Examining the Cash-Only Price Discount and the Driving Forces of Cash-Only Transactions in the Housing Market

Youngme Seo¹ · Cynthia Holmes¹ · Mark (Seung Hwan) Lee²

Accepted: 18 November 2020/Published online: 26 July 2021

© Crown 2020

Abstract

This paper investigates the effects of cash-only transactions on residential property values before, during and after the financial crisis. Using a comprehensive database of residential property sales in Tallahassee, FL from 2006 to 2015 and a propensity score matching model, we find that, on average, cash-only transaction is associated with a 4.9% discount to the overall housing price. Further analyses reveal that the cash-only discount is present only in the lower-price segment after the financial crisis. Although cash-only transactions are more common for distressed, investor-purchased and rental properties, we find no significant cash-only price discount for these property categories except for the lower-priced segment. Overall, we demonstrate that cash-only price discounts are less contingent on the distressed status, but more so driven by the increased supply and attractiveness of lower-priced homes by investors.

Keywords Cash-only transaction · Cash discount · Residential real estate · Financial crisis

Introduction

Cash-only transactions have become more common in the residential housing market. According to Corelogic,¹ Boesel, 2015, 2016 the rate of cash-only transactions increased from 15% to 32% from 2008 to 2015. Coates et al. (2016) similarly report that cash-only transactions have been increasing since 2010. One of the most compelling explanations for the growth of cash-only transactions is that the high volume of foreclosures after the financial crisis have stimulated the sale of distressed properties (Allen et al., 2018; Tidwell et al., 2018; Mills et al., 2019). In addition, the frequency of

¹<https://www.corelogic.com/blog/2015/08/cash-sales-accounted-for-32-percent-of-all-home-sales-in-may-2015.aspx>

✉ Youngme Seo
ymseo@ryerson.ca

cash-only transactions may depend on mortgage availability and extraneous market conditions. Sellers may favor cash-only transactions to avoid the risk that a buyer will not be able to obtain mortgage financing. This risk is amplified when market conditions make underwriting standards tighter and regulations more stringent. In addition, a cash-only offer closes more quickly than one with a mortgage, expediting the transaction cycle. These benefits of a cash-only offer may place downward pressure on the transaction price (Asabere et al., 1992).

In response, investors have turned their attention to the housing market as an investment opportunity. These investors are likely to rely on cash-based transactions as it allows them to have easier access to low-cost and foreclosed homes (e.g., via auctions); the lack of reliance on mortgages allow them to be more competitive against other bidders (Mills et al., 2019; Allen et al., 2018). Allen et al. (2018) note that investors tend to purchase lower-priced and distressed homes to presumably capture cash flow from renting while potentially enjoying the benefits of property value appreciation.

In this study, we seek to identify the main factor that drives cash-only discounts. In the previous literature, the cash-only price discount has been defined as the difference in the price of homes between homes purchased via a mortgage vs. cash (Asabere et al., 1992). Estimating the cash-only price discount is challenging due to the confounding factors associated with such transactions (Jauregui et al., 2017). For instance, cash-only transactions are more common for distressed and lower-priced homes, and the hedonic price model is not effective in ruling out such confounding factors (Jauregui et al., 2017; Tidwell et al., 2018). To resolve this issue, we take a propensity matching approach using a dataset of 26,211 residential sales in Tallahassee, Florida. We include both distressed and non-distressed homes in our inquiry, and extend our analyses to examine investor-purchased homes and rental properties. We also compare the cash-only price discount across lower-, medium- and higher-price homes to gain further insights about the type of transactions that are most sensitive to cash-only price discounts. Further, to measure how market conditions affect cash-only transactions and discounts, we use a wider timeframe from 2006 to 2015 to deliberately include transactions that took place before, during, and after the financial crisis.

We find that cash-only transactions are more common for lower-priced, distressed, investor-purchased and rental properties, as expected. Cash-only transactions are associated with smaller and older houses in marginalized neighborhoods, particularly when mortgage credit availability is constrained (during the post-crisis period). On average, there is a cash-only price discount of 4.9%. Upon further investigation of price categories, only the lower-priced segment had a significant cash-only price discount, and the magnitude of the discount varied depending on the timeframe. Specifically, the data revealed the discount to be 5.87% in the years preceding the crisis, 13.66% during the crisis, and 22.72% after the crisis. Interestingly, we did not find cash-only price discounts for medium- and higher-price properties. Distressed and rental properties have a statistically significant cash-only price discount in comparison to the counterparts of non-distressed properties, particularly for the low-price segment and the post-crisis period. On the other hand, there are no significant cash discounts for investor-purchased rental properties.

We contribute to the literature by demonstrating that cash-only price discounts are not related to whether the property is distressed or not, but are driven by the increased

supply and attractiveness of lower-priced homes by investors. We find that this is more apparent after the crisis, as low-income households face more difficulty in accessing mortgage financing; this creates increased investment opportunities for investors in the lower-priced segment. The propensity matching score empirical approach enables the estimation of cash-only price difference by directly comparing price range and property categories while controlling for confounding factors. Finally, we investigate the dynamic variability of cash-only transactions in different time periods, allowing us to examine cash-only price discounts across various market conditions.

The remainder of the paper is organized as follows. Sections 2 and 3 provide an overview of the existing literature and the dataset. Section 4 discusses the empirical procedures including the propensity score matching method. Section 5 presents the corresponding results. Finally, we conclude with key insights and implications.

Theoretical Backgrounds and Prior Literature

In a real estate context, “Cash is King” is a widely accepted idiom due to the advantages associated with non-mortgage-based, cash-only transactions (Nason & Patel, 2016). Indeed, cash-only transactions have risen steadily in recent years as investors have responded to market cycles and opportunities to acquire properties at a lower price (Coates et al., 2016). To the sellers, cash-only transactions have benefits such as lower transaction costs, reduced risk and a shorter closing period (Asabere et al., 1992). To the buyers, cash-only transactions are favorable because they increase the probability of winning the bid and a likelihood of a cash-only price discount (Coates et al., 2016).

Asabere et al. (1992) report that cash-only transactions in the residential market are associated with a 13.4% discount in the sales price. They also find that cash-only transactions are more likely to occur in marginalized neighborhoods and are not correlated with interest rates. Lusht and Hansz (1994) find a 16% discount on the sales price for cash-only transactions and conclude that it is unrelated to the shortened closing period. They posit that the magnitude of the discount is largely determined by the buyer’s ability to obtain debt financing. However, their results may have been impacted by external market conditions; cash offers were relatively high due to the declining housing market in their specific residential area of interest.

Some view the increased frequency of cash-only transactions as temporary, while others argue that cash-only transactions are dependent on certain financing and market conditions (Garvey, 1992). As mortgage underwriting standards tighten, more buyers have used cash-only transactions for investment purposes (Rioja, 2017). In Asabere et al. (2015)’s work, the authors estimate the discount associated with cash-only transactions using 55,278 sales of foreclosed homes from 1999 to 2008 in the Dallas/Fort Worth area. They found varying cash-only price discounts across different price ranges. Specifically, their results reveal a discount of 10% for all sales, 8% for sales below the median price, and 4% for sales above the median price.

In contrast to Asabere et al. (2015)’s findings, Hansz and Hayunga (2016) report a 4% premium (not a discount) for cash-only transactions for expensive homes in a golf resort community in Pinehurst, North Carolina. They also find that cash buyers were willing to pay 14% more for homes with a golf course view, which implies that in some

markets, cash-only offers may be used as a bidding war strategy. However, their limited timeframe of 2002–2004 may not consider the dynamic market conditions.

Several papers have noted that the hedonic price model is limited in ruling out the confounding factors associated with cash-only transactions (Jauregui et al., 2017; Tidwell et al., 2018). For instance, Jauregui et al. (2017) argue that cash payments are not random but are subject to systematic confounding factors including buyer characteristics, market conditions, as well as location. Jauregui et al. (2017) use propensity score matching and sample selection models to examine the influence of distances to environmental amenities and neighborhood level income on cash transactions. They find that there are variations in observed cash discounts and large cash discounts are detected in areas that are located within close proximity to environmental hazards.

Tidwell et al. (2018) investigate the differences in cash discounts for distressed and non-distressed properties. They employ a sample selection and dual sample selection models to control for potential confounding selectivity and spatial biases in their analyses. Their sample includes both distressed and non-distressed, examining the boom period of 2003/2004 and the bust period of 2010/2011 in San Diego, CA. In their study, the sample selection models demonstrate that discounts for distressed properties significantly increased from 1% in the pre-recession time period to 6% in the post-recession time-period, while cash discounts decreased 13% in the pre-recession period to 6.5% in the post-recession period. The dual sample-selection model results also show that there is a significant reduction in the cash discount for distressed properties between pre- and post-recession, while the cash discount for non-distressed properties remained consistent during these periods. They explain cash discounts increase as the supply of distressed properties increases, and cash discounts decrease as the supply of cash buyers of distressed properties increases.

However, we expect sellers will prefer cash transactions in lower-priced segments. As shown in Fig. 1, we conjecture that an increased supply of distressed properties from S pre to S' post-crisis and subsequently lower-priced homes is an attractive target for cash-only transactions for investment purposes. Therefore, we hypothesize that cash-only price would decrease from CP to CP' and lower cash price increases cash-only transactions and a higher cash-only price discount as distressed properties and lower-priced homes increase. In contrast, as demand for distressed properties increases and investors purchase a large number of distressed properties, cash price would move up to CP'' . In addition, we assume that cash-only discounts are more pronounced post-crisis when mortgage credit availability is restricted (Garvey, 1992; Rioja, 2017). Thus, we aim to investigate the impact of cash transactions on homes of various price ranges and status type (distressed, investor-purchased, and rental) by considering a longer time frame before, during, and after the financial crisis.

Data

We utilize a database of residential sales from Tallahassee, Florida from 2006 to 2015. Figure 2 presents the locations of the transacted homes, with most of the sales located near the center of town (near Florida State University and the State Capitol Complex) and along the major routes in the north surrounded by residential neighborhoods.

Fig. 1 Relationship between the quantity of distressed properties and cash discounts. Note: Fig. 1 displays the relationship between the quantity of distressed properties and cash discounts. X axis represents the quantity of distressed properties, while Y axis indicates the size of the cash discount. As the quantity of distressed properties increases from S pre-crisis to S' post-crisis, the cash discount increases from C_d to C'_d

In preparing the dataset, we constructed a unique dataset by merging the regional multiple listing service (MLS) database and the residential property sales data obtained from the Leon County Property Appraiser office. The MLS data included information on whether the sale was cash-only or not, the property address, the transaction details (the sales price, list price, relevant dates and other items), the property's physical characteristics (including the number of bedrooms, number of bathrooms, square

Fig. 2 Residential property sale observations by location in Leon County. Note: Fig. 2 presents the locations of the transacted homes in the city of Tallahassee, Florida from 2006 to 2015

footage and other items), and the zip code. The initial MLS data contained approximately 40,000 sale records. We excluded transactions located in zip codes with fewer than 500 transactions. We also excluded properties with a sales price greater than \$1,000,000 and less than \$10,000 to remove outliers. We also deleted transactions with missing sales information and those that were unmatched between the MLS data and the Leon County Property Appraiser office's database. In the end, the final database contained 26,211 observations.

The Leon County Property Appraiser data included information pertaining to the buyer and seller names, their addresses, and transaction details. The address information allowed us to geocode and identify the census block group for each sale. To complement this, we used the 2013 American Community Survey to extract neighborhood characteristics. We included the neighbourhood unemployment rate, vacancy rate, median income, percentage of white population, and the percentage of residents with bachelor's degrees. Using a geographic information system program, we determined the distance from each property to the center of Tallahassee and ascertained if the property was within 500 ft of a major road or railroad.

We classified properties as distressed if the real estate listing identified the property as REO, bank approved short sale, short sale potential, soon to be foreclosed, or foreclosed. This classification resulted in approximately 13% of transactions coded as distressed in our dataset. Using the buyer's name from the Appraiser data, we categorized the buyers as an investor if we uncovered one of the following text strings in the buyer's name: LLC, Property, Homes, Banks, Trust, Construction, Venture, Tallahassee and Federal. We also classified the buyer as an investor if they performed more than five transactions during the study period. We found that 7% of the transactions were classified as having an investor as the buyer. In line with previous studies, we compare the property location to the owner's mailing address to identify rental properties. If the property address was different from the property owner's address, the property was categorized as rental properties (Wang et al., 1991). Finally, the MLS listing identified whether or not the property was vacant.

Figure 3 demonstrates that cash-only transactions in our database were stable and consistent around 12% from 2006 to 2009. The rate of cash transactions increased quickly in 2009 and 2010, and then settled at about 29% in 2011–2015. In our study, the pre-crisis timeframe is defined to be from the beginning of our sample in 2006 to August 2008. We define the crisis period to begin in September 2008 when the situation at Fannie Mae, Freddie Mac and Lehman Brothers came to the forefront and the Dow Jones index dropped over 500 points. As described in Hartley (2010), mortgage delinquencies continued at record-high rates through 2010, so we include this year as part of the crisis period. Our post-crisis period is therefore defined as the years 2011–2015. Figure 2 demonstrates the relationship between the average housing price in Tallahassee, FL and the volume of cash transactions by year. The housing price peaked in 2007 then gradually declined until 2011. It then stabilized, but slightly increased through 2015.

Li and Goodman (2014) document the degree of residential mortgage availability using a measure referred to as the HCAI (Urban Institute's Housing Finance Policy Center Credit Availability Index). The HCAI measures the amount of default risk taken on by mortgage lenders through product risk (e.g., subprime loans would have more product risk than a standard amortizing mortgage) and through borrower risk. Lower

scores at a given time frame mean that lenders are taking a smaller amount of risk, which implies that mortgage credit is less accessible. During our timeframe, the average HCAI score is at 7.5%, with a range between 16.8% (first quarter of 2006) and 4.6% (third quarter of 2013) (See Fig. 4). The HCAI demonstrates that mortgage credit became less accessible as time progressed from the pre-crisis, the crisis, and the post-crisis periods. In particular, product risk declined dramatically by year 2008.

Figure 5 provides a breakdown of the proportion of cash-only transactions by timeframe for all observations, and then broken down by property transaction types (distressed, vacant, investor status, and rental). The rate of cash-only transactions grows from the pre-crisis to the crisis and the post-crisis periods. Distressed properties and rental properties have a higher rate of cash-only transactions than the average. Notably, the largest rate of cash-only transactions and the largest increase in the rate are seen for the investor category; the cash-only transaction rate grew from 30% before the crisis to 73% after the crisis.

As shown in Fig. 6, we break down the sales price into three categories (lower, medium, higher) annually. After removing observations with a sales price below \$10,000 and above \$1,000,000, we created three categories for each year using the quantile category function in the Stata statistical software. Therefore, the category boundaries vary by year and are driven by the sales conditions for that year. For example, the lower price category includes properties with prices from \$10,000 to \$125,070 in 2006, from \$10,000 to \$85,792 in 2010, and from \$10,000 to \$73,158 in 2015. The lower-priced category revealed the highest frequency of cash-only transactions. In particular, the lower-priced distressed properties, the lower-priced rentals and the lower-priced properties purchased by investors have the highest proportion of cash-only transactions. When comparing the rate between the medium priced and the high-priced properties, the differences were marginal.

Table 1 reports the means and standard deviations for all sales, cash-only sales, and sales with financing. Of the 26,211 transactions recorded in our database, 5673 of them were cash-only, representing 22% of the transactions. Relative to the sales with

Fig. 3 Percentage of cash-only transactions & housing price by year. Note: Fig. 3 displays the relationship between the average housing price and the volume of cash transactions by year. The average housing price and the volume of cash transactions are calculated based on the Tallahassee MLS dataset

Fig. 4 HCAI: mortgage credit availability index: default risk taken by the mortgage market. Note: Fig. 4 is obtained from Urban Institute and is modified by the authors. The sources of data are eMBS, CoreLogic, HMDA, IMF, and Urban Institute. Figure 4 indicates mortgage availability and default risk from product and borrower risks

financing, cash-only transactions have a lower mean price, have a smaller mean square footage, is older, have fewer bedrooms, bathrooms, and fireplace. Across the property types, cash-only transactions are more frequent for condominiums compared to single-family detached homes and townhouses. Cash-only transactions are seen more often with distressed properties and rental properties. They are also more prevalent for investors. The median income in the census block group is lower for cash-only sales relative to financed sales on average.

Table 2 reports descriptive statistics of the variables used for our analyses broken down by property status of distressed, vacant, investor and rental. The results confirm that cash-only transactions are more prevalent for smaller and older properties, and in marginalized neighborhoods even among distressed, vacant, investor, and rental properties. Overall, we see that 42% of distressed properties are acquired as cash-only, compared to 19% of vacant properties, 62% of investor purchases and 40% of rentals. The table also documents the degree of overlap across our property status variables. Notably, 32% of investor purchases are distressed properties while 73% are rentals.

Fig. 5 Prevalence of cash-only transactions by property status and by timeframe. Note: Fig. 5 provides a breakdown of the proportion of cash-only transactions by timeframe for all observations, and then broken down by property transaction types (distressed, vacant, investor status, and rental)

Fig. 6 Prevalence of cash-only transactions by property status and by price category. Note: Fig. 6 provides a breakdown of the proportion of cash-only by property transaction types (distressed, vacant, investor status, and rental) and then we break down the sales price into three categories (lower, medium, higher) annually

There is also a sizeable overlap between rentals and distressed properties; 40% of distressed properties are rentals and 18% of rentals are distressed.

Empirical Approach

The goal of our empirical approach is to estimate the unbiased cash-only discount after controlling for the underlying confounding factors including more frequent cash-only transactions for distressed properties in varying certain market conditions along with physical and neighborhood characteristics. We compare the sales price of the same property through both a cash-only transaction, denoted as $Y_i(1)$ and a mortgage-based transaction, denoted as $Y_i(0)$. However, this is not possible for the property to be transacted by both cash and mortgage.

Alternatively, we compare the average sales price for cash-only and non-cash transactions. To estimate the difference between selling price with and without the cash transaction, the equation is expressed as follows:

$$E(\delta_i) = E(Y(1)|X = x, C = 1) - E(Y(0)|X = x, C = 0) \quad (1)$$

Where $E(\delta_i)$ is the expected average price difference between cash-only and non-cash transaction, known as the average treatment effect (ATE), for each sale, i , X is a vector of physical conditions including the number of bedrooms, the number of bathrooms, the square footage of the property size, age of the house, and fireplace, as well as neighborhood characteristics including percentage of white population, unemployment rates, vacant rates, and household median income. C is the indicator of cash-only transactions, and 0 and 1 correspond to non-cash and cash-only transactions, respectively.

However, the average treatment effect (ATE) is useful to evaluate the expected effect on the outcome if individuals in the population were randomly assigned to a treatment (Heckman et al., 1997). As noted earlier, the cash transactions occur for

Table 1 Descriptive statistics

Variable	Description	All sales		Cash sales		Non-cash sales	
		Mean	Std.	Mean	Std.	Mean	Std.
Price	Sale price	\$193,389	\$120,995	\$146,256	\$126,927	\$206,408	\$115,979
sqf	Floor size in square feet	1718.05	716.99	1529.48	700.73	1770.14	712.69
ln_living	Log of total living size	7.373	0.383	7.245	0.413	7.409	0.367
CND	1 for condominium; 0 otherwise	0.076	0.265	0.166	0.372	0.051	0.221
TWN	1 for townhouse; 0 otherwise	0.163	0.369	0.639	0.480	0.794	0.404
DET	1 for detached; 0 otherwise	0.761	0.427	0.195	0.396	0.154	0.361
ln_age	Log of house age	2.592	1.217	2.824	1.151	2.528	1.227
year_built	Average year built	1989	17	1986	19	1989	17
Bedrooms	Number of bedrooms	3.106	0.762	2.883	0.827	3.167	0.731
Bathrooms	Number of bathrooms	2.309	0.748	2.167	0.790	2.349	0.731
Fireplace	1 if fireplace; 0 otherwise	0.583	0.493	0.455	0.498	0.619	0.486
Vacant	1 for vacant house sales; otherwise 0	0.109	0.311	0.097	0.296	0.112	0.316
Water	1 for houses with water view; 0 otherwise	0.026	0.159	0.026	0.159	0.026	0.159
dis_center	Distance to Tallahassee center in feet	28,552	16,887	24,233	16,980	29,745	16,665
Major road	1 for houses within 500 ft to major roads; 0 otherwise	0.119	0.324	0.152	0.359	0.110	0.313
Railroad	1 for houses within 500 ft to railroad; 0 otherwise	0.033	0.179	0.045	0.207	0.030	0.170
%_ba	Percentage of households with bachelor degree in the block group	0.283	0.100	0.268	0.108	0.286	0.097
ln_inc	Log of median income	10.949	0.582	10.735	0.651	11.009	0.547
%_white	Percentage of white population in the block group	0.299	0.107	0.291	0.126	0.301	0.101
%_unemp	Percentage of unemployment in the block group	0.056	0.054	0.069	0.062	0.053	0.051
%_vacant	Percentage of vacant properties in the block group	0.095	0.077	0.114	0.084	0.090	0.073
Distressed	1 for distressed house sales; otherwise 0	0.131	0.338	0.253	0.435	0.098	0.297

Table 1 (continued)

Variable	Description	All sales		Cash sales		Non-cash sales	
		Mean	Std.	Mean	Std.	Mean	Std.
Invest	1 for investor-purchased; otherwise 0	0.067	0.250	0.192	0.394	0.032	0.176
Rent	1 for rented house sales; otherwise 0	0.266	0.442	0.494	0.500	0.203	0.402
b_risk	Housing credit availability index	7.978	3.490	7.005	2.941	8.246	3.581
Cash	1 for house sales with cash; otherwise 0	0.216	0.412				
Obs.		26,211		5673		20,538	

Note: This table reports the means and standard deviations for physical and neighborhood characteristics, and other variables. All sale transactions are included in the first column, the second column includes only those transactions that were cash-only and the final column has all transactions that were not cash-only, meaning that a mortgage was present

Table 2 Descriptive statistics; mean values for all sales, distressed, investor-purchased and rental properties

Variable	Distressed		Investor-purchased				Rental		
	All	Cash	Non-cash	Investor-purchased		Rental			
				All	Cash	Non-cash	All	Cash	Non-cash
Price	\$127,902	\$81,403	\$161,135	\$115,797	\$89,346	\$159,653	\$127,433	\$95,504	\$148,858
sqf	1594.90	1359.81	1762.93	1362.73	1275.18	1507.89	1326.89	1247.16	1380.39
ln_living	7.295	7.142	7.404	7.136	7.075	7.237	7.131	7.065	7.176
CND	0.086	0.160	0.034	0.194	0.201	0.182	0.207	0.256	0.174
DET	0.708	0.599	0.786	0.589	0.557	0.641	0.501	0.478	0.516
TWN	0.206	0.241	0.181	0.217	0.242	0.176	0.292	0.266	0.310
ln_age	2.854	3.163	2.634	2.877	3.089	2.524	2.658	2.954	2.460
year_built	1987	1982	1991	1983	1982	1986	1986	1983	1988
Bedrooms	3.049	2.821	3.211	2.828	2.697	3.047	2.748	2.633	2.825
Bathrooms	2.276	2.084	2.412	2.093	1.994	2.257	2.102	1.994	2.174
Fireplace	0.468	0.334	0.564	0.320	0.303	0.348	0.349	0.285	0.392
Vacant	0.079	0.068	0.087	0.097	0.092	0.106	0.122	0.106	0.133
Water	0.020	0.015	0.024	0.011	0.012	0.009	0.013	0.013	0.012
dis_center	27.563	22.764	30.994	20.036	19.243	21.352	20.567	19.349	21.385
Major road	0.146	0.200	0.108	0.178	0.198	0.146	0.164	0.187	0.149
Railroad	0.055	0.070	0.044	0.062	0.080	0.033	0.054	0.068	0.045
%_ba	0.263	0.248	0.273	0.250	0.250	0.249	0.256	0.250	0.261
ln_inc	10.836	10.638	10.977	10.539	10.521	10.569	10.559	10.473	10.617
%_white	0.275	0.263	0.284	0.265	0.271	0.254	0.275	0.272	0.277
%_unemp	0.068	0.082	0.057	0.088	0.084	0.096	0.081	0.084	0.078
%_vacant	0.106	0.118	0.097	0.123	0.129	0.112	0.126	0.135	0.119
Distressed		NA		0.318	0.421	0.147	0.198	0.324	0.113

Table 2 (continued)

Variable	Distressed		Investor-purchased			Rental	
	All		Cash	Non-cash	All	Cash	Non-cash
Invest	0.162		0.320	0.048			
Rent	0.401		0.634	0.235			
b_risk	6.275		5.963	6.499	0.726	0.754	0.678
Cash	0.417				7.243	6.433	8.586
Obs.	3438		1433	2005	0.624	1091	658
					1749	2801	4174
					6975		

Note: This table reports the mean values for physical & neighborhood characteristics and other variables. Only transactions on distressed properties are included in the column headed “Distressed” and the means for all transactions on distressed properties, cash-only distressed transactions and non-cash-only distressed transactions are included. Similarly, investor-purchased and rental properties are also shown

particular price ranges and property types. We use the average treatment effect on the treated (ATT) approach as suggested by literature. This is defined as follows;

$$E(Y(1)-Y(0)|X=x, C=1) = E(Y(1)|X=x, C=1) - E(Y(0)|X=x, C=1) \quad (2)$$

Equation (2) expresses the counter-factual difference in outcomes between cash and non-cash transaction. The first term is the average sales price for cash-only transaction, while the second term is the average cash-only sales price for mortgaged transactions. However, the average cash-only sales price for mortgaged transaction, which is the counterfactual mean for those being treated, $E(Y(0)|X=x, C=1)$, is not observed. To implement an identifiable statistical comparison, we assume C is independent, conditional on the observed X variables as follows:

$$\begin{aligned} E(Y(1)|C=1, X=x) - E(Y(0)|C=0, X=x) \\ = E(Y|C=1, X=x) - E(Y|C=0, X=x) \end{aligned} \quad (3)$$

If Eq. (3) holds, then there is no systemic difference in the sales price conditional on observed variables. Therefore, we can estimate the average effect of cash-only transactions on sales prices through the differences in sales prices conditional on the controlled variables X .

One popular matching approach is to balance scores through propensity score matching. The basic idea is to find the properties in non-cash transactions that are similar to those in cash-only transactions in all relevant characteristics X . The propensity score is a balancing score:

$$P(C=1|X, e(X)) = P(C=1|X) = e(X) \text{ where } C \perp X | e(X) \quad (4)$$

If the balancing hypothesis holds, observations with the same propensity score must have the same distribution of observable characteristics. That is, for a given propensity score, the observed cash-only transactions are random and distributed identically to the non-cash transactions.

To obtain the propensity score, logit or probit models are commonly used and yield similar results (Caliendo & Kopeining, 2008). We use the logit model to estimate a propensity matching score as follows;

$$P(C=1|x) = F(h(X)) = \frac{\exp(h(X))}{1 + \exp(h(X))} \quad (5)$$

In this estimation, we begin with a model that includes just the physical characteristics. Then, in other models, we add neighborhood characteristics, location, and property transaction status including distressed, investor-purchased and rental properties, as well as different market conditions in the pre, during, and post-crisis timeframes, HCAI, and quarter fixed variables. These estimations identify the major driving forces that underlie cash-only transactions.

Once the propensity scores are estimated, the matching for each transaction is constructed as a weighted average over the outcome of non-cash transactions, where the weights W depend on the distance between P_i and P_j . We use two matching methods: nearest neighbor and kernel matching. The nearest neighbor matching makes a pair based on the minimum distance. That is, $\min\|P_i - P_j\|$, while a kernel estimator is $K\left(\frac{P_i - P_j}{h}\right)$ where $K(\cdot)$ is a kernel weighted average of the outcome and h is a bandwidth. We used various bandwidths with similar results, and ultimately chose a bandwidth of 0.01.

The propensity score matching technique to estimate price differences between cash-only and comparable non-cash transactions has two major advantages over methodologies used in the previous literature including the hedonic price model (Asabere et al., 1992; Lusht and Hansz, 1994) and the sample selection model (Jauregui et al., 2017; Tidwell et al., 2018). First, the propensity matching method uses a logit model to estimate the likelihood of similarity of properties, yielding a propensity score that allows us to identify major driving forces of cash-only transactions. Second, cash-only transactions are associated with confounding factors, and this technique allows us to control for non-observable confounding factors, and to directly compare price differences. Furthermore, this technique works well even if there are only a small number of observations in a particular sub-category.

Results

Table 3 displays the results of the baseline models. There are seven models of logit models with the dependent variable being a dummy variable equal to 1 if the transaction is cash-only and 0 otherwise. Moving from models (1) to (7), we add variables to account for the physical characteristics to neighborhood characteristics along with a variety of market conditions. Panel A presents the coefficients, marginal effect and significance levels. Panel B exhibits the price differences between cash-only and non-cash transactions, based on the average treatment effect on the treated (ATT) from both the nearest neighbor matching method and the kernel method.

Models (1) and (2) report the probability of cash-only transactions and the price difference between cash-only and non-cash transactions after controlling for physical and neighborhood characteristics, respectively. We find that the condominium property type has a significantly higher likelihood of a cash-only transactions compared to townhouses and single-detached houses. Using single-family detached homes as the reference, the coefficient for condominiums is positive and significant with a marginal effect of 22.2%. The results for townhouses are similar but with a smaller magnitude. The sign for the age variable is positive, implying that older properties are more likely to involve cash-only transactions. Cash-only transactions are associated with fewer bedrooms, fewer bathrooms, no fireplace and being farther away from water. In Panel B of Model (1), using the Nearest Neighbor technique, the average sales price for cash-only transactions is \$146,256 and non-cash transactions is \$168,576, which yields a price difference of \$60,151, equal to 13.24%. We also report the results using the Kernel technique and find the cash-only discount to be 16.09%. This result is consistent with past literature, but we find cash-only discounts to be smaller in other models when

Table 3 Baseline estimate of cash-only price discount

	Panel A: logit model results							
	(1)	(2)	(3)	(4)	Estimates	SE	ME	Estimates
CND	1.143*** (17.45)	0.222*** (16.28)	0.219*** (16.28)	0.866*** (11.59)	0.761*** (10.07)	0.146*** (10.07)	0.146*** (10.07)	0.761*** (10.07)
TWN	0.264*** (5.12)	0.042*** (5.71)	0.048*** (5.71)	0.084 (1.49)	-0.063 (-1.07)	0.012 (0.038)	0.012 (0.038)	-0.063 (-1.07)
Ln_living	-0.459*** (-5.46)	-0.072*** (-1.99)	-0.028* (-1.99)	0.263** (2.81)	0.503*** (4.77)	0.038** (2.81)	0.038** (2.81)	0.503*** (4.77)
Ln_age	0.268*** (17.63)	0.042*** (17.54)	0.045*** (17.54)	0.235*** (13.63)	0.182*** (10.00)	0.033*** (13.63)	0.033*** (13.63)	0.182*** (10.00)
Bedrooms	-0.017 (-0.50)	-0.003 (-1.88)	-0.010 (-1.88)	-0.166*** (-4.54)	-0.177*** (-4.82)	-0.024*** (-4.54)	-0.024*** (-4.54)	-0.177*** (-4.82)
Bathrooms	0.020 (0.57)	0.003 (-0.27)	-0.001 (-0.27)	-0.077* (-2.14)	-0.106** (-2.96)	-0.011* (-2.14)	-0.011* (-2.14)	-0.106** (-2.96)
Fireplace	-0.347*** (-9.44)	-0.055*** (-7.02)	-0.042*** (-7.02)	-0.155*** (-3.82)	-0.146*** (-3.55)	-0.022*** (-3.82)	-0.022*** (-3.82)	-0.146*** (-3.55)
Vacant	-0.288*** (-5.57)	-0.045*** (-5.48)	-0.044*** (-5.48)	-0.205*** (-3.79)	-0.226*** (-4.15)	-0.029*** (-3.79)	-0.029*** (-3.79)	-0.226*** (-4.15)
Water	0.461*** (4.63)	0.073*** (3.43)	0.055*** (3.43)	0.373*** (3.58)	0.390*** (3.75)	0.053*** (3.58)	0.053*** (3.58)	0.390*** (3.75)
Dis_center	-0.000*** (-3.70)	-0.000*** (-1.67)	-0.000 (-1.67)	-0.000 (-0.98)	-0.000 (-1.51)	-0.000 (-0.98)	-0.000 (-1.51)	-0.000 (-1.51)
Major road	0.029 (0.62)	0.005 (1.73)	0.013 (1.73)	0.021 (0.41)	-0.002 (-0.04)	0.003 (0.41)	0.003 (0.41)	-0.002 (-0.04)
Railroad	0.316*** (3.99)	0.050*** (3.15)	0.040** (3.15)	0.125 (1.42)	0.102 (1.16)	0.018 (1.42)	0.018 (1.42)	0.102 (1.16)
%_ba		-0.200 (-0.99)	-0.031 (-0.99)	-0.123 (-0.58)	-0.014 (-0.07)	-0.018 (-0.58)	-0.018 (-0.07)	-0.014 (-0.07)
Ln_inc		-0.043 (-0.80)	-0.007 (-0.80)	-0.010 (-0.18)	-0.008 (-0.15)	-0.001 (-0.18)	-0.001 (-0.15)	-0.008 (-0.15)
%_white		-0.761*** (-4.36)	-0.119*** (-4.36)	-0.198 (-1.08)	0.259 (1.36)	-0.028 (-1.08)	-0.028 (1.36)	0.259 (1.36)
%_unemp		0.484 (1.22)	0.076 (1.22)	-0.022 (-0.05)	-0.028 (-0.07)	-0.003 (-0.05)	-0.003 (-0.07)	-0.028 (-0.07)
%_vacant		1.712*** (6.85)	0.268*** (6.85)	1.544*** (5.84)	1.441*** (5.43)	0.220*** (5.84)	0.220*** (5.43)	1.441*** (5.43)
Distressed				0.885*** (20.53)	0.811*** (18.35)	0.126*** (20.53)	0.126*** (18.35)	0.811*** (18.35)
Investor-purchased				1.338*** (23.30)	1.306*** (22.70)	0.191*** (23.30)	0.191*** (22.70)	1.306*** (22.70)
Rental				0.807*** (20.54)	0.785*** (19.91)	0.115*** (20.54)	0.115*** (19.91)	0.785*** (19.91)
Med-Priced					-0.576*** (-10.90)			-0.576*** (-10.90)
Hi-priced					-0.482*** (-6.23)			-0.482*** (-6.23)
During								
Post-crisis								

Table 3 (continued)

HCAI	(1)				(2)				(3)				(4)			
Quarter	No	Diff./%_Diff.	T-stat	Treated/ controls	No	Diff./%_Diff.	T-stat	Treated/ controls	No	Diff./%_Diff.	T-stat	Treated/ controls	No	Diff./%_Diff.	T-stat	Treated/ controls
Zip	No	Yes			No	Yes			No	Yes			No	Yes		
Const	1.5064**	(2.80)			.166	(0.22)			-3.568***	(-4.47)			-4.879***	(-5.69)		
Obs.	26,211				26,211				26,211				26,211			
Pseudo R-sq	0.062				0.070				0.135				0.139			
Log likelihood	-12,839,388				-12,732,367				-11,844,886				-11,783,075			
Panel B: propensity score matching results																
	(1)				(2)				(3)				(4)			
	Treated/ controls	Diff./%_Diff.	T-stat	Treated/ controls	Treated/ controls	Diff./%_Diff.	T-stat	Treated/ controls	Treated/ controls	Diff./%_Diff.	T-stat	Treated/ controls	Treated/ controls	Diff./%_Diff.	T-stat	Treated/ controls
Nearest neighbor	\$146,256	-\$60,151	-8.14***	\$146,256	\$146,256	-\$21,060	-7.81***	\$146,256	\$146,256	\$-19,008	-5.77***	\$146,256	\$146,256	-\$12,848		
	\$168,576	(-13.24%)		\$167,317	\$167,317	(-12.59%)		\$165,264	\$165,264	(-11.5%)		\$159,104	\$159,104	(-8.07%)		
Kernel	\$146,508	-\$23,567	-11.37***	\$146,256	\$146,256	-\$22,220	-10.99***	\$147,475	\$147,475	\$-16,671	7.47***	\$147,645	\$147,645	-\$14,350		
	\$170,075	(-16.09%)		\$168,476	\$168,476	(-15.19%)		\$164,146	\$164,146	(-11.3%)		\$161,994	\$161,994	(-9.72%)		
Panel A: logit model results																
	(4)				(5)				(6)				(7)			
	ME	Estimates	SE	ME	Estimates	SE	ME	Estimates	SE	ME	Estimates	SE	ME	Estimates	SE	ME
CND	0.126***	0.789***	(10.17)	0.127***	0.801***	(10.39)	0.131***	0.788***	(10.06)	0.131***	0.788***	(10.06)	0.125***	0.788***	(10.06)	0.125***
TWN	-0.009	-0.088	(-1.47)	-0.012	-0.086	(-1.44)	-0.012	-0.078	(-1.30)	-0.012	-0.078	(-1.30)	-0.010	-0.078	(-1.30)	-0.010
Ln living	0.071***	0.452***	(4.19)	0.062***	0.460***	(4.29)	0.064***	0.459***	(4.24)	0.064***	0.459***	(4.24)	0.062***	0.459***	(4.24)	0.062***
Ln age	0.026***	0.055**	(2.95)	0.008**	0.079***	(4.19)	0.011***	0.051**	(2.68)	0.011***	0.051**	(2.68)	0.007**	0.051**	(2.68)	0.007**
Bedrooms	-0.025***	-0.209***	(-5.54)	-0.029***	-0.205***	(-5.48)	-0.028***	-0.206***	(-5.46)	-0.028***	-0.206***	(-5.46)	-0.028***	-0.206***	(-5.46)	-0.028***
Bathrooms	-0.015***	-0.148***	(-4.02)	-0.020***	-0.140***	(-3.82)	-0.019***	-0.152***	(-4.12)	-0.019***	-0.152***	(-4.12)	-0.021***	-0.152***	(-4.12)	-0.021***
Fireplace	-0.021***	-0.102*	(-2.45)	-0.014*	-0.118***	(-2.85)	-0.016***	-0.095*	(-2.27)	-0.016***	-0.095*	(-2.27)	-0.013*	-0.095*	(-2.27)	-0.013*
Vacant	-0.032***	-0.163**	(-2.93)	-0.022**	-0.187***	(-3.38)	-0.026***	-0.160**	(-2.87)	-0.026***	-0.160**	(-2.87)	-0.022**	-0.160**	(-2.87)	-0.022**

Table 3 (continued)

[illegible]

Table 3 (continued)

Kernel	152,873	(-4.33%)	154,991	(-5.64%)	153,853	(-4.94%)
	-6.36***	-\$7994	-3.32***	-\$10,144	147,215	-\$7956
	147,290	(-5.43%)	147,377	(-6.88%)	155,171	-3.31***
	155,285		157,521			(-5.4%)

*****Notes: Panel A reports the coefficients and marginal effect from a logit model with the dependent variable equal to 1 if the transaction is cash-only and 0 otherwise. Significance levels are denoted by at the 5% level, at the 1% level and at the 0.1% level. We do not report the coefficients and marginal effects from the quarter dummies and zip code dummies but simply indicate their presence by specification with "No" and "Yes". Panel B reports the sales prices for the treated (cash-only) and control (not cash-only) under two methods for propensity score matching, nearest neighbor and kernel. The difference between these two sales prices is shown as a dollar amount and as a percentage and the significance level is indicated

we factor in these additional controls. Model (2) adds the neighborhood characteristics and finds a significant negative coefficient on percentage of white residents in the neighborhood and a significant positive coefficient on the percentage of vacant properties in the neighborhood. These results are broadly consistent with Jauregui et al. (2017). After controlling for neighborhood characteristics, the cash-only price discount is 12.59% with the nearest neighbour method and 15.19% with the kernel method.

Model (3) adds the indicator variables for distressed, investor, and rental properties and model (4) adds indicators for the property price category (with lower-priced properties being the omitted category). The result is a large positive coefficient on the distressed, investor and rental indicators, indicating an increased probability of a cash-only transaction. Relative to lower-priced homes, the likelihood of a cash-only transaction is 8.6% lower for medium priced homes and 7.4% lower for higher priced homes, confirming our empirical observation that cash-only transactions are most frequent for lower-priced homes. After controlling for both property transaction types and price range variables, the cash-only discount is 8.07% (using the nearest neighbour method) implying that such property transaction types and price categories play a critical role in determining cash-only transactions.

Models (5) through (7) use different variables to control for market conditions. Model (5) has dummy variables indicating whether the transaction took place before, during or after the financial crisis, model (6) uses the HCAI which measures mortgage availability, and model (7) includes the quarter fixed effects. Using the indicator variable for the pre-crisis period as a reference point, Model (5) reveals cash-only transactions were more likely during and after the crisis relative to before the crisis. More precisely, cash-only transactions are 15.2% more likely to occur in the post-crisis period vs. the pre-crisis period. The inclusion of these variables results in a cash-only price discount of 4.33% (based on the nearest neighbour method). In Model (6), the negative and significant result on the HCAI variable confirms that mortgage credit availability plays a significant role in triggering the probability of a cash-only transaction. The sign of HCAI is negative as expected, as low HCAI scores indicate reduced access to mortgage credit. As HCAI increases, mortgage credit is more widely available, and the likelihood of cash-only transactions decreases. Specifically, one less unit of HCAI increases the likelihood of cash-only transactions by 1.8%. Considering that HCAI declined from a peak of 16.78 in the first quarter of 2006 to a trough of 4.57 in the third quarter of 2013, the difference of 12.21 points suggests an increase in cash-only transactions of about 20%.

We also find that cash-only transactions are associated with low mortgage credit availability. This is shown directly in Model (6) with the HCAI variable and indirectly in Model (5) using the timeframe dummy variables. The results in Model (7) using the quarter fixed effect are similar to those of Models (5) and (6) and results in a cash-only price discount of 4.94% using the nearest neighbour method and 5.40% using the kernel method. This value marks the baseline for the magnitude of the cash-only price discount. We assume that the quarter fixed effects capture not only the effect of the financial crisis and the changes in mortgage availability (HCAI), but also the other market conditions such as the inventory of distressed properties and residential property market price changes. Therefore, in our subsequent analysis, we will use the quarter fixed effects to control for market conditions as we pursue additional analyses to

understand the circumstances where the cash-only price discount is higher or lower than our baseline of 4.94%.

Motivated by the previous literature and the descriptive statistics that reveal that cash-only transactions are more frequent for lower-priced properties, we investigate price discounts for cash-only transactions across three price categories within our three proposed timeframes, pre, during, and post crisis. Tables 4 to 6 reports the results of high-priced, medium-priced, and lower-priced homes, respectively. Each table has four models, with (1) being unmatched, (2) being matched with physical characteristics controlled, (3) being matched with both physical and neighbourhood characteristics controlled and (4) being matched with both physical and neighborhood characteristics plus quarter indicator variables.

In Table 4, for high-priced homes in Model (1), the results across the full timeline revealed a significant price premium (not a discount) of 4.26%. More specifically, the sales price for cash-only transactions is \$335,127 versus \$321,428 for non-cash (i.e., mortgage-based) transactions. Breaking this down by timeframe, the price premium is consistently significant across the timeframe, pre-, during the pre-crisis and post-crisis. However, when we apply our matching technique and apply the controls, we find that the significance of the cash-only price effect is no longer present during and the post-crisis period, while the cash premium remains significant the pre-crisis period, accounting for 8.82% in Model (4). Table 5 reports the similar analysis for medium-priced properties. Unlike the high-priced home category that presents a price premium, the medium-priced homes exhibit mixed results with discounts and premiums; there are discounts during and after the crisis and premiums before the crisis. However, they are not statistically significant other than the cash discounts after the crisis. After controlling for all factors, no significant price discount or premium is seen in Model (4), with one exception being that the cash-only premium before the crisis becomes prominent and is statistically significant at 5%.

Table 6 reports the results for lower-priced transactions. For Model (1) unmatched, very large cash-only price discounts are observed. Across the entire timeframe, we see prices of \$104,040 for non-cash-only transactions (with a mortgage) and just \$63,642 for cash-only transactions, a significant difference of 38.83%. A portion of this discount is attributable to physical characteristics, and when we control for this, the discount is reduced to 33.29%. Unlike the other price categories, controlling for neighborhood conditions for the lower-priced category slightly increases the discount to 34.02%. Controlling for market conditions using quarter dummies reduces the discount to 19.49% as shown in Model (4). These results indicate that the cash-only discount is largely driven by the combination of market and physical conditions. After factoring in all control variables, we observe that the cash-only discount has become a larger from 5.87% before the crisis to 13.66% during the crisis and 22.72% after the crisis. The overall cash-only price discount of 4.94% from Table 3 is the baseline, but the analysis in Tables 4 to 6 reveals that this cash-only price discount is not significantly present in the high and medium priced segments; it is the largest in the lower-priced segment and varies across the timeline.

The analysis in Table 7 focuses on distressed properties, with panels that break down the timeframes in Panel A and price category segments in Panel B. Panel A shows the results for distressed properties by timeframe, where Model (1) has the unmatched results with no controls, (2) has the matched results with just the physical characteristics

Table 4 Cash-only price discount for high price segment

	Unmatched			Matched			Observations							
	(1)			(2)			(3)			(4)				
	Treated/ controls	Diff. / %_Diff.	T-stat	Treated/ controls	Diff. / %_Diff.	T-stat	Treated/ controls	Diff. / %_Diff.	T-stat	Treated/ controls	Diff. / %_Diff.	T - stat	Untreated/ Treated	Total
Full	\$335,127	\$13,699 (4.26)	3.78***	\$335,127	\$6440 (1.96)	1.17	\$335,127	\$5465 (1.66)	0.98	\$335,127	\$10,717 (3.3)	1.95	7462	8684
Pre	\$321,428			\$328,687			\$329,662			\$324,410			1222	
	\$361,290	\$15,412 (4.46)	2.09**	\$361,290	-\$6944 (-1.89)	-0.53	\$362,053	\$26,846 (8.01)	2.26**	\$362,053	\$14,489 (4.17)	1.06	2581	2544
	\$345,877			\$368,234			\$335,207			\$347,564			378	
During	\$331,016	\$25,885 (8.48)	2.93***	\$331,016	\$20,542 (6.62)	1.50	\$331,016	\$23,132 (7.51)	1.65	\$331,016	\$112 (0.03)	0.01	1303	1583
	\$305,131			\$310,475			\$307,885			\$330,904			181	
Post	\$325,216	-\$5688 (-1.72)	0.01	\$325,216	\$9899 (3.14)	1.42	\$325,216	\$3362 (1.04)	0.48	\$325,216	\$3337 (1.04)	0.46	3816	4547
	\$330,904			\$315,317			\$321,854			\$321,879			731	
Physical	No			Yes			Yes			Yes				
Neighborhood	No			No			Yes			Yes				
Zip	No			No			Yes			Yes				
Quarter	No			No			No			Yes				

*****Notes: This table includes only transactions in the high price segment. We do not report the results from the underlying logit model with the dependent variable equal to 1 if the transaction is cash-only and 0 otherwise, but instead show only the sales prices for the treated (cash-only) and control (not cash-only). The difference between these two sales prices is shown as a dollar amount and as a percentage and the significance level is indicated by at the 5% level, at the 1% level and at the 0% level. We show which controls are included using “No” and “Yes” at the bottom of the table. The rightmost column reports the number of observations for the untreated (non-cash-only) and treated (cash-only) and total. The rows denote the timeframes, where full includes 2006 to 2015, pre-crisis is 2006 to August 2008, during the crisis is September 2008 to December 2010 and post-crisis is

Table 5 Cash-only price discount for medium price segment

	Unmatched			Matched			Observations						
	(1)	(2)	(3)	(4)									
	Treated/ controls	Diff./ %_Diff.	T-stat	Treated/ controls	Diff./ %_Diff.	T-stat	Treated/ controls	Diff./ %_Diff.	T-stat	Untreated/ Treated	Total		
Full	\$165,894	-\$2873 (-1.7)	-3.64***	\$165,894	-\$3734 (-2.2)	-3.03**	\$165,894	-\$4339 (-2.55)	-3.55***	\$165,894	-\$190 (-0.11)	7420	8759
Pre	\$168,767			\$169,628			\$170,233			\$166,084		1339	
	\$187,638	\$1674 (0.9)	1.30	\$187,638	-\$596 (-0.32)	-0.26	\$187,638	\$435 (0.23)	0.19	\$187,638	\$5293 (2.9)	2225	2568
During	\$185,963	-\$291 (-0.17)	-0.18	\$188,234			\$187,203			\$182,345		343	
	\$168,369			\$168,369	-\$4344 (-2.52)	-1.88	\$168,369	-\$2688 (-1.57)	-1.17	\$168,369	\$2031 (1.22)	1429	1605
Post	\$168,660			\$172,713			\$171,057			\$166,338		176	
	\$156,267	-\$2381 (-1.5)	-2.41**	\$156,267	-\$4174 (-2.6)	-2.87***	\$156,267	-\$2756 (-1.73)	-1.86	\$156,267	-\$1314 (-0.83)	3114	4586
Physical	\$158,648			\$160,441			\$159,023			\$157,581		653	
Neighborhood		No			Yes			Yes			Yes		
		No			No			Yes			Yes		
Zip		No			No			Yes			Yes		
Quarter		No			No			No			Yes		

*****Notes: This table includes only transactions in the medium price segment. We do not report the results from the underlying logit model with the dependent variable equal to 1 if the transaction is cash-only and 0 otherwise, but instead show only the sales prices for the treated (cash-only) and control (not cash-only). The difference between these two sales prices is shown as a dollar amount and as a percentage and the significance level is indicated by at the 5% level, at the 1% level and at the 0.1% level. We show which controls are included using "No" and "Yes" at the bottom of the table. The rightmost column reports the number of observations for the untreated (non-cash-only) and treated (cash-only) and total. The rows denote the timeframes, where full includes 2006 to 2015, pre-crisis is 2006 to August 2008, during the crisis is September 2008 to December

Table 6 Cash-only price discount for low price segment

	Unmatched			Matched			Unmatched/ Treated			Observations		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Treated/ controls	Diff./ %_Diff.	T-stat	Treated/ controls	Diff./ %_Diff.	T-stat	Treated/ controls	Diff./ %_Diff.	T-stat	Treated/ controls	Diff./ %_Diff.	T-stat
Full	\$63,642	-\$40,398 (-38.83)	-60.02***	\$63,642	-\$32,137 (-33.55)	-30.12***	\$63,642	-\$32,800 (-34.01)	-30.84***	\$63,642	-\$14,615 (-18.68)	-10.64***
Pre	\$104,040	-\$17,182 (-13.95)	-10.58***	\$95,779	-\$10,156 (-8.74)	-3.70**	\$96,443	-\$9,534 (-8.25)	-3.43***	\$78,257	-\$6,533 (-5.81)	-2.26**
During	\$105,992	-\$13,951 (-13.01)	-10.58***	\$105,992	-\$10,156 (-8.74)	-3.70**	\$105,992	-\$9,534 (-8.25)	-3.43***	\$105,992	-\$6,533 (-5.81)	-2.26**
Post	\$123,174	-\$32,030 (-26.35)	-20.59***	\$116,148	-\$26,613 (-23.35)	-10.81***	\$115,526	-\$23,470 (-20.28)	-9.30***	\$112,526	-\$13,046 (-11.60)	-4.25***
Physical	\$74,398	-\$30,111 (-40.48)	-36.86***	\$74,398	-\$26,613 (-35.79)	-10.81***	\$74,398	-\$23,470 (-31.35)	-9.30***	\$74,398	-\$13,046 (-17.53)	-4.25***
Neighborhood	\$106,428	-\$25,733 (-24.17)	-36.86***	\$101,011	-\$26,351 (-26.08)	-10.81***	\$97,868	-\$23,981 (-24.50)	-9.30***	\$87,444	-\$14,921 (-17.00)	-4.25***
Zip	\$56,834	-\$25,733 (-45.27)	-36.86***	\$56,834	-\$19,413 (-34.17)	-17.79***	\$56,834	-\$19,382 (-34.10)	-16.92***	\$56,834	-\$17,296 (-30.41)	-13.07***
Quarter	\$82,568	-\$31,171 (-37.82)	-36.86***	\$76,247	-\$25,461 (-33.41)	-17.79***	\$76,216	-\$25,431 (-33.37)	-16.92***	\$74,131	-\$23,331 (-31.20)	-13.07***
		No			Yes			Yes			Yes	
		No			No			Yes			Yes	
		No			No			Yes			Yes	
		No			No			No			Yes	

*****Notes: This table includes only transactions in the low price segment. We do not report the results from the underlying logit model with the dependent variable equal to 1 if the transaction is cash-only and 0 otherwise, but instead show only the sales prices for the treated (cash-only) and control (not cash-only). The difference between these two sales prices is shown as a dollar amount and as a percentage and the significance level is indicated by the 5% level, at the 1% level and at the 0.1% level. We show which controls are included using “No” and “Yes” at the bottom of the table. The rightmost column reports the number of observations for the untreated (non-cash-only) and treated (cash-only) and total. The rows denote the timeframes, where full includes 2006 to 2015, pre-crisis is 2006 to August 2008, during the crisis is September 2008 to December 2010 and post-crisis is

as controls, (3) has the matched results and includes physical and neighborhood characteristics and zip code, and (4) has the complete model that includes the quarter indicator variables. Model (5) is the same as (4) but includes only transactions on non-distressed properties. In model (1), we note that for distressed properties across the full timeline, the price for a cash-only transaction was \$81,403 and the price for a non-cash-only transaction was \$161,135, representing a significant 49.48% difference. However, when models include both matching and control variables, the magnitude of the cash-only price discount becomes smaller. Moving to model (2) and (3), the magnitude of the discount for the full timeframe becomes 23.87% when the physical controls are included and then 19.89% when the neighborhood controls are included. Finally, when all controls are in place, in model (4), the cash-only price discount is reduced to 14.09%. Interestingly, the results of the non-distressed properties (shown in model 5) are not significantly different from those distressed, except for the post-crisis period, and exhibit a cash-only price discount of 1.92% before the crisis, 8.10% during the crisis and 4.67% after the crisis, but none of them are statistically significant. These results are different from the findings of previous studies that the cash discount is associated with distressed properties, but we find the cash discount for such property is found only after the crisis. The changes in the magnitude of the price discount across the models reinforce the fact that these controls are necessary in the analysis to manage the confounding effects. This result confirms our theory that increased supply of distressed properties and subsequent physical deterioration after the post crisis period became an attractive target for cash-only transactions.

In Panel B, the distressed properties are analyzed across price category. In our preferred model (4), there are significant cash-only price discounts of 19.06% for distressed and 17.35% for non-distressed in the lower-priced property category. These findings suggest that in analyzing cash-only price discounts, the price category appears to be more relevant than whether the property is distressed or not. In the previous literature, larger price discounts were associated with distress, and indeed we do replicate these findings in model (1). There is no significant cash-only price discount for medium-priced distressed properties or for high-priced distressed properties. But by using the matching procedure and including the appropriate controls, we found a significant result for lower-priced distressed properties.

Results for investor-purchased properties in Table 8 report similar results to the previous distressed models. Once we control for physical and market characteristics, significance of cash-only price discount is no longer present for investor-purchased, while non-investor-purchased exhibit a significant cash discount after the crisis. As seen in Panel A, cash transactions for non-investor purchased properties is associated with 4.29% of cash discount during the full period and -6.47 after the crisis, which are statistically significant. This result is similar to the studies on investor's behavior that investors are likely to pay substantially pay more than other types of buyers, even after controlling for property distress, other property conditions (Miller et al., 2019) and pay a premium in order to obtain the targeted properties with in a short time period (Allen et al., 2018). In Panel B, the only significant cash-only price discount is in the lower-priced category where investors receive a 11.51% discount and non-investors receive 19.69%.

Table 9 for rental properties is similar to the previous findings as the significant cash discounts are observed in the low-price category as well as the post-crisis period. In

Table 7 Cash-only price discount for distressed properties

Panel A: matched & unmatched result by crisis									
	Distressed			Matched			(3)		
	Unmatched			(2)			Treated/controls		
	(1)	Treated/controls	Diff./%_Diff.	T-stat	Treated/controls	Diff./%_Diff.	T-stat	Treated/controls	Diff./%_Diff.
Full		\$81,403	-\$79,733	-24.17***	\$81,673	-\$25,606	-5.46***	\$81,958	-\$20,348
		\$161,135	(-49.48)		\$107,278	(-23.87)		\$102,306	(-19.89)
Pre		\$151,551	-\$44,134	-2.13*	\$150,203	-\$11,739	-0.48	\$159,503	-\$13,666
		\$195,685	(-22.55)		\$161,942	(-7.25)		\$173,169	(-7.89)
During		\$114,023	-\$59,601	-6.85***	\$114,023	-\$12,839	-0.97	\$118,104	-\$15,254
		\$173,625	(-34.33)		\$126,863	(-10.12)		\$133,358	(-11.44)
Post		\$74,232	-\$77,672	-22.01***	\$74,780	-\$21,748	-3.91***	\$74,762	-\$19,070
		\$151,904	(-51.13)		\$96,527	(-22.53)		\$93,832	(-20.32)
Panel B: matched & unmatched result by price									
		Treated/Controls	Diff./%_Diff.	T-stat	Treated/Controls	Diff./%_Diff.	T-stat	Treated/Controls	Diff./%_Diff.
Low		\$55,158	-\$30,777	-26.49***	\$55,341	-\$21,725	-10.75***	\$55,395	-\$19,000
		\$85,935	(-35.81)		\$77,066	(-28.19)		\$74,395	(-25.54)
Med		\$152,010	-\$5038	-2.30**	\$152,059	-\$565	-0.18	\$151,359	-\$12,041
		\$157,048	(-3.21)		\$152,624	(-0.37)		\$163,400	(-7.37)
High		\$335,322	\$26,093	1.84	\$330,727	-\$35,159	-1.29	\$331,901	\$6785
		\$309,230	(8.44)		\$365,885	(-9.61)		\$325,116	(2.09)
Physical	No				Yes			Yes	
Neighborhood	No				No			Yes	

Table 7 (continued)

Zip	No	No	Yes	No
Quarter	No	No	No	No
Panel A: matched & unmatched result by crisis				
Distressed				
Matched				
(4)				
	Treated/controls	Diff./%_Diff.	T-stat	Non-distressed
				(5)
Full	\$83,169	-\$13,645	-2.39**	Treated/controls
	\$96,814	(-14.09)		
Pre	\$165,358	-\$7623	-0.22	
	\$172,980	(-4.41)		
During	\$116,174	-\$938	-0.08	
	\$117,112	(-0.8)		
Post	\$75,932	-\$16,408	-2.39***	
	\$92,339	(-17.77)		
Panel B: matched & unmatched result by price				
Distressed				
Matched				
(4)				
	Treated/Controls	Diff./ %_Diff.	T-stat	Non-distressed
				(5)
Low	\$55,785	-\$13,140	-6.17***	Treated/Controls
	\$68,926	(-19.06)		
Med	\$152,465	-\$3040	-0.85	
	\$155,505	(-1.95)		
High	\$335,924	\$1120	0.04	
Observations				
	Unreated/	Diff./ %_Diff.	T-stat	Unreated/
	Treated			Treated
Full	2005 (18,533)	-\$5576	-1.66	2005 (18,533)
	1433(4240)	(-3.21)		1433(4240)
Pre	125(6610)	-\$4324	-0.61	125(6610)
	28(900)	(-1.92)		28(900)
During	524(3517)	-\$15,369	-1.76	524(3517)
	193(566)	(-8.1)		193(566)
Post	1351(8406)	-\$7344	-1.74	1351(8406)
	1204(2769)	(-4.67)		1204(2769)
Total				
Low	880(4774)	-\$14,557	-10.18***	880(4774)
	1129(1885)	(-17.35)		1129(1885)
Med	619(6763)	-\$1918	-1.45	619(6763)
	137(1181)	(-1.13)		137(1181)
High	432(6996)	\$14,883	2.67	432(6996)

Table 7 (continued)

Physical	Yes	\$334,804	(0.33)	\$319,985	(4.65)	62(1139)
Neighborhood	Yes			Yes		
Zip	Yes			Yes		
Quarter	Yes			Yes		

*****Notes: This table includes only distressed properties in specifications (1) to (4) and only non-distressed properties in specification (5). We show only the sales prices for the treated (cash-only) and control (not cash-only). The difference between these two sales prices is shown as a dollar amount and as a percentage and the significance level is indicated by at the 5% level, at the 1% level and at the 0.1% level. We show which controls are included using “No” and “Yes” at the bottom of the table. The rows in Panel A denote the timeframes, where full includes 2006 to 2015, pre-crisis is 2006 to August 2008, during the crisis is September 2008 to December 2010 and post-crisis is 2011 to 2015. The rows in Panel B show the breakdown by price category. The observation numbers are distressed transactions while those in the parentheses are non-distressed

Panel A, in the post-crisis timeframe, the discounts are 37.85% in model (1) and 24.85% in Model (2), of which a portion of this is attributable to physical characteristics. Including neighborhood effects in model (2), the discount is reduced to 21.18%. Further, as seen in the analysis of distressed and investor-purchased properties, adding the market controls reduce the discount to 20.23%, and it remain statistically significant at the 5%. There is no significant cash-only price discount for rental properties before the crisis or during the crisis, and owner-occupied homes do not have a significant cash-only price discount. The analysis of price categories in Panel B again demonstrates our result that the cash-only price discount is only significant in the lower-priced category and after the crisis.

Conclusion

This paper examines the effect of housing price on cash-only price discounts. To correct potential biases due to systematic confounding factors associated with cash-only transactions, we separately run the propensity score matching method to estimate the respective cash-only price discount for different price segments, distressed, investor-purchased, and rental properties before, during and after the financial crisis. Overall, we find that cash transactions are more frequent for homes in the lower-priced segment, during and after the financial crisis. Moreover, cash-only transactions are more likely to occur in distressed, investor-purchased, and rental properties during a time with tighter mortgage availability.

On average, we find the cash-only price discount to be at 4.9%. When breaking down the magnitude of the cash-only price discount by price segment, we find that there is a significant cash-only price discount for lower-priced properties. Notably, the cash-only price discount is larger post-crisis than pre-crisis, and this is due to the increased supply of distressed properties and the evolving financial market conditions. When comparing cash discounts for distressed versus non-distressed properties, investor-purchased versus non-investor-purchased, and rental versus owner-occupied homes, we find that, cash discounts are typically larger for distressed, investor-purchased and rental properties compared to the counterparts across the different timeframe. However, we are reluctant to conclude that the larger cash discounts are as a result of the distressed properties, due to the mixed results of statistical significance. For instance, there is no statistically significant difference in the cash discount for distressed vs non-distressed throughout the study period, while statistical differences in the cash discounts for investor-purchased and rental properties are observed only in the post-crisis timeframe. On the contrary, the results of the price segment for those properties consistently indicate that there is a significant difference in the cash discount for the lower-priced homes regardless of their status. These findings lead us to conclude that an abundance of lower-priced homes impact the prevalence of cash transactions, and thus, have become an attractive target for cash-only transactions for investment purposes.

A key implication of this research is that while there may appear to be a growing incidence of cash-only transactions, and cash-only price discounts vary across price categories under certain market conditions. We contribute to the literature by finding varying effects of cash discounts based on price segmentation, specifically isolating the

Table 8 (continued)

Investor-purchased									
Unmatched				Matched					
(1)				(2)				(3)	
Zip	No			No			Yes		
Quarter	No			No			No		
Investor-purchased				Non invest		Observations			
Matched									
(3)	(4)			(5)					
Panel A: matched & unmatched result by crisis									
Full	T-stat	Treated/controls	Diff./%_Diff.	T-stat	Treated/controls	Diff./%_Diff.	T-stat	Untreated	Total
	-4.66***	\$93,863	-\$18,222	-1.84	\$160,046	-\$7175	-2.31**	658(19,880)	1650 (24,453)
Pre	0.40	\$112,085	(-16.26)		\$167,221	(-4.29)		992(4573)	
		\$195,489	\$6417	0.23	\$222,718	\$11,620	1.70	254(6486)	346 (7316)
During		\$189,072	(3.39)		\$211,098	(5.5)		92(830)	
	-0.94	\$104,190	-\$14,947	-0.72	\$172,917	-\$6863	-0.90	88(3953)	213 (4568)
Post		\$119,137	(-12.55)		\$179,780	(-3.82)		125(615)	
	-1.16	\$75,587	-\$15,978	-1.18	\$141,049	-\$9759	-2.46**	316(9441)	1133 (12,562)
		\$91,565	(-17.45)		\$150,808	(-6.47)		817(3121)	
Panel B: matched & unmatched result by price									
T-stat	Treated/controls	Diff./%_Diff.	T-stat	Treated/controls	Diff./%_Diff.	T-stat	Untreated	Total	

Table 8 (continued)

	Investor-purchased		Non invest		Observations
	Matched				
	(3)	(4)	(5)		
Low	-4.57***	\$56,707	-1.71	\$66,744	Treated 368(5288) 1160 (7526)
		\$64,080		\$83,104	
Med	-2.73***	\$155,912	-1.58	\$167,080	792(2238) 8450 (211)
		\$166,648		\$168,116	
High	0.21	\$322,485	-1.58	\$334,777	1186(77) 173 (8463)
		\$386,059		\$327,370	
Physical	Yes	Yes		Yes	64(1135)
Neighborhood	Yes	Yes		Yes	
Zip	Yes	Yes		Yes	
Quarter	No	Yes		Yes	

*****Notes: This table includes only properties purchased by investors in specifications (1) to (4) and only properties not purchased by investors in specification (5). We do not report the results from the underlying logit model with the dependent variable equal to 1 if the transaction is cash-only and 0 otherwise, but instead show only the sales prices for the treated (cash-only) and control (not cash-only). The difference between these two sales prices is shown as a dollar amount and as a percentage and the significance level is indicated by at the 5% level, at the 1% level and at the 0.1% level. We show which controls are included using “No” and “Yes” at the bottom of the table. The rows in Panel A denote the timeframes, where full includes 2006 to 2015, pre-crisis is 2006 to August 2008, during the crisis is September 2008 to December 2010 and post-crisis is 2011 to 2015. The rows in Panel B show the breakdown by price category. The observation numbers are investor-purchased transactions while those in the parentheses are non-investor-purchased

Table 9 Cash-only price discount for rental properties

Panel A: matched & unmatched result by crisis									
Rental									
Unmatched		Matched							
(1)			(2)			(3)		(4)	
Treated/controls	Diff./%_Diff.	T-stat	Treated/controls	Diff./%_Diff.	T-stat	Treated/controls	Diff./%_Diff.	Treated/controls	T-stat
Full	\$95,504 \$148,858	-\$53,354 (-35.84)	-26.31***	\$95,760 \$127,623	-\$31,863 (-24.97)	-10.56***	-\$31,154 (-24.55)	\$95,768 \$126,922	-9.62***
Pre	\$170,098 \$162,547	\$7551 (4.65)	1.70	\$170,098 \$165,304	\$4794 (2.9)	0.62	-\$3569 (-2.06)	\$170,098 \$173,667	-0.45
During	\$102,334 \$149,995	-\$47,661 (-31.77)	-9.17***	\$102,920 \$122,263	-\$19,343 (-15.82)	-1.73	-\$18,187 (-14.61)	\$106,331 \$124,518	-2.61***
Post	\$79,869 \$128,505	-\$48,636 (-37.85)	-17.87***	\$80,427 \$107,027	-\$26,599 (-24.85)	-6.06***	-\$21,619 (-21.18)	\$80,467 \$102,086	-4.58***
Panel B: matched & unmatched result by price									
	Treated/controls	Diff./%_Diff.	T-stat	Treated/controls	Diff./%_Diff.	T-stat	Treated/controls	Diff./%_Diff.	T-stat
Low	\$60,626 \$100,990	-\$40,364 (-39.97)	-43.32***	\$60,790 \$93,456	-\$32,666 (-34.95)	-23.63***	-\$30,371 (-33.35)	\$60,706 \$91,077	-20.56***
Med	\$160,883 \$167,668	-\$6785 (-4.05)	-4.67***	\$160,883 \$166,351	-\$5468 (-3.29)	-2.25*	-\$7510 (-4.47)	\$160,636 \$168,146	-3.32***
High	\$312,468 \$308,401	\$4067 (1.32)	0.45	\$314,724 \$298,777	\$15,948 (5.34)	1.27	\$2899 (0.93)	\$312,997 \$310,099	0.20
Physical	No			Yes			Yes		
Neighborhood	No			No			Yes		

Table 9 (continued)

Zip	No	No	No	Yes	No		
Quarter	No	No	No	No	No		
Panel A: matched & unmatched result by crisis							
Rental Matched (4)				Non-Rental (5)			
	T-stat	Treated/controls	Diff./%_Diff.	T-stat	Treated/controls	Diff./%_Diff.	Observations
Full	-9.62***	\$96,759	-\$15,769 (-14.01)	-4.21***	\$195,835	-\$7770 (-3.82)	Untreated 4174 (16,364) Treated 6914 (19,233)
Pre	-0.45	\$112,528	-\$5561 (-3.22)	-0.66	\$203,605	\$463 (0.18)	2740 (2869) 2060 (4680) 2455 (5218)
During	-2.61***	\$167,347	-\$19,343 (-15.82)	-1.73	\$255,533	-\$6998 (-3.22)	395 (538) 690 (3351) 1050 (3739)
Post	-4.58***	\$172,908	-\$20,697 (-20.23)	-4.19***	\$210,244	-\$4931 (-2.72)	360 (388) 1424 (8333) 3376 (10,262)
Panel B: matched & unmatched result by price							
	T-stat	Treated/controls	Diff./%_Diff.	T-stat	Treated/controls	Diff./%_Diff.	Total
Low	-20.56***	\$60,849	-\$12,098 (-16.58)	-6.74***	\$70,296	-\$16,399 (-18.92)	Untreated/ Treated 2313(3336) 4420 (4310)
Med	-3.32***	\$72,946	\$2211 (1.39)	0.83	\$86,695	-\$1332 (-0.78)	2107(974) 1323(6097) 1782 (6974)
High	0.20	\$161,052	\$18,320	1.34	\$168,534	\$11,260	459(877) 528(6924) 722 (7939)

Table 9 (continued)

Physical	Yes	Yes	\$294,413	(6.22)	\$328,679	(3.43)	194(1015)
Neighborhood	Yes	Yes			Yes		
Zip	Yes	Yes			Yes		
Quarter	No	Yes			Yes		

*****Notes: This table includes only rental properties in specifications (1) to (4) and only owner-occupied (not rentals) properties in specification (5). We do not report the results from the underlying logit model with the dependent variable equal to 1 if the transaction is cash-only and 0 otherwise, but instead show only the sales prices for the treated (cash-only) and control (not cash-only). The difference between these two sales prices is shown as a dollar amount and as a percentage and the significance level is indicated by at the 5% level, at the 1% level and at the 0.1% level. We show which controls are included using “No” and “Yes” at the bottom of the table. The rows in Panel A denote the timeframes, where full includes 2006 to 2015, pre-crisis is 2006 to August 2008, during the crisis is September 2008 to December 2010 and post-crisis is 2011 to 2015. The rows in Panel B show the breakdown by price category. The observation numbers are rental property transactions while those in the parentheses are non-rental

cash discount to the lower-priced market segment. We observe that cash-only discounts largely respond to changes in home prices, not to whether it is distressed or not. As it stands, the combination of mortgage tightness, foreclosures, and physical deteriorations impacts lower-priced properties to be more attractive as targets for cash-only transactions. We note that these characteristics are often attractive for investors, and thus, they are more likely engage in cash-only transactions. Going forward, we also acknowledge that our results may vary based on other exogenous shocks such as the COVID-19 pandemic that will likely place additional strains on the real estate market. For example, the pandemic has negatively disrupted the employment market, further reducing the number of capable buyers in the market. In response, it is likely that trends of cash-based transactions may be affected in a post-COVID-19 real estate environment. Together, our paper stands to contribute to the ongoing development of knowledge in the area of cash-discount home purchases. We believe that our findings will be useful to various constituents in a real estate transaction, including buyers, sellers, brokers, and policy makers.

References

- Allen, M. T., Rutherford, J., Rutherford, R., & Yavas, A. (2018). Impact of investors in distressed housing markets. *The Journal of Real Estate Finance and Economics*, 56(4), 622–652.
- Asabere, P. K., Huffman, F. E., & Mehdiyan, S. (1992). The price effects of cash versus mortgage transactions. *Real Estate Economics*, 20(1), 141–154.
- Asabere, P. K., Huffman, F. E., & Rutherford, R. C. (2015). The discounts associated with cash deals in the foreclosed home submarket. *Journal of Housing Research*, 24(2), 163–174.
- Boesel, M. 2015. Cash sales accounted for 32 percent of all home sales in May 2015. <https://www.corelogic.com/blog/2015/08/cash-sales-accounted-for-32-percent-of-all-home-sales-in-may-2015.aspx>
- Boesel, M. 2016. Cash sales update: June 2016. Retrieved from <https://www.corelogic.com/blog/2016/09/cash-sales-update-june-2016.aspx>
- Caliendo, M., & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys*, 22(1), 31–72.
- Coates, D., McNeill, J., & Williams, B. (2016). Estimating cash buyers and transaction volumes in the residential property sector in Ireland 2000–2014. Central Bank of Ireland Quarterly Bulletin, 3, 2016.
- Garvey, G. T. (1992). Leveraging the underinvestment problem: How high debt and management shareholdings solve the agency costs of free cash flow. *Journal of Financial Research*, 15(2), 149–166.
- Hanzs, J. A., & Hayunga, D. K. (2016). Revisiting cash financing in residential transaction prices. *Real Estate Finance, Summer*, 33–46.
- Hartley, D. (2010). The impact of foreclosures on the housing market. *Economic Commentary*, (2010–2015).
- Heckman, J. J., Ichimura, H., & Todd, P. E. (1997). Matching as an econometric evaluation estimator: Evidence from evaluating a job training programme. *The Review of Economic Studies*, 64(4), 605–654.
- InsideMortgage Finance (2013). Buyers increasingly using cash to purchase homes, some then get a mortgage as a refi. http://www.insidemortgagefinance.com/housing_pulse/findings.html.
- Jauregui, A., Tidwell, A., & Hite, D. (2017). Sample selection approaches to estimating house price cash differentials. *The Journal of Real Estate Finance and Economics*, 54(1), 117–137.
- Li, W., & Goodman, L. (2014). A better measure of mortgage application denial rates. Washington: Urban Institute.
- Lusht, K., & Hanzs, A. (1994). Some further evidence on the price of mortgage contingency clauses. *Journal of Real Estate Research*, 9(2), 213–217.
- Mills, J., Molloy, R., & Zarutskie, R. (2019). Large-scale buy-to-rent investors in the single-family housing market: The emergence of a new asset class. *Real Estate Economics*, 47(2), 399–430.
- Nason, R. S., & Patel, P. C. (2016). Is cash king? Market performance and cash during a recession. *Journal of Business Research*, 69(10), 4242–4248.
- Rioja, Y. A. (2017). Cash-only real estate transactions and property prices in San Francisco, California. *Journal of Property Tax Assessment & Administration*, 14(1), 19–39.

- Tidwell, A., Jauregui, A., Sah, V., & Narwold, A. (2018). Cash and distressed house sales price discounts: Dual sample selection spatial interdependence approaches. *The Journal of Real Estate Finance and Economics*, 56(1), 101–139.
- Wang, K., Grissom, T. V., Webb, J. R., & Spellman, L. (1991). The impact of rental properties on the value of single-family residences. *Journal of Urban Economics*, 30(2), 152–166.
- What are the Advantages to Buying a Home with Cash? 2013. Retrieved 2019. <https://www.realtor.com/advice/buy/advantages-to-buying-a-home-with-cash/>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Affiliations

Youngme Seo¹ · Cynthia Holmes¹ · Mark (Seung Hwan) Lee²

Cynthia Holmes
cynthia.holmes@ryerson.ca

Mark (Seung Hwan) Lee
lee.mark@ryerson.ca

¹ Ted Rogers School of Management, Ryerson University, Toronto, CA, USA

² Department Retail Management, Ted Rogers School of Management, Ryerson University, Toronto, Ontario, Canada