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E-commerce's Impact on Big-Box Retailers

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Honors Thesis

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Abstract

The history of retail has been an evolutionary process of new innovations and transformations. Previous changes include: the development of catalogue based retail, and the recent innovation of super stores, known as big-box retailers. It is possible that we are dawning upon a new revolution of the retail environment as electronic commerce (e-commerce) continues to grow. This paper will analyze the impact of e-commerce on retail markets, specifically big-box stores (warehouse style retailers with over 750 million in sales). Using financial and real estate data from Bloomberg™, and e-commerce data from eMarketer™ and the US Census Bureau two models were built. These two models will be utilized to answer the following questions. Has the growth of e-commerce affected the retail real estate market and the retail financial market? Which retail submarkets have been affected most by the growth of e-commerce? The first model will test whether growth in e-commerce spending in retail submarkets (i.e. sporting goods and bookstores) will cause a decrease in the stock performance of big-box retailers within those market sectors. The second model will test whether growth in the different e-commerce retail submarkets will cause a decrease in the square footage growth rate of the big-box stores in those same retail submarkets.

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Literature Review

With electronic commerce, or e-commerce, now at 71 billion or 6.2% of total retail in the first quarter of 2014 and growing at a pace of 15% annually as compared to 2.4% for all of retail, e-commerce is quickly gaining ground on the overall market. (U.S. Census Bureau, 2014) Some industries have already abdicated to the growing power of e-commerce and other industries surely await. By 2014 e-commerce already had a 39% market share in computer and consumer electronics, 29% in office products, and 60% in books, video, and music. (U.S. Census Bureau 2014) Those percentages have only continued to grow, and now 43.8% of books are sold online, 25% more than brick and mortar retailers, staggering growth since the early 2000's (Greenfield, 2013) These numbers do not necessarily mean that retail as a whole is exploding, but rather transforming. From mom and pop specialty stores, to catalogues, to department stores, to big-box retailers, e-commerce is the next stage of development. This is a fascinating area of research and since the tech boom in the late 90's there has been significant literature on the possible impacts of electronic shopping. Some predictions have proved incorrect, while other pieces have proved to be prophetic. E-commerce was predicted to impact various areas, including landlord tenant relationships, real estate value, transportation, and geography.

One of the most interesting areas of impact from e-commerce is on the structure of commercial real estate leases. Typically rents are structured where tenants pay a base rent and then their rent increases by a certain percentage of their sales. This way the interests of the landlord and the tenant coincide. The tenant obviously wants to increase sales in a desire to make the space profitable, and the landlord will desire to make the surrounding area and environment of the shopping center appealing to customers in order to increase their rent profits. However, the introduction of e-commerce has caused a few problems with the landlord tenant relationship. Two areas of difficulty are the existence of 'devil customers', and the issue of showrooming. Devil customers are people who buy 20 different styles or colors of a product, only to keep 1 and return the other 19 (Laseter *et al*., 2007). Although this is a huge hassle in terms of return policy, it can also cause a disruption in the percentage leases. When a customer returns 19 items to a store that were purchased online it counts against their sales at the store, thereby reducing their rent cost, even though the items were originally purchased outside the store. The second problem is showrooming. Someone may enter their local Best Buy™ and be looking at digital cameras, try out all the devices, but then decide that the store does not have the desired color. If Best Buy™ had that color available online, the customer could then buy it online in the store and that sale could not be tracked in order to be factored into the percentage lease.

Researchers have long recognized this problem and have offered suggestions to modify the lease system into what is known as a "wired lease". A wired lease is a lease that factors e-commerce sales into the percentage rent calculations. A few suggestions to correct the problem included using an inverse or negative percentage lease, raising the base rent, or using the web to drive in-store customer sales (Miller, 2000). The idea of an inverse lease is giving the retailer a higher than market level rent, but then providing an incentive to increase in-store sales by having the rent cost decrease as sales increase. This would then motivate the retailer to include in-store online sales in their per-store calculations as well as create a system for managing online returns so as not to negatively affect sales levels at their brick and mortar stores. This does however have the possibility of disrupting the mutual relationship between landlord and tenant. The landlord no longer has as much incentive to maintain the grounds, as it will cause his/her rent levels to decrease. However, if the landlord responds in this manner, it is unlikely that retailers will accept these types of leases in the future. Yet if nothing is changed the growing threat of undocumented e-commerce sales still remains. Raising the base rent is another more simple possibility, but it also has its consequences. Although raising the rent would likely account for possible lost revenue due to devil customers or in-store

online sales, it is likely that retailers would react negatively and possibly transition their stores into smaller spaces and embrace the concept of showrooming. A smaller store would have a cheaper rent and with the availability of the online marketplace, stores could still have the same product variety available to customers, with a smaller store inventory. This would negatively affect landlords and is an unlikely option.

The third suggestion encouraged property owners to embrace the "web" of challenges and use the Internet to drive traffic to the shopping centers. This could occur through a couple different formats, using web-generated coupons, or have consumers order online and pick-up in the store. These two suggestions have been embraced the most by retailers since the digital age. Groupon™ is just one of the many online coupon marketplaces that are designed to drive customers to the store, where they are more likely to make impulse purchases. Retail researchers have long noted that the more time a shopper spends in a store and looks at products the more likely they are to buy (Beatty and Ferrell, 1998). The same strategy is in place for the buy online pick-up in store option, which essentially turns the store into a mini-warehouse, a practice now in heavy use by retailers such as Wal-Mart™, Best Buy™, and Home Depot™. This is especially prevalent with items that are inconvenient to ship to personal residences, like home appliances, furniture, and flat-screen TV's. These three ideas have been implemented with various success, and even though in 2001 16% of retailers claimed to be under a wired lease, this growth has since stagnated (Worzala *et al*., 2002). Landlords have seen their power decreased and retailers are not bending to their demands. The process of measuring sales from e-commerce and applying it to specific stores is quite difficult, and to this day it has not been solved. "'Many landlords are fighting to get percentage sales that somehow worm their way into Internet revenues,' Brown said. 'But the big retailers are generally saying 'No,' and most landlords are backing down, ultimately.' 'It is one thing if you have a solo shop with a website, but realistically how do you try to claim a piece of Williams-Sonoma's™ e-commerce revenues for one store, say in Colorado? Plus the landlords need the retailers now more than they need any one particular landlord,' Brown added. 'So outside of a few major players like Simon, Westfield, Macerich and others, it is not like the landlords have all that much leverage'"(Heschmeyer, 2014). As e-commerce continues to grow, it will be fascinating to see how this landlord tenant relationship is resolved.

As shopping trends change so does the value of real estate. Big-box retail, the latest retail real estate development, quickly became the centerpiece of 'suburbia', large-scale shopping centers designed to meet all the needs of the surrounding community in one large real estate property. Research has shown that large-scale general merchandizers greatly outpaced the growth of smaller specialty stores from 1997-2007 (Basker *et al*., 2012). It remains to be seen whether e-commerce will have a similar effect on real estate value. In the early 2000's retailers acknowledged the existence of e-commerce, but most did not view it as a major threat to their brick and mortar operations at the time. In 2001, two-third's of retailers expected their space requirements to increase or stay the same while only a third expected their warehouse or distribution space needs to increase (Worzala, 2002). This illustrates their complacency regarding the future growth of the online shopping model. Although mobile shopping, which is using a smart-phone to browse and purchase products online, did not exist at the time, some did predict its future. "Imagine, now a similar scanner with a built in computer, web browser and cell phone. Consumers could review products, try them, test them out, examine quality, then scan the product bar codes and search for the lowest priced retailer in either physical space or cyber space, then place the order" (Miller, 2000). He has perfectly described mobile showrooming, which now takes place at a large majority of electronic stores. Since January 2014 58% of adults in the U.S. own a smartphone (Pew Internet, 2014). Not only is the worlds largest inventory available online, it is available at anytime, anywhere. It begs the question, how will the value of storefront property change now that products are so accessible from all locations? Most of the hype would say that this spells the death of brick and mortar retail, but further research would describe it differently. Although

some industries are specifically at-risk to e-commerce domination, for example: book stores, travel agencies, CD stores, and computer stores, (Baen, 2000) most have embraced the concept of omnichannel retailing. This means having your brand meet the needs of the customer across all possible platforms, online, mobile, and in-store. Rather than decreasing the value of storefront property, the importance of prime location has become all the more important. Consumers now have multiple fronts to shop from, and therefore shopping is viewed as more of the entertainment option.

Since the recession in 2008, a great divide has emerged between the profitability of shopping centers with prime location, and those under depressed conditions (Ahlburn, 2014). Jones Lang LaSalle™, a research real estate firm analyzed vacancy rates of four different types of centers; community centers, neighborhood and strip centers, power centers, and regional and super regional centers. They then classified them into two groups, centers with at least 80% occupancy prior to the recession (prime location), and centers with less than 80% occupancy (poor location). The vacancy rates of regional and super regional centers with prime location (Centers with anchors tenants like Home Depot or Best Buy) have fallen below 3% while those with poor location have risen above 50%, a stark contrast. (Ahlburn, 2014) Although this does not necessarily demonstrate that e-commerce was the cause, there is evidence that it could have possibly been a factor. There are a couple reasons that this could be the case. The two types of centers that have performed the worst in poor locations are the regional and super regional centers as well as the power centers. These are the two largest types of centers, malls and shopping centers with multiple big-box tenants. While on the other hand, in the areas of prime surroundings, the centers with the lowest vacancy rates are also the super regional, regional, and power centers. The narrative that could be at play is as follows: the entertainment value of shopping has become a greater priority than the necessity of shopping with the emergence of e-commerce. Therefore, when consumers *desire* to shop they will go to an area of prime location and environment, and when they *need* a product they will be more likely to use the convenience of the online platform. This means that areas of poor location are performing worse with the emergence of e-commerce, because they will purchase their necessities online and go to areas of prime location for a shopping experience. More data is needed in this area, but it seems that with the growth of mobile e-commerce the real estate value of shopping centers with good location have risen dramatically, while those with aging assets or poor surroundings have seen their investment struggle.

E-commerce also provides intriguing questions on issues of transportation and geography. Where will the new retail investment take place? What transformations of transportation and shipping will take place in order to meet the growing demand of in-home customer fulfillment? One of the first changes is a shift in transportation, from personal car to freight. The responsibility of movement to the consumer's residence is now shifted to the retailer or contracted out to one of the major courier services, such as UPS™ or FedEx™. This is added responsibility on the retailer and an extra expense to the consumer; but as logistics services improve, it will likely become more efficient and less expensive. At first thought it would seem that individual parcel delivery would be more expensive than large scale deliveries to a store; however, the sheer scale at which courier services like UPS and FedEx operate allows there to be cost savings in combining multiple individual shipments and reducing the cost of holding a large inventory (Anderson *et al*., 2003). There has also been growth in areas of large-scale crowdsourcing in order to deliver products. Crowdsourcing is a term for utilizing and organizing the masses for a specific purpose using online forums. This has been used in everything from fundraising (Kickstarter™) to taxi services (Uber™), which connects drivers and passengers together on their everyday normal routes through a mobile app. The same process is beginning with courier services. Deliv™ is a mobile app that connects drivers and consumers for the purpose of delivering an item bought online. For only a small fee of $5 a consumer can buy an item online and have it delivered the same day. Since its inception in 2012 its client list already includes major

commercial real estate companies such as Simon Property Group™, and large number of major retailers including Staples™, Banana Republic™, Chico's™, and Williams-Sonoma™. The growth of this service is a competitive win for traditional retailers over e-commerce power Amazon™, as it provides competition in a space that Amazon™ was looking to dominate, same-day service. Whether by growth of major courier services or crowdsourcing, e-commerce is changing the transportation between the retailer and the consumer.

Geographical change is just as likely as growth in distribution centers will cause some shift away from brick and mortar retail. Amazon as of 2013 has 94 fulfillment centers worldwide (Kucera, 2013). Even though it would seem that e-commerce with all its technological promise would cause there to be less physical investment, the reality is that space is just shifting location. "…there are significant 'back region' spaces, which are needed to sustain and fulfill B2C (*Business to Consumer*) e-commerce orders. These back region spaces, warehouse and distribution centers, are the lifeblood of the e-commerce industry and are where many 'e-tailers' have faltered" (Wrigley and Currah, 2006). These backroom spaces are expensive, which is why current large-scale retailers have a huge advantage in already having the distribution center infrastructure. Retailers must adapt and use their existing structures (stores and distribution centers) to meet the needs of customers in multiple formats, an entertaining shopping experience, a pick-up in store option, and an in-home delivery option. Home Depot™ clearly demonstrates this in their annual 10k: "The interconnected retail initiative is woven throughout our business and connects our other three key initiatives. At the core of this initiative is using our almost 2,000 U.S. stores as a network of convenient locations for our customers who shop online. In fiscal 2013, we completed our rollout of Buy Online, Ship to Store ("BOSS") and Buy Online, Return In Store ("BORIS"), which complement Buy Online, Pick-up In Store ("BOPIS"), introduced in fiscal 2011. We also began the groundwork for Buy Online, Deliver From Store ("BODFS"), which will give us the capability to deliver orders placed online from our stores to the customer's home or job site"(Home Depot 2014). E-commerce has and will continue to change the retail process, from where the product originates, to how the goods are transported to the customer; traditional structures of retail are continually being challenged.

Financial Model Methodology

The first model is a panel data statistical model, which means the data is cross-sectional and time series in nature. This Fama-French stock response model is meant to model the impact of different variables on stock returns. The Fama French model was developed as an improvement of the CAPM (Capital Asset Pricing Model) which is used to describe the performance of stocks. Two University of Chicago professors, Kenneth French and Eugene Fama helped develop this model and it is now considered the standard asset pricing model in finance (Armstrong, 2013). This model is continually being developed and they currently have two more factors outlined in a working paper (Fama French, 2014)

$$FP_{it} = u_i + B_1MEcom_{jt} + B_2RmRf_t + B_3SMB_t + B_4HML_t + B_5UMD_t + E_{it}$$

FP = Annual Stock Return of Big-box retailer

MEcom = Market percentage of e-commerce in each retail category

RmRf = Return of the market minus the risk free rate

SMB = Small cap stock minus big cap stocks

HML = High book to market stocks minus low book to market stocks

UMD = Carhart Momentum factor

E = random error

This model will attempt to get a more accurate picture of the impact of e-commerce on the financial performance of big-box retailers. I will explain the role that each variable plays in the model.

The subscript i and j stand for the differences in the data-set of each of the variables. Some data I have at the individual firm level (ex. stock returns of the big box retailers) Some data is at the industry level (e-commerce market percentage), and the other four Fama French factors are at the national level, measuring the overall health of the US Economy

FP: This is the dependent variable. It is the annual stock return of each individual big-box retailer.

MEcom: This is the e-commerce market percentage growth rate in each retail category. The first factor is the return of the market minus the risk free rate. This is attempting to control for the performance of the overall stock market and its affect on the limited number of stocks that are in my models portfolio.

RmRf: This is one of the 4 factors in a Fama-French stock response model. The first factor is the return of the market minus the risk free rate. This is attempting to control for the performance of the overall stock market and its affect on the limited number of stocks that are in my models portfolio.

SMB: This is one of the 4 factors in a Fama-French stock response model. This checks to see how exposed the dependent variable data set is to small cap stocks. Kenneth French found that small caps tend to perform better than large cap stocks, so this variable is important to see how weighted the data set is to one or the other.

HML: This is one of the 4 factors in a Fama-French stock response model. The factor is High book to market minus Low book to market, essentially comparing the difference between value and growth stocks. This checks to see how exposed the dependent variable data set is to high book to market ratio stocks. Kenneth French found that high book to market ratio stocks tend to perform better than low book to market stocks.

UMD: This is one of the 4 factors in a Fama-French stock response model. It is called the Carhart momentum factor. If a stock is on a massive rise or decline, it controls for its effect on the overall model.

Real Estate Model Methodology

The second model is a panel data time series model in which we used a fixed effects regression to measure the impact of e-commerce market percentage growth on the square footage growth rate of big-box retailers. This model uses elements of a similar study, which depicts the growth in square footage of the office building sector market (Rosen, 2003).

$$SF_{it} = u_i + B_1 MEcomlag1_{jt} + B_2 CPX_{jt} + B_3 TotalSaleslag1_{jt} + B_4 Rexp_t + B_5 Closelag1_{jt} + E_{it}$$

SF = Annual growth rate in retail square footage for each company

MEcomlag1 = One year lag of the e-commerce market percentage growth rate

CPX = Capital Expenditures growth rate in each retail category

TotalSaleslag1 = One year lag of the growth rate of total sales in each retail category

Rexp = Estimated price per square foot growth rate of each big-box retailer

Closelag1 = Estimated size of business (sales) that closed in an industry lagged by one year

SF: This is the dependent variable, assembled from the 10k of each big-box retailer.

MEcomlag1 = Market percentage of e-commerce in each retail category lagged by 1 year. This is because we anticipate that the e-commerce market percentage from the year before is going to be affecting the decisions made on real estate expansion for this year.

CPX = Capital Expenditures is attempting to control for economy wide growth of new buildings. If the overall economy is investing in commercial real estate then it is likely big-box retailers will also experience growth.

TotalSaleslag1 = Controlling for the growth rate in industry-wide sales for that year. It is lagged one year because if sales in the industry had a large growth rate from the year before, it is likely to mean greater expansion in square footage the next year.

Rexp = Estimated cost of price per sq foot. We determined an estimated price per square foot by dividing the total rent expense for that year by the total amount of retail square footage leased. Price per square foot is important because the higher the market prices per square foot are for commercial real estate leases, than the less likely a company is to expand

Closelag1 = Controlling for businesses that closed in an industry that year. With the Closelag1 variable we are attempting to control for a large business in an industry closing its doors, and the other companies gaining retail square footage due to less competition

One particular point in the data set required an extra regression to estimate a specific variable. In the year a company went out of business, their real estate growth rate was -1, but we needed a way to estimate what the price per square foot (Rexp) would have been that next year in order to keep that variable within the model. Therefore, we ran a separate regression to estimate what the price per square foot growth rate would have been based on a few different variables. The regression is as follows: Price per square foot growth rate is a function of the square footage growth rate of big-box retailers plus the total sales growth rate of the retail category plus the capital expenditures growth rate in the retail category plus the growth rate of US GDP.

Financial Model Data

I compiled data from various agencies. I have used the U.S. Census Bureau E-stats and statistical abstract reports, eMarketer's™ e-commerce data, Bloomberg™ financials, and Kenneth French's stock-response model data. The E-stats provide market percentages (ex. e-commerce sales in retail category/total sales in retail category) and total sales of e-commerce in each retail category from 2000 to 2007. The U.S. Census Bureau statistical abstract provides total retail sales in each category from 2000 to 2014. The eMarketer™ reports give e-commerce sales from 2008-2014. Bloomberg™ provided the financial data for various big-box retailers. Kenneth French provides the data for the four variables of the Fama-French stock response model.

The first task for the first model was to separate the retail data into six different retail categories: Apparel, Books Music and Video, Consumer Electronics, Health, Toys and Hobby, and Office. For the financial data we compiled the stock returns for the largest public big-box retail companies. There are a total of 32 companies in the data set.

Data Variables:	Stock Returns		Provided by:	Bloomberg	
	E-commerce Market Percentages			eMarketer and US Census	
	Fama French Factors			Kenneth French Website	
Consumer Electronics:	Health:	Apparel:	Office:	Toys and Hobby:	Books, Music, and Video:
Best Buy	CVS	Gap	Staples	ToysRus	Borders
hhgregg	RiteAid	TJX	Office Depot	GameStop	Barnes and Noble
Conns	Walgreens	Ross	Office max	JoAnns	BooksAMillion
Circuit City		SteinMart		AC Moore	Hastings Enternatinment
Ultimate Electronics		American Eagle		Hancock Fabrics	TransWorld Entertainment
RadioShack		Ann Taylor			Blockbuster
		Chico's FAS			Movie Gallery
		Urban Outfitters			

The first model also needed data on the e-commerce market percentages for each retail category from 2000-2013. Unfortunately the data from the U.S. Census Bureau and eMarketer™ did not line up as they likely had different assumptions in collecting the data. Therefore I had to make estimates on what the e-commerce market percentage was in each of the retail categories from 2008-2013. Although they are estimates I will share the process of how I achieved these numbers, and I believe they are fairly accurate.

For the years 2000-2007 we have e-commerce total sales in each category as well as e-commerce market percentage provided by the US Census. When we divide the total sales by the market percentage we can obtain the "implied" total retail sales. However the US Census also maintains a separate data-set which collects supposedly that same figure "total retail sales in a retail category". Unfortunately these two data-sets do match up, likely due to differing assumptions. When-Marketer began collecting the data in 2008, they only collected e-commerce total sales in the category, not the e-commerce market percentage. Therefore we needed to determine the market percentage by dividing the total e-commerce sales, by the total retail sales. The problem lied in the fact that the implied total retail sales from the previous data in 2000-2007 did not match up with the total retail sales from those same years as shown in the figure below. In order to determine the implied total retail sales for the years 2000-2014 we used the growth rates from the total retail numbers in order to have the same pattern of growth. The math is shown in the equations below.

Year	Ecommerce Sales (billions)	Market Percentage	Implied Total Retail Sales	Total Retail Sales (billions) US Census	
2000	3.4	1.2%	283.3333333	167.674	Total Retail Growth Rate
2001	4.7	1.6%	286.5853659	167.287	0%
2002	6.7	2.3%	292.5764192	172.304	3%
2003	8.7	2.9%	304.1958042	178.694	4%
2004	10.7	3.4%	318.452381	190.253	6%
2005	14	4.2%	336.5384615	200.969	6%
2006	19.1	5.4%	352.398524	213.189	6%
2007	21.4	6.3%	338.6075949	221.205	4%
2008	23.7	7.2%	329.7920567	215.446	-3%
2009	23.7	7.6%	312.5650958	204.192	-5%
2010	27.5	8.4%	325.8136604	212.847	4%
2011	33.5	9.6%	348.9844892	227.984	7%
2012	39.8	10.9%	365.4996554	238.773	5%
2013	46.2	12.3%	374.3396855	244.548	2%
2014	55.5	14.5%	383.8716106	250.775	3%

In order to prevent confusion between the two data sets we will call the first data-set the "implied total retail sales" (ITRS), and the second data set the "bureau total retail sales" (BTRS).

In order to find the implied total retail sales for 2008-2013, we must multiply the implied total retail sales from 2007 by the growth rate of the bureau total retail sales data. This insures that the implied total retail sales data from 2008-2013 matches the same pattern as the bureau total retail sales.

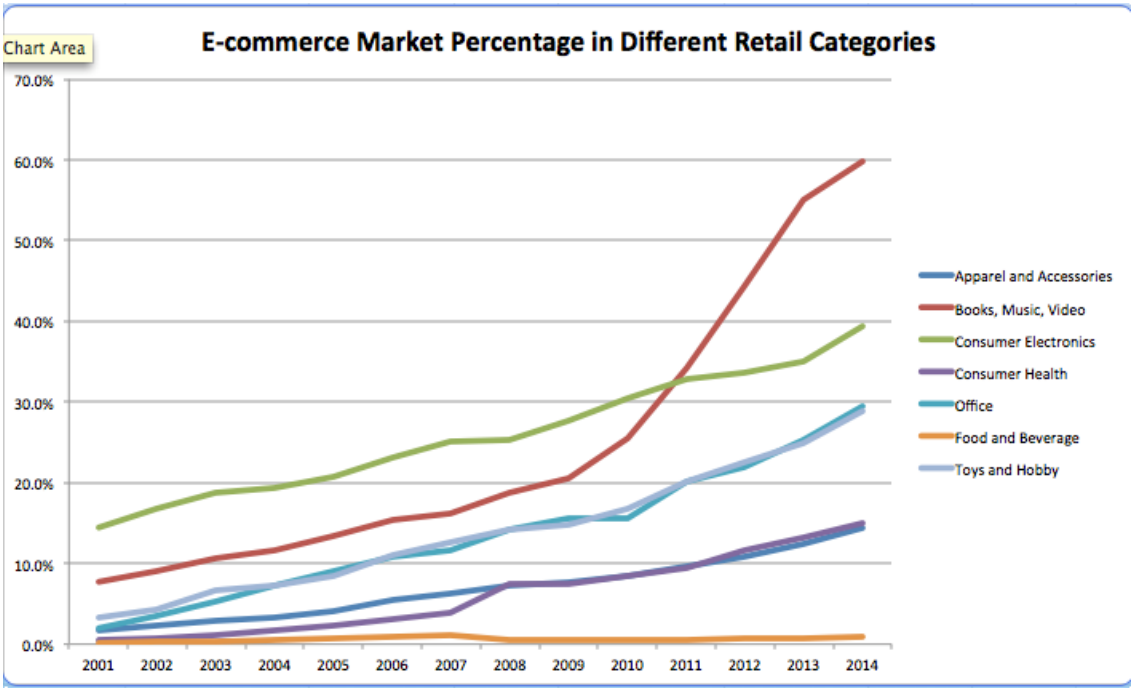
ITRS 08 = ITRS 07 * [(BTRS 08 –BTRS 07)/BTRS 07]

Now that we have the implied total retail sales from 2008-2013, we are able to use the total e-commerce sales from 2008-2013 from eMarketer to figure out what the e-commerce market percentage is from 2008-2013. We do this by dividing the e-commerce total sales by the implied total retail sales in order to get the e-commerce market percentage. When we do this for all the retail categories we are able to have a complete data set of e-commerce market percentage from 2000-2014.

E-commerce market percentage 2008 = e-commerce total sales / ITRS 08

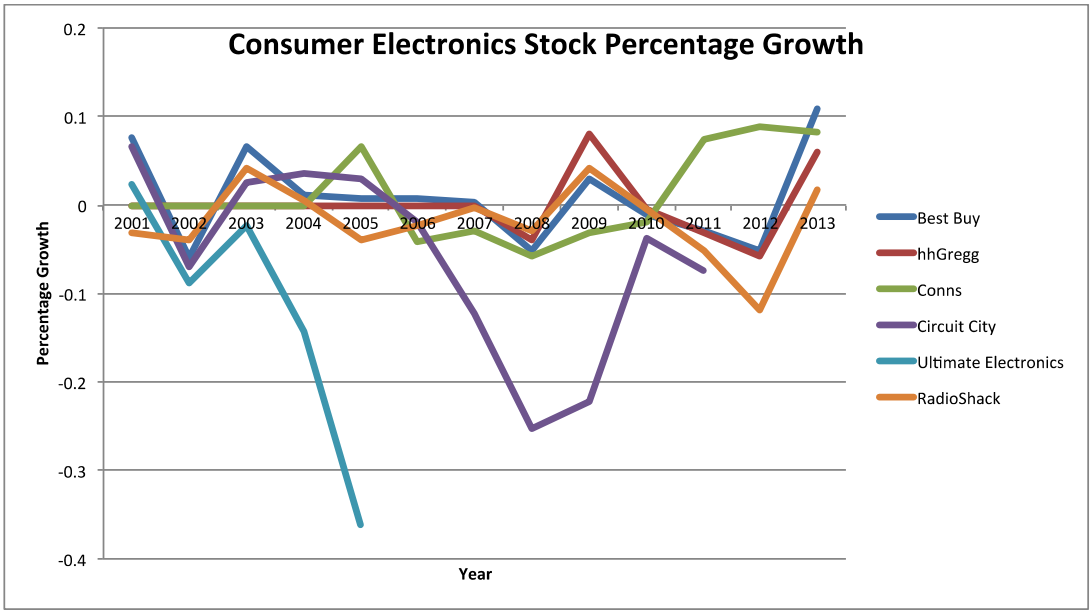
Now that we have a background on the origin of the data, I can present the hypothesis over-arching hypothesis behind the two models.

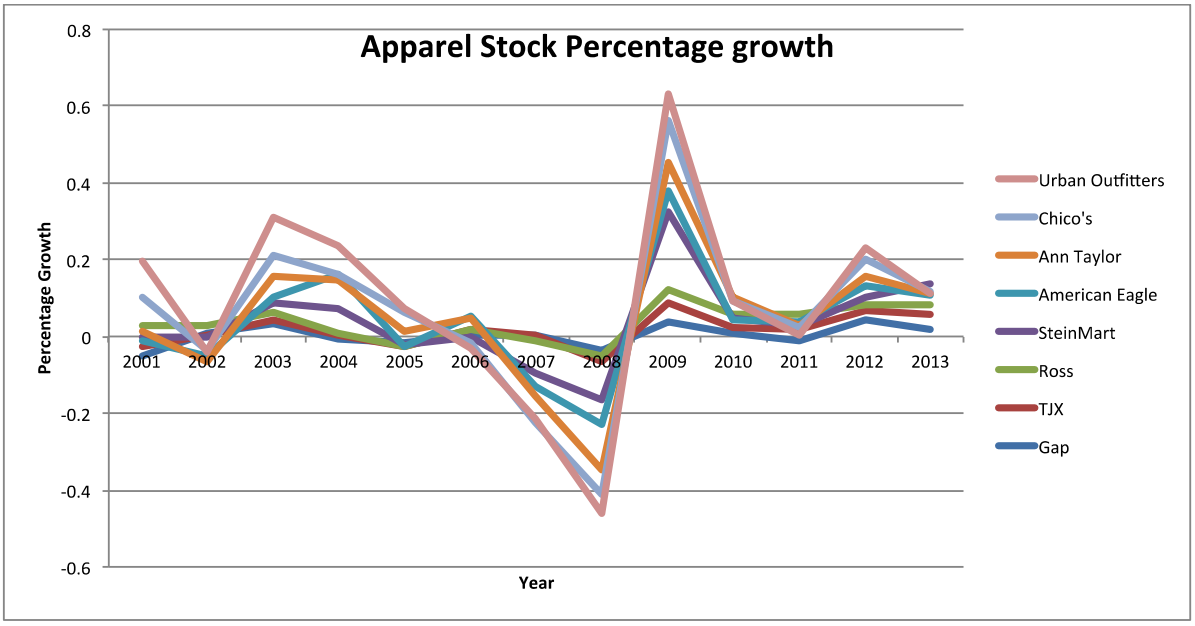
Using the data described above we can make some interesting observations from the graphs of the e-commerce market percentage growth over time as well as the stock returns of each retail category over time. In viewing the graph of the e-commerce market percentage growth from 2001-2014 you can see that the different retail categories are dramatically different in terms of their market percentage growth.



As would be expected, Books Music and Video has the highest e-commerce market percentage with 60% of those goods sold online, a growth from only 8% in 2000. With the dominance of Amazon and Netflix this is to be expected. Consumer electronics is the next highest with 39% of those goods sold online. At 29% are both Office products and Toys and Hobby. At around 12% is Apparel and Consumer Health. Despite the efforts of Amazon Fresh and others the Food and Beverage sector is still negligible in terms of e-commerce market percentage.

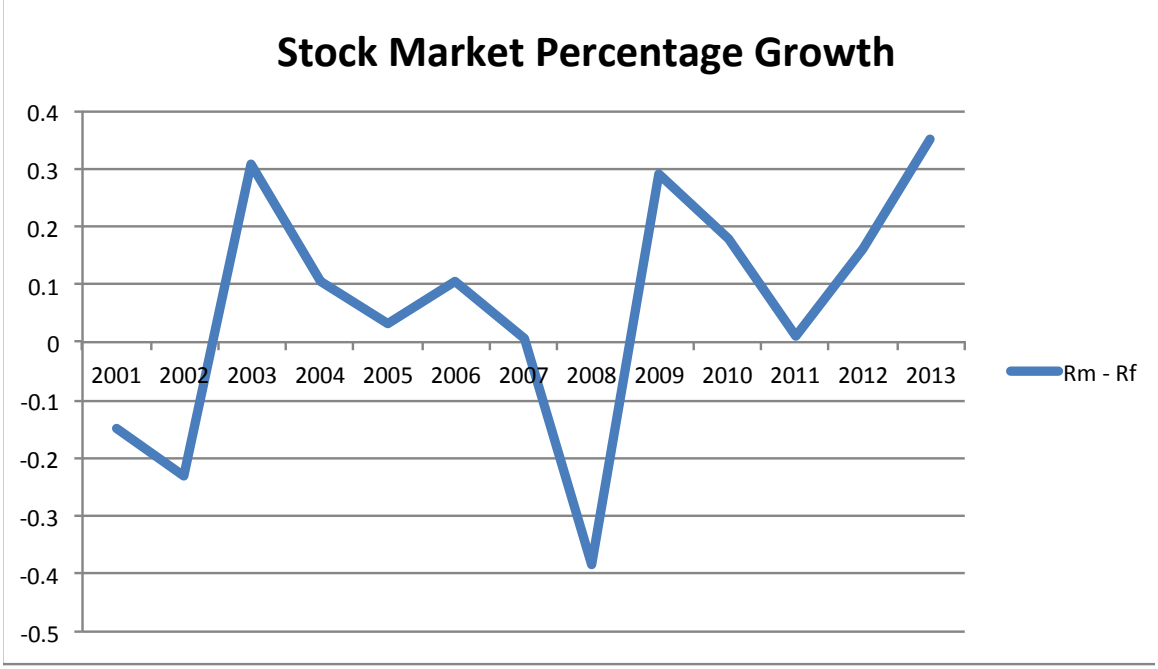
It is interesting to then compare to the stock returns of each of these retail categories to see if there is any correlation between the e-commerce market percentage and the stock return in that big-box retail category. If you look at the Consumer Electronics stock percentage growth graph you can see how the six different retailers have performed since 2001. Two have ceased to exist, Ultimate Electronics in 2005, and Circuit City in 2011. The other companies tend to oscillate between positive and negative percentage growth, but lean overall toward negative returns in the stock market. This is then an interesting comparison to the Apparel Stock Percentage Growth graph. This graph has 8 different apparel big- box retailers, and it is incredible how they move together in lock step. Aside from the recession time period from 2007-2008 the apparel retail category sector has generally seen small but positive return in the stock market.





Another point of comparison is to the overall economy. Using Kenneth French's RmRf variable which calculates the return of the market minus the risk-free rate, we can see how the overall economy has

performed. Looking at the Stock Market Percentage Growth graph it is fascinating how similar it is to the Apparel stock return graph. This shows that even though e-commerce might be having some effect on the stock return of these big-box retailers, most of the change is highly correlated to how the overall economy is performing. However, due to the variability shown in the consumer electronics stock return sector, whose retail category has seen a much higher e-commerce market percentage growth, it is probable that some of this variation in the stock return is due to the growth of e-commerce.



Before describing the model and results of the regression it is important to fully explain the original hypothesis. From the raw data as described in the previous section we can see that many different retail sectors have seen large growth in e-commerce market percentage. The question is has that e-commerce growth come from the e-commerce programs of the big-box retailers themselves? Or, is it the result of online only retailers like Amazon? From the figure in the appendix we can see that Amazon's total online sales dwarf the competition from the next 9 retailers combined. From this figure we can imply that the online growth is largely the result of Amazon and other e-tailer's gaining market share of each of these retail categories, not the result of the big-box retailers themselves.

So the hypothesis is as follows, as the e-commerce market percentage grows (likely as the result of Amazon gaining market share) the stock returns of the big-box retailers will struggle as a result. Therefore, when we run a regression we are expecting to see a negative coefficient on the e-commerce market percentage growth variable and for that variable to be significant to the model.

Real Estate Model Data

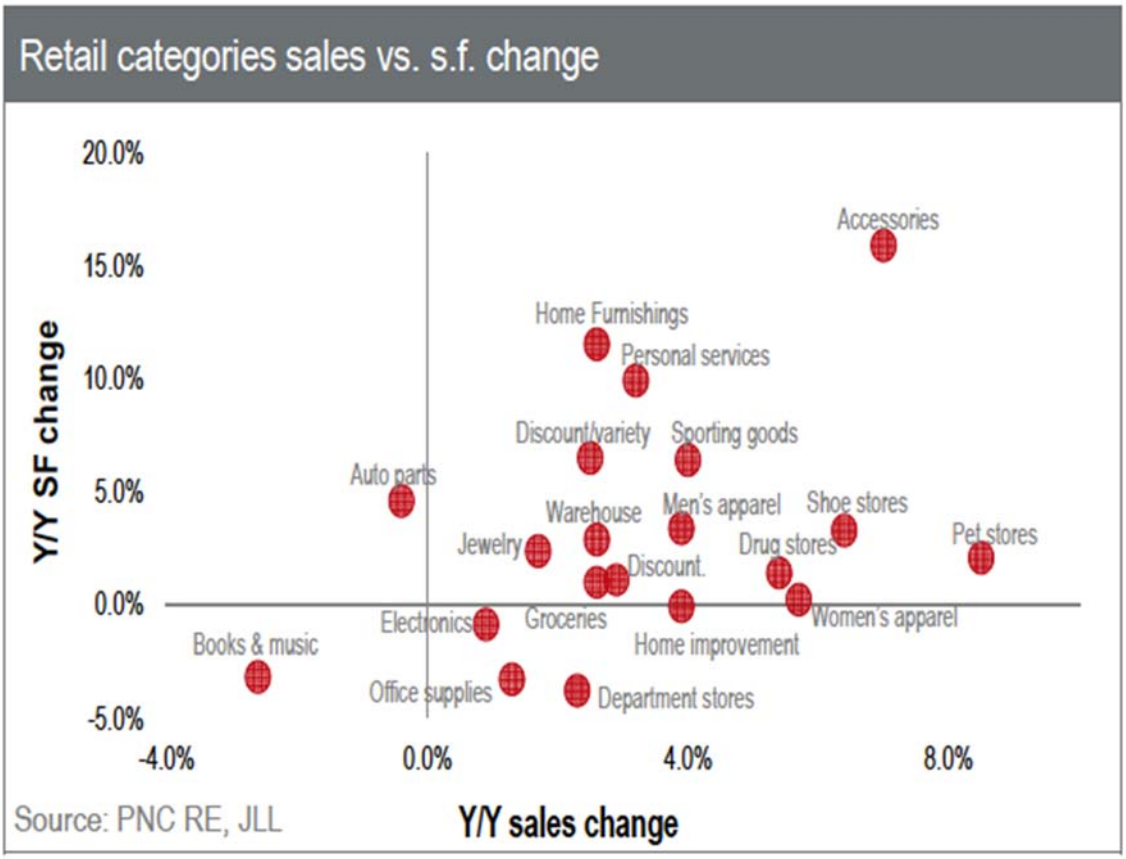
The second model has similar sources, US Census, eMarketer, and Bloomberg, but is compiling a different set of data. The e-commerce market percentage is compiled the same way, with a combination of both US Census and eMarketer data that is merged according to the formulas that I described in the last model. The dependent variable in this model is the growth rate of retail square footage for big box retailers. The source of this data is within the annual reports of the big-box retailers, which Bloomberg has compiled for our usage. Another important variable that we obtained was the price per square foot for each big box retailer. Using the total square footage and total rent expense, both obtained from Bloomberg, I estimated the price per square foot for each retailer.

Price per square foot = total retail square footage / total rent expense

I also obtained two different data sets from the US Census Bureau. Total sales in each retail category as well as capital expenditure spending in each retail category. Lastly I used Gale Virtual Reference Library to estimate the approximate size (total sales) of private businesses for the year that they ceased to exist. This is to counteract the impact that a large private business would have on the industry if it went out-of-business.

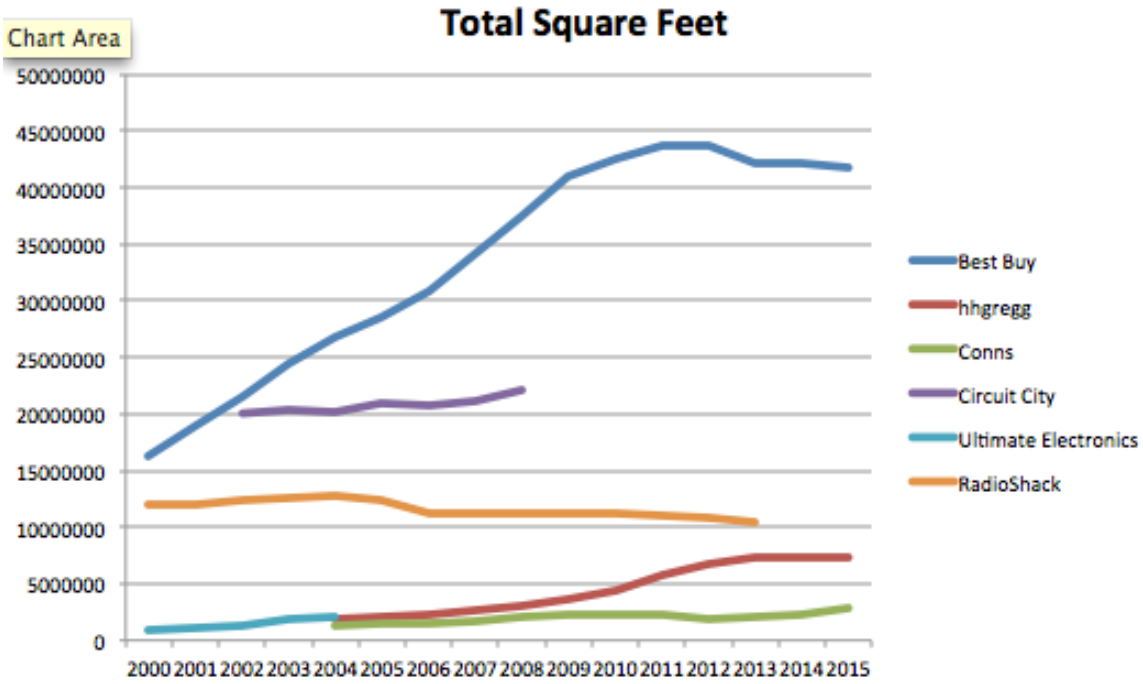
Data Variables:	Total Retail Square Footage		Provided by:	Bloomberg	
	Price per square foot				
	E-commerce market percentage			eMarketer and US Census	
	Capital Expenditure Spending			US Census	
	Total Retail Sales				
	Size of out-of-business retailers			Gale Virtual Reference Library	
Consumer Electronics:	Health:	Apparel:	Office:	Toys and Hobby:	Books, Music, and Video:
Best Buy	CVS	Gap	Office Depot	GameStop	Borders
hhgregg	RiteAid	TJX		Hancock Fabrics	Barnes and Noble
Conns	Walgreens	Ross			Hastings Enternatinment
Circuit City		SteinMart			
Ultimate Electronics		American Eagle			
RadioShack		Urban Outfitters			

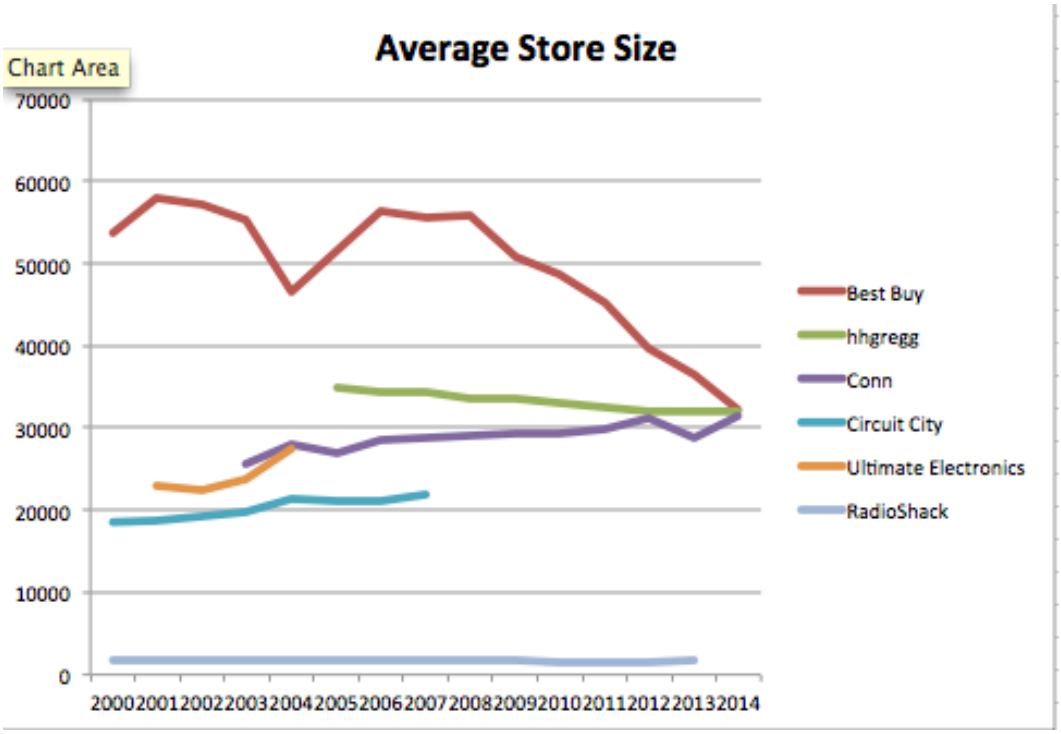
The first data set that was a possible clue to the emerging changes in retail real estate was a 2012 study done by Jones Lang and Lasalle on the year over year square footage growth as compare to the year over year sales growth. The fascinating aspect was that there were multiple segments experiencing growth in sales but a decrease in their retail footprint. Albeit it was for a single year and could have been an anomaly, but the retail sectors that were experiencing the most square footage downsizing were books and music, electronics, office supplies, home improvement, and department stores, all of which have received significant competition from Amazon in recent years.



This study provided the basis for my research, as I wanted to see if e-commerce could be a possible explanation for the increased sales, but reduced retail footprint.

Using the square footage data compiled from Bloomberg I analyzed a specific sector, Consumer Electronics, that had been greatly affected by e-commerce in recent years to see what the data showed. The only company in the data-set that had grown significantly since the year 2000 was Best Buy, although it had stalled since the recession and decreased slightly in footprint. Every other company, other than slight growth from hhgregg, has seen retail square footage stagnate or decrease since the year 2000. Another interesting aspect of this data is that we have 3 companies which have ceased to exist. With stock return data we see a gradual decrease before going out-of-business, but with square footage we mainly see the square footage stagnate and then cease to exist. There is never any significant downward trend, or square footage downscaling prior to liquidation.





Secondly I looked at an estimated average store size (total retail sq. footage / number of locations) to see if the retailers were perhaps downscaling in the size of their stores in response to e-commerce. Interestingly the only company once again that we see significant changes with is Best Buy. Originally they had some of the largest stores in the industry in the early 2000's, around 55000 sq ft, but after the recession they have steadily downsized their stores to a size of 30000 sq ft. This has been around the average store size for the two remaining competing retailers, hhgregg and Conn electronics. The rest of the retailers have stuck to their original store sizes that we saw in the early 2001.

The question now is whether a similar story is happening in the other retail categories, and if yes, then is e-commerce having any impact on the variation that we are seeing.

Financial Model Results

In order to test e-commerce's impact on the financial health of the big-box retailers we need to run a regression to see if the data showed the variable to be significant. Using the statistical analysis program Stata we were able to set up the model and run a fixed effects panel data-set regression. There are a total of 395 observations in the data-set that is attached in the appendix. We ran a fixed effects model because we do not believe that the data is random in origin.

Financial Model Results		
Variable	Coefficient	P Value
mecom	-0.0416	0.058
rmrf	0.0891	0
smb	0.0579	0.3
hml	0.1756	0.006
umd	0.0338	0.165

As shown from the results above, the regression, to a certain extent, confirms the original hypothesis. The Mecom variable has a negative coefficient and has a p value of .058. Although the ideal would be to have the p value be below .05, we can make the claim with at least 94% certainty that this variable is having some effect on the stock returns of the big-box retailers. The other variable that is not significant is the SMB variable, which tests to see the exposure of the data set to small cap stocks. It makes sense that this variable would not be significant as the data set is composed of big-box retailers, none of which would be classified as a small cap stock. The momentum factor is also not significant, but seems to have a negative effect on the model when removed so we maintained its presence in the model.

In reality, there are likely many more variables having an effect on the stock returns of big-box retailers, but this model at least gives some clue that growth in market percentage of e-commerce is having some effect on the stock returns of these retailers. A significant amount of new data is being published on e-commerce every year by companies like eMarketer and Forrester research, and as this body of data grows, we can add more to the model and make stronger claims about the growing effect of e-commerce on the marketplace.

Real Estate Model Results

In order to test whether e-commerce is having an impact on big-box retailers real estate footprint we need to run a regression to see if the data showed the variable to be significant. Using the statistical analysis program Stata we were able to set up the model and run a fixed effects panel data-set regression. There are a total of 236 observations in the data-set that is attached in the appendix. We ran a fixed effects model because we do not believe that the data is random in origin.

Real Estate Model Results		
Variable	Coefficient	P Value
mecomlag1	0.0154	0.743
totalsaleslag1	0.6047	0.024
capex	-0.0706	0.013
closelage1	0.0092	0.011
rexp	0.1024	0.0512

As shown from the results above, the regression does not confirm the original hypothesis. In fact the Mecomlag1 variable is not significant at all and has a positive rather than negative coefficient. The Totalsaleslag1 variable is showing to be significant with a positive coefficient, which makes sense as we would expect industry-wide sales growth to result in expansion of the retail footprint. Capital expenditures are also significant and have a negative coefficient. This is likely due to the fact that most of the big-box retailers lease their buildings rather than build them. Closelag1 is significant and has a positive coefficient, meaning that when a business in an industry closes, it will result in positive square footage growth for the rest of the industry in the following year. Interesting price per square foot is not showing to be a significant variable in the model.

So why is e-commerce not seeming to have a significant effect on big-box square footage growth rates? I believe that the model is not robust enough and there are a few issues with its structure that is preventing it from picking up these changes. Unlike the financial model which had 32 companies, the real estate model

only has 22. These 11 companies do not report total square footage numbers in their 10k's. It is likely that these specific companies can have significant effect on industry data, ex. Staples and Office Max, Blockbuster, JoAnn Fabrics, ToysRus. The retailers that are missing make up significant portions of the industries that have seen large-scale e-commerce growth (Office, Books Music Video, and Toys and Hobby), and because they are missing we are unable to observe their possible impact on the regression. Secondly it is very difficult to measure the impact of companies that go out-of-business. Unlike stock return data that shows a downward trend in company performance, the square footage of retailers tends to stagnate and then drop out of the model the year it ceases to exist. There is no downward trend to measure. The reality is companies want to hold onto the assets that result in sales as long as possible, so they are likely to hold onto their stores all the way until they are liquidated. In addition it is difficult to measure how much impact a company dropping out of the industry will have on the other companies within that industry. The closelag1 variable attempts to account for this but it is difficult to measure how much of an impact it has on the individual retailers, and which ones are more likely to experience positive square footage growth as a result the next year.

Conclusion

Although these are valuable observations and clues as to what is happening in the retail marketplace, more concrete data is needed to confirm the causality of the relationships in both the financial and real estate models. As research progresses a few data areas are needed in order to improve the statistical model. More data about the individual e-commerce programs of the big-box retailers and their growth can tell us where the e-commerce market percentage growth is coming from, and whether a big-box retailer investing in the e-commerce market has any effect on their stock return. We can give better answers to questions like, as Home-Depot improves their e-commerce operations, are they less at risk to market penetration from online only retailers like Amazon?

The second area of improvement is with the financial model. Mass digital data collection on commercial real estate is a relatively new phenomenon pioneered by companies like CoStar. However, there is not enough historical information on specific company growth in physical retail space in order to analyze e-commerce's impact on the real estate market. As this data set continues to grow we can improve the model and have greater analysis using private research from companies like Costar even if the information is not published in the 10k's. It will also be interesting to analyze the growth of warehouse and distribution space since the dawn of e-commerce. In recent years has the growth rate of warehouse space been greater than storefront property? This is an intriguing question not only for real estate, but social anthropology as the structure of society moves away from "shopping-centered" communities into the digital world of online space supported by distribution centers and warehouses.

This is a rapidly expanding area of research as our society begins to feel the effects of the digital revolution. This first financial model will provide a baseline for future research in this sector as we seek more clues the nature of this sector of the market. The second model is incomplete at this point, but improvements in the data-set will likely lead to more robust and revealing results.

It is evident that e-commerce is impacting many different structures in the market and society, from the landlord tenant relationship, to the geography of cities. Current analysis gives us some clues as to which retail categories are being impacted the most. We now understand that e-commerce is a significant variable in impacting the stock returns of big-box retailers, especially those retail categories which have seen the greatest e-commerce market penetration. It is yet to be confirmed, but there are some clues that e-commerce is impacting the commercial real estate market but the data-set and model will need to be improved in future iterations.

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