WHEN WALMART COMES TO TOWN:
ALWAYS LOW HOUSING PRICES? ALWAYS?

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ABSTRACT

Walmart often faces strong local opposition when trying to build a new store. Opponents often claim
that Walmart lowers nearby housing prices. In this study we use over one million housing transactions
located near 159 Walmarts that opened between 2000 and 2006 to test if the opening of a Walmart
does indeed lower housing prices. Using a difference-in-differences specification, our estimates suggest
that a new Walmart store actually increases housing prices by between 2 and 3 percent for houses
located within 0.5 miles of the store and by 1 to 2 percent for houses located between 0.5 and 1 mile.

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1.   Introduction

One of the most significant changes over the past two decades in the U.S. retail market is the expansion of large box stores and supercenters. Walmart is the largest of these rapidly growing retailers and is currently the biggest private employer in the world. In the United States alone, Walmart currently operates more than 4,400 retail facilities and employs almost 1.4 million people.[1] Phone surveys suggest that 84% of households in the U.S. shop at Walmart in a given year with 42% of households reporting to be regular Walmart shoppers (Pew Research Center, 2005). These surveys also show that lower-income households are more likely to shop at Walmart than upper-income households. In fact, Basker, (2005b), Hausman and Leibtag (2007), and Basker and Noel (2009) have shown that Walmart "Supercenters" that sell groceries offer many identical food items as other grocers at an average price that is substantially lower than their competitors. Hausman and Leibtag (2007) also find that these lower prices translate into a significant increase in consumer surplus.

Despite the consumer benefits from the expansion of supercenters into new geographic markets, there is often significant opposition and controversy when Walmart tries to open a new store. One concern of opponents is the impact that a new Walmart will have on local employment opportunities and wages. There is a small literature that has analyzed this common concern including Basker (2005a), Hicks (2007a) and Neumark et al. (2008). The findings of these studies have been mixed with Basker (2005a) and Hicks (2007a) finding positive effects on employment and/or wages, while

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[1] These numbers were taken from the August 2011 fact sheet provided on the Walmart website and can be found at http://walmartstores.com/pressroom/factsheets/

Neumark et al. (2008) found negative effects.[2] Another primary concern of opponents to

a new Walmart, is the effect it will have on crime, traffic and congestion, noise and light

pollution, the visual aesthetics of the local area, and ultimately the impact that these

externalities will have on local housing prices.[3] However, unlike the academic literature

that surrounds the labor-market effects of Walmart, there has been no peer-reviewed

work that attempts to understand the impact of Walmart on housing prices.[4]

In this paper we try to understand if building a new Walmart has a positive or

negative effect on nearby housing prices. Answering this question is important as citizens

and local governments grapple with the economic impacts of allowing Walmart to build a

new store in their jurisdiction. Analyzing housing prices is a particularly useful way to

understand the economic value of a Walmart entering a community. For example, when a

Walmart is built, it generally is not built in isolation. The Walmart store often acts as a

hub that attracts a variety of other businesses, which in turn, can also have impacts on

housing markets. If households value convenient access to the goods and services that

Walmart and these other businesses provide, then the new stores would have a positive

impact on housing prices. However, if Walmart and the businesses that agglomerate

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[2] The different findings in these studies depend primarily on the identification strategy employed to account for the potential endogeneity of the location and timing of Wal-Mart openings. See Basker (2007) and Neumark et al. (2008) for a discussion of these differences.

[3] An example of these concerns can be seen in a document created by the non-profit community organization called "Responsible Growth for Northcross." This group was formed to oppose a Walmart supercenter being built near the Northcross mall in Austin, Texas. They made a top 10 list for why Walmart shouldn't be built in their town. Number two on their list was that "Wal-Marts Lower Prices. Including your property value." The full list can be found at
http://corpethics.org/downloads/northcross_no_walmart.pdf

[4] There is a paper on the impact of Walmart on annual property tax collections and commercial properties by Hicks (2007b) and a working paper by Vandegrift, Loyer, and Kababik (2011). There is also a small but growing literature on the impact of Walmart on a variety of other outcomes outside of labor and housing markets. These include poverty rates (Goetz and Swaminathan, 2006), small business activity (Sobel and Dean, 2008), obesity (Courtemanche and Carden, 2011), social capital (Goetz and Rupasingha, 2006; Carden et al., 2009a), leisure activities (Carden and Courtemanche, 2009) and traditional values (Carden et al., 2009b).

nearby also impose negative externalities such as increased pollution, crime, and traffic, then this could adversely impact prices of nearby houses. Thus the housing price effect *a priori* is ambiguous. Accurately estimating the housing price changes that result from the building and opening of a Walmart and the agglomeration it spurs may help local policymakers to better understand if the net effect of a new Walmart is perceived as beneficial to nearby households. This could in turn provide some economic justification for a local government to encourage or discourage the building of a Walmart store in its jurisdiction.

Our analysis of the impact that Walmart has on housing prices utilizes two unique datasets. The first dataset describes when and where Walmarts opened between 2000 and 2006. The second dataset includes data for more than one million residential housing transactions that occurred within four miles of 159 Walmarts that opened during this time period. In contrast to the county-level analyses conducted by most previous work on the impacts of Walmart, the micro-level nature of our dataset allows us to develop an identification strategy that can help us to overcome the potential endogeneity of the location and timing of Walmart openings. More specifically, we employ a difference-in-differences analysis that compares housing prices before and after a Walmart opens for areas very close to a newly built Walmart, to areas slightly farther away.

The results from this analysis suggest that a new Walmart store increases nearby housing prices. Our primary analysis suggests that houses located within 0.5 miles of the store see increases in their prices of about 2-3 percent when comparing the two and a half years before the Walmart opened to the two and a half years after the opening. Houses between 0.5 and 1 mile from the Walmart see an increase of 1-2 percent. It does not

appear that these price impacts are caused by an abrupt increase in the number of houses that sold in the area or by a change in the composition of houses that sold. Furthermore, graphical evidence and falsification tests provide no evidence of a spurious, positive effect due to differential housing price growth at the Walmart location and are therefore supportive of a causal interpretation of our difference-in-differences estimates of the impact of Walmart on housing prices.

The paper proceeds as follows. In section 2 we discuss the potential impacts of Walmart in terms of the value of accessibility and the costs of negative externalities. We proceed in section 3 to describe the key datasets used in our analysis. In section 4, we describe our empirical strategy for estimating the impact of Walmart on housing prices and in section 5, we present the results. Finally, we conclude in section 6.

2.   Accessibility and Externality Effects of Walmart

Walmart likely affects housing prices through two main channels—accessibility and negative externalities. Many studies at the intersection of economics and geography have shown that land and housing prices vary with accessibility to "business districts" that provide shopping and employment. For example, the American Housing Survey (AHS), which is constructed by the U.S. Census Bureau and is based on household surveys that are aimed at better understanding the determinants of housing values throughout the United States, specifically asks households if there is "satisfactory shopping within 1 mile." Using this data, Emrath (2002) provided evidence that having satisfactory shopping within one mile increased housing prices substantially inside metro areas. Others, including Sirpal (1994) and Des Rosiers et al. (1995), have also found a

positive correlation between shopping centers and housing prices. These studies suggest that having convenient access to a Walmart might increase housing prices.

On the other hand, the introduction of a Walmart store in a community also has the potential to lower housing prices through increased local crime, noise and light pollution, traffic congestion, garbage accumulation, and loss of perceived visual aesthetics. Several studies have shown that these disamenities are capitalized into housing prices. For example, Linden and Rockoff (2008) and Pope (2008) have both recently shown that a discrete change in the risk of a localized crime can have a causal impact on housing prices, Smith et al. (2002) showed that freeway noise can have a negative impact on housing prices, and Lim and Missios (1995) showed the negative impact of landfills on housing prices.

An important question that has not been addressed in the literature is whether or not the benefits of access to a Walmart outweigh the costs imposed by any negative externalities that it imposes on the local community when it builds a store. Analyzing housing prices before and after a Walmart is built in a given locale offers the potential to test whether or not the benefits of accessibility outweigh the costs of negative externalities. If one were to see a decrease in housing prices near a Walmart store after it was built, this might signal that there are significant negative externalities imposed on landowners and households nearby Walmart. However, if one were to see an *increase* in housing prices, this might suggest that the benefits of easy access to Walmart's lower prices or the other shopping that naturally agglomerates near a Walmart outweigh any negative externalities imposed on local residents.

There is some evidence that the value of accessibility declines less rapidly across space than the costs of localized externalities. Li and Brown (1980) provide empirical evidence to suggest that although proximity to industry and commercial areas impose negative externalities on nearby houses, this same proximity creates substantial benefits to households far enough away to avoid the sphere of influence from the negative externalities. In the next sections we examine the impact of building Walmart stores on surrounding housing prices to test whether the benefits of accessibility to Walmart outweigh the costs of negative externalities that Walmart may impose.

3.   Data

The analysis relies on two key datasets. The first is data on Walmart stores that opened over the relevant time frame of our study. The second is data on single family residential properties in areas where the Walmart stores opened. In this section we describe each source of data in preparation for our empirical analysis.

3.1 Walmart Data

The Walmart data includes the address and opening dates of regular Walmart stores and Walmart supercenters in the United States.[5] The original data contain the full universe of Walmart stores that were built between 1962 and Jan. 31, 2006. However, because of housing data constraints, we focus on 159 stores that were built between July 2000 and January 31, 2006 for which we have corresponding housing data. Table 1

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[5] The data was generously provided to us by Thomas J. Holmes of the University of Minnesota and was used in his paper, Holmes (2011). The data and additional information on how the data were collected can be found at Professor Holmes' website at: http://www.econ.umn.edu/~holmes/research.html

provides summary statistics for this dataset over time and space. Panel A shows the years in which the 159 Walmarts in our primary sample were built. It may seem curious that there were 9 stores built in 2006 when our dataset ends January 31, 2006. However, Panel B of Table 1 shows that January is the most common month for Walmarts to open. This is because January 31st is considered the end of Walmart's fiscal year and so it appears there is a push to open new Walmarts before this date. Panel C shows the twenty U.S. states in our primary sample in which Walmarts were built.

We also collected some additional information on when it was announced that these Walmarts were to be built. This information was collected using the internet to find newspaper articles or other online sources that indicated the timing of when the building of a particular Walmart was announced to the community. After collecting these dates, we found that the median number of days from when the Walmart store was announced until its construction was completed and the Walmart store was open for business was 516 days. This information is useful in our analysis to help determine the appropriate size of the temporal window in which to analyze the housing price effects from a Walmart opening. The announcement information is also useful for explicitly estimating if there are price effects from the announcement itself.

3.2 Housing Price Data

Our analysis is based on a large housing dataset of more than one million observations on the sales of single-family residential properties across the United States between January 1, 1998 and January 31, 2008. We purchased the data from a commercial vendor who had assembled them from assessor's offices in individual towns

and counties.[6] The data include the transaction price of each house, the sale date, and a consistent set of structural characteristics, including square feet of living area, number of bathrooms, number of bedrooms, year built, and lot size. Using these characteristics, we performed some standard cleaning of the data, removing outlying observations, removing houses built prior to 1900, and removing houses built on lots larger than 5 acres.

The data also include the physical address of each house, which we translated into latitude and longitude coordinates using GIS street maps and a geocoding routine. The lat-long coordinates were then used to determine the distance of each house to the nearest Walmart location. In our primary analysis we restrict the data to include only those houses that are within four miles of a Walmart and that sold in the two and a half years before the nearest Walmart opened or in the two and a half years after it opened.[7] Table 2 provides summary statistics of our primary housing dataset. The first column reports the summary statistics for the over 600,000 housing transactions between 1998 and 2008 that will be used in our primary analysis. The average sale price, square footage, # of baths, age, lot size, and number of bedrooms in our full sample of homes was approximately 267,000 dollars, 1,767 square feet, 2 baths, 30 years old, 0.25 acres and 3 bedrooms respectively. Also, about 15% of houses in our sample of transactions were newly constructed, approximately 2% are located within 0.5 miles of where a Walmart has or will be built, 7% are located between 0.5 and 1 mile, and 25% between 1 and 2 miles.[8] The columns labeled "1 to 2 miles", "0.5 to 1 mile" and "within 0.5 mile" provide summary statistics for houses within these distances to where a Walmart has or will be built. The summary statistics indicate that, houses closer to a Walmart tend to be smaller in size, somewhat newer, and on slightly smaller lots. These small differences in housing

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[6] The commercial data vendor is Dataquick whose housing data is often used for academic research.

[7] A four mile radius was chosen *a priori* following Holmes (2011) assumption that houses within 2 miles are considered within the Walmart's "neighborhood." Houses between two and four miles were included in our sample to act as a natural control group.

[8] A house was defined as new construction if the year it sold was the same year it was reportedly built or the year after it was built.

characteristics suggest that new Walmarts were not built in random locations. The endogenous placement of Walmarts motivates the empirical strategy that we outline below.

4. Empirical Strategy

4.1 Hedonic Pricing Method

When a household chooses to purchase a house, it is choosing more than just housing characteristics; it is also choosing a bundle of locational characteristics such as school quality, levels of criminal activity, proximity to work, and access to shopping. The hedonic model was developed by Rosen (1974) to provide a theoretical foundation for the relationship between prices and attributes. For over 40 years economists have used the hedonic pricing method in conjunction with the housing market to reveal household preferences for important locational characteristics.[9]

Early work in this area typically used cross-sectional data to try and identify the implicit price of the locational attribute of focus. The primary concern with this literature has been the possibility that omitted variables lead to a bias in the estimates for key implicit prices. For example, if Walmarts tend to be built in areas where there is higher crime, then a cross-sectional estimate of the implicit price for living near a Walmart that excludes the relevant measures of crime will be biased downwards (more negative). Recognizing the importance of mitigating this type of omitted variable bias, a new wave of hedonic analyses have exploited quasi-experiments in time and/or space to better overcome omitted variable bias and identify implicit prices of interest. Examples of this

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[9] Ridker and Henning's (1967) study on the value of air quality is one of the earliest examples in this literature. See Palmquist (2005) for a more complete review of the hedonic method applied to housing markets.

new wave of quasi-experimental hedonic research include Black (1999), Figlio and Lucas (2004), Chay and Greenstone (2005), Pope (2008) and Linden and Rockoff (2008), among others.[10]

A quasi-experiment that exploits a temporal shock to better "difference" away time-invariant omitted variables is not without some costs as was recently pointed out in a paper by Kuminoff and Pope (2012). A large exogenous shock to the spatial distribution of a nonmarket good(s) may also cause the hedonic price function to adjust in order to clear the market. If this occurs, comparing implicit prices of the nonmarket good before and after the shock (the capitalization effect) may not correspond to the change in the willingness to pay for the nonmarket good (the welfare effect). Thus the quasi-experimental capitalization effects we estimate in section 5 may not have an exact welfare theoretic interpretation (though the estimates may be suggestive of the sign and magnitude). While the estimates may not be directly useful for a strict welfare-theoretic, benefit-cost analysis of the impact of the placement of a Walmart in a community, they can still be useful to homeowners, renters, assessors, appraisers, and the beneficiaries of programs funded by property tax revenue in areas where Walmarts are built, since they describe the size and sign of the capitalization effect on housing prices.

The work presented in this study builds off of this quasi-experimental literature in the construction of an identification strategy to understand the impact of Walmart openings on housing prices. However, we begin by constructing a traditional hedonic specification for the analysis. The most basic hedonic price specification that we employ takes the following cross-sectional form:

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[10] See Parmeter and Pope (2012) for a more detailed review of the quasi-experimental method applied to housing and hedonic models.

(1) $\log(P_{ijym}) = \alpha_{jym} + \gamma \mathbf{X}_i + \beta_0 D_{ij}^{0.5} + \theta_0 D_{ij}^{1} + \phi_0 D_{ij}^{2} + \varepsilon_{ijym}$

The log of the sale price of the house is a function of a store (j) by year (y) by month (m) specific effect (α_{jym}), observable individual (i) property characteristics ($\mathbf{X}_i$), indicator variables of individual houses within 0.5, 0.5 to 1, and 1 to 2 miles of a Walmart where the omitted indicator variable is an indicator for homes between 2 and 4 miles from the nearest Walmart ($D_{ij}^{0.5}; D_{ij}^{1}; D_{ij}^{2}$) and a random error term that allows for year by month by store area specific correlation in housing prices (ε_{ijym}). Absent any omitted variable bias and using only houses that sold after the nearest Walmart was built, estimation of Equation 1 will yield estimates of the key parameters ($\hat{\beta}_0; \hat{\theta}_0; \hat{\phi}_0$) that show the impact that being near a Walmart has on housing prices for homes within 0.5, 0.5 to 1, and 1 to 2 miles of a Walmart relative to homes that are 2 to 4 miles from the store.[11] This estimation strategy can be considered the "traditional" cross-sectional hedonic approach.

A traditional approach to analyzing the impact that Walmart has on housing prices may of course be plagued with omitted variable bias. Another hedonic specification that could be used to help overcome the omitted variable bias would be a spatial difference-in-differences specification of the following form:

(2)

$\log(P_{ijym}) = \alpha_{jym} + \gamma \mathbf{X}_i + \beta_0 D_{ij}^{0.5} + \theta_0 D_{ij}^{1} + \phi_0 D_{ij}^{2} + (\beta_1 D_{ij}^{0.5} + \theta_1 D_{ij}^{1} + \phi_1 D_{ij}^{2}) * Post_{iym} + \varepsilon_{ijym}$

The key difference between Equation (2) and Equation (1) is that we are exploiting the timing of the opening of the Walmart. To estimate Equation (2), housing data near a

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[11] This is of course assuming that the correct functional form is being used as well as other underlying assumptions for linear regression hold.

Walmart both before and after the opening of the Walmart store would be used. The key parameters in this specification are the estimates for the spatial indicators ($\hat{\beta}_1; \hat{\theta}_1; \hat{\phi}_1$) that have been interacted with an indicator for whether the housing transaction took place after the Walmart was opened ($Post_{iym}$). These parameters give us the local effect on the treated spatial zones.[12]

The key advantage of the difference-in-differences specification is that by including spatial fixed effects and looking at housing prices before and after the opening of Walmarts, we can difference away time-invariant omitted variables that could bias our estimates. However, we must rely on the identifying assumption that housing price trends for areas near the Walmart and those areas slightly farther away from the Walmart would have been the same had the Walmart store (and any other stores from the agglomeration effect) not been built. This assumption would be less attractive if we were using county-level averages of housing prices to make comparisons between "treated" counties and "control" counties. As discussed earlier, much of the literature on the labor market effects relied on county-level measures for their analyses. This is why, for example, Basker (2005a) and Neumark (2008) relied on instrumental variable strategies to deal with the endogeneity of Walmart location decisions. In our analysis, instead of needing housing price trends in treatment and control *counties* to be the same before and after Walmart is built, all we need is housing price trends to be the same in the *four mile zone* surrounding the Walmart. Given that the area of a circle with a radius of 4 miles is approximately 1/12th of the area of the median county in the U.S., exploiting the miro-level housing data

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[12] The estimates generated from this specification are clearly for the houses near the Walmarts in our sample and may not be externally valid, for example, in very rural areas for which we do not have housing transactions.

in this way is very attractive.[13] Furthermore, the micro-level housing data allows us to explore any change in the rate at which houses sold or a change in the composition of houses that sold after Walmart was announced or built that could affect the interpretation of our estimates. Furthermore, the micro-level housing data allows us to look at housing price trends graphically and also to conduct falsification tests by shifting the Walmart open dates forward. We explore the housing composition issue and do both of the checks on the validity of our key identifying assumption in the difference-in-differences framework in the results section.

5.   Results

5.1 Cross-Sectional Results

We first describe the results from estimating a "traditional" cross-sectional hedonic analysis following Equation (1) above. The housing data used in this regression are restricted to approximately 358,000 houses within four miles of a Walmart that sold in the two and a half years *after* the Walmart was built. The regression includes store-by-year-by-month fixed effects and the structural characteristics that were described in Table 2. The store-by-year-by-month fixed effects provide the regression with flexible control over time and space. This is important since we have pooled housing observations across the country to conduct our analysis and the fixed effects force identification to come from spatial differences within a four mile area surrounding a Walmart. The regression includes three spatial indicator variables that indicate if a house is less than 0.5 miles, 0.5

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[13] To calculate that a circle with a radius of 4 miles is 1/12th the size of the median county, note that the median county size is approximately 622 square miles and the area of a 4 mile circle is approximately 50 square miles.

to 1 mile, or 1 to 2 miles from the nearest Walmart. In the traditional hedonic framework, the coefficients on these indicators provide information about the marginal willingness to pay to live near a Walmart store.

Column (1) in Table 3 provides the coefficients and their standard errors for the three spatial indicator variables. The standard errors have been clustered at the Walmart store level. Taken literally, the coefficient on the within 0.5 mile indicator suggests that Walmarts in our sample reduce the prices of homes within 0.5 miles by approximately 2.5% (statistically significant at the 5% level) and homes between 0.5 and 1 mile by a little less than 2% (statistically significant at the 10% level). Of course the concern with interpreting these estimates as the causal impact of Walmart on nearby housing prices is that they are likely to suffer from omitted variable bias. For example, if Walmart tends to open stores in areas that are less expensive for unobserved reasons (i.e. lower quality schools, the local landfill is nearby, further away from downtown, etc.) then these unobservable disamenities could potentially bias the traditional hedonic coefficients downwards.

5.2 Difference-in-Differences Results

To help mitigate the concern of omitted variable bias in our analysis we implement difference-in-differences regressions following Equation (2). The housing data used in this regression are restricted to houses within four miles of a Walmart that sold in the two and a half years after (just like in the cross-sectional analysis), but now we also include houses that sold in the two and a half years *before* the Walmart was built. The regression again includes store-by-year-by-month fixed effects and structural

characteristics of the house that were described in Table 2. Besides the three spatial indicator variables that were included in the cross-sectional analysis, interactions of these indicators with an indicator for the house having sold after the Walmart opened are also included. The coefficients on these interaction indicators are of primary interest in the difference-in-differences analysis.

Column (2) in Table 3 provides the coefficients and their standard errors for the three spatial indicator variables and their interactions with the post-opening indicator variable. The standard errors have again been clustered at the Walmart store level. The coefficient on the "within 0.5 miles" indicator suggests that homes within a half mile of the future Walmart location sold for approximately 5% less than homes two to four miles away. However, the coefficient on "within 0.5 miles*post" suggests that homes within 0.5 miles of the constructed Walmart store actually sold for approximately 2.5% more than baseline, after the Walmart was built. In other words, while homes within 0.5 miles of the future Walmart location sold for 5% less than homes 2 to 4 miles away, they only sold for 2.5% less after the Walmart was built. Similarly homes between 0.5 and 1 mile of the future Walmart sold for approximately 3% less before the Walmart, but experienced an increase in sales prices of approximately one percentage point after the Walmart was built. Homes between 1 and 2 miles experience a small, but statistically insignificant increase in housing prices after the Walmart opening relative to the 2 to 4 mile control band.

Column (3) of Table 3 performs a heterogeneity check on our key findings in Column (2) by focusing the analysis on the 88 Walmart "supercenters" in our sample.[14].

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[14] A Walmart supercenter is typically larger than a regular Walmart store and also sells grocery items.

The magnitude of the coefficient on the indicator "within 0.5 miles*post" is approximately the same in column (2). The biggest difference is that the coefficient on "0.5 to 1 mile*post" is twice as large as before suggesting that Walmart supercenters increase housing prices by approximately 2% for homes between one half and one mile after a Walmart supercenter opens.

Our Analysis thus far has been using a window of two and a half years before and after a Walmart opens for the inclusion of housing data in the regressions. In an ideal quasi-experiment for Walmart openings, the building of a Walmart would be announced one day and then the next day it would be built and operating. With this sharp discontinuity in time, one could potentially narrow the temporal window to something less than two and a half years before and after the opening of the nearest Walmart. However, the Walmarts in our sample took approximately one and a half years on average to be built after they were publicly announced. Therefore if there is some change in housing prices due to the announcement rather than the opening, narrowing the temporal window would cause the estimates to be attenuated. On the other hand, if we allow the temporal window to be very large, then we would be forced to drop many Walmarts from our sample since we analyze only Walmarts that have enough housing data around the opening date to create a symmetric temporal window. Since we only have housing data from 1998 to 2008 available to us, requiring five years of pre-opening housing data and five years of post-opening housing data would only allow us to use Walmart's that were built in 2003. Thus two and a half years was chosen to balance the tradeoff between excluding too many Walmarts and including enough housing sales that

occurred before the announcement of the Walmart in an effort to mitigate the attenuation that may occur from the announcement effect.

Although from an experimental perspective it is nice to keep the temporal window for the inclusion of housing data symmetric around the Walmart opening date, one could potentially relax this to include Walmart stores in the analysis that have *at least* two and a half years of housing data before and after the opening, but then include housing observations that were temporally more distant than two and a half years before or after the opening. Column (4) shows the results of this difference-in-differences specification that does not exclude housing observations that are temporally more distant than two and a half years before or after the nearest Walmart's opening. The key coefficients are slightly larger with the within 0.5 mile*post coefficient suggesting an approximate 3.3 percent increase in housing prices and the 0.5 to 1 mile*post coefficient suggesting an approximate 2.3 percent increase.

One could also potentially widen or narrow the temporal window to check for robustness. Column (5) in Table 3 redoes the difference-in-differences analysis but widens the temporal window to include three years of housing data pre and post Walmart opening, while Column (6) narrows the temporal window to include only two years of housing data pre and post. The main findings are robust to these changes in the temporal window. The size of the coefficient on the "within 0.5 mile*post" indicator is slightly larger than in column (2) when the window is expanded to three years before and after, and slightly smaller when contracted to two years before and after. This is consistent with our earlier conjecture that if there is some change in housing prices due to the

announcement or construction of the Walmart prior to the opening, narrowing the temporal window would cause the estimates to be attenuated downwards.

We can also more formally analyze whether or not there is an announcement effect on housing prices by applying our difference-in-differences analysis to the announcement date rather than the opening date. This time we include the housing data covering the two and a half years before and after the Walmart is *announced*. Column (7) of Table 3 shows the results of this analysis. The coefficient on "within 0.5 miles" shows once again that homes within a half mile of the future Walmart location sold for approximately 5% less than homes two to four miles away. The interaction of the post-Walmart opening indicator for this distance suggests a 1.6% increase in housing prices although it is not statistically significant using conventional measures. The "0.5 to 1 mile*post" coefficient suggests an approximate 1.4% increase in housing prices in the year after the announcement in this spatial zone and this result is statistically significant at the 5 percent level. These results are suggestive of there being some impact even from the announcement of the Walmart.

5.3 Housing Composition Effects

One issue with how we interpret the results we have found, has to do with whether or not the types of houses that are selling after a Walmart is built (or announced) are substantially different than the types of houses that were being sold previously. If there is a large compositional difference in the types of houses that transacted before and after, then this may signal that the housing price effects we observe are being at least partially driven by supply rather than demand. To be clear, this is still an impact of the

Walmart being built (or announced), but it suggests that the estimates are not as tightly linked to household preferences and their perceptions about local externalities and the benefits of accessibility to shopping.

To explore the composition effects in this application, we ran a series of linear regressions with our key housing attributes on the left hand side and the distance to Walmart zone indicators and interactions on the right hand side. In these regressions we continued to control for store-by-year-by-month fixed effects and clustered the standard errors at the Walmart store level. Once again, the coefficients on the Walmart zone indicators interacted with the "post" time period are of primary interest as they will signal if there were substantial changes in these housing characteristics after the Walmart was built (or announced). Table 4 provides the results from these regressions. Panel A shows the results where we analyze changes in structural characteristics before and after Walmart *opened*, and Panel B shows the results where we analyze changes in structural characteristics before and after Walmart was *announced*. Of the 18 interaction coefficients that are estimated in Panel A, only one is statistically significant (at the 10% level) suggesting there was no substantial housing composition change before and after Walmart opened. Of the 18 interaction coefficients estimated in Panel B, 3 are statistically significant at the 10% level but only 1 of those is significant at the 5% level. This lone coefficient suggests that there was an approximate 5% decrease in new houses that were sold after the Walmart was announced in the 0 to 0.5 mile zone. Overall, these regressions do not seem consistent with strong housing composition effects before and after either a Walmart's opening or announcement.

Another signal of potential instability in the marketplace caused by either the opening or announcement of a Walmart would be if there was an abrupt change in the number of homes that were being sold after the opening or announcement. To explore this hypothesis we analyzed the number of houses that transacted each quarter for the 10 quarters leading up to and the 10 quarters after the Walmarts in our sample opened. Figure 1 shows this graphically for each of the 4 spatial zones in our analysis relative to the opening date and the "approximate" announcement date.[15] The natural log of the number of housing transactions by quarter is used so that each of the zones can be easily compared.[16] As can be seen in Figure 1, the log number of houses in each area is gradually increasing over the time period and there do not appear to be any dramatic percentage changes or divergences between the 4 zones, suggesting that the housing markets were relatively stable over this time period.

5.4 Graphical Analysis and Falsification Tests

A key assumption in our difference-in-differences identification strategy is that within a localized four mile zone, Walmarts were not built in areas where there was a preexisting trend in housing prices. If for example, houses located within 1 mile of where a Walmart opened were experiencing faster growth in housing prices relative to homes in the 1 to 4 mile band, this could lead to estimating a spurious positive effect of Walmart openings in our difference-in-differences analysis. One way to better examine if there are

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[15] The approximate announcement date is based on the median number of days between announcement and opening for the Walmart's in our sample.

[16] The 2-4 mile zone is substantially larger in area than the 0-0.5 mile zone so it mechanically has many more housing transactions such that taking the natural log makes for an easier comparison. We also created a plot that shows the residuals from regressing the ln(number of house sales in a quarter) on quarter of the year from Walmart opening and by distance from the new Walmart which also reveals no significant change in house sales due to a Walmart opening.

preexisting trends in the housing prices near where Walmart stores are built is to graphically illustrate housing price trends in the spatial zones before and after Walmart opens.

To provide this graphical evidence we first run a regression following Equation (2) using the data in our primary specification (Table 3, column (2)), but we leave out the spatial indicators and their interactions. We then aggregate the residuals by quarter of the year, for two and a half years before and after the Walmart opened, for each spatial zone (within 0.5 miles, 0.5 to 1 mile, 1 mile to 2 miles and 2 miles to 4 miles from the Walmart), relative to the opening date of the nearest Walmart. Figure 2 plots the residuals from this regression. The y-axis ranges from -0.06 and 0.02 which represents an approximate 8 percentage point difference in housing prices. The x-axis ranges from -10 to 10 which represents the ten quarters before the Walmart opened and the ten quarters after the Walmart opened. The vertical line in the center of the graph shows the timing of the opening date for the Walmarts in our sample. The vertical line at -5.67 illustrates the approximate announcement date that is based on the statistic reported earlier that the median time between announcement and the opening of a Walmart in our sample is 516 days.

The top two lines in Figure 2 show that the residuals for houses between one and four miles from the Walmart are generally close to zero and unchanging over the five-year period. The third line down represents the residuals of houses between a half and one mile from the nearest Walmart and it can be seen that they trend about -0.02 log price points lower until about one year before the nearest Walmart opens, and then they experience a slow rise. The fourth line down, representing the residuals of houses within

0.5 miles of the Walmart, shows the most dramatic change from before and after the Walmart opens. The residuals start out around -0.04 until about one year before the Walmart opens and then there appears to be a dramatic increase in the residuals until they are near zero, two and a half years after the Walmart opens. Overall the residuals for the four zones are "fanned out" before the Walmart opens, are relatively steady until a year before the Walmart opens, and then they compress until they are nearly identical two and a half years after the Walmart opens. Given that it is likely to be apparent to homebuyers that a Walmart is being built two or three quarters before it is complete, this graphical evidence bolsters the argument that our difference-in-differences estimates are causal.

Figure 3 provides similar graphical evidence for the change in the residuals in the four spatial zones, before and after the Walmart was announced to be built. Again, before the announcement date there does not appear to be much of a trend in the residuals for any of the four zones. However, after the announcement of the new Walmart is made the residuals for the homes between 0.5 and 1 mile appear to begin trending upward and the homes within 0.5 miles trend upward even more rapidly.

Another check for whether or not the increase in housing prices after the opening of a Walmart is due to differential trends in housing prices between homes nearest the Walmart relative to housing prices farther away is to conduct a falsification test. We do this by estimating Equation (2) using our 2.5 year pre and post window but including false Walmart opening dates. The false opening dates are set to two years, two and a half years, and three years prior to the actual opening dates of Walmart. The results presented in Table 4 provide no evidence of a spurious, positive effect due to differential housing price growth at the Walmart location. Thus this falsification test in combination with the

graphical analysis is supportive of a causal interpretation of our difference-in-differences estimates of the impact of Walmart on housing prices.

6.   Conclusion

Although recent academic work has made it clear that the opening of a Walmart lowers retail prices for consumers in the area, there has been little work that systematically tests whether or not the opening of a Walmart lowers *housing* prices. In this paper we have attempted to answer this question. We compiled a unique dataset that linked micro-level housing data to 159 Walmarts that opened in the United States between 2000 and 2006. Exploiting the spatial resolution of the data we compared areas very near the Walmarts to areas slightly further away before and after the Walmarts opened. The results from our primary difference-in-differences specification suggest that a new Walmart store actually increases housing prices by between 2 and 3 percent for houses located within a half mile of the store and by 1 to 2 percent for houses located between a half and one mile from the store. For the average priced home in these areas this translates into an approximate $7,000 increase in housing price for homes within a half mile of a newly opened Walmart and a $4,000 increase for homes between a half and one mile.

Overall, the estimated capitalization effects that we find suggest a revealed preference by many households to live near a Walmart and the stores that naturally agglomerate nearby. On average, the benefits to quick and easy access to the lower retail prices offered by Walmart and shopping at these other stores appear to matter more to households than any increase in crime, traffic and congestion, noise and light pollution,

or other negative externalities that would be capitalized into housing prices. This result is useful to policymakers that consider passing zoning regulations and other laws that could affect Walmart's ability to build new stores within their jurisdiction.

Although we in general find the results to be reasonably credible, some caveats should also be made. It is possible that while the accessibility benefits appear to extend out to at least a mile, there may still be negative externalities that affect households that live very close to a Walmart. Furthermore, our findings provide evidence that Walmarts increase housing values *on average*, but it is possible that in certain cases a new store may actually decrease housing values due to externalities. Finally, our estimates may be internally valid, but they may not be accurate in more rural areas, for example, where we do not have housing data. Examining the housing price impacts of Walmart in these other settings may be important to policymakers and could be looked at in future research.

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Figure 1: Log Counts of Housing Transactions by Distance to Walmart
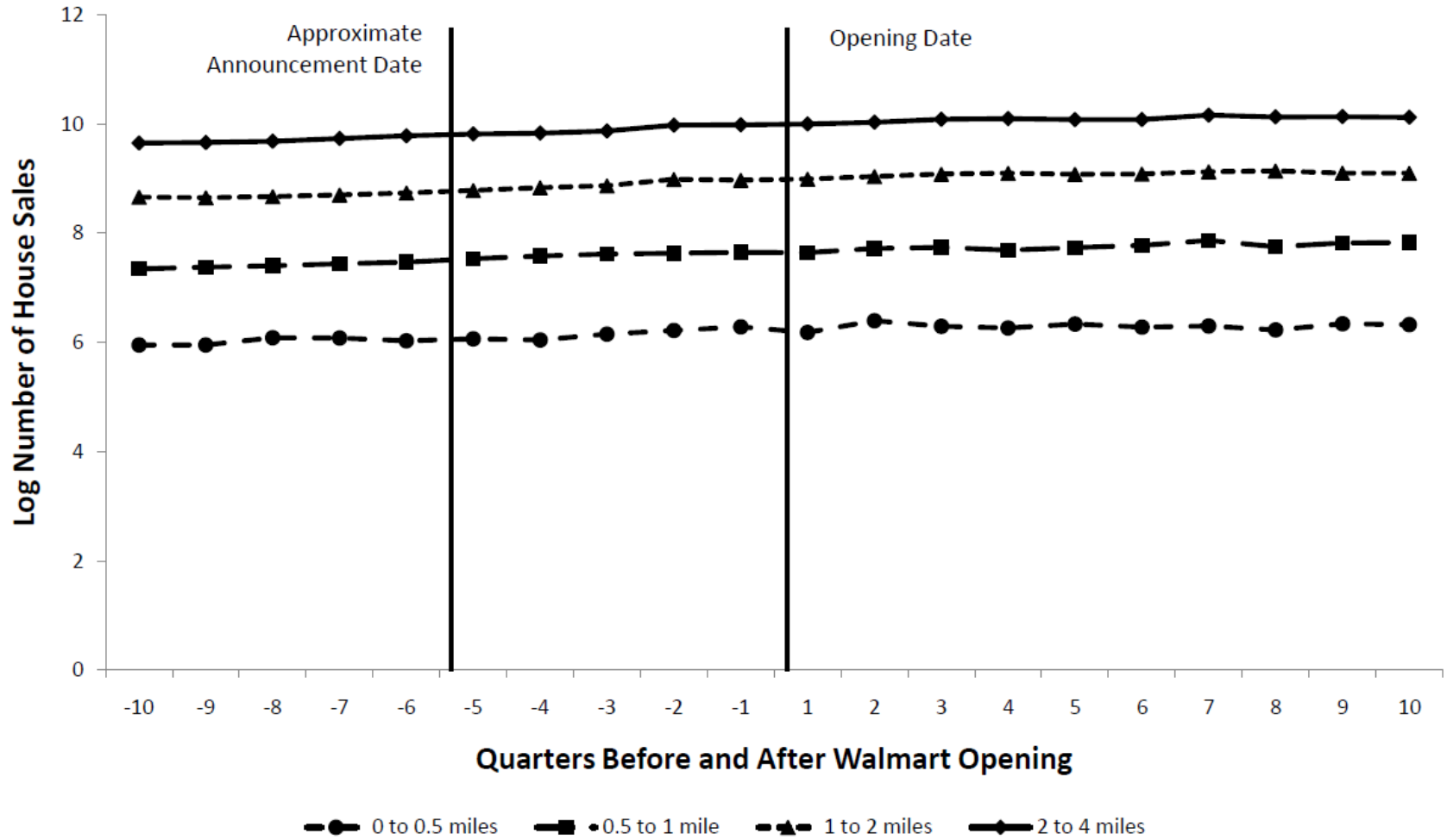
Note: Log counts have been aggregated by quarter for each of the 4 zones (0 to 0.5 miles, 0.5 to 1 mile, 1 to 2 miles, and 2 to 4 miles) around the 159 Walmarts in our sample. The x-axis shows the 2.5 years before (negative numbers) and 2.5 years after (positive numbers) the opening of a Walmart in quarters.

Figure 2: Residual Plot of Log Price Regression Before and After Walmart Opening
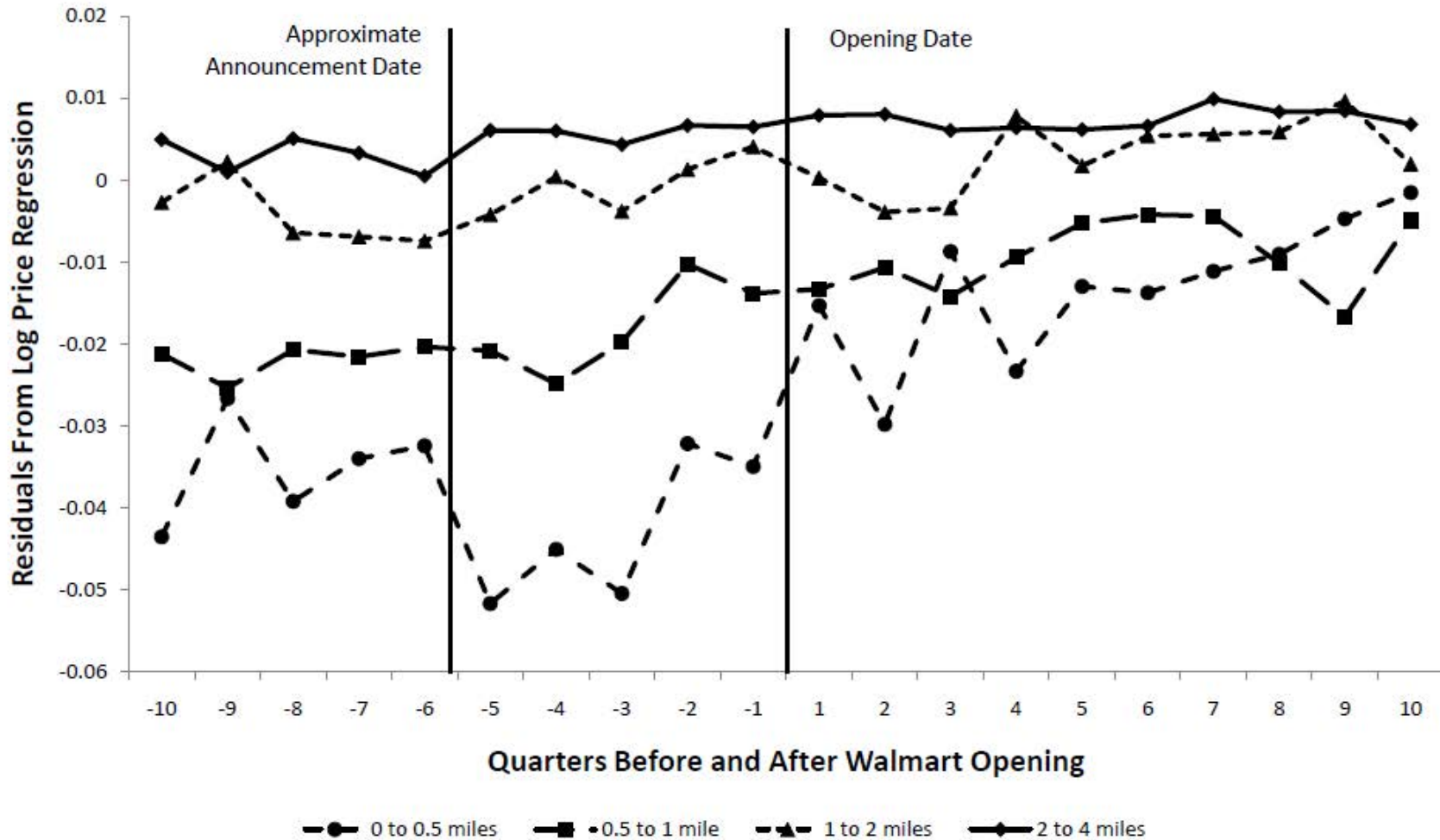
Note: Residuals have been aggregated by quarter. The y-axis shows the residuals from regressing ln(price) on housing characteristics by quarter of the year from the event (Walmart opening) and by distance from the new Walmart (0 to 0.5 miles, 0.5 to 1 mile, 1 to 2 miles, and 2 to 4 miles). The x-axis shows the 2.5 years before (negative numbers) and 2.5 years after (positive numbers) the opening of a Walmart in quarters.

Figure 3: Residual Plot from Log Price Regression Before and After Walmart Announcement
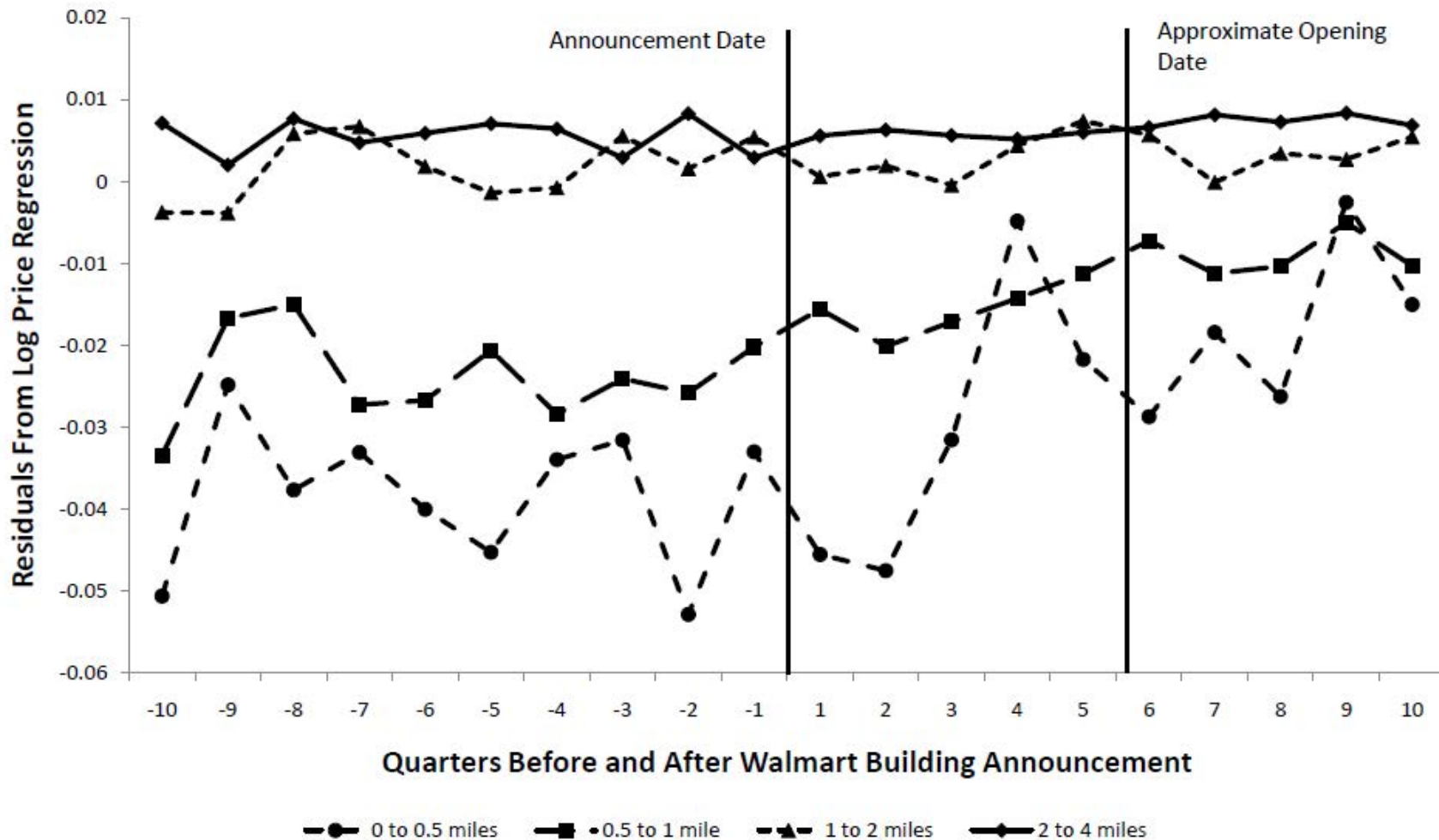
Note: Residuals have been aggregated by quarter. The y-axis shows the residuals from regressing ln(price) on housing characteristics by quarter of the year from the event (Walmart announcement) and by distance from the new Walmart (0 to 0.5 miles, 0.5 to 1 mile, 1 to 2 miles, and 2 to 4 miles). The x-axis shows the 2.5 years before (negative numbers) and 2.5 years after (positive numbers) the announcement of a Walmart in quarters.

Table 1: Tabulations of the Year, Month and State that Walmarts Opened

PANEL A			PANEL B			PANEL C		
Year Walmart Opened			**Month Walmart Opened**			**State Walmart Opened**		
Year	Freq.	Percent	**Month**	Freq.	Percent	**State**	Freq.	Percent
2000	7	4.4	**Jan.**	44	27.67	**CA**	36	22.64
2001	22	13.84	**Feb.**	0	0	**CO**	13	8.18
2002	34	21.38	**Mar.**	10	6.29	**CT**	14	8.81
2003	29	18.24	**Apr.**	5	3.14	**DE**	1	0.63
2004	34	21.38	**May**	14	8.81	**FL**	21	13.21
2005	24	15.09	**June**	3	1.89	**MA**	8	5.03
2006	9	5.66	**July**	10	6.29	**MI**	1	0.63
			Aug.	23	14.47	**MN**	3	1.89
Total	159	100	**Sept.**	11	6.92	**MO**	1	0.63
			Oct.	37	23.27	**NV**	8	5.03
			Nov.	2	1.26	**NC**	6	3.77
			Dec.	0	0	**OH**	10	6.29
						OR	2	1.26
			Total	159	100	**PA**	17	10.69
						RI	1	0.63
						SC	2	1.26
						TN	1	0.63
						VA	5	3.14
						WA	8	5.03
						WI	1	0.63
						Total	159	100

Note: Tabulations of the year, month and state for the 159 Walmarts that are in our primary sample.

Table 2: Summary Statistics of Housing Data

Distance to Walmart:	**All Houses**	**1 to 2 miles**	**0.5 to 1 mile**	**Within 0.5 mile**
	mean (st. deviation)	mean (st. deviation)	mean (st. deviation)	mean (st. deviation)
Sale price	267,423 (188,323)	263,628 (181,397)	253,039 (161,573)	237,924 (145,603)
Square footage	1,767 (743)	1,742 (720)	1,721 (681)	1,625 (593)
# of baths	2.198 (0.854)	2.196 (0.856)	2.201 (0.832)	2.087 (0.759)
Age	30.116 (25.480)	30.300 (25.936)	28.487 (25.222)	29.069 (24.312)
Lot size (in acres)	0.254 (0.327)	0.242 (0.285)	0.226 (0.262)	0.213 (0.236)
# of Bedrooms	3.198 (0.811)	3.186 (0.807)	3.199 (0.783)	3.134 (0.756)
	Percentage	Percentage	Percentage	Percentage
New Sale	15.29%	15.07%	16.28%	11.70%
Within 0.5 miles	1.57%	0%	0%	100%
0.5 to 1 mile	6.64%	0%	100%	0%
1 to 2 miles	24.54%	100%	0%	0%
Sample size	626,750	153,775	41,622	9,826

Note: Summary statistics for all houses in our primary sample as well as summary statistics for areas closer to the locations of Walmarts in our sample.

Table 3: Impact of Walmart Store Openings and Announcements on Property Values

Analysis Type:	Walmart Opening						Announcement
Temporal Selection:	2.5 years post	2.5 years & post	pre	>=2.5 yrs pre & post	3 years pre & post	2 years pre & post	2.5 years pre & post
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	lnprice	lnprice	lnprice	lnprice	lnprice	lnprice	lnprice
Within 0.5 miles	-0.0260**	-0.0486***	-0.0504***	-0.0512***	-0.0502***	-0.0484***	-0.0496***
	(0.012)	(0.013)	(0.015)	(0.013)	(0.013)	(0.013)	(0.016)
Within 0.5 miles * post		0.0237**	0.0249*	0.0331***	0.0296***	0.0209**	0.0155
		(0.010)	(0.013)	(0.009)	(0.009)	(0.010)	(0.010)
0.5 to 1 mile	-0.0178*	-0.0268**	-0.0295**	-0.0299***	-0.0255**	-0.0243**	-0.0338**
	(0.009)	(0.010)	(0.015)	(0.011)	(0.011)	(0.011)	(0.013)
0.5 to 1 mile * post		0.00942*	0.0187**	0.0233***	0.0125**	0.00746	0.0139**
		(0.005)	(0.008)	(0.007)	(0.005)	(0.005)	(0.006)
1 to 2 miles	-0.0051	-0.00878	-0.00712	-0.0089	-0.00812	-0.0081	-0.00611
	(0.007)	(0.008)	(0.011)	(0.009)	(0.009)	(0.008)	(0.009)
1 to 2 miles * post		0.004	0.00368	0.0103**	0.00535	0.00373	0.00167
		(0.004)	(0.006)	(0.005)	(0.004)	(0.003)	(0.006)
Store by year by month fixed effects	X	X	X	X	X	X	X
Store-level clustering of std. errors	X	X	X	X	X	X	X
Housing characteristics	X	X`	X	X	X	X	X
Super walmart only			X				
# of walmart stores	159	159	88	159	155	164	119
Observations	358,076	626,750	347,371	1,481,811	721,200	513,962	401,383
R-squared	0.86	0.86	0.85	0.85	0.86	0.86	0.86

Note: All but column (1) are DID regressions. Analysis type refers to whether the analysis is focused on housing prices before and after the Walmart opening date or the Walmart announcement date. The temporal selection of 2.5 years post means that only houses transacted in the 2.5 years after the Walmart opened are included. All other temporal selections refer to the years pre and post the Walmart opening (or announcement in the case of the announcement analysis). Standard errors are clustered at the store level. A * means the estimate is significant at the 10% level, ** at the 5% level and *** at the 1% level.

Table 4: Housing Composition Regression Results

Panel A:	Before and After Walmart Opening					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	sqft	bath	age	lotacre	bedrms	new_sale
Within 0.5 miles	-172.5***	-0.108**	-1.713	-0.0655***	-0.0920***	0.00378
	(37.000)	(0.042)	(1.431)	(0.010)	(0.032)	(0.029)
Within 0.5 miles * post	-18.81	-0.0168	0.151	-0.00497	-0.01	-0.0396
	(22.120)	(0.022)	(0.710)	(0.011)	(0.020)	(0.030)
0.5 to 1 mile	-110.3***	-0.0629**	-0.695	-0.0488***	-0.0479**	0.0245
	(26.150)	(0.026)	(1.114)	(0.009)	(0.022)	(0.017)
0.5 to 1 mile * post	11.13	0.0294*	-0.575	-0.00331	0.0118	-0.0251
	(14.980)	(0.017)	(0.622)	(0.004)	(0.014)	(0.016)
1 to 2 miles	-65.84***	-0.0342*	0.447	-0.0304***	-0.0454***	-0.000509
	(19.490)	(0.020)	(0.721)	(0.007)	(0.014)	(0.012)
1 to 2 miles * post	6.73	0.0126	-0.461	-0.00122	0.0121	-0.00424
	(12.200)	(0.010)	(0.395)	(0.004)	(0.011)	(0.012)
Observations	626,750	626,750	626,750	626,750	626,750	626,750
R-squared	0.19	0.258	0.513	0.193	0.128	0.249

Panel B:	Before and After Walmart Announcement					
	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	sqft	bath	age	lotacre	bedrms	new_sale
Within 0.5 miles	-169.7***	-0.0845*	-2.651	-0.0578***	-0.0597*	0.0209
	(32.190)	(0.045)	(1.626)	(0.011)	(0.031)	(0.030)
Within 0.5 miles * post	-1.738	-0.0194	0.51	-0.00422	-0.00915	-0.0510**
	(21.910)	(0.025)	(0.809)	(0.010)	(0.022)	(0.025)
0.5 to 1 mile	-129.2***	-0.0669**	-1.002	-0.0520***	-0.0508**	0.0470*
	(27.400)	(0.030)	(1.341)	(0.010)	(0.025)	(0.024)
0.5 to 1 mile * post	34.91*	0.0410*	-1.021	0.00501	0.0113	-0.0227
	(20.520)	(0.023)	(0.742)	(0.006)	(0.019)	(0.023)
1 to 2 miles	-71.60***	-0.0306	0.386	-0.0287***	-0.0403**	0.00689
	(19.200)	(0.023)	(0.909)	(0.007)	(0.016)	(0.011)
1 to 2 miles * post	1.473	0.00354	-0.618	-0.00551	-0.0145	0.0105
	(16.120)	(0.014)	(0.418)	(0.004)	(0.014)	(0.015)
Observations	401,383	401,383	401,383	401,383	401,383	401,383
R-squared	0.182	0.265	0.481	0.206	0.116	0.25

Note: These linear regressions put the housing characteristics on the left hand size and the distance to the Walmart zones and interactions on the RHS while continuing to control for store-by-year-by-month fixed effects. Standard errors are clustered at the Walmart store level and a * means the estimate is significant at the 10% level, ** at the 5% level and *** at the 1% level.

Table 5: Falsification Tests of Walmart Opening on Property Values

Analysis Type:	Opening Date Falsification Tests		
# of Years Open Date is Shifted:	3 years earlier	2.5 years earlier	2 years earlier
	(1)	(2)	(3)
VARIABLES	lnprice	lnprice	lnprice
Within 0.5 miles	-0.0540***	-0.0571***	-0.0504***
	(0.017)	(0.015)	(0.014)
Within 0.5 miles * post	-0.00222	0.00785	0.00959
	(0.011)	(0.009)	(0.008)
0.5 to 1 mile	-0.0398**	-0.0363***	-0.0333***
	(0.015)	(0.014)	(0.012)
0.5 to 1 mile * post	0.00677	0.00461	0.0082
	(0.007)	(0.007)	(0.006)
1 to 2 miles	-0.00162	-0.0127	-0.0119
	(0.011)	(0.011)	(0.009)
1 to 2 miles * post	-0.000522	0.00413	0.00325
	(0.006)	(0.006)	(0.005)
Store by year by month dummies	X	X	X
Store-level clustering of std. errors	X	X	X
Housing Characteristics	X	X	X
# of walmart clusters	90	105	123
Observations	257,904	314,302	396,289
R-squared	0.859	0.853	0.848

Note: These are the results from difference-in-differences specifications that move the opening date forward for a falsification test. The # of years open date is shifted refers to how many years the open date is shifted forward.