

Do Drugstores Contribute to Urban Food Deserts?

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“The story of the CVS Pharmacy due to open at Broadway and West 102nd Street is not just about a chain store that squeezes out a Mom and Pop store. This CVS joins a four-block area already crowded by two Duane Reades and a Rite Aid, and replaces a supermarket that residents say they need much more...

CVS is not troubled. 'We're not going to be worried about a few individuals because once the store opens, they'll be very favorable,' said Mike DeAngelis, a CVS spokesman. 'I can't speak to why the supermarket closed, but we've found that New York City is underserved and needs quality pharmacies. We consider ourselves to be good corporate neighbors....'"

“Neighborhood Report: Upper West Side; One Drugstore Too Many, One Grocery Too Few?” , *New York Times*, Kelly Crow, July 16, 2000

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ABSTRACT

Problem | This project explores the possible role of competition from chain pharmacies in the lack of access to healthy foods in low-income neighborhoods by seeking to answer the question, “How and to what extent is the prevalence of chain pharmacies related to the prevalence of food stores in New York City?” Since any competition for commercial space between chain pharmacies and food stores should be greatest in low-income neighborhoods, and, in addition, should center on medium-sized food stores as opposed to small or large food stores, the correlation between pharmacy space and food store space should be more negative in low-income neighborhoods and for medium-sized food stores.

Methodology / This project uses a dataset of all food retailers in NYC provided by the New York State Department of Agriculture and Markets and compares the results from three multiple linear regression models relating chain pharmacy space to small- (Y1), medium- (Y2), and large-size (Y3) food store space across three community income levels.

Results / As pharmacy space increased by 1 sqft/capita, small food store space in high-income neighborhoods increases by 0.55 sqft/capita ($p < 0.000$). There was no significant relationship between pharmacy space and small food store space in low- or middle-income neighborhoods at the $p = 0.05$ level. As pharmacy space increased by 1 sqft/capita, medium-sized food store space increased by 0.24 sqft/capita ($p = 0.001$). This positive relationship did not vary across community income levels. As pharmacy space increased by 1 sqft/capita, large food store space increased by 0.45 sqft/capita ($p = 0.039$). Again, this relationship did not vary across community income levels.

Conclusion / The findings did not support the study hypothesis that the presence of chain pharmacies contributes to the creation of food deserts in New York City.

I. INTRODUCTION

Since a lack of access to healthy foods adversely affects public health, and media and food retailers often suggest that the prevalence of pharmacies is inversely associated with the presence of food stores, this project seeks to examine the possible role of chain pharmacies in New York City’s (NYC) worsening food deserts. To that end, the project will discuss the presence of and debate around food deserts in NYC, summarize the literature on the possible relationships between pharmacy and food store access, outline the methodology employed for answering the research questions, present the results, and discuss the implications for public health, city planning, and neighborhood development.

This project is significant in that it examines the potential contribution of chain pharmacies in the creation of food deserts, an unexamined question to date. The project will also speak to pharmacy access across community income levels, an issue underrepresented in the literature, especially in comparison to the volume of research on

access to healthy food. The project will contribute to the conversation around the nature and extent of New York City's food deserts, the validity of the blame placed on chain pharmacies, and the likely efficacy of some proposed solutions.

The Paradox of Food Deserts in the Big Apple

In what appear to be proverbial “lands of plenty,” huge numbers of residents of low-income, urban neighborhoods find themselves without basic access to healthy foods. Though “access” may refer to a combination of any number of factors, “access” will refer to geographic availability throughout this study. Food rights advocates refer to areas without sufficient access to foods as “food deserts,” a term reportedly coined by a resident of a public sector housing in the west of Scotland in the early 1990s (Cummins). While true food deserts imply virtually no access to food of any kind, the term has been more widely applied to neighborhoods where an exodus of supermarkets has left consumers to choose among high-cost, low-nutrient groceries (Winne). In a 1992 hearing before the U.S. House Select Committee on Hunger, Mark Winne, then Executive Director of Hartford Food Systems, testified:

“During the past two decades, food stores of enormous size and diversity sprouted throughout suburbia, offering customers quality, convenience and low prices. Meanwhile, back in the inner city these same chains that were investing heavily in state-of-the-art food retailing formats were abandoning the urban marketplace like refugees fleeing the plague.”

New York City, like many other densely populated urban areas, is faced with a patchwork of food deserts, which corresponds to geographic patterns of poverty, racial residential segregation, obesity, and diet-related disease. NYC's food deserts are of the less-severe but increasingly common variety: void of large grocery stores and instead

populated by smaller, independent corner groceries or “bodegas”, convenience stores, discount stores, and retail pharmacies, whose stocks of food are limited to convenience items and non-perishables marked by high prices and empty calories. A 2008 study by NYC Department of City Planning confirmed that an estimated 3 million New Yorkers live in areas in “high need” of additional grocery stores and that “pharmacies, convenience stores, and discount stores are the largest segment of food retailers in some neighborhoods.” Food is otherwise available in suburban supermarkets, largely out of reach for transit-dependent consumers, or in the many fast food restaurants that have rushed in to fill the retailing void.

Possible Role of Chain Pharmacies as Competitors for Space and Demand

The question for policy makers, community organizers, and public health officials hoping to reverse the pattern of food deserts then becomes, “Why do food deserts exist and persist?” Reasons for a grocer’s initial divestment and continued reluctance to re-enter low-income areas are numerous, variable by city, and entangled. A report by the Congressional Research Service found that food deserts were initially created when grocers followed a large number of customers migrating from the inner city to the suburbs beginning in the 1960s. As the typical food store format morphed into a larger and more multi-purpose entity, smaller, “older stores in the inner city were deemed obsolete” and closed.

It remains difficult to reverse the flight pattern, as residents lack the collective “food dollars” to attract new groceries who rely on voluminous sales to survive on a typical 1%-2% profit margin (“Urban Grocery Gap: Hearing before the Select Committee on Hunger). Unlike in other urban areas, it is important to note that the majority of

NYC's grocery stores, especially the small- and medium-sized stores, are independently, rather than corporately, owned. In the NYC case, start-up capital for new medium-sized stores must be raised by individual store owners whose livelihoods depend on the success of those few stores. This means that food stores are far more risk averse than chain pharmacies. Additionally, many medium-sized stores do not sell convenience items, toiletries, or drugs, which are the items winning pharmacies relatively higher profit margins (Interviews and observation by author, 6/09). Due to their uncommonly high risk aversion, neighborhood crime, politics, infrastructure, transportation, zoning laws, and uncertain labor supply, among other factors, keep grocers far from the inner city ("Second Plenary Session of the New York Supermarket Commission"). The task is large, the resources small, and the communication poor in the struggle to understand grocers' experiences and decisions.

As an intern in the New York City Mayor's Office I had the opportunity to delve deeper into the question "What are the challenges for grocery owners in low-income neighborhoods?" through interviews with seven supermarket owners in low-income NYC neighborhoods. While many of their responses were similar to those listed above, all of the owners discussed the challenge of rent increases when they renegotiated leases and the competition they faced from the city's most popular chain pharmacies such as CVS, Duane Reade, Rite Aid, and Walgreens, in securing new spaces. According to an owner in the Bronx, "When you go to a landlord everyone's talking about triple net, and we just can't afford to pay what Rite Aide and those guys pay. They're offering \$35/sq. ft. A reasonable price for me would be \$20 or less (Interviews by author, 6/17/2009)." Several

interviews revealed that owners were burdened by triple net leases, in which the tenant is responsible for real estate taxes, insurance, and any maintenance fees in addition to rent.

It is clear from current policy that the city government is also mindful of possible real estate competition from pharmacies. NYC is currently engaged in the approval process for a new package of financial and zoning incentives for supermarkets in underserved areas. The Food Retailing Expansion to Support Health (FRESH) was announced along with a state program called Healthy Food, Healthy Communities to bring larger food retailers into low-income areas. In order to protect dedicated food retailers from competition for these incentives from pharmacies, policy makers included provisions to disallow use of the incentives by pharmacies, including:

- “(1) Provide a minimum of 6,000 square feet of retail space for a general line of food and nonfood grocery products intended for home preparation, consumption and utilization;
- (2) Provide at least 50 percent of a general line of food products intended for home preparation, consumption and utilization;
- (3) Provide at least 30 percent of retail space for perishable goods that include dairy, fresh produce, fresh meats, poultry, fish and frozen foods; and
- (4) Provide at least 500 square feet of retail space for fresh produce.”

In a New York Times article about FRESH, the city’s Food Policy Coordinator, Ben Thomases, said “The new zoning would break down some barriers that grocery stores face, including competition from drugstores and other retailers that have higher profit margins than supermarkets do and can pay higher rents” (Cardwell). In a later paragraph:

“Santino Montalbano, the director of real estate for Western Beef, which operates a number of large warehouse-style stores in mixed-income New York neighborhoods, also praised the proposal, which he said would make it easier to compete with stores like Rite Aid. ‘They’re just making more on their drugs than we are’ on groceries, he said. ‘We’re just making pennies on our cans of corn.’”

Anecdotal evidence is strong for competition from pharmacies such that New York City's current food policy reflects a fear of Rite Aid and others in recreating healthy food retailing environments.

How the Urban Food Gap Contributes to an Urban Health Gap in NYC

The problem of food deserts and the urgent search for solutions spring from the many adverse consequences of lack of access to healthy food in affected neighborhoods. Controlling for other relevant variables, researchers have shown that food deserts negatively affect public health. In an article relating racial residential segregation to poor health outcomes, Williams and Collins tie food deserts to nutrition:

“The consumption of nutritious food items is positively associated with their availability, and the availability of healthful products in grocery stores varies across counties as well as zip Codes. Thus, the high cost and poor quality of grocery items in segregated neighborhoods can lead to poorer nutrition.”

A study by Morland et al corroborates the linkage between food environment and health outcomes. Morland writes:

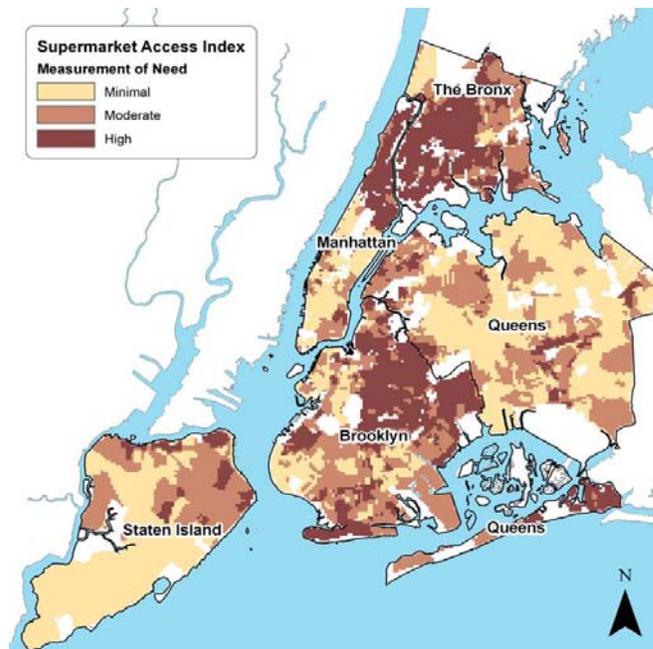
“...Compared to people who lived in areas without any supermarkets, a 9% lower prevalence of overweight..., a 24% lower prevalence of obesity..., and a 12% lower prevalence of hypertension...was observed in areas with at least one supermarket. Adjustment for other food stores or food service places produced similar estimates.”

According to the NYC Department of Health and Mental Hygiene (DHMH), 1.1 million New York City residents, or 20%, are obese and another 2 million, or 34%, are overweight (“Physical Activity and Nutrition”). The prevalence of Type II diabetes more than doubled in NYC between 1994 and 2003 to more than 12% or 1 in 8 residents. Accounting only for diagnosed, self-reported cases, the NYC prevalence is 28% higher

than the national average in 2004. According to *Diabetes in New York City: Public Health Burden and Disparities* (Kim, Berger, & Matte) from DHMH:

“Between 1994 and 2003, the overall diabetes hospitalization rate in NYC increased by 20%, but rates were much higher in some neighborhoods. New Yorkers in low-income neighborhoods consistently experienced diabetes hospitalization rates nearly 3 times higher than those living in wealthier neighborhoods.”

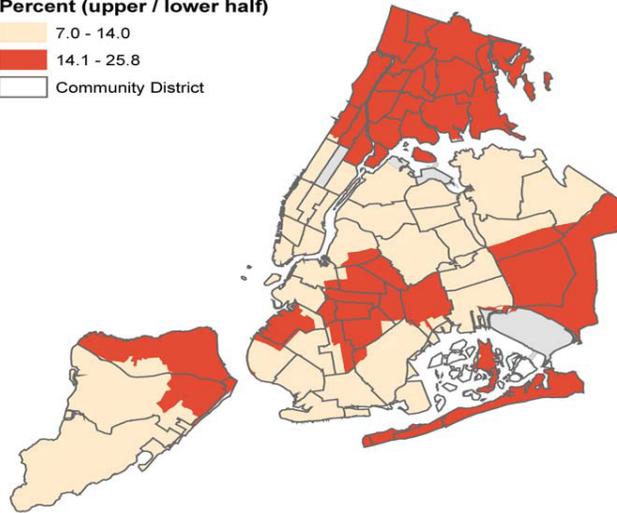
Maps from the NYC Department of City Planning’s report *Going to Market* reveal how supermarket need (Map 1) is geographically related to poor consumption of fresh fruits and vegetables (Map 2) and prevalence of obesity and diabetes (Map 3). While each of these geographic distributions are also surely related to the city’s geographies of income and race, the aforementioned work by Morland et al suggests that the positive relationship between supermarket need and obesity is not fully explained by income.



Map 1

Percent reporting no fruits / vegetables in the previous day, by UHF Neighborhood

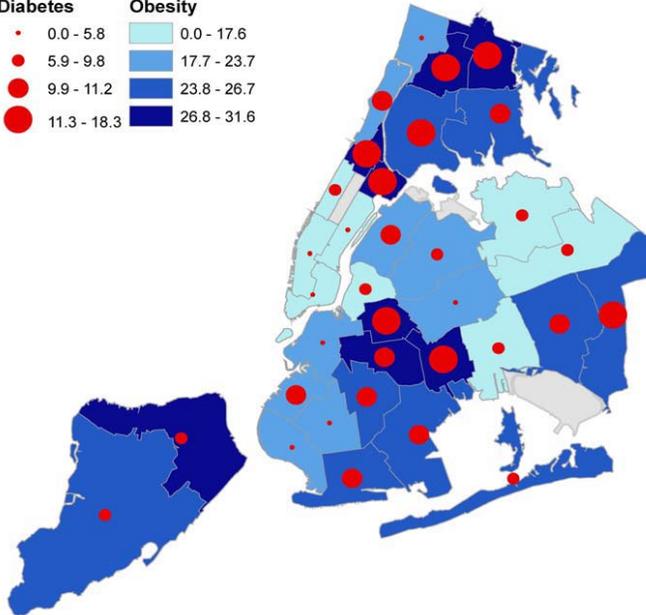
Percent (upper / lower half)
7.0 - 14.0
14.1 - 25.8
Community District



Map 2

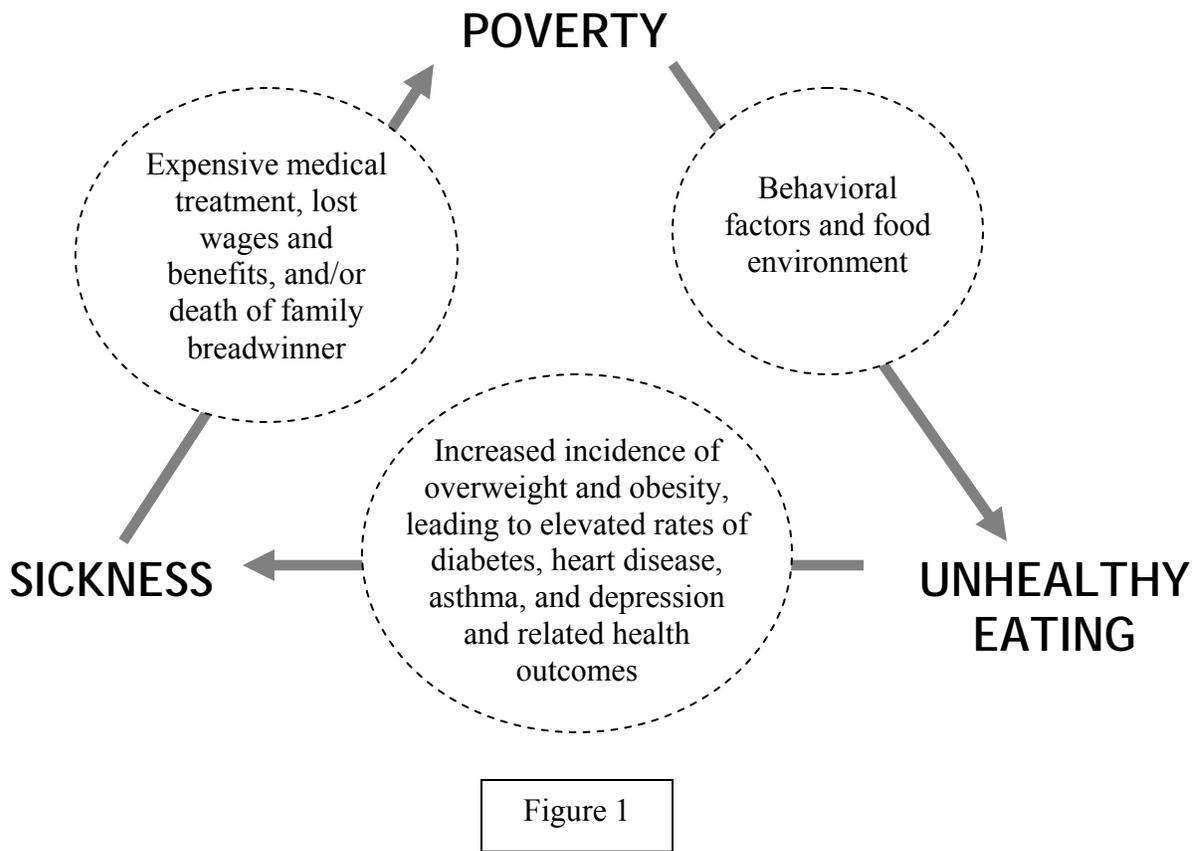
Prevalence of Diabetes and Obesity by UHF Neighborhood

Diabetes **Obesity**
0.0 - 5.8 0.0 - 17.6
5.9 - 9.8 17.7 - 23.7
9.9 - 11.2 23.8 - 26.7
11.3 - 18.3 26.8 - 31.6



Map 3

Obesity and diabetes are very costly to those affect, tax payers, and the health care system. According to the American Diabetes Association’s Diabetes Cost Calculator, the total cost of diabetes in New York City, congressional districts 5 through 17, in 2007 was approximately \$4.1 billion in excess direct medical costs and \$2.1 billion in lost productivity. As diabetes disproportionately affects people of color and people occupying the lowest-income levels (Morland), many patients who are diagnosed with diabetes cannot bear the resulting financial burden, sinking them deeper into poverty and perpetuating a cycle of sickness and indebtedness, graphically represented in Figure 1.



Food deserts also contribute to urban food injustice, or inconsistency in the amount and quality of food available for a given number of food dollars across

neighborhoods of differing racial/ethnic make-up, median income, etc. In 1991, a study conducted by the New York City Department of Consumer Affairs found that low-income urban residents paid about 8.8%, or \$350, more for food annually than residents of more affluent neighborhoods. The Community Food Resource Center in New York also found that those low-income shoppers who depended on mass transportation and taxis spent an additional \$400 to \$1,000 annually to shop at supermarkets outside their neighborhoods (“Urban Grocery Gap: Hearing before the Select Committee on Hunger”). Inflation and increased food prices since 1991 notwithstanding, these studies are clear: shopping in a food desert can be cost prohibitive for the lowest-income residents.

Additionally, the grocery gap results in poor value for money for programs such as the Supplemental Nutrition Assistance Program (SNAP), previously the Food Stamp Program, and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) supported by federal and state tax dollars. Winne argued: “A can of instant formula, a basic part of the WIC food package, will cost \$2.19 at a supermarket, but \$2.90 at a ‘mom and pop’ grocer. Either way, government funds will pay for it (“Urban Grocery Gap: Hearing before the Select Committee on Hunger”).” In a country with soaring healthcare costs, persisting race and class tensions, and multi-trillion dollar debt, food deserts remain a concern for everyone.

Research Question

In response to the consistency of anecdotal evidence and several news stories of competition from pharmacies, this project seeks to examine the possible role of chain pharmacies in New York City’s worsening food deserts. Through analysis of the relationship between food store and pharmacy selling space across neighborhoods of

differing income levels, this project seeks to answer the question, “How and to what extent is prevalence of pharmacies related to prevalence of food stores in New York City?” Given that food deserts exist almost exclusively in low-income areas, the project will consider pharmacy prevalence to have a negative affect on food store prevalence if this relationship is most extreme in low-income neighborhoods and between pharmacies and food stores of similar sizes.

II. THEORY AND LITERATURE

Disparities in Food Store Access and Market Potential

Published studies repeatedly document that urban areas of high poverty and high public assistance receipt have fewer and smaller grocery stores. A careful study by Cotterill and Franklin related 1990 Population Census tract data to a complete census of the supermarkets with gross sales of at least \$2 million in the nation’s 21 most populous metropolitan areas. The study showed that zip codes with the highest percentage of residents on public assistance have the fewest stores and square feet of selling space per capita compared to zip codes requiring less public assistance. Additionally, residents in zip codes receiving the highest public assistance tended not to own vehicles, meaning residents could not travel outside their zip codes to shop for food using private transportation. In New York City, zip codes where 2.18-3.48% of residents received public assistance saw 3.31 square feet of food retail space per capita, while zip codes with 9.14% or more on public assistance saw 0.88 square feet of food retail space per capita (Cotterill and Franklin). The disparities were supported by research in the Minneapolis-St. Paul area demonstrating that chain grocery stores, shown to have lower prices and wider selection, were more likely to be located in areas where less than 10% of

households fell under the poverty line (King, Leibtag and Behl). The disparity in access is well documented; hence I expect to see the negative effects of pharmacy prevalence on food store prevalence most noticeably in low-income neighborhoods. Furthermore, this project will follow the convention of framing access issues in terms of square feet per capita.

At the same time, literature suggests that there is significant, often untapped market potential in low-income neighborhoods. Business leaders have spoken out about the economic wisdom of locating supermarkets in densely populated neighborhoods. In an interview about its two New York City locations, the vice president of the large grocery chain Pathmark, Stan Storkin, asserted that both stores “make good business sense because of...population density, and the amount of food dollars available in the community,” evidenced by the fact that they are “exceeding trends for our other stores” with “profitability levels...higher than the company averages” (Lavin). Indeed, the NYC Department of City Planning estimates that, even after the development of the large Pathmark stores, the city loses \$1 billion to suburban supermarkets, enough to support 100 more stores in the city (“Going to Market”). While the literature shows that food stores are hesitant to enter low-income markets, the literature also presents low-income neighborhoods as viable, available markets.

Discourse on Food Quality and Price as Related to Food Store Type

As previously noted, New York City’s food retailing environment is somewhat unique in that what appear to be chain stores are actually owned by individuals who own one to a small number of stores. They operate in a type of franchise model and, in many cases, receive technical assistance and make wholesale purchases from two wholesale

distributors, Krasdale Foods and White Rose Food. These stores are smaller than the national standard for supermarkets, but given the size constraints from real estate prices and physical space availability, medium-sized grocery stores function as comprehensive neighborhood supermarkets, selling a full line of food products including some produce, low-fat milks, and lean meats (Interviews and observation by author, 6/09). Though the literature to date has categorized stores as supermarkets using square footage minimums of 10,000 or by identifying “name brand” stores (Chung et al; Morland et al; “Going to Market”), it becomes important to consider medium-sized stores in NYC and to realize that larger and “name brand” stores are not the only potential sellers of healthy food.

Literature on the types of food sold in different types and sizes of food stores or in pharmacies is extremely limited. A NYC Department of Health and Mental Hygiene study comparing East Harlem, one of the poorest neighborhoods in the country, to the Upper East Side, one of the richest neighborhoods in the country, and Central Brooklyn found that 33% of the food stores in the Upper East Side were bodegas, compared to 66% in East Harlem, of which only 25% sold fruits and 4% sold leafy green vegetables (Gordon et al). Other anecdotal evidence suggests that food quality and variety decreases with decreasing size of a store and with decreasing community income, and pharmacies tend to sell convenience and snack foods such as soda, candy, canned nuts, canned soups, and breakfast cereals. Literature also shows that poor consumers tend to spend more for food than their higher income counterparts due the structure and size of the food retailing market in poor neighborhoods. Specifically, shoppers at chain food stores pay significantly less than shoppers at non-chain food stores for the same market basket of

foods (Chung et al), meaning that low-income shoppers living in areas lacking chain supermarkets pay more for lesser quality food in NYC.

Scarcity of Literature on Pharmacy Access

A scarcity of literature on pharmacy access leads one to believe that significant disparities do not exist to a great degree or in many cities. A study by Alwitt and Donley showed that poor areas of Chicago “have fewer and smaller retail outlets overall than non-poor areas, including fewer supermarkets, banks, and large drugstores.” In these neighborhoods, residents had to travel over 2 miles to have access similar to residents of non-poor neighborhoods. The only other mentions of disparities in pharmacy access refer to disparities in access to particular services or prescriptions, for example, access to analgesics in low-income, racially diverse neighborhoods. According to a study on the availability of opioid analgesics in a random sample of New York City pharmacies, Morrison et al found that pharmacies in predominantly nonwhite neighborhoods were significantly less likely to stock opioids than pharmacies in predominantly white neighborhoods, even after controlling for age, and rates of burglary, robbery, and drug-related arrest. Such evidence points to a need for further examination of the retail pharmacy business on the whole, though it suggests that low-income neighborhoods may be underserved by large drug stores. There are too few news stories or anecdotes of chain pharmacy competition in NYC to ascertain the extent to which chain pharmacy access is related to community income in NYC neighborhoods.

Evidence Bearing on Possible Competition from Pharmacies

Several local news stories corroborate supermarket owner’s claims of competition by chain pharmacies in New York City as well as other northeastern cities. In Larchmont,

NY, just north of Manhattan, a struggle over the use of a vacant lot once occupied by a large supermarket spurred local protest (Marszalek). CVS, who gained control of several leases after the closure of Grand Union supermarkets, was “willing to talk to interested parties” but was not otherwise deterred from their plans to open another CVS in Larchmont even after “150 people showed up at a Village Hall meeting to voice their opposition.” Those desiring a supermarket tried, in vain, to convince smaller local food retailers to expand into the larger space. Local grocers opined:

“...While the Grand Union site offers a prime location, taking over CVS's lease would cost about \$15,000 a month for the 10,000-square-foot store...That, along with stiff competition from area superstores that average 60,000 to 70,000 square feet, makes the Grand Union site a tough sell...”

Another story (O’Grady) from Queens in New York City relates an increasingly common tendency of failing grocery stores to sublet to chain pharmacies with the ability to pay higher rents and bear greater risks:

“When John Donofrio, 62, used to need a prescription filled, he had seven drugstores within a square mile to choose from. Then in July, a CVS drugstore replaced a Key Food supermarket...Now he has eight drugstores. But, to buy food, Mr. Donofrio and his neighbors, many of them elderly residents of Clearview Gardens Apartments, must travel more than a mile to a Waldbaum's at the Whitestone Shopping Center. In response to the change, he and dozens of local residents have picketed the CVS three times since it opened, most recently three weeks ago. They claim that CVS deceived them by promising before the store opened to carry essential food items and by hanging a sign that said, ‘Food Shoppe.’ But all they got, they say, were milk, soda and snack foods. ‘This is a real issue,’ said City Councilman Tony Avella, whose district includes the store. ‘CVS is selling high-profit items like cosmetics and paper towels and cookies, and not the labor-intensive products like vegetables, meat and poultry. It's disgraceful.’ ...Muss

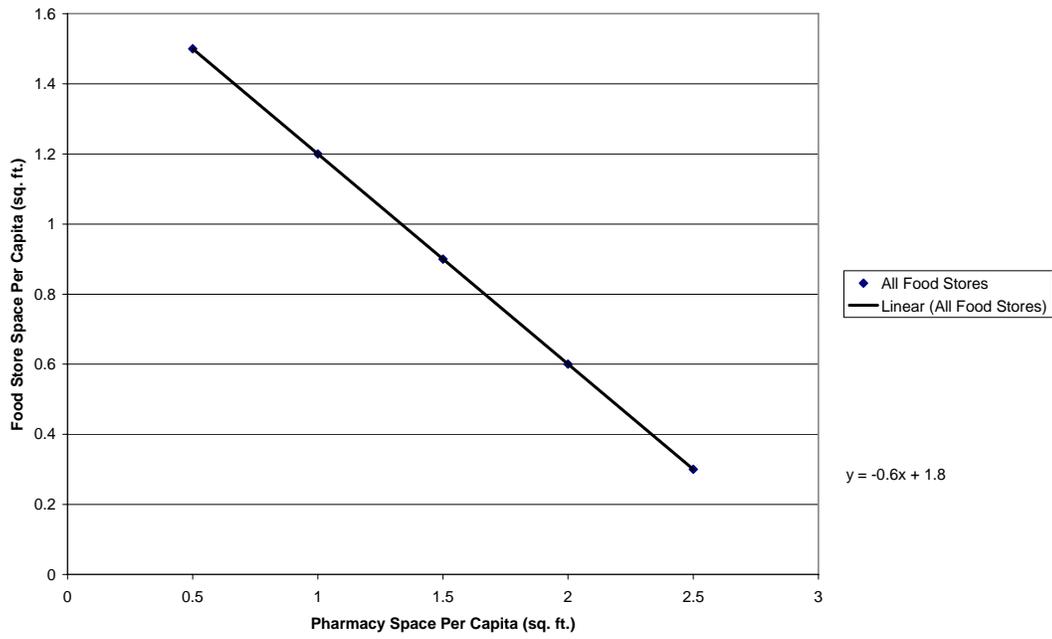
Development, which owns the building, said Key Food has a lease there until 2011. But when 'they couldn't make it at that location,' he said, Key Food sublet 10,500 square feet to CVS and returned 3,500 square feet to Muss..."

Combined with the interviews with food store owners and claims by NYC officials, evidence supports the claim that competition from pharmacies prevents the survival and expansion of food stores in low-income neighborhoods.

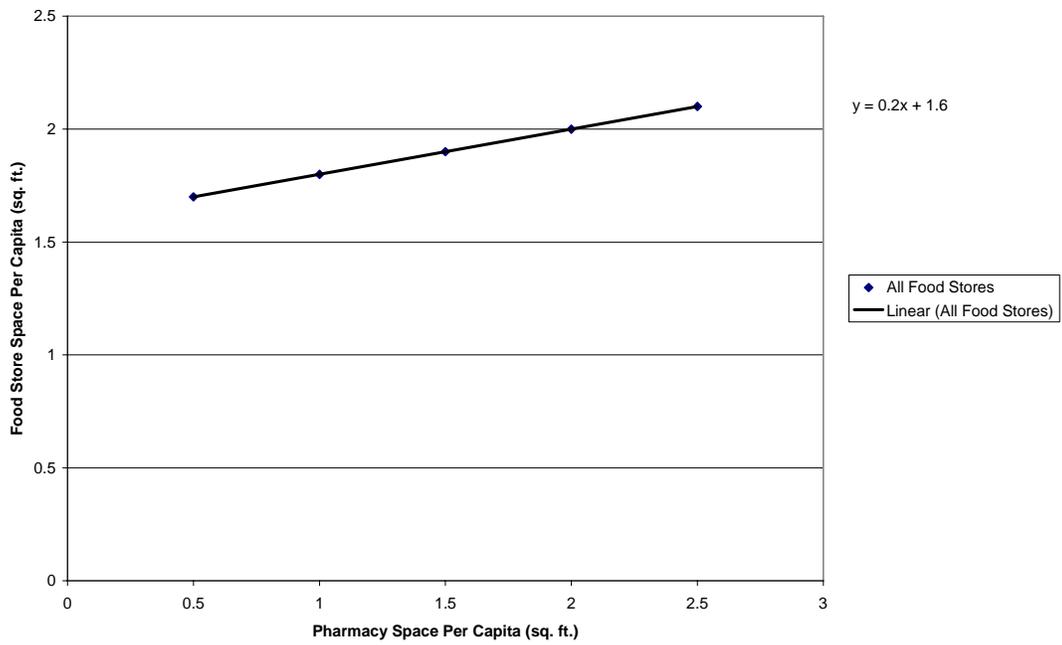
Study Hypotheses

Due to the consistency of anecdotal evidence claiming adverse consequences from the increasing presence of pharmacies and the evidence from the literature that the presence of food deserts is negatively correlated with income, I expect that the effect of pharmacy selling space on food store selling space will be most negative in low-income areas relative to the effect in middle- and high-income areas. Since the literature does not present a pharmacy:food store ratio that would demonstrate a null effect, it should be noted that the hypothesis is not that the effect will be negative in low-income neighborhoods, though it could be, but simply that the effect in low-income neighborhoods will be relatively more negative than in medium- or high-income neighborhoods. A hypothetical representation where the effect in low-income neighborhoods is negative might appear as:

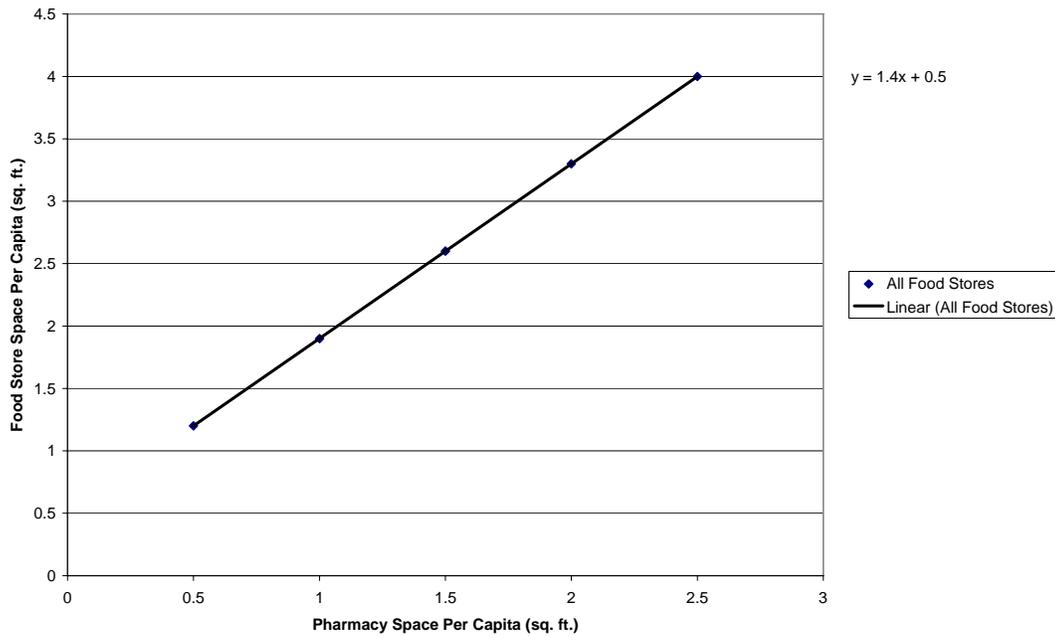
Food Store Space as a Function of Pharmacy Space in Low-Income Neighborhoods



Food Store Space as a Function of Pharmacy Space in Medium-Income Neighborhoods

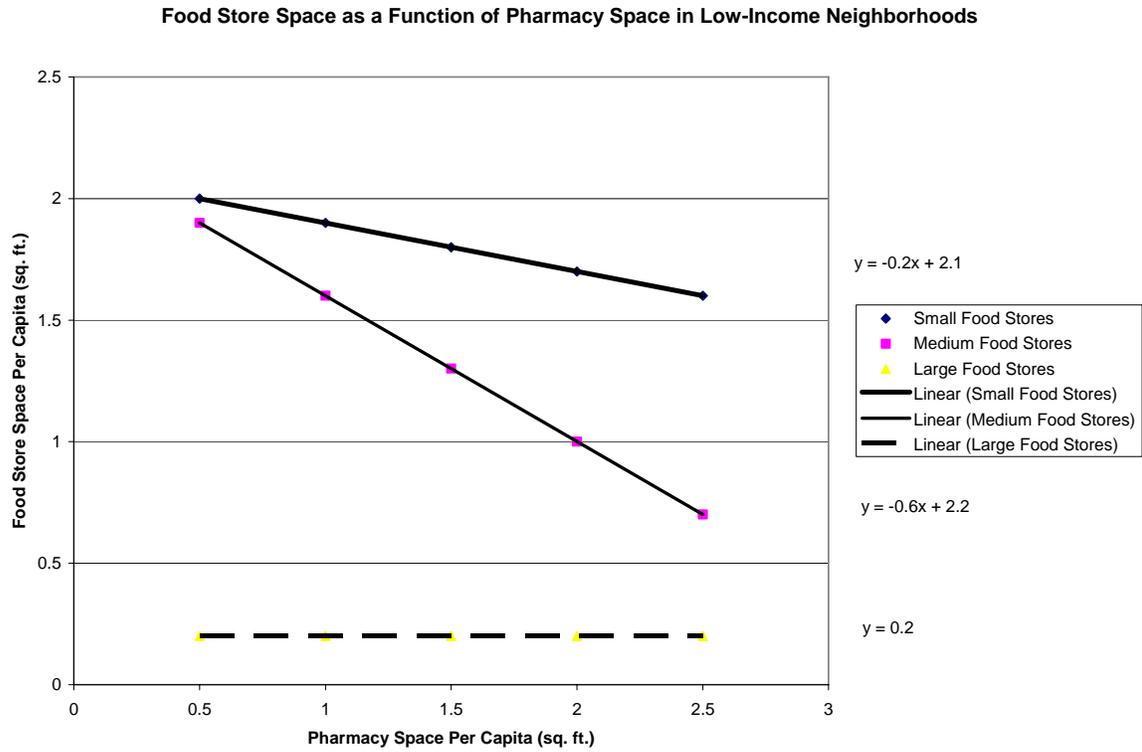


Food Store Space as a Function of Pharmacy Space in High-Income Neighborhoods

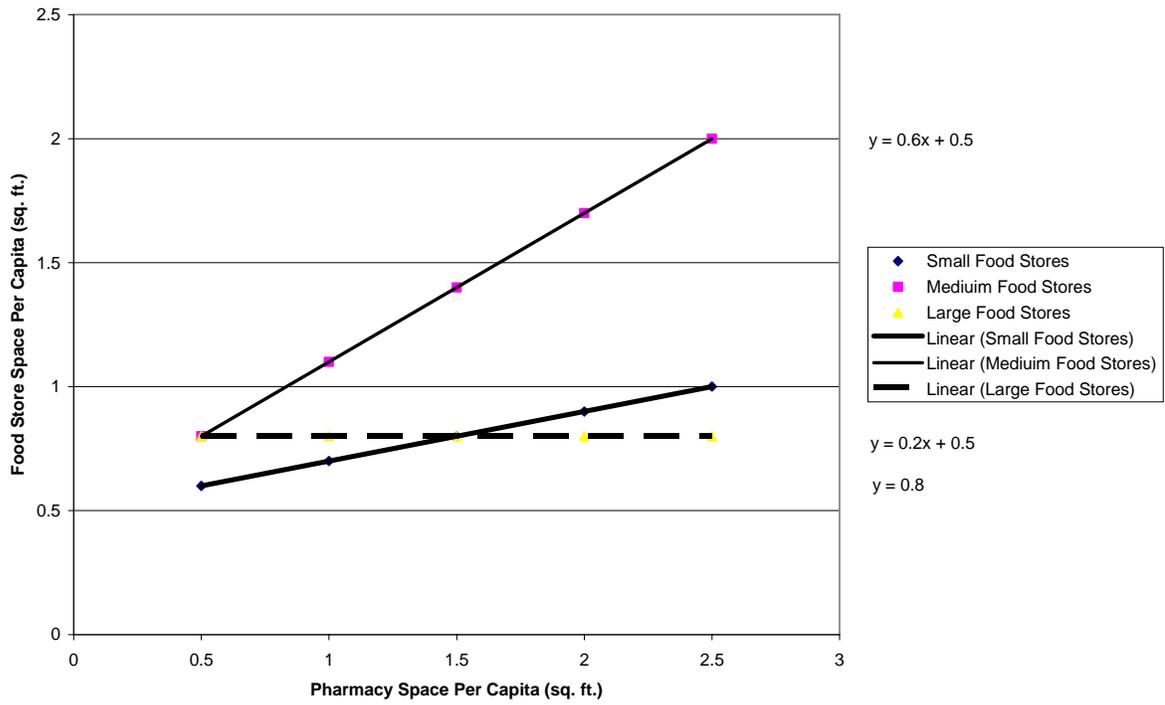


To answer the competition question more convincingly, food stores have been categorized as small, medium, or large food stores. I expect that, if competition is occurring, it would occur most noticeably between pharmacies and food stores of similar sizes. Given that pharmacies are comparable in size to medium food stores and the largest of the small food stores, I also expect to see the negative effect of pharmacy competition most strongly in the relationship between pharmacies and medium food stores, less strongly in the relationships between pharmacies and small food stores, and least strongly in the relationship between pharmacies and large food stores. A hypothetical representation of this relationship might appear as in the graphs below, where the relationship between pharmacy space and medium food store space becomes positive with increasing income, the relationship between pharmacy space and small food store space becomes positive, albeit more slowly, with increasing income, and the relationship

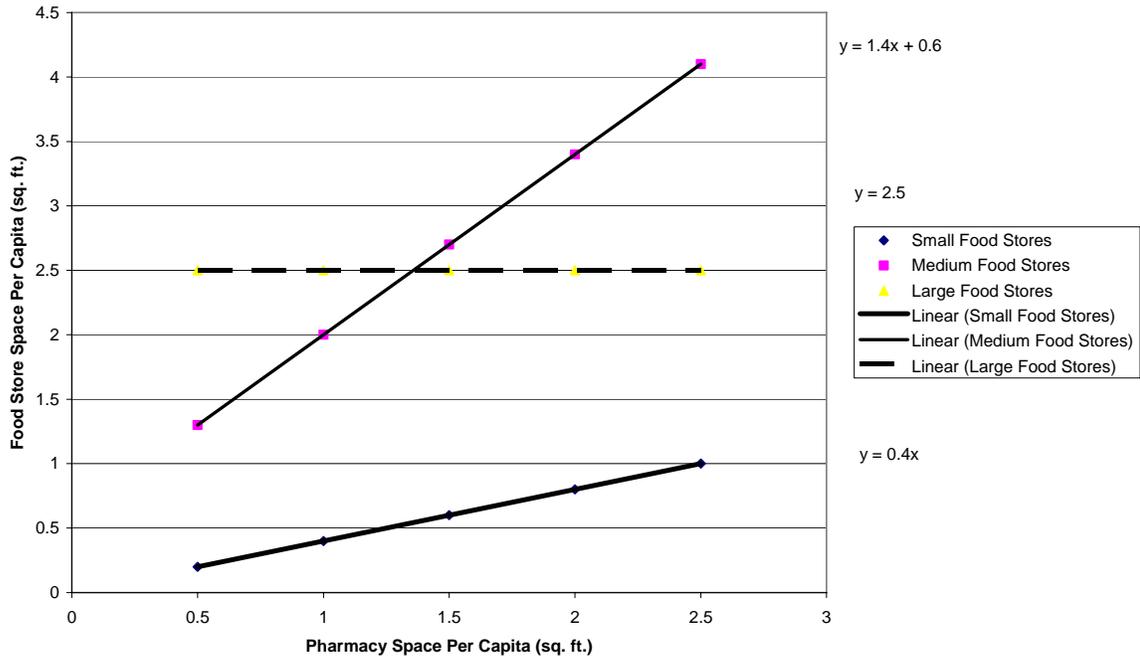
between pharmacy space and large food store space is relatively unaffected by increasing income.



Food Store Space as a Function of Pharmacy Space in Medium-Income Neighborhoods



Food Store Space as a Function of Pharmacy Space Per Capita in High-Income Neighborhoods



III. METHODOLOGY

In order to test the hypothesis that competition from chain pharmacies contributes to the creation of food deserts, the project will compare the effect of pharmacy space over small, medium, and large food store space in low-, medium-, and high-income neighborhoods. Following from the hypothesis represented above, the project will examine if and to what extent the ratio of pharmacies to different sized food stores in a neighborhood increases as income increases.

Because I could not locate sufficient site-level data over time and the literature does not suggest an appropriate or average pharmacy:food store ratio, this project takes a cross-sectional approach and compares relative relationships across income levels and food store types rather evaluating absolute effects. The project compares three multiple regression models produced by STATA software, comparing the pharmacy:food store ratio for small food stores, medium food stores, and large food stores.

Data Sources

As the project compares per capita selling space for supermarkets and pharmacies across zip codes in three community income levels, the project requires population, income, and site-level retailer data across NYC. Population data are 2007 Census estimates from the U.S. Census Bureau. Data was retrieved at the zip code level for all 179 New York City zip codes. Community income levels were determined by separating zip codes at two natural breaks in zip codes' household median incomes, leaving 49 zip codes earning annual median incomes less than \$35,000, 55 zip codes with households earning between \$35,000 and \$50,000, and 70 zip codes with households earning more than \$50,000. Two zip codes (11359 and 11451) were excluded based on missing Census

information, likely due to the extremely small number of residents living in each zip code, reported as 0 and 21 residents, respectively.

Food store and pharmacy data are subsets of a census of all food retailers in New York City procured through a Freedom of Information Act request from the New York State (NYS) Department of Agriculture and Markets. NYS Agriculture and Markets updates a database of food retailers constantly as field agents perform routine site inspections. Names, addresses, and square footage for each store were current as of 09-03-09. The original dataset included 12,353 food retailers, 1,107 of which were excluded because they contained no data on square footage. Analysis of the excluded stores reveals that square footage non-response was roughly consistent across community income levels. Food retailers were then coded as food stores, or establishments dedicated to the sale of unprocessed foods, and chain pharmacies, including CVS, Duane Reade, Rite Aid, Walgreens. This study excluded non-chain pharmacies as they were very low in number in the dataset and because the logic behind possible competition between chain pharmacies and food stores does not hold for non-corporately owned pharmacies that would suffer the same risk aversion as food stores of a similar size. Because the NYS Dept. of Agriculture and Markets considered all data to fall under the category of “food stores”, these food retailers were coded as “food stores” by default and recoded as “pharmacies” if their trade names included the names of those chain pharmacies listed above. This resulted in a dataset of 10,710 food stores and 536 pharmacies. Food stores were then coded as small-, medium-, or large-sized food stores according to cut-offs used in NYC food policy for comprehensive food stores (6,000 sqft minimum) and zoning restrictions for most retailers (30,000 sqft maximum), with small stores showing sizes

greater than 0 sqft and less than 6000 sqft, medium foods stores being 6000 sqft to less than 30,000 sqft, and large food stores being 30,000 sqft or more. Because the retailer dataset listed no relevant food retailers in some zip codes, an additional two zip codes were eliminated from the analysis.

Method of Analysis

The project then fits multiple regression models relating the independent variable, per capita chain pharmacy space, to the response variable, per capita food store selling space, for small-, medium-, and large-sized food stores across zip codes of three community income levels. The models take the form

$$Y_{1i} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \varepsilon_i$$

$$Y_{2i} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \varepsilon_i$$

$$Y_{3i} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \varepsilon_i$$

Y_{1i} =No. sqft small food store space per capita in zip code i

Y_{2i} =No. sqft medium food store space per capita in zip code i

Y_{3i} =No. sqft large food store space per capita in zip code i

X_{1i} =No. sqft chain pharmacy space per capita in zip code i

X_{2i} =Binary variable for medium-income (1 if medium-income in zip code i, 0 if not)

X_{3i} =Binary variable for high-income (1 if high-income in zip code i, 0 if not)

X_{4i} =Interaction term between pharmacy space and income in medium-income neighborhoods ($X_1 \cdot X_2$)

X_{5i} =Interaction term between pharmacy space and income in high-income neighborhoods ($X_1 \cdot X_3$)

Finding that the data for all three store sizes is reasonably normally distributed, STATA tests for significance of the effect of the beta values on the overall model. The p-values around β_1 indicate if pharmacy space has a significant effect on food store space overall, while β_4 and β_5 indicate if any additional effect of the pharmacies' location in medium-income and high-income neighborhoods, respectively, is significant. A comparison of the models' total target effects, the effect of pharmacy selling space in the

three income levels (β_1 in low-income zip codes, $\beta_1+\beta_4$ in medium-income zip codes, and $\beta_1+\beta_5$ in high-income zip codes) provide a relative sense of the impact of pharmacy space on food store selling space across the city.

IV. EMPIRICAL ANALYSIS

Description of Data

| | | Low-Income \$0-\$35K/yr | Medium-Income \$35K-\$50K/yr | High-Income \$50K+/yr |
|---------------------------|--|----------------------------|---------------------------------|--------------------------|
| SUPERMARKET ACCESS | | | | |
| 1 | No. food stores (total) | 4777 | 3760 | 2211 |
| 2 | No. small food stores | 4455 | 3432 | 1927 |
| 3 | No. medium-sized food stores | 284 | 286 | 241 |
| 4 | No. large food stores | 38 | 42 | 43 |
| 5 | Average no. food stores/zip | 95.54 | 68.36 | 32.04 |
| 6 | Per capita food store selling space (sqft) | 3.97 | 4.19 | 3.99 |
| 7 | Average sqft per food store (all) | 2425.99 | 3216.55 | 4308.68 |
| 8 | Average sqft per small food store | 1430.88 | 1571.71 | 1598.88 |
| 9 | Average sqft per medium-sized food store | 11550.77 | 12523.08 | 13429.25 |
| 10 | Average sqft per large food store | 50894.74 | 74250.45 | 74627.91 |
| PHARMACY ACCESS | | | | |
| 11 | No. chain pharmacies (total) | 114 | 173 | 232 |
| 12 | Average no. pharmacies/zip | 2.28 | 3.15 | 3.36 |
| 13 | Per capita pharmacy selling space (sqft) | 0.31 | 0.44 | 0.87 |
| 14 | Average sqft per pharmacy | 8003.43 | 7478.09 | 8951.07 |

Chart 1

The data on access to food stores seems to support the existing literature (Morland et al; Chung et al) that access to large food stores increases with income (Chart 1, Line 4) and that small stores are highly prevalent in low-income neighborhoods relative to high-income neighborhoods (Chart 1, Line 1). Regardless of access, however, the average store in each store size group is larger in high-income areas relative to low-income areas (Chart 1, Lines 8-10). This would imply that, given that a consumer has access to a food store, he would be better off in a high-income neighborhood where the average store size is largest.

Data on pharmacies shows a strong positive relationship between access and income. Similar to food stores, an average pharmacy in a high-income neighborhood is almost 1,000 sqft larger than an average pharmacy in a low-income neighborhood, though the relationship between average size and income is not consistent when medium-income pharmacies are included. The strength of the access to income relationship is surprising given the lack of literature on pharmacy access.

Regression Analysis

As per the methodology, STATA produced regression results for each model, showing the p-values of each beta value. Variables were eliminated from the model, beginning with the variable with the beta value with the highest p-value, until all beta values were significant at the p=0.05 level. Beta values were added to find the total effect of pharmacy selling space in a given community income level over food store space in that income level as shown below:

| | Small Food Stores | Medium Food Stores | Large Food Stores |
|---|------------------------------|-------------------------------|------------------------------|
| Effect of Pharmacy Space in Low-Income Neighborhoods β_1 | ~0 | 0.24 p=0.001 | 0.45 p=0.039 |
| Effect of Pharmacy Space in Middle-Income Neighborhoods $\beta_1+\beta_4$ | ~0 | 0.24 | 0.45 |
| Effect of Pharmacy Space in High-Income Neighborhoods $\beta_1+\beta_5$ | 0.56 p<0.000 | 0.24 | 0.45 |

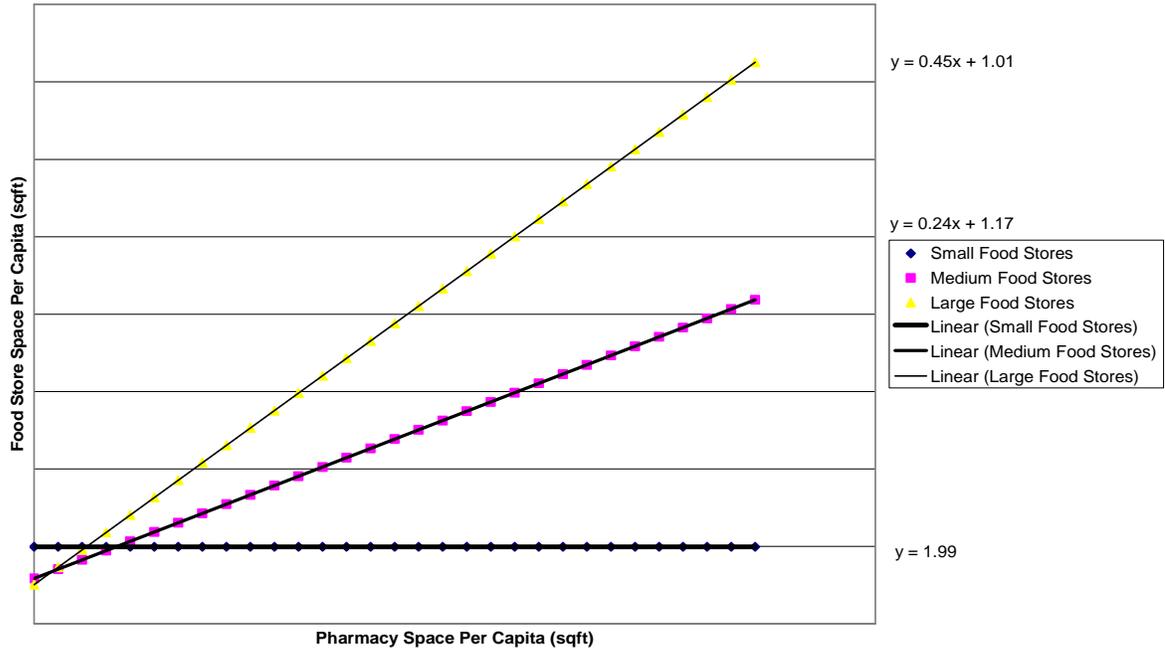
These results show that as there is no significant relationship between pharmacy space and small food store space in low- and medium-income neighborhoods. As pharmacy space increases by 1 sqft per capita in high-income neighborhoods, small food store space increases by 0.56 sqft per capita. As pharmacy space increases by 1 sqft per capita, medium store space increases by 0.24 sqft per capita, but the effect does not differ

significantly across income levels, as β_4 and β_5 were not significantly different from 0 and so added nothing to the overall effect of pharmacies on medium food store space. As pharmacy space increases by 1 sqft per capita, large food store space increases by 0.45 sqft per capita, but this relationship is also unaffected by differences in community income level.

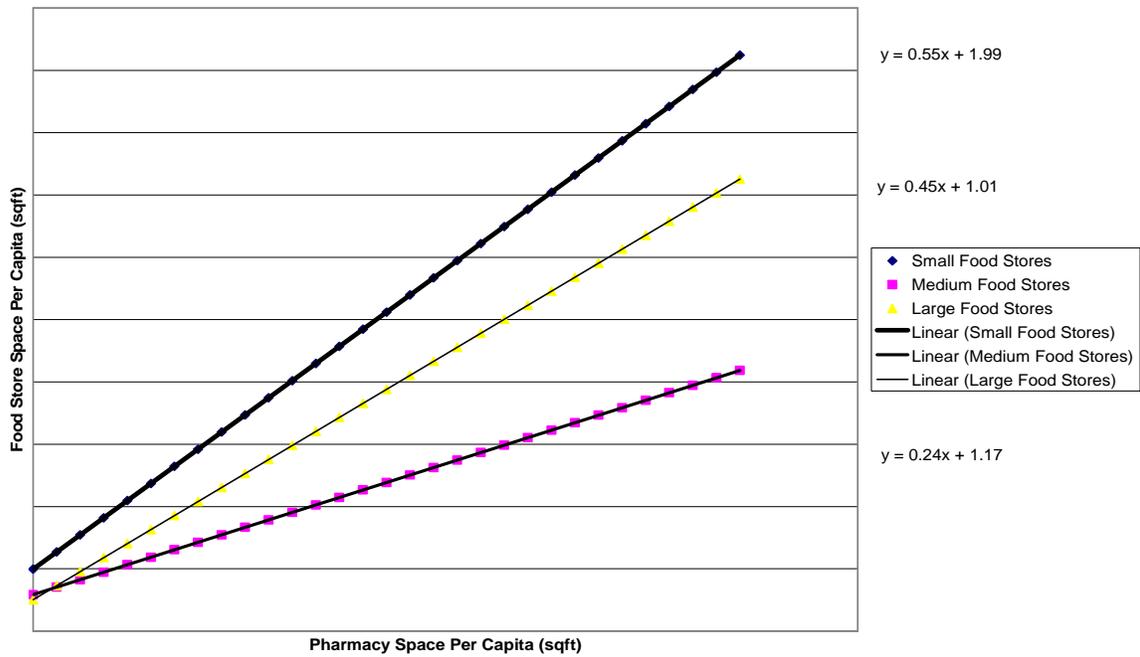
It should be noted that I was able to verify the assumption for data normality for all models in order to use linear regression, but the data in the right tail of the distribution of large food stores behaved somewhat abnormally. I was unable to correct for this problem through a common transformation of the dependent variable (large food store space per capita) through typical methods of log or power transformations because the dependent variable dataset contained zeros, but I was able to use the Box-Cox transformation to transform the y-variables. Experimentation with lambda-values in the Box-Cox transformation resulted in datasets that were less normally distributed than the dataset of untransformed y-values, so I proceeded with linear regression.

For purposes of comparison against the hypothesized relationships, graphs showing the relative effects found through STATA modeling appear as:

Food Store Space as a Function of Pharmacy Space in Medium- and Low-Income Neighborhoods



Food Store Space as a Function of Pharmacy Space in High Income Areas



V. DISCUSSION

Pharmacies are Unlikely Contributors to Food Deserts in NYC

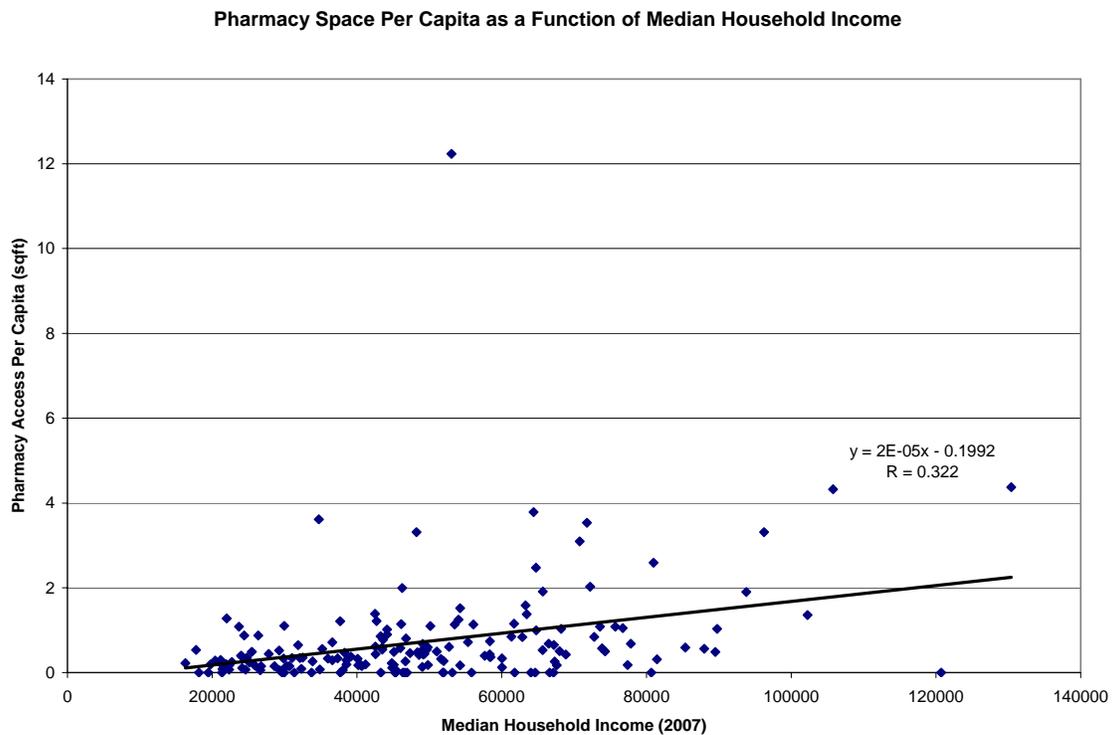
The regression results do not support the expected relationships between pharmacy and food store space. It was hypothesized that the relationship would become increasingly positive with increasing income and, relative to other food store sizes, most negative for medium- and small-sized food stores in low-income neighborhoods. In fact, the relationship between pharmacies and both small- and medium-sized food stores is the same in low- and medium- and high-income neighborhoods. The relationship between pharmacies and large-sized food stores, which was hypothesized to be 0, is the only one that becomes increasingly positive with income. In terms of the relationship between pharmacies and food stores given food store size, the relationship between pharmacies and medium- and small-sized food stores in low-income neighborhoods is indeed more negative than the relationship between pharmacies and large-sized food stores, but the relationships between pharmacies and medium-sized stores were hypothesized to be the most negative, where, as observed, the most negative relationship is between pharmacies and small-sized food stores. This points to income as a strong confounder and away from a causal relationship between pharmacy access and food store access in low-income neighborhoods. The results do not support the hypothesis that pharmacies contribute to the creation of food deserts in NYC.

Positive Assertions from the Data Analysis

This means that the strong anecdotal evidence regarding competition between food stores and pharmacies in major cities is largely groundless. However, contrary to logical assumption about food deserts, food stores in low-income areas do face a

significant amount of competition from other food stores. Literature is not particularly nuanced in its discussion of access to food stores and, as the description of the data revealed, low-income zip codes were home to an average of 95 food stores each. Low-income neighborhoods are labeled food deserts due to a lack of access to large food retailers, but operating within a food desert does not constitute operating alone or controlling a local monopoly on food retailing.

As previously noted, the strong relationship between income and pharmacy access is surprising given the scarcity of literature on the subject. A graph of pharmacy access on income appears as:



Given the literature relating the strong relationship between food store access and income, this presents income as a possible confounder even within community income

level groups. It also calls for increased research on the possibility of “pharmacy deserts” in low-income urban areas.

Additionally, the huge numbers of small food stores in low-income areas and the competition they likely experience from neighboring food retailers supports a view of small food stores as strong businesses in the low-income context. The literature engages in too general a conversation about small food retailers as the problem as opposed to the food they sell as the problem and in so doing overlooks their potential to mitigate the adverse effects of so-called food deserts. Though pharmacies do not seem to be correlated with food deserts, the same could be said of pharmacy foods. If in the future pharmacies are found to exacerbate the negative health effects of food deserts, the success and prevalence of pharmacies should be leveraged as a solution to the food desert problem.

VI. CONCLUSION

Possible Explanations for Claims of Pharmacy Competition

The failure of the regression analyses to support the hypothesis calls into question the information on which the hypothesis was based. Possible explanations for claims that competition from pharmacies stifles operation and expansion by grocery stores are varied. In the case of the claims voiced by food retailers themselves, we might cite some resentment toward corporately owned businesses and what are seen as any form of “big box” business, in which a company enters a neighborhood with large start up capital, a standardized floor plan, and the potential to push out local businesses. Another potential explanation is a generalization about pharmacy prevalence across NYC, when, in fact, pharmacies are only highly prevalent in the highest-income neighborhoods. As for the same claim made by policy makers, it is possible that policy makers are simply echoing

complaints heard from louder or most politically active small food retailers in high-income areas. As seen from the previous data, data may support a hypothesis of competition between pharmacies and small food retailers in high-income areas, where the relationship between pharmacies and small food stores becomes negative with increasing income. Additionally, policy makers' provisions to exclude pharmacies from taking advantage of the incentives in the FRESH program may have been more a move to ensure that grocers selling a full line of food products benefited than a statement about direct competition from pharmacies in general food retailing.

Alternative Hypotheses for the Causes of Food and Possible Pharmacy Deserts

This study failed to support the hypothesis that pharmacy competition may contribute to the creation of food deserts because, in general, both food stores and pharmacies were shown to be scarce in low-income areas, precluding competition from occurring. This leads to a new discussion about what might be preventing both supermarkets and chain pharmacies from locating in the poorest neighborhoods.

As previously noted, many hypotheses seeking to explain the scarcity of medium-sized food stores in low-income areas stem from the idea that medium-sized food store owners are particularly risk averse. This hypothesis does not fit, however, for corporately owned chain supermarkets or for chain pharmacies if one thinks they can be buoyed by the success of other stores. The other widely held explanation, which has been supported by extensive literature, is that income has a significant effect on the prevalence of supermarkets. The idea that low-income areas lack sufficient community food dollars has not, however, been supported by several successful case studies of chain supermarket development in NYC, Philadelphia, and other large metropolitan cities.

Instead, it seems plausible that some retailer redlining is occurring, whereby chain supermarkets and pharmacies are making systematically discriminatory decisions not to locate stores in areas with high black and Hispanic populations. The evidence on possible redlining is mixed. Controlling for purchasing power, poor neighborhoods in Chicago were found to have lower access to drugstores than non-poor areas but, surprisingly, did not have lower access to supermarkets (Alwitt and Donley). This would indicate that race, in addition to income, could play a significant role in pharmacy access but not in supermarket access. In another study by Raja et al, however, the racial makeup of a neighborhood was shown to have a unique and significant effect on the prevalence of food stores in a neighborhood while controlling for other factors. Zenk et al found that among the lowest-income neighborhoods in Detroit, “neighborhoods in which African Americans resided were, on average, 1.1 miles further from the nearest supermarket than were white neighborhoods.” The effect of possible supermarket and pharmacy redlining is important to understand, as racial considerations will prevent the success of otherwise effective development efforts regardless of the types or amounts of incentives offered to chain retailers.

Implications for Allocation of Resources for Food Store Development

The prevalence of small food retailers also calls into question some of the goals and pathways for change provided through the FRESH program. FRESH aims to support medium- and large-sized food retailers with improvements and expansions into low-income neighborhoods, but does not take into account the extremely high prevalence and neighborhood importance of smaller food stores. The most notable investment from a supermarket chain in a low-income neighborhood in NYC came in the late 1990s when

the city in partnership with the Local Initiatives Support Corporation, was successful in bringing a large Pathmark store to East Harlem. Though Pathmark Vice President Stan Strorkin claims the store to be one of the chain's most profitable, the development project was what NYC Food Policy Coordinator Ben Thomases called "a very bad case study in how to attract a supermarket," because the direct costs of the project as well as the politicking required to actuate it required all funds from a budget meant to cover the development of several more supermarkets (Personal communication, 6/09). While FRESH does not provide such comprehensive funding and so, if effective, will be a more efficient project than the Pathmark case, the FRESH program has set aside a significant amount of money for the project which, given the funds required to attract the East Harlem Pathmark, may not be successful at all.

Meanwhile, NYC has divested somewhat from the Healthy Bodegas program, which works with small food stores to stock produce and low-fat milks through technical assistance and increased access to selling space. Though the program began with a target of improving the food offerings in 1,500 bodegas, the program recently narrowed its focus to less than 100 (Cardwell). Given the number of small stores in low-income areas, a targeted improvement in just 100 stores will have limited impact on the overall food retailing environment.

Though smaller stores are thought to currently stock fewer healthy foods, their ability to retail successfully and prolifically in low-income areas make them easier and more immediate vehicles for improving healthy food access in low-income neighborhoods relative to long-term campaigns to develop chain supermarkets in these neighborhoods. Organizing efforts and technical assistance would do well to target

smaller retailers with a vested personal interest in the success of their stores and the health of the neighborhood in which many of them both live and operate their businesses. In NYC, this would mean reinvesting a portion of the funds dedicated to the FRESH program to the Healthy Bodegas programs where efforts have a higher chance and lower cost of improving access to healthy food.

Limitations and Areas for Further Research

This project was limited by the completeness of the dataset and the lack of control variables in the regression model. As noted, the original dataset provided by the NYS Department of Agriculture and Markets included over 11,000 data points, 1,107 of which had no data recorded for store size. The reason for this omission is unknown and may have affected the final results. Additionally, the subset of “food stores” included some establishments that do not offer access to food for individual customers, including distribution centers, wholesale markets, corporate offices, and warehouses. Unfortunately, due to the size of the dataset and researcher’s resources, these establishments could not be identified and eliminated from the dataset. For this reason, descriptions of absolute access should be viewed with caution. Last, the statistical modeling did not include control variables for possible confounders such as neighborhood crime, competition from food stores in the same or adjacent zip codes, zoning laws, etc. Future studies should include these variables.

This project could be improved upon in four major ways with knowledge and practice provided through further research. First, the project might have more potential to demonstrate causality through a time-series analysis. Unfortunately, site-level data could not be located over a significant amount of time, but additional datasets might be

procured through such agencies as the Internal Revenue Service or the US Department of Labor. Second, the project could employ an analysis of variation to test the specific effect of income level on both pharmacy access and food store access. Given the results, it seems that income is a likely confounder. Third, the project would have benefited from improved methods for locating relevant food stores from a large dataset. As noted, some of the establishments coded as “food stores” were warehouses, food-related business offices, and the like, which do not provide consumer-level access to food and skewed the data to overstate consumer access to food. Lastly, further research on this topic might perform a sensitivity analysis for the community income level cut-off points. Using different or more income categories might have significantly changed the distribution of types of food stores across income levels and provided a more nuanced picture of food store and pharmacy access.

Finally, researchers should consider the lack of access to pharmacies in low-income areas highlighted by this study. Many of the zip codes had one or no pharmacies, begging the question: “Where do residents buy their prescription drugs and toiletry items, and how much do they cost as a result?” Unfortunately this project cannot provide a sufficiently rigorous picture of pharmacy access because the dataset included only those pharmacies that sell food and are inspected by the NYS Dept of Ag & Markets. If one thinks that chain pharmacies are more likely to sell food than independent pharmacies, and that, as with food stores, there are more small, independent drugstores in low-income neighborhoods, this project may overstate the lack of access in low-income areas. Small independent providers could be effectively closing the gap in access as we found that small, independent grocery stores are doing. This is supported in “Patient Satisfaction

with Pharmaceutical Services in Independent and Chain Pharmacies”: “Fifty-five percent of the respondents for the independent pharmacies were nonwhite, compared with only 48% for the chain sites.” This topic is especially pertinent as the national health care debate continues in the US Congress. Specifically, it is important to ask, “Will closing the health care gap effectively close the health gap?” A disparity in pharmacy access, among other important disparities in quality and access to care, suggest not.

Though this project could not confirm a role for pharmacies in creating and perpetuating food deserts, further research should seek to explore other specific pathways rather than to describe the problem, which is now well documented. In particular, researchers with contacts and experience in the food retailing industry should seek to elucidate how and why food retailers make particular location decisions and how those decisions are affected by local policy.

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