Effect of Proximity to Fire Departments on Single-Family Property Values in Estero, Florida

Nick Melillo

May 1, 2025

Abstract

This research investigates the impact that distance to fire departments has on single-family residential property values in Estero, Florida that sold in 2024 for a price between $270,000 and $1,000,000. Using a dataset of 92 observations collected from the Florida Department of Emergency Management, Florida Department of Revenue, and the Lee County Property Appraiser a hedonic pricing model was employed to isolate the effect of distance to fire departments while controlling for structural, locational, and neighborhood characteristics. The analysis reveals a statistically significant and positive relationship between proximity to fire departments and property values, indicating that homebuyers in Estero view proximity as a disamenity. These findings support the hypothesis that nearby fire services contribute mostly negatively to property value and also highlight the importance of optimizing the locations of fire departments as results have implications for urban planning, appraisal practices, and local policy decisions regarding the locations of emergency service facilities.

I. *Introduction*

The influence of external factors on residential property values has long been a significant area of study, particularly the relationship between amenities, disamenities, and their effects on residential property values. One such factor, which remains relatively understudied, is the proximity of residential properties to fire departments, especially in markets as unique as Southwest Florida. Lee County, having the largest population of the five main Southwest Florida counties (Lee, Collier, Charlotte, Hendy & Glades) attracts an overwhelming proportion of upper-middle class retirees compared to the rest of Florida. This unique demographic supports the effort of researching such a unique geographical area in order to determine the impact that proximity to fire-departments has on single-family homes. Typically, in 2024, retirees and other single-family home purchasers in Estero, purchased homes priced between $270,000 and $1,000,000. This range will provide an accurate basis for analyzing the value determination in the typical consumer.

At first, proximity to a fire department may seem desirable as a result of improved safety benefits and a likely reduction in response time if one is required. Proximity comes with a trade-off though; consumers may view the close proximity as a disamenity due to an increase in noise pollution and frequent disturbances for emergency responses. This research aims to empirically investigate whether proximity to fire departments is perceived positively, negatively, neutrally by homebuyers, or whether buyers subconsciously incorporate this proximity into their valuation of residential properties.

Previous literature on the impacts of various public amenities and disamenities on property values provides foundational insights for this analysis. Studies frequently employ hedonic pricing models to isolate and quantify the effects of specific characteristics and externalities on housing prices. For example, proximity to amenities like quality public schools have empirically demonstrated a positive impact on residential property values (Black). On the other hand, proximity to disamenities such as rail projects or waste sites have shown a negative effect on residential property values (Mohammad & Schuett).

There is a variety of research available publicly regarding the effect that distance to fire departments has on both commercial and residential property values. Much of this research is done with very large datasets considering data pertaining to an entire state or a very large geographic area. This study reflects behavioral patterns of the average consumer in Estero but does not narrow down the decision making of specific demographic or socioeconomic groups. This study will provide insight into the purchasing decisions of consumers in a region consisting mostly of retirees that are financially well-off. Instead of viewing the proximity as an amenity or disamenity, it is also possible that homebuyers neither explicitly recognize nor directly evaluate the proximity of fire stations during their purchasing decisions but may rather subconsciously factor it into their general perception of property desirability.

This study specifically aims to clarify how such proximity is perceived by buyers in Estero, Florida. This research will test four hypotheses: (1) homebuyers view proximity to fire departments primarily as a disamenity, negatively affecting property values; (2)

homebuyers view this proximity positively, perceiving it as an amenity; (3) homebuyers are aware of the proximity but do not significantly factor it into their purchasing decisions; and (4) homebuyers are unaware of proximity as a factor but subconsciously alter their valuations based on implicit considerations. Through empirical analysis utilizing an ordinary least squares (OLS) regression model, this study will contribute valuable insights into the nuanced dynamics between fire departments and residential property valuation.

II.   Literature Review

Understanding how proximity to public amenities, such as fire departments, influences residential property values is critical across a variety of fields, including urban economics, regional economics, real estate valuation, and more broadly, general real estate studies. Existing literature provides a robust foundation for exploring the nuanced manners in which amenities and disamenities affect property prices through externalities, either explicitly acknowledged or implicitly perceived by homeowners.

Brueckner (1981) significantly contributes to understanding the valuation of congested public goods, specifically fire protection services. He underscores the importance of evaluating public services beyond mere geographic proximity by emphasizing service quality metrics from the Insurance Services Office. My study will focus solely on response times and noise pollution and ignore the quality of such services. Brueckner's analysis helps illustrate the complex balance between proximity-related

benefits (quick response times during emergencies) and costs (noise, visual disruption) inherent in fire department locations, a dynamic highly relevant to this study in Estero.

Similarly, Trey Dronyk-Trosper provides valuable insights through two separate yet complementary studies. His 2018 paper focuses on the effects of emergency service access specifically on non-residential properties within all of Florida, which parallels similarly with the geographic context of Estero. My study will offer specific insight to the purchasing decisions and value determination of a smaller geographic region. Though his focus differs from residential properties, the methodological rigor and the regional context of his research are highly pertinent for comparative analysis. Additionally, Dronyk-Trosper's earlier study (2017) elaborates on the concept of a "Goldilocks zone," demonstrating how residential property values capitalize local public services based on optimal distances. This nuanced view directly aligns with this study's hypotheses, particularly regarding residents' varying perceptions of proximity as either an amenity or a disamenity. The idea of a "Goldilocks zone" will be utilized in this study to provide a foundation of amenities determination based off of location.

Sandra Black (1999) further enriches this discussion by tackling the issue of edge effects—externalities stemming from proximity to various public amenities or disamenities. In this study, Black looked at the differences in home values based on varying access to public schools. Homes in better school districts ended up costing more than those in inferior school districts or zones. My study will not integrate any controls for edge effects, as they are not quite as applicable in determining the effect that fire department

proximity has on single-family homes. Black's methodological rigor in defining and managing spatial boundaries to mitigate bias is crucial to accurately assess property values influenced by nearby public services. Her approach is particularly valuable to this research in Estero, where single-family homes situated directly adjacent to fire departments may experience complex and multidimensional valuation effects.

Feng and Humphreys (2018) expand the analysis of spatial impacts on residential values specifically by researching the effect that proximity of sports facilities has on residential properties. They demonstrate the significant role of spatial autocorrelation (meaning that properties nearby should reflect similar values than those far away), warning against any potential biases in ordinary least squares (OLS) regression results. Given that there are spatially dependent variables included in this Estero study, such as distances to schools, parks, and malls, incorporating the spatial hedonic methodology proposed by Feng and Humphreys is vital for ensuring robust and accurate results.

Meta-analytic studies further deepen our understanding of valuation complexities in proximity studies. Mohammad et al. (2013) synthesize previous research on rail infrastructure and its effects on property values, highlighting significant variability in outcomes attributable to exogenous variables. Their findings caution researchers about assuming uniform valuation effects, reinforcing the need for a careful selection of variables and thorough analytical methods.

Further strengthening this methodological rigor, Schuett (2021) conducts a different meta-regression analysis on the impact of hazardous waste sites on residential property

values, revealing sharp contrasts in valuation outcomes based on perceived risk and proximity. His follow-up study (2024) examining wind turbines similarly reveals nuanced and differentiated valuation impacts based on distance and visual or auditory disruptions. These insights significantly reinforce the current research hypothesis regarding the potential for both explicit and implicit homeowner perceptions about proximity to fire departments and how these perceptions translate into measurable property valuation effects.

Lastly, Winger (1973) provides foundational insights into the influence of distance from urban centers on property values through the lens of the Alonso-Muth-Mills Model, which is sometimes referred to as the monocentric city model. His findings underscore the importance of considering additional explanatory variables beyond simple distance metrics, aligning closely with this Estero study's multifaceted approach. This reinforces the necessity to incorporate a comprehensive array of structural property characteristics—such as total living area, building age, improvement quality, yard area, presence of amenities (pool, water views), and functional features (garage spaces, bedrooms, bathrooms)—to ensure accurate and meaningful valuation conclusions. This study proves to be more useful than others that focus on a polycentric city; Estero is more of a monocentric town.

In light of the above literature, this research aims to fill existing gaps by explicitly examining the relationship between residential property values and proximity to fire departments in Estero, Florida. Fire departments were of particular interest due to their

consistent noise pollution, and specific locations in Estero. With the potential for dual

externalities (both amenities and disamenities), and varying homeowner awareness, this

paper will explicitly test four primary hypotheses: (1) proximity as a disamenity, negatively

influencing property values due to noise and disturbances; (2) proximity as an amenity,

positively influencing values due to enhanced safety and response times; (3) homeowner

awareness of proximity but demonstrating indifference to its valuation impact; and (4)

homeowner unawareness of proximity impacts yet subconsciously adjusting valuation

perceptions and decisions accordingly.

By systematically addressing these hypotheses and integrating robust spatial

econometric approaches informed by existing literature, this study will contribute

significantly to the nuanced understanding of residential property valuation dynamics in

the unique context of Estero, Florida. Through this research, we should be able to better

understand the ways that consumers in such a unique area like Estero Florida respond to

proximity to fire departments.

III.   Conceptual Model

To evaluate the effect of proximity to fire departments on single-family property

values in Estero, Florida, this research applies two complementary economic theories: the

Hedonic Pricing Model and the Alonso-Muth-Mills Model.

Hedonic Pricing Model

The Hedonic Pricing Model, introduced by Sherwin Rosen in 1974, provides a sound theoretical framework for understanding how property prices reflect implicit valuations of varying characteristics. According to this model, value will be defined equivalently as property prices (P), which can be decomposed into distinct attributes, broadly grouped into:

- *Structural Attributes (S):* Building size, age, the number of depreciated years, yard area, room count, amenities (pool, garage spaces, water view), and physical condition.
- *Neighborhood Attributes (N):* Quality of schools, crime rates, access to parks and shopping facilities, as well as general community appeal.
- *Location-Specific Attributes (L):* Proximity to amenities or disamenities, including fire departments, hospitals, highways, and central business districts (CBD).

Formally, the hedonic pricing equation can be expressed as:

$P = f(S, N, L, \varepsilon)$

Specifically, this study investigates the proximity attribute to fire departments (FD):

$P = f(S, N, FD, \varepsilon)$

Finally, this study will leave neighborhood attributes exogenous and focus soley on the building characteristics and locational attributes:

$P = f (S, FD, \varepsilon)$

The hedonic model posits that proximity to fire departments has dual potential externalities:

- *Amenity Effect:* Increased safety, lower insurance premiums, rapid emergency response positively influencing property values.
- *Disamenity Effect:* Noise pollution, visual obstruction, traffic, frequent disruptions negatively influencing property values.

Therefore, property prices near fire departments reflect a trade-off between these positive and negative externalities. Results may show that the general population views proximity as either an amenity or a disamenity, but on an individual level, purchasers may acknowledge both and some may view it as mostly and amenity and others may view it as mostly a disamenity.

Alonso-Muth-Mills Model

Complementing the hedonic approach, the Alonso-Muth-Mills model provides a foundational framework for analyzing how spatial location and distance from urban centers influence property values. Originating from William Alonso in 1964, then expanded by Richard Muth in 1969, and eventually enriched further by Edwin Mills in 1972, the Alonso-Muth-Mills model describes the urban structure based on transportation costs and accessibility, suggesting that land and property values decline as distance from a central business district increases, reflecting higher transportation costs and decreased

accessibility. As properties move away from the city center, commuting time and costs increase, resulting in lower prices per dwelling units, which results in more floorspace being consumed (larger buildings), which in turn leads to decreased density.

This study accepts the Alonso-Muth-Mills model but considers proximity to fire departments as an exogenous variable that could potentially affect values. Thus, the Alonso-Muth-Mills model can help illustrate how proximity to fire departments influences residential location decisions and property valuation, accounting for both accessibility to emergency services and nuisance costs. Distance to the central business district can still affect property values, while proximity to fire departments does as well; these two ideas can coexist.

Formally, the adapted Alonso-Muth-Mills function can be represented as:

$P = f (D_{CBD}, D_{FD}, T, Z)$

where:

- P = Property value

- D_{CBD} = Distance to Central Business District (CBD)

- D_{FD} = Distance to nearest fire department

- T = Transportation/accessibility factors

- Z = Other neighborhood and structural factors

The following figure illustrates the combined application of the Hedonic and Alonso-Muth-Mills models regarding proximity to fire departments:
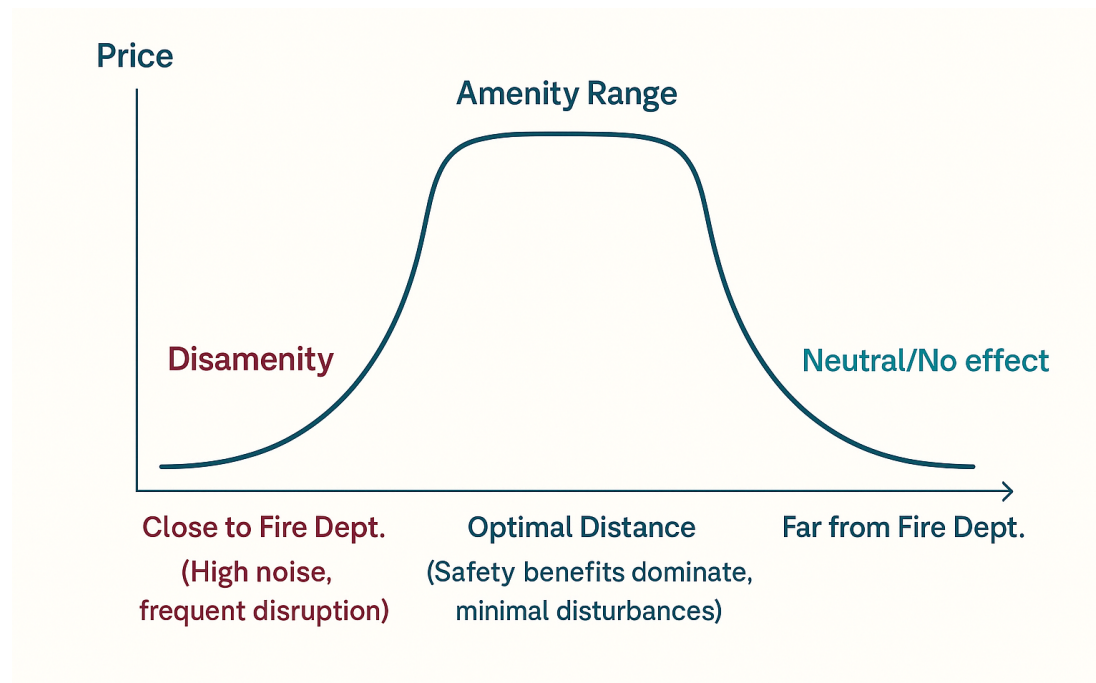

Figure 1; The effect of distance to fire departments on home value.

Interpretation:

- Buyers implicitly evaluate both positive and negative externalities of proximity to fire departments, leading to a nuanced valuation pattern. The optimal zone ("Goldilocks zone") represents the central flat line where positive safety benefits outweigh negative nuisance costs.
- Viewing fire departments as local service nodes, property values initially increase with proximity due to enhanced accessibility to emergency services, until proximity-related nuisance outweighs the benefits, reducing values at closer distances.

Combining both frameworks facilitates robust empirical evaluation of the four key hypotheses. Thus, by applying the hedonic pricing framework enhanced by the Alonso-Muth-Mills spatial perspective, this study thoroughly assesses how proximity to fire departments affects single-family property values in Estero, Florida.

IV.   Data and Methodology

To empirically examine how proximity to fire departments impacts single-family residential property values in Estero, Florida, comprehensive data was collected and rigorous econometric modeling was conducted. This section describes the sources of data, the characteristics of the data collected, the econometric model developed based on economic theory, and the methods that were applied to analyze the data effectively.

The dataset used for this study was meticulously compiled from several credible and relevant sources to ensure the comprehensiveness and accuracy required for a robust econometric analysis. These sources included the Florida Division of Emergency Management (FDEM) which was utilized to find the coordinates of the five different fire departments in Estero. I also used the Florida Department of Revenue (FDOR) which provided parcel level data regarding the sale price, sale date, and some structural attributes. Finally, the Lee County Property Appraiser's office was used to obtain data regarding whether or not there was a water view, pool, and provided the coordinates of each individual parcel as well.

More specifically, the Lee County Property Appraiser provided detailed property transaction data and structural property characteristics. These data points included sale prices, gross living areas, lot sizes, building ages, effective building ages, improvement quality, the

presence of amenities (such as pools and waterfront views), and functional features such as garage spaces, bedrooms, and bathrooms. The timeframe of the sales data covered transactions from May and June of 2024 specifically, in order to ensure recent and relevant market data from the same approximate time period. This allowed me to not need to control for any differences in time between sale prices as the difference between these two months could be considered negligible for the sake of this analysis.

Geographic proximity data, crucial for testing the four hypotheses, were sourced using Google Maps. The geographical coordinates of neighborhood amenities were sourced from Google Maps, then plugged into an equation to calculate the distance to each single-family parcel being observed. Specifically, distances were measured between each residential property and the nearest fire department, as well as additional relevant neighborhood amenities, such as schools (Pinewoods Elementary and Estero High School), shopping centers (Coconut Point Mall and Miromar Outlets), higher educational institutions (Florida Gulf Coast University), major highways (Interstate 75 entrances), and community parks (Estero Community Park). This meticulous spatial data collection facilitated precise measurement of proximity-related variables. Some of these variables showed signs of multicollinearity and were later omitted in order to improve the robustness of the entire model overall.

To determine the distance between a single-family property and the closest fire department, I used a geographic distance formula that calculates the shortest path between two points on the surface of the Earth. This method relies on each location's latitude and longitude coordinates. Because the Earth is roughly spherical, the formula applies principles from spherical geometry to account for the curvature of the planet. By converting the geographic coordinates

from degrees into a format usable by trigonometric functions, the formula estimates the central angle between the two points and then translates that angle into a real-world distance. The final result is the Euclidean distance measured in miles.

A summary statistics table is provided below to succinctly illustrate the dataset's key variables and their characteristics:

Table 1; Summary table of observed variables.

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Log(Sale Price)	92	13.279	0.279	12.514	13.800
Depreciated Years	92	0.598	1.158	0	8
Yard Area (sqft)	92	4,637.207	2,220.655	218	11,571
Distance to Elementary School (miles)	92	2.853	1.649	0.251	6.904
Distance to Coconut Point Mall (miles)	92	4.146	2.582	0.807	10.140
Distance to FGCU (miles)	92	3.384	1.723	1.127	7.901
Waterview (dummy)	92	0.467	0.502	0	1
Garage Spaces	92	2.141	0.459	1	3
Bathrooms	92	2.435	0.464	2	3.5
Bedrooms	92	3.000	0.889	2	6
Pool (dummy)	92	0.446	0.500	0	1
Distance to Fire Dept. (miles)	92	1.159	0.495	0.233	2.232
Total Living Area (sqft)	92	3,406.207	994.888	1,609	6,616

Guided by the Hedonic Pricing Model and the Alonso-Muth-Mills spatial framework, an Ordinary Least Squares (OLS) regression model was developed to test the hypotheses empirically. The hedonic pricing model was selected due to its ability to accurately measure implicit valuations of varying property attributes, while the Alonso-Muth-Mills model informed spatial considerations regarding proximity and distance metrics.

Formally, the model specification used to analyze the data is as follows:

$Log(Price) = \beta_0 + \beta_1(Depreciated\ Years) + \beta_2(Yard\ Area) + \beta_3(Distance\ to\ Elementary\ School) + \beta_4(Distance\ to\ Coconut\ Point\ Mall) + \beta_5(Distance\ to\ FGCU) + \beta_6(Waterview) + \beta_7(Garage\ Spaces) + \beta_8(Bathrooms) + \beta_9(Bedrooms) + \beta_{10}(Pool) + \beta_{11}(Distance\ to\ Fire\ Department) + \beta_{12}(Total\ Living\ Area) + \varepsilon$

Where:

- Log(Price) is the natural logarithm of the property's sale price.
- Depreciated Years measures the property's effective depreciation. This is calculated by subtracting the properties' effective age provided by the Lee County Property Appraiser from the year 2024.
- Yard Area represents the non-living outdoor space. This is calculated by subtracting the lot size by the size of the building.
- Proximity variables include Distance to Elementary School, Coconut Point Mall, FGCU, and importantly, the Distance to Fire Department.
- Structural and amenity variables include Waterview, Garage Spaces, Bathrooms, Bedrooms, Pool, and Total Living Area.
- ε is the error term, capturing unobserved variation.

This econometric specification directly aligns with the conceptual model, where proximity to fire departments (Distance to Fire Department) explicitly tests the hypotheses regarding valuation impacts due to amenity and disamenity externalities.

The model was estimated using an OLS regression, initially with standard errors and subsequently with robust standard errors to correct for potential heteroskedasticity. Diagnostic tests included a variance inflation factor (VIF) analysis to assess multicollinearity among explanatory variables as well as a residual analysis through histograms and scatter plots of residuals against fitted values to ensure model adequacy. Running a VIF test resulted in a mean VIF of 2.82 which is acceptably below the general threshold of 10. Anything under 5 is furthermore generally considered to be stable with low levels of multicollinearity.

Moreover, specific focus was placed on the interpretation of the Distance to Fire Department variable. The data, econometric model, and analytical approach form the robust methodological foundation necessary for deriving credible and valuable research regarding the effects of fire department proximity on single-family residential property values in Estero, Florida.

V.   Results

The econometric analysis investigates how proximity to fire departments affects single-family property values in Estero, Florida. To reiterate, in order to empirically assess the hypotheses outlined earlier, an Ordinary Least Squares (OLS) regression was conducted. The dependent variable utilized is the natural logarithm of the property's sale price (log_price), allowing for an interpretation of the coefficients in percentage terms.
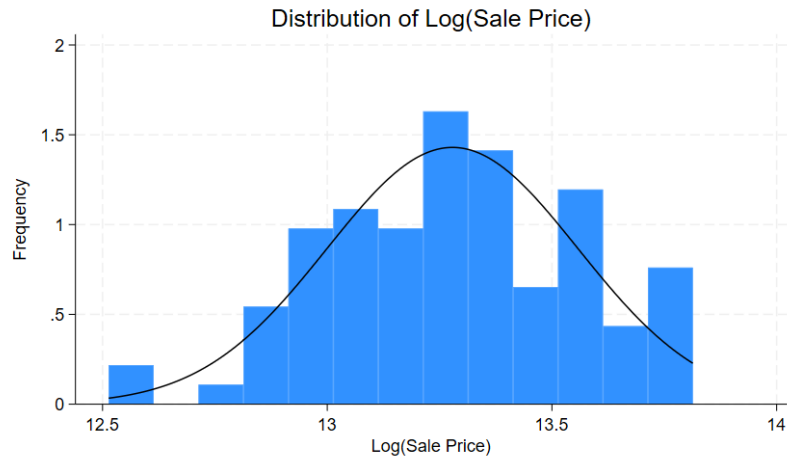
Figure 2; Normal distribution of log-transformed sale prices.

The histogram above displays the normal distribution of log-transformed sale prices helping justify the usage of an OLS regression. The overlay of a normal curve also helps support the credibility of the log-transformation and validify the existence of a normal distribution.

Additionally, as seen below, the normal distribution of the residuals creates more support for the utilization of an OLS regression. An OLS regression creates a line of best fit that minimizes the sum of squared residuals. This type of regression punishes outliers by squaring them and which results in a greater number compared to residuals that are closer to the mean. This normal distribution below shows that most residuals fall near the mean and the number of residuals that are further from the mean are increasingly scarce.
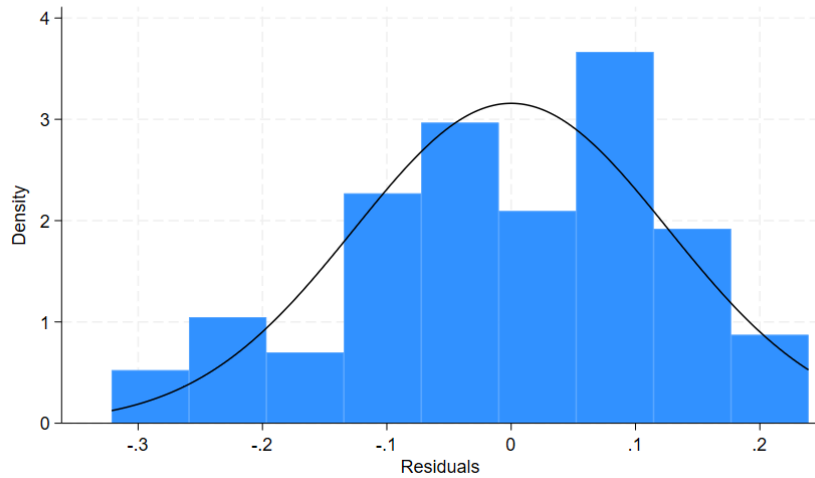
Figure 3; Normal distribution of residuals.

Below resides a summary table of the variables from the econometric model followed by an analysis and explanation.

Variable	Coefficient	Robust Std. Error	t-value	P>|t|	95% Conf. Interval
Depreciated Years	-0.0265	0.0174	-1.52	0.132	[-0.0612, 0.0081]
Yard Area (sq ft)	0.000019	0.000010	1.87	0.066	[-0.0000013, 0.000040]
Distance to Elementary	-0.0093	0.0173	-0.54	0.592	[-0.0437, 0.0251]
Distance to Coconut Point	-0.0059	0.0145	-0.41	0.684	[-0.0347, 0.0229]
Distance to FGCU	0.0245	0.0196	1.25	0.216	[-0.0146, 0.0636]
Waterview (Dummy)	0.0595	0.0280	2.13	0.037	[0.0038, 0.1152]
Garage Spaces	0.0381	0.0462	0.82	0.412	[-0.0539, 0.1300]
Bathrooms	0.0417	0.0380	1.10	0.275	[-0.0339, 0.1174]
Bedrooms	-0.0494	0.0266	-1.86	0.067	[-0.1023, 0.0034]
Pool (Dummy)	0.1102	0.0551	2.00	0.049	[0.0004, 0.2199]
Distance to Fire Dept.	0.0785	0.0386	2.03	0.045	[0.0017, 0.1552]
Total Living Area (sq ft)	0.000152	0.000041	3.70	0.000	[0.00007, 0.00023]
Constant	12.4526	0.1132	109.96	0.000	[12.2272, 12.6780]

The regression analysis indicates several key findings relevant to the hypotheses. Firstly, proximity to fire departments (Distance to Fire Dept.) demonstrates a positive and statistically significant coefficient (0.0785, p-value=0.045). This result suggests that, *ceteris paribus*,

properties located further from fire departments experience an increase in value. Specifically, each additional mile away from a fire department is associated with an approximate 7.85% increase in property value. This positive statistical relationship suggests that proximity acts as a disamenity, likely due to noise pollution rather than any expected benefits from safety and rapid emergency responses.

Below resides a scatterplot displaying the log-transformed sales prices against distance to the nearest fire department. There is a linear trendline overlayed in red color. There is a slightly positive slope, indicating that as distance to a fire department increases, property values rise. This can serve as a visual to solidify the finding that proximity to fire departments serves as a disamenity to residents in Estero, Florida.
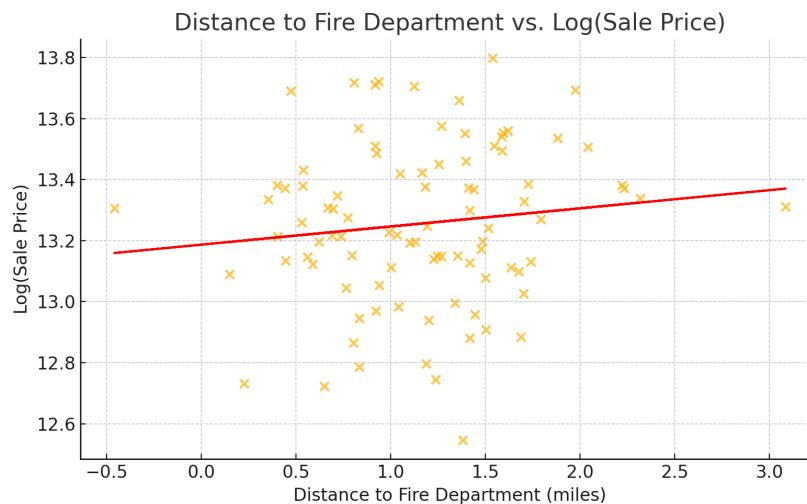
The variable representing total living area (Total Living Area) also shows significant positive impacts on property value, indicating that, larger homes command higher prices, controlling for other factors. A 1 square foot increase in total living area is associated with approximately a 0.015% increase in property value. This metric is statistically significant at the 99% level and considered extremely robust, and a very strong indicator of value determination.

Properties featuring pools and water views demonstrate positive valuation impacts, with pools contributing approximately an 11% increase in value and water views approximately 5.95%. This makes intuitive sense and aligns approximately with the cost of constructing a new pool based on the sale prices of homes in the sample range; the mean sale price from the sample was ~$600,000. These results align with expectations from the hedonic pricing literature, confirming that such amenities are desirable. Both of these variables were statistically significant at the 95% level, and support the general sentiment that pools and views increase property values.

Conversely, structural attributes such as the number of bedrooms reveal a negative relationship, where each additional bedroom reduces property values by approximately 4.94%. This result may reflect diminishing returns or market preference for fewer bedrooms paired with larger common areas or higher quality features. This may seem surprising at first, but after analyzing the data, you can see that most the average home from the dataset has three bedrooms. Most typical buyers from this dataset likely do not need more bedrooms than that, and if they do they likely will not need any more than four. This could also support a claim that buyers value less bedrooms, but ones that are larger in size.

The variable representing depreciated years was negatively correlated with property values, as anticipated, though statistically insignificant (p-value = 0.132). This aligns with the general understanding that older homes depreciate but suggests age alone may not significantly impact valuation independently of condition. Most homes in Estero have either been built recently or maintained at a high standard. The minimum observed effective age was zero and the maximum was eight. This reflects a tight range and also verifies the newly built environment in

Estero. Age and depreciation can intuitively not have a lot of impact on a market like Estero as most properties are potentially "similar enough" in the minds of homebuyers in the market.

Distance variables to other local amenities, including Coconut Point shopping center, Florida Gulf Coast University (FGCU), and elementary schools, were found to be statistically insignificant. These findings imply that these distances do not substantially influence property valuation within the sampled Estero residential market, or that their effects are already captured by other included variables.
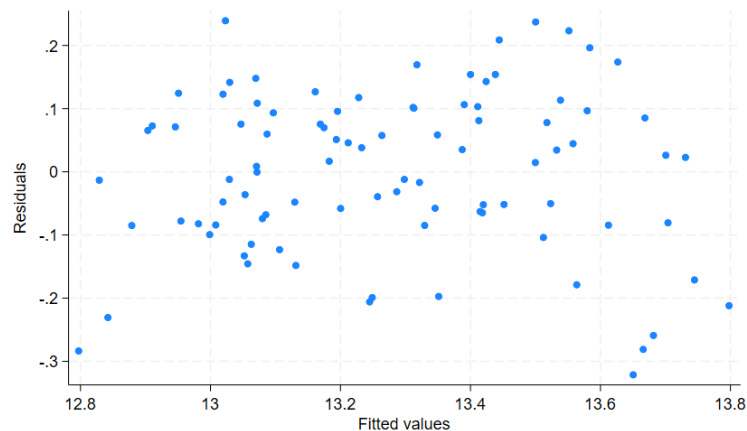
In scatter plot above, plotting the residuals and fitted values, no clear pattern emerges promoting support for constant variance throughout the error terms. This helps assess the heteroskedasticity of the model. Additionally, the visually random dispersion supports the idea of a homoscedastic model, which in turn reinforces the accuracy of the model's estimates.

Diagnostic checks confirmed no severe multicollinearity, with variance inflation factors (VIFs) averaging 2.82, indicating robustness in the regression specification. Previously, there were additional locations being analyzed such as distance to a local community park, and

distance to a local state park. These, along with a few other variables were dropped from the analysis in order to remove any multicollinearity in the model.

Overall, these empirical findings provide robust support for the disamenity hypothesis related to fire department proximity. Despite expectations that safety benefits might outweigh nuisance factors, market participants in Estero appear to primarily perceive proximity negatively. These results suggest that buyers either consciously or subconsciously consider the disturbances associated with living close to fire departments as outweighing the any potential amenities. This insight provides important implications for urban planning, residential real estate development, and emergency services policy.

VI.   Conclusion

This study set out to investigate whether proximity to fire departments in Estero, Florida, has a significant effect on single-family residential property values. Drawing on economic theory, particularly the Alonso-Muth-Mills model, using a hedonic pricing model, the analysis aimed to determine whether the presence of nearby fire departments is perceived as an amenity, a disamenity, or is not considered at all in the housing market. Using a dataset compiled from the Florida Department of Emergency Management (FDEM), Florida Department of Revenue (FDOR), the Lee County Property Appraiser, and spatial data from Google Maps, a multiple linear regression model was estimated using 92 observations consisting of a comprehensive set of structural, locational, and neighborhood characteristics.

The results indicate that proximity to fire departments has a statistically significant and positive relationship with property values (meaning that proximity serves as a disamenity),

controlling for other relevant variables. Specifically, the positive coefficient on distance to the nearest fire department suggests that as the distance increases, the log of sale price increases, implying that buyers are willing to pay a premium to be located further away from these emergency service facilities. These findings show that buyers in the marketplace view fire departments as a nuisance rather than an overall benefit.

Other important findings include the significance of traditional value determinants such as total living area, presence of a pool, water view, and yard size, which all positively correlate with higher property values. Notably, structural features such as bathrooms, garages, and depreciated years did not reach statistical significance, which may reflect large variations in buyer preferences or even some limitations in the smaller sample size.

Overall, this analysis contributes to the body of real estate and economic literature by providing localized insight into how public service infrastructure like fire departments affects residential property markets. The findings suggest that in communities like Estero with such a district demographic population, where safety and service accessibility are supposedly valued, proximity to fire departments plays an economically meaningful role in shaping market valuations. These insights are useful for urban planners, appraisers, and policymakers in designing communities and allocating public resources in a way that aligns with homeowner preferences and enhances neighborhood value.

References

Black, Sandra E. "Do Better Schools Matter? Parental Valuation of Elementary Education." *The Quarterly Journal of Economics*, vol. 114, no. 2, 1999, pp. 577–599, https://doi.org/10.1162/003355399556070.

> This article offers great insight regarding edge effects. This is something I am worrying about when calculating the property values of different residential properties. I do not want other public services nearby to alter the credibility of the results and I also do not want exogenous spatial variables to do the same. This article by Sandra Black provides details on how to mitigate any edge effects in my study. I believe that the paper does an excellent job at creating spatial boundaries and analyzing when certain data points would be potentially compromising to the results.

Brueckner, Jan K. "Congested public goods: The case of fire protection." *Journal of Public Economics*, vol. 15, no. 1, 1981, pp. 45–58, https://doi.org/10.1016/0047-2727(81)90052-9.

> Brueckner is able to offer a benefit in this paper by providing details regarding how to measure the level of fire protection in an area beyond just the proximity to a fire department. This may be useful in my study in order to expand my results and create a more comprehensive conclusion. He shows that the Insurance Services Office is an adequate source to measure the level of fire protection in any given area. The modeling and empirical approach in this article also help me conduct my research and create viable conclusions.

Dronyk-Trosper, Trey. "Effects of Emergency Service Access on Non-Residential Pricing." 25 Aug. 2018.

Trey Dronyk-Trosper provides excellent material in this paper on a very similar topic to my research question. He is essentially studying the same question but focusing on non-residential property values instead of residential values. The paper will be a great source to compare with. My paper will be valuable in addition to this one because firms and households act differently. Firms operate to maximize profits and households operate to maximize utility. It will be interesting to see the effects of emergency services on different types of property values given their positive and negative externalities. Additionally, this paper uses Florida properties as data, so the data sources in this paper will be helpful for me to find similar data for my own paper.

Dronyk-Trosper, Trey. "Searching for Goldilocks: The Distance-Based Capitalization Effects of Local Public Services." *Real Estate Economics*, vol. 45, no. 3, 2017, pp. 650–678, https://doi.org/10.1111/1540-6229.12171.

Now, this paper by Trey Dronyk-Trosper focuses even closer on the research question that I am studying. The data in his paper was based on 1994-2011 data, so I would like to use more recent and updated data. Also, this paper used data on Florida homes which is very applicable to my study as well. This paper is the most closely related paper I have found that studies the same research question as my paper. Finally, this paper will be useful in that it too will provide guidance on what data sources to use.

Feng, Xia, and Brad Humphreys. "Assessing the Economic Impact of Sports Facilities on Residential Property Values: A Spatial Hedonic Approach." *Journal of Sports Economics*, vol. 19, no. 2, 2018, pp. 188–210, https://doi.org/10.1177/1527002515622318.

This article studies a similar concept by seeing the impact that certain things have on residential property values. In this case, the authors are examining sports facilities in

Columbus, Ohio. The authors are able to determine that spatial autocorrelation plays a large role in the outcome of the test results and finds that OLS regressions overestimate the results. This paper will provide me with valuable insight when adjusting the empirical approach to my paper. The article has a good framework that will provide a credible basis for my paper. The authors' empirical approach is sound and corrects for any natural biases that occur in spatial evaluations.

Mohammad, Sara I., et al. "A meta-analysis of the impact of rail projects on land and property values." *Transportation Research Part A: Policy and Practice*, vol. 50, 2013, pp. 158–170, https://doi.org/10.1016/j.tra.2013.01.013.

This paper in contrast to most of the other papers I found is a meta-analysis; a study based on other studies. It is a unique paper in that sense, so it will provide a unique perspective and details regarding the conductivity of the research. The topic is still focusing on the impact that a certain type of thing has on land and property values, so it is highly relevant to my research as well. This paper finds a variety of variation between past results and is able to determine the reasons why. This will be useful to my paper to help me learn what exogenous variables can affect property and land values. It will be important to be aware of these factors when conducting my own research in my paper.

Schuett, Marvin. "Systematic Variation in Waste Site Effects on Residential Property Values: A Meta-Regression Analysis and Benefit Transfer." *Environmental & Resource Economics*, vol. 78, no. 3, 2021, pp. 381–416, https://doi.org/10.1007/s10640-021-00536-2.

In addition to the previous paper, being a meta-analysis this paper reviews the work of 83 other studies about the effects of waste sites on residential property value s. One great thing about this paper, is that it corrects for publication bias. The paper finds

that residential property values are severely negatively affected by hazardous waste sites but are unaffected by non-hazardous sites. This paper is more recent and offers guidance on modern econometric modeling. It also helps provide direction for different data sources and empirical techniques.

Schuett, Marvin. "Wind Turbines and Property Values: A Meta-Regression Analysis." *Environmental & Resource Economics*, vol. 87, no. 1, 2024, pp. 1–43, https://doi.org/10.1007/s10640-023-00809-y.

This final meta-analysis focuses on the impact that wind turbines have on property values. The empirical approach of this topic is similar to that of my research paper. Data sources are also going to be similar, although this analysis focuses also on commercial property data which is not something that I am concerned about in my paper. My paper is focusing on residential property values because I want to see how households value public services, not firms. This meta-analysis narrows down the ambiguity in the past research by showing that properties very close to wind turbines do face negative property values as a result of their proximity, but as properties are further away, they receive no effect from the wind turbines.

Winger, Alan R. "How important is distance from the center of the city as a determinant of urban residential land value." *The Appraisal Journal*, vol. 41, no. 4, 1973, p. 558.

This final paper from the highly esteemed and credible appraisal journal, which is a leading journal from the Appraisal Institute written by qualified industry professionals, sheds light on the early work of von Thünen and the monocentric city model as well. It focuses on explaining the significance that distance from the CBD has on residential land values and concludes that the theory is in line with empirics. It also shows that there are

still other factors and variables that play a role in the valuation of urban residential land values. The model finds an R squared around 70% leaving 30% of the explanation to other variables that were exogenous to the regression in this paper. My paper will focus on that 30% and examine the impact specifically that public services have on the remainder of not only land values, but property values as well. I may find it useful after starting my research to solely look at land values rather than improved property values in order to mitigate the effects of additional variables.