

Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

Journal of Urban Economics

www.elsevier.com/locate/jue

When Walmart comes to town: Always low housing prices? Always? ☆

Devin G. Pope^a, Jaren C. Pope^{b,*}^aBooth School of Business, University of Chicago, 5807 S Woodlawn Ave, Room 310, Chicago, IL 60637, United States^bDepartment of Economics, Brigham Young University, 180 Faculty Office Building, Provo, UT 84602–2363, United States

ARTICLE INFO

Article history:

Received 18 July 2012

Revised 8 October 2014

Available online 28 October 2014

Keywords:

Walmart

Housing prices

ABSTRACT

Walmart often faces strong local opposition when trying to build a new store. One common complaint is 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 lowers 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% for houses located within 0.5 miles of the store and by 1–2% for houses located between 0.5 and 1 mile.

© 2014 Elsevier Inc. All rights reserved.

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 4400 retail facilities, employs almost 1.4 million people (approximately 1% of the workforce), and accounts for about 11% of retail sales.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 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 which are likely to aggregate the positive and negative effects of a Walmart opening in a locality.³ However, unlike the academic literature that surrounds the labor-market effects of Walmart, there

* We thank Emek Basker, Nick Kuminoff, Lars Lefgren, Chris Parmeter and Arden Pope and seminar participants at Brigham Young University, the summer meetings of the European Association of Environmental and Resource Economists, and the meetings of the Weimer/Seldin School for Advanced Studies, as well as colleagues at the University of Chicago and Brigham Young University for helpful discussions about this paper. We also thank Chris Bruegge and Brendan Forster for excellent research assistance on this project. The standard disclaimer applies.

* Corresponding author.

E-mail addresses: devin.pope@chicagobooth.edu (D.G. Pope), jaren_pope@byu.edu (J.C. Pope).

¹ These numbers were taken from the August 2011 fact sheet provided on the Walmart website and can be found at <http://www.walmartstores.com/press-room/factsheets/>.

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 Basker's (2007) overview article on the causes and consequences of Walmart's growth states that “Wal-Mart's effects on local government expenditures urban sprawl, traffic, crime, and social capital have received some attention in popular discourse.” It also states that “places that have limited Wal-Mart's entry have often cited its potential impact on urban sprawl, traffic, and congestion; however, research is needed to test these claims.” Prominent concerns listed by opponents of Walmart on the internet include less local employment opportunities and lower wages, lower property values, increased crime, traffic, congestion, noise and light pollution. See for example: http://www.corpethics.org/downloads/northcross_no_walmart.pdf.

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 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.⁵ 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 sale prices of about 2–3% 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%. 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, [Lin \(2013\)](#) showed the negative impact of brownfields (and the positive impact of state certification against liability for new owners) on property values, and [Lim and Missios \(2007\)](#) 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.

The most common method for investigating the effects of accessibility and externalities on property values is called the hedonic method. The hedonic model was developed by [Rosen \(1974\)](#) to provide a theoretical foundation for the relationship between prices and attributes. The hedonic price function describes the equilibrium relationship between the characteristics of a house (including both structural characteristics and locational attributes such as accessibility and externalities). For over 40 years

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 et al. \(2011\)](#). 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](#)), traditional values ([Carden et al., 2009b](#)), and on other grocery stores ([Ellickson and Grieco, 2013](#)).

⁵ Clearly, estimates of the average treatment effect of Walmart on housing prices would have to be adjusted by a policymaker for the income and preferences of the households in a specific locale.

economists have used the hedonic pricing method in conjunction with the housing market to reveal household preferences for important locational characteristics.⁶

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 reduced form, quasi-experiments in time and/or space to better overcome omitted variable bias and identify implicit prices of interest. Examples of this new wave of quasi-experimental hedonic research include Black (1999), Filio and Lucas (2004), Chay and Greenstone (2005), Pope (2008) and Linden and Rockoff (2008), among others.⁷

Ultimately the impact of building a Walmart store on housing prices depends on the sorting of households into, and out of homes near the Walmart in general equilibrium. This sorting fundamentally depends on heterogeneity across households in income and preferences for the accessibility and externality aspects of a Walmart store. For example, if on average higher income households place greater weight on the externalities of Walmart than the accessibility benefits, then the bid-rent curve for higher income households would be shifted down while the lower income household's bid-rent curves would be shifted up with the opening of a Walmart (in an Alonso (1964) bid-rent context). This and other examples would suggest that the impact of Walmart on property values would fundamentally depend on the income and preferences of the community in which the Walmart store were opened.

If Walmart is sensitive to these issues, the sorting and bid-rent arguments used above would suggest that Walmart may be more likely to locate new stores in relatively lower income communities. A simple investigation of household income in the counties where Walmart has built its stores relative to other counties in a given state reveals that, during the 1970's, 1980's, and 1990's, Walmart did tend to build their stores in counties where median household income was approximately three thousand dollars, two thousand dollars, and one thousand dollars, respectively, below the average for the state. This is consistent with the intuition from our example above. However, during the time frame of our data (Walmart openings between 2000 and 2006) it appears that Walmart is now building in counties that have an average median household income of approximately two thousand dollars *above* the average for the state. This is presumably since Walmart already built Walmart stores in the "ideal" lower-income communities in the previous decades.⁸

⁶ 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.

⁷ See Parmeter and Pope (2012) for a more detailed review of the quasi-experimental method applied to housing and hedonic models. Also, see Kuminoff and Pope (2012) for an in-depth discussion of the correspondence between capitalization effects identified in a quasi-experimental hedonic application and the welfare effects that the traditional hedonic model describes.

⁸ These comparisons of household income for counties in which Walmart was built relative to the state of that county, were derived using median household information for census tracts in the 2000 decennial census. We geolocated the census tract for each Walmart that opened between 1970 and 2006. We found that the 241 Walmarts that opened in the 1970's, the 1073 Walmarts that opened in the 1980's, and the 1121 Walmarts that opened in the 1990's, opened in counties where household income was \$3,239, \$2,053, and \$867 below the average county's median household income in that state. However, we found that the 705 Walmarts that opened between 2000 and 2006, opened in counties where household income was \$1,972 above the average county's median household income in that state. For the 159 Walmarts in our primary analysis for this paper, the amount is \$2,119 above the average state county which is very similar to other Walmart's counties during the 2000–2006 time period.

Fully investigating the sorting of households and the location decisions of Walmart would require a general equilibrium sorting model and detailed information on household income and preferences which is well beyond the scope of this paper. This paper instead focuses on a set of Walmarts that were opened in areas where we had access to appropriate housing data and could perform a reduced form, quasi-experimental analysis of the impact of these store openings on housing prices. While this selected set of openings is unlikely to be very representative of the average impact of Walmart openings in earlier decades on lower-income communities, our quasi-experimental estimates should have more validity for the types of communities most likely to have a Walmart store built in the future. In the next sections we examine the impact of recently built Walmart stores on surrounding housing prices.

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.⁹ The original data contain the full universe of Walmart stores that were built between 1962 and January 31, 2006. However, because we only have access to housing data between 1998 and 2008 (see next section), we focus on 159 stores that were built between July 2000 and January 31, 2006 for which we have corresponding housing data. Table 1 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.¹⁰ 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.¹¹ 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

⁹ 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>.

¹⁰ While we think the open dates are 100% accurate since they are the dates reported by Walmart itself, the announcement dates are based on the earliest newspaper reference to the Walmart being built and therefore is more of an approximate date. We used www.newsbank.com which has a fully searchable database of more than 2000 newspaper titles to find these approximate announcement dates.

¹¹ This number corresponds reasonably well with the statement that Walmart made in the Wall Street Journal on September 25, 2006 that it generally takes them 18–24 months to plan, construct and open a store.

Table 1
Tabulations of the year, month and state that Walmarts opened.

Panel A Year Walmart opened			Panel B Month Walmart opened			Panel C State Walmart opened		
Year	Freq.	%	Month	Freq.	%	State	Freq.	%
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.

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.¹² 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.¹³

¹² The commercial data vendor is Dataquick Inc. (see their website at <http://www.dataquick.com/>), a real estate data aggregator whose housing data is often used for academic research. Dataquick collects the housing data from county recorder and assessor offices. When a single-family house is transacted, the recorder's office records the transaction price and then these prices can be publicly disclosed in most areas of the country. The assessor's office, which is tasked with assessing the value of properties in a county for tax purposes, compiles information about the structural characteristics of all single-family houses in a county. Our data represents the combination of these two datasets and therefore is the universe of transactions in a given county (before cleaning the data). We only use sales prices for property values and do not use the non-sale property assessments.

¹³ 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. Also, Ellickson and Grieco (2013) find that the effect of Walmarts that open with grocery stores on other grocery stores extends about three miles.

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.¹⁴ 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.¹⁵ 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 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

The work presented in this study builds off of the reduced form, quasi-experimental literature (discussed previously in Section 2) in the construction of an identification strategy to understand the impact of Walmart openings on housing prices. As was mentioned earlier, the concern with using a "traditional" hedonic approach to analyzing the impact that Walmart has on housing prices is of course 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

¹⁴ The dollar figures are not referenced to a specific year but are from the raw data. In our regressions later on, our fixed effects strategy means that the estimates are referenced to the 1998 base year.

¹⁵ 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.

Table 2
Summary statistics of housing data.

Distance to Walmart	All Houses Mean (st. deviation)	1 to 2 miles Mean (st. deviation)	0.5 to 1 mile Mean (st. deviation)	Within 0.5 mile Mean (st. deviation)
Sale price	2,67,423 (188,323)	2,63,628 (181,397)	2,53,039 (161,573)	2,37,924 (145,603)
Square footage	1767 (743)	1742 (720)	1721 (681)	1625 (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%
0.5–1 mile	6.64%	0%	100%	0%
1–2 miles	24.54%	100%	0%	0%
Sample size	6,26,750	1,53,775	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.

could potentially bias the traditional hedonic coefficients downwards.

A quasi-experimental hedonic specification that could be used to help overcome the omitted variable bias concerns of the traditional approach would be a spatial difference-in-differences specification of the following form:

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

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, 0.5–1, and 1–2 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), interactions of each of these spatial indicator variables with an indicator ($Post_{ijym}$) for whether the housing transaction took place after the Walmart was opened (or announced), and a random error term that allows for year by month by store area specific correlation in housing prices (ε_{ijym}). The key parameters in this specification are the estimates for the spatial indicators ($\hat{\beta}_1$; $\hat{\theta}_1$; $\hat{\phi}_1$). These parameters give us the local effect on the treated spatial zones.¹⁶ 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.¹⁷ 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,

¹⁶ 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.

¹⁷ There is often an inherent tension in choosing a reasonable “control” group in these types of analyses. The closer the control group is to the treatment group, the more comparable it becomes to the treatment group, but it is also more likely to get treated.

Basker (2005a) and Neumark et al. (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.

Holmes (2011) convincingly argues that the roll-out of new Walmart stores was more about the shipping costs of retail items rather than the demand or cost characteristics of local markets. Given these motivations of Walmart, it becomes more plausible that conditional on some of the observables we can control for, that the siting of Walmart is quasi-random. Also, 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 micro-level housing data in this way is very attractive.¹⁸ 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. The micro-level housing data also 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. 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

¹⁸ This calculation is performed by noting that the median county size is approximately 622 square miles and the area of a 4 mile circle is approximately 50 square miles.

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, 0.5–1 mile, or 1–2 miles from the nearest Walmart.

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.

5.2. Primary difference-in-differences results

To help mitigate the concern of omitted variable bias in our analysis we implement difference-in-differences regressions following Eq. (1). The housing data used in this regression are restricted to houses within 4 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 2–4 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 1% 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 2–4 mile control band. This is our preferred specification and has been bolded in the table.

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

Table 3
Impact of Walmart store openings and announcements on property values.

Analysis type	Walmart opening					Announcement
	2.5 Years post	2.5 Years pre & post	≥2.5 Years pre & post	3 Years pre & post	2 Years pre & post	2.5 Years pre & post
Temporal selection	(1)	(2)	(3)	(4)	(5)	(6)
<i>Variables</i>	Inprice	Inprice	Inprice	Inprice	Inprice	Inprice
Within 0.5 miles	-0.0260** (0.012)	-0.0486*** (0.013)	-0.0512*** (0.013)	-0.0502*** (0.013)	-0.0484*** (0.013)	-0.0496*** (0.016)
Within 0.5 miles * post		0.0237** (0.010)	0.0331*** (0.009)	0.0296*** (0.009)	0.0209** (0.010)	0.0155 (0.010)
0.5–1 mile	-0.0178* (0.009)	-0.0268** (0.010)	-0.0299*** (0.011)	-0.0255** (0.011)	-0.0243** (0.011)	-0.0338** (0.013)
0.5–1 mile * post		0.00942* (0.005)	0.0233*** (0.007)	0.0125** (0.005)	0.00746 (0.005)	0.0139** (0.006)
1–2 miles	-0.0051 (0.007)	-0.00878 (0.008)	-0.0089 (0.009)	-0.00812 (0.009)	-0.0081 (0.008)	-0.00611 (0.009)
1–2 miles * post		0.004 (0.004)	0.0103** (0.005)	0.00535 (0.004)	0.00373 (0.003)	0.00167 (0.006)
Store by year by month fixed effects	X	X	X	X	X	X
Store-level clustering of std. errors	X	X	X	X	X	X
Housing characteristics	X	X	X	X	X	X
# Of Walmart openings	159	159	159	155	164	119
Observations	3,58,076	6,26,750	14,81,811	7,21,200	5,13,962	4,01,383
R-squared	0.86	0.86	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 preferred opening date specification is bolded. 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). All housing characteristics shown in this table are included in the regressions and results can be obtained from the authors upon request. The number of store-level fixed effects included in the regression is one less than the number of Walmart openings. Standard errors are clustered at the store level.

* The estimate is significant at the 10% level.

** The estimate is significant at the 5% level.

*** The estimate is significant at the 1% level.

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 convenient to keep the temporal window for the inclusion of housing data symmetric around the Walmart opening date to better avoid contamination from longer temporal trends and to keep the sample more balanced, 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 also include housing observations that were temporally more distant than two and a half years before or after the opening. Column (3) 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% increase in housing prices and the 0.5–1 mile * post coefficient suggesting an approximate 2.3% increase.

One could also potentially widen or narrow the temporal window to check for robustness and further analyze the time-path of treatment effects. Column (4) 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 (5) 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 (6) 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 "0.5–1 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% 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, using the same data as in our primary analysis, 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 0–0.5 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. Fig. 1 shows this graphically for each of the 4 spatial zones in our analysis relative to the opening date and the "approximate" announcement date.¹⁹ The natural log of the number of housing transactions by quarter is used so that each of the zones can be easily compared.²⁰ As can be seen in Fig. 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 1–4 mile band, this could lead to estimating a spurious positive effect of Walmart openings in our

¹⁹ The approximate announcement date is based on the median number of days between the earliest announcement date we found published in a local newspaper and the opening for the Walmart's in our sample.

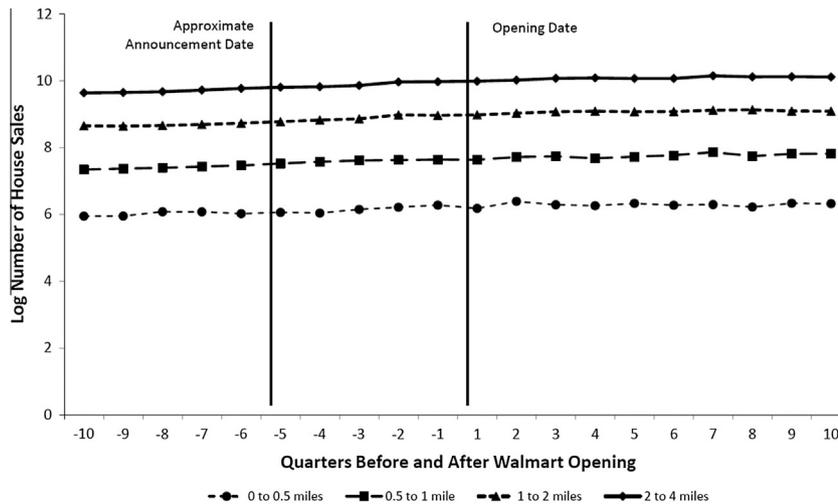
²⁰ The 2–4 mile zone is substantially larger in area than the 0–0.5 mile zone so it mechanically has many more housing transactions such that taking the natural log makes for an easier comparison. We also created a plot that shows the residuals from regressing the ln(number of house sales in a quarter) 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.

Table 4
Housing composition regression results.

Panel A	Before and after Walmart opening					
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Within 0.5 miles	Sqft -172.5*** (37.000)	Bath -0.108** (0.042)	Age -1.713 (1.431)	Lotacre -0.0655*** (0.010)	Bedrms -0.0920*** (0.032)	New_sale 0.00378 (0.029)
Within 0.5 miles * post	-18.81 (22.120)	-0.0168 (0.022)	0.151 (0.710)	-0.00497 (0.011)	-0.01 (0.020)	-0.0396 (0.030)
0.5–1 mile	-110.3*** (26.150)	-0.0629** (0.026)	-0.695 (1.114)	-0.0488*** (0.009)	-0.0479** (0.022)	0.0245 (0.017)
0.5–1 mile * post	11.13 (14.980)	0.0294* (0.017)	-0.575 (0.622)	-0.00331 (0.004)	0.0118 (0.014)	-0.0251 (0.016)
1–2 miles	-65.84*** (19.490)	-0.0342* (0.020)	0.447 (0.721)	-0.0304*** (0.007)	-0.0454*** (0.014)	-0.00051 (0.012)
1–2 miles * post	6.73 (12.200)	0.0126 (0.010)	-0.461 (0.395)	-0.00122 (0.004)	0.0121 (0.011)	-0.00424 (0.012)
Observations	6,26,750	6,26,750	6,26,750	6,26,750	6,26,750	6,26,750
R-squared	0.19	0.258	0.513	0.193	0.128	0.249
Panel B	Before and after Walmart announcement					
Variables	(7)	(8)	(9)	(10)	(11)	(12)
Within 0.5 miles	Sqft -169.7*** (32.190)	Bath -0.0845* (0.045)	Age -2.651 (1.626)	Lotacre -0.0578*** (0.011)	Bedrms -0.0597* (0.031)	New_sale 0.0209 (0.030)
Within 0.5 miles * post	-1.738 (21.910)	-0.0194 (0.025)	0.51 (0.809)	-0.00422 (0.010)	-0.00915 (0.022)	-0.0510** (0.025)
0.5–1 mile	-129.2*** (27.400)	-0.0669** (0.030)	-1.002 (1.341)	-0.0520*** (0.010)	-0.0508** (0.025)	0.0470* (0.024)
0.5–1 mile * post	34.91* (20.520)	0.0410* (0.023)	-1.021 (0.742)	0.00501 (0.006)	0.0113 (0.019)	-0.0227 (0.023)
1–2 miles	-71.60*** (19.200)	-0.0306 (0.023)	0.386 (0.909)	-0.0287*** (0.007)	-0.0403** (0.016)	0.00689 (0.011)
1–2 miles * post	1.473 (16.120)	0.00354 (0.014)	-0.618 (0.418)	-0.00551 (0.004)	-0.0145 (0.014)	0.0105 (0.015)
Observations	4,01,383	4,01,383	4,01,383	4,01,383	4,01,383	4,01,383
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.

- * The estimate is significant at the 10% level.
- ** The estimate is significant at the 5% level.
- *** The estimate is significant at the 1% level.



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.

Fig. 1. Log counts of housing transactions by distance to Walmart.

difference-in-differences analysis. One way to better examine if there are 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.

These residual plots are critical for establishing that the pre-treatment trends appear to be comparable, and that the timing of the housing price increase relative to Walmart announcements and openings is reasonable.

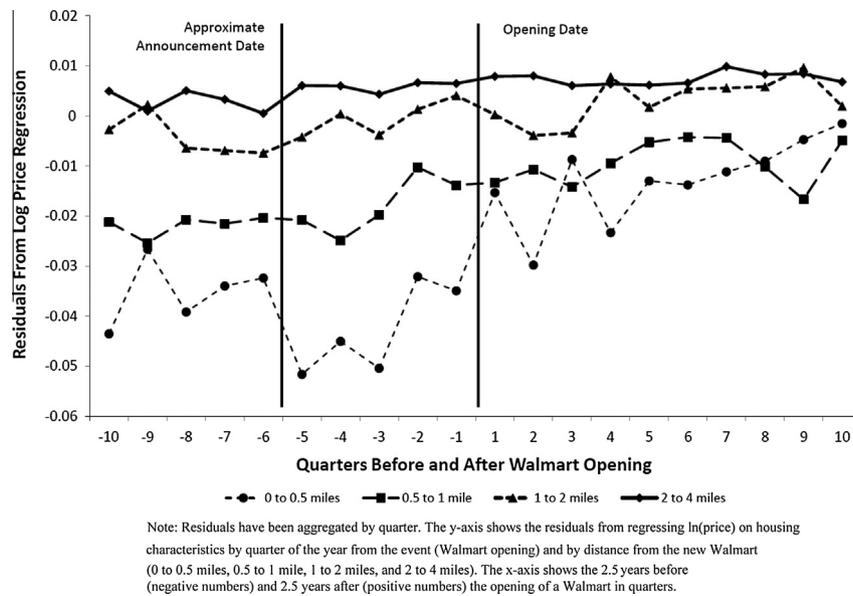


Fig. 2. Residual plot of log price regression before and after Walmart opening.

To provide this graphical evidence we first run a regression following Eq. (1) 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, 0.5–1 mile, 1–2 miles and 2–4 miles from the Walmart), relative to the opening date of the nearest Walmart. Fig. 2 plots the residuals from this regression. The y-axis ranges from -0.06 and 0.02 which represents an approximate 8% 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 Fig. 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, 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.

Fig. 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

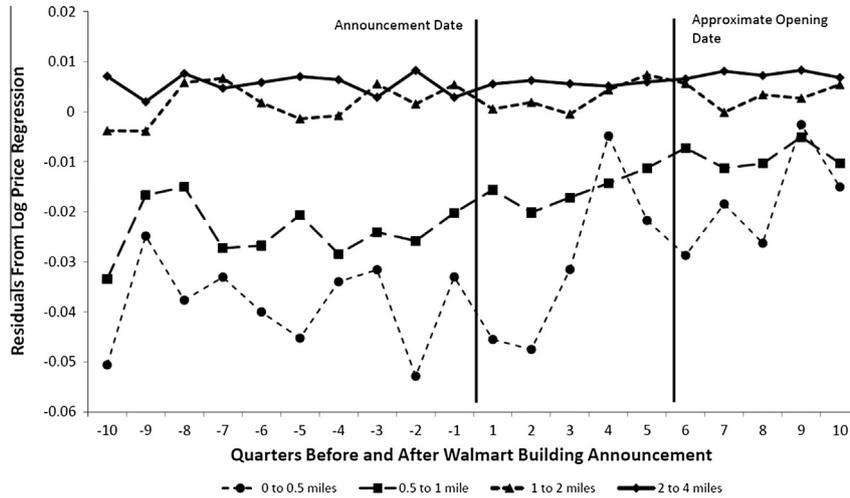
any of the four zones. However, after the announcement of the new Walmart is made the residuals for the homes between 0.5 and 1 mile appear to begin trending upward and the homes within 0.5 miles trend upward even more rapidly. We find the residual plots presented in Figs. 2 and 3 to be compelling evidence of a Walmart effect.

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 Eq. (1) 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 5 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.

5.5. Heterogeneity analysis

While it appears that Walmart has a positive impact on housing prices in the areas for which we have data (our estimates are clearly average treatment effects on the treated and therefore are not externally valid to Walmart areas outside our sample), we have done little to establish the mechanisms by which this price increase occurs. We hypothesized at the outset of the paper that there are potentially countervailing influences of Walmart on housing prices. Negative externalities such as increased traffic, noise, crime and light pollution could cause nearby housing prices to be lower while increased accessibility for households to the goods and services Walmart provides could cause nearby housing prices to be higher. Our analysis suggests that the accessibility effect appears to overwhelm the negative externality effect.²¹

²¹ There are other mechanisms that our data does not lend itself to testing. For example, it would be useful to test if some of the price impact stems from Walmart providing more taxes and reducing residents' tax liability, leading to a change in housing prices. The ideal data to do this test would be to have different tax jurisdictions near the Walmart and a boundary discontinuity design could be used to tease out differences in housing price changes near the boundary. Unfortunately these data are not readily available.



Note: Residuals have been aggregated by quarter. The y-axis shows the residuals from regressing $\ln(\text{price})$ 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.

Fig. 3. Residual plot from log price regression before and after Walmart announcement.

Table 5
Falsification tests of Walmart opening on property values.

Analysis type	Opening date falsification tests		
	3 Years earlier	2.5 Years earlier	2 Years earlier
# Of years open date is shifted	(1)	(2)	(3)
<i>Variables</i>	$\ln(\text{price})$	$\ln(\text{price})$	$\ln(\text{price})$
Within 0.5 miles	-0.0540*** (0.017)	-0.0571*** (0.015)	-0.0504*** (0.014)
Within 0.5 miles * post	-0.00222 (0.011)	0.00785 (0.009)	0.00959 (0.008)
0.5–1 mile	-0.0398** (0.015)	-0.0363*** (0.014)	-0.0333*** (0.012)
0.5–1 mile * post	0.00677 (0.007)	0.00461 (0.007)	0.0082 (0.006)
1–2 miles	-0.00162 (0.011)	-0.0127 (0.011)	-0.0119 (0.009)
1–2 miles * post	-0.000522 (0.006)	0.00413 (0.006)	0.00325 (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	2,57,904	3,14,302	3,96,289
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.

To test this mechanism further we perform a heterogeneity analysis. If the accessibility effect is indeed a key mechanism for the rise in housing prices, then areas that differ in characteristics that likely affect how households access a local Walmart may provide additional supporting evidence that accessibility matters. For example, areas where Walmart supercenters open may be more important in terms of accessibility since a supercenter offers access to groceries and households tend to take more frequent trips to buy groceries (see the recent paper by [Ellickson and Grieco \(2013\)](#), which find impacts on other grocery stores from Walmart opening within about 3 miles). Also, in more densely populated areas, traveling a mile or two may be much more costly than in less populated areas. Thus living near a Walmart in a more densely populated area may confer more accessibility benefits than in a less densely populated area. Finally, areas with lower income, less education, a higher percentage of whites and a lower percentage of

owner occupied housing might be areas that would be predicted *a priori* to place a higher premium on accessibility than areas with the opposite demographic characteristics.

Table 6 performs a series of heterogeneity specifications to better test the intuition we have about the heterogeneity in the value of access to Walmarts across areas with different Walmart types and different household types. Each of these specifications uses the same spatial differences-in-differences specification that generated our primary result in column (2) of Table 3. That primary result is reproduced in column (1) of Table 6 for convenience of comparison. To conduct the heterogeneity analysis we used information in our Walmart dataset on whether or not a Walmart that opened was a supercenter, and collected 2000 census information on household income, education levels, percent non-white, and percent owner occupied homes at the census tract or block group level. We spatially merged the census information to each housing

Table 6
Heterogeneity of Walmart store openings on property values.

Sample split type	Walmart Opening heterogeneity analysis						
	All Walmarts	Super Walmarts only	>Median population density	<Median household income	<Median associates degree	>Median percent non-white	<Median percent owner occ.
<i>Variables</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Inprice	Inprice	Inprice	Inprice	Inprice	Inprice	Inprice
Within 0.5 miles	−0.0486*** (0.013)	−0.0504*** (0.015)	−0.0467*** (0.016)	−0.0475** (0.020)	−0.0614*** (0.016)	−0.0591*** (0.017)	−0.0712*** (0.020)
Within 0.5 miles * post	0.0237** (0.010)	0.0249* (0.013)	0.0325*** (0.011)	0.0205 (0.015)	0.0318* (0.014)	0.0310** (0.013)	0.0343* (0.016)
0.5–1 mile	−0.0268** (0.010)	−0.0295** (0.015)	−0.0271 (0.017)	−0.0222 (0.017)	−0.0420*** (0.015)	−0.0348*** (0.012)	−0.0449*** (0.015)
0.5–1 mile * post	0.00942* (0.005)	0.0187** (0.008)	0.0112 (0.009)	0.00675 (0.009)	0.0182** (0.009)	0.00874 (0.006)	0.0151* (0.008)
1–2 miles	−0.00878 (0.008)	−0.00712 (0.011)	0.00316 (0.014)	−0.00814 (0.016)	−0.0296** (0.013)	−0.0230** (0.009)	−0.0210* (0.012)
1–2 miles * post	0.004 (0.004)	0.00368 (0.006)	−0.00413 (0.007)	0.00131 (0.007)	0.0108* (0.006)	0.00544 (0.005)	0.00847 (0.005)
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
# Of Walmart openings	159	88	79	79	79	79	79
Observations	6,26,750	3,47,371	2,46,223	2,94,318	3,05,879	3,78,358	3,24,060
R-squared	0.86	0.85	0.85	0.83	0.86	0.86	0.85

Note: The results shown in column (1) are the same as the results in column (2) of Table 3. Sample Split Type refers to how the sample was split for each heterogeneity analysis. The temporal selection for each of these specifications is using housing data from 2.5 years prior and post Walmart opening. Standard errors are clustered at the store level.

* The estimate is significant at the 10% level.

** The estimate is significant at the 5% level.

*** The estimate is significant at the 1% level.

location in our dataset. Columns (2) and (3) of Table 6 show the results for specifications where we focus the analysis on Walmart supercenters and on Walmart areas above the median population density in our Walmart sample. The results in column (2) suggest that the positive housing price impact from the 88 supercenter Walmarts that opened in our sample was slightly larger within a half mile relative to the 71 regular Walmarts that opened. However, the impact of supercenters on housing prices in the half to one mile area appears to be twice as large suggesting an increase in housing prices after a supercenter opens of approximately 2%. Column (3), which analyzes just houses in Walmart areas that are above the median population density for our sample, also shows an increase in our point estimate for houses within a half mile. The new estimate is approximately 3.3% which is almost a 1% point increase from our baseline estimate of approximately 2.4%. While these results are not statistically different from our baseline results, both of these results conform to our intuition that the treatment effect would be larger due to the availability of groceries at supercenters and the increased costs of travel in higher population density areas.

Columns (4) through (7) report results for a series of specifications that solely analyze the 79 Walmart areas that are below the median for household income, below the median for having at least an associate's degree, above the median for percentage non-white, and below the median for percentage owner occupied homes. These specifications also largely conform with our priors that these median splits of the data would increase the importance of accessibility for the relevant demographic groups. Areas with lower education, higher percentage of non-whites and lower percentages of owner occupied housing all have higher point estimates for houses that sold within one half mile after a Walmart opened. Lower education and smaller percentage of owner occupied home areas also see a substantial increase in the point estimate for houses that sold after Walmart was built in the half to one mile zones. Areas with low income are the lone exception with

the point estimate being slightly lower and less significant. While no individual point estimate is statistically different than our baseline estimates, taken as a whole, these estimates support our hypothesis that increased accessibility to the low cost goods and services of Walmart and any other stores that agglomerate nearby is what drives the price increases we have documented after the announcement and opening of Walmarts.

5.6. Other Big-Box stores: Target

An interesting question is whether or not the property value effects we have identified from the building of Walmart stores are specific to Walmart or if we would find similar results for the opening of any "Big Box" retailer in a community. To examine this question we gathered information on Walmart's closest discount retail competitor—Target. While both Walmart and Target are competing discount retailers, they clearly cater to different customers. Target is known for marketing to households with higher income than those that frequent Walmart.²² For example, Target is well known for carrying more upscale designer clothes and home décor, whereas Walmart tends to focus on stocking basics at the lowest possible price. Clearly the differences in customers and their preferences for shopping and access to that shopping could potentially lead to differing impacts on property values for the opening of Targets relative to Walmarts.

Given the average differences in the types of customers that frequent Target stores relative to Walmart, an analysis of all Targets that opened during the same temporal window as our Walmart analysis, may lead to different results that stem simply from differences in the types of locations where Target chooses to build new stores. To mitigate this bias in our comparison, we gathered

²² See for example the CBS/AP report on November 18, 2012 that reports that the average household yearly income ranges from \$30,000 to \$60,000 whereas the median household income of customers at Target is \$64,000.

Table 7
Comparing the impact of Walmart and target store openings and on property values.

Analysis type	Walmart opening		Target opening		Walmart opening	
	2.5 Years post	2.5 Years pre & post	2.5 Years post	2.5 Years pre & post	2.5 Years post	2.5 Years & post
<i>Variables</i>	(1)	(2)	(3)	(4)	(5)	(6)
Within 0.5 miles	lnprice −0.0260** (0.012)	lnprice −0.0486*** (0.013)	lnprice −0.0332 (0.033)	lnprice −0.0386 (0.036)	lnprice −0.0283 (0.019)	lnprice −0.0565*** (0.020)
Within 0.5 miles * post		0.0237** (0.010)		0.00588 (0.016)		0.0289* (0.014)
0.5–1 mile	−0.0178* (0.009)	−0.0268** (0.010)	0.0162 (0.024)	0.00434 (0.023)	−0.0236 (0.017)	−0.0361* (0.021)
0.5–1 mile * post		0.00942* (0.005)		0.0121 (0.009)		0.0125 (0.011)
1–2 miles	−0.0051 (0.007)	−0.00878 (0.008)	0.0217 (0.015)	0.00642 (0.014)	−0.0279** (0.012)	−0.0341** (0.013)
1–2 miles * post		0.004 (0.004)		0.0154*** (0.005)		0.00651 (0.006)
Store by year by month fixed effects	X	X	X	X	X	X
Store-level clustering of std. errors	X	X	X	X	X	X
Housing characteristics	X	X	X	X	X	X
# Of Walmart/Target openings	159	159	42	42	42	42
Observations	3,58,076	6,26,750	1,08,968	1,94,887	93,102	1,60,952
R-squared	0.86	0.86	0.83	0.84	0.84	0.83

Note: The results shown in columns (1) and (2) are the same as the results in columns (1) and (2) of Table 3. The temporal selection of 2.5 years post means that only houses transacted in the 2.5 years after the Walmart or Target opened are included. All other temporal selections refer to the years pre and post the Walmart or Target opening. All housing characteristics shown in Table 2 are included in the regressions and results can be obtained from the authors upon request. The number of store-level fixed effects included in the regression is one less than the number of Walmart/Target openings. Standard errors are clustered at the store level.

* The estimate is significant at the 10% level.

** The estimate is significant at the 5% level.

*** The estimate is significant at the 1% level.

information on the location of the *closest* Target store to each of the 159 Walmarts used in our primary Walmart analysis. These Target stores therefore are typically in the same county as the Walmart stores from our primary analysis. We then determined the opening date for each of these Targets.²³ Of these Target stores, 42 were built during the same time period as our Walmart openings (July 2000 through January 31, 2006). The median distance to the nearest Walmart for these Target stores was 3.9 miles and only 3 stores were within a mile of the closest Walmart. We then use the differences-in-differences specification in Eq. (1) and apply it to the Target openings to replicate the primary analysis that we conducted for Walmart.²⁴

Table 7 gives the results of this analysis. Columns (1) and (2) reproduce our main Walmart cross-sectional and differences-in-differences results for convenience. Columns (3) and (4) show the corresponding results for the 42 Target openings. Looking at column (4), while not statistically significant, the coefficient on “Within 0.5 miles” suggests that homes nearest these Targets sell for about 4% less, which corresponds well to the equivalent result in our primary Walmart specification. The coefficients on the interactions of our within 0.5 mile and 0.5–1 mile variables with the post Target opening variable are both statistically insignificant. The point estimate for the “within .5 miles * post” coefficient is smaller than the corresponding point estimate using the Walmart sample and the point estimate for the “.5–1 mile * post” coefficient is larger than the corresponding point estimate using the Walmart sample. The coefficient on the interaction with the 1–2 mile variable in the Target sample is positive and statistically significant. Taken literally, this result suggests that the opening of a new Target store increases property values by 1.5% for houses that

are 1–2 miles away from the Target. This point estimate is larger than the corresponding point estimate using the Walmart sample.

Overall, the Target estimates are in the same direction and of roughly the same magnitude of the Walmart estimates. The larger effect found for the “1–2 miles * post” variable in the Target regression is larger and the only interaction estimate that is statistically different from the Walmart regression. It is possible that Target customers value access to Target, but may prefer living a reasonable distance from Target after it opens given different constraints for visiting the store. In general, however, we find evidence consistent with the story that any large box store, along with the other businesses that it attracts, has positive effects on nearby housing prices.

One concern with the comparison we have made is that there is additional selection bias since we only included the 42 (out of 159) Targets that happened to open during the same time frame as our Walmart sample. We therefore re-estimate our Walmart results for just the 42 Walmarts that are closest to the 42 Targets in our Target sample. As can be seen in columns (5) and (6) of Table 7, the results for these selected 42 Walmarts that coincide with the Target sample are very similar to the primary Walmart results suggesting that this form of selection bias is not impacting the Target–Walmart comparison we have made.²⁵

6. Conclusions

Although recent academic work has made it clear that the opening of a Walmart lowers retail prices for consumers in the area,

²³ We had research assistants call each Target to request an open date. These dates were then corroborated with information collected at <http://flowingdata.com/2009/10/22/target-store-openings-since-the-first-in-1962-data-now-available/>.

²⁴ During this time frame there were approximately three times as many Walmarts being built as Targets and so this smaller number reflects this fact.

²⁵ Another concern for comparing these two samples might be that the Walmarts were systematically built before the Targets and so the accessibility effect is dampened for the Targets that arrive in a county after the Walmart was built. However, when comparing opening dates and dropping the 4 Walmart/Target locations where the two stores were built within 100 days of each other, Walmart was built before Target at 22 locations and Target before Walmart at 16 of the locations suggesting that the timing of the building is not a primary factor impacting the comparison that we make.

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% for houses located within a half mile of the store and by 1–2% 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 \$7000 increase in housing price for homes within a half mile of a newly opened Walmart and a \$4000 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 potentially 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 or important differences across communities in the income and preferences for accessibility and externalities that stem from Walmart. 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.

References

- Alonso, W., 1964. *Location and Land Use*. Harvard University Press, Cambridge.
- Basker, E., 2005a. Job creation or destruction? Labor-market effects of Wal-Mart expansion. *Review of Economics and Statistics* 87, 174–183.
- Basker, E., 2005b. Selling a cheaper mousetrap: Wal-Mart's effect on retail prices. *Journal of Urban Economics* 58, 203–229.
- Basker, E., 2007. The causes and consequences of Wal-Mart's growth. *Journal of Economic Perspectives* 21, 177–198.
- Basker, E., Noel, M., 2009. The evolving food chain: competitive effects of Wal-Mart's entry into the supermarket industry. *Journal of Economics and Management Strategy* 18 (4), 977–1009.
- Black, S., 1999. Do better schools matter? Parental valuation of elementary education. *Quarterly Journal of Economics* 114 (2), 577–599.
- Carden, A., Courtemanche, C., 2009. Wal-Mart, leisure, and culture. *Contemporary Economic Policy* 27, 450–460.
- Carden, A., Courtemanche, C., Meiners, J., 2009. Does Wal-Mart reduce social capital? *Public Choice* 138, 109–136.
- Carden, A., Courtemanche, C., Meiners, J., 2009b. Painting the town red? Wal-Mart and values. *Business and Politics* 11 (Article 5).
- Chay, K., Greenstone, M., 2005. Does air quality matter? Evidence from the housing market. *Journal of Political Economy* 113 (2), 376–424.
- Courtemanche, C., Carden, A., 2011. Supersizing supercenters? The impact of Walmart Supercenters on body mass index and obesity. *Journal of Urban Economics* 69 (2), 165–181.
- Des Rosiers, F., Lagana, A., 1995. Shopping centres and house values: an empirical investigation. *Journal of Property Valuation and Investment*, 9–13.
- Ellickson, P.B., Grieco, P.L., 2013. Wal-Mart and the geography of grocery retailing. *Journal of Urban Economics* 75, 1–14.
- Emrath, P., 2002. Explaining housing prices. *Housing Economics*, 9–13.
- Figlio, D.N., Lucas, M.E., 2004. What's in a grade? School report cards and the housing market. *American Economic Review* 94 (3), 591–604.
- Goetz, S., Rupasingha, A., 2006. Wal-Mart and social capital. *American Journal of Agricultural Economics* 88, 1304–1310.
- Goetz, S., Swaminathan, H., 2006. Wal-Mart and county-wide poverty. *Social Science Quarterly* 87, 211–226.
- Hausman, J., Leibtag, E., 2007. Consumer benefits from increased competition in Shopping centres and house values: an empirical investigation effect of Wal-Mart. *Journal of Applied Econometrics* 22 (7), 1157–1177.
- Hicks, M., 2007a. Job turnover and wages in the retail sector: the influence of Walmart. *Journal of Private Enterprise* 22, 137–159.
- Hicks, M., 2007b. Wal-Mart's impact on local revenue and expenditure instruments in Ohio, 1988–2003. *Atlantic Economic Journal* 35, 77–95.
- Holmes, M., 2011. The diffusion of Wal-Mart and economies of density. *Econometrica* 79, 253–302.
- Kuminoff, N., Pope, J., 2012. 'Rosen bias' in the willingness to pay for nonmarket goods. *Mimeo*.
- Li, M., Brown, H., 1980. Micro-neighbourhood externalities and hedonic housing prices. *Land Economics* 56, 125–140.
- Lim, J., Missios, P., 2007. Does size really matter? Landfill scale impacts on property values. *Applied Economic Letters* 14 (10), 719–723.
- Lin, J., 2013. The effect of voluntary brownfields programs on nearby property values: evidence from Illinois. *Journal of Urban Economics* 78, 1–18.
- Linden, L., Rockoff, J.E., 2008. Estimates of the impact of crime risk on property values from Megan's laws. *The American Economic Review* 98 (3), 1103–1127.
- Neumark, D., Zhang, J., Ciccarella, S., 2008. The effects of Wal-Mart on local labor markets. *Journal of Urban Economics* 63, 405–430.
- Palmquist, R.B., 2005. Property value models. In: Mäler, Karl-Göran, Vincent, Jeffery R. (Eds.), *Handbook of Environmental Economics*. Amsterdam, North-Holland.
- Parmeter, C., Pope, J., rmetter et al., forthcoming. Quasi-experiments and hedonic property value methods. In: List, John A., Price, Michael K. (Eds.), *Handbook on Experimental Economics and the Environment*. Edward Elgar Publishing, Northampton, MA.
- Pew Research Center for the People and the Press, 2005. Wal-Mart a Good Place to Shop But Some Critics Too. <<http://www.people-press.org/report/265/wal-mart-a-good-place-to-shop-but-some-critics-too>>.
- Pope, J., 2008. Fear of crime and housing prices: household reactions to sex offender registries. *Journal of Urban Economics* 64 (3), 601–614.
- Ridker, R.G., Henning, J.A., 1967. The determinants of residential property values with special reference to air pollution. *Review of Economics and Statistics* 49 (2), 246–257.
- Rosen, S., 1974. Hedonic prices and implicit markets: product differentiation in pure competition. *Journal of Political Economy* 82 (1), 34–55.
- Sirpal, R., 1994. Empirical modeling of the relative impacts of various sizes of shopping centers on the values of surrounding residential properties. *Journal of Real Estate Research* 9 (4), 487–505.
- Smith, V.K., Poulos, C., Kim, H., 2002. Treating open space as an urban amenity. *Resource and Energy Economics* 24, 107–129.
- Sobel, R., Dean, A., 2008. Has Wal-Mart buried mom and pop? The impact of Wal-Mart on self employment and small establishments in the United States. *Economic Inquiry* 46, 676–695.
- Vandegrift, D., Loyer, J., Kababik, D., 2011. The effect of Walmart on the tax base: evidence from New Jersey. Unpublished Manuscript.