

# **MAKING THE HOUSE A HOME: THE STIMULATIVE EFFECT OF HOME PURCHASES ON CONSUMPTION AND INVESTMENT\***

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## **Abstract**

We introduce and quantify a new channel through which the housing market affects household spending: the home purchase channel. Households spend on average \$8,000 more on home-related durables and home improvements in the two years following a home purchase. Expenditures on nondurables and durables unrelated to the home remain unchanged or decrease modestly. The home purchase channel played a substantial role in the Great Recession, accounting for one-third of the decline in spending on home-related durables and home improvements from 2005 to 2010.

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## I. INTRODUCTION

Why do household consumption and the housing market move in tandem through periods of both prosperity and decline? This question has been central to macroeconomic analysis and monetary policy-making in the United States since 2000, as the aggregate economy experienced a dramatic expansion and contraction that mirrored the boom and bust in the housing market. Previous studies of this pattern have focused on the role of housing wealth in spurring household consumption through its effects on overall wealth, credit constraints, and employment.<sup>1</sup>

In this paper we propose and provide evidence for a further link between the housing market and household consumption that does not operate directly through house prices. We argue that home purchases, which experienced a boom and bust similar to that of home prices since 2000, stimulate durable consumption by raising demand for goods and services complementary to the home. This relationship follows from two main assumptions. First, owing to search frictions, households cannot find homes that match their specific tastes and stock of durable goods. Buyers therefore tailor their newly purchased home to their preferences by altering the physical structure and by buying new furnishings and appliances. Second, these alterations and purchases are at least in part irreversible. Home renovations and additions, for example, cannot be moved from one residence to the next. Many fixtures,

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<sup>1</sup> Several empirical studies have examined the relationship between consumption and housing wealth, including Case, Quigley, and Shiller (2005, 2012); Campbell and Cocco (2007); Attansio et al. (2009); Attanasio, Leicester, and Wakefield (2011); Carroll, Otsuka, and Slacalek (2011); Mian, Rao, and Sufi (2013); Kaplan, Mitman, and Violante (2016); Aladangady (2017); and Guren et al. (2020). Other studies focus particularly on the role of home equity in relaxing credit constraints, such as Hurst and Stafford (2004), Mian and Sufi (2011), Cooper (2013), DeFusco (2018), and Cloyne et al. (2019). Mian and Sufi (2014) shows that housing wealth effects extend beyond credit and consumption to employment. Finally, theoretical studies by Berger et al. (2018), Gorea and Midrigan (2018), Chen, Michaux, and Roussanov (2020), and Kaplan, Mitman, and Violante (2019) use calibrated models to explore the mechanisms by which housing wealth affects consumption.

appliances, and furnishings also complement a particular physical space, so are purchased anew after a move. Given these assumptions, aggregate consumption will expand and contract with the number of transactions during housing cycles. This “home purchase channel” is particularly potent in housing downturns, when sales tend to move more strongly with – and react proportionately more than – home prices.

Our primary analysis uses microdata on household spending and building permits to estimate the relationship between home purchases and home-related spending. We analyze expenditures reported by homeowners in the Consumer Expenditure Survey (CE) and Panel Study of Income Dynamics (PSID) between 2001 and 2013. We also analyze home-improvement activity using the building permit history of approximately nine million homes that sold between 2001 and 2013.

A great deal of household spending is tied to the home. Homeowners surveyed in the CE spend an average of \$1,370 per year on home durables and \$2,660 per year on home improvement and maintenance. This home-related spending constitutes nearly 40% of homeowners’ total durable and improvement spending of \$10,500 per year.

We use an event-study methodology to estimate both the timing and magnitude of spending responses after the purchase of a home. Home values and home purchases move in tandem, which complicates the separate identification of home value and home purchase effects in aggregate data.<sup>2</sup> Individual-level data, however, enable an analysis of homebuyers’ expenditures precisely around the date of their home purchase. This feature allows us to isolate spending by new homebuyers from spending by existing owners who have

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<sup>2</sup> The correlation of home sales and house prices in levels is between 0.75 and 0.85 and in log changes is between 0.4 and 0.5. See Online Appendix A and Online Appendix Figure OA.I for details.

experienced a change in housing wealth. The variation in the timing of home purchases further allows for time fixed effects that absorb general business-cycle fluctuations in spending. Lastly, our preferred specification makes use of the panel nature of the CE and PSID by controlling for household fixed effects. These fixed effects narrow the identifying variation to within-household differences in time after home purchase and absorb fixed household-level spending differences that relate, for example, to differences in wealth, income, or stage of life.

We estimate that homebuyers in the CE sample spend \$8,230 (measured in 2009 dollars) more on home durables and improvements from three months before through two years after the purchase of a primary residence. This includes \$2,450 of additional spending on home-related durables, which amounts to a tripling of spending when added to longer-tenured owners' \$1,130 baseline annual spending on home-related durables. Home durables spending increases particularly in the first quarter following a home purchase and remains modestly higher for six to nine months before leveling off at its long-term average by the end of the first year of ownership. Home improvement and maintenance spending also spikes in the first quarter of ownership and then remains elevated for the first year and a half of ownership. Cumulatively, home improvement and maintenance investments more than triple in the first two years after the home purchase, increasing by \$5,780 relative to longer-tenured owners' average annual investment of \$2,460. These estimates pertain to households' purchases of primary residences, for which the CE collects more precise and comprehensive information about property characteristics and expenditures than for additional properties. Households that purchase additional properties also boost home-

related spending substantially. The average purchase, whether primary residence, vacation home or investment property, leads to a \$7,750 increase in total home-related spending.

Our analyses of the PSID and building permit data confirm the substantial increase in spending after a home purchase and show minimal, if any, intertemporal substitution from the delay of pre-purchase spending. Recent homebuyers in the PSID raise their home-related spending by roughly \$10,000 in the two years following a purchase. In the prior two years, leading up to the purchase, they reduce their spending by a statistically insignificant \$940. The incidence of building permits likewise increases significantly, by three-fold, just after a home purchase. Leading up to the transaction home sellers, on average, do not reduce their improvement spending. In fact, they obtain building permits at an increasing rate beginning around nine months before a transaction, perhaps in order to prepare their properties for sale. We conclude that the new owners' home-related spending is incremental, since it does not merely replace investments that they or the seller would have made prior to the transaction.

The event-study methodology is not immune to omitted variables critiques. For instance, a shock that causes a household to buy a new home – such as a windfall increase in wealth, a job promotion that raises income expectations, or a change in family status, such as the birth of a child – may also increase durable spending even in the absence of a home purchase. One would expect that such omitted variables would cause *systematically* higher spending, even among categories that are unrelated to the home. Yet we find no evidence that recent homebuyers increase their non-home spending in either the PSID or CE sample. The detailed CE data reveal that only audiovisual goods, which we view as home-related but which the Bureau of Economic Analysis's National Income and Product Accounts (NIPA)

classify as recreational, show an increase after home purchase. By contrast, spending on nondurable goods and services, vehicles, computers, and recreational equipment is very similar between first-year and long-tenured owners and modestly lower in the three months leading up to a home purchase. These declines are more than offset by the rise in home-related spending, resulting in a substantial increase in total spending around home purchases. The fact that households' additional spending is so tightly associated with the home reinforces our causal interpretation of the main results and suggests household fixed effects are successful in absorbing omitted variables in our main analysis.

One might also wonder whether homebuyers' increase in spending relates to moving rather than to the purchase of a home. We disentangle these effects by using the PSID to contrast renters' and homeowners' spending around moves. Renters' home-related spending increases very modestly when they move, whereas recent homebuyers' spending increases substantially, as noted above. The differential responses indicate that homebuyers' spending is tied to their home purchases rather than their coincident moves.

The relationship between home purchases and spending has proven important in the aggregate, particularly during the Great Recession. Figure I shows the time series for home sales (in blue and scaled to the left axis) and for combined home durables, improvement, and maintenance spending (in red and scaled to the right axis) through the Great Recession. Home sales plunged by nearly 50% between 2005 and 2010, from 8.36 million units per year to 4.50 million units per year. Spending on home durables and home improvement and maintenance also declined drastically, falling in real terms by 12% and 28%, respectively, over the same period. These were some of the largest declines in spending across all categories in the Great Recession. Drawing on our event-study estimates for spending after

a home purchase (primary, secondary or rental property) and the decline in home sales from 2005 to 2010, we calculate that the collapse of home purchases led to a roughly \$23 billion annual decline in spending and investment during the Great Recession. This partial equilibrium aggregation excludes spending by suppliers of real estate services who earn income from home purchases and improvements, such as realtors and building contractors. Nevertheless, this channel explains one-third of the decline in spending on home durables and improvements during the housing bust.

We provide a further point of comparison to the literature on housing wealth and consumption by analyzing aggregate spending at furniture, appliance and home improvement stores by metropolitan area in the Economic Census. Previous studies find an elasticity of *non-durable* or *total* spending to housing wealth of between 0.05 and 0.30 (e.g., Case, Quigley, and Shiller 2005, 2012; Attansio et al. 2009; Mian, Rao, and Sufi 2013; Kaplan, Mitman, and Violante 2016; and Guren et al. 2020.) Using variation in housing cycles across metropolitan areas, we jointly estimate the elasticities of *home-related* spending to both home prices and home purchases. Home-related spending moves strongly with home purchases, displaying an elasticity of 0.26 in the housing boom (2002 to 2007) and 0.12 in the subsequent bust (2007 to 2012). By comparison, the elasticity to home prices is 0.29 in the boom and 0.23 in the bust. These price-elasticity estimates are at the high end of the range from previous studies, but are consistent with Mian, Rao and Sufi (2013), who document a particularly strong response of home-related spending to housing wealth. In quantifying the total impact of the home purchase and housing wealth channels on home-related spending one must also consider the size of the “shocks” to home purchases and housing wealth. Notably, the 50% decline in home purchases during the housing bust was

five times larger than the 10% decline in housing net worth (Mian, Rao, and Sufi, 2013). The housing wealth channel nevertheless had larger effects on aggregate consumption because of its breadth, which was manifest in spending declines on non-housing durables, non-durables and services. Yet the home purchase channel is a meaningful driver of *home-related* spending separate from, and complementary to, the housing wealth channel.

In addition to this connection to the literature on housing wealth and consumption, our work relates to two contemporaneous studies of home ownership and consumption. Sodini et al. (2017) use privatizations of municipal apartment buildings in Sweden to show that exogenous increases in homeownership result in greater household spending of SEK 66,000 (\$8,800) in the first four years of ownership. Best and Kleven (2018) estimate the impact of housing transaction taxes on the quantity and timing of home purchases in the United Kingdom. Using annual cross-sectional data on U.K. households they estimate that home purchases stimulate consumption, triggering additional spending of £6,400, or \$10,700, in the first two years of ownership. Our findings largely concur with these studies. We make four main contributions. First, by using panel data with household fixed effects and comparing homeowners and renters, we improve on the empirical identification of Best and Kleven (2018). Second, we validate the household survey findings on home improvements in a large administrative data sample of building permits. Third, relative to Sodini et al. (2017), our detailed consumption data allow us to characterize where new homebuyers increase their spending, thereby providing perspective on the theoretical mechanism linking home purchases and spending. Fourth and finally, by studying a representative sample of home purchases as opposed to a subset of transactions as in Sodini et al. (2017), we are able to quantify and demonstrate the aggregate importance of the home purchase channel.

The rest of the paper is organized as follows. Section II describes the data, summary statistics, and empirical methodology. Section III presents the empirical results of household spending patterns around home purchase, and presents placebo and robustness tests. Section IV explores heterogeneity in the home purchase channel. Sections V and VI provide estimates of the aggregate effect of the home purchase channel and a comparison to the effect of home prices. Section VII concludes.

## II. DATA AND METHODOLOGY

We use survey data on household spending from the Consumer Expenditure Interview Survey (CE) and Panel Survey of Income Dynamics (PSID), administrative data on building permits from the data analytics firm BuildFax, and census data on retail sales from the Economic Census.

### *II.A. Consumer Expenditure Survey*

Our primary data source is the CE, which provides monthly panel data on household spending for a random sample of nearly thirty thousand households per year. The data are ideal for our study because they combine measures of household expenditures with information on the characteristics of the home and the timing of its purchase. Survey participants remain in the sample for one year and report their expenditures retrospectively through four quarterly interviews.

We use the CE's detailed data on the timing, value, and category of expenditures to construct monthly data on purchases of durable goods and spending on home-related maintenance and improvement projects. The survey includes an extensive set of questions

about spending on durables, with separate sections devoted to home furnishings, appliances and household equipment, vehicles, and home maintenance and improvement projects. For durable goods purchased over the previous three months, households report the type of product (e.g., dining table or refrigerator), the price paid, and the month of purchase. For new and used vehicles, households report the month of purchase, the net price paid, and the value of any trade-in. Finally, for home maintenance and improvement projects, survey participants report the type of project (e.g., adding insulation or replacing siding) and their monthly spending on supplies and contractor labor. These projects include home additions and remodeling projects as well as repairs and maintenance throughout the interior and exterior of the home. We deflate all expenditures to 2009 dollars using the Consumer Price Index (CPI).

In addition to tracking household spending, the survey gathers information on home ownership that allows us to measure the time elapsed since home purchase. For each home, including the household's main residence as well as any vacation and investment properties, the survey collects the month and year the property was acquired and the estimated current value. For owner-occupied properties, the survey also collects the age and basic physical characteristics (e.g., number of bedrooms and bathrooms) of the home. We therefore focus our main analysis on the purchase of primary residences, for which we can observe and control for the age and characteristics of the home. For each household we calculate the number of months since acquiring their primary residence. In further analysis we estimate the aggregate effects of all home purchases by considering purchases of non-primary residences and investment properties as well. In that case we measure time-since purchase as the minimum time since acquisition across the household's properties.

The CE data are not without limitations and drawbacks. One limitation of the CE survey design is that it does not follow households that move after entering the sample; these households exit the sample upon moving. As a result, we observe at most three months of expenditures before a move, with pre-move spending reported retrospectively by the few households that enter the CE sample just after moving into their new residence. Our main analysis thus primarily exploits the variation in time-since-purchase for survey participants while they remain at a given residence. In these tests, we use the pre-moving expenditures to examine intertemporal substitution in the three months preceding the move, although confidence intervals widen in these months because of small sample sizes. Another limitation is that the CE data does not include the time elapsed since moving for renters. To provide additional perspective on spending around home moves for renters, we examine the Panel Study of Income Dynamics. Finally, an important drawback of consumption survey data, including the CE, is the underreporting of expenditures, particularly for durable goods and by wealthier respondents (Kojien, Vestman and Van Nieuwerburgh 2015). These shortcomings motivate, in part, our analysis of administrative data on building permits.

### *II.B. Panel Study of Income Dynamics*

Our second data source is the Panel Study of Income Dynamics (PSID), a longitudinal survey of roughly 9,000 families that provides information on home ownership, moving, and household spending between 2001 and 2013. In bi-annual interviews during this period, respondents reported their total spending on large home improvement projects (greater than \$10,000 in total cost) over the past 24 months. On a bi-annual basis beginning in 2005, respondents also reported their spending on home durables and basic home repairs over the

prior calendar year. Though the PSID does not identify home purchases per se, we assume that a household is a homebuyer when they move to a new primary residence that they own. Both homeowners and renters report their spending and the timing of their most recent move. By providing longitudinal data on a consistent set of households, the survey allows us to estimate within-household differences in spending during interview periods in which they moved compared to periods during which they remained at the same residence. The PSID data make possible two additional tests that are not feasible in the CE. First, we contrast homebuyers' and renters' spending responses during periods with a move. Second, we examine intertemporal substitution over a longer window, including multiple years prior to a purchase.

### *II.C. Building Permit Data*

Our third data source is a database of residential building permits compiled by BuildFax. City or county agencies typically require homeowners or their contractors to obtain building permits before making significant home additions and alterations. BuildFax collects these records from permitting agencies and organizes them into property-level histories of permitting activity. BuildFax reports the number of permits, broken down by the type of work: electrical, mechanical, plumbing, or structural. In some jurisdictions, BuildFax observes an estimate of the job cost submitted by the permit applicant. The data span 1990 to 2013, with BuildFax's coverage of permitting jurisdictions growing over this time period from roughly 25% to 50% of U.S. homes.

We restrict our sample to homes with a sales transaction. Using property deed data from DataQuick, we obtain the property addresses of all single-family homes with a sales

transaction between 2001 and 2013. BuildFax then matches these addresses to the permit records in its database and returns a panel dataset with the quarterly permitting activity for each property in a jurisdiction with data coverage. The matched BuildFax–DataQuick dataset includes nine million properties for which there is at least one home purchase transaction during our sample period. We analyze a random 10% sample of those properties.

While the permit data are less comprehensive than the CE data, they do provide three advantages for the study of residential improvements. First, because of the substantially larger sample of home transactions, the permit data provide more statistical power and allow for more precise inferences about heterogeneous effects. Second, the permit data cover a wider time window around home purchases. Whereas the CE data are available only three months before a home purchase, the permit data enable the study of improvements in the years leading up to a home sale. This wider time window allows us to evaluate the extent to which a property buyer’s improvements merely offset deferred improvements by the property seller. Third, the permit data are built from administrative records that do not rely on households’ recall and reporting of past spending within a retrospective survey.

#### *II.D. Economic Census Data*

Our fourth data source is the U.S. Census Bureau’s Economic Census, which measures the annual sales and employment of all businesses every five years. The most recent three surveys provide data for 2002, 2007, and 2012, which correspond roughly to the beginning, peak, and trough of the housing cycle. We examine aggregate sales by metropolitan area for retailers of home-related goods, including furniture, electronics and appliances, and building supplies. These data are useful for comparing the importance of the home purchase channel

to that of the housing wealth channel, for which existing studies typically use regression analysis of aggregate data.

### *II.E. Sample Description and Summary Statistics*

Table I presents summary statistics for the CE sample, divided into household characteristics (Panel A), property characteristics (Panel B), and household spending (Panel C). The CE sample includes all homeowners surveyed between April 2001 and March 2013. The sample includes 571,871 monthly observations for 60,642 homeowners with non-missing information on the date of home purchase.

Panel A summarizes household characteristics, and Panel B reports summary statistics on property characteristics. The average household annual income and financial asset holdings, measured in 2009 dollars, are \$77,492 and \$62,766, respectively. The typical property in our sample was purchased around thirteen years before the survey date. More than 65% of the households have a mortgage, and about 7% of the households have refinanced their mortgage in the twelve months before the survey. The average home is 36 years old and has 3 bedrooms and 2 bathrooms.

Panel C presents information on household spending that we use to construct our dependent variables in the regression analysis. The CE expenditure data are detailed and comprehensive. We classify spending as (1) home improvement and maintenance, (2) home durables, (3) non-home durables, and (4) non-durables and services. The improvements and maintenance variable includes all spending for materials, tools, and labor but excludes the cost of home appliances, which we allocate to spending on home durables. More than 75% of spending on non-home durables is on vehicles.

As Panel C demonstrates, the average spending on home improvement and maintenance is \$222 per month, amounting to \$2,660 per year, while the average spending on home durables is \$114 per month, or \$1,370 per year. The other spending categories of non-home durables and non-durables and services average \$536 and \$2,643 per month, respectively. Households make home improvement expenditures in about 18% of the months in our sample. They purchase home durables more frequently, in 29% of the household-month observations in the CE sample.

Table II shows descriptive statistics on moving and expenditures among PSID respondents. Homeowners move less often than renters. Only 14% of current homeowners (Panel A) moved residences over the prior two years whereas 56% of renters (Panel B) did so. Homeowners spend more than renters across all categories, but with disproportionate increases in home-related durable goods and projects. For example, home repair spending is ten times higher among homeowners than among renters, whereas non-home spending is only 67% higher.

Table III presents summary statistics for the building permit sample. The permitting sample includes a random 10% sample of all homes with at least one purchase transaction between 2001 and 2013. For each purchase transaction we evaluate permitting activity during a window beginning eight quarters before the transaction and ending eight quarters after the transaction. The sample includes 19,727,786 property-quarter observations on 1,287,725 transactions and 967,904 unique properties. As Panel A illustrates, the average property has 0.88 permits during the roughly 4-year window around a transaction. The estimated job cost is populated for nearly 60% of those permits. Excluding observations with missing cost data, the mean total job cost for all property-quarter observations in the data is

\$749 per quarter. Conditional on property-quarters with positive permit-related expenditure, the mean total job cost is \$42,045. This high average job cost relative to the CE reflects the fact that building permits are typically necessary for only large home improvements. Because of this, we see our analysis of the BuildFax data as supportive of the dollar figures that we find in the main CE analysis.

Panel B of Table III provides summary statistics on home characteristics. They are similar in age, number of bedrooms and number of bathrooms to those in Panel B of Table I, although the properties in the BuildFax sample are more likely to be mortgaged. This difference likely relates to the BuildFax sample selection criterion of having been purchased recently. Long tenured owners, who are more likely to have paid down their mortgage balance, are included in the CE sample but excluded from the BuildFax sample, which includes a four-year window around purchase transactions.

### III. ESTIMATING HOME-RELATED SPENDING PATTERNS FOLLOWING HOME PURCHASE

As highlighted in the Introduction, home purchases are highly correlated with home values. Time-series regressions using aggregate data fail to identify home purchase effects separately from home value effects because of this collinearity. Cross-sectional analyses using instruments that project onto both price and sales volume, such as the Saiz (2010) instrument, also cannot separate the home purchase channel from housing wealth or collateral effects.

In this paper we apply a methodology that is in essence similar to an event study. We use spending microdata at the household level, which provides additional variation to

identify home purchase effects: cross-sectional variation in spending categories as well as time-series variation measured as time since home purchase.

### *III.A. Average Consumption and Permitting Activity by Time Since Purchase*

Table IV provides a first pass at exploiting this variation by showing households' average monthly spending relative to the date they purchased their primary residence. The raw differences in spending around home purchase events are not necessarily caused by the home purchase, but they provide a useful point of departure for the subsequent analysis.

Panel A of Table IV reports average monthly spending by category in each of the first four quarters after the purchase. The final row of the table shows average monthly spending for households that purchased five or more quarters ago. All spending figures are in real terms (2009 dollars) and adjusted for inflation using the Consumer Price Index for All Urban Consumers (CPI-U) price deflator.

As Panel A of Table IV shows, the average monthly home improvement spending in the first quarter after the home purchase is \$615 compared to the mean of \$209 per month after the first year of ownership. That is, households spend nearly three times more in each of the first three months after the home purchase. Moreover, home improvement spending remains elevated in the second quarter after the purchase—spending is \$399 per month, which is nearly twice as large as the average spending beyond the first year of ownership. Spending on home improvement also remains high in the third and fourth quarters after the home purchase, at \$338 and \$297 per month, respectively.

Likewise, household spending on home durables increases dramatically in the first quarter after the purchase of a property. The average monthly spending on home durables

in the first three months after the home purchase is \$798 per month, compared to a mean \$97 per month after one year of ownership, representing eightfold greater spending on home durables. The level of spending on home durables remains higher than the mean throughout the first year after the home purchase. We also find an increase in spending on non-home durables in the year after the home purchase, but this increase is smaller than those for home improvement or home durables. For example, spending on non-home durables is \$788 per month in the first quarter after the home purchase, representing an increase of 50% over the \$525 per month spent among households beyond the first year of ownership. Finally, we observe that non-durables and services spending is lower by \$125 to \$185 per month during the first year of home ownership than it is thereafter. This difference represents a 4-7% decline relative to the \$2,656 average monthly spending on non-durables and services beyond the first year of ownership.

Panel B of Table IV compares expenditures of PSID homeowners during periods in which they moved primary residences to periods in which they did not. Owners that move to a new residence make substantially greater home-related expenditures than do non-movers. In total, they spend almost twice as much as non-movers on improvements, home repairs and home durables. By contrast, movers and non-movers spend roughly the same amount on non-home goods and services.

In Panel C of Table IV we summarize the building permit activity following home purchases. The fraction of properties with at least one permit is 7.7% in the first quarter following a purchase. The incidence of permits then falls steadily during the first year of ownership and reaches 2.6% among homes that are more than one year beyond the purchase date. The estimated total job cost displays a similar pattern, declining from an average of

\$1,292 in the first quarter following the purchase to \$506 per quarter beyond the first year of ownership.

These raw differences in spending of course may reflect selection into who purchases rather than spending caused by the home purchase itself. For example, if wealthier households both spend more on non-home durables and move more often, we would observe similar spending patterns even if durables spending were unaffected by a home purchase. Our empirical strategy aims to address this issue and provide a causal estimate of the spending responses to home purchase.

### *III.B. An Empirical Model of Spending Patterns*

The summary statistics in Table IV suggest that households spend dramatically more on home improvement and home durables immediately after purchasing a property. We now turn to a multivariate analysis of household spending and permitting activity following home purchases.

We use an event-study methodology, estimating the following regression model in the CE sample:

$$(1) \text{ Spending}_{it} = \delta_t + \theta_i + \sum_{m=-3}^{23} \beta_m 1\{\text{Months since Purchase} = m\} + \boldsymbol{\gamma}' \mathbf{X}_{it} + \varepsilon_{it},$$

where the dependent variable is spending by household  $i$  in month  $t$ . As measures of spending, we consider alternately the level of spending (dollars per month), the log of spending (natural logarithm of 1 + dollar spending), and the incidence of spending (an indicator for spending > 0). Aside from different scaling, the levels specification tends to focus on fitting large expenditures, whereas the log specification puts more weight on small purchases.

The coefficients of interest are fixed effects for each month relative to the time of the home purchase ( $\beta_m, m \in [-3, 23]$ ). These fixed effects measure the household's incremental spending in each of the 3 months before the house purchase as well as the first 24 months of home ownership relative to an excluded category of 2 or more years after purchase. Time since purchase pertains to the household's purchase of its primary residence, for which we can observe and control for the age and physical characteristics of the home. We include these property characteristics in the vector  $\mathbf{X}$ , which also includes controls for household income and wealth, as well as demographics: household size, the age of the head of household, and indicators for the head of household's marital status, retirement status, race, and education. The model also includes month-by-year fixed effects ( $\delta_t$ ) to control for common variation in spending over time, such as fluctuations through the business cycle.

Most important, our preferred specification makes use of the panel nature of the CE by controlling for household fixed effects  $\theta_i$  in addition to the control variables discussed above. These fixed effects narrow the identifying variation to within-household differences in time after purchase and absorb household-level spending differences that are driven by such factors as wealth, income, or stage of life.

We estimate the model with ordinary least squares using the sample weights provided by the CE. We calculate Huber-White standard errors with observations clustered two ways by year and by state. Most of the analysis is presented using figures that plot the  $\beta_m$  coefficients for each month relative to the date of the home purchase. Tables that provide detailed results can be found in the Online Appendix.

For the analysis of spending in the PSID we estimate the model:

$$(2) \text{ Spending}_{it} = \delta_t + \theta_i + \beta 1\{\text{Moved Residences Since Prior Interview}\} + \boldsymbol{\gamma}' \mathbf{X}_{it} + \varepsilon_{it}.$$

The dependent variable is the prior 12- or 24-month spending reported in the year  $t$  interview.<sup>3</sup> In lieu of the month-since-purchase fixed effects of Equation (1), we include an indicator for whether the household moved residences during the roughly two-year period between the current (year  $t$ ) interview and the prior interview. Similar to the analysis of the CE data, we control for household and time fixed effects ( $\theta_i$  and  $\delta_t$ ) as well as household and property characteristics ( $X_{it}$ ). For the estimation, we use PSID longitudinal sample weights to obtain nationally representative estimates and we cluster observations by state of residence and year in calculating standard errors.

Lastly, in the building permit analysis we estimate the model:

$$(3) \text{Permits}_{pt} = \delta_t + \theta_p + \sum_{q=-8}^8 \beta_q 1\{\text{Quarters Since Purchase} = q\} + \boldsymbol{\gamma}' \mathbf{X}_{pt} + \varepsilon_{pt}.$$

The unit of observation in this analysis is the property  $p$  in a quarter  $t$ . An important feature of the permitting data is that we can observe permitting in the years before a transaction, so we are able to expand the time-relative-to-purchase dummies to include each of the eight quarters before the home purchase. We measure permitting activity alternately as the incidence of a permit (per quarter), the number of permits (per quarter), the total estimated job cost (per quarter), and the log of the estimated job cost (natural logarithm of 1 + job cost). As control variables, we include quarter-by-year fixed effects ( $\delta_t$ ), property fixed effects ( $\theta_p$ ), and indicators for a property foreclosure within one year prior to the sale and for incidence of prior building permits up to one year prior to the sale date. We estimate the model by ordinary least squares and two-way cluster observations by year-quarter and state.

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<sup>3</sup> All spending is reported bi-annually in the PSID but the category of home improvements has a 24-month reporting horizon whereas home durables and home repairs have only 12-month horizons. Home durables and home repairs are also available for a shorter time period, from 2005 to 2013 compared to 2001 to 2013 for home improvements.

### *III.C. Home Durable Spending Following Home Purchase*

Figure II presents estimates from Regression (1) with a measure of home durables spending as the dependent variable and the full set of control variables. Each panel plots the  $\beta_m$  coefficients with a different dependent variable: Panel A uses the logarithm of home durables spending, Panel B uses the dollar amount of home durables spending, and Panel C uses an indicator for positive home durables spending.

The figures illustrate that home durables spending increases substantially during the year following a home purchase. As shown in Panel A, log spending increases by 1.9 log points in the month of a home purchase, 2 log points in the following month, and 1 log points in the second month after the transaction. These log differences equate to proportional increases of 575%, 660%, and 180%, respectively. Log spending remains elevated, but by smaller amounts, in the second and third quarters after the home purchase. The spending differences are statistically significant at the 5% level through the 7<sup>th</sup> month following purchase. The estimated spending response reaches zero in the 14<sup>th</sup> month after purchase. The zero coefficient indicates that the homebuyer's spending is the same as spending by homeowners who are more than two years beyond the date of their home purchase.

Panel B shows that the level of home durable spending displays a similar pattern to log spending in the months after a home purchase. Spending increases by \$918 in the month of the purchase, \$787 in the month after the purchase, and \$332 and \$205 in the subsequent two months. These increases are all statistically significant and represent substantial proportional increases above the \$94 of monthly spending typical of longer-tenured owners. Panel C shows that the incidence of home durable spending also rises around home

purchases. The propensity to spend on home durables increases by 20% in the month of the transaction and by 25% and 12% in the subsequent two months.

Figure II also shows that household spending on home durables falls in the three months prior to home purchase. For example, Panel A shows that the propensity to spend is 18%, 20%, and 15% lower in months -3, -2, and -1 relative to the home purchase, respectively. The spending patterns in these three months are consistent with some intertemporal substitution of consumption in which both buyers and sellers in a pending transaction may delay durable goods purchases until the transaction is completed. However, the analysis of dollar spending shows no difference in spending before a home purchase, and the analysis of log spending indicates that spending after the purchase dwarfs the decline before the purchase. In the analysis of log spending, the coefficients imply a cumulative spending difference of +7.51 log points in the two years after a purchase, which is 3.5 times as large as the cumulative -2.16 log point decline in the three months before the purchase. Cumulatively, the dollar spending on home durables increases by \$2,447 from the three months before a home purchase to two years after a purchase.

The estimates reported above are conditional on the full set of control variables – household and property characteristics as well as household fixed effects. In Online Appendix Figure OA.II we show how the control variables affect the estimated response of log spending. The inclusion of control variables and household fixed effects does not meaningfully reduce the magnitude of the spike in spending in the quarter of the home purchase. The control variables and household fixed effects do, however, reduce the estimated spending responses for months 3 to 12 following the purchase. Estimates of elevated log spending late in the first year of ownership—reflected in coefficients that

average around 0.2 to 0.3 for months 12 to 24 in a baseline specification without controls—decline to small and statistically insignificant differences centered around 0 after controlling for household fixed effects. Some of the elevated spending in the first year of ownership evident in the raw data, therefore, is caused by generally higher spending by households that tend to buy homes more frequently rather than by a home purchase per se. The household fixed effects eliminate that source of bias in the coefficient estimates.

#### *III.D. Home Improvement and Maintenance Following Home Purchase*

Figure III analyzes homebuyers' spending on home improvement and maintenance around home purchases. Panel A illustrates that log spending peaks one month after a home purchase and remains elevated subsequently for more than a year. The post-purchase rise in home improvements is less steep but more persistent than that of home durables. Improvement spending increases by 1 log points, 1.2 log points, and 0.8 log points in the first three months of ownership. Thereafter log spending remains elevated until 19 months after the purchase, when it hits zero. Panel B shows that the level of improvement spending also increases following home purchases. In the month of the purchase and the two months thereafter, dollar spending increases by \$618, \$634, and \$428, respectively. These increases represent more than a tripling of spending compared to the \$205 of monthly improvement spending by owners who purchased more than a year ago. As shown in Panel C, the incidence of home improvement spending likewise rises by 14%, 19%, and 13% in quarter of a home purchase and remains elevated for two years after the transaction.

In contrast to the findings for home durables, we do not observe intertemporal substitution of improvements from before to after the transaction. The point estimates

suggest spending on improvements increases in the three months leading up the purchase, though these increases are not statistically significant. In the analysis of dollar spending we observe a large but imprecisely estimated increase in spending three months prior to the transaction. Both the large coefficient and the wide confidence interval are explained by the small number of transactions for which we observe data three months before the transaction.<sup>4</sup> Within that small subsample estimation precision is low and a single large improvement expenditure exerts more influence on the estimated coefficient. Summing up the marginal spending responses for 3 months before a home purchase through 24 months after the purchase, we estimate a total spending increase of \$5,784 on home improvements and maintenance.

### *III.E. Home-related Spending Around Moves: Homebuyers Versus Renters*

An important question about the foregoing results is whether homebuyers' spending responses are prompted by moving residences or by the home purchase. The answer to this question matters for understanding the aggregate implications of an increase in home purchases. For example, during a period of high transaction volume but constant mobility, the incremental home purchases of former renters will only raise aggregate spending if home purchases, rather than moves, induce extra spending. We estimate Equation (2) on the PSID sample to separate the impact of home purchases from the impact of moving.

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<sup>4</sup> Based on the CE sample design, only the small number of households who happened to purchase their home in the month they enter the CE sample report their spending for the three months prior to purchase. This group is about one twentieth of the number of homeowners for whom we observe spending at longer tenures of ownership.

The estimation results in Table V show that homebuyers increase their spending substantially on both durables and improvements when they move whereas renters only increase their spending modestly on durables and do not spend on improvements when they move. Homebuyers spend, on average, roughly \$10,000 more on home-related durables and improvements during a two-year window with a move compared to periods without. This additional spending is composed of \$6,227 on home improvements, \$1,916 on home repairs and maintenance, and \$1,924 on home furnishings, equipment and appliances. Renters, by contrast, only increase their home-related spending by \$378 when they move. Their move-related spending is concentrated in home furnishings, equipment and appliances, on which they spend an additional \$238. Irrespective of whether they have moved, renters spend relatively little on home improvements and home repairs, which are covered by landlords.

Within the PSID sample we also investigate intertemporal substitution over a longer horizon. We find only modest reductions in housing and non-housing spending in the two years leading up to a household move, as shown in Online Appendix Table OA.VI.

The magnitudes of homebuyers' spending responses in the PSID and CE are broadly similar, though total spending is somewhat higher in the PSID. The cumulative two-year spending response for primary home purchases in the CE is \$8,231, composed of \$5,784 of spending on improvements and maintenance, and \$2,447 of spending on home durables. Homebuyers in the CE therefore increase their home durable spending by more than homebuyers in the PSID, but increase their home improvements and maintenance spending by less than homebuyers in the PSID.

### *III.F. Permitting Activity Around Home Purchases*

Figure IV displays the results from estimating Equation (3) on our BuildFax-DataQuick sample of building permits. The dependent variable is either the natural logarithm of 1 + total job cost, the total job cost in dollars or an indicator for whether the property had a building permit during the quarter. Each of these measures shows an increase in permitting activity following a home purchase. Panel A shows an increase of 0.22 log points in permit total job cost during the quarter in which a home is purchased, or an increase of 25% in permit cost. The estimated job cost is also 0.16 and 0.08 log points higher in the first and second quarters after the purchase, representing proportional increases of 17% and 8%, respectively. Panel B shows that the total job cost increases by \$731, on average, during the quarter of the home purchase and by \$820 in the first quarter after the purchase. In the second and the third quarters after the purchase, the average job cost remains elevated by \$534 and \$331, respectively. Cumulatively, the permit cost rises by \$2,650 in the two years following a purchase. Finally, in Panel C we find that the likelihood of having a permit increases by 5% during the quarter of the home purchase, followed by a 3% increase in the first quarter after the purchase and 1.4% and 1% increases respectively in the second and third quarters after the purchase.

Interestingly, permit job costs also increase *before* the purchase, suggesting that home sellers invest meaningfully in their homes before selling. For instance, the estimates displayed in Figure IV.B show an increase in activity beginning four quarters before a sale. Cumulatively, the permit cost increases by \$485 in the two years before the transaction, which is nearly one-fifth of the \$2,650 following the transaction. This pattern reveals that sellers, on average, do not intertemporally substitute by deferring maintenance on their old home before purchasing a new home and investing in it. It also suggests that, if anything, our

estimate of home improvement and maintenance in the CE is an underestimate because it does not fully account for upgrades made to sell a prior home before the purchase that we observe.

A comparison of the BuildFax and CE estimates reveals a disproportionate rise in the probability of high-cost improvements around home purchases. In particular, the CE analysis shows that the probability of making any improvement roughly doubles in the quarter after a home purchase – an increase of roughly 15 percentage points (see Figure IV.C) relative to a baseline probability of 18% for longer-tenured owners. By contrast, the probability of permitted improvements, which typically involve higher expenditures, triples in quarter of after a home purchase. That is, the probability of having a permitted job jumps by 5 percentage points (see Figure IV.C) from a baseline of 2.6% for longer-tenured owners to 7.6% for new owners in the quarter following their home purchase. The CE data corroborate this finding, as the incidence of large improvement expenditures (above \$10,000) likewise rises disproportionately – by five-fold – in the quarter after a home purchase (see Online Appendix Figure OA.III). Since large projects may be more likely to be capitalized in the value of the housing stock, this may indicate a channel by which housing market busts have a longer-lasting impact on the physical quality of the housing stock.

The permit data overall corroborate the results from the CE. Although we do not wish to take a strong stand on aggregate dollar values given that not all home improvements require a permit, the general time pattern is highly consistent with what we see in the CE, and a two-year look-back produces no evidence consistent with intertemporal substitution.

### *III.G. Causality and Robustness*

The results so far suggest that households increase their spending on home durables, improvement, and maintenance when they purchase a house. The evidence sheds light on the link between the housing market and consumption through a transaction channel rather than a price channel. However, it is important to explore more deeply whether these effects are causal or whether unobserved heterogeneity at the household level is driving the results.

Our regressions control for household income and wealth and various demographics: household size and head of household age, marital status, retirement status, race, and education. Our results are robust to the inclusion of household fixed effects, which absorb fixed differences in expenditures during the year that the household appears in the data. By including household fixed effects, we exploit the exact timing of spending rather than relying on a coarse comparison between households that recently purchased a home and those that did not. To clarify this point, it is helpful to consider the example of elderly homeowners, who tend to stay in the same home and to keep their current household appliances. A model without controls or household fixed effects would find higher spending on durables in each month during the first year of ownership, since the elderly spend at a low rate and are disproportionately represented in the excluded category: owners who purchased more than one year ago. Omitting age from the model causes an upward bias in the spending coefficients across the board in each of the first twelve months after purchase. Controlling for age or, more flexibly, absorbing unobserved heterogeneity with a household fixed effect resolves this problem.

It is still possible, however, that unobserved shocks that coincide with (and may potentially drive) home purchase cause increased spending precisely in the first few months after the purchase. These potential omitted variables may include: (1) unobserved financial

or housing wealth that permits higher spending; (2) an increase in permanent income that may result in an increased propensity to consume; and (3) an increase in family size that requires greater spending on durables and may also cause the household to move. It also may be easier to borrow the amount needed for additional home-related expenses with the mortgage.

We next consider a series of placebo tests to alleviate concerns that our results are driven by omitted factors unrelated to the home purchase. To test whether omitted variables are driving our results, we investigate whether household spending in categories unrelated to home purchase display the same patterns as spending on home durables and home improvement and maintenance. Using information provided in the CE, we study spending on non-home durables, and non-durable goods and services.

Figure V shows spending patterns for non-home durable goods as well as non-durable goods and services. In each panel, we plot the time-since-purchase fixed effects in Equation (1), with log spending or dollar spending as the dependent variable. The figure shows modest declines in log spending in these categories. We find a very modest response of spending on non-home durables. Similarly, our analysis of spending in the PSID shows a small and statistically insignificant reduction in non-home spending following a household move (see Table V). If any wealth, income, or household size shocks coincided with home purchases and caused short-run increases in spending, one would expect them also to boost non-housing spending. Instead, we find much a larger response of home-related spending both in the CE and PSID samples. The PSID panel structure allows further analysis two-year period prior to the home purchase. We find no evidence that spending adjusts upward in advance of the home purchase (see Online Appendix Table OA.VI). We should also note here

that non-home durables and non-durables spending are not insensitive to income and wealth – coefficients on those controls show the expected relationship. The failure to find a non-housing and non-durable spending response thus does not result from any general inelasticity of these spending categories to income and wealth.

One other reason why a home purchase may be important in causing home-related durable spending relates to transactions costs. Eberly (1994) shows that households follow an (S, s) adjustment model when they face income uncertainty and transactions costs in reducing their stock of automobiles. In addition to income uncertainty, households also face uncertainty about the minimum length of ownership or tenancy at their current residence. A home purchase likely reduces that uncertainty, triggering a narrowing of (S, s) bounds and the purchase of home durables and improvements for which the household had latent demand. Under this model of home-related spending, the home purchase might be triggered by another event, like a wealth shock, but still give rise to substantial home-related spending coincident with the purchase.

### *III.H. Summary of Cumulative Effect of Home Purchase on Spending*

Figure VI summarizes the overall results by showing the cumulative impulse responses of spending to home purchases. As discussed above, the increases in spending on home durables and home improvement and maintenance following purchase significantly exceed the declines in spending on non-housing categories. Cumulatively, the increase in home-related spending from three months before purchase until two years after is \$8,230, composed of \$5,780 of spending on home improvements and \$2,450 on home durables. The cumulative decline in non-housing spending is \$4,530, split nearly equally between spending

reductions of \$2,620 on non-durables and services and \$1,910 on non-home durables. Net spending therefore increases by an average of \$3,700 per home purchase.

#### IV. HETEROGENEITY IN THE HOME PURCHASE CHANNEL

The large sample and richness of the building permit data allow us to explore heterogeneity in the home purchase channel and provide more insight on how it operates. We examine how the strength of the home purchase channel varies through the housing cycle. In particular, we re-estimate Equation (3) but interact the indicator for quarters since purchase with (1) an indicator for whether the transaction is a foreclosure or short sale, (2) an indicator for whether the transaction occurred during the housing bust (2007-2013), and (3) an indicator for whether house prices in the property's ZIP Code have risen or fallen in the 3 years prior to the transaction. We include all interactions in a single model to disentangle the differences in the home purchase channel over time, by foreclosure status and by recent housing market performance.

Panel A of Figure VII displays the estimates for log permit cost. The baseline coefficients, plotted in solid black, show the pattern in permitting for homes: a) purchased before 2007; b) with positive home price appreciation over the past three years; and c) without any foreclosure. As in the full sample, spending rises sharply in the quarter of the transaction before receding in the subsequent year. The gray line shows the permit activity for homes purchased in 2007 or later. The permit activity for these transactions rises more dramatically at the time of the transaction, by a statistically significant and economically meaningful 0.10 log points in the quarter of the transaction and 0.04 log points in the quarter after the transaction. The permit activity before and after the transaction is otherwise similar

to the baseline pattern. These estimates are consistent with purchasers putting more into home improvements on properties purchased in the bust, though not evidently in response to immediately prior underinvestment. In contrast, the permit activity on foreclosure and short sale transactions show evidence of investment cut-backs prior to the transaction. The quarterly permit activity on foreclosures and short sales, indicated by the dotted line, dips below the baseline by 0.02 to 0.05 log points for roughly a year and a half before the transaction. Following a distressed transaction, the permit activity exceeds the baseline for nine months, perhaps to compensate for prior cutbacks. The spending patterns for distressed transactions are consistent with distressed sellers underinvesting, perhaps due to the agency conflict created by debt overhang (Melzer 2017), and the subsequent buyers taking up some of those deferred investments. Finally, the pattern in permitting for transactions in zip codes with negative past home price growth, shown with a dashed line, is quite similar to that of distressed transactions. Permit activity falls below the baseline in the years leading up to the sale and then exceeds the baseline at the time of the transaction. Among other possibilities, these permitting patterns may reflect underinvestment in anticipation of foreclosure or short sale that ultimately does not materialize or investment cuts that are typical for properties sold during a bust.

The subsequent two figures repeat the same analysis using different measures of permitting activity. The estimates for permit incidence, shown in Panel C of Figure VII, display the same key patterns around home purchases as do the estimates for log permit cost. The spike in permitting is largest in the bust and there are declines in permitting prior to sale for both distressed sales and sales in poor performing housing markets. With permit cost measured in levels, however, the spending patterns change significantly, particularly in

the six quarters prior to sale. As shown in Panel B of Figure VII, the distressed and weak-market transactions no longer show investment cut-backs prior to sale. Transactions in the bust still show a significant spike in permitting at the time of the transaction, but have less activity prior to the transaction than transactions in the boom. Integrating over each quarter's marginal effect yields similar estimates for home purchase-related spending in the boom as in the bust: from eight quarters prior to purchase to eight quarters post, spending is \$2,938 in the boom and \$2,812 in the bust. The contrasting patterns in the level of spending and log spending leading up to sale suggest a similar frequency of projects between the boom and the bust, but the boom period has a greater share of high-cost projects such as significant additions or remodeling. We suspect home "flipping," in which investors purchase and remodel before selling, contributes to this pattern. Such investors likely invest more in remodeling than an average seller and were also more active in the boom than in the bust.

To summarize, the permit data does seem to indicate that houses sold in the bust have more and larger permitting activity immediately after sale but less before the sale and several quarters after the sale. Consequently, the cumulative dollar spending is somewhat larger in the boom, though not significantly so. The heterogeneity we document thus does not dramatically alter the overall strength of the home purchase channel.

## V. THE AGGREGATE EFFECT OF THE HOME PURCHASE CHANNEL FROM 2000 TO 2011

In this section, we assess how much the home purchase channel contributed to changes in consumption in the housing boom from 2001 to 2005 and the ensuing bust from 2005 to 2011. To do so, we compare the change in consumption that one would predict by multiplying the change in home sales by our preferred estimates of the effect of a home

purchase on consumption in each category to the actual change in consumption in that category in the CE. This provides a simple, partial equilibrium accounting, similar to the literature on housing wealth effects, that assesses how much of the observed change in consumption can be accounted for by the home purchase channel.<sup>5</sup>

To create the national time series for consumption and home improvement and maintenance, we aggregate the CE expenditures using the provided sample weights. We do not use NIPA aggregates due to difficulty measuring expenditures on home maintenance, repair, and improvements, which NIPA splits among residential investment, “other services” in personal consumption, and “imputed rent” in personal consumption. We deflate subcategories of durable consumption by their subcategory CPI deflator and subcategories of improvement and maintenance by their NIPA deflator.<sup>6</sup> For home sales, we use non-seasonally adjusted data on existing home sales for the entire U.S. from the National Association of Realtors together with monthly, non-seasonally adjusted data on sales of new homes from the Census Bureau. We multiply the monthly time series by our preferred estimates of average dollar spending in the 3 months before purchase, the month of purchase, and each of the following 24 months and then aggregate the implied time series to the annual level. Because we did not find significant differences for the boom and bust in

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<sup>5</sup> One may worry that our effects overstate the aggregate consumption change because some durables consumption is canceled out in the aggregate by sales of durables. However, the CE asks whether households have received “Money from the sale of household furnishings, equipment, clothing, jewelry, pets, or other belongings” over the prior 12 months and we find no evidence that this income increases around a home purchase. We thus conclude that our estimates do not overstate the aggregate change in consumption.

<sup>6</sup> The use of category-specific deflators affects the estimated change in aggregate real spending on home durables, because those goods experienced meaningful price deflation between 2001 and 2010, in contrast to modest overall price inflation in the CPI-U and the NIPA deflator for home improvements. As a result, the category-specific deflator implies a larger aggregate increase in real spending on home durables in the boom and a smaller aggregate decrease in real spending in the bust. Using category-specific deflators has little to no impact on the estimated impact of home purchases on spending.

dollars spending in the heterogeneity analysis in Section IV we use our baseline estimates from Section III for this calculation. We next take differences between 2001 or 2002 and 2005 for the boom as well as from 2005 to 2008–2011 for the bust. We then divide this change by the actual change in the aggregate consumption time series for the same category created using the CE microdata and weights, which gives us the percentage of the aggregate change explained by the home purchase channel. We use 2005 as our base year since home sales peaked in 2005.

The results in Table VI show that the home purchase channel explains a meaningful portion of the rise and decline in home-related spending in the 2000s. Column (1) of Table VI shows that the home purchase channel accounted for about 7.8% to 8.0% of the growth in spending on home durables during the boom. During the subsequent bust the home purchase channel contributed 21.5% to 37.2% percent of the decline in spending on home durables. Column (2) shows a similarly large effect on home improvements and maintenance spending. The home purchase channel accounted for 19.4% to 25.6% of the spending growth in the boom and 31.5% to 43.1% of the spending decline in the bust. The impact of the home purchase channel was more meaningful in the bust for two reasons. First, home sales fell more in the bust than they rose in the boom. Second, home durables consumption and, to a lesser extent, improvements grew by more in the boom than it shrank in the bust, so the denominator is bigger in the boom than the bust. Said otherwise, the home purchase effect during that period was relatively less important than other consumption drivers such as changes in income, wealth and credit availability.

The categories of spending affected by the home purchase channel are only part of overall durables and home improvement spending. Column (3) of Table VI shows that the

home purchase channel has minimal effect on non-home durables spending. Column (4) shows the overall effect on total durables plus home improvements and maintenance. In the boom, the aggregate effect on total durables and improvements was 7.9% to 10.1% when spending on maintenance and improvements is added. In the bust, the effect was 13.5% to 17.2%. Note that these figures are likely underestimates for the impact of home transactions on maintenance and improvements spending, because the CE design precludes us from accounting for improvements made by sellers in order to market and sell their house.

To provide a sense of the magnitude of the aggregate effect of the home purchase channel, we calculate the lost spending attributable to declining home sales between 2005 and 2010. The average home purchase, whether owner-occupied, second home or investment property, triggers net spending of \$7,866 on durables, home improvement, and maintenance from three months before purchase to two years after purchase.<sup>7</sup> Relative to 2005, the rate of home sales declined by an average of 2.92 million units per year between 2006 and 2010. This implies an annual decline in spending of approximately \$23 billion, or approximately 0.15% of GDP. As a yardstick for comparison, Mian, Rao, and Sufi (2013) find that home equity fell by \$5.6 trillion from 2006 to 2009 and find a marginal propensity to consume (MPC) metric out of housing wealth of 5.4%, implying a total decline in consumption of \$302.4 billion, with \$128.8 billion accounted for by autos, \$89.6 billion by non-durables, and \$61.6 billion by non-auto durables. In annual averages, their estimates imply a total decline in consumption of \$100.8 billion and a non-auto durable decline of \$20.5 billion. Our annual effect of \$23 billion is thus as large as wealth effect for non-auto durables.

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<sup>7</sup> The incremental spending on a newly purchased home is slightly smaller for vacation and investment properties than for owner-occupied homes. Thus, the incremental spending of \$7,866 on the average purchase is slightly less than incremental spending of \$8,230 on the purchase of a primary residence.

The housing wealth channel therefore has a broader and larger impact on overall consumption, but the home purchase channel is of similar importance for *home-related* spending.

## VI. COMPARING THE EFFECTS OF HOME PURCHASES AND HOME VALUES ON CONSUMPTION USING CITY-LEVEL SPENDING

To benchmark the home purchase channel relative to the more-widely-studied housing wealth effect channel, we carry out an analysis of aggregate, city-level spending and home purchases and compare the responses of spending to house prices and house purchases. We use data on retail sales from the Economic Census, which collects the annual sales of all businesses every five years. The most recent three surveys provide data for 2002, 2007, and 2012. These dates correspond roughly to the beginning, peak, and trough of the housing cycle. We focus on sales in home-related goods, which include sales by furniture, electronics and appliances, and building supplies stores.

We measure the elasticity of spending to both home purchases and home values at the CBSA level over these five-year horizons. To parse the separate effects of home purchases and home values, we estimate multivariate regressions that rely on variation in housing cycles across CBSAs to separately identify the effects of home purchases and home values.

Our methodology is similar to the OLS regressions in Mian, Rao and Sufi (2013), who measure the elasticity of spending to housing wealth at the county level over a three-year horizon (2006 to 2009). We estimate elasticities over five-year horizons using the following model:

$$(4) \Delta(\text{Log Spending})_{ct} = \alpha + \beta \Delta \text{Log}(\text{Home Purchases})_{ct-1} + \gamma \Delta \text{Log}(\text{Home Price Index})_{ct-1} + \delta_t + \varepsilon_{ct},$$

where the dependent variable is the five-year change in log annual retail sales in CBSA  $c$  as of year  $t$ . We use data from CoreLogic to measure the annual volume of home purchases and the year-end CoreLogic home price index for prices. We compute these measures for the year  $t-1$ , in order to examine spending that occurs subsequent to the changes in home purchases and home prices. Similar to the dependent variable, we take five-year changes in log home purchases and the log home price index. The coefficients  $\beta$  and  $\gamma$  therefore measure the elasticities of spending to home purchases and home prices, respectively, and are separately identified by differences in the time series patterns of purchases and prices. We include year fixed effects ( $\delta_t$ ) to absorb changes in spending common to all metropolitan areas over each five-year period. We estimate the model using ordinary least squares with population weights and clustering by metropolitan area for the calculation of standard errors. Our estimation sample includes an observation for 246 CBSAs with the requisite spending and housing data in 2007 and 267 CBSAs with the requisite data in 2012.

The model estimates, reported in Table VII, show significant positive elasticities of home-related spending to both home purchases and home prices. In the housing boom, between 2002 and 2007, the elasticities of spending to home purchases and home prices are 0.26 ( $p < 0.01$ ) and 0.29 ( $p < 0.01$ ), respectively. In the subsequent housing bust, between 2007 and 2012, the elasticities of spending to home purchases and home prices decline somewhat to 0.12 ( $p < 0.01$ ) and 0.23 ( $p < 0.01$ ), respectively. Our estimates for the elasticity of spending to home prices are slightly high relative to the range of 0.13 to 0.26 implied by

Mian, Rao, and Sufi (2013).<sup>8</sup> This difference makes sense because their analysis considers all consumption expenditures whereas ours examines home-related spending on which households spend disproportionately when housing wealth increases.<sup>9</sup> In quantifying the total impact of the home purchase and housing wealth channels, one must consider also the size of the “shock” to purchases and housing wealth. The 50% decline in home purchases during the housing bust (Figure I) was five times larger than the 10% decline in housing net worth (Mian, Rao, and Sufi, 2013) during that time. In summary, our aggregate elasticity estimates provide complementary evidence that helps to benchmark the strength of the home purchase channel relative to the more-studied housing wealth effect and underscore our main conclusion that the home purchase channel is important and complementary to housing wealth effects.

## VII. CONCLUSION

This paper describes and quantifies a new channel for the causal relationship between housing markets and spending: the home purchase channel. In the months before and in the year following a home purchase, households spend roughly \$8,000 on home-related durable goods, improvements and repairs. Our main analysis relies on an event-study design that includes household-level fixed effects, so that all identification comes from a variation within households before and after a home purchase. To address concerns that

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<sup>8</sup> Berger et al. (2018) calculate this range of elasticities after re-scaling the reported elasticity to housing net worth shocks into an elasticity to home price changes.

<sup>9</sup> Mian, Sufi, and Rao (2013) report separate marginal propensities to consume (MPC) out of housing wealth in Figure IV of their paper. The category “other durables,” which includes purchases at furniture, home appliance, and home center stores, accounts for one-fifth of the MPC out of housing wealth. The fact that this share of MPC far exceeds homeowners’ expenditure shares in these categories (generally less than 10%) implies an above-average elasticity of home-related spending to housing wealth.

the spending is caused by an event that triggers a home purchase rather than the home purchase itself, we show that there is no related increase for non-home spending. Indeed, non-home spending declines modestly but offsets only a portion of the home-related spending induced by home purchases.

The home purchase channel played a quantitatively sizable role in the Great Recession and a more modest role in the prior housing boom. It accounted for one-third of the decline in spending on home durable goods, home improvements and home maintenance during the Great Recession. A back-of-the-envelope calculation implies that the home purchase channel accounted for a \$23 billion – or about 0.2% of GDP – decline in spending per year in the Great Recession. This decline is equivalent to the roughly \$20 billion decline in non-auto durable spending due to the decline in housing wealth during the Great Recession. Relative to the housing wealth channel that has been the focus of recent literature (e.g., Mian, Rao, and Sufi 2013), the home purchase channel is of similar importance to home-related spending but of smaller importance to overall spending.

Beyond understanding the mechanisms connecting the housing market and spending in the Great Recession, our estimates are of relevance to policy makers. Monetary policy can have a substantial impact on housing transaction volume through its impact on mortgage interest rates. Our estimates are a crucial input for monetary policy makers who wish to understand the effect of home purchases on consumption and residential investment. In addition, our figures are a crucial input into the cost-benefit analysis for fiscal policy makers interested in pursuing policies designed to stimulate home sales, such as the new homebuyer tax credit in the Great Recession (Berger et al., 2020).

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**Table I.**  
**Summary Statistics for Homeowners in Consumer Expenditure Survey**

<i><b>PANEL A:</b></i>			<i><b>PANEL B: Property</b></i>		
<i>Household</i>			<i>Characteristics</i>		
<i>Characteristics</i>	Mean	Std. Dev		Mean	Std. Dev
<b>Income/Wealth</b>			Months since purchase	157	154
Annual income	77,492	68,610	Purchased in previous 12 months? (%)	6.66	24.94
Financial assets	62,766	310,118	Mortgagor? (%)	66.43	47.22
Assets information missing?	0.11	0.32	Months since refinancing#	58	69
<b>Education</b>			Refinanced prior 12 mths? (%)	7.18	25.82
No HS diploma	0.10	0.30	Age of home (years)	36	29
HS diploma	0.25	0.43	Age of home missing?	0.09	0.28
Some college	0.29	0.46	Rooms	6.67	2.06
College degree	0.22	0.42	Bedrooms	3.13	0.90
Graduate degree	0.14	0.34	Bathrooms	1.83	0.74
<b>Race/Ethnicity</b>			Central air?	0.70	0.46
White	0.72	0.45	Swimming pool?	0.12	0.32
Black	0.09	0.28	Porch?	0.82	0.38
Hispanic	0.14	0.35	Off-street parking?	0.83	0.38
Asian	0.04	0.19			
Other	0.01	0.12			
<b>Marital Status</b>			<i><b>PANEL C: Household Spending</b></i>		
Married	0.64	0.48	<b>Spending per month (\$)</b>		
Widowed	0.10	0.30	Home improvement and maintenance	222	2,071
Divorced	0.13	0.33	Home durables	114	739
Separated	0.01	0.12	Non-home durables	536	3,617
Never married	0.11	0.31	Non-durables and services	2,643	2,199
<b>Other</b>			<b>Likelihood of purchase (per month)</b>		
Age (HH head)	52.57	15.74	Any home improvement?	0.18	0.39
Family size	2.66	1.46	Any home durables?	0.29	0.45
Retired? (%)	0.23	0.42	Any non-home durables?	0.53	0.50
			Any durables or improvement?	0.65	0.48

Notes: This table presents summary statistics for homeowners interviewed in the Consumer Expenditure Survey between 2001 and 2013. The sample includes 571,871 monthly observations on 60,642 households. The sample excludes homeowners who do not report their date of home purchase.

**Table II.**  
**Summary Statistics for Panel Study of Income Dynamics**

<i>PANEL A: Homeowners</i>	Mean	Std. Dev.	N
Moved residence since prior interview (%)	14	35	30,125
<b>Household spending (\$)</b>			
Home improvements (Past 2 years)	5,067	27,109	30,125
Home repairs (Past year)	2,891	13,690	22,132
Home furnishings and equipment (Past year)	1,402	5,271	22,132
Non-home goods and services (Past year)	30,314	22,420	22,132
<i>PANEL B: Renters</i>	Mean	Std. Dev	
Moved residence since prior interview (%)	56	50	18,278
<b>Household spending (\$)</b>			
Home improvements (Past 2 years)	316	8,661	18,278
Home repairs (Past year)	264	2,370	14,171
Home furnishings and equipment (Past year)	586	1,871	14,171
Non-home goods and services (Past year)	18,105	14,839	14,171

Notes: This table presents summary statistics of homeowners (Panel A) and renters (Panel B) surveyed in the Panel Study of Income Dynamics between 2001 and 2013. The sample includes 48,403 observations from bi-annual interviews of 10,358 unique households. We classify homeownership as of the interview date. The survey measures cumulative spending on home improvements over a roughly two-year period preceding the interview. It measures cumulative spending on home repairs, furnishings, equipment, and non-home goods and services over a one-year period preceding the interview. Home improvement spending is available for the full sample period, while spending in other categories is available from 2005 to 2013.

**Table III.**  
**Summary Statistics on Building Permits**

***PANEL A: Building Permits***

<b>Estimated Total Job Cost (\$)</b>		
Unconditional, per quarter	749	14,928
Conditional on permit	42,045	103,780
<b>Number of permits, by type (per property)</b>		
Electrical	0.16	1.10
Mechanical	0.10	0.75
Plumbing	0.10	0.78
Structural	0.53	2.64
All	0.88	4.23

***PANEL B: Property Characteristics***

	Mean	Std. Dev
Mortgagor? (%)	72.3	44.7
Age of home (years)	35.8	27.5
Bedrooms	3.2	0.8
Bathrooms	2.1	0.9
Transaction price (\$, 2009)	285,526	249,892
Foreclosure or short sale (%)	19.7	39.8
Change in log CBSA-level housing price index in 3 years (%)	19.5	26.9

Notes: This table presents summary statistics of building permits and property characteristics for homes sold between 2001 and 2013. The sample includes 19,727,786 property-quarter observations on 1,287,725 transactions and 967,904 unique properties. The source of the permit data in Panel A is Buildfax and the source of the property characteristics in Panel B is DataQuick.

**Table IV.**  
**Household Spending and Building Permit Activity Following a Home Purchase**

*Panel A: Spending After Home Purchase – Consumer Expenditure Survey*

Quarters Since Purchase	Average Monthly Spending (\$)			
	Home Improvement	Home Durables	Non-home Durables	Non-durables and Services
1	615	798	788	2,531
2	399	265	702	2,473
3	338	178	659	2,486
4	297	158	648	2,502
5+	209	97	525	2,656

*Panel B: Spending by Homeowners After Moving – Panel Study of Income Dynamics*

Moved in Prior 2 Years?	Average Spending (\$)			
	Home Improvement (Past 2 Years)	Home Durables (Past Year)	Home Repairs (Past Year)	Non-home Goods and Services (Past Year)
Yes	8,887	2,709	3,654	30,614
No	4,485	1,196	2,771	30,185

*Panel C: Building Permits After Home Purchase – BuildFax-DataQuick Sample*

Quarters Since Purchase	Building Permit Activity		
	Any Permit?	Number of Permits	Estimated Job Cost (\$)
1	0.077	0.12	1,292
2	0.057	0.09	1,344
3	0.040	0.06	1,032
4	0.034	0.05	813
5+	0.026	0.04	506

Notes: This table summarizes homeowners' spending and building permit activity after they purchase a home. In Panel A we report average monthly spending for homeowners in the Consumer Expenditures Survey between 2001 and 2013. In Panel B we report average bi-annual or annual spending for homeowners in the Panel Study of Income Dynamics between 2001 and 2013. In Panel C, we report the incidence of building permits and the average estimated job cost for home purchases in the BuildFax-DataQuick sample between 2001 and 2013. We measure spending and job cost in real terms, using the CPI-U as price deflator and January 2009 as the base period.

**Table V.**  
**Household Spending by Homebuyers and Renters that Move (PSID)**

*Panel A: Homebuyers*

	Home Improvement	Home Repair and Maintenance	Home Furnishings, Equipment and Appliances	Non-home Expenditures
Moved residences?	6,227*** (1364)	1,916* (741)	1,924*** (309)	-421 (746)
N	29,316	21,125	21,125	21,125
R <sup>2</sup>	0.329	0.268	0.284	0.715
<i>Control variables:</i>				
Property characteristics?	Y	Y	Y	Y
HH characteristics?	Y	Y	Y	Y
HH fixed effects?	Y	Y	Y	Y
Year fixed effects?	Y	Y	Y	Y

*Panel B: Renters*

	Home Improvement	Home Repair and Maintenance	Home Furnishings, Equipment and Appliances	Non-home Expenditures
Moved residences?	42 (148)	98 (77)	238** (61)	292 (427)
N	17,145	13,008	13,008	13,008
R <sup>2</sup>	0.64	0.4	0.382	0.685
<i>Control variables:</i>				
Property characteristics?	Y	Y	Y	Y
HH characteristics?	Y	Y	Y	Y
HH fixed effects?	Y	Y	Y	Y
Year fixed effects?	Y	Y	Y	Y

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Notes: This table presents regression analysis of home-related spending by homebuyers and renters in the Panel Study of Income Dynamics (PSID) between 2001 and 2013. We regress real spending (measured in 2009

dollars) on control variables and an indicator for whether the household moved residences during the prior two-year period. The control variables are: year fixed effects, household fixed effects, the number of rooms in the residence, log household income, log household size, household wealth (transformed by inverse hyperbolic sine), and indicators for the marital status, retirement status, education and race of the household head. Home improvement spending is measured over the two-year period prior to the household interview, while the remaining home-related spending is measured over a one-year period prior to the interview. We estimate the model using ordinary least squares and double-cluster observations by the state of residence and year in the calculation of standard errors.

**Table VI.**  
**Aggregate Effect of Home Purchase Channel in Great Recession**

	Home Durables	Home Improvements and Maintenance	Non-Home Durables	Total Durables, Improvements and Maintenance
2001– 2005	7.8%	19.4%	0.3%	7.9%
2002– 2005	8.0%	25.6%	0.5%	10.1%
2005– 2008	37.2%	43.1%	0.3%	17.2%
2005– 2009	21.5%	33.5%	0.8%	16.4%
2005– 2010	30.7%	31.5%	0.2%	13.5%
2005– 2011	36.2%	33.7%	0.6%	16.2%

Notes: Each cell reflects the fraction of the total change in a consumption category for a given time period explained by the home purchase channel, computed by multiplying the change in home sales for the time period by our preferred estimate of the dollar amount of consumption associated with a home purchase. For the preferred estimate and the consumption time series used in the denominator, the CE data is deflated by a category-level deflator from the CPI (for durables) or NIPA (for home improvements as well as maintenance, which does not have its own deflator). This is done at the monthly level and aggregated to the annual level. Each column reflects a consumption category, while each row reflects the time period over which changes are computed. The data on the total change in a consumption category for a given time period are aggregates computed with the CE data using CE sample weights. The sales series is created by combining National Association of Realtors (NAR) data on existing home sales with Census data on sales of new single-family homes, both taken from FRED (note that the NAR data is no longer on FRED but can be obtained from the NAR).

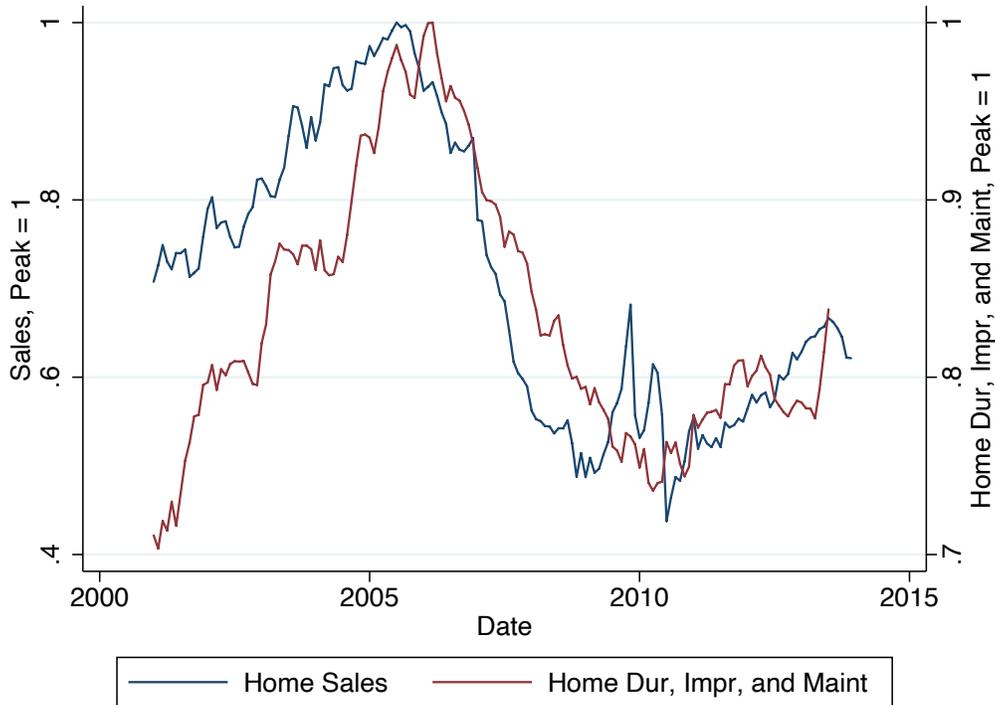
**Table VII.**  
**Elasticities of Home-related Retail Spending to Home Purchases and Home Prices**

Time Period:	Dependent variable: Δ Log (Home-related retail spending)	
	2002-2007	2007-2012
Δ Log (Home Purchases)	0.26*** (0.06)	0.12*** (0.02)
Δ Log (Home Price Index)	0.29*** (0.03)	0.23*** (0.04)
Year fixed effects?	Y	Y
N	246	267
R <sup>2</sup>	0.44	0.28

\*\*\* significant at 1%

Notes: This table reports jointly-estimated elasticities of home-related spending to home purchases and home prices. The spending data come from the 2002, 2007 and 2012 Economic Census, which report annual retail spending at all home improvement and home furnishing stores within a metropolitan area. The data on home purchases and home prices, which are also at the metropolitan area level, come from CoreLogic. We measure real spending and real home prices in 2012 dollars, using the CPI-U as the price deflator. We estimate the model with ordinary least squares, weighted by population, and cluster observations by metropolitan area when calculating standard errors, which are reported in parentheses.

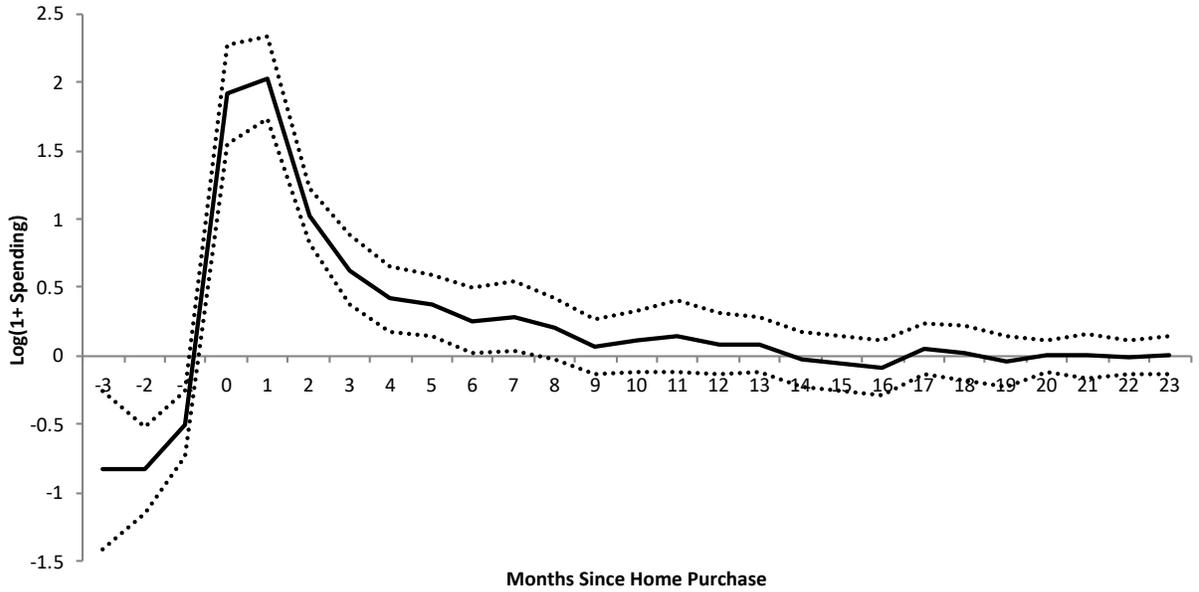
**Figure I.**  
**Home Sales and Home-Related Spending in the Great Recession**



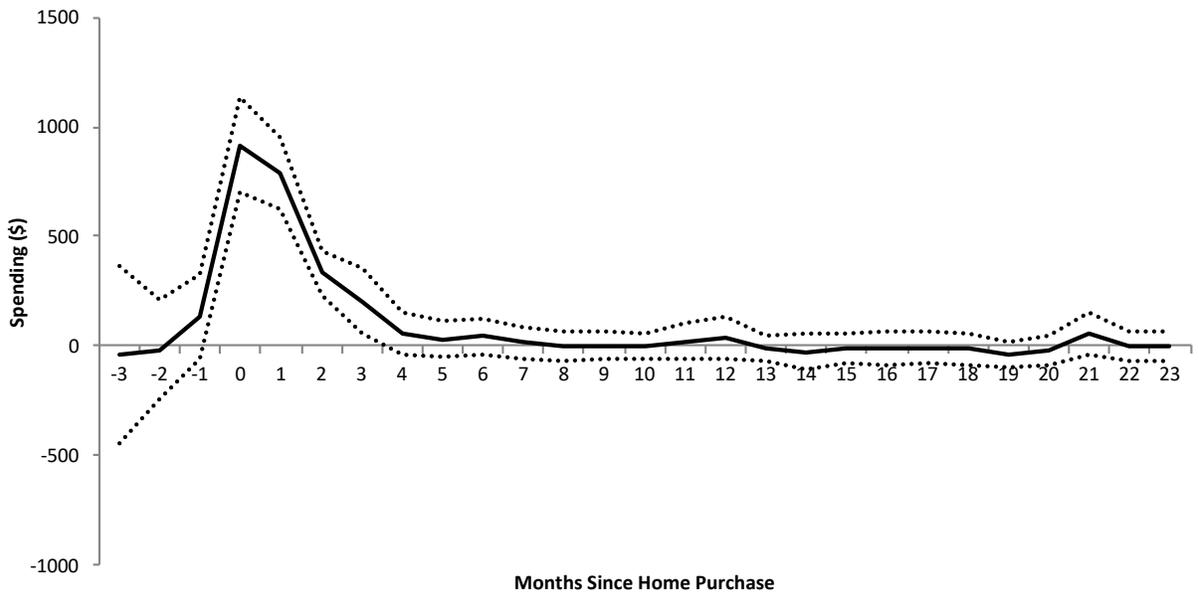
Notes: This figure illustrates the time patterns in home sales and home durables, improvements and maintenance spending between 2001 and 2014. Both series are normalized by their maximum value. Home sales, in blue and scaled to the left axis, are the sum of the National Association of Realtors' existing home sales series and the Census's series of new home sales. A 12-month moving average centered at the indicated date is shown to smooth out seasonality. Home durables, improvement, and maintenance, in red and scaled to the right axis, is the sum of these categories from the Consumer Expenditure Survey aggregated up by the survey weights and normalized to 2009 dollars using the category price index.

**Figure II.**  
**Home Durables Impulse Response Response to Home Purchase**

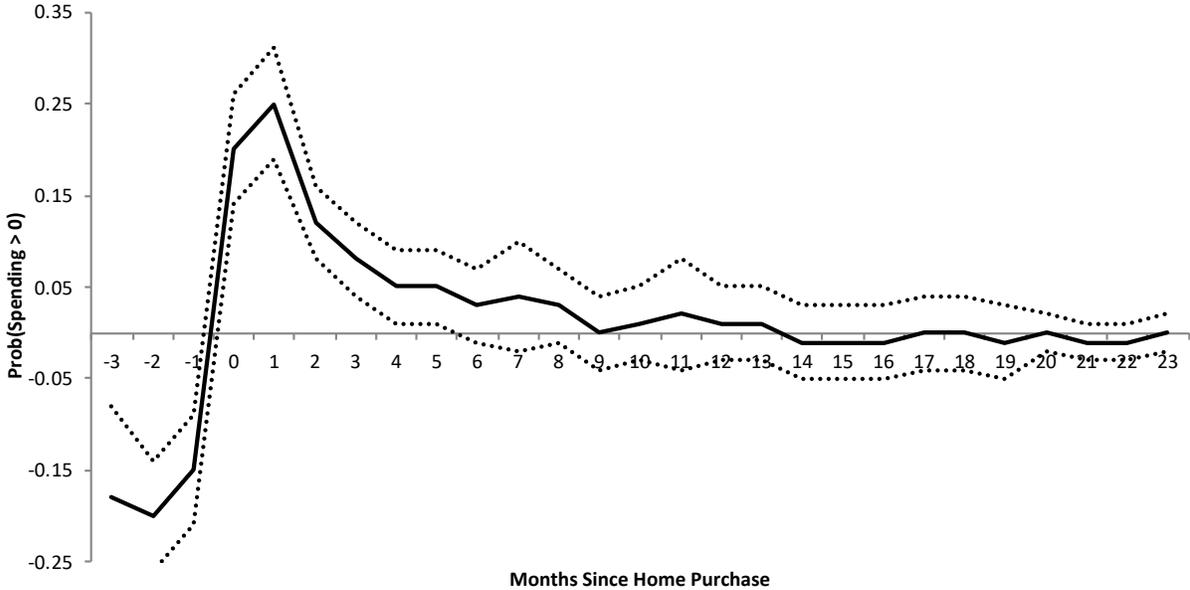
**A. Log(1 + Home Durable Spending) Relative to Home Purchase**



**B. Home Durable Spending Relative to Home Purchase**



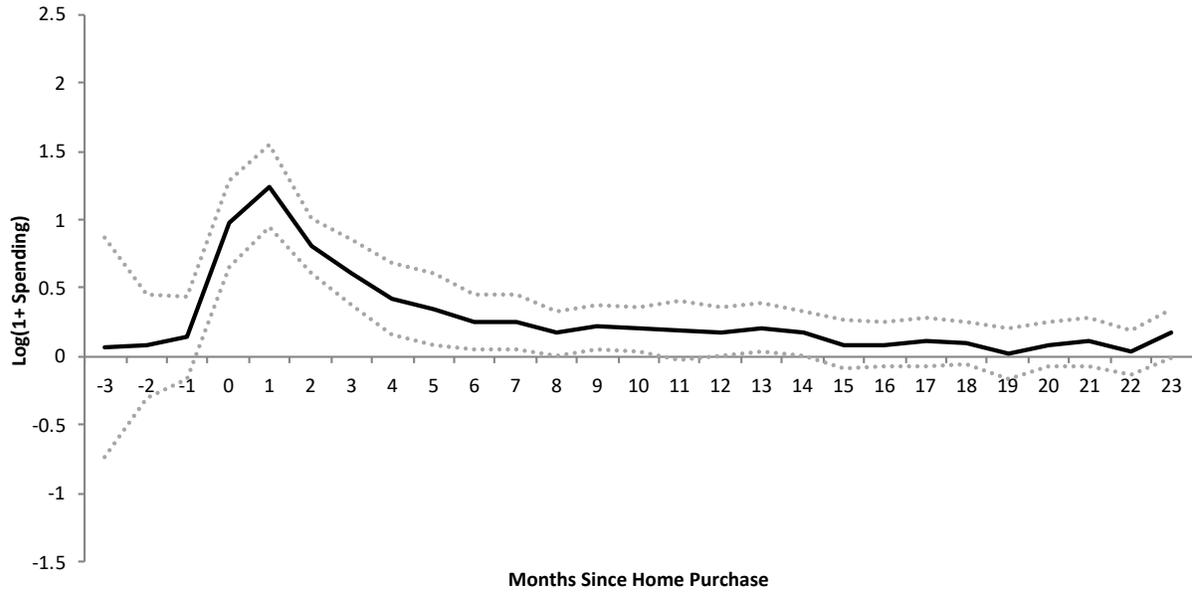
**C. Incidence of Home Durable Spending Relative to Home Purchase**



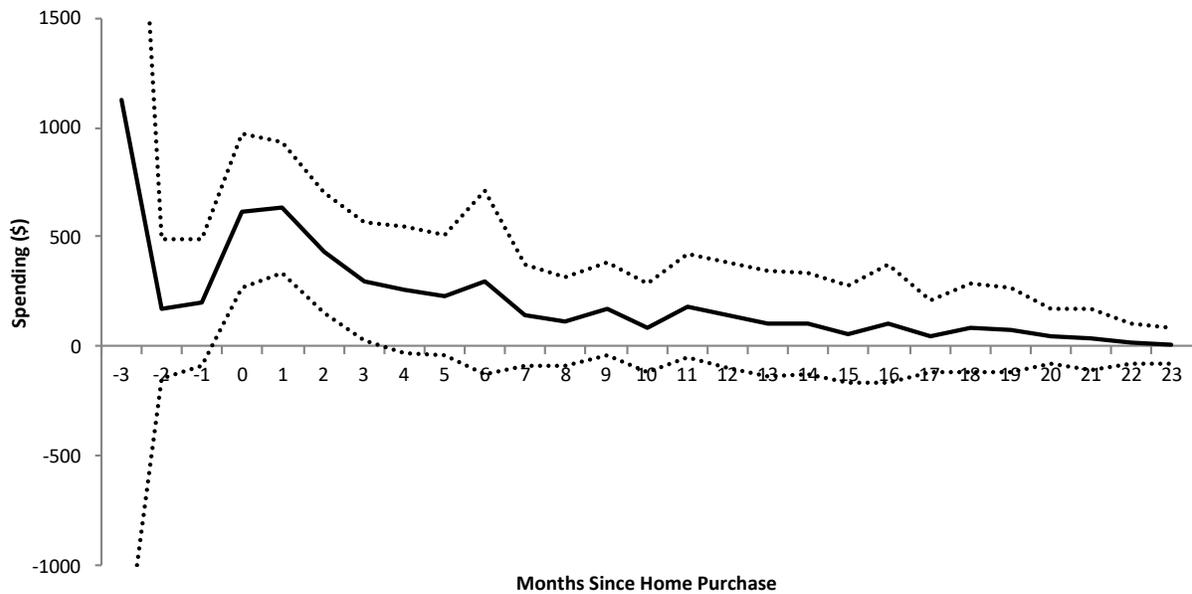
Notes: The figures above show the time pattern in homebuyers' home durable spending from three months before to two years after their home purchase. In each panel we plot the coefficient estimates (solid line) and 95% confidence interval bounds (dotted lines) from estimating Equation (1) in the CE sample. Only the functional form of the spending measure varies across the three panels. Each model includes controls for property and household characteristics as well as household and year-by-month fixed effects. We estimate the models by ordinary least squares and two-way cluster observations by state and year-month in calculating standard errors.

**Figure III.**  
**Home Improvement and Maintenance Impulse Response to Home Purchase**

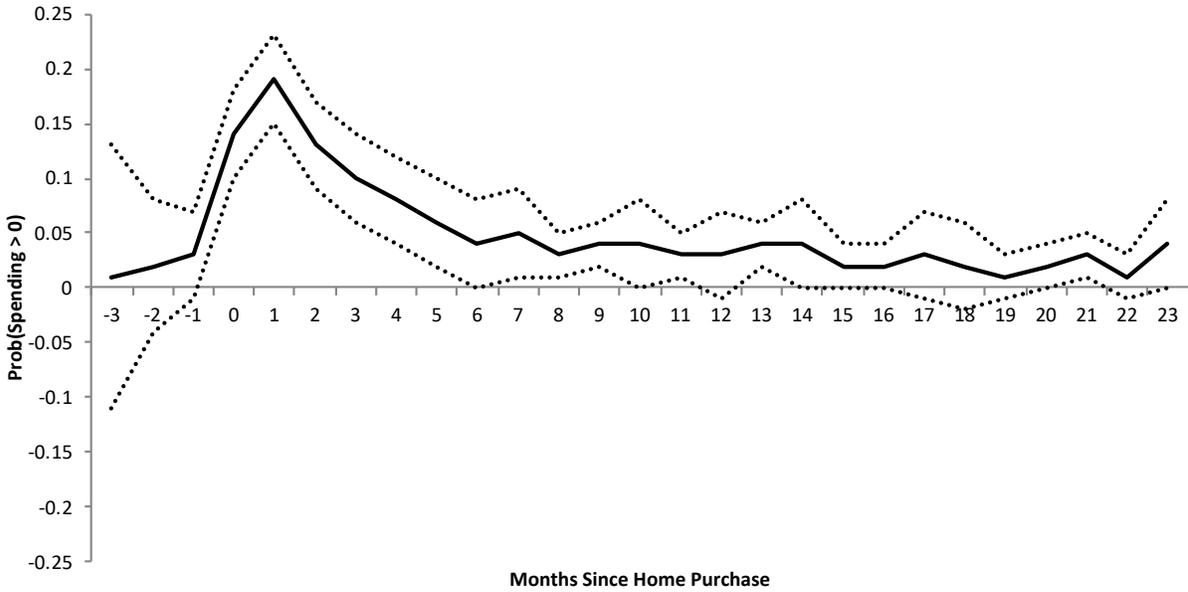
**A. Log(1 + Home Improvement and Maintenance Spending) Relative to Home Purchase**



**B. Home Improvement and Maintenance Spending Relative to Home Purchase**



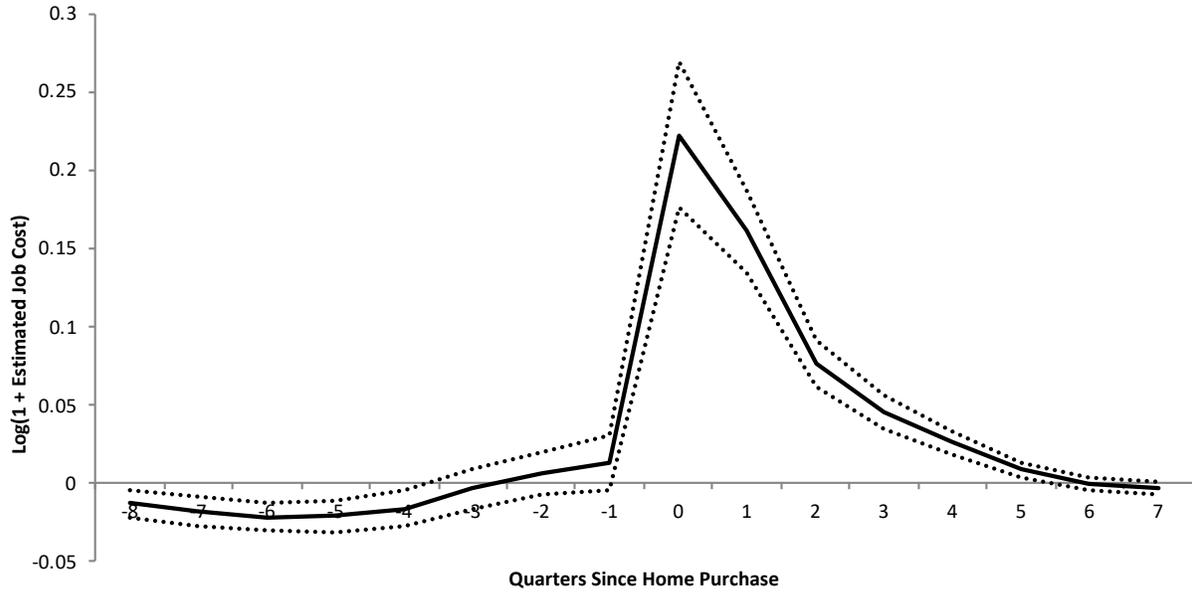
**C. Incidence of Home Improvement and Maintenance Spending Relative to Home Purchase**



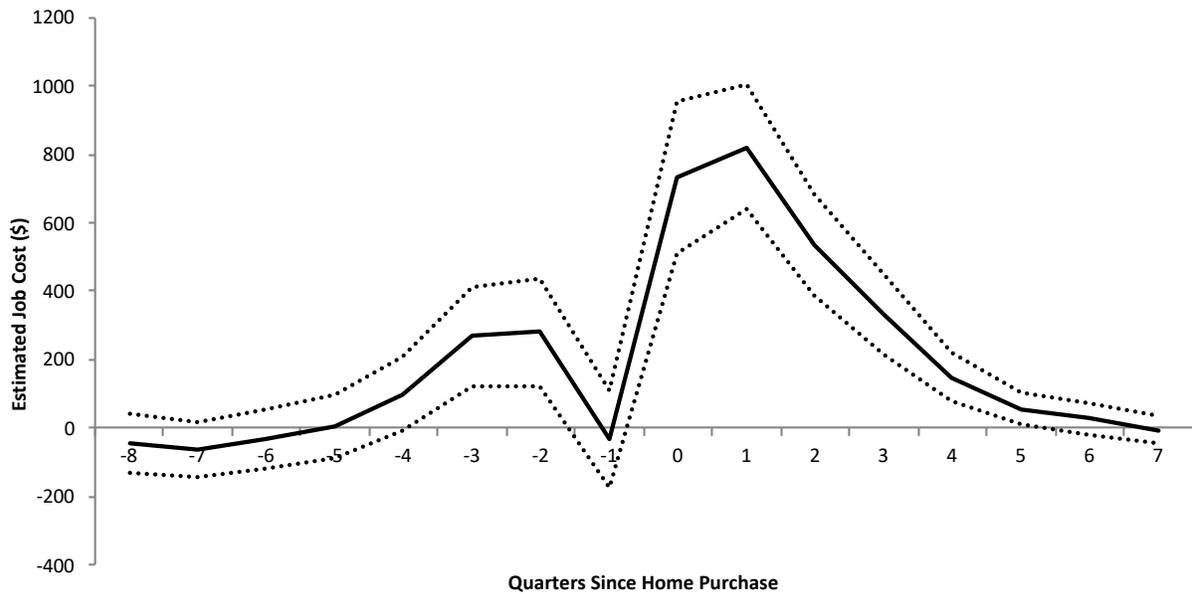
Notes: The figures above show the time pattern in homebuyers' home improvement and maintenance spending from three months before to two years after their home purchase. In each panel we plot the coefficient estimates (solid line) and 95% confidence interval bounds (dotted lines) from estimating Equation (1) in the CE sample. Only the functional form of the spending measure varies across the three panels. Each model includes controls for property and household characteristics as well as household and year-by-month fixed effects. We estimate each model by ordinary least squares and two-way cluster observations by state and year-month in calculating standard errors.

**Figure IV.**  
**Building Permit Impulse Response Response to Home Purchase**

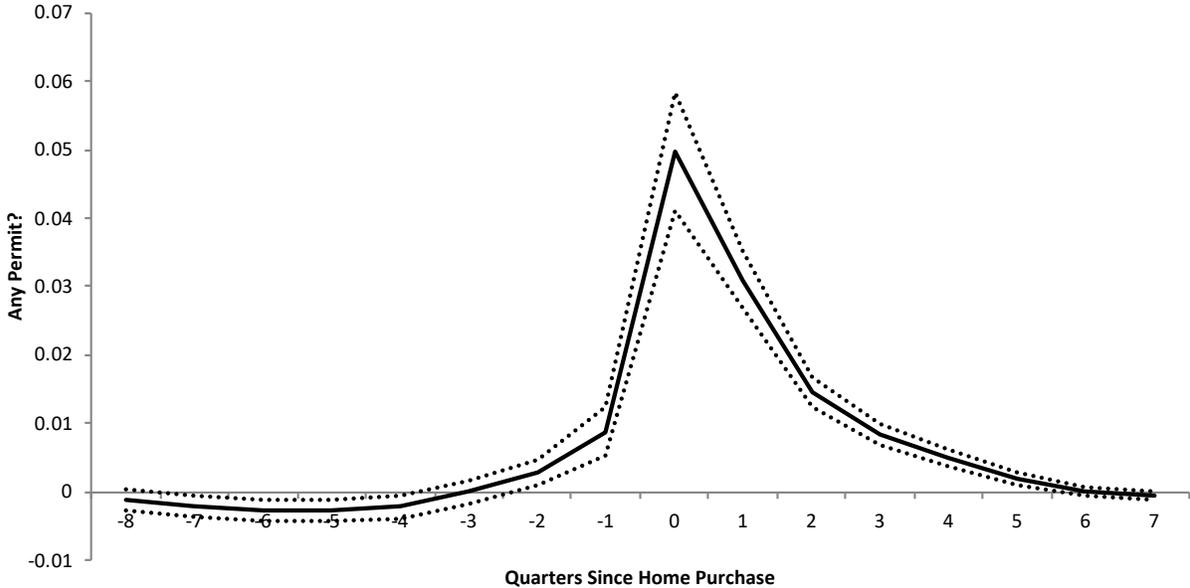
**A. Log(1 + Estimated Job Cost) Relative to Home Purchase**



**B. Estimated Job Cost Relative to Home Purchase**



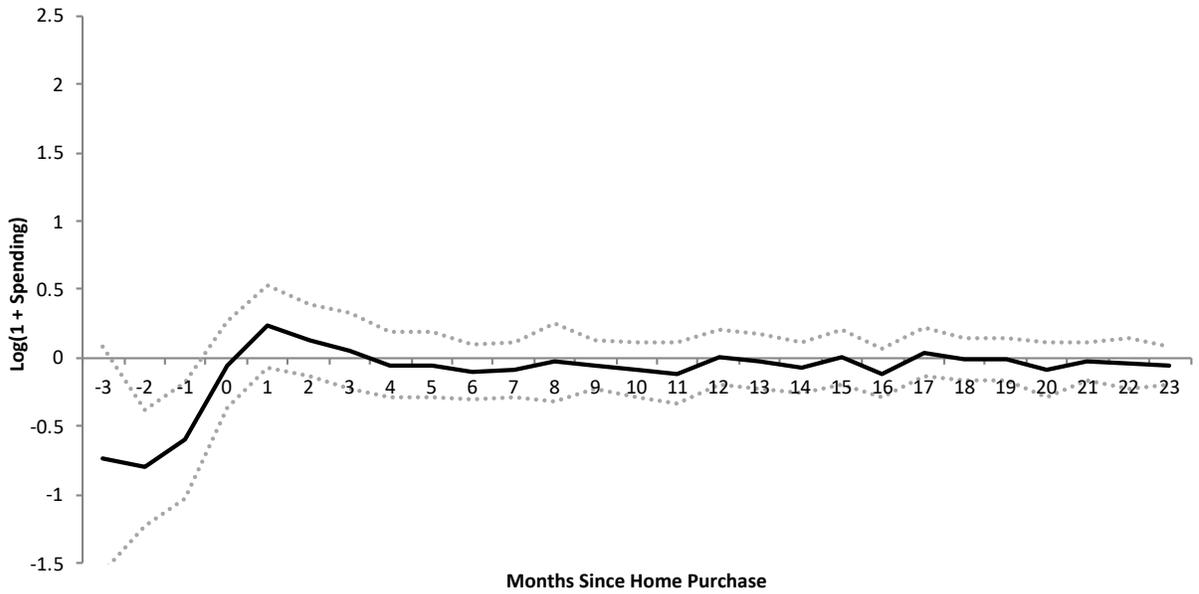
### C. Incidence of Building Permit Relative to Home Purchase



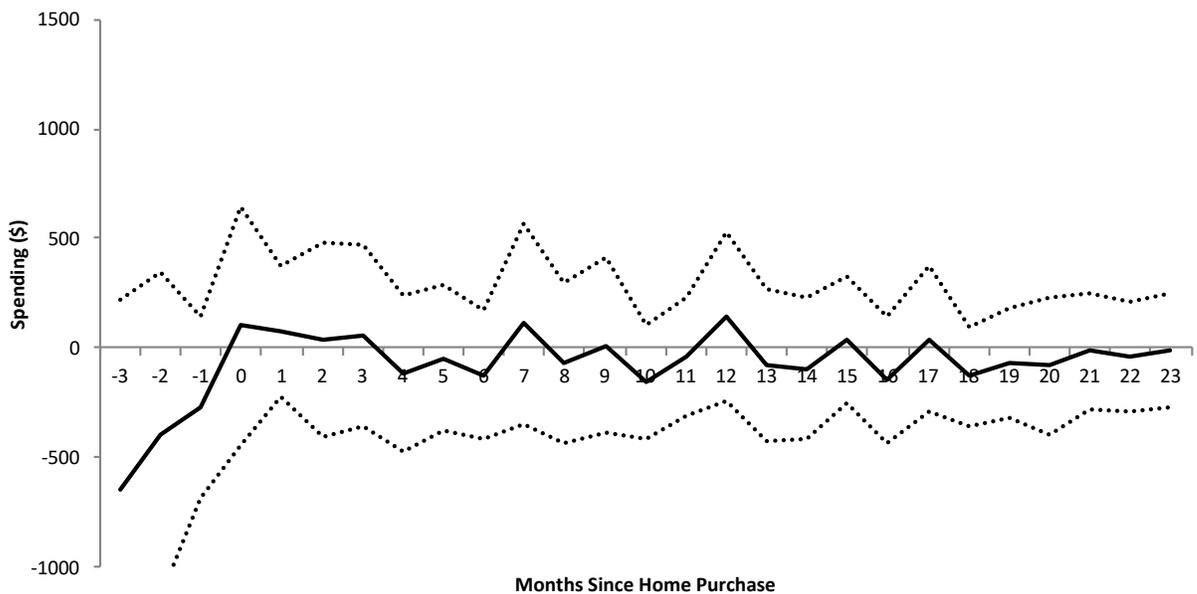
Notes: The figures above show the time pattern in homebuyers' building permitting activity from two years before to two years after their home purchase. In each panel we plot the coefficient estimates (solid line) and 95% confidence interval bounds (dotted lines) from estimating Equation (3) in the BuildFax-DataQuick sample. The dependent variable is the estimated cost of building permits, in logs or levels, in the first two panels and an indicator for any building permit in the third panel. Each model includes controls for property characteristics as well as property and year-by-quarter fixed effects. We estimate each model by ordinary least squares and two-way cluster observations by CBSA and year-quarter in calculating standard errors.

**Figure V.**  
**Non-Home Durables and Non-durables and Services Responses to Home Purchase**

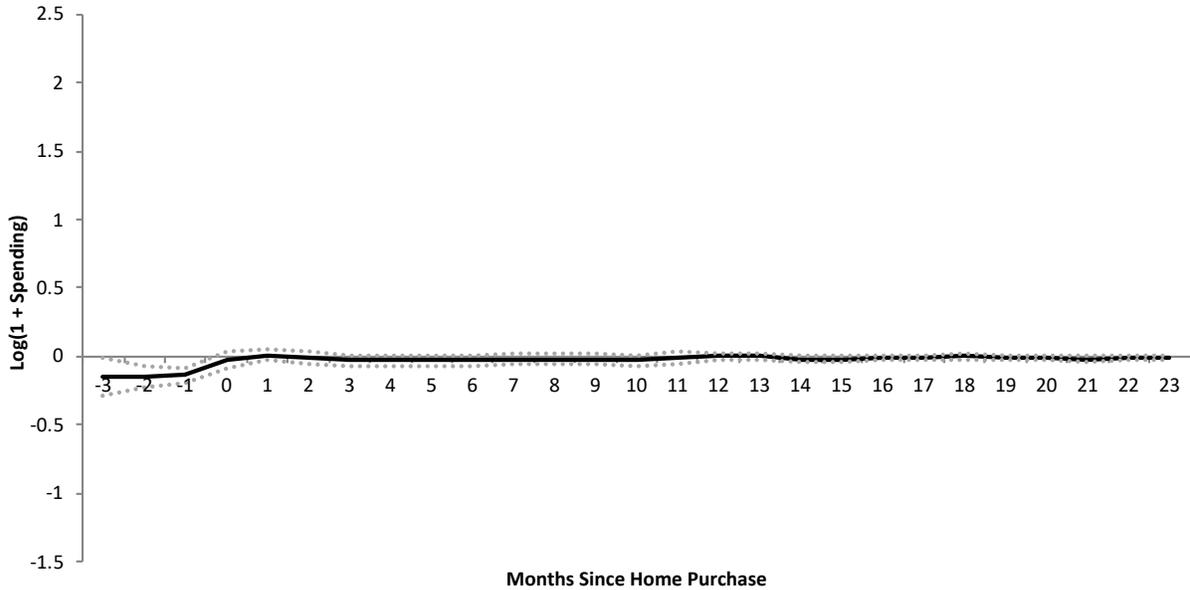
**A. Log(1 + Non-Home Durables Spending) Relative to Home Purchase**



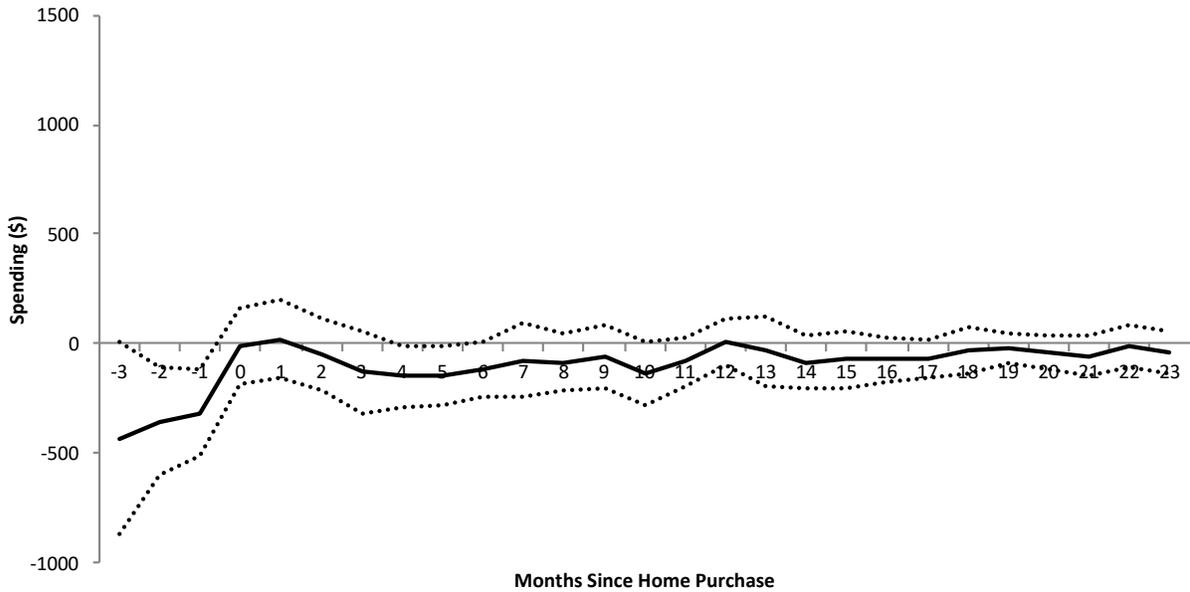
**B. Non-Home Durables Spending Relative to Home Purchase**



**C. Log(1 + Non-Durables and Services Spending) Relative to Home Purchase**

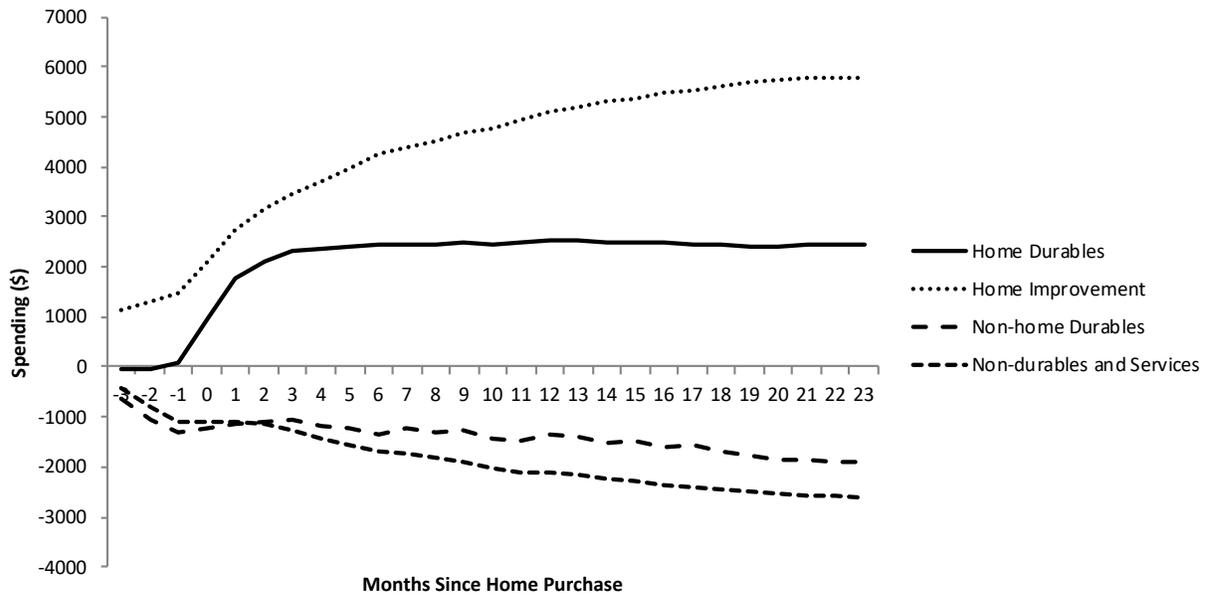


#### D. Non-Durables and Services Spending Relative to Home Purchase



Notes: The figures above show the time pattern in homebuyers' spending on non-home durables (Panels A and B) and nondurables and services (Panels C and D) from three months before to two years after their home purchase. In each panel we plot the coefficient estimates (solid line) and 95% confidence interval bounds (dotted lines) from estimating Equation (1) in the CE sample. Each model includes controls for property and household characteristics as well as household and year-by-month fixed effects. We estimate each model by ordinary least squares and two-way cluster observations by state and year-month in calculating standard errors.

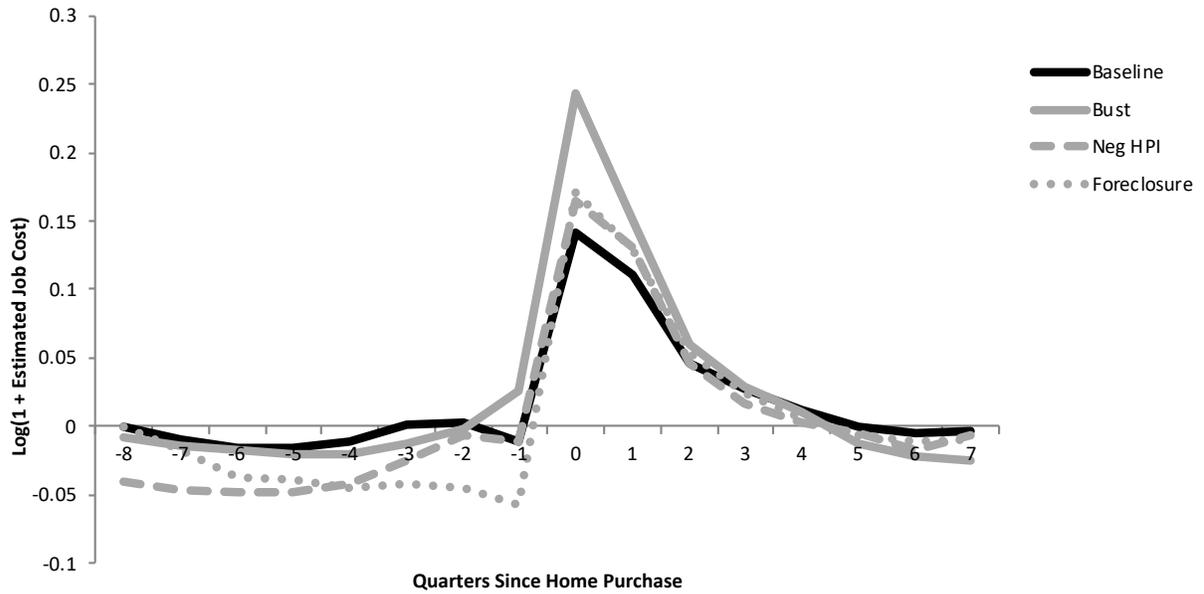
**Figure VI.  
Cumulative Spending Relative to Home Purchase**



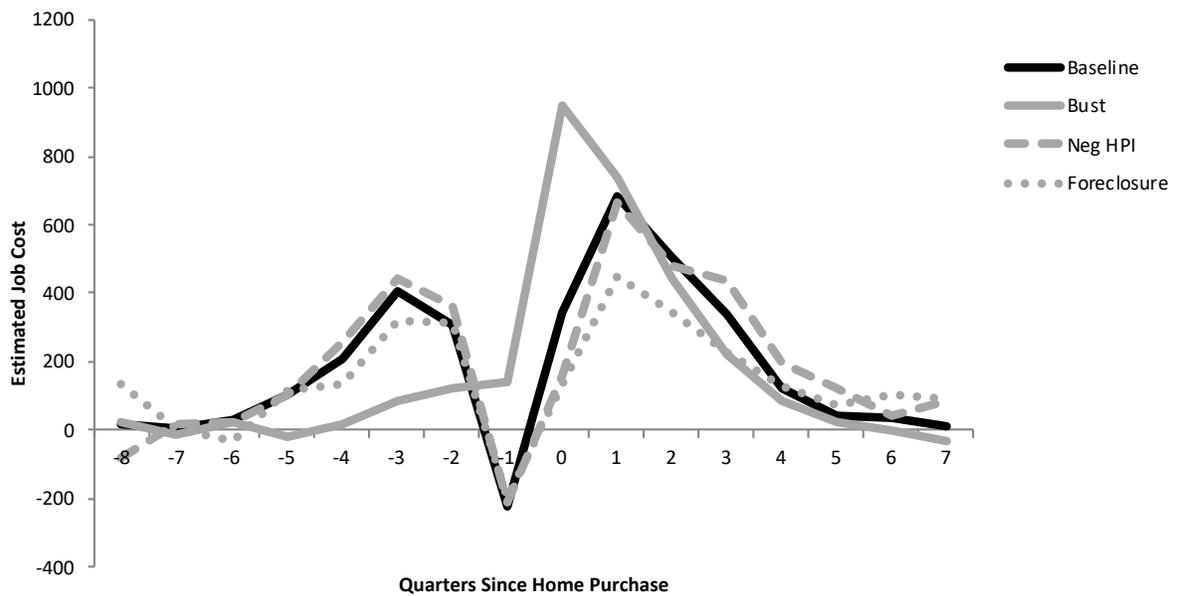
Notes: The figure above plots homebuyers' estimated cumulative spending relative to the month of their home purchase. We calculate cumulative spending by adding up the monthly spending responses estimated from Equation (1) and reported in Figures II.B, III.B, V.B and V.D.

**Figure VII.**  
**Heterogeneity in Response of Permit Activity to Home Purchase**

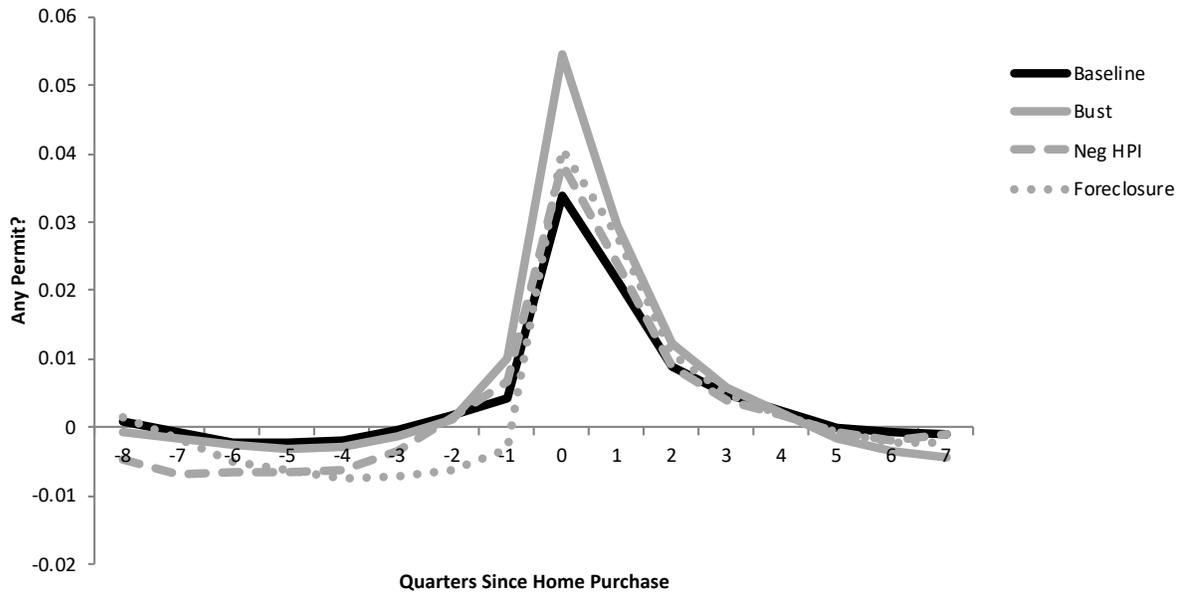
**A.  $\text{Log}(1 + \text{Estimated Job Cost})$  Relative to Home Purchase**



**B. Estimated Permit Cost Relative to Home Purchase**



### C. Incidence of Permits Relative to Home Purchase



Notes: The figures above show heterogeneity in homebuyers’ building permitting activity around the date of their home purchase. We consider heterogeneity in three dimensions: 1) timing of purchase relative to the housing boom (2001-2006) or bust (2007-2013); 2) timing of purchase relative to the local home price cycle (an indicator for negative zip code-level home price appreciation in prior three years); and 3) seller distress (an indicator for whether the transaction was a foreclosure or short sale). In each panel we plot coefficient estimates from a single model estimated in the BuildFax-DataQuick sample. The dependent variable is the estimated cost of building permits, in logs or levels, in the first two panels and an indicator for any building permit in the third panel. “Baseline” indicates the estimated permitting response for non-distressed transactions that occurred during the housing boom (2001-2006) and within zip codes with positive home price appreciation in the prior three years. The remaining three lines show the estimated permitting response when varying one dimension of heterogeneity at a time. We estimate the heterogeneous responses jointly in a single model to disentangle the differences in the home purchase channel over time, by foreclosure status and by recent housing market performance. Each model includes controls for property characteristics as well as property and year-by-quarter fixed effects. We estimate each model by ordinary least squares and two-way cluster observations by CBSA and year-quarter in calculating standard errors.