatch between buildings on the market and what tenants want from their space. As business practices change and technologies improve, tenants demand up to date facilities. When there is no office space available to match tenant demands, those spaces become vacant until landlords can either renovate the space or build a new building. Cyclical vacancy is caused by economic factors outside the control of the landlord. Commercial real estate office is a market with inelastic supply in the short run due to the time it takes to construct new buildings (Edelstein 2012). In good economic conditions that encourage businesses to expand, building owners will need to increase rents in accordance with the limited supply of office space. While Amazon may demand more space, it cannot produce new buildings in the short run that will be able to fix the problems of frictional and cyclical vacancy.

This project is primarily concerned with structural vacancy, which occurs when the minimum price a landlord can offer exceeds the maximum willingness of a tenant to pay. This situation is an economic mismatch, where landlords artificially hold their space above market price and no deal takes place (Marcato 2016). This price inflation is a form of price discrimination, as owners attempt to capture more consumer surplus from tenants that need to expand and cannot wait to construct to new buildings. Owners will look for more profit by waiting to rent their space to an “ideal” tenant. A tenant is considered ideal if the tenant is willing to pay above market price for a space that fits their specific needs. Structual vacancy allow savvy landlords to price discriminate and collect excess cash flow, improving the value of their building when they sign a long-term lease with an ideal tenant.

However, structural vacancy also provides a possible reason for how landlords may overestimate future cash flows based on comps. In a market with an abundance of ideal tenants (e.g. Amazon), landlords and potential real estate investors may be tricked into believing that rents offered to an ideal tenant are not different from the market equilibrium rent. Economists have found that “office rents *only* gradually adjust toward their long-run equilibrium levels and that, as a result, prevailing rents *do* deviate from these *implicit* long run levels” (Mourouzi 2002). A new owner, using comps, may misinterpret a deviation for a long run equilibrium in prices, which will cause overestimated cash flow projections as markets gradually return to equilibrium. The next sections explore if owners in Seattle are making the mistake of overinflating their expectations of future cash flows.

Rent Expectations Derivation:

There is anecdotal evidence that structural vacancy exists in the Seattle. Amazon’s insatiable demand for office in the Seattle market has caused landlords to leave large chunks of space empty until Amazon or another large tenant needs to rent office space. A senior managing director for Savills Studley lamented, “Some landlords aren’t even talking to us about (leasing) full floors…they’re holding out for a full building user” (Gonzalez 2017). This type of market dynamic is indicative of structural vacancy. Amazon is an ideal tenant and their presence in Seattle is encouraging owners to believe that other ideal tenants will rent in the city, a situation that may lead to overinflated expectations. To measure the market expectations of landlords, I will derive rent growth expectations from Smith's fundamental value and a metric used in commercial real estate called the capitalization ("cap") rate.

To calculate fundamental value, we calculate the net present value of the sum of cash flows over period t. CF_i represents the cash flow in period i, g represents the growth rate of the cash flows, and R is the required rate of return of the investor.

$$Fund.Value = \sum_{i=0}^{t} \frac{CF_i(1+g)^i}{(1+R)^i}$$

While the holding period, t, is finite in practice, we can assume it to be infinite. When t is large, the cash flow added to the fundamental value is relatively small. In addition, assets in commercial real estate are typically held long term, which means that simplifying to infinite time horizon will not drastically alter the cash flow projections. If the holding period is infinite, the fundamental value equation can be simplified to the following:

$$Fund.Value = \frac{CF}{R-g}$$

This equation is used in real estate to calculate the cap rate. At the sale of commercial real estate buildings, the capitalization rate is defined as the NOI divided by the sale price.

$$Cap\ Rate = \frac{NOI}{Sale\ Price}$$

The cap rate has a few of unique properties. The first is that, ignoring any discount rate, the cap rate represents what percent of the purchase price an investor gains back each year. Second, it can be an indicator of investor cash flow expectations. Rearranging the cap rate equation, it becomes:

$$Sale\ Price = \frac{NOI}{Cap\ Rate}$$

For a building, the cash flow is the building's NOI and the sale price should therefore be equal to the fundamental value calculated by the investor at the time of purchase. Putting the cap rate and fundamental value equations together, the cap rate can be defined as the required rate of return minus the growth rate of the net operating income.

$$Cap\ Rate = R - g$$

While the data do not record the required rate of return for each investor or the exact growth rate of cash flows, calculation of the cap rate can suggest whether an investor expects their return to be generated from a growth in cash flows or from requiring a high rate of return. A high cap rate suggests that the required rate of return is much larger than the projected growth of cash flows, implying that an investor does not expect much value from a growth in cash flows. Whereas a low cap rate suggests that the required rate of return is only slightly larger than the expected growth rate, implying that an investor expects a growth in cash flows, perhaps by leasing ideal tenants above market prices, to generate most of the buildings value. Since the cash flow growth is mostly increases in rent (expenses are unlikely to fall rapidly), I will redefine g as "rent growth expectations" which will be a measure of rent expectations relative to an investor's required rate of return. This project is primarily interested in the relative rent expectations the required rate of return can be set to a single value, allowing rent expectations to be calculated by the cap rate. In reality, investors have different required rates of return and will have different rent projections based on how conservative or aggressive they want to be with their investment. However, setting the required rate of return equal across all buildings will allows the comparison of future expectations, where high future expectations may lead to overinflated sale prices.

Data:

The data for the project come from two sources: Real Capital Analytics (RCA) and CoStar. RCA is a real estate investment database that tracks real estate transactions across the United States. From

RCA, I collected the address, square footage, occupancy, and price of the building at the point of sale. RCA has transactions data dating back to 2001, but the CoStar data is limited to post 2008, so the RCA data was truncated to match.

CoStar is an information provider for real estate professionals, tracking $1.5 trillion worth of commercial real estate tracking activity with regularly updated information on over 5.3 million buildings (CoStar). The CoStar data contains office rents since 2008, containing information for the total market, as well as subdivisions of the market into different classes and submarkets. Submarkets are geographic neighborhoods, divided to more accurately measure the smaller markets within a city. Our data contain information from the submarkets with Amazon occupied buildings, as well as the neighboring submarkets. These submarkets are Lake Union, Central Business District (CBD), Belltown, Central District, and Queen Anne. CoStar also divides submarkets further into "building class." The Building Owners and Management Association International (BOMAI) defines building class as "a subjective quality rating of buildings which indicates the competitive ability of each building to attract similar types of tenants" (BOMAI 2018). Buildings are thereby subdivided into three classes, defined as follows:

- Class A: Most prestigious buildings competing for premier office users with rents above average for the area. Buildings have high quality standard finishes, state of the art systems, exceptional accessibility, and a definite market presence.
- Class B: Buildings competing for a wide range of users with rents in the average range for the area. Building finishes are fair to good for the area and systems are adequate, but the building does not compete with Class A at the same price.
- Class C: Buildings competing for tenants requiring functional space at rents below average for the area.

Although building ratings are subjective, they still provide quality information about the nature of the leasing market in each submarket. As an ideal tenant, Amazon typically rents Class A office space and most buildings bought and sold in and around the central business tend to be mostly Class A, a few Class B, and hardly any Class C. To compare Amazon buildings to the rest of the buildings in the market, I assume that most buildings are Class A and the leasing market exists at the higher rental price. To filter out some Class B and Class C properties that exist in the RCA database, I filtered out older buildings, extremely low occupancy buildings, as well as buildings that were labeled as not Class A.

After cleaning the data from RCA and Costar to include Class A properties in submarkets of interest sold since 2008, the data contain 93 total transactions. Additionally, the *Seattle Times* has reported on the addresses of all Amazon occupied buildings (Gonzalez 2017). After cross referencing the addresses to the buildings in the dataset, 17 of the buildings, all sold after 2010, in our dataset are Amazon occupied.

Cap Rate Calculation:

The last step to building the dataset was to calculate the cap rates for every sale. However, cap rates are not always reported as part of the sale. The data give the sale price, square footage, occupancy, and market rent (divided by year and submarket), from which it is possible to derive estimates of the revenue at time of sale. Regarding expenses, the Building Owners and Management Association International (BOMAI) keeps estimates for building maintenance per square foot and management fees as a percentage of revenue for buildings across the country. Lastly, property tax is recorded by the King County tax assessor and the expense is estimated to be a percentage of the revenue. The following is the equation used to calculate the NOI,

$$NOI = (1 - prop.tax.rate) \times Sq.Ft \times CoStar\ Rent \times Occ. \times (1 - Mng.Fee) - (Maint. \times Sq.Ft)$$

BOMAI estimates that the management fee is six percent of revenues with maintenance costs of two dollars a square foot per year (BOMAI 2017). Property taxes are apportioned based on the county tax assessor's valuation of the land. Although property taxes can vary from location to location, buildings in the data average approximately 10 percent of NOI, so property taxes are assumed to be 10 percent for all buildings (King County). The cap rate was then calculated by dividing the NOI by the sale price.

$$Cap\ Rate = \frac{NOI}{Sale\ Price}$$

In the interest of keeping the data set consistent, I calculated the cap rates for all buildings, whether the cap rate had been reported or not. For the required rate of return, real estate investment trusts (REITs) averaged a return between 11.1% and 12.4% a year over a 20-year period (Case 2016). For this project I took the low end of this average, setting R to equal 11%. To calculate rent expectations, g, I will subtract the cap rate from .11, completing our data by adding the estimated rent growth expectations for an investor at the point of sale.

$$g = .11 - Cap\ Rate$$

The rent growth expectations metric is the primary variable used for the analysis. Figure 2 in the appendix shows boxplots summarizing rent growth expectations for office building sales in each year. The chart suggests that negative rent growth expectations are possible. However, it is very unlikely an investor would buy a building with shrinking cash flow. The negative rent growth expectations in the data are the product of setting the required rate of return to eleven percent. The future cash flows of a building could be more uncertain than usual, forcing owners to require a substantially larger rate of return than eleven percent. In these cases, the rent growth expectations, which assume returns of eleven percent, will appear negative. However, rent growth expectations are only meant to be a relative metric to compare buildings in the Seattle market to each other, so having some expectations as negative does not alter the results.

Calculation example: Amelia

As an example, this section will analyze one of the buildings that Amazon occupies in downtown Seattle. Amazon is leasing space at a building called “Amelia” located at 501 Fairview Avenue North in the South Lake Union submarket in downtown Seattle. Amelia was sold in 2017 for a price of approximately $269 million and a calculated NOI of approximately $9.5 million. From the NOI and sales price, the cap rate is .0357, which I calculate as a rent growth expectation of .0743. Figure 1 of the appendix shows the present value of Amelia on the y-axis with rent expectations on the x-axis. The fundamental value is shown with a horizontal line and it intersects the present value curve at the calculated rent growth expectation. The purpose of this plot is to show what happens when investors misjudge rent growth. If an investor underestimates rent growth, then the present value explodes providing a lot of value to the investor. But if rent growth is overestimated, investors are set to lose a lot of money.

Analysis: Permutation Testing

With rent growth expectations, it is possible to use permutation tests analyze the two questions posed in the introduction: do building owners value Amazon occupied buildings more than other buildings and does the valuation of Amazon occupied buildings cause other buildings to be overpriced in the Seattle market. A permutation test is a statistical method using a convenient sample to complete a hypothesis test. Since the data are relatively small for each year and there are only 17 Amazon buildings, a permutation test is more advantageous than other statistical tests such as a regression. A permutation test shuffles the data with respect to a single variable, assigning that variable randomly among all observations. Then, with the new assignments, I recalculate the statistic of interest and compares it to the observed data. If the statistic using observed data is greater than 95% percent of the permutations, the observed data are statistically significant.

The first question is whether Amazon is an ideal tenant that causes buildings to be valued more than other buildings. Amazon would be an ideal tenant if the average rent expectation of Amazon buildings were greater than the average rent expectation for other buildings. In the permutation test framework, the null hypothesis is that Amazon buildings and other buildings have equal average rent expectations. To test this hypothesis, I calculated the difference between Amazon and other buildings' average rent growth expectations. Then, as the first permutation, I randomly assigned seventeen buildings as "Amazon" and recalculated the difference in means between Amazon buildings and other buildings. Over the course of 1000 permutations, I counted how often the permuted difference of means is greater than the difference of means in the observed data.

The second question asks if rent growth expectations are too high in the entire Seattle market. To answer this question, I analyzed the average rent expectations for each year. For this permutation test, I took the dataset and permuted the variable year, reassigning a different year each building was sold and calculating the average rent expectation in each permutation. Rent growth expectations are too high if the average rent growth expectations for each year in the observed data are higher than 95 percent of the permutations. To determine a possible correlated relationship, I ran this test separately on Amazon buildings and non-Amazon buildings. If there is consistent statistical significance among Amazon buildings and statistical significance in non-amazon buildings, then the overinflated prices are likely correlated. As with the first permutation test, over 1000 permutations I counted how often the permuted difference for each year was greater than the observed data.

Results:

Figures 2 and 3 of the appendix summarize the rent expectations for the entire dataset. Figure two, showing a series of boxplots grouped by year, suggest that the data are converging in recent years to a rent growth expectation between .06 and .07. There exists a large dispersion of expectations between 2007 and 2008, which can be explained by the Great Recession. There were only a few buildings sold during the beginning of the recession because few people looking to buy buildings in uncertain economic conditions. Also, due to the economic conditions of the recession buildings that were sold were either very stable in their cash flows (high rent growth expectations) or very cheap buildings with unstable cash flows (low or negative rent growth expectations). Figure 3 shows the average rent expectation in each year over time. The graph also shows that that the average rent growth expectation for Amazon is much higher than the other buildings or the total average of all buildings. In the past few years the rent growth expectations seem to be steadily rising, towards the same .06 to .07 number shown in Figure 2.

The results from the first permutation test, testing if Amazon was an ideal tenant, was statistically significant at the 95% level with a p-value of .014. This p-value means that in 1000 permutations only 14 permutations showed a greater difference between the rent expectations for Amazon buildings and the rent expectations for other buildings. These results are consistent with what is shown by Figure 2, as Amazon's rent expectations seem much higher. This result is intuitive: buildings that are Amazon occupied are more valuable. Amazon is a large, growing company that will likely keep renewing space in downtown Seattle for a long time. If an investor attracts Amazon as a tenant for their building, that building has a high chance of strong cash flows and calls for a higher valuation.

The results from the second permutation test measuring the valuation of other buildings, showed more mixed results. For Amazon, every year was statistically significant at the 95% level (see Table 1). The first permutation test established that Amazon is an ideal tenant, so their rent growth expectations should consistently be much higher in a given year. For other buildings, there does not seem to be any statistical significance at the 95% level. However, the years 2016 and 2017 were significant at the 90% level. This suggests that in the past two years, rent growth expectations seem to be unusually high. This may serve as evidence that investors are expecting more ideal tenants to enter the market, matching their rent expectations to Amazon occupied buildings.

Table 1:

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Amazon P-Values	NA	NA	NA	.002**	.000**	.006**	.045**	.038**	.000**	.000**
Non-Amazon P-Values	.966	.120	.912	.966	.286	.546	.674	.208	.097*	.074*

*significant at 10% level. **significant at 5% level

Conclusion:

To explore the changes in rent expectations among commercial real estate investors in Seattle after Amazon's expansion, this project sought to determine if Amazon was an ideal tenant and if their high rents served as an indicator to non-Amazon occupied buildings. Due to the enormous demand by Amazon for office space, the permutation tests showed that Amazon is an ideal tenant, reporting an average rent expectation higher in more than 95% of permutations. This result suggests that building owners are altering their cash flow projections for an Amazon as opposed to other tenants, which not only reflects high investor confidence in the market, but also confidence in Amazon to keep growing (or at least not shrink) in the Seattle area, locking in cash flows for the foreseeable future. However, there was limited significant evidence for Amazon as an indicator. While the rent expectations for Amazon buildings were significant in every year of an Amazon sale in the dataset, only two years were close to being significant at the 95% level for non-Amazon occupied buildings. This evidence does not support the theory that the price and cash flows of Amazon occupied buildings are indicating other building owners to increase their own prices. However, the two years that were close to significant were 2016 and 2017, suggesting that investors may have started to look towards Amazon occupied buildings as a signal for their own rents, but this claim is not supported by the current evidence.

While Amazon may not have had a direct effect on the commercial real estate market, Amazon has changed the face of Seattle for the foreseeable future. Amazon's expansion has brought new businesses and people to the city, allowing Seattle to experience substantial economic growth in the last ten years. This may cause some indirect effects on the commercial real estate market. Amazon's presence may encourage companies like Google and Facebook to expand in Seattle, increasing the demand for premium office space. Also, as Amazon grows, Seattle may become dependent on Amazon's business. If Amazon ever leaves, Seattle's commercial real estate market (at a minimum) would be devastated. These indirect effects are not addressed as part of this project but may be the subject of future research. Beyond commercial real estate, the Amazon effect in Seattle can teach a lesson about how cities must adapt to the challenges of economic growth.

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Appendix:

Figure 1:

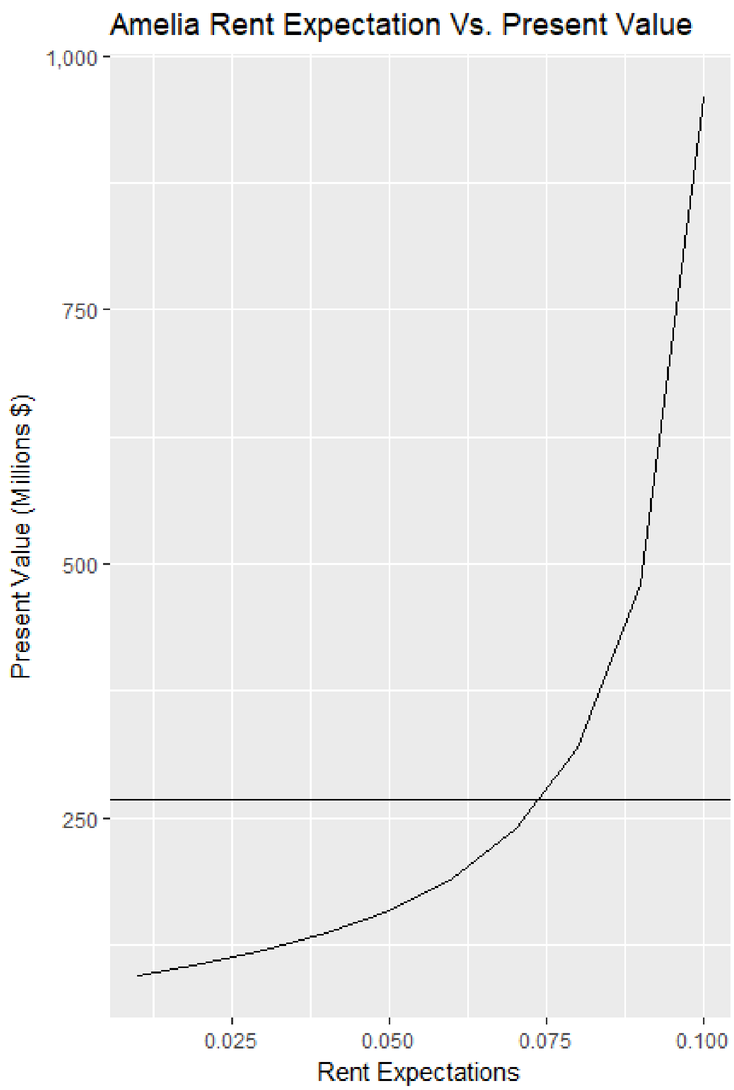

Figure 1: Rent Expectations versus the present value for a sample Amazon building Amelia. The rent growth expectations cross the fundamental value (horizontal line) at the calculated rent growth expectation. The present value is lower if rent growth is lower than expected (left of intersection) and the present value is higher if rent growth is higher than expected (right of intersection).

Figure 2:

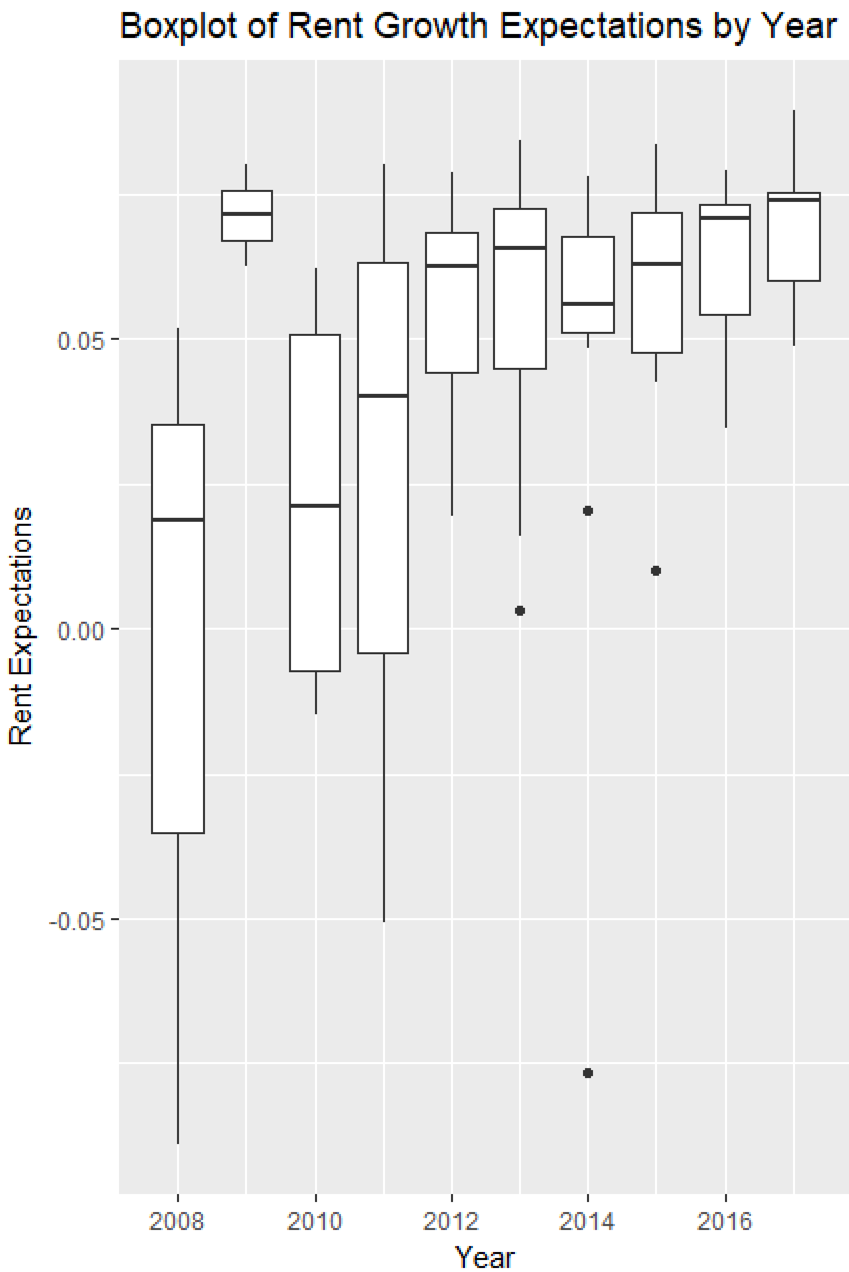

Figure 2: Each boxplot represents a year in the data set, showing the variation and convergence of rent growth expectations over the course of the last ten years.

Figure 3:

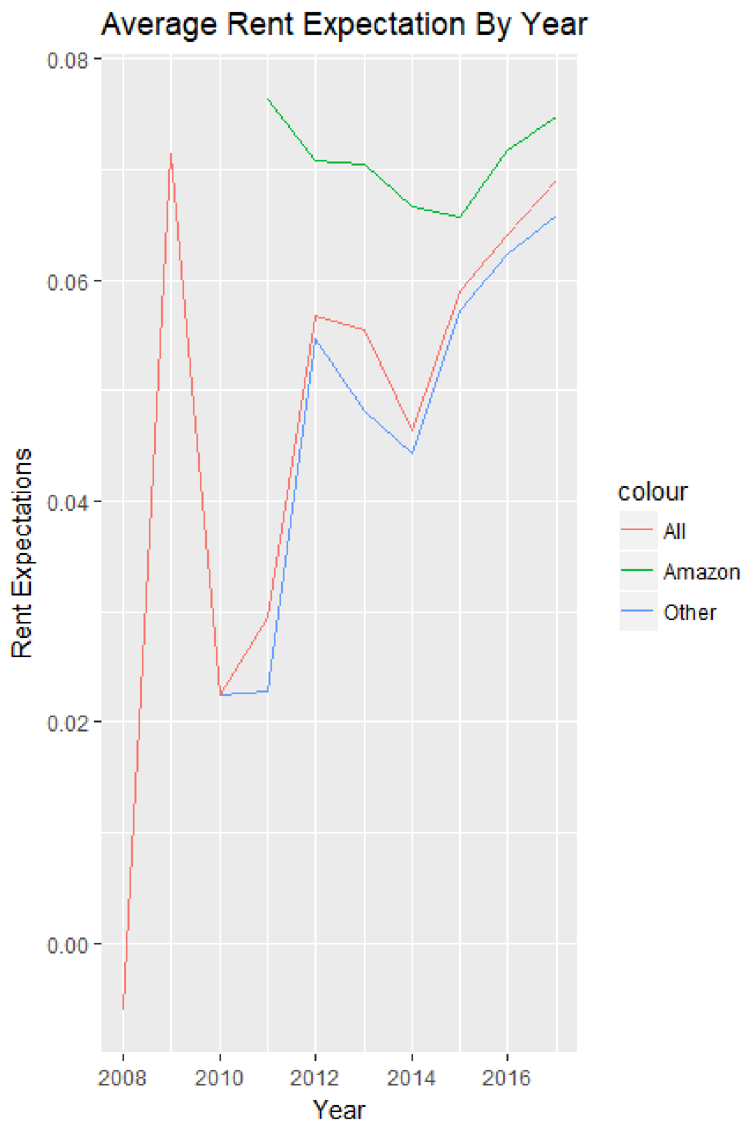

Figure 3: Average rent growth expectations over time for all buildings, Amazon buildings, and non-Amazon buildings ("other"). There were no Amazon occupied buildings purchased before 2011, so the Amazon occupied buildings are represented for only part of period covered in the dataset.