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Real Estate Investments in 18-hour Cities: Do 18-hour cities offer superior investments compared to 24-hour cities?

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Abstract

With the rise of the millennial generation, a new roster of cities has sprung to life – the 18-hour cities. They can be defined as a vibrant second-tier city where there's a big potential for employment and economic growth and at the same time they offer a lower cost of living and doing business than in 24-hour gateway cities like New York City or San Francisco. They have been named the hottest places for real estate investments by industry literature which poses the question if 18-hour cities really offer better investments than 24-hour cities. This paper uses a statistical analysis framework complemented with qualitative interviews of industry professionals based in 18-hour markets to test this notion.

From the statistical analysis, it has been found that 18-hour cities offer higher yields than the 24-hour markets but the cash return cannot be said to differ between the two. Furthermore, the interviews with industry professionals indicate that the 18-hour markets have major future growth prospects because of their job growth, population growth and the large in-migration of high-skilled labor gravitating towards these amenity-rich areas where they can receive the highest reward-for-skill.

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Examensarbete

Titel: Fastighetsinvesteringar i 18-timmarsstäder: Erbjuder 18-timmarsstäder bättre investeringsmöjligheter än 24-timmarsstäder?

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Sammanfattning

Med millenniegenerationens framfart har en ny rad städer vaknat till liv – 18-timmarsstäderna. De kan definieras som en levande andrastad där det finns stor potential för arbete och ekonomisk tillväxt samtidigt som de erbjuder lägre levnadskostnad och kostnad för att driva företag än 24-timmarsstäder som New York eller San Francisco. De har utsetts till de hetaste marknaderna för fastighetsinvesteringar av tidsskrifter vilket väcker frågan om 18-timmarsstäder verkligen erbjuder bättre investeringsmöjligheter än 24-timmarsstäder. Denna studie använder statistisk analys kompletterat med intervjuer av personer verksamma i fastighetsbranschen för att testa den hypotesen.

Från den statistiska analysen fanns det att 18-timmarsstäder erbjuder högre direktavkastning än 24-timmarsstäder men avkastningen på kapital kan inte sägas skiljas mellan de två klustren. Vidare indikerade intervjuerna med branschfolk att 18-timmarsstäder har stor framtida tillväxtpotential tack vare stark jobbtillväxt, befolkningsökning och stor inflyttning av högutbildad arbetskraft som drar sig till områden med mycket bekvämligheter och där de kan få bäst belöning för sin utbildningsnivå.

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1 Introduction

1.1 Background

The ongoing urbanization of America is currently giving life to a roster of cities which historically have only been active from nine to five. It is no longer accepted that only the coastal cities like San Francisco, New York and Los Angeles can stay alive after the work day is done. Downtown mixed-use environments encompassing a blend of housing, retail, entertainment and walk-to-work offices have emerged around the country which is spurring investments and improving the competitiveness for a range of cities. This change is catalyzed by walk-to-work housing that encourages companies in the knowledge and talent industries to locate their offices in the city core. These emerging 18-hour cities have found inspiration from downtown areas such as Manhattan which has demonstrated that the right urban mix bolsters occupancy, that density raises values and that vibrancy attracts investment capital (PwC and Urban Land Institute 2014). A range of cities formerly mentioned as the "poster children of sprawl" like Atlanta, Charlotte and Houston now boasts unexpected commercial ventures, culture and entertainment in their respective downtown areas (Wachs 2013). Furthermore, walkable city cores in Portland and San Diego feature a range of exotic restaurants, art galleries and walk-to-work offices where highly educated millennials are moving downtown alongside senior citizens who are consciously electing a retirement in central locations with better amenities.

Figure 1 shows the spread between the non-family household income and cost of living for 16 large U.S. metropolitan areas. It shows that except for San Francisco which has had a boom in the tech sector and offers high salaries for professionals in the IT-industry, the secondary cities to the left show a bigger spread between the required income for basic needs and the median non-family household income. This indicates that residents in these cities will have more money to spend on for example consumption, dining and entertainment than in the established markets like New York City.

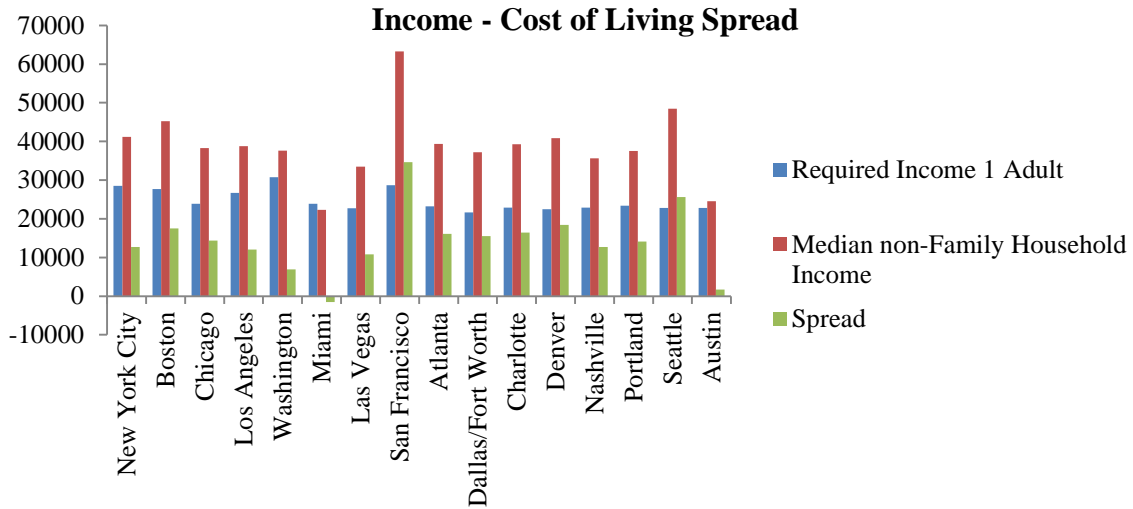


Figure 1. Income – Cost of Living spread in 16 major U.S. cities

Sources: U.S. Census Bureau; Glasmeier (2014)

For more than a decade it has been asserted that real estate in 24-hour cities outperform those in a 9-to-5 environment (Kelly 2009), and as investments in prime properties has long predominated those in secondary locations, the prime stock becomes more and more difficult to source. Figure 2 illustrates the difference in capitalization rate between 18-hour cities and 24-hour cities which shows that the prime stock is associated with a lower yield.

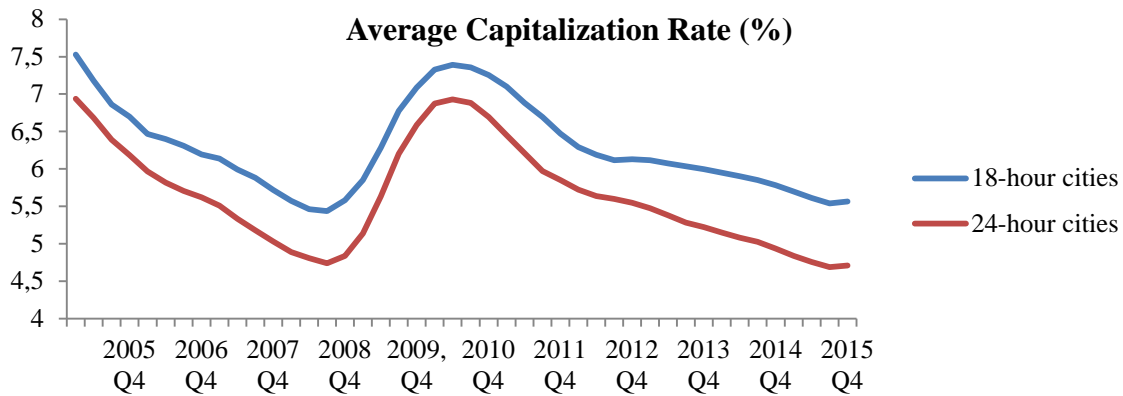


Figure 2. Average capitalization rates for 24-hour and 18-hour cities

Source: CBRE Econometric Advisors

Thus, investors are being forced up the risk curve where secondary locations offer an attractive investment opportunity (Lim, Berry and Sieraki 2013) with high growth potential. In an Investor Intentions Survey carried out by CBRE (CBRE 2015), well over half of all respondents answered that they are willing or are forced to take on more risk nowadays than before. 37% of the respondents answered that their risk appetite is higher in 2015 than in 2014, a quite remarkable increase. With lower rent levels than 24-hour cities, 18-hour cities like Austin, Charlotte and Nashville (Cushman & Wakefield 2015) that are on the trajectory towards being a 24-hour city may attract investors looking for a greater balance between expenses and margins in their operations.

Rogerson (1998) suggested a link between the attraction of capital and quality of life, mainly because a city with a high level of amenities is dependent on the continued capital investment to uphold the same level of services. The millennial generation seemingly prefers to reside in urban amenity rich live-work-play environments with compact, diverse, mixed-use and walkable areas (Malizia and Song 2015) where community and social interaction are vital parts of daily life. However, cities are complicated mixtures of services with different rooted meanings for individuals. For example, a student may place great importance on the access to cultural establishments for socializing while a family may place a greater value on having access to a playground for their kids to play (Insch and Sun 2013).

The millennial generation, people born between 1980 and 2000, is now shaping the US's demographics. Urban environments of larger metropolitan areas are showing lower levels of per capita travel and employment and other activity opportunities are often closer in these spaces (Polzin et al. 2014). In a survey made by Smart Growth America (2015), it was shown that when companies seek a new location, they often look for vibrant, walkable mixed-use neighborhoods where people both want to live and work. In a study by Wilson et al. (2012) it was shown that 365 designated U.S. metropolitan areas in 2010 contained 84% of the population. Although this is a very high number, a large fraction of these reside and work in the suburbs (Hobbs and Stoops 2002). Still, there is a perception that downtowns are considered a more attractive place to live. Of the 27.3 million population increase during 2000 to 2010, 92.45% was in the cores of metropolitan areas (Wilson et al. 2012). In the U.S. 2015 Census survey (2015) it was shown that many of the new emerging 18-hour cities are among the fastest growing urban environments in the U.S. in terms of population. In addition to growing in population, the 18-hour cities are showing an intense job growth, almost with a 2-to-1 ratio compared to the 24-hour markets (Chlarson 2015) and a recent surge in

entrepreneurship. In the Kauffman Index for Entrepreneurial Activity (Kauffman Foundation 2015), many of the cities being identified as 18-hour cities (e.g. Austin, Denver and Atlanta) are highly ranked.

A key to successful property investments is the identification and pricing of the time and location components on property yields. Investors are widening their search geographically for investments which requires a deeper understanding of the component on yields since regional economic conditions, demographic trends and real estate market trails underpin yield levels (Tsolacos and Peng 2009). Now when investors are starting to gaze beyond the gateway markets, this thesis will investigate whether 18-hour markets offer superior investment opportunities in terms of growth and higher yields. The concept of hypothesized 18-hour markets is brand new (PwC and Urban Land Institute 2014) and there is, to the author's knowledge, no previous research carried out on the subject of real estate investments in these cities. In PwC and Urban Land Institute's U.S. Markets to Watch (2015), eight out of ten hottest cities to invest in real estate in 2016 are defined as 18-hour cities. This raises the question if 18-hour cities, who are realizing a strong economic development and population growth, can match 24-hour gateway cities in terms of downtown commercial real estate performance. Previous studies on the subject have focused on the relationship between 24-hour and 9-to-5 markets and live-work-play environments (e.g. Kelly et al. 2013; Malizia and Song 2015) but there is a gap in existing research regarding the performance of 18-hour markets which this thesis aims to fill.

1.2 Purpose

The objective of this thesis is to test the hypothesis that 18-hour cities provide better investment opportunities than 24-hour cities. The purpose of this is to give us information regarding the relationship between the attributes and expected future growth of a city and its yields. If there is a legitimate distinction to be made between the investment opportunities in 24-hour cities and 18-hour cities, empirical evidence marking such differences should be found.

1.3 Research Questions

In order to investigate the assumptions of higher yield levels and faster growing yields in 18-hour cities, the following research questions will be answered:

- R₁: Why would investments in an 18-hour city be more profitable than investments in a 24-hour city?
- R₂: What are the key factors leading to higher investments in 18 hour cities?
- R₃: Are there any proofs of higher yields in 18-hour cities compared to 24-hour cities?

1.4 Hypotheses

In order to answer the research question, these hypotheses are proposed for testing using a regression analysis framework:

- H₁: Investments in 18-hour cities are more profitable than 24-hour cities
- H₂: The inherent attributes of 18-hour cities makes a market attractive
- H₃: 18-hour cities see higher cap rates compared to 24-hour cities

1.5 Metropolitan areas considered in the study

A review of industry literature and research by Kelly et al. (2013) and Birch (2005a, 2005b) have been the basis for the selection of eight hypothesized U.S. 24-hour and 18-hour markets respectively which are considered in the study.

24-hour markets	18-hour markets
New York City	Atlanta
Boston	Dallas/Fort Worth
Chicago	Charlotte
Los Angeles	Austin
San Francisco	Denver
Miami	Nashville
Washington, DC	Portland
Las Vegas	Seattle

Sources: Birch (2005a), Birch (2005b), PwC and Urban Land Institute (2015), Kelly et al. (2013)

1.6 Data collection

The data used in this thesis for statistical analysis is gathered from number of different sources, including the U.S. Census Bureau and CBRE Econometric Advisors. To achieve continuity in the research, the data is cross sectional in character, i.e. gathered without regards to differences in time. Most the socio-economic data is from 2014 or 2015 and the property performance data is gathered from the fourth quarter of 2015.

2 Literature review

2.1 The Real Estate Market

To understand how commercial real estate performance in 24-hour and 18-hour markets relates to each other, one must first have a basic understanding of the real estate market as a whole. This chapter gives a brief overview of the different components of the property market and a basic introduction to portfolio theory with real estate applications.

2.1.1 Microeconomic factors

Microeconomics is the theory of how firms and individual persons allocate scarce resources. Land, labor and capital are used to produce goods to satisfy human needs and the microeconomics is the study of the allocation of these resources. Langdana (2009) proposes a scenario in which the real estate market can be simplified to a situation where owners of land supply properties and businesses demand these properties. The behaviors of these two actors are illustrated in figure 3 where the demand curve is downwards sloping and the supply curve is upwards sloping. At $Q_1 = D_1$, where supply (Q) and demand (D) is equal, a transaction takes place. This point is called the market equilibrium. If demand rises, all things held constant, figure 3 shows that prices will rise when $Q_2 = D_2$.

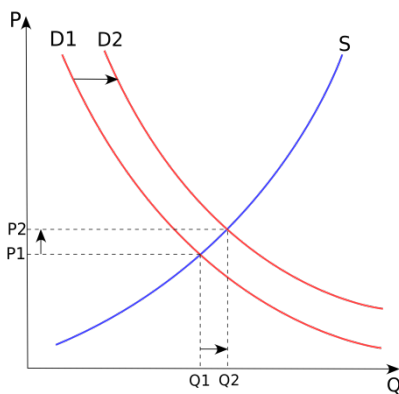


Figure 3. Supply and demand curve

These market forces require careful study since the potential income of a property is a function of the supply and demand in the market. Supply and demand determine how much space can be occupied by tenants and the level of rents paid, i.e. the income of the property (Mangianelli 2014).

Manganelli (2014) argues that the real estate market is an imperfect market where the main factor of this imperfection is the heterogeneity of the assets present in the market. It is also stated that the lack of transparency is a determinant for the imperfection since there is trouble obtaining full information about transactions. Instead, prices are negotiated between actors often having asymmetrical information and decisions must be made without perfect knowledge of the market conditions.

2.1.1.2 Market drivers

Real estate demand does not solely depend on prices but also other factors that can prompt the demand curve to shift. These drivers have to be carefully examined to forecast future demand and assess the market prospects. According to Sivitanidou (2011) the exogenous forces can be divided in four categories: Market size; income/wealth; price of substitutes; and expectations. Variables contained in *market size* include population, employment or output, depending on property type. As *income/wealth* increases, *ceteris paribus*, it raises the demand for residential and retail properties since with a higher purchasing power, more households have money for consumption and for buying a home. *The price of substitutes* can affect the demand curve if for example the rents would increase, then owning a home would be relatively cheaper and some renters might cross over to purchasing a home because it is more attractive. Lastly, *expectations of consumers or firms* can induce shifts in the demand curve if e.g. rents are expected to increase in the future the demand for office space may be affected. Further, if an office firm in a rapidly growing market is projecting a future growth, they might need to sign up for more space today to meet future needs of office space.

2.1.2 Macroeconomic factors

The macroeconomic determinants are factors which affect an economy on a national level. Ling and Naranjo (1997) found these determinants to be vital to the performance of real estate since the economic performance of a nation is interlinked with the performance of the real estate market. Below is a review of the most important macroeconomic concepts.

2.1.2.1 Unemployment

The unemployment rate is defined as the percentage of a labor force that is presently unemployed, but looking for employment and is willing to work. Muscatelli and Tirelli (2001) studied the empirical relationship between unemployment and economic growth. By constructing a statistical model using annual data from OECD economies, they demonstrated that unemployment has a negative impact on productivity growth.

2.1.2.2 Gross Domestic Product (GDP)

GDP is the total value of a country's output, defined as the total market value of all goods and services produced domestically within a time period. Langdana (2009) argues that by itself, the GDP per capita – total GDP divided by the population – says very little about the quality of life in a nation since the GDP ignores the income dispersions realized in nations where the wealth is amassed by a few individuals.

However, the GDP is a good indicator of a nation's economic performance and further analysis of the measure with regards to demographics can forecast a rise or downturn in the economy (De Bernardi and Rodenhalm 2013).

2.1.2.3 Inflation

Inflation is the percentage price change of a price index such as the Consumer Price Index (CPI). The CPI tracks the market price of a set range of goods, a so called "market basket" which is constructed to represent the monthly consumption of a family of four. It is defined as:

$$CPI = \frac{\sum P_i q_o}{\sum P_0 q_o}$$

where P_i = current prices; q_o = set "market basket"; P_0 = base year prices (Langdana 2009).

2.1.2.4 Interest rate

The interest rate is the cost of borrowing money. The price is determined when market actors looking to lend money and actors who want to borrow money for investments meet at the market equilibrium. Thus, the interest rate is determined by market forces. A high inflation lowers the relative value of money which leads to a demand for higher interest in order to compensate for the loss of value (De Bernardi and Rodenhalm 2013). Long-term interest rates are linked to inflation and the real interest rate through the Fisher Effect, defined as:

$$i_{LT} = r + \pi^E$$

where i_{LT} = long-term interest rate; r = real interest rate; π^E = expected inflation over the duration of the loan (Langdana 2009).

Chaney and Hoesli (2010) studied the interest sensitivity of real estate by modelling the whole life of an investment property. They found interdependencies between inflation, office market rents, current rent, and inflation in an empirical analysis with results showing a 13.1% sensitivity to interest rate changes and a standard deviation of 7.8%.

2.1.2.5 Property cycles

The real estate market has shown to be cyclical in its behavior and seem to correlate with other economic cycles but with a slightly higher volatility. Figure 4 shows a property cycle as suggested by Grover and Grover (2013).

Property crash Bankruptcy of tenants, landlords and developers Liquidation of bankrupt stock	DEPRESSION	RECOVERY	Increasing demand Rents start to rise New developments and buildings initiated
	Credit crunch	Increasing availability of credit	
Increasing completions Demand decreases Falling rents and land prices	RECESSION	PROSPERITY	Demand intensified Speculative developments First wave of completions Rents peak
	Tightening of credit	Credit boom	

Figure 4. Property cycle

2.1.3 Real Estate Investments

As a part of the finance community, the real estate market uses the same recognized mathematical models to measure risk and return as stocks. More importantly, this gives a way to include real estate in mixed-asset portfolios for use in investment strategies such as the capital asset pricing model and modern portfolio theory. According to theory, an asset that carries a return must also carry a risk which principally can be divided into two sub-groups: market risk and specific risk (Schulmerich et al. 2015).

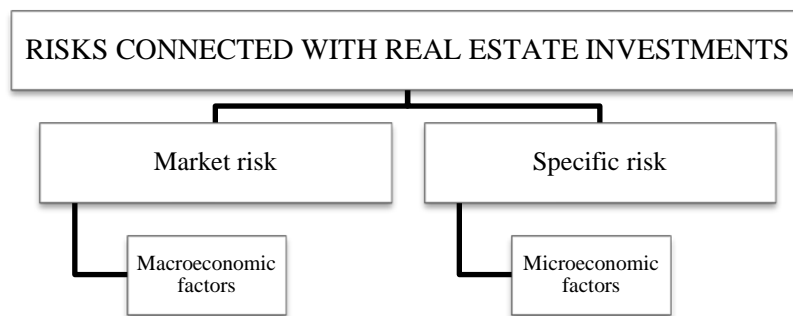


Figure 5. Risks in real estate investments

The market risk, also called systematic risk, is the result of macroeconomic factors which is common to all assets in the market. Empirical and theoretical research linking macroeconomic determinants to the performance of real estate has been carried out by several scholars, however it is limited. The go-to method is to examine real estate returns' sensitivity to the exposure of macroeconomic factors is by regressing ex ante returns with a set of predetermined explanatory variables where the sensitivity is represented by the beta coefficient of every variable (e.g. Ling and Naranjo 1997; Chen et al. 1986). Chen et al. (1986) explored the effect of a set of economic state variables on asset returns and concluded that asset prices should depend on their connection to these variables, including inflation, production output and returns on government bonds. Ling and Naranjo (1997) suggested the growth rate in real per capita consumption, the high-grade and low-grade bond spread, the term structure of interest rates and unexpected inflation as the main macroeconomic determinants affecting real estate performance.

The specific risk, also called unsystematic risk, is the result of microeconomic factors and asset- or company specific hazards which is inherent in each investment. These factors include: Liquidity risk, Financial risk and Business risk. Liquidity risk is the risk of not being able to buy or sell an asset quickly enough, Business risk refers to the risk of an issuer of a

security going bankrupt. Financial risk can be divided into two basic components: the risk of leverage and interest rate risk. The risk of leverage is connected to the amount of debt used in a capital investment. A positive leverage can amplify the returns on an investment if the cost of lending is less than the returns from the investment. However, in a business downturn a heavily leveraged corporation may experience a default risk if the cost of lending is greater than the returns from the investment. Interest rate risk is connected to the event that market interest rates change and lead to unexpected costs for the investor (Manganelli 2014; Sitek 2013).

2.1.3.1 Portfolio Theory

Since the real estate market is opaque and the data available is scarce, the research investigating risk reduction in real estate portfolios is limited. Most studies on specific risk originate in the work of Markowitz (1952) who established Modern Portfolio Theory (MPT). He proposed that specific risk can be diversified away by adding more assets with specific risks to a multi-asset portfolio. The standard deviation (risk) of the portfolio return in MPT is defined as:

$$\sigma_p = \sqrt{\sum_i \omega_i^2 \sigma_i^2 + \sum_i \sum_{j \neq i} \omega_i \omega_j \sigma_i \sigma_j \rho_{ij}}$$

where σ_p is the standard deviation of the portfolio, ω is the asset weight, σ is the asset volatility and ρ is the correlation coefficient between two assets. Thus, when adding more assets to the portfolio that are not perfectly correlated ($-1 \leq \rho_{ij} < 1$), the individual weights are reduced which results in a lower asset-specific risk (Markowitz 1952). The expected return (R) of a portfolio in Markowitz's theory is the weighted return of every single asset in the portfolio, defined as:

$$E(R_p) = \sum_i \omega_i E(R_i)$$

In his seminal work, Sharpe (1964) proposed a measure of the reward-to-risk ratio of an asset which measures the excess return per unit of standard deviation. The Sharpe ratio is defined as:

$$S_a = \frac{E[R_a - R_b]}{\sqrt{\text{var}[R_a - R_b]}}$$

where R_a is the asset return, R_b is the return on the risk-free rate and $E[R_a - R_b]$ is the expected value of the excess return. Since a higher Sharpe ratio indicates a higher reward-to-risk ratio, an investor should always construct a portfolio with the highest possible Sharpe ratio. Building on the work of Markowitz (1952), several scholars introduced the Capital Asset Pricing Model (CAPM) (see e.g. Lintner 1965; Sharpe 1964). The CAPM is a model for pricing an asset or a portfolio in relation to its expected return and market risk. A linear function is used to construct a security market line defined as:

$$E(R_m) = R_f + \beta_i(E(R_i) - R_f),$$

where β_i is the sensitivity of expected return of the asset to the excess market returns. The CAPM assumes that there exists an optimal portfolio for which an investor realizes the highest return for the lowest risk. Markowitz (1952) proposed that portfolios can be scattered in a diagram with $E(R_i)$ on the Y-axis and $\sigma(R_i)$ on the X-axis where after a hyperbola can be drawn up connecting the portfolios with the highest return-to-risk ratio, or Sharpe ratio, to form an efficient frontier. An investor should always pick a portfolio on this line under the assumption that an investor is rational and risk-averse.

2.1.3.2 Methods of investing

The traditional way of investing in real estate is by purchasing the property directly in a transaction. However, with securitization of asset classes in the 1990s a new way of investing in real estate emerged: the Real Estate Investment Trust (REIT). REITs are securitized real estate which is traded on a daily basis on the stock exchange, thus they are exposed to the same volatility as a regular stock. Both ways of investing have their perks and downsides: the direct investments carry a better inflation hedge but lack information transparency while securitized real estate have a higher return (and risk) and liquidity in the market than direct investment (Falk 2012).

Falk (2012) studied the performance of direct and securitized real estate in Sweden together with other asset classes to construct an optimal mixed-asset portfolio according to MPT. He managed to show that real estate, both direct and securitized enhances a mixed-asset portfolio's risk-adjusted return. However, it was found that securitized real estate outperforms direct real estate by far with a 283 and 176 basis point increase of returns respectively.

2.2 Urban Amenities

Lancaster (1966) suggested that when a consumer is seeking to acquire goods, they are not seeking to acquire the goods per se but the attributes they contain. A further development to Lancaster's theory about hedonic utility was proposed by Rosen (1974) who stipulated that property values can be decomposed into several attributes which are priced according to their contribution to the total value of a property. Since then, property value hedonics is the go-to model for valuing public goods and amenities and a multitude of studies have been carried out examining the contribution of amenities to property prices (see e.g. Ding et al. 2010; Contreras et al. 2014). Economic development is a prerequisite for high levels of amenities (Feldman et al. 2016); this chapter will begin with providing a brief overview on the literature regarding this subject and then carry on to the determinants making a city attractive for residents i.e. the amenities investors are willing to pay for (Ding et al. 2010).

Economic development is often confused with economic growth. The latter has a strong theoretical background and is easily quantified as the increased output of an economy while the former is more qualitative and hard to measure. Economic development represents the conditions determining the microeconomic functioning of the market. From this standpoint, economic development is tied to the quality and level of institutions, social capital, human capital, capital mobility, wealth and income equality (Feldman et al. 2016). Feldman et al. (2016) defines economic development as:

“Economic Development is the means to achieve sustained increases in prosperity and quality of life realized through innovation, lowered transaction costs, and the utilization of capabilities toward the responsible production and diffusion of goods and services”

Even though the increase in prosperity and quality of life is hard to quantify, Lucas (1988) proposed that a simplified measure of economic development is the level and growth rate of income per capita. Since the level and growth rate of income per capita depend on the per capita gross domestic product (Lucas 1988), economic growth is a vital part of economic development. In traditional growth theory, Solow (1956) proposed that the most important factor in generating economic growth is physical capital. On the other hand, according to other models (e.g. Lucas 1988; Jacobs 1969), the driving force of economic growth is knowledge spillover and the fact that concentrations of large groups of people in a bounded spatial environment such as a city core allows personal interactions which can generate new ideas or ventures. Entrepreneurship has long been connected to economic growth (e.g.

Schumpeter 1934; Kirzner 1973; Hafer 2013) and recently, high levels of entrepreneurship has been linked to urban growth as well as economic growth. A study by Acs and Armington (2006) on 394 local areas in the U.S. displayed a link where “higher rates of entrepreneurial activity were strongly associated with faster growth in local areas” and Hafer (2013) concluded that areas with higher levels of entrepreneurial activity are more likely to experience economic growth.

In 2002, Florida (2002) posited the creative class, a socioeconomic class consisting of e.g. scientists, engineers and people working in knowledge-based fields such as health care and finance, which is proposed to be the driving force behind the economic development of post-industrial U.S. cities. Florida constructed a creativity index with three determinants (Technology, Talent and Tolerance) in which cities, regions and nations are ranked according to their scores. Between 1990 and 2000, the top 11 creative regions generated almost three times as many jobs as the bottom 11 creative regions. Florida argues, in contradiction to other researchers, that our technologies or collective knowledge aren't the primary human and economic resources, but our shared creativity and what attracts talented people is first of all the presence of other talented people – not the presence of jobs.

Florida (2015) suggests three factors that determine the flows of talent. The first is amenities. It has been shown that about 40 percent of the employment growth of college graduates is credited to a higher quality of life. The second factor is education. Some regions (e.g. Boston and San Francisco) have high quality education which aggregates talent. The third determinant is a low entry barrier to the market. Tolerance is as a key factor behind talent migration; talent will flow to the place that is most welcoming. This is illustrated by a strong correlation between high-tech industry clustering and the openness to minorities such as gays, ethnic minorities and immigrants. In order to attract these high skilled workers, cities are competing through the provision of public goods to improve their competitiveness and thus attract the creative class (Buettner and Janeba 2015).

In her study on the motivations of revitalization in the post-industrial city Scranton, Pennsylvania, Rich (2013) examined the use of the creative class construct by various actors. It was found that although not knowingly or intentionally using the construct, it was very influential in the actions of key players. There was a strong belief that promoting arts, culture and creating a consumer based live-work-play center is critical for urban revitalization. The revitalizers understood that Scranton could not boost its competitiveness if it could not attract

highly educated white-collar laborers who will gravitate towards a more tolerant, diverse and entertaining environment. Efforts were therefore focused on making the downtown more livable, interesting and economically viable.

Rogerson (1998) indicated that a city's competitiveness is a reflection of their ability to attract capital. In this respect, cities will try to develop a specific niche to stand out from the crowd and specifically attract or retain capital which upholds this niche. Pedroni (2011) lists one such example as the now-declining city of Detroit which has long been a global manufacturing center for the car industry. Deindustrialization has led to the city desperately trying to hold on to its niche with large shifts away from public investments and towards attracting more investment capital which in turn has led to a decline in the city's amenities. Markusen and Schrock (2006) proposed that in order to stand out in the competition, a city has to be distinctive in its productive structure, consumption and identity. They studied employment in different sectors for the 50 largest metropolitan areas in the U.S. to construct an index for distinctive cities. This concept is also used in Kelly (2011) to distinguish 9-to-5 cities from 24-hour cities.

Birch (2002, 2005a, 2005b) finds that the downtown areas of cities are the most important components in a city's competitiveness and that city leaders have focused mainly on investing in office districts, retail areas, transportation and special activity generators (such as sports complexes) to improve these areas. Though the support of a vibrant urban core is seen as an important factor in city competitiveness, only 17 of 45 studied cities had higher downtown population in 2000 compared to 1970. In her 2005 publication, she proposed that downtowns could be categorized in five clusters: fully-developed downtowns; emerging downtowns, downtowns on the edge of takeoff; slow-growing downtowns; and declining downtowns. The category to which every city belongs was determined by attributes such as population growth rate, diversity, educational attainment of residents, age patterns and median income.

Fully-Developed Downtowns	Emerging Downtowns	Downtowns on the Edge of Takeoff	Slow-Growing Downtowns	Declining Downtowns
Boston*	Atlanta*	Chattanooga	Albuquerque	Cincinnati
Chicago*	Baltimore	Dallas*	Austin*	Columbus, GA
Manhattan*	Charlotte*	Miami*	Boise	Des Moines
Philadelphia	Cleveland	Milwaukee	Colorado Springs	Detroit
	Denver*	Washington, DC*	Columbus, OH	Jackson
	Los Angeles*		Indianapolis	Lexington
	Memphis		Lafayette	Mesa
	New Orleans		Phoenix	Minneapolis
	Portland*		Pittsburgh	Orlando
	San Diego		Salt Lake City	San Antonio
	San Francisco*			Shreveport
	Seattle*			St. Louis

Sources: Birch (2005a, 2005b), Kelly (2011)

Note: * = City considered in this study

The population growth in downtown areas is an indicator of current conditions, but can also help forecast the future growth. Birch (2005b) states that if the emerging downtowns in the typology, ones that added 3,000 or more residents in the 1990s, will maintain their growth rate, they will most likely join or surpass other cities with high concentration. Further, she claims that race, age, level of education and income are key market determinants which will affect the demand for housing, floor space and amenities. In 2000, only 29% of downtown households were family households, compared to 59% in the cities and 71% in the suburbs. In Birch's study, about 45% of downtown residents are in the segment 18-34 years of age. Further, she notes that in 2000, about 44% of downtown residents have a bachelor degree or higher which was well above the national average of 27% for cities. Birch (2005b) also found that downtowns with a high density have had better historical success in attracting residents to its downtowns.

Glaeser et al. (2001) argued that the success of a city depends on its ability to attract and retain consumers. Thus, if a city is an attractive place for a consumer to live, it will also thrive in the future. Conversely, it is claimed that unattractive cities will decay. They posited four urban amenities that are critical in attracting consumers to a city. First is the existence of a vast range of services and consumer goods. Cities with more restaurants and live performance venues per capita have had a faster growth in the past 20 years. Further, cities with a more educated population have seen a more rapid growth in rents than in wages. The interpretation of this fact was that while the productivity has risen in areas with large concentrations of

high-skilled labor, the quality of life has risen faster. The second amenity is aesthetics and physical setting. There is a lack of evidence regarding the role of architectural beauty but Glaeser et al. (2001) claimed that attractive cities perform better. In addition, weather is named as the most important physical feature of a city. The third critical amenity is good public services such as well performing schools and low crime rate. The fourth amenity is speed. It is posited that the services and jobs available in a metropolitan area must be easily accessible in order for people to use them. According to Glaeser et al. (2001), growth is stimulated by educating and attracting high human capital individuals by providing high quality basic services such as schools and safe streets. They also argued that a large employer base provides an advantage over smaller cities because residents can change jobs more easily which can help the younger population find the right career for themselves.

Kresl and Singh (2012) constructed an index over U.S. metropolitan area competitiveness for the period 1997-2002 through a quantification of competitiveness viewed as economic determinants (e.g. manufacturing value added and retail sales per capita) and city amenities (e.g. hospital beds and the number of cultural institutions). Their approach suggests that competitiveness can be seen as a function of several factors which makes a city attractive.

Using data on all U.S. metropolitan areas for the period 1940-1986, Simon (1998) empirically confirmed that there is a linkage between higher level of human capital of a city and its future economic growth. Since then, several studies have been carried out on the subject of what attracts human capital and makes a city competitive. Hunt and Mueller (2004) studied migration in North America where it was shown that individuals relocate to areas where they realize the highest returns for their skill because skills will be rewarded more generously in these areas through higher wages. This is consistent with Arntz's (2010) study on job migration in Germany where it is suggested that high-skilled workers will migrate to areas with high regional income disparities whereas less-skilled workers migrate mainly due to regional differences in job opportunities. Buch et al. (2014) showed a weak indication that cities with relatively high wages, low unemployment and an intense employment growth attract mobile labor. Further, it was suggested that the quality of life and local amenities such as recreational areas, low crime rate and an adequate housing supply are vital determinants in attracting workers.

Insch and Sun (2013) used focus groups to find the attributes of a host city which makes it attractive to university students. Certain factors not relevant to their current life situation such as economic growth of the city, wage levels and chance of promotion were not included in the study but in reviewing previous research a list of 13 attributes were listed. The study showed that residents value e.g. vibrancy, natural environment, safety and public transport which is consistent with other research on the subject (e.g. Okulicz-Kozaryn 2011; Hu et al. 2013). Ding et al. (2010) used a hedonic price model approach to study the capitalization effects of access to jobs and amenities such as public transit, schools and parks with application on 613 residential housing projects in Beijing, China sold at market price during the period 2000 and 2005. A statistical analysis showed that residents have a strong willingness to pay for better access to urban amenities. However, the amenities that make a city attractive differ from individual to individual depending on life situation but previous research on the subject highlights several attributes appealing to a city's residents.

Amenity	Source(s)
Natural environment (the city's landscapes, views, outdoor attractions and air quality)	Insch and Sun (2013), Buch et al. (2014), Hu et al. (2013)
Personal and public safety (protection from crimes and other threats such as terrorist attacks or natural disasters)	Insch and Sun (2013), Okulicz-Kozaryn (2011), Buch et al. (2014), Sinkienè and Kromalcas (2010)
Public transport (well connected, affordable and reliable service)	Insch and Sun (2013), Okulicz-Kozaryn (2011), Sinkienè and Kromalcas (2010), Hu et al. (2013)
Community assets (the city's parks and gardens, museums, libraries, sporting facilities and historic buildings)	Insch and Sun (2013), Buch et al. (2014), Sinkienè and Kromalcas (2010)
High quality education and health care services	Sinkienè and Kromalcas (2010), Hu et al. (2013), Glaeser et al. (2001)
Shopping and dining (wide range of shops, choice of restaurants and cafes)	Insch and Sun (2013), Sinkienè and Kromalcas (2010), Glaeser et al. (2001)
Cultural scene (the city's cultural events, festivals and night life)	Insch and Sun (2013), Okulicz-Kozaryn (2011), Sinkienè and Kromalcas (2010), Florida (2015), Glaeser et al. (2001)
Employment opportunities	Insch and Sun (2013), Buch et al. (2014), Sinkienè and Kromalcas (2010)
Appeal and vibrancy (the city's design and energy)	Insch and Sun (2013), Hu et al. (2013), Glaeser et al. (2001)
Openness of residents to new people, ideas and diversity	Insch and Sun (2013), Hu et al. (2013), Florida (2015)
Accessibility and location relative to other destinations (easy access to the city's airport and other destinations)	Insch and Sun (2013), Buch et al. (2014), Hu et al. (2013)
Socializing and sense of community (ease of meeting people and making friends, cultural diversity and sense of community)	Insch and Sun (2013), Hu et al. (2013), Glaeser et al. (2001)
Accommodation (reasonable cost of renting, adequate quality and supply of housing)	Insch and Sun (2013)
Cost of living	Okulicz-Kozaryn (2011), Buch et al. (2014), Hu et al. (2013)

Table 1. Attributes appealing to a city's residents according to previous research

2.3 City Categories

Previous industry literature and published articles have hypothesized 24-hour, 18-hour and 9-to-5 city real estate markets (see e.g. Miller 2002; Kelly et al. 2013; PwC and ULI 2015). Following are definitions of these three city categories derived from existing research.

2.3.1 24-hour cities

In Miller (2002), 24-hour cities are defined as “major urban cores that enjoy prime residential neighborhoods, a thriving business environment, a critical mass of service retail, pedestrian-friendly multifaceted attractions (parks, cultural institutions and entertainment facilities), relatively safe environments, and mass transportation”. Kelly (2011) states that in order for a city to be classified as a 24-hour city, it has to have at least four of the following six attributes:

- More than 13 percent of daily car traffic between 9 p.m. and 5 a.m.
- Over 25 drug stores open 24-hours, within 16 kilometers of the city center.
- City population density of 9,000 per square mile or greater.
- A Regional Distinctiveness Rank above 20.
- A crime rate under 6,000 crimes per 100,000 residents.
- Over 38 percent of workers are commuting with non-car transportation.

2.3.2 18-hour cities

The millennial generation is now shaping the U.S. demographics, which has given life to a new range of metropolitan areas – the 18-hour cities. The expression was coined by PwC and Urban Land Institute (PwC and ULI 2014) in their report *Emerging Trends in Real Estate 2015* and can be defined as a vibrant second-tier city where there’s a big potential for employment and economic growth and at the same time it offers a lower cost of living and doing business than in 24-hour gateway cities like New York City or San Francisco. However, Birch (2002) mentioned 18-hour cities when she claimed that city leadership were realizing that their cities would have urban ghost-town centers if the downtowns of these cities weren’t becoming more vibrant by substituting an 18- or 24-hour downtown for the current 9-to-5 downtown.

These 18-hour cities have become an inbound destination for both millennials and baby-boomers, migrating for work and in search of an urban lifestyle. The 18-hour cities are often experiencing revitalization in downtown areas where the previous 9-to-5 lifestyle rendered the places empty when the work day was done. The developments in these areas often include

restaurants, bars, and cultural establishments (e.g. art galleries or cinemas) that caters both to the youth and the older demographic.

2.3.3 9-to-5 cities

9-to-5 cities are defined as having “struggling urban cores that lack residential underpinnings and empty out when office workers go home” and do not meet more than two of the criteria above (Kelly et al. 2013).

2.4 Commercial Office Performance in Live-Work-Play Centers

The performance of real estate investments in 18-hour cities versus 24-hour cities has, to the author’s knowledge, not yet been studied in academia; however, the concept of 18-hour cities per se has been discussed in several news articles and industry reports (see e.g. Mattson-Tieg 2015; Piperato 2015; PwC and ULI 2015). This section will give a brief overview of previous research carried out on the subject of real estate investment performance in live-work-play cities and the empirical results already achieved.

Malizia and Song (2015) analyzed the relationship between live-work-play centers and downtown office performance. They were able to show that downtown office rents are higher and cap rates are lower in centers with better live-work-play city cores. Kelly (2009) examined office property performance in U.S. 24-hour markets compared to 9-to-5 markets and, in line with Malizia and Song (2015), concluded that the hypothesized 24-hour markets have superior results in terms of office rents and vacancies compared to the 9-to-5 city metropolitan areas.

Kelly et al. (2013) analyzed rents, vacancy rates, prices and investment return data for proposed 24-hour and 9-to-5 clusters in the U.S. They could show a difference in quarterly return between the two markets on a 0.01 level of confidence. Cumulative returns were shown to have a 2.65% premium in 24-hour markets compared to 9-to-5 markets. Further, there was evidence of a disproportionate share of investment capital flow to the seven studied 24-hour markets (44% of the NCREIF office portfolio by dollar volume) compared to the seven studied 9-to-5 markets (22% of the NCREIF office portfolio by dollar volume). However, the study showed great similarities in performance of 24-hour cities and the balance of the 25 largest metros pre-1996 but there is a lack of examination of the causality of this phenomenon.

An important finding in Kelly et al. (2013) was that the urbanization (i.e. the density) in the 24-hour markets was more than twice as much as in the 9-to-5 markets. Further, through a socio-economic analysis carried out in association with the study showed that the amenities of 24-hour cities (e.g. transportation, density, crime rate and regional distinctiveness) are changing very slowly. Thus, the paper proposes that the amenity advantage of 24-hour markets will be difficult to catch up to in the foreseeable future.

The hypothesized 18-hour cities are among the fastest growing in the U.S. (US Census Bureau 2015), but although these cities are growing markets, in the past, real estate investments by U.S. commercial banks and thrifts have largely been based on prior rather than future real estate returns. A negative correlation has been shown (May and Saunders, 1997) between commercial banks' real estate investments and the expected future excess returns. Strengthening this behavior is the difficulty to forecast future returns. Plazzi et al. (2004) performed a study on the predictability of rental growth based on cap rates which for office buildings showed limited evidence of lower cap rates implying higher future rent growths and then only on long horizons.

3 Methodology

This chapter will give an overview of the methodology used in this thesis, starting with a general summary of the research approach, followed by a rundown of the statistical analysis framework and interviews.

3.1 Research method

The chosen research method for this thesis is a combination of quantitative analysis and qualitative interviews with industry professionals. The quantitative analysis will be carried out as a statistical analysis to find empirical support for the hypotheses laid out in section 1.4. Further, in order to get an understanding of the use of the 18-hour city construct by industry professionals, representatives from leading U.S. real estate advisors are to be interviewed. These results will then be used to draw conclusions about the performance of real estate in 18-hour cities compared to its 24-hour counterpart.

3.2 Statistical analysis

3.2.1 The hedonic price model

First proposed by Court (1939) for his analysis of automobile prices, the hedonic price model is a method of estimating the value of an item. It decomposes the item into its characteristics and obtains an estimation of the contribution to the value of the item by every attribute. Therefore a requirement for this method is that the item can be decomposed into its constituent characteristics. Rosen (1974) applied the hedonic pricing model on real estate and defined hedonic prices as implicit prices of attributes which are revealed to economic agents from observed prices of differentiated products and the specific amounts of characteristics associated with them. Thus, if a property is made up of a range of attributes, then the market price of that property must be an aggregation of the individual prices of these attributes (Contreras et al. 2014). A common way to estimate the price of each of these attributes is by a statistical analysis in the form of linear regression (Rosen 1974).

3.2.2 Linear regression

In multiple linear regression analysis, the value of a dependent variable y is estimated with help of a number of explanatory variables x_j . Every explanatory variable will affect the dependent variable y with a factor β_j as follows:

$$y = \sum_{j=0}^k \beta_j x_j$$

The value of x_0 is set equal to one, which means that β_0 is the value of the dependent variable y if all other explanatory variables x_j is equal to zero. Another name for β_0 is the intercept (Jangestål and Wallin 2015).

3.2.2.1 The explanatory power of a linear regression

For a standard linear regression model, the goodness-of-fit measure is the R-squared (R^2) coefficient which lies in a $[0,1]$ interval. R^2 is usually interpreted as the proportion of variation explained by the explanatory variables in the regression model. This carries that a $R^2 = 1$ indicates that the model explains all variability in y while $R^2 = 0$ indicates no linear relationship between the dependent variable y and the explanatory variables x_1, \dots, x_n . If R^2 is denoted λ such as $\lambda : \lambda \in \{0,1\}$, it may be interpreted as “100 λ percent of the variance in the dependent variable can be explained by the explanatory variables”. The value is calculated using two different mean square error formulas as follows:

Let \bar{x} be the mean of the observed data $\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$,

then the R^2 of the model can be calculated using the sum of total squares and the sum squares of residuals.

$$R^2 = 1 - \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{\sum_{i=1}^n (x_i - f_i)^2},$$

where f_i is the error between the regression model and the data set. (Cameron and Windmeijer 1997)

3.2.3 Hypothesis testing

Next to point estimation and confidence sets, hypothesis testing is a key tool in statistical inference. It aims to decide whether or not a hypothesis on the nature of a population is supported by a sample of the population. The problem under test is formalized by the null hypothesis H_0 , and the alternative hypothesis H_a . Next, the test statistic is stated which is the measure of which a decision can be made whether the hypothesis is rejected or not. There are four different outcomes of a statistical test, shown in table 2.

	Do not reject H_0	Reject H_0
H_0 true	Correct decision	Type I error
H_0 false	Type II error	Correct decision

Table 2. Outcomes of statistical tests

(Taeger and Kuhnt 2014)

3.2.3.1 Two-Sample Pooled T-test

The two-sample pooled t-test is used to test if the means of two populations μ_1 and μ_2 differ less than, more than or exactly by the value d_0 . Let X_1, \dots, X_n be independent normal distributed observations $N(\mu, \sigma^2)$ from a population with mean μ and variance σ^2 .

Hypotheses: $H_0 : \mu_1 - \mu_2 = d_0$ versus $H_a : \mu_1 - \mu_2 \neq d_0$
 $H_0 : \mu_1 - \mu_2 \leq d_0$ versus $H_a : \mu_1 - \mu_2 > d_0$
 $H_0 : \mu_1 - \mu_2 \geq d_0$ versus $H_a : \mu_1 - \mu_2 < d_0$

Test statistic:
$$T = \left[(\bar{X}_1 - \bar{X}_2) - d_0 \right] / \left[s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}} \right]$$

where
$$s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

Test decision: Reject H_0 if for the observed value t of T
 $t < t_{\alpha/2, n_1+n_2-2}$ or $t > t_{1-\alpha/2, n_1+n_2-2}$
 $t > t_{1-\alpha, n_1+n_2-2}$
 $t < t_{\alpha, n_1+n_2-2}$

Notes: The test statistic T is t-distributed with $n_1 + n_2 - 2$ degrees of freedom

t_{α, n_1+n_2-2} is the α -quantile of the t-distribution with $n_1 + n_2 - 2$ degrees of freedom.

(Taeger and Kuhnt 2014)

3.2.3.2 Equality of Regression Coefficients

A strategy to test the difference between two groups of samples is to test the difference between two regression coefficients β_1 and β_2 across independent samples using a Z-score.

Hypothesis: $H_0 : \beta_1 = \beta_2$ versus $H_a : \beta_1 \neq \beta_2$

Test statistic:
$$Z = \frac{\beta_1 - \beta_2}{\sqrt{SE\beta_1^2 + SE\beta_2^2}}$$

Test decision: Reject H_0 if for the observed value z of Z

$$z < z_\alpha$$

Notes: $SE\beta_i$ is the standard error of regression coefficient β_i

α represent the α -quantile of the z-distribution

(Paternoster et al. 1998)

3.2.4 Variables Used In The Statistical Analysis

The variables used in the regressions and statistical tests are all based on previous research on urban amenities (see section 2.2), economic theory (see section 2.1) and property performance indicators (see section 3.4) listed in the literature review. Many variables are a quantification of the amenities listed in table 1 in section 2.2, based on the work of several researchers. Table 3 shows a summary of the used variables, their unit of measurement and the source of data.

Variable	Unit of Measurement	Source
Income	Median Income (\$)	U.S. Census Bureau
Cap Rate	Cap Rate	CBRE Econometric Advisors
Investment Return	Investment Returns	CBRE Econometric Advisors
Unemployment	Percent of people currently unemployed	U.S. Bureau of Labor Statistics
Investment Activity	Investment Volume (\$)	CBRE Econometric Advisors
Air Pollution	Air Quality Index	Airnow.gov
Walkability	Walkscore	Walkscore.com
Safety	Violent crimes per 100,000 residents	FBI
Population Density	People per sq. mile	U.S. Census Bureau
Regional Distinctiveness	See section 3.5	Markusen and Schrock (2006)
Journey to Work	Percent of people using public transport	U.S. Census Bureau
Share high skilled workers	Percent of residents with bachelor degree or higher	U.S. Census Bureau
Internet capacity	Bandwidth (Mbit/s)	Speedtest.net
Job Growth	Increase in jobs, 12 month moving average (%)	W.P. Carey
Cost of Renting	Average cost of renting an apartment (\$)	Zillow.com
Cost Of Developing	Raw price per sq. ft. (\$)	CBRE Econometric Advisors
Seaside	Coastal city dummy	Google maps
Warm Climate	July deviation from 70 degrees (F)	Weather.com
Cost of Living	Dollar amount for a family of 4 (\$)	Economic Policy Institute
Restaurants per capita	Number of restaurants / residents	City-Data.com

Table 3. Variables used in the statistical analysis

The variables in table 3 are presented further, one by one, below in section 3.2.4.1 and 3.2.4.2.

3.2.4.1 Economic variables

Cap Rate. The yield on investments is measured as the cap rate (see section 3.4.2). This variable is used as a dependent variable in the linear regression to identify key features of successful cities. The cap rates are generously provided by CBRE Econometric Advisors.

Investment return. Profitability of investments is measured as the return. The return data is provided by CBRE Econometric Advisors (see section 3.4.3).

Unemployment. Literature has indicated that unemployment is one of the main economic determinants behind economic growth, why the variable is included in the analysis. Unemployment data is drawn from the U.S. Census Bureau.

Investment Activity. The investment activity is an indicator of the attractiveness of a market since more money will be put into a market with good prospects. Data on investment volume by city is provided by CBRE Econometric Advisors.

Job Growth. The employment growth has been named as the most important factor for future growth of cities since it increases the output of services and goods, and thus the wealth. Job growth data is made available by JPMorgan Chase Economic Outlook Center at W.P. Carey School of Business at Arizona State University.

Cost of Developing. The cost of developing is connected to the investment activity. An attractive city with low cost per raw square ft. would most likely see a strong demand for land. Data on raw price per square ft. is provided by CBRE Econometric Advisors.

3.2.4.2 Socio-economic variables

Income. Studies have shown that income and return-for-skill is a main factor when people choose where to locate. The data on metropolitan statistical area income is gathered from the U.S. Census Bureau.

Air Pollution. Literature indicates that residents seek to reside in locations with a clean environment. Data on air pollution is drawn from the Air Quality Index (AQI) on the AirNow.gov website.

Walkability. Since walkability is named in industry literature as an important feature of the 21st century vibrant city, it is included in the regression. Data for walkability is drawn from Walkscore.com, a website that uses a GIS algorithm to measures the density of places such as stores, shops, parks and public facilities in a city.

Safety. The crime rate is an important feature for which there is a lot of data available in the Federal Bureau of Investigation's Uniform Crime Report. Kelly (2011) proposed that there is a difference in crime-rate between 24-hour cities and the less vibrant 9-to-5 cities.

Population Density. The concentration of people in a bounded spatial environment has been considered a driver of economic growth (Jacobs 1969) and Birch (2005b) stressed its importance in cities. The inclusion of population density will investigate if it affects property yields. Data on population density is drawn from the U.S. Census Bureau.

Regional Distinctiveness. Markusen and Schrock (2006) stated that in order for a city to stand out in the competition, it has to be distinctive in its employment base (see section 3.5). Data on regional distinctiveness is drawn from their study.

Journey to Work. Previous research indicates that the mode of transportation is a factor distinguishing developed cities with a well-functioning mass transit from less developed car dependent cities. Data on the percent of people using mass transit to commute is drawn from the U.S. Census Bureau.

Share High Skilled Workers. The presence of high quality human capital and its connection to economic development have been discussed in several studies (e.g. Birch 2005b; Florida 2015). They have proposed that cities with higher levels of human capital are more prone to grow. Data on percentage of residents with a bachelor degree or higher is drawn from the U.S. Census Bureau.

Internet Capacity. The internet has been highlighted as a driver behind the death of distance and a facilitator of access. A higher capacity would increase the speed in which people can enjoy e.g. streaming services which is a vital part of today's entertainment industry. The internet capacity for every city is gathered from the private company Speedtest.net which offers comparisons of internet providers' speed in the respective city.

Home prices. The cost of renting an apartment can be a deciding factor in relocation, especially for the younger demographics with a limited income. A study by Insch and Sun (2013) showed that one of the amenities university students look for is a reasonable cost of renting. Data on apartment rents are gathered from the private company Zillow, a major U.S. real estate marketplace.

Seaside. Nature and the landscape is a factor for a well-functioning city. A dummy variable is included indicating if a city is located close to the sea or not close to the sea. The data is done by the author by research on Google Maps.

Warm Climate. Glaeser et al. (2001) proposed that the weather is the most important physical feature of a city. Therefore, a variable showing the deviation from 70 Fahrenheit (21 degrees Celsius) in the average July temperature is added. Data is drawn from Weather.com and is on metropolitan statistical area basis.

Cost of Living. Studies have shown that in migration decisions, the return for skill is a major factor (e.g. Hunt and Mueller 2004). The cost of living is measuring the cost for which the resident can enjoy a city's urban amenities. Data for cost of living is collected from the Economic Policy Institute.

Restaurants Per Capita. Restaurants are part of the nighttime economy mentioned in Kelly (2011) and a vital part of a vibrant post-industrial city. A city with more restaurants per capita is thought to have more people staying out after the work day is done. The data for total restaurants is gathered from City-Data.com, which is then divided by the total population to get the per capita amount.

3.3 Interviews

To get a more in-depth knowledge of the use of the 18-hour concept by industry professionals, qualitative interviews were carried out via e-mail with 10 representatives of leading real estate advisors in the U.S. The interviewees were all based in seven out of eight hypothesized 18-hour cities and working with research, capital markets and investment properties to ensure knowledge of the local market. Table 4 presents an overview of the respondents.

Field	Organization	Age	Gender	Years in the industry	City	Interviewee
Research	CBRE	29	Female	3	Denver	A
Research	Colliers	32	Male	7	Denver	B
Capital Markets	Colliers	27	Male	3	Portland	C
Research	Jones Lang LaSalle	33	Female	11	California	D
Investment Properties	CBRE	30	Female	5	Nashville	E
Research	Jones Lang LaSalle	25	Male	2	Charlotte	F
Research	Jones Lang LaSalle	40	Female	3	Atlanta	G
Capital Markets	CBRE	44	Male	21	Denver	H
Investment Properties	CBRE	55	Male	29	Seattle	I
Capital Markets	CBRE	29	Male	10	Portland	J

Table 4. Demographics and experience of the respondents in the interviews

The interview questions used were standardized (see Appendix 1) with a small modification to fit a specific city and modeled to evaluate research question R₁ and R₂. By leaving open questions, the respondents could elaborate their thoughts about the construct and the prospects of investments in 18-hour cities for use as a complement to the quantitative analysis.

3.4 Property performance indicators

To analyze the real estate market, one must also understand the constructs describing property performance. This section will provide definitions and formulas of the indicators of real estate performance used in this thesis.

3.4.1 Market Value

The market value of a property can be defined as "the estimated amount for which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arm's-length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently, and without compulsion" (Dorchester Jr 2011).

3.4.2 The Capitalization Rate

The capitalization rate (cap rate) plays a vital role in the valuation of an asset. The current or expected future net operating income is translated into an asset value using a capitalization rate (R) equal to the first year net operating income of the property (NOI) divided by the value of the property (V) as follows (Jud and Winkler 1995):

$$R = \frac{NOI_1}{V}$$

From an asset pricing perspective, the asset price (e.g. price of a commercial property) should equal the present value of its future rental incomes. This relationship implies that the fluctuations in real estate prices should incorporate the variations in future rents and discount rates (Plazzi et al. 2004). If the net operating income is expected to increase with a constant rate g in the near future, Bruggeman and Fisher (1993) showed that the value of a property can be estimated using a perpetual income stream and a discount rate r in rework of Gordon's (1959) classic growth model for determining the intrinsic value of a stock as follows:

$$V = \frac{NOI_1}{r - g}, \text{ which gives the cap rate}$$

$$R = r - g = \frac{NOI_1}{V},$$

under the assumption that the income stream will grow with a rate of g . Thus, a city experiencing rental growth will most likely see a compression in capitalization rates.

Sivitanidou and Sivitanides (1999) used an econometric analysis on office property transaction data in order to study the determinants making up the capitalization rate. They found that the most important components were the traits of the local market such as tenant diversity, net absorption and vacancy rate rather than the national traits as inflation or stock returns.

The cap rates used in this study are generously provided by CBRE Econometric Advisors and they are smoothed to eliminate noise in the National Council of Real Estate Investments Fiduciaries (NCREIF) data used to calculate them.

3.4.3 Total return

The yield on an investment is the realized rate of return for the investor. The return formula used in this study is a combination of the cash flow return of the property and the appreciation return of the property:

$$\text{Total Return}_t = A_t + \text{Yield}_t$$

where the appreciation return A_t is calculated as:

$$A_t = 100 * (\text{Value}_t - \text{Value}_{t-4}) / \text{Value}_{t-4}$$

and the yield Yield_t is calculated as:

$$\text{Yield}_t = (\text{CF}_t / \text{Value}_t) * 100,$$

where CF_t is the cash flow of the property at time t .

3.5 Regional Distinctiveness

Markusen and Schrock (2006) proposed that in order to stand out in the competition, a city has to be distinctive in its productive structure, consumption and identity. Employment in different sectors in a metropolitan area is studied against the average of the 50 largest metropolitan areas in the U.S. according to the formula:

$$RDI_r = \sum_o \frac{|E_{or} / E_r - E_{oR} / E_R| * 100}{2}, \text{ where}$$

E_{or} = employment in occupation o in region r ; E_r = total employment in region r ; E_{oR} = average employment in occupation o in the 50 largest U.S. Metropolitan areas; E_R = total

employment in the 50 largest U.S. Metropolitan areas. An index is then constructed where the metropolitan areas are ranked from highest to lowest regional distinctiveness. From Markusen and Shrock (2006), the scores for regional distinctiveness is drawn:

Metro Area	RDI Rank	RDI Score	Hypothesized market
Washington	3	5.99	24-hour
Las Vegas	7	4.01	24-hour
San Francisco	10	3.23	24-hour
Los Angeles	12	3.19	24-hour
Charlotte	13	3.17	18-hour
Boston	16	3.04	24-hour
Austin	17	2.90	18-hour
New York City	18	2.90	24-hour
Miami	19	2.77	24-hour
Denver	25	2.39	18-hour
Seattle	26	2.30	18-hour
Nashville	27	2.18	18-hour
Portland	37	1.42	18-hour
Atlanta	42	1.27	18-hour
Chicago	43	1.18	24-hour
Dallas/Ft. Worth	44	1.17	18-hour

Previous research proposes a different measure for the ratio of an industry's share of the regional economy, the location quotient (Isserman 1977). Assuming that the area of study is the region R of a nation N and that employment E is the appropriate measure of economic activity. Then, the location quotient for industry I can be defined as:

$$LQ_i = \frac{E_{ir} / E_r}{E_{in} / E_n}$$

Isserman (1977) argued that the early empirical work on the location quotient showed signs of inaccuracy in the model. For the regional share of a nation's employment in industry *i* to be representative, the productivity per employee in region *r* must be the same as in the nation.

Further, for region r 's share of national employment to represent the region's share of the total national consumption, there must be identical consumption per employee of the products from industry i in the region and in the nation. Thus, the median income in every region must be the same, an assumption which has been proven to be false.

4 Results

In this chapter, results from both the quantitative and the qualitative analysis of the two proposed city clusters are presented. First, responses from the interviews are presented. Following, results from several statistical analyses are shown together with a summary of the tested hypotheses.

4.1 Interviews

The interviews were carried out in order to get an understanding of the use of the 18-hour city concept by industry professionals and how they perceive the construct relative to the more well-known 24-hour city. To get an in-depth knowledge of the local 18-hour markets, the interviewees were then asked why an investor should invest in their respective city instead of a gateway market.

To examine the understanding of the 18-hour city construct, the respondents were asked to provide their perception of the term. The question was formulated as: ***“What is your understanding of the 18-hour city concept relative to 24-hour cities like New York and San Francisco?”*** The answers given by the interviewees were:

“It is my understanding that 24 hour cities have retailers, services and public infrastructure that is generally open on a 24-hour basis. There is a reason New York is called the city that never sleeps. 18-hour cities are similar in that they may have public transport, restaurants and shops in the urban core that are open about 18 hours—somewhere between 6am and 2am (on weekends). The problem I see with this hourly assessment of cities is that it really only pertains to the downtown areas. The outskirts, even still in the urban core, may not have shops open that long, although some do. I think a more accurate reflection of what is actually happening in the so-called 18-hour cities is that the downtowns and urban infill areas are being transformed into “live, work, play” areas.

Whereas many downtowns in the U.S. were run-down and industrialized into the 1990s there has been a sort-of reinvestment into making them livable again. This has to do with changing demographics and lifestyles where (young) people want to be close to work and social options. They want to take public transport instead of using cars. Whereas the 24-hour cities provided this option, the secondary “18-hour cities” didn’t until recently. Cities like Denver are now catching up. People want to be in secondary markets like Denver that provide the infrastructure advantages of the larger gateway cities but not the high cost of living.” (A1)

“My understanding of the 18-hour city (like Denver) compared to 24-hour, gateway cities is that the 18-hour city has a vibrant night life in core or central city areas. However, unlike cities like New York, San Francisco, London, 18-hour cities shut down between the hours of midnight and 6 am.” (B1)

“18-hour cities are an evolution of what 24-hour cities offered citizens over the past decade or two. It’s a second tier concept that cities (like Portland) aren’t going to have the hustle and bustle of cities like New York and San Francisco because we still shut down at night and the workforce predominately quiets. Recently, however, there has been a greater demand for restaurants, bars, stores, etc. in the central city core. People are moving away from the suburbs and this has resulted in more activity and investment into the ‘live, work, play’ model where people want to be near all of their favorite amenities.” (C1)

“The ultimate 24-hour U.S. city is New York City, which boasts some of the densest neighborhoods in the U.S., has myriad late-night food and entertainment options, and always has a bit of hustle and bustle at all hours of the day and night. Essentially, the streets are almost never empty, any time of day. Internationally, places like London, Hong Kong, and Tokyo share these same qualities. An 18-hour city is one with less density, fewer food and entertainment options, and where the streets of the city seem to slow down after a certain hour. There are fewer reasons for the populous to be out at all hours of the night because there’s not much open after 2am. I would even hesitate to call San Francisco a 24 hour city (closer to 20 hours at best, if we’re splitting hairs). Cities like Denver, Portland, Austin, and Dallas would definitely qualify in my opinion.” (D1)

“Honestly, I’ve never heard of this concept, though it makes sense. Typically we refer to these markets like New York as “Primary,” Nashville as “Secondary” markets, with Nashville suburbs as “Tertiary” markets.” (E1)

“My understanding is that 24 hour cities such as New York and San Francisco were considered more attractive to companies in the past, over the past few years the tables have turned. Companies felt that in order to attract and retain talent, they needed to be in the areas that had the most action occurring, so to speak. Smaller scale cities like Charlotte, Raleigh-Durham, Austin, and Denver are growing tremendously with population, which in turn helps populate the workforce and talent pool for companies. These smaller scale cities have been utilizing the live-work-play concept that larger cities like New York, San Francisco, and Chicago have used for so long. Employees want to be able to have shorter commutes, pay less for rent, and have entertainment all in the same area.”(F1)

“Secondary markets like Atlanta that have become 18 hour cities have gained a lot of interest due to the high quality of life, low cost of doing business, and low cost of living. By comparison, on a scale of 100 being the median cost in America to live (C2ER), Atlanta ranks 96 versus Manhattan at 228 and San Francisco now at 243. Meaning a \$100,000 dollar salary in Atlanta goes two and a half times farther than other 24 hour cities. 18 hour cities are gaining enough momentum to offer many of the benefits of a traditional 24 hour city without the cost.” (G1)

“18-hour cities will be 24-hour when they grow up, are just not as expensive [and will] attract millennials & baby boomers alike, those that want to live in or near the city center.” (H1)

“My take on it is that 24 hour cities are more attractive to millennials and empty nesters. So investing in an 18 hour city such as Seattle has more upside due to its trajectory towards 24 hour status.” (I1)

“By definition I would assume an 18 hour city to be one that is quite active, perhaps on the rise in terms of growth, but not necessarily a major hub for culture, economic activity and population sizes in excess of 7-10million. Where New York never sleeps, most clubs close in Portland around 2am. The 18 hour city may be a major influence in culture, or economic activity yet is not the behemoth that New York, San Francisco or London have grown into.” (J1)

Comments

These answers are in line with the general definition of an 18-hour city as laid out in industry literature such as *Emerging Trends in Real Estate* (2015). Thus, an 18-hour city is seemingly understood by industry professionals to be a growing city with plentiful of urban amenities, a positive in-migration, a large talent pool and at the same time it offers lower cost of living than 24-hour cities with similar attributes.

To get a more in-depth knowledge of why an investor should consider these markets instead of a gateway city, the respondents were asked why an investor should invest in the aforementioned 18-hour city instead of a 24-hour city. This inquiry relates to the second research question and the aim was to identify the attributes spurring higher investments in 18-hour markets. The question was formulated as: ***“Why should an investor ever invest in an 18-hour city instead of a 24-hour city?”*** The responses were as follows:

“Simply, there is a greater return on investment in the 18-hour cities because competition for investment has not inflated property values and compressed cap rates the way it has in gateway markets. Also, 18-hour cities are poised for greater growth than some of the 24 hour cities that may have already utilized all available space in the urban core. People and companies are flocking to secondary markets, for cost and lifestyle advantages—with this type of growth there is also less risk associated with investing in places that were once considered ‘cowtowns’.” (A2)

“I think investors should consider 18-hour cities, especially in the current commercial real estate climate, because of the relatively low cost of entering those markets compared to coastal markets, with opportunity for a higher return. When considering a market like Denver, investors should consider the overwhelming interest millennials have in our market. For the past five years Denver has continually been in the top markets in the US for in-migration of millennials. Factors such as abundant employment opportunities, low cost of living compared to coastal markets, on-going investment in the light rail transportation system, and the availability of year-round outdoor activities play an enormous role. I feel Denver is the ultimate live, work, play city, which, as I’m sure you know, has become the driving factor in a millennial’s choice of where to establish themselves.” (B2)

“The prices in Portland are still affordable to investors and the potential hasn’t been maxed out yet. There’s a risk to being a second tier city, but the odds of all of the jobs leaving or people decided they want to go back out to the suburbs is low. We also haven’t seen a huge influx of jobs from the larger cities (yet), but if the larger 24-hour cities keep seeing their rates and the cost of employment increasing, 18-hour (or second tier cities) will benefit even more. “ (C2)

“The yield on investment in an 18-hour city has the potential to be higher than in a 24-hour city, but this is because there are more risks inherent in these types of investments. Places like NYC [i.e. New York City], Boston and [Washington] DC have larger employment bases, and more diverse economies (except [Washington] DC), and have the quality of life features that a 24-hour city provides, making them solid investments that offer steady rates of return over a long period of time. In contrast, 18-hour cities offer greater return opportunities, but they are also prone to increased risk because they have less diverse industry bases, smaller employment and talent pools, and therefore have lower rent growth prospects, thus limiting returns. But, if an 18-hour city is showing rapid employment growth, and seeing increased demand for real estate as a result, then these markets can see quick value appreciation and therefore see great returns on investment in a short period of time. The downside is that these markets are also prone to increased volatility, so [they] are at risk for a steep decline in values if the one or two industries supporting growth in these places suddenly falters.“ (D2)

“A capitalization rate in “24-hour” or Primary market, such as New York, for a retail investment property could be around 4% or even less, whereas you can purchase the same asset, same tenant, same lease term, etc. in a market like Nashville for a cap rate of 6% or 7% or more, thus giving you a better return on the same type of product. You often get a better value and better return in Nashville, in my opinion. We’re seeing a lot of this in Nashville right now with apartment developers in California selling their sites for 4% caps and flipping the money into 6.5% cap retail investments in Nashville. I’m doing a deal right now exactly like this. Basically you can get a higher yield for these investments as you can get a higher cap rate in Nashville than you can in NYC [i.e. New York City], but the same exact loan with the same interest rate = greater yield.” (E2)

“Charlotte is considered one of the up and coming mid-sized markets in the country, it is by no means on the same scale as cities like New York and San Francisco, but from a population growth perspective it is up there. Investors should consider Charlotte because it is one area where jobs are chasing people, compared to major cities where it is the other way around. Companies recognize that the Sun belt region, specifically Charlotte, has low labor costs and an affordable environment for people to live in. Charlotte’s population is expected to grow by 70% from now until 2030. The allure to high profile cities hasn’t gone away, but it has lost some muscle to second tier cities. Cities like Austin, TX, Charlotte, NC, and Raleigh-Durham, NC have taken center stage as the unique type of city that today’s younger (millennial employee) is looking for.” (F2)

“Because of the issues surrounding the mobility of capital, people are gravitating toward cities that are livable from a cost perspective – as are corporates. If you look at where all the greatest in-migration is going on in the US, it will be found in the Southeast and Texas – areas that offer nice climate, low cost of living, places to recreate, and where businesses can cost effectively run. The biggest example is this: Atlanta has gained five Fortune 500 headquarter relocations in the same time that New Jersey has lost the four. This is where talent is gravitating. New York and other areas are not gaining positive in-migration only birth rate additions. No one wants to pay for this kind of cost anymore. My favorite example is that the median home price in the city of San Francisco is \$1.1+ million dollars. Atlanta is \$229k. Which would you pick?” (G2)

“Lower cost relative to the 24-hour cities, but still attract similar employers seeking talent [or the] above mentioned [millennials and baby boomers] demographics”(H2)

Comments

The answers indicate a broad consensus of the attributes making 18-hour cities attractive markets. Many of the respondents highlighted the livability aspect of 18-hour cities, i.e. the fact that they offer urban amenities but with a lower cost of living than their 24-hour counterparts. They seem to agree also on the fact that corporations in 18-hour cities are searching for talent is a competitive edge since it creates a strong in-migration of high-skilled labor. Furthermore, E2's answer "*We're seeing a lot of this in Nashville right now with apartment developers in California selling their sites for 4% caps and flipping the money into 6.5% cap retail investments in Nashville*" shows that investors are willing to leave the gateway cities in search for higher yields in secondary markets. D2 also recognized the fact that these markets inherently carry a greater risk than 24-hour cities because the employment base is not as diverse in 18-hour cities which makes them prone to increased volatility of returns.

4.2 Statistical analysis

4.2.1 Descriptive Statistics.

Table 5. Summary statistic

	Mean	S.D.	Minimum	Maximum
unemployment	4.506	0.882	3.1	6.2
investment volume	2104.477	3778.562	83.2	15705.3
job growth	2.504	0.861	0.59	3.81
median income	54,221	9,674.515	43,099	78,378
air pollution	43	17.531	16	78
walkability	59.063	20.904	24	88
violent crimes	411.431	132.628	258.7	743
property crimes	2,802.663	904.76	321.6	4,189.4
cost of living	74,139	14,260	54,389	106,493
population density	4,460.372	1,738.031	2,122.296	8,773.987
regional distinctiveness	2.694	1.220	1.17	5.99
journey to work	0.173	0.158	0.022	0.562
share high skilled workers	0.402	0.105	0.216	0.579
internet capacity	156.859	141.929	54.41	557.19
raw price per sq. ft.	298.043	147.6512	147.04	602.15
home prices	1,921.25	632.695	1200	3300
coastal city dummy	0.4375	0.512	0	1
warm climate	8.39375	5.586	0.7	21.2
rent	32.898	11.49	17.73	62.97
return	13.49	6.159	0	30.77
cap rate	5.216	0.632	3.75	6.29

Table 5 describes the summary of the explanatory variables used in the regression analysis of the effect on cap rates from these variables. The number of observations was 16, one for each market, and the small number of observations led to large standard deviations in most variables. Worth noting is the substantial disparity in investment volume for Q4 2015 between the lowest (Portland) and the highest (New York City).

4.2.2 Regression Results

The results from a comprehensive regression analysis is shown and interpreted in this section. The analysis was carried out to test a number of hypotheses regarding the property performance in 18-hour cities versus 24-hour cities similar to the framework used by Kelly (2011). First, a linear regression is done to assess the attributes of a city which affect the cap rate. Secondly, two t-tests are performed on returns and cap rates to examine whether these differ statistically between the two clusters.

4.2.2.1 Linear Regression

Table 6. Results of regressions (dependent variable = capitalization rate)

	(1) β_i	(2) β_i	(3) β_i
unemployment	0.343*** (6.26)	0.0693 (0.97)	-0.0647 (-0.75)
investment volume	-5.71e-06 (-0.23)		-0.000249 (-0.96)
job growth	0.2614*** (4.33)	0.432** (4.95)	0.03481** (3.81)
median income	-0.0000547*** (-7.35)	-0.0000311 (-2.33)	-0.0000731** (-5.60)
air pollution	-0.0135*** (-5.46)		
walkability	-0.0321034*** (-7.68)	-0.0202** (-3.54)	-0.01675* (-2.59)
violent crimes	-0.0011679** (-3.21)	0.00043 (0.47)	
cost of living		0.0000893* (2.57)	0.0000893** (4.17)
population density			-0.0000817* (-2.70)
regional distinctiveness	-0.145 (-1.71)	-0.315 (-2.13)	-0.0364783** (-3.81)
journey to work	0.184 (0.16)	-1.617 (-1.00)	
share high skilled workers		-3.946* (-3.08)	
restaurants per capita			3181.216** (4.31)
internet capacity		0.00127 (1.61)	
raw price per s. ft.			-0.0018021 (-2.10)
cost of renting		-0.0009829** (-4.34)	
coastal city dummy			-0.1508 (-0.60)
warm climate		-0.0564 (-2.35)	0.01879 (1.90)
R-Squared	0.9544	0.9420	0.9493

Notes: t-statistics are shown in parentheses; * significance at the 0.1 level; ** significance at the 0.05 level; *** significance at the 0.01 level.

The results of several regressions are summarized in table 6. The models seem to explain the variability in cap rates very well since the R^2 lies in the range of 0.9420 to 0.9544 for all models. Further, there are numerous significant variables that influence the cap rates in the studied markets.

Column (1) shows the baseline model used in the regression. This model includes the most important economic variables and amenities of a 21st century urban city laid out in the literature review and the model is used to test the variables' significance in relation to property yields. After running the model, the results indicate a great importance of the local labor market due to job growth and unemployment being significant at the 99% confidence level, as well as the crime rate and high walkability. However, the investment volume showed no statistical significance and thus it is understood that in this particular model, the dollar amount of investments do not affect the cap rate. Further, the baseline model revealed that the regional distinctiveness is not significant.

In column (2), the baseline model is modified and the cost of urban living is added. The results indicate that a high cost of living for a family of four is associated with high-cap cities, which contradicts the theory that more expensive 24-hour cities have lower cap rates. Although the cost of living had a positive coefficient, the cost of renting an average house showed a negative coefficient, indicating that housing is more expensive in cities with low cap rates. Further, the model shows that cities with low cap rates have a higher fraction of residents with a bachelor degree or higher.

In column (3), population density and restaurants per capita were added to the model to assess the vibrancy aspect of urban amenities. The results show a negative effect on cap rates from density and a positive effect from restaurants. This indicated that low-cap cities have a higher density than high-cap cities but high-cap cities offer more restaurants per capita.

According to the results, cities with low cap rates are walkable, dense and offer residents a high income. It is also shown that they contain disamenities such as high crime rate and air pollution.

4.2.2.2 Two-sample Independent t-test

A two-sample independent t-test was carried out on return and cap rate data for the two clusters to test hypothesis H_1 : Investments in 18-hour cities are more profitable than 24-hour cities; and H_3 : 18-hour cities see higher cap rates compared to 24-hour cities. The results are shown in the tables below.

Total Returns

Table 7. Two-sample independent t-test on total returns

Group	Obs	Mean	Std. Error	Std. Dev.	95% Conf. Interval	
18-hour	8	13.72125	3.02018	8.542359	6.579659	20.86284
24-hour	8	13.25875	1.012043	2.862489	10.86565	15.65185
Combined	16	13.49	1.539772	6.15909	10.20805	16.77195
diff		.4625002	3.185234		-6.369148	7.294148
diff = mean(18-hour) – mean(24-hour)					t =	0.1452
H_{01} : diff = 0					degrees of freedom =	14
H_a : diff < 0			H_a : diff \neq 0		H_a : diff > 0	
P = 0.5567			P = 0.8866		P = 0.5533	

In the t-test on the mean value of total returns in the two hypothesized clusters, the null hypothesis that the clusters have the same profitability cannot be rejected ($t < 1.96$). Thus, hypothesis H_1 that investments in 18-hour cities are more profitable than investments in 24-hour cities is rejected.

Capitalization Rates

Table 8. Two-sample independent t-test on total returns

Group	Obs	Mean	Std. Error	Std. Dev.	95% Conf. Interval	
18-hour	8	5.56625	0.1726778	.4884066	5.157932	5.974568
24-hour	8	4.865	.2053046	.5806892	4.379532	5.350468
Combined	16	5.215625	.1580769	.6323076	4.878692	5.552558
diff		.70125	.2682678		.1258727	1.276627
diff = mean(18-hour) – mean(24-hour)					t =	2.6140
H_{03} : diff = 0					degrees of freedom =	14
H_a : diff < 0			H_a : diff \neq 0		H_a : diff > 0	
P = 0.9898			P = 0.0204		P = 0.0102	

By testing the mean value of cap rates in the two hypothesized clusters in a t-test it is shown that there exists a statistically significant ($t > 1.96$) difference in cap rates between 18-hour

cities and 24-hour cities. Thus, the null hypothesis is rejected in favor of the alternative hypothesis which means that H₃ that 18-hour cities see higher cap rates than 24-hour cities is accepted.

4.2.2.3 Test on Equality of Coefficients

Total Returns

Table 9. Test on equality of regression coefficients for total returns

Coefficient	Median Income	Unemployment	Rent
β_1	-807.916	-0.673	0.870
β_2	2088.9	-0.272	1.77
SE ₁	446.9	0.033	0.485
SE ₂	1716.8	0.181	1.122
Z-score	-1.632	-2.180	-0.736

The test on equality of regression coefficients on total returns show a difference in slopes of the regression between the two clusters in two variables. The median income has a statistically significant difference at the 10% level and unemployment at the 5% level. Rent was shown to not differ between the two clusters. Holding all other factors constant, unemployment has a bigger negative impact in 24-hour cities than in 18-hour cities. Thus, if a large proportion of the population in 24-hour cities is unemployed, it will have a greater negative impact on real estate returns than in 18-hour cities.

Capitalization Rates

Table 10. Test on equality of regression coefficients for total capitalization rates

Coefficient	Median Income	Unemployment	Rent
β_1	-14,466.6	1.008	-6.946
β_2	-11,1189.1	0.384	-4.595
SE ₁	5,646.1	0.478	8.381
SE ₂	4,013.0	0655	3.794
Z-score	-0.473	0.769	-0.256

The test on equality of regression coefficients on cap rates failed to show a statistically significant difference between the two clusters. Thus, because the interactive effects of these variables cannot be said to differ, a change in median income, unemployment and office rents could affect the two clusters equally.

4.2.3 Hypothesis testing

A summary of the tested hypotheses are shown below.

Table 11. Summary of the tested hypotheses and the decisions

Tests	Null Hypotheses	Test Statistics
Two sample t-test on total returns	$H_{01} : diff = mean(18h) - mean(24h) = 0$	$diff \neq 0$
Linear regression	$H_{02} : \beta_i = 0, \text{ for all } \beta_i$	$\sum_i^{16} \beta_i \neq 0^{**}$
Two sample t-test on capitalization rates	$H_{03} : diff = mean(18h) - mean(24h) = 0$	$diff \neq 0^{**}$

Notes: ** significance at the 0.05 level.

From the statistical analysis it is shown that 18-hour and 24-hour cities do not differ in terms of returns, however cap rates are significantly higher in 18-hour cities. The regression analysis also shows that inherent attributes of 18-hour cities e.g. job growth and walkability affect cap rates.

5 Discussion

When *Emerging Trends in Real Estate* (2015) named 18-hour cities the hottest markets in the U.S., it raised the question if these markets really are better for investing than gateway cities like New York or San Francisco. In order to do an assessment of the investment prospects in these two hypothesized clusters, a statistical analysis framework was used to test three hypotheses: investments in 18-hour cities are more profitable than in 24-hour cities; there are inherent attributes of 18-hour cities that leads to higher yields; 18-hour cities have higher cap rates than 24-hour cities. These hypotheses, complemented with qualitative interviews with industry professionals, were used to evaluate the three research questions utilized in this paper: Why would investments in an 18-hour city be more profitable than investments in a 24-hour city?; What are the key factors leading to higher investments in 18-hour cities?; Are there any proofs of higher yields?

The quantitative analysis performed on return data for 18-hour and 24-hour markets failed to show a statistically significant difference, which would indicate that the profitability in these two market clusters are in the same range. The performance of these two clusters have not been studied before but in Kelly et al.'s (2013) comparison of two hypothesized 24-hour and 9-to-5 market clusters it was shown that the 24-hour market outperforms the 9-to-5 market. Here, a distinction between returns in 24-hour and 18-hour cities cannot be made which should indicate that 18-hour cities are leaving its low 9-to-5 appeal behind and are on the trajectory towards being 24-hour cities.

However, the attractiveness of 18-hour markets does not lie solely in its present returns but the growth potential of future rents. As many respondents pointed out in the interview, these markets are experiencing the highest in-migrations in the country where a high fraction is educated people, adding to a high-skilled labor pool. Traditional growth theory (Solow 1956) tells us that the most important determinant in economic growth is human capital, and with high quality human capital flowing in to these cities they are bound to see a strong economic development. Birch (2005b) stated that if the emerging downtowns in her typology will continue in their pace of growth, they will most likely surpass or join the fully-developed downtowns. Emerging downtowns are the likes of Atlanta, Charlotte, Denver and Seattle which are all experiencing a strong population growth. If these cities continue to grow at the same rate, they may transition to a 24-hour status in a few years. Although the population is growing, it is known from Kelly et al.'s (2013) socio-economic analysis that amenities are changing in a slow pace, which should mean the amenity advantage of 24-hour cities will

remain a factor in the foreseeable future.

From the analysis of cap rates in the two clusters it could be asserted that 18-hour cities have higher cap rates than its 24-hour counterpart. This result is in line with Malizia and Song's (2015) conclusion that cities with more advanced live-work-play centers show better downtown office performance, and thus less risk. The results failed, however, to show a statistical significant difference in regression coefficients for cap rates between the two clusters. This shows that the interaction effects from the explanatory variables median income, unemployment, and office rent on cap rates are the same between 18-hour cities and 24-hour cities even though the cap rates differ statistically. This means that if income, unemployment and office rent fluctuate, the two clusters will not be affected differently in terms of cap rates. D2 mentioned in the interview that 18-hour markets inherently carry a greater risk than 24-hour markets because of their less diverse employment base. If a company with a large proportion of the local labor force (e.g. Coca Cola Company in Atlanta) decides to relocate, this can seriously hurt a city with a less distinctive character, even though Markusen and Schrock (2006) posited that a city must be distinctive in order to thrive.

In the current market where investors are showing a greater appetite for risk (CBRE 2015) one might speculate that markets with higher yield, and higher risk, will be on more investors' radar in the years to come. From a portfolio perspective, MTP tells us that adding more assets with specific risks to a portfolio lowers the asset specific risk for that portfolio (Markowitz 1952). If investors historically have invested most of their capital in 24-hour markets, then assets in 18-hour markets would be great instruments for diversification of a portfolio. This phenomenon is already happening though. The interviews indicated that developers are leaving low cap sites in primary locations and gravitating towards 18-hour markets in search for higher yields.

It is impossible to assess the attractiveness of cities without discussing demographics. Generation Y is now the largest generation in the U.S. (Census 2015) and is shaping the country in terms of culture and labor. The millennial generation is set on an urban lifestyle, which reflects in the fast urbanization of America (Wilson et al. 2012) and the need for urban amenities. Many interviewees highlight the fact that 18-hour cities offer great urban amenities but at a lower cost of living than gateway cities and today people are drawn to cities that are affordable but at the same time offer high livability. As an example, G2 mentioned in the interview that *"the median home price in the city of San Francisco is \$1.1+ million dollars.*

Atlanta is \$229k. Which would you pick?" This relates to Hunt and Mueller's (2004) study on migration in the U.S. where it was concluded that people relocate to areas where they realize the highest return for their skill. If a person can realize a higher relative income in Atlanta than in San Francisco and at the same time enjoy high quality urban amenities, why would someone then locate in San Francisco? This is probably one of the reasons why 18-hour cities are experiencing a strong in-migration while New York and other areas are not seeing a positive in-migration, only birth rate additions. With a strong in-migration of high-skilled labor, could it be that the creative class Florida (2002) posited is gravitating towards 18-hour cities? From Simon's (1986) research we know that cities with high quality human capital realize a strong economic growth. Thus, 18-hour cities should be headed for a future economic development, and with it, increased return prospects in the real estate sector.

The regressions show that there are a number of urban amenities influencing cap rates. In line with research carried out by e.g. Insch and Sun (2013), Hu et al. (2013) and Okulicz-Kozaryn (2011) it was demonstrated that factors such as employment opportunities, vibrancy and cost of living are significant features of cities pertaining to the city's associated cap rate. This goes to show that urban amenities play a big role today in terms of where people want to live and work. Employment opportunities, vibrancy and cost of living are three essential traits of 18-hour cities mentioned by interviewees which is an indication that an 18-hour city inherently contains many of the urban amenities sought after by the millennial generation. Conforming to traditional agglomeration theory, density was shown to affect cap rates negatively at the 10% confidence level. A denser city will see lower cap rates, which connects to Jacobs' (1969) and Birch (2005b) theories, who both stressed the importance of the knowledge spillover coming from large concentrations of people being bound in a spatial environment. One might speculate that if a corporation is located in the core of a major city, the proximity to other organizations for agglomeration effects and the range of services offered in the area will drive up prices. As the 18-hour cities transition from being car-dependent poster children of sprawl to incorporating a live-work-play environment in the planning of their city cores, more people will want to reside in the downtowns of these markets and further drive the urbanization forward.

Contradictory to for example Kelly (2011), cost of living and restaurants per capita have positive beta values, which indicates a correlation between high cap cities and a higher cost of living and more restaurants per capita. One might think that these two variables would affect the cap rate negatively since a 24-hour city is thought to be more vibrant and more expensive

than an 18-hour city. A reason for these results differing from theory might be inaccuracies in data collection or faulty modeling. However, the model managed to find that 24-hour, or big cities, contain disamenities such as air pollution and a high crime rate which is not yet present in up-and-coming 18-hour cities. Glaeser et al. (2001) discussed weather as the most important physical feature of a city, alongside the harder-to-quantify aesthetics, but strangely, a deviation from 70 degrees Fahrenheit (21 degrees Celsius) average temperature in July was not shown to affect cap rates. To improve the model and assess the impact of weather, a more accurate measure might be the precipitation instead of temperature.

6 Conclusion

The objective of the current study was to assess if 18-hour cities offer better investment opportunities than 24-hour cities. The purpose of this was to give us an understanding of the relationship between the attributes and expected future growth of a city and its yields.

A statistical analysis was used to test the hypothesis that cap rates and returns are higher in 18-hour cities than 24-hour cities. While cap rates were shown to be significantly higher in 18-hour cities, the returns in the two clusters cannot be distinguished. This indicates that the market values in 18-hour cities are significantly lower, which in turn helps an investor to achieve a higher yield in these markets for the same product the investor would purchase in a 24-hour city to a higher price.

Further, a regression analysis was utilized to test if the attributes making a city attractive laid out in literature affects cap rates. It was shown that most of the traits of 18-hour cities named in industry literature have an impact on cap rates. Unemployment, job growth, crime rate, cost of living, walkability and density among other variables were all shown to affect cap rates, which indicate that the inherent characteristics of 18-hour cities affect cap rates.

Interviews were carried out with industry professionals to assess the use of the 18-hour city construct and get an insight into why 18-hour markets are attractive compared to 24-hour markets. The respondents indicated that 18-hour markets are more attractive due to the fact that they are amenity-rich, have a relatively low cost of living and a strong in-migration of high-skilled labor. However, risks inherent in 18-hour cities were also mentioned. Because of its less diverse employment base there is risk of vacancies if companies choose to relocate. Overall, the respondents were very positive to investments in 18-hour cities owing to the notion that these markets will grow tremendously in both terms of population and quality of urban amenities in the coming years.

7 Suggestions for Further Research

Future research on the subject of real estate investments in 18-hour cities versus 24-hour cities should focus on identifying global cities in these clusters to achieve a greater geographical spread. Globally, there are a number of 24-hour cities (e.g. Tokyo, Hong Kong, and London) that would pose as a greater contrast to the 18-hour cities identified in this study.

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Appendices

Appendix 1. Interview questions

1. What is your understanding of the 18-hour city concept relative to 24-hour cities like New York and San Francisco?
2. Why should an investor ever consider to invest in an 18-hour city instead of in a 24-hour city?

Appendix 2. Outputs from the statistical analysis

Model 1

reg CAP UEMP INVV JGTH INCO AQI WALK VCRI COST RDI2 COM

Source	SS	df	MS	Number of obs =	16
-----+-----				F(10, 5) =	32.39
Model	5.90601574	10	.590601574	Prob > F	= 0.0006
Residual	.091176846	5	.018235369	R-squared	= 0.9848
-----+-----				Adj R-squared =	0.9544
Total	5.99719259	15	.399812839	Root MSE	= .13504

CAP	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
-----+-----						
UEMP	.3432889	.0548806	6.26	0.002	.2022138	.484364
INVV	-5.46e-06	.0000236	-0.23	0.826	-.0000662	.0000553
JGTH	.2613758	.060373	4.33	0.008	.106182	.4165697
INCO	-.0000547	7.44e-06	-7.35	0.001	-.0000739	-.0000356
AQI	-.0134781	.0024707	-5.46	0.003	-.0198293	-.0071269
WALK	-.0321034	.0041802	-7.68	0.001	-.0428489	-.0213578
VCRI	-.0011679	.0003644	-3.21	0.024	-.0021045	-.0002313
COST	.0000487	.0000161	3.02	0.029	7.22e-06	.0000902
RDI2	-.1447757	.0849007	-1.71	0.149	-.36302	.0734685
COM	.1838644	1.174927	0.16	0.882	-2.836381	3.20411
_cons	5.695533	.9005275	6.32	0.001	3.380654	8.010413

Model 2

reg CAP UEMP JGTH INCO WALK VCRI COST RDI2 COM SCHOOL BWT HOME TEMP

Source	SS	df	MS	Number of obs =	16
-----+-----				F(12, 3) =	21.30
Model	5.92760527	12	.493967106	Prob > F	= 0.0142
Residual	.069587315	3	.023195772	R-squared	= 0.9884
-----+-----				Adj R-squared =	0.9420
Total	5.99719259	15	.399812839	Root MSE	= .1523

CAP	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
-----+-----						
UEMP	.0692865	.0715624	0.97	0.404	-.1584569	.29703
JGTH	.4314591	.0871379	4.95	0.016	.1541472	.7087709
INCO	-.0000311	.0000133	-2.33	0.102	-.0000735	.0000113
WALK	-.0202358	.005712	-3.54	0.038	-.0384138	-.0020578
VCRI	.0004299	.0009079	0.47	0.668	-.0024594	.0033193
COST	.0000893	.0000348	2.57	0.083	-.0000215	.0002001
RDI2	-.3151531	.1480685	-2.13	0.123	-.7863731	.1560669
COM	-1.617077	1.622711	-1.00	0.392	-6.781268	3.547115
SCHOOL	-3.946485	1.279362	-3.08	0.054	-8.017984	.1250154
BWT	.0012725	.00079	1.61	0.206	-.0012416	.0037865
HOME	-.0009829	.0002267	-4.34	0.023	-.0017044	-.0002614
TEMP	-.0563814	.0240027	-2.35	0.100	-.1327688	.0200061
_cons	4.779724	1.360612	3.51	0.039	.4496489	9.109798

Model 3

reg CAP UEMP INVV JGTH INCO WALK COST DENS RDI2 REST RAWP SEA TEMP

Source	SS	df	MS	Number of obs =	16
-----+-----				F(12, 3) =	24.39
Model	5.93635488	12	.49469624	Prob > F	= 0.0116
Residual	.060837702	3	.020279234	R-squared	= 0.9899
-----+-----				Adj R-squared =	0.9493
Total	5.99719259	15	.399812839	Root MSE	= .14241

CAP	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
-----+-----						
UEMP	-.0648658	.0863437	-0.75	0.507	-.33965	.2099183
INVV	-.0000249	.0000261	-0.96	0.410	-.000108	.0000581
JGTH	.3481129	.0914068	3.81	0.032	.0572156	.6390102
INCO	-.0000731	.000013	-5.60	0.011	-.0001146	-.0000316
WALK	-.0167533	.0064686	-2.59	0.081	-.0373392	.0038325
COST	.0000893	.0000214	4.17	0.025	.0000211	.0001575
DENS	-.0000817	.0000303	-2.70	0.074	-.0001781	.0000147
RDI2	-.364783	.0956497	-3.81	0.032	-.669183	-.0603829
REST	3181.216	738.8957	4.31	0.023	829.7205	5532.712
RAWP	-.0018021	.0008583	-2.10	0.127	-.0045337	.0009294
SEA	-.1507526	.2498866	-0.60	0.589	-.9460032	.644498
TEMP	.0187919	.0099101	1.90	0.154	-.0127463	.0503301
_cons	3.788347	.6791804	5.58	0.011	1.626892	5.949802
-----+-----						

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