THE IMPACT OF COMMERCIAL DEVELOPMENT ON SURROUNDING RESIDENTIAL PROPERTY VALUES

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Executive Summary

This study examines the impact of commercial development on surrounding residential property values. The topic is explored utilizing an innovative approach that combines multiple data sources for the Atlanta, Georgia metropolitan area. Residential transaction prices in the neighborhood immediately surrounding a new commercial development are evaluated using a matched sample methodology and hedonic pricing models. Georgia MLS data – totaling over 1.5 million transactions of single-family detached properties – is merged with a registry of commercial property deliveries collected from CoStar Market Reports for Atlanta. CoStar Reports account for project delivery dates and property characteristics, such as property type, building size, category, and precise location.

Development impacts are evaluated at the .5, .75 and 1 mile radius surrounding the site. For each observation of a transaction that occurs within the specified radius, a matched sample is constructed that consists of all transactions from that calendar quarter in the same zip code (but outside the radius) for properties that have the same number of bedrooms, same number of bathrooms and were constructed within five years of the subject property. Only transactions that occur under normal sale conditions are considered. In doing so, the empirical results relate housing values for highly similar assets that are sold inside the radius to those that are sold just outside the radius but in the same zip code, and this comparison is made at all possible points in time relative to the project completion date. Valuation differences for properties sold inside the radius are

available as early as 20 years prior to and up to eight years following development completion. Fixed effects variables are applied to control for differences in submarkets, market timing within submarkets, property-specific physical attributes, and transaction-specific financial conditions – attempting to isolate the component of relative house price change that can be attributed to the introduction of a new commercial development.

Property types for new development considered in this study include industrial, office and retail spanning the period 2006 to 2014. Interactions between housing markets and commercial developments are revealed in the analysis, with project completions treated as an event study. Sites targeted for new industrial development exist in neighborhoods where values are relatively lower and already experiencing a downward trend in advance of the project completion. While price compression continues in the post-completion period, the trajectory is not significantly different than the counterfactual projection (supposing no industrial development had occurred). Industrial is one of the least desirable land uses, so it is not surprising to observe industrial development rights allocated in localities where housing values are on the decline. In close proximity to industrial development sites, a localized contraction in house prices appears during the predevelopment period and this may be the market response to a zoning change that allows the new project to be constructed. However, the focus in this study is on the impact of development completions and, lacking additional information about the particular timing of permitting and approvals, it is difficult to disentangle whether zoning changes cause prices to decline. Or, instead, do zoning changes that favor industrial development occur in areas that already have declining housing values? The sample of industrial developments includes a disproportionate count of large-scale projects (e.g.,

those delivering more than 150,000 square feet of gross leasable area), yet the existing trend is largely unaffected in the period that follows an industrial development completion.

By comparison, site selection for office development occurs in neighborhoods that are relatively more expensive, and at times when values are recently increasing. Post-completion, the trend stabilizes at elevated price points in recipient neighborhoods for new office buildings, yet the valuation spread is no longer increasing. Out of 273 new office developments identified for Atlanta during 2006 to 2014, a total of 252 are classified as either small projects (less than 100,000 square feet of building area) or suburban office (not located in Downtown, Midtown, Buckhead or Central Perimeter). The findings are heavily influenced by small projects and suburban office, rather than high-rise CBD office towers. Housing values appear largely unchanged by new office deliveries over the long-horizon.

In the immediate vicinity of retail development site, home prices are relatively lower than the surrounding area during the period leading up to the development. While the trend is trivial prior to completion, it is significantly impacted in the period immediately following a new retail delivery. Home prices inside the radius are initially relatively lower (even more so than before), but set on a path that is steadily increasing relative to comparables in the surrounding area. It takes only a couple of years for the initial reduction to be more than offset, and – within a few years after that – home prices inside the radius even surpass those in the surrounding area (when previously they were significantly lower). Of the three commercial real estate product types considered, proximity to retail development is the most likely to be considered a neighborhood

amenity and an important aspect to community revitalization – although it can take a few years for the submarket to fully incorporate positive price effects following the completion of a new shopping center.

Perhaps most surprising is the lack of evidence for negative and significant impacts of commercial developments on housing values. Scores of political arguments to the contrary are voiced at local debates across the nation, yet this research does not find substantive evidence of a negative interaction.

Background & Synthesis of Relevant Literature

Numerous neighborhood externalities have been evaluated for their impact on residential property values, including rail transit stations (Grass, 1992; Gatzlaff and Smith, 1993; Bowes and Ihlanfeldt, 2001; Debrezion, Pels and Rietveld, 2007), greenbelts and open spaces (Correll, Lillydahl and Singell, 1978; Bolitzer and Netusil, 2000; Irwin, 2002; Anderson and West, 2006), brownfields (Kaufman and Cloutier, 2006), airport noise (Espey and Lopez, 2000), churches (Carroll, Clauretie and Jensen, 1996), and landfills (Reichert, Small and Mohanty, 1992). The noted advantage from the existence of this extensive literature is in the existence of an established framework for estimating localized externality effects on residential property values. However, few studies consider the impact of commercial property development on residential property values. Yet, commercial development proposals arguably represent a very large component of policy debate in many jurisdictions across the nation, and NIMBY (not-in-my-backyard) is a recent addition to the modern vocabulary – even though it is not a recent concept.

Other studies discuss the political environment associated with commercial development proposals, including Feinerman, Finkelshtain and Kan (2004), Van der Horst (2007), and Schively (2007). The most closely related studies to the topic of a commercial development interaction tend to focus on the impact from very specific and niche products, such as Superfund sites (Kiel and Williams, 2007), livestock facilities (Herriges, Secchi and Babcock, 2005), oil and gas facilities (Boxall, Chan and McMillan, 2005), or new urbanism (Song and Knaap, 2003). This study aims to address the topic using a unified framework and consistent methodology to explore the outcome for surrounding residential property values resulting from new retail, office and industrial development for a major U.S. metropolitan market.

Hypothesis 1: *The delivery of new industrial development has no impact on surrounding residential property values.*

Industrial development, by comparison to the other two property types, is typically an unpopular land use, associated with increased pollution and trucking traffic. Industrial development is commonly horizontal on a single-story, rather than vertical, and the number of employees per square foot of building area is the lowest of the three commercial property types discussed in this proposal (e.g., typically 1 to 1.5 employees per 1,000 square feet of building area). Some industrial uses are resource-intensive and can place an excessive burden on the community's access to water and electricity.

Hypothesis 2: *The delivery of new office development has no impact on surrounding residential property values.*

New office development is typically the recipient of the highest property tax assessments (e.g., on both a value per square foot and value per acre basis). As a

consequence, new office buildings generally make positive contributions to a community's resources and infrastructure in excess of the resources absorbed. The disadvantage is that office buildings are highly-densified vertical land uses, increasing traffic flow and parking demand. Office buildings have also been accused of creating dark canyons or solar shadows as negative neighborhood externalities. If parking and traffic are not properly accommodated during the adjustments for development impact, then increased congestion will result as an undesirable consequence of new office construction. The advantage to office development is its ability to attract employers to the community who offer jobs in the business and professional services sectors. Residents seeking to minimize commute times may be attracted to neighborhoods that receive new office development.

Hypothesis 3: *The delivery of new <u>retail</u> development has no impact on surrounding residential property values.*

From a revenue perspective, retail development tends to be a jurisdictional favorite due to higher property tax assessments combined with additional cash flows sourced from local-option retail sales taxes. In the context of the surrounding housing market, whether retail development is net beneficial or detrimental depends on the outcome from competing effects. On the downside, new retail development often increases traffic volume, adds stress to public transportation systems, and attracts retail employees to the community who may seek low-income housing. A political argument is sometimes made to the effect that low-income residents decrease the quality of public education options. On the other hand, the quality and quantity of retail is commonly

ranked as one of the most desirable neighborhood attributes and new shopping and restaurants can attract residents to the community, increasing local housing demand.

If either the favorable or detrimental outcomes associated with any of the property types listed above are offset by the other, then Hypotheses 1, 2 or 3 will be rejected in favor of the alternative that commercial development of that property type *does* have a significant impact on the surrounding residential property values.

Summary of Data & Methods

This study combines market information from two important real estate events: new commercial real estate developments and single-family residential transactions. All empirical estimations in this study consider the values of single-family homes, as proxied by transaction prices. The series of residential transactions are for the metro Atlanta market area, generously provided by Georgia MLS, including a sample of 1,571,479 residential observations during the period 1985Q4-2014Q4. After deleting observations for listing status other than "Sold", transactions occurring under special sale conditions (e.g., foreclosure, short sale), homes under construction at time of sale, reported transaction prices of $0 or $1, homes reported to have zero bedrooms or zero bathrooms, and those with missing information about the date of sale, year built or listing price, the useable sample is reduced to 664,556 observations.

Longitude and latitude coordinates are necessary in order to evaluate the impact of residential transactions that occur in close proximity to new commercial development. However, the Georgia MLS data does not include information about the longitude and latitude of the property sold. To collect this information, the entire residential transaction

series is submitted through the Census Geocoder tool to convert property address to longitude-latitude coordinates. The Geocoder returns unavailable information for 53,971 observations (about 8 percent of the sample), further reducing the final sample to 610,585 observations.

Figure 1 shows the pattern of single-family residential home prices in the Atlanta metro and corresponding transaction volume over the period 1985Q4Q1 thru 2014Q4. During 2006-2007, average home prices in Atlanta peak over $230,000, approaching $250,000. By 2009Q1, the average home price was under $190,000 – down more than 24 percent from the peak. By 2014Q2, those losses had largely been recovered as home prices once again steadied with averages over $250,000. Transaction volume displays a high degree of seasonality, peaking in Q2 of every year. Over 16,000 transactions occurred during 2006Q2, and never more than 9,000 in any quarter during 2008 to 2012. While prices have recovered, transaction volume remains below the height of activity.

The specific focus of this research is to estimate the relative impact on housing values in close proximity to new commercial developments. The list of new commercial development projects includes industrial, office and retail property types, collected from the CoStar Property database – based on year of completion. In total, there were 193 industrial, 273 office and 467 retail projects completed since 2006 in the Atlanta metro area.

Figure 2 shows the commercial development completions over a time series. Industrial development accounts for the largest amount of total space delivered at over 26.6 million square feet, with nearly one-third of that delivered during 2006 alone. Industrial deliveries drop to around 1 million square feet per year during the five year

period from 2009 to 2013; although it appears to have begun a sharp comeback by 2014. By comparison, office and retail development fall to near extinction during 2009 to 2013. All three categories of commercial real estate development display dramatic cyclic behavior.

Figure 3 presents the breakdown of new commercial developments by property type, sub-type and project size. For industrial, warehousing facilities represent the greatest number of new projects (in project count observations). Distribution centers constitute the second largest category, and are generally larger projects (typically over 75,000 square feet). Office buildings are often designed with flexibility to accommodate a variety of possible tenants, and general purpose office buildings represent the largest portion of new product. Medical office buildings are typically smaller (less than 50,000 square feet) and represent the second largest component of new office development. The largest category of new retail development observations is general retail, second is strip centers, and third is neighborhood shopping centers. The number of observations for new retail development types is inversely proportionate to shopping center size.

CoStar data already includes longitude-latitude coordinates for each new delivery. Using these coordinates, the relative distance between each development site and every residential transaction in the sample is calculated in nautical miles (measuring distance "as the crow flies") using the haversine formula and solving for distance:

$$\text{Distance} = 2r \cdot \arcsin\left(\sqrt{\sin^2\left(\frac{\phi_2-\phi_1}{2}\right)+\cos(\phi_1)\cos(\phi_2)\sin^2\left(\frac{\lambda_2-\lambda_1}{2}\right)}\right),$$

where ϕ_1 and ϕ_2 are the latitudes, and λ_1 and λ_2 are the longitudes of points 1 and 2. *r* is the radius of the earth: 3963.17 miles. The distance measures are used to create the Close

indicator variable, identifying residential transactions that occur within the following radii of a new commercial development: .5 mile, .75 mile, and 1 mile. The objective is to identify relative valuation effects for the surrounding residential area pre- vs. post-completion. Observations located within radius of more than one new development for a commercial property type are removed from the analysis.

Table 1 describes the sample of residential transactions. The average home is 27 years old and sold for over $202,000. The most common home sold has three bedrooms (47 percent of the sample), two bathrooms (65 percent of the sample), and no half-bath (55 percent of the sample). Properties located close to new industrial developments are significantly lower priced (average price of $134,000), as are those close to new retail development (average price of $164,000). By comparison, homes close to new office development are more expensive (average price of $223,000).

To provide a more careful comparison, this study utilizes a matched sample methodology whereby for each Close transaction observation, a matched sample is constructed for transactions of "comparable" properties that are sold in the same calendar quarter, located in the same zip code (but outside the radius), having the same number of bedrooms, same number of bathrooms, and constructed within five years of the Close observation. All properties are single-family detached and sold under normal sale conditions. On average, each observation of a Close transaction corresponds to a matched sample comprised of seven to nine comparables. Observations that do not have at least one comparable transaction are excluded from the analysis.

Observations that are neither identified as Close, nor comparable are omitted from the respective estimation. In doing so, the empirical findings relate the percentage

difference in transactions prices for Close properties relative to comparable properties sold in the same quarter and zip code only – but outside the radius for development impact. The specification is akin to a difference-in-difference approach, attempting to compare effects for the subject group of observations close to a new development to effects for a control group of highly similar observations. The comparison is made at all possible points in time, before and after the development completion. In doing so, the technique attempts to resolve concerns that new commercial developments are neither randomly assigned to submarkets nor evenly distributed over a time series, and instead may respond to locally endogenous conditions such as population and economic growth.

The appropriateness of this method relies on its underlying assumptions. First, it assumes that neighborhood characteristics do not differ significantly between the area depicted by the radius that receives the new development and area in the same zip code that does not. Second, it assumes that the trend in property values beyond the radius but in the same zip code are representative of the trend in property values that would have occurred inside the radius had commercial development activity not taken place. The empirical analysis evaluates both assumptions by measuring the trend within the radius relative to comparable properties in the remaining zip code before development, after development, as well as counterfactually – supposing no development.

A hedonic model is used to specify valuation effects, which assumes that the value of a property is a function of physical, financial, locational, and market timing attributes. The basic model to be estimated is written as:

$$\ln(\text{Sale price}) = \beta_0 + \beta_1 \cdot \ln(\text{Age}) + \beta_2 \cdot 1 \text{ bedroom} + \beta_3 \cdot 2 \text{ bedrooms} + \beta_4 \cdot 4 \text{ bedrooms} + \beta_5 \cdot >4 \text{ bedrooms} + \beta_6 \cdot 1 \text{ bathroom} + \beta_7 \cdot 3 \text{ bathrooms} + \beta_8 \cdot 4 \text{ bathrooms}$$

$$+\beta_9 \cdot >4 \text{ bathrooms} + \beta_{10} \cdot 1 \text{ half-bath} + \beta_{11} \cdot 2 \text{ half-baths} + \beta_{12} \cdot >2 \text{ half-baths}$$
$$+\beta_{13} \cdot \text{Close} + \beta_{14} \cdot \text{Close*After} + \beta_{15} \cdot \text{Close*After*Trend}$$
$$+\sum_{i=1}^{15} \beta_{t+16} \cdot \text{Financing}_i + \sum_{j=1} \beta_{j+31} \cdot \text{Zip-quarter}_j + \varepsilon. \quad (1)$$

The dependent variable is the transaction price, logged. Variables measuring the physical characteristics include property Age, logged, along with indicator variables for the number of bedrooms, bathrooms and half-baths. Indicators for 3 bedrooms, 2 bathrooms, and 0 half-baths are suppressed – representing the largest categories and to avoid multicollinearity. Financing conditions are controlled through 15 indicator variables (e.g., all cash, conventional, 100 percent financing, seller financing). Time-varying differences in market conditions are controlled through calendar-quarter indicator variables for each zip code, represented by the Zip-quarter_j variables. This approach allows intra-market dispersion in real estate cycles and seasonality to be controlled at the zip code level.

The Close variable is an indicator for transaction observations located within the specified radius. After is an indicator variable for transactions that occur in the year following completion of a new commercial development. Trend measures years relative to development completion, {-20,-19,…,-1,0,+1, …,+8}, where 0 represents the year of completion. Given the log-linear and fixed-effects model specification, the parameter estimates for β_{13}, β_{14}, and β_{15} are the central focus of this estimation. The β_{13} coefficient (for Close) measures the constant pricing difference for observations within the radius relative to the remaining zip code over the full horizon. The β_{14} coefficient (for the Close*After interaction term) measures the constant change in the basis spread for the radius following the completion of a new development. The β_{15} coefficient (for the Close*After*Trend interaction term) measures the change per year in the trend for the radius relative to the remaining zip code following the completion of a new development.

A potential issue with the specification of Equation (1) is that the difference in property values within the radius relative to the remaining zip code may not be constant leading up to the development; rather values may be either relatively increasing or decreasing over time. In addition, the trend may have changed recently, altering the favorableness of conditions for development inside the radius. To evaluate these issues, two spline variables are added to the model. Equation (2) simply includes these two additional variables.

$$\begin{aligned}\ln(\text{Sale price}) = {} & \beta_0 + \beta_1 \cdot \ln(\text{Age}) + \beta_2 \cdot 1 \text{ bedroom} + \beta_3 \cdot 2 \text{ bedrooms} + \beta_4 \cdot 4 \text{ bedrooms} \\ & + \beta_5 \cdot >4 \text{ bedrooms} + \beta_6 \cdot 1 \text{ bathroom} + \beta_7 \cdot 3 \text{ bathrooms} + \beta_8 \cdot 4 \text{ bathrooms} \\ & + \beta_9 \cdot >4 \text{ bathrooms} + \beta_{10} \cdot 1 \text{ half-bath} + \beta_{11} \cdot 2 \text{ half-baths} + \beta_{12} \cdot >2 \text{ half-baths} \\ & + \beta_{13} \cdot \text{Close} + \beta_{14} \cdot \text{Close*After} + \beta_{15} \cdot \text{Close*After*Trend} + \beta_{16} \cdot \text{Spline 1} + \beta_{17} \cdot \text{Spline 2} \\ & + \sum_{i=1}^{15} \beta_{t+18} \cdot \text{Financing}_i + \sum_{j=1} \beta_{j+33} \cdot \text{Zip-quarter}_j + \varepsilon. \end{aligned} \quad (2)$$

Spline 1 is the same as the Trend variable, measuring years relative to development completion for observations inside the radius, {-20,-19,…,+8}, although not interacted with the After variable. Spline 1 measures the overall trend, or change in prices, within the radius relative to the remaining zip code – this measure is naïve with regard to development effects. Spline 2 is the same as the Trend variable, but interacted with an indicator variable for transactions that occur within five years prior to completion and beyond. Thus, Spline 2 introduces a knot-point in the trend line at -5 years relative to completion, and the Trend*After interaction term introduces a third knot-point at year +1 following completion. The coefficient on Spline 2 reveals whether the overall trend has changed recently in the pre-development period. The coefficient on the Trend*After interaction term is then measured relative the counterfactual trend implied by Spline 2. The spline regression approach, zip-quarter fixed effects, and exclusion of all remaining

market data that is not in the same zip code is consistent with the methodology applied by Ellen, Schill, Susin and Schwartz (2001), who evaluate development impacts of subsidized owner-occupied housing in New York City. The empirical results for the .5, .75 and 1 mile radii for industrial, office and retail property types are discussed in the next section.

Discussion of Results

Table 2 presents results from estimation of the base model, considering the relative impact on residential transactions within a .75 mile radius of new industrial, office, and retail developments in three separate estimations. The estimation is a fixed effects model, controlling for differences across Atlanta submarkets (defined by zip code) at the quarterly frequency. The estimated coefficient for Age is negative and significant; property values depreciate with age. Property values are generally increasing in the number of bedrooms, bathrooms and half-baths. The bedroom and bathroom coefficients are relatively large because they serve as proxies for the property size, since square footage is unavailable in the Georgia MLS data. Other studies tend to report lower estimated coefficients after controlling for property size. For conciseness, the estimated fixed-effect coefficients for Financing type and Zip-quarter indicator variables are unreported.

For new industrial developments, there were 4,272 transaction observations within a .75 mile radius over the sample period with at least one comparable observation that occurred outside the .75-mile radius, yet in the same zip code and calendar quarter. The 4,272 Close transactions along with the 34,191 observations of comparable

transactions appear in 1,350 distinct zip code-quarters. The coefficient for Close is estimated to be -0.01 and significant at the 10 percent level. Properties inside the .75 mile radius sell at a discount of 1 percent over the sample period, independent of the new development. This result suggests that neighborhood characteristics may vary to a limited extent for areas targeted for new industrial development. The coefficient for the Close*After interaction term is estimated at -0.044, and the coefficient for the Close*After*Trend variable is estimated to be -0.007. Following completion of a new industrial development, residential properties in the .75 mile radius are discounted an additional 4.4 percent relative to comparable properties outside the radius but inside the same zip code, and the discount widens by 0.7 percent per year following completion. This interpretation relies on the assumption that the basis difference in valuation for property values within the radius is constant and does not change over time – an assumption that is found to be inappropriate (discussed in results for Table 3).

For new office development, the estimated effect is zero. The 7,520 residential transactions that occur within the .75 mile radius of new office development are not sold at a significantly different price relative to the 51,505 transactions of comparable properties that are sold in the zip code and quarter, but located outside the radius. There is no significant difference in prices before or after the office development is completed, and no change in the trend for residential prices within the radius relative to prices outside the radius.

New retail development generally follows residential growth, and there is a much higher concentration of single-family transactions within the .75 mile radius. Properties inside the radius are discounted 2.3 percent relative the surrounding zip code. The

discount drops sharply following the new development, estimated at a 4.5 percent reduction, but prices subsequently rise by 1.3 percent per year relative to comparables outside the radius following the completion of the new development. If prices inside the radius are discounted 2.3 percent with no development, prices are discounted 5.5 percent in the year following development completion, 4.2 percent two years after, 2.9 percent after three years, and 1.6 percent after four years. Thus, the completion of new retail development has a negative impact in the immediate-term that is subsequently offset over a relatively short horizon. By the fourth year following completion of a new retail development, prices inside the radius are higher relative to outside the radius than they were pre-development and steadily increasing.

Table 3 presents a more complete evaluation of development effects. Recall the finding of negative post-development effects for the .75 mile radius following industrial completions. However, when the spline variables are included in the estimation, the coefficients for Close*After and Close*After*Trend are no longer significant, while the estimated coefficient for Spline 2 is negative and significant. This suggests that property values within the .75 mile radius had already begun to decline at a rate of 1.3 percent per year, and that the timing of the new industrial completion had no significant impact on this pace of decline. The same result obtains for the new industrial developments at the 1 mile radius.

Figure 4, Panel A illustrates the pattern for property values inside the .75 mile radius relative to a new industrial completion. During years -20 to -6 relative to the project completion, values within the radius experience a trivial (and insignificant from zero) decline relative to values outside the radius. Five years prior to the new industrial

development, there is a significant change in the trend with values inside the radius being temporarily 4 percent higher, but falling at a rate of 1.3 percent per year. The dashed line depicts the counterfactual projection for what would have occurred following this new trend. The actual change in trend following new industrial development is insignificant from the existing trend. That is, while property values are found to have declined following a new industrial completion, the direction and magnitude of the decline are consistent with what would have been expected for the area had no development activity occurred.

Results for new office development are also provided in Table 3. Inclusion of the spline variables reveals that property values inside the .75 mile radius for new office development are relatively higher valued than their outside radius counterparts, estimated at a location premium of 2.1 percent for the Close variable. During the five-year pre-development horizon, a positive trend appears within the radius with values appreciating 0.8 percent per year. In the period following the office development completion, the price appreciation trend reverts to zero (estimated coefficient of -0.008 for Close*After*Trend effectively cancels out coefficient of equal and opposite magnitude for Spline 2). This result is illustrated in Figure 4, Panel B. Sites selected for new office development are located in relatively higher priced residential neighborhood which had begun to experience an upward trend in prices. While prices inside the radius remain relatively higher in the post-development period, they are neither significantly different from pre-development values, nor appreciating at a rate that is significantly different from zero.

Findings for the impact of new retail development are largely unaffected by the addition of the spline variables, as shown in Table 3. New retail development occurs in

neighborhoods with significantly lower property values, estimated at 2.8 percent below comparable properties for the .75 mile radius. Following the completion of a new development, the initial impact is negative 2.5 percent (net of coefficients for Close*After and Close*After*Trend), followed by positive annual price appreciation at a rate of 1.5 percent. Figure 4, Panel C illustrates the impact of retail development on surrounding residential property values for the .75 mile radius. Properties close to the development site are discounted relative to similar properties that are outside the radius. Following completion of a new retail development, the basis drops but price appreciation adjusts sharply upward. The initial negative price impact following completion of a new retail development is more than offset by positive gains after a few years. Over a longer horizon, residential properties in the area targeted for new retail development ultimately sell at a significant premium to those located outside the radius.

In Table 3, the sensitivity of the results with respect to the choice of radius is provided. Choosing a narrowly-specified radius (such as .5 mile) establishes a more direct connection between the new commercial development and immediately surrounding property values, but the empirical test has less power since there are fewer transactions in a given period for the smaller radius. Table 3 illustrates this tradeoff. The volume of transactions in the 1 mile radius is considerably higher than the transaction volume in the .5 mile radius, leading to more accurate parameter estimates. However, observations that are 1 mile away from the new development are less likely to be as directly affected by the completion as observations that are within the .5 mile radius.

Comparing results across the select radii for industrial, the Spline 2 and Close coefficients are negative and increase in magnitude with proximity to the development

site. At the .5 mile radius, property values are lower by 5 percent, compared to 3.5 percent for the .75 mile radius and 2.5 percent for the 1 mile radius. The downward trend that begins in the predevelopment period is most acute for properties closest to the development site. Five years before development completion, property values begin to decline by 1.9 percent per year in the .5 mile radius, 1.3 percent in the .75 mile radius, and 0.5 percent in the 1 mile radius. These findings suggest that locally depressed and relatively declining property values are likely influence by proximity to the development site, although the impact is less likely a result of the project completion and more likely a consequence of events that occur during the predevelopment phase – such as zoning changes, project approval or entitlement (however these issues are not directly tested in this study).

Discussion of Policy Implications

The comprehensive approach adopted in this research study considers office, retail and industrial under a consistent framework and evaluates the impact of new commercial development for Atlanta, Georgia – a major U.S. metropolitan market. The results have the potential to be generalized to a broader audience, although some limiting factors should be noted. First, Georgia MLS data has some limitations including the lack of a square footage measure, which should increase the accuracy of the residential pricing estimation. Second, CoStar Market Reports provide information on select major developments, which typically includes the largest and most visible projects. However, there may be confounding factors that bias the results, including the presence of unobserved new developments or other unobservable factors. Third, this study makes use

of a matched sampling methodology which does not include the maximum data available, although alternative methods may be considered such as analysis of the full sample. Matched samples increase the precision of the comparison between subject and control group observations at the expense of lower statistical power (due to fewer observations). The results are noticeably sensitive with respect to choice of radius and matching criteria. Fourth, this study considers the Atlanta metro area, which is characterized by relatively loose permitting and entitlement. In unrestrictive markets, development impact fees may be insufficient to offset the actual impact from a community stakeholder perspective. Future research may consider more restrictive markets and compare the long-horizon impacts. Finally, the nature of the research question attempts to relate the occurrence of new commercial developments to changes in surrounding residential property values, although the connection between the two series may be indirect at best due to the time required for development externalities to be fully incorporated in housing values. Over a long horizon many factors can enter the picture which will affect property values, including changes in market conditions. In addition, the association becomes increasingly indirect as the distance between the residential observation and the development site increases. Notably, much of the commercial development activity occurred pre-2008, just before the Atlanta housing market experienced a significant downturn. Even though the empirical analysis attempts to account for these changes, post-development horizons are heavily comprised of observations from depressed market conditions.

This study applies a novel methodology for evaluating the impact of commercial development on surrounding residential property values, and this approach may serve as a foundation for future studies that investigate issues related to commercial development

externalities. It is possible that the findings are referenced in ongoing media discussion and policy debates at jurisdictional permitting and entitlement hearings as evidence in favor of or against new development proposals. From a legal standpoint, communities often seek development impact fees which invoke rational nexus and rough proportionality yardsticks. *Ex ante*, it can be very difficult to predict the actual impact that a singular new commercial development will cause. *Ex post*, industrial developments coincide with a preexisting downward trend in local housing values, yet the completion of an industrial development does not have a significant impact on the trend (at the .75 mile radius). Residential property values near office development sites experience an effect that essentially nets to zero upon completion. Retail developments, by comparison, have a positive and significant impact that differs from the existing trend – albeit over a longer horizon.

Perhaps most surprising is the lack of evidence for negative and significant impacts of commercial real estate development on residential property values. Volumes of political arguments to the contrary are voiced at local planning debates across the nation, yet this study does not provide substantive evidence of a negative interaction.

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Tables & Figures for Empirical Results

Table 1. Sample of Single-family Residential Transactions

	Close to Industrial			**Close to Office**			**Close to Retail**			**Full**
Radius	*.5 mile*	*.75 mile*	*1 mile*	*.5 mile*	*.75 mile*	*1 mile*	*.5 mile*	*.75 mile*	*1 mile*	**Sample**
Observations	1,880	4,272	6,220	4,324	7,520	10,438	9,993	15,335	15,287	664,556
Variable	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Close	1	1	1	1	1	1	1	1	1	
Sale Price	$133,975	$129,485	$132,969	$222,778	$207,350	$188,234	$163,976	$161,183	$159,523	$202,014
Age	17.931	17.901	18.310	23.350	21.058	18.836	20.823	19.527	17.788	27.164
1 bedroom	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
2 bedrooms	0.029	0.040	0.032	0.044	0.035	0.025	0.031	0.023	0.023	0.031
4 bedrooms	0.260	0.257	0.265	0.306	0.308	0.329	0.275	0.300	0.306	0.348
>4 bedrooms	0.054	0.042	0.038	0.105	0.094	0.086	0.061	0.062	0.064	0.149
1 bathroom	0.118	0.147	0.126	0.089	0.074	0.067	0.113	0.114	0.105	0.059
3 bathrooms	0.122	0.108	0.102	0.202	0.177	0.163	0.137	0.149	0.149	0.210
4 bathrooms	0.018	0.008	0.005	0.062	0.051	0.038	0.026	0.022	0.025	0.063
>4 bathrooms	0.001	0.000	0.000	0.012	0.009	0.008	0.006	0.004	0.005	0.021
1 half-bath	0.420	0.426	0.418	0.437	0.458	0.475	0.384	0.404	0.408	0.434
2 half-baths	0.003	0.003	0.003	0.009	0.010	0.011	0.006	0.007	0.008	0.012
>2 half-baths	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.001
Matched samples										
	.5 mile	*.75 mile*	*1 mile*	*.5 mile*	*.5 mile*	*1 mile*	*.5 mile*	*.75 mile*	*1 mile*	
Observations	16,282	34,191	52,935	29,840	51,505	82,457	89,918	122,661	112,041	
Variable	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	
Close	0	0	0	0	0	0	0	0	0	
Sale Price	$140,456	$139,831	$141,037	$184,627	$174,039	$164,181	$152,740	$153,036	$151,758	

Notes: Table 1 presents summary statistics for the full sample of single-family residential transactions, along with the subsamples that are located in close proximity to new industrial, office and retail developments based on .5, .75 and 1 mile radii from the development site. Commercial developments are identified using the CoStar Property database for the period 2006-2014. During this period, there were 193 new industrial developments, 273 new office developments, and 467 new retail developments identified for the Atlanta (GA) metropolitan area. Residential transaction data are for the period 1985Q4-2014Q4 from the GA MLS database. Geographic distance is calculated in nautical miles based on longitude-latitude coordinates of the new commercial development and each residential transaction. The Observations row reports the number of residential transactions in the full sample and respective subsamples. The bottom panel reports the mean Sale Price and number of Observations for the matched samples of transactions that occur in the same calendar quarter and zip code as an observations located inside the specified radius, and have the same number of bedrooms, same number of bathrooms and were constructed within five years of the property that is inside the radius.

Variable definitions: Close is an indicator variable for observations that are located within the respective .5, .75 or 1 mile radius of a commercial development site, taking on a value of one for location inside the radius and zero otherwise. Sale Price is the transaction price paid at closing (in USD). Age measures the difference between the sale year and the year the residential single-family home was constructed. The 1, 2, 3, 4 and >4 bedroom [bathroom] variables are indicators for the number of bedrooms, taking on a value of one of the transaction was for a home that included a number of bedrooms [bathrooms] matching that category, and zero otherwise. Similarly, 0, 1, 2, and >2 half-bath variables are indicators for the number of half-bathrooms. Transactions reporting zero bedrooms or zero bathrooms are not considered in this sample.

Table 2. Base Model

Radius: .75 mile	**Industrial**		**Office**		**Retail**	
Variable	Coefficient	(*t*-stat)	Coefficient	(*t*-stat)	Coefficient	(*t*-stat)
Constant	12.217***	(60.7)	11.481***	(65.6)	11.252***	(59.4)
log(Age)	-0.133***	(-37.2)	-0.145***	(-46.8)	-0.143***	(-81.5)
1 bedroom			-0.276	(-1.1)	-0.258	(-1.3)
2 bedrooms	-0.071***	(-3.8)	-0.029	(-1.6)	-0.120***	(-10.3)
4 bedrooms	0.124***	(25.1)	0.116***	(26.9)	0.127***	(51.5)
>4 bedrooms	0.179***	(12.3)	0.173***	(17.7)	0.176***	(27.7)
1 bathroom	-0.258***	(-26.7)	-0.393***	(-33.4)	-0.313***	(-58.2)
3 bathrooms	0.249***	(30.0)	0.273***	(46.0)	0.252***	(70.9)
4 bathrooms	0.568***	(19.4)	0.623***	(49.7)	0.600***	(58.1)
>4 bathrooms	0.839***	(6.0)	0.792***	(23.8)	0.803***	(29.8)
1 half-bath	0.161***	(47.3)	0.187***	(63.9)	0.200***	(113.8)
2 half-baths	0.212***	(8.4)	0.367***	(24.2)	0.345***	(35.8)
>2 half-baths	-0.017	(-0.2)	0.292***	(4.0)	0.439***	(11.7)
Close	-0.010*	(-1.9)	0.007	(1.5)	-0.023***	(-8.6)
Close*After	-0.044**	(-2.4)	0.020	(1.3)	-0.045***	(-4.4)
Close*After*Trend	-0.007*	(-1.7)	0.000	(0.0)	0.013***	(6.0)
Financing indicators:	Included [15]		Included [15]		Included [15]	
Zip-quarter indicators:	Included [1350]		Included [2217]		Included [2834]	
R^2	76.9%		74.0%		75.5%	
Observations	38,463		59,025		137,996	

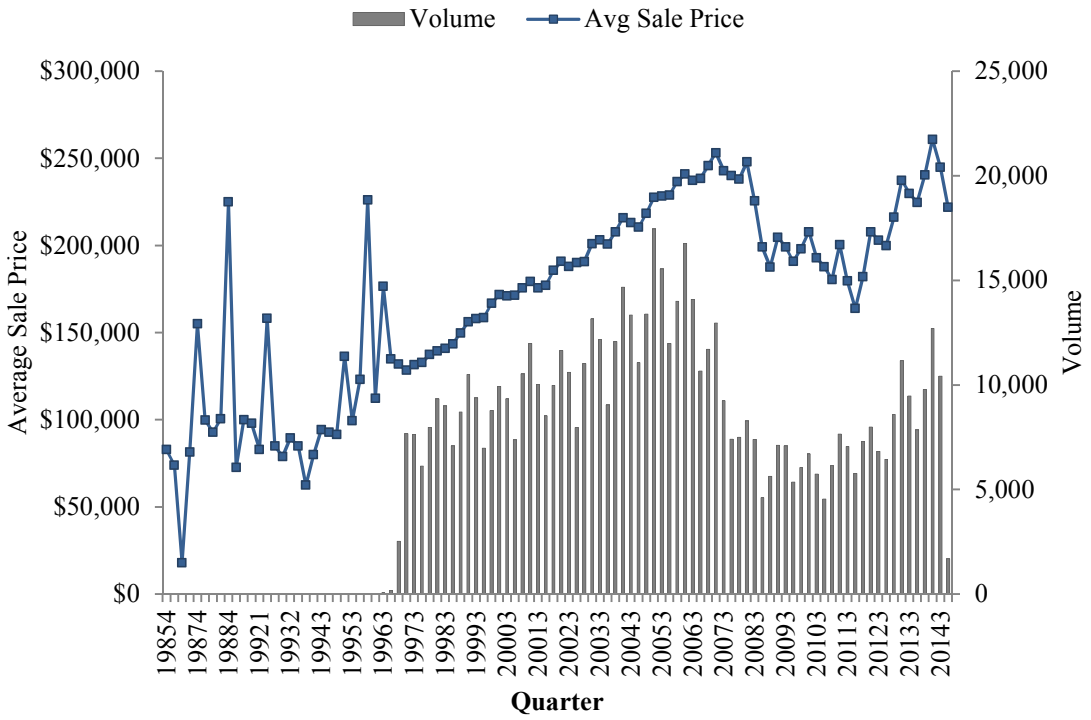
Notes: This table presents the results from three least squares estimations of Equation (1). The dependent variable is Sale Price, logged, which is the transaction price for each residential property in the sample. Close is an indicator variable for residential transactions that occur within the specified radius (.75 miles) of any new commercial real estate development during the sample period. Results for industrial, office and retail developments are presented in separate estimations, including the estimated Coefficient and corresponding *t*-statistic (*t*-stat) in parentheses. The interaction term Close*After is an indicator variable for residential transaction that occur within the specified radius and after the development project is completed. The interaction term Close*After*Trend takes on positive values counting the year since project completion for observations inside the radius that occur in the post-completion period, and values of zero otherwise. The estimations also include 15 indicator variables for transaction-specific financing conditions, as well as zip code-calendar quarter fixed effect indicators controlling for (unreported) geographic time-varying differences of the housing market. All other variables are defined in the notes to Table 1. The following variables are suppressed to prevent a linear combination: 3 bedrooms, 2 bathrooms, and 0 half-bath. ***, **, and * indicate statistical significance of estimated coefficients at the 1%, 5% and 10% levels of confidence respectively.

Table 3. Results by Distance, Spline Regressions

Radius:	***.5 mile***		***.75 mile***		***1 mile***	
Equation:	(1)	(2)	(1)	(2)	(1)	(2)
Panel A. Industrial	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Close	-0.015 **	-0.050 ***	-0.010 *	-0.035 ***	-0.006	-0.025 ***
Close*After	-0.117 ***	-0.082 ***	-0.044 **	-0.017	-0.017	0.002
Close*After*Trend	0.005	0.024 ***	-0.007 *	0.006	-0.007 **	-0.002
Spline1		-0.003		-0.002		-0.003 ***
Spline2		-0.019 ***		-0.013 ***		-0.005 *
R^2	79.0%	79.0%	76.9%	76.9%	72.0%	72.0%
Observations	18,162		38,463		59,155	
Panel B. Office	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Close	0.003	-0.009	0.007	0.021 **	0.000	0.007
Close*After	0.019	0.031	0.020	0.005	0.015	0.007
Close*After*Trend	-0.003	-0.005	0.000	-0.008 *	-0.002	-0.008 **
Spline1		-0.005 ***		0.001		-0.001
Spline2		0.002		0.008 **		0.006 **
R^2	74.8%	74.8%	74.0%	74.0%	75.7%	75.7%
Observations	34,164		59,025		92,895	
Panel C. Retail	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Close	-0.021 ***	-0.030 ***	-0.023 ***	-0.028 ***	-0.031 ***	-0.048 ***
Close*After	-0.043 ***	-0.034 **	-0.045 ***	-0.040 ***	-0.035 ***	-0.019 *
Close*After*Trend	0.013 ***	0.017 ***	0.013 ***	0.015 ***	0.013 ***	0.019 ***
Spline1		-0.001		-0.001		-0.002 ***
Spline2		-0.004		-0.001		-0.006 ***
R^2	74.5%	74.5%	75.5%	75.5%	76.8%	76.8%
Observations	99,911		137,996		127,328	

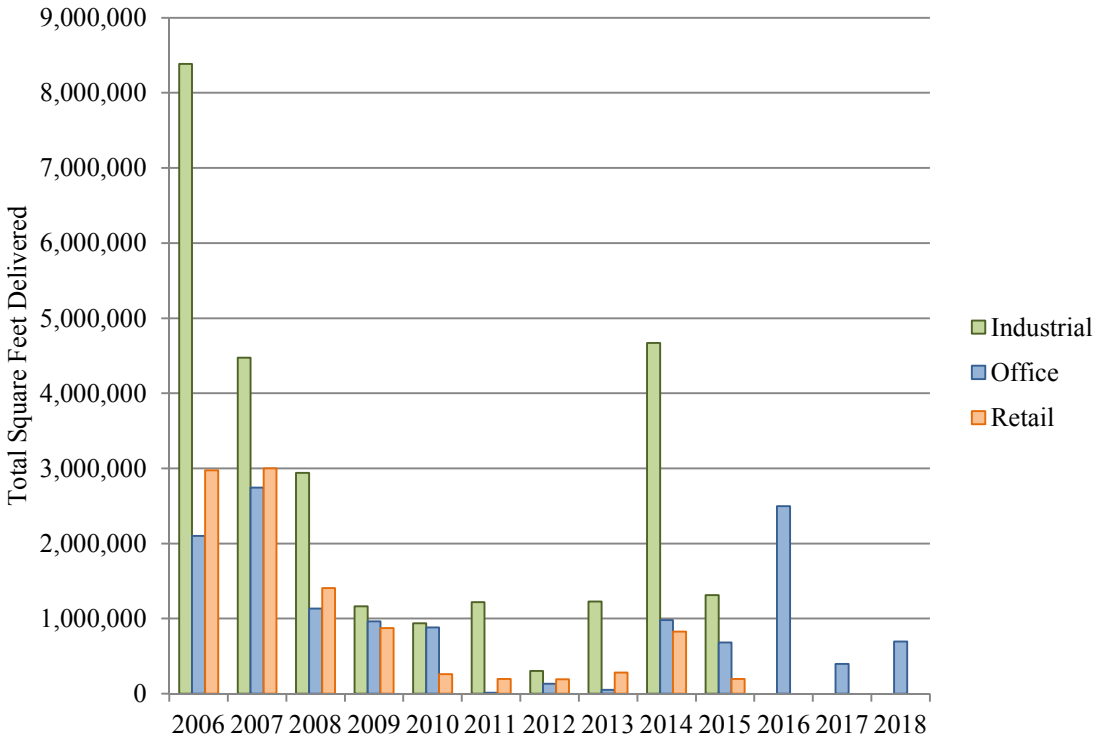
Notes: This table presents the results from the least squares estimations of Equations (1) and (2). The dependent variable is Sale Price, logged, which is the transaction price for each residential property in the sample. D_Close is an indicator variable for residential transactions that occur within the specified radius (.75 miles) of any new commercial real estate development during the sample period. Results for industrial, office and retail developments are presented in separate estimations, including the estimated Coefficient and corresponding *t*-statistic (*t*-stat) in parentheses. The interaction term Close*After is an indicator variable for residential transaction that occur within the specified radius and after the development project is completed. The interaction term Close*After*Trend takes on positive values counting the year since project completion for observations inside the radius that occur in the post-completion period, and values of zero otherwise. Spline 1 measures the year relative to development completion over the full horizon (i.e., beginning with year -20 thru year +8) for all observations inside the radius, while Spline 2 measures year relative to completion beginning in year -5, and takes on a value of zero for earlier years and for observations outside the radius. The estimations also include 15 indicator variables for transaction-specific financing conditions, as well as zip code-calendar quarter fixed effect indicator variables controlling for (unreported) geographic time-varying differences of the housing market. All other variables are defined in the notes to Table 1. The following variables are suppressed to prevent a linear combination: 3 bedrooms, 2 bathrooms, and 0 half-bath. ***, **, and * indicate statistical significance of estimated coefficients at the 1%, 5% and 10% levels of confidence respectively.

Figure 1. Atlanta Home Prices & Transaction Volume, 1985Q4-2014Q4



Notes: Figure 1 illustrates the average single-family residential transaction prices per quarter in the sample, during the period 1985Q4 to 2014Q4, using the blue line and corresponding to values on the left axis. Over the same period, the time-series distribution of residential transaction volume is depicted quarterly by the black bars, corresponding to values on the right axis.

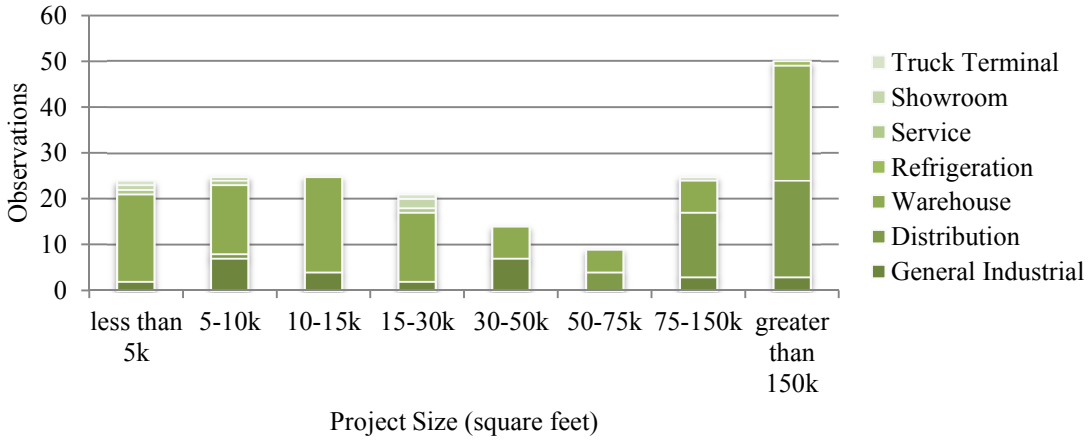
Figure 2. Commercial Real Estate Developments, 2006-2018



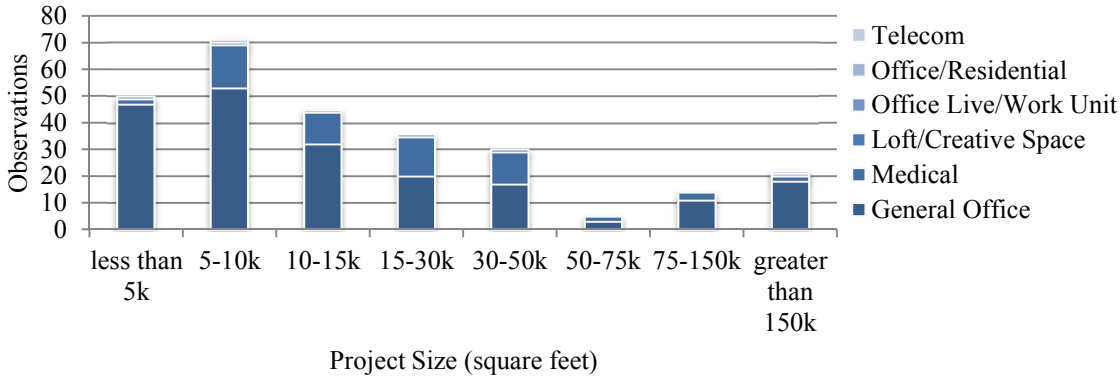
Notes: Figure 2 illustrates the time-series distribution of total square footage of new commercial real estate projects delivered annually, by property type, over the period 2006 to 2018 (using expected values for the period 2014 thru 2018). Industrial space delivered is represented by the green bars, office space by the blue bars, and retail by the orange bars.

Figure 3. Sample of Commercial Developments, by Property Size & Category

A. Sample of Industrial Developments



B. Sample of Office Developments



C. Sample of Retail Developments

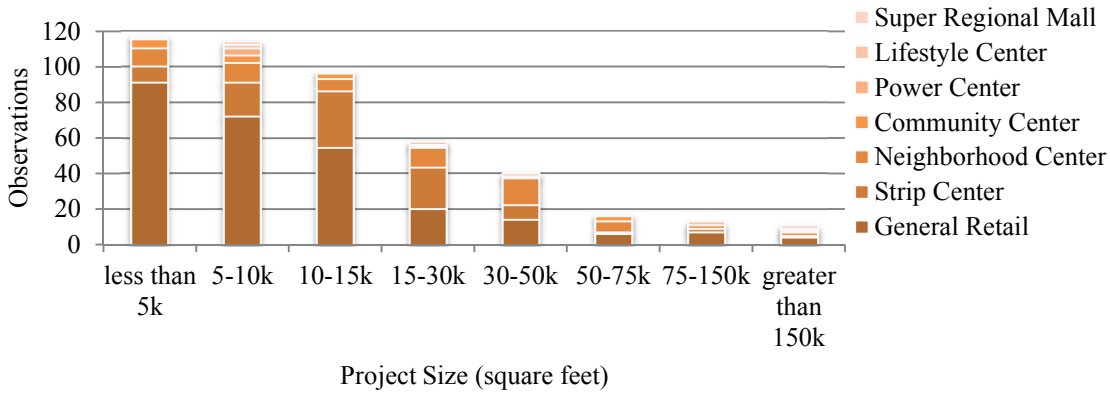
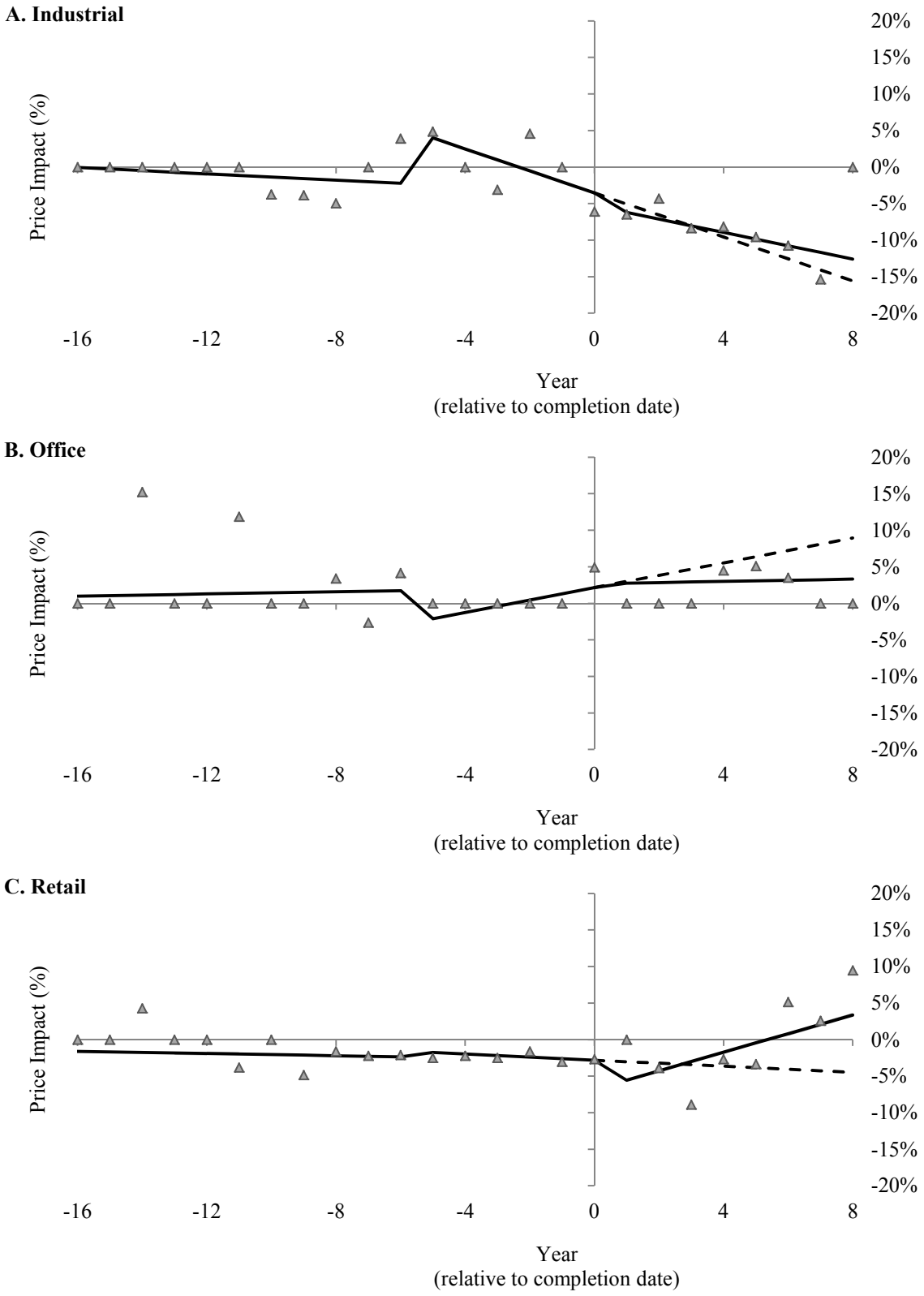


Figure 4. Estimated Price Impact following New Commercial Development



Notes: This figure presents the estimated price impact for single-family residential properties located within a .75 mile radius of a new industrial development (Panel A), office development (Panel B), and retail development (Panel C). Price impact is measured relative to a matched sample of single-family residential properties that have the same number of bedrooms, the same number of bathrooms, are built within 5 years, located in the same zip code (but outside the radius) and sold in the same calendar quarter of at least one subject property inside the radius. The grey triangles represent the estimated coefficients for each relative year interaction term for properties located inside the radius. Grey triangles take on a value of zero for coefficients that are statistically insignificant from zero at the 10% level. The solid black line depicts the trend from the spline regression with breakpoints at the -5 and +1 years relative to project completion. The dashed black line represents the counterfactual trend that would have been expected to occur for the .75 mile radius had the development not occurred.