MAKING THE HOUSE A HOME: THE STIMULATIVE EFFECT OF HOME PURCHASES ON CONSUMPTION AND INVESTMENT[1]

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Abstract

We introduce and quantify a new channel through which the housing market affects household spending: the home purchase channel. Using an event-study design with data from the Consumer Expenditure Survey, we show that households spend on average $3,700 more in the months before and the first year following a home purchase. This spending is concentrated in the home-related durables and home improvements sectors, which are complementary to the purchase of the house. Expenditures on nondurables and durables unrelated to the home remain unchanged or decrease modestly. We estimate that the home purchase channel played a substantial role in the Great Recession, accounting for one-third of the decline in home-related durables spending and a fifth of the decline in home maintenance and investment spending from 2005 to 2010, together totaling $14.3 billion annually.

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.

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, appliances, and furnishings are also purchased to complement a particular physical space and 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 monthly expenditures reported by homeowners in the Consumer Expenditure Survey (CE) between 2001 and 2013. We also analyze quarterly 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 $1,300 per year on home durables and $2,500 per year on home improvement and maintenance. This home-related spending constitutes nearly 40% of homeowners' total durable and improvement spending of $10,200 per year.

We use an event-study methodology to estimate both the timing and magnitude of spending responses after the purchase of a home. With aggregate data, home values and home purchases move in tandem, which complicates the separate identification of home value and home purchase effects.[2] 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 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 by controlling for household fixed effects. These fixed effects narrow the identifying variation

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2. 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 Appendix B for details.

to within-household differences in time after home purchase and absorb household-level spending differences that relate, for example, to variation in wealth, income, and stage of life.

We estimate that homebuyers spend $5,740 (measured in 2009 dollars) more on home durables and improvements from three months before the purchase through one year after the purchase of a primary residence. This increase includes $2,340 of additional spending on home-related durables, which amounts to a *tripling* of spending compared to longer-tenured owners' $1,130 annual spending on home-related durables. Recent homebuyers also spend substantially more on home improvement and maintenance. These investments in the home more than *double* in the first year after purchase, increasing by $3,400 relative to longer-tenured owners' average annual investment of $2,350. Both home durables and investment spending spike particularly in the first quarter following home purchase and remain modestly higher for six to nine months after home purchase before leveling off at their long-term average by the end of the first year of ownership. Households that purchase additional properties—vacation homes or investment properties—also boost spending, but by a smaller amount than owner-occupants.

Our analysis of building permits likewise shows a substantial increase in home improvements: the estimated cost of permitted jobs more than doubles in the first year of homeownership, increasing by $2,500. The building permit data allow further examination of any intertemporal substitution of home improvements. We find that home sellers also increase spending on improvements by an average of $730 in the year before the sale. We conclude that first-year owners' improvement spending is incremental, since it does not merely replace sellers' deferred investments.

In contrast to the patterns we observe for home-related spending, we find that spending on nondurables and durables unrelated to the home remain flat or decline modestly around home purchases. On net, the increases in home durables, improvement, and maintenance spending are not offset by spending declines in other consumption categories. The absence of spending increases unrelated to the home also reinforces a causal interpretation of the main results.

The event-study methodology is not immune to omitted variables critiques. For instance, a shock that causes the 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, however, that such omitted variables would cause *systematically* higher spending, even among categories that are unrelated to the home. Yet purchases of vehicles, jewelry, books, and health equipment are very similar between first-year and long-tenured owners after accounting for household fixed effects. Indeed, 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. This observance of spending increases so tightly associated with the home suggests that household fixed effects are successful in absorbing omitted variables in our main analysis.

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 on the left axis) and for combined home durables, improvement, and maintenance spending (in red and on 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 home purchase and the decline in home sales from 2005 to 2010, we calculate that the collapse of home purchases led to a $14.3 billion annual decline in spending and investment during the Great Recession. This partial equilibrium aggregation excludes any spending by suppliers of real estate services, such as realtors and building contractors, who earn income from home purchases and improvements. Nevertheless, this channel explains more than one-third of the decline in spending on home durables and 15% to 20% of the decline in home improvements spending following the late-2000s housing crisis.

We provide a further point of comparison to the literature on home prices and consumption (e.g., Mian, Rao, and Sufi, 2013) by analyzing the aggregate sales of home-related durables by metropolitan area in the Economic Census. Using variation in housing cycles across metropolitan areas, we jointly estimate the elasticities of home-related spending to home prices and to home purchases. Home-related spending moves strongly with home purchases during both the housing boom (2002 to 2007) and bust (2007 to 2012). The elasticity of spending to purchases is 0.26 during the boom and 0.12 during the bust. By comparison, the elasticity of spending to home prices is 0.29 in the boom and 0.23 in the bust. While these results do not have as convincing identification as our event-study results, they help to compare the home purchase channel to the housing wealth effect

channel and illustrate that the home purchase channel is a meaningful driver of spending in the housing sector.

Our work relates to a broad literature on the relationship between the housing market and consumption. Several papers have quantified this relationship and generally find that households consume between four and eleven cents of each dollar change in housing wealth. This literature includes work with regional variation by Case, Quigley, and Shiller (2005, 2012), Mian and Sufi (2011, 2014a, 2014b), Mian, Rao, and Sufi (2013), and Guren et al. (2018); work with household-level data by Hurst and Stafford (2004), Campbell and Cocco (2007), Attansio et al. (2009), and Attanasio, Leicester, and Wakefield (2011); and work with aggregate data by Carroll, Otsuka, and Slacalek (2011). In terms of understanding the mechanism, Cooper (2013) and DeFusco (2018) use novel empirical approaches to show that the collateral channel is important. On the theoretical side, Chen, Michaux, and Roussanov (forthcoming), Gorea and Midrigan (2018), Berger et al. (2018), and Kaplan, Mitman, and Violante (2019) use calibrated models to inspect the mechanism, mainly focusing on the collateral channel. Most directly related to this paper is work by Best and Kleven (2018), who estimate the stimulus effects of changes in housing transaction taxes using identification from tax notches in the United Kingdom. In an extension, they use annual U.K. microdata to estimate that a housing purchase triggers auxiliary spending equal to 5% of the house's price in the first year and 1% the following year. Their analysis uses annual repeated cross sections and cannot capture the fineness in consumption and heterogeneity that is a focus of our paper.

Our paper also relates to the literature on the consumption of durables. Most of the theoretical literature focuses on (S,s) adjustment models with fixed costs (e.g., Eberly 1994).

Our findings highlight that many durable goods purchases are complementary to other goods or life changes, such as purchasing a new house.

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 for home durables and home improvements and maintenance. In Section IV we discuss our empirical identification strategy and present placebo and robustness tests. Section V explores heterogeneity in the home purchase channel. Sections VI and VII provide estimates of the aggregate effect of the home purchase channel and a comparison to the effect of home prices. Section VIII concludes.

II. DATA AND METHODOLOGY

We use survey data on household spending from the Consumer Expenditure Interview Survey (CE), administrative data on building permits from the data analytics firm BuildFax, and 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 home purchase timing, home characteristics, and household mortgage borrowing. 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) for each spending category for durables and using NIPA deflators for home maintenance and improvement.

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 number of months since acquisition across the household's properties.

An important feature 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 additional tests, we use the pre-moving expenditures to examine intertemporal substitution in the months preceding the move, although confidence intervals widen in these months because of small sample sizes.

II.B. Building Permit Data

Our second 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 building, electrical, mechanical, plumbing, and total job cost. The

data span 1994 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.

The permit data provide two advantages over the CE data for the study of residential improvements. First, the permit data afford more statistical power because of the substantially larger sample of home transactions. 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 and months leading up to a home sale. To the extent that sellers are also buyers of a new property, this wider time window allows us to evaluate the extent of intertemporal substitution in improvements.

II.B. Economic Census Data

Our third 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.

II.C. Sample Description and Summary Statistics

Table I presents summary statistics for the CE and BuildFax samples. The table reports household characteristics (Panel A), property characteristics (Panel B), and household spending (Panel C) for the CE data, and it reports permitting activity (Panel D) for the BuildFax data.

The CE sample includes all homeowners surveyed between April 2001 and March 2013. The sample includes 665,802 monthly observations for 70,529 homeowners with non-missing information on the date of home purchase.

As the sample statistics in Panel A show, average household annual income and financial asset holdings, measured in 2009 dollars, are $73,516 and $57,444, respectively. In terms of education, 11% of household heads in the sample lack a high school diploma, 26% have only a high school diploma, 29% have some college education, 21% have a college degree, and 13% have a graduate degree. Of the sampled household heads, 73% are white, 14% are Hispanic, 8% are black, and 3% are Asian. Moving to marital status, 65% of the household heads are married, 13% are divorced, 11% are widowed, and 10% have never been married. The mean family size is 2.6. The average age for the head of household is 53 years, and 24% of households have a head of household or spouse who is retired.

Panel B reports summary statistics on property characteristics. The typical property in our sample was purchased around thirteen years before the survey date. More than 60% 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 37 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) food. 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. The vast majority of spending on non-home durables, more than 75%, goes toward vehicles.

As Panel C demonstrates, the average spending on home improvement and maintenance is $209 per month, amounting to $2,508 per year, while the average spending on home durables is $108 per month, or $1,296 per year. The other spending categories of non-home durables and food average $532 and $612 per month, respectively. Households make home improvement expenditures in about 17% of the months in our sample. They purchase home durables more frequently, in 28% of the household-month observations in the CE sample.

The permitting sample includes all homes with a sales transaction between 2001 and 2013. Our sample includes 9,081,284 properties with at least one purchase transaction during our sample period, with 44.1 quarters of BuildFax data coverage per property on average, with a total of 400,060,883 property-quarter observations. As Panel D illustrates, the average property has 1.85 permits during our sample period, with a mean count of 0.31 permits for electrical work, 0.21 permits for mechanical work, 0.22 permits for plumbing work, and 1.11 permits for structural work. The mean total job cost for all property-quarter

observations in the data is $634 per quarter. However, conditional on property-quarters with positive permit-related expenditure, the mean total job cost is $42,990. This high average job cost relative to the CE reflects the fact that building permits are necessary for large home improvements but not for smaller improvements. Because of this, we see the analysis of the BuildFax data as supportive of the more representative figures in the CE.

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 II 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 II reports average monthly spending by category in the quarter before a home purchase and each of the first four quarter 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 II shows, the average monthly home improvement spending in the first quarter after the home purchase is $598 compared to the mean of $196 per month after the first year of ownership. That is, households spend 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 $382 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 $325 and $280 per month, respectively.

Likewise, household spending on home durables increases dramatically in the first quarter after the purchase of a property. As Table II shows, the average monthly spending on home durables in the first three months after the home purchase is $750 per month, compared to a mean $94 per month after one year of ownership, representing an almost eightfold increase in 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 $787 per month in the first quarter after the home purchase, representing an increase of 51% over the $521 per month spent among

households beyond the first year of ownership. Finally, we do not find any significant changes in household spending on food following a home purchase, suggesting that the purchase itself is unlikely to lead to a dramatic change in the household's lifestyle.

In Panel B of Table II 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 food and move more often, we would observe similar spending patterns even if food 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 presented above suggest that households spend dramatically more on home improvement and home durables during the first year of ownership. 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) $Spending_{it} = \alpha + \sum_{m=-3}^{11} \beta_m 1\{Months\ since\ Purchase = m\} + \delta_t + \boldsymbol{\gamma}'\ \boldsymbol{X}_{it} + \varepsilon_{it},$

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 (β_m, $m \in [-3, 11]$). These fixed effects measure the household's incremental spending in each of the three months before the house purchase as well as the first twelve months of home ownership relative to an excluded category of thirteen or more months 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 **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 (δ_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 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, and in robustness tests we show similar findings for Probit and Tobit models designed for discrete and censored outcome variables. We calculate Huber-White standard errors with observations clustered by household. Most of the analysis is presented using figures that plot the pattern in household spending following home purchase or mortgage refinancing. The figures are plotted based on the coefficients of the fixed effects for each month relative to the date of the home purchase ($\beta_m, m \in [-3, 11]$). These fixed effects measure the household's incremental spending in each of the three months before the purchase as well as the first twelve months of home ownership relative to an excluded category of thirteen or more months following the purchase after we control for property and household characteristics.

We estimate a similar model in the permitting analysis:

$$(2) \quad Permits_{pt} = \alpha + \sum_{q=-8}^{8} \beta_q 1\{Quarters\ Since\ Purchase = q\} + \delta_t + \theta_p + \varepsilon_{pt}.$$

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 and after the home purchase. Even though the quarters before the sale concern a different homeowner, which means that we cannot measure intertemporal substitution for a single household with the permit data, we can nevertheless test whether on average sellers defer maintenance or upgrade their house before selling. Because most sellers repurchase, this helps us assess intertemporal substitution for permitted home

improvements. By contrast, because the CE does not track movers, we can observe only up to three months before a 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 in some specifications, we include quarter-by-year fixed effects (δ_t) and property fixed effects (θ_p). We estimate the model with ordinary least squares and cluster observations by property.

III.C. Home Durable Spending Following Home Purchase

Table III presents results from estimating Regression (1) using a measure of home durables spending as a dependent variable. As the table illustrates, there is an increase in spending during the twelve months following a home purchase. When we do not control for household or property characteristics, log spending increases by 1.87 log points in the first month, 2.02 log points in the second month, and 1.09 log points in the third month. These log differences equate to proportional increases of 549%, 654%, and 197%, respectively. This pattern of increased consumption that peaks in the second month remains similar when we control for property and household characteristics and year fixed effects in Column (2) as well as when we control for household fixed effects in Column (3).

Controlling for household characteristics and then household fixed effects reduces the estimated spending responses modestly for the first few months following a home purchase and more substantially for months 6 to 12 following the purchase. The elevated spending late in the first year of ownership—reflected in coefficients of 0.2 to 0.3 for months 9 to 11 of the first specification—falls modestly after controlling for household

characteristics and then by more than half 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 variation across specifications is shown visually in Appendix A. Nevertheless, there is a substantial home durables spending response in the first nine months after purchase even for the most stringent specification that includes household fixed effects.

In terms of dollar spending, home durables spending increases by \$851 in the first month and \$744 in the second month after a home purchase. In the third and the fourth months after the purchase, spending increases by \$303 and \$184, respectively. Finally, in Column (5) of Table III we use the incidence of spending as our dependent variable and find that the propensity to spend on home durables increases by 20% in the first month, 24% in the second month, and 12% in the third month after a home purchase. The incidence of home durables spending is 5%–8% higher in months 4, 5, and 6 and 3%–4% higher in in months 7, 8, and 9.

Table III also presents household spending for the three months before the home purchase. As the table demonstrates, households reduce their spending on home durables in the three months before making a home purchase. For example, the propensity to spend is 18%, 19%, and 13% 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 and home improvements 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, for example, the coefficients imply a cumulative spending difference of +6.97 log points in the twelve months after a purchase, which is three times as large as the cumulative −2.13 log point decline in the three months before the purchase.

The pattern of spending on home durables is illustrated in Figures II.A, II.B, and II.C. Each figure is plotted based on the coefficients of the fixed effects for each month relative to the date of the home purchase, using as dependent variables the logarithm of home durables spending (Figure II.A), the dollar amount of home durables spending (Figure II.B), or the incidence of home durables spending (Figure II.C).

III.D. Home Improvement and Maintenance Following Home Purchase

We also analyze household spending patterns on home improvement and maintenance and report the results in Table IV and Figures III.A, III.B, and III.C. As Table IV demonstrates, we find a significant increase in home improvement and maintenance spending following a home purchase. The incidence of home improvement spending is 11% in the month of the home purchase, while it is not statistically different from zero in the three months before the purchase. The likelihood that a household will conduct home improvement and maintenance increases to 15% in the first month after the purchase and is 10% and 7% in the second and third months, respectively, after the purchase. The magnitudes of these spending are also significant, amounting to an average of $485, $479, and $301 in each of the three months after the home purchase.

To gauge the total effect of a home purchase on spending, we analyze the combined spending on all durable goods (home and non-home) as well as on home improvement and maintenance. The results are presented in Table V and in Figures IV.A, IV.B, and IV.C. As Table V, Column (4) shows, the combined spending on durables and home improvement and maintenance is $1,462 in the month of the home purchase. Spending remains high in the next three months, with a total of $1,323 in the first month after the purchase and $659 and $452 in the second and third months after the purchase, respectively.

III.E. Permitting Activity Around Home Purchases

Results from estimating Regression (2) for our analysis of building permits are presented in Table VI. The dependent variable in Columns (1) to (3) is the natural logarithm of 1 + total job cost, while in Columns (4) and (5), the dependent variable is the actual job cost in dollars. Column (1) shows an increase of 0.241 log points in permit total job cost during the quarter in which a home is purchased, or an increase of 27.3% in permit cost. The estimated job cost is also 0.181 and 0.094 log points higher in the first and second quarters after the purchase, representing proportional increases of 19.8% and 9.9%, respectively. The pattern of increased job cost during the quarter of the home purchase and the following two quarters also remains similar when we control for year fixed effects in Column (2) and property and year fixed effects in Column (3).

In terms of actual job cost, the average increases by $763 during the quarter of the home purchase and by $835 in the first quarter after the purchase. In the second and the third quarters after the purchase, the average job cost increases by $561 and $365, respectively, and it increases by an additional $223 in the fourth quarter after the purchase,

as shown in Column (4). Interestingly, permit job costs also increase before the purchase, suggesting that home sellers invest in their homes before selling. This reveals that households that are both buyers and sellers 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 before a sale that occur more than three months before the purchase.

Finally, in Column (5) of Table VI we use the incidence of having any permit as our dependent variable and find that the likelihood of having a permit increases by 5.5% during the quarter of the home purchase, followed by a 3.5% increase in the first quarter after the purchase and 1.9% and 1.3% increases respectively in the second and third quarters after the purchase.

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 consumer survey, and a two-year look-back produces no evidence consistent with intertemporal substitution.

IV. 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 private 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 lead to 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.

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, food, and entertainment.

Figures V.A, V.B, and V.C show spending patterns for non-home durables (Figure 5.A), food (Figure V.B), and entertainment (Figure V.C) corresponding to fixed effects in Regression (1).[3] As the figures demonstrate, there is little change in consumption patterns in any of these categories. We find a very modest response of spending on non-home durables and no response of spending on food or entertainment in the months following home purchase. 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. We should also note here that non-home durables and food 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.

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3. The figures are constructed from regressions that use the logarithm of the expenditure as a dependent variable. Figures that use the actual dollar cost look similar and can be found in Appendix A.

V. Heterogeneity in the Home Purchase Channel

The richness of our data allows us to explore heterogeneity in the home purchase channel to provide more texture on how it operates. Table VII assesses several dimensions of heterogeneity in the home purchase channel by reporting the cumulative change in dollar spending from three months before a home purchase through twelve months after the purchase.

We first split the sample into a boom period with high sales from 2001 to 2006 and a bust period with low sales from 2007 to 2012. We find that marginal purchases in the boom period induce more home durable spending but less home improvement spending than do purchases in the bust period. The next four splits are by characteristics of the purchased home. We find that there are larger responses for larger homes in terms of size (number of bedrooms) and home value. In terms of home age, the increase in durables and improvement expenditures is largest for homes under three years old, suggesting that there is still some customization of newer homes. The purchase of homes serving as a primary residence induces more home durable spending and substantially more improvement spending than does the purchase of a vacation or investment property. The final two sample splits are by homeowner characteristics. We find that older and higher-income homeowners increase their spending on durables and improvements by a larger amount following a home purchase.

V.A. Summary of Cumulative Effect of Home Purchase on Spending

Figure VI summarizes our overall results by showing the cumulative impulse response of spending to a home purchase by category. As discussed above, the increases in

spending on home durables and home improvement and maintenance following purchase dwarf the declines in these series and on non-home durables spending before purchase. Cumulatively, the increase in spending from three months before purchase until twelve months after is about $3,400 for home improvement and $2,340 for home durables, with an $850 decline in non-home durables spending. The aggregate effect is thus nearly $5,000 for the purchase of primary residences. These effects are somewhat smaller for secondary residences, so the aggregate cumulative effect unconditional on whether the residence is primary or secondary is $3,700.

VI. 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 2000 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.[4,5] This provides a simple, partial equilibrium accounting, similar to the

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5. We do not compare to NIPA tables because NIPA uses different definitions that make it difficult to compare levels changes. This problem is particularly acute for home maintenance, repair, and improvement, because these CE categories are split across residential investment, "other services" in personal consumption, and "imputed rent" in personal consumption.

6. One may worry that our effects overstate the aggregate consumption change because households sell home durables around a sale, and so some of the durables consumption is canceled out in the aggregate by sales of durables. However, we find no evidence of increased household income from sales of goods around a home sale in the CE. We thus conclude that our estimates do not overstate the aggregate change in consumption for this reason.

literature on housing wealth effects, that assesses how much of the observed change in consumption can be accounted for by the home purchase channel.

To create the national time series for consumption and home improvement and maintenance, we aggregate the CE using the provided sample weights. We deflate subcategories of durable consumption by their subcategory CPI deflator and subcategories of improvement and maintenance by their NIPA deflator. For home sales, we use non-seasonally adjusted data on existing home sales for the entire United States from the National Association of Realtors together with monthly, non-seasonally adjusted data on sales of new homes from the Census Bureau. These data provide a more accurate time series of home sales than home sales aggregated using the CE weights, although reassuringly the two series are quite consistent. This is the case because these categories had lower inflation than the aggregate CPI in the boom but higher inflation than the aggregate in the bust. Consequently, deflating by category price indices leads to a larger run-up in consumption in the boom and a smaller decline in consumption in the bust. We multiply the monthly time series by our preferred estimates of average dollar spending in the three months before purchase, the month of purchase, and each of the following twelve months and then aggregate the implied time series to the annual level. We next take differences between 2000–2002 and 2005 for the boom as well as 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 because home sales peaked in 2005.

Our results are shown in Table VIII, with the boom above the horizontal line and the bust below the horizontal line. Our results are generally stronger for the bust than the boom 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 the other categories – grew by more in the boom than it shrank in the bust, so the denominator is bigger in the boom than the bust.

Column (1) of Table VIII shows that in the boom the home purchase channel accounted for about 8.5% to 9.0% of the growth in spending on home durables, while in the bust the home purchase channel contributed 23% to 39% percent of the decline in spending on home durables.[6] The home purchase channel has a small negative effect on non-home durables spending, mostly because households cut back slightly on non-home durables spending in the months preceding a move. Column (4) shows the effect on home improvements spending, which was 7.4% to 9.3% in the boom and 13% to 19% percent in the bust. Maintenance is a much more erratic time series, particularly in the boom, but we can see a 10% to 40% effect in the bust, as shown in Column (5). Column (6) combines improvements and maintenance spending, finding slightly higher numbers when maintenance is added than for improvements alone.

The categories of spending affected by the home purchase channel are only part of overall durables and home maintenance spending. To show the effect of the home purchase channel on these larger categories, Table VIII shows the aggregate effect of these declines on total durables in Column (3) and on total durables plus home improvements and

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7. The differences between 2005–2008, 2009, 2010, and 2011 can largely be ascribed to the time path of the denominator. This is because home sales fall from 2005 to 2008 and then stay at roughly the same low level, while home durables consumption continues to decline slightly until 2009, after which it begins to rebound. Similar patterns can be seen for the other variables.

maintenance in Column (7). In the boom, the aggregate effect on total durables spending was 1.5% to 2.0%, rising to 3.7% to 4.8% when spending on maintenance and improvements is added. In the bust, the effect on total durables spending was 2.7% to 3.6%, rising to 6.6% to 9.1% when spending on maintenance and improvements is added. 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 this effect, the average home purchase triggers a net spending of $3,700 on durables, home improvement, and maintenance from three months before purchase to one year after purchase,[7] and from 2005 to 2010 sales fell by 3.86 million units. This implies an annual decline in spending of approximately $14.3 billion, or approximately 0.1% 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. Our annual effect of $14.3 billion over three years is thus equivalent to roughly three-quarters of Mian, Rao, and Sufi's average annual estimated decline in non-auto durables associated with the decline in housing prices from 2006 to 2009 in the Great Recession, or roughly 15% of their overall decline in consumption.

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8. This figure differs from the analysis presented above because it combines both primary residences and second homes, whereas the main analysis above is for primary residences only.

VII. 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 response 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 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 that of Mian, Rao and Sufi (2013), which measures 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:

$$(3) \ \Delta(Log\ Spending)_{ct} = \alpha + \beta\Delta Log(Home\ Purchases)_{ct-1} +$$

$$\gamma\Delta Log(Home\ Price\ Index)_{ct-1} + \boldsymbol{\delta_t} + \varepsilon_{ct},$$

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 β and γ 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 (δ_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 IX, 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. While these results are not as well-identified as our event-study results, they 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.

VIII. 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 $3,700, primarily on home-

related durable goods and home maintenance and repair. To address concerns that this relationship is driven by unobserved heterogeneity, we use 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 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 effect for food or entertainment spending, and a modest offsetting effect for non-home durable goods spending (included in the $3,700 figure above).

This channel played a quantitatively sizable role in in the Great Recession and a more modest role in the prior housing boom. It accounted for a third of the decline in home durable goods spending during the Great Recession and a fifth of the decline in home improvement and maintenance spending. A back-of-the-envelope calculation implies that the home purchase channel accounted for a $14.3 billion – or 0.1% of GDP – decline in spending per year in the Great Recession.

The home purchase channel complements the response of consumption to changes in housing wealth driven by house prices that has been the focus of recent literature (e.g., Mian, Rao, and Sufi 2013). Appendix A shows that changes in housing prices and sales volume are highly correlated, both in levels and in log changes. The home purchase channel is quantitatively smaller than the housing wealth channel because it only affects non-auto durables spending, but for these categories it is substantial: the magnitude of our effect is equivalent to three-quarters of the causal effect of the 2006–2009 change in housing wealth on non-auto durables consumption estimated by Mian, Rao, and Sufi (2013).

Beyond understanding the mechanisms connecting the housing market and spending in the Great Recession, our estimates are of relevance to policy makers. To the extent that

monetary policy is passed through into mortgage interest rates, monetary policy can have a substantial impact on housing transaction volume. Our estimates are a crucial input for monetary policy makers who wish to understand the effect of these sales on durables and home improvement spending. 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., forthcoming).

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Table I.
Summary Statistics

PANEL A: Household Characteristics	Mean	Std. Dev	PANEL B: Property Characteristics	Mean	Std. Dev
Income/Wealth			Months since purchase	160	156
			Purchased in previous 12 months? (%)	6.37	24.42
Annual income	73,516	66,335			
Financial assets	57,444	291,913	Mortgagor? (%)	63.96	48.01
Assets information missing?	0.11	0.32	Months since refinancing#	59	70
			Refinanced in previous 12 months? (%)	6.82	25.21
Education			Age of home (years)	37	29
No high school diploma	0.11	0.32			
High school diploma only	0.26	0.44	Age of home missing?	0.09	0.29
Some college	0.29	0.46	Rooms	6.63	2.03
College degree	0.21	0.41	Bedrooms	3.11	0.89
Graduate degree	0.13	0.33	Bathrooms	1.80	0.74
Race/Ethnicity			Central air?	0.68	0.47
White	0.73	0.44	Swimming pool?	0.11	0.31
Black	0.08	0.27	Porch?	0.82	0.38
Hispanic	0.14	0.35	Off-street parking?	0.83	0.37
Asian	0.03	0.18			
			PANEL C: Household Spending		
Other	0.01	0.12			
Marital Status					
Married	0.65	0.48	**Spending per month ($)**		
			Home improvement and maintenance	209	1,960
Widowed	0.11	0.31	Home durables	108	698
Divorced	0.13	0.33	Non-home durables	532	3,623
Separated	0.02	0.12	Food	612	500
Never married	0.10	0.30	**Likelihood of purchase (per month)**		
			Any home improvement?	0.17	0.38
Other			Any home durables?	0.28	0.45
			Any non-home durables?	0.52	0.50
Age of household head	52.86	15.82			
Family size	2.63	1.45	Any durables or improvement?	0.38	0.49
Retired? (%)	23.69	42.52			

Notes: Sample includes 665,802 monthly observations on 70,529 homeowners with non-missing information on date of home purchase in CE sample between 2001 and 2013.

Table I.
Summary Statistics (Continued)

PANEL D: Building Permits

Estimated Total Job Cost ($)		
Unconditional, per quarter	634	13,149
Conditional on permit	42,990	99,502
Number of permits, by type (per property)		
Electrical	0.313	1.989
Mechanical	0.208	1.420
Plumbing	0.224	1.525
Structural	1.106	5.936
All	1.850	8.999

Notes: Building permits data includes 400,060,883 quarterly observations on 9,081,284 properties between 2001 and 2013.

Table II.
Household Spending Following Home Purchase or Mortgage Refinancing

Panel A: Spending After Home Purchase

	Average Monthly Spending ($)			
Quarters Since Purchase	Home Improvement	Home Durables	Non-home Durables	Food
1	598	750	787	596
2	382	251	717	607
3	325	175	627	608
4	280	151	657	606
5+	196	94	521	613

Panel B: Building Permits After Home Purchase

	Building Permit Activity		
Quarters Since Purchase	Any Permit?	Number of Permits	Estimated Job Cost ($)
1	0.077	0.122	1,292
2	0.057	0.094	1,344
3	0.040	0.063	1,032
4	0.034	0.052	813
5+	0.026	0.039	506

Notes: Real spending per month measured in January 2009 dollars (CPI-U as price deflator).

Table III.
Spending on Home Durables Surrounding a Home Purchase

	Dependent Variable: Home Durables				
Months since purchase	Log Spending	Log Spending	Log Spending	Spending ($)	Spending > 0?
-3	-0.45***	-0.48***	-0.86***	-53	-0.18***
	(0.15)	(0.15)	(0.22)	(226)	(0.04)
-2	-0.66***	-0.61***	-0.79***	4	-0.19***
	(0.06)	(0.06)	(0.10)	(78)	(0.02)
-1	-0.38***	-0.36***	-0.48***	121	-0.13***
	(0.05)	(0.05)	(0.09)	(78)	(0.02)
0	1.87***	1.90***	1.84***	851***	0.20***
	(0.07)	(0.07)	(0.09)	(63)	(0.02)
1	2.02***	2.02***	1.93***	744***	0.24***
	(0.06)	(0.06)	(0.08)	(54)	(0.01)
2	1.09***	1.07***	0.95***	303***	0.12***
	(0.06)	(0.06)	(0.07)	(39)	(0.01)
3	0.77***	0.73***	0.58***	184***	0.08***
	(0.05)	(0.05)	(0.07)	(41)	(0.01)
4	0.54***	0.49***	0.36***	51**	0.05***
	(0.05)	(0.05)	(0.06)	(23)	(0.01)
5	0.52***	0.47***	0.35***	35	0.06***
	(0.05)	(0.05)	(0.06)	(22)	(0.01)
6	0.40***	0.36***	0.23***	44	0.03***
	(0.05)	(0.05)	(0.06)	(27)	(0.01)
7	0.40***	0.36***	0.24***	13	0.04***
	(0.04)	(0.04)	(0.05)	(18)	(0.01)
8	0.38***	0.34***	0.21***	18	0.03***
	(0.04)	(0.04)	(0.05)	(22)	(0.01)
9	0.22***	0.18***	0.07	8	0.01
	(0.04)	(0.04)	(0.05)	(19)	(0.01)
10	0.26***	0.23***	0.10**	-4	0.02*
	(0.04)	(0.04)	(0.05)	(19)	(0.01)
11	0.26***	0.23***	0.11**	19	0.02**
	(0.04)	(0.04)	(0.05)	(23)	(0.01)
N	665,802	665,802	665,802	665,802	665,802
R^2	0.01	0.06	0.29	0.22	0.30
Control variables:					
Prop characteristics?	N	Y	Y	Y	Y
HH characteristics?	N	Y	Y	Y	Y
HH fixed effects?	N	N	Y	Y	Y
Year fixed effects?	N	Y	Y	Y	Y

Table IV.
Spending on Improvement and Maintenance Surrounding a Home Purchase

Months since purchase	Log Spending	Log Spending	Log Spending	Spending ($)	Spending > 0?
	Dependent Variable: Home Improvement and Maintenance				
-3	0.03	0.07	-0.02	1182	-0.02
	(0.22)	(0.22)	(0.25)	(1063)	(0.03)
-2	-0.09	-0.03	-0.08	40	-0.01
	(0.07)	(0.07)	(0.10)	(148)	(0.02)
-1	0	0.05	-0.01	149	0.00
	(0.05)	(0.05)	(0.08)	(98)	(0.01)
0	0.75***	0.81***	0.77***	485***	0.11***
	(0.06)	(0.06)	(0.08)	(95)	(0.01)
1	1.06***	1.10***	1.01***	479***	0.15***
	(0.06)	(0.06)	(0.08)	(80)	(0.01)
2	0.72***	0.75***	0.63***	301***	0.10***
	(0.05)	(0.05)	(0.07)	(74)	(0.01)
3	0.57***	0.60***	0.41***	197**	0.07***
	(0.05)	(0.05)	(0.07)	(82)	(0.01)
4	0.40***	0.42***	0.25***	123*	0.04***
	(0.05)	(0.05)	(0.06)	(67)	(0.01)
5	0.32***	0.34***	0.18***	97	0.03***
	(0.04)	(0.04)	(0.06)	(65)	(0.01)
6	0.23***	0.25***	0.08	163	0.01
	(0.04)	(0.04)	(0.06)	(136)	(0.01)
7	0.24***	0.26***	0.11**	43	0.02**
	(0.04)	(0.04)	(0.05)	(52)	(0.01)
8	0.16***	0.19***	0.03	19	0.01
	(0.04)	(0.04)	(0.05)	(39)	(0.01)
9	0.19***	0.21***	0.07	67*	0.01
	(0.04)	(0.04)	(0.05)	(38)	(0.01)
10	0.18***	0.20***	0.05	-13	0.01
	(0.04)	(0.04)	(0.05)	(29)	(0.01)
11	0.17***	0.19***	0.04	70	0.00
	(0.04)	(0.04)	(0.05)	(48)	(0.01)
N	665,802	665,802	665,802	665,802	665,802
R^2	0.00	0.03	0.27	0.23	0.29
Control variables:					
Prop characteristics?	N	Y	Y	Y	Y
HH characteristics?	N	Y	Y	Y	Y
HH fixed effects?	N	N	Y	Y	Y
Year fixed effects?	N	Y	Y	Y	Y

Table V.
Total Spending on Durables, Improvement & Maintenance Surrounding a Purchase

Months since purchase	Dependent Variable: All Durables, Home Improvement & Home Maintenance				
	Log Spending	Log Spending	Log Spending	Spending ($)	Spending > 0?
-3	-0.05	-0.24	-0.69**	818	-0.08**
	(0.27)	(0.26)	(0.31)	(1105)	(0.04)
-2	-0.82***	-0.85***	-1.00***	-350	-0.14***
	(0.10)	(0.10)	(0.13)	(269)	(0.02)
-1	-0.48***	-0.55***	-0.64***	19.48	-0.10***
	(0.07)	(0.07)	(0.11)	(201)	(0.02)
0	1.49***	1.42***	1.38***	1,462***	0.10***
	(0.07)	(0.06)	(0.10)	(188)	(0.01)
1	1.70***	1.58***	1.48***	1,323***	0.11***
	(0.06)	(0.06)	(0.09)	(161)	(0.01)
2	1.11***	0.96***	0.82***	659***	0.07***
	(0.06)	(0.06)	(0.08)	(143)	(0.01)
3	0.91***	0.72***	0.52***	452***	0.05***
	(0.06)	(0.06)	(0.08)	(154)	(0.01)
4	0.66***	0.46***	0.28***	164	0.04***
	(0.06)	(0.05)	(0.07)	(150)	(0.01)
5	0.59***	0.40***	0.22***	52	0.03***
	(0.05)	(0.05)	(0.07)	(117)	(0.01)
6	0.44***	0.26***	0.09	61	0.01
	(0.05)	(0.05)	(0.07)	(166)	(0.01)
7	0.43***	0.25***	0.11*	118	0.02
	(0.05)	(0.05)	(0.06)	(119)	(0.01)
8	0.41***	0.23***	0.08	-50	0.01
	(0.05)	(0.05)	(0.06)	(93)	(0.01)
9	0.37***	0.19***	0.07	66	0.01
	(0.05)	(0.05)	(0.06)	(99)	(0.01)
10	0.35***	0.17***	0.03	-112	0.01
	(0.05)	(0.05)	(0.06)	(93)	(0.01)
11	0.35***	0.18***	0.04	73	0.01
	(0.05)	(0.05)	(0.05)	(105)	(0.01)
N	665,802	665,802	665,802	665,802	665,802
R^2	0.01	0.13	0.42	0.18	0.46
Control variables:					
Prop characteristics?	N	Y	Y	Y	Y
HH characteristics?	N	Y	Y	Y	Y
HH fixed effects?	N	N	Y	Y	Y
Year fixed effects?	N	Y	Y	Y	Y

Table VI.
Building Permitting Activity Surrounding a Home Purchase

Quarters since purchase	Dependent Variable: Building Permits				
-8 (Omitted)	Log Job Cost	Log Job Cost	Log Job Cost	Job Cost ($)	Any permit?
-7	-0.006	-0.004	-0.005	-7	-0.001
	(0.000)	(0.000)	(0.000)	(5.283)	(0.000)
-6	-0.010	-0.006	-0.007	2	-0.001
	(0.000)	(0.000)	(0.000)	(5.456)	(0.000)
-5	-0.007	-0.004	-0.005	48	-0.001
	(0.000)	(0.000)	(0.000)	(5.625)	(0.000)
-4	0.002	0.003	0.002	146	0.000
	(0.000)	(0.000)	(0.000)	(5.841)	(0.000)
-3	0.011	0.015	0.014	268	0.002
	(0.000)	(0.000)	(0.000)	(6.057)	(0.000)
-2	0.022	0.027	0.026	288	0.006
	(0.000)	(0.000)	(0.000)	(6.029)	(0.000)
-1	0.030	0.035	0.034	29	0.012
	(0.000)	(0.000)	(0.000)	(5.513)	(0.000)
0	0.241	0.245	0.244	763	0.055
	(0.001)	(0.001)	(0.001)	(7.057)	(0.000)
1	0.181	0.188	0.187	835	0.035
	(0.001)	(0.001)	(0.001)	(7.255)	(0.000)
2	0.094	0.104	0.103	561	0.019
	(0.000)	(0.001)	(0.001)	(6.828)	(0.000)
3	0.063	0.073	0.072	365	0.013
	(0.000)	(0.000)	(0.001)	(6.458)	(0.000)
4	0.043	0.054	0.053	223	0.009
	(0.000)	(0.000)	(0.001)	(6.137)	(0.000)
5	0.023	0.038	0.037	135	0.006
	(0.000)	(0.000)	(0.000)	(5.895)	(0.000)
6	0.010	0.029	0.028	95	0.005
	(0.000)	(0.000)	(0.000)	(5.814)	(0.000)
7	0.007	0.026	0.026	78	0.004
	(0.000)	(0.000)	(0.001)	(5.770)	(0.000)
8	0.003	0.023	0.023	63	0.003
	(0.000)	(0.000)	(0.001)	(5.708)	(0.000)
N	194,786,763	194,786,763	194,786,763	194,786,763	197,457,069
R^2	0.00	0.00	0.05	0.03	0.06
Year fixed effects?	N	Y	Y	Y	Y
Property fixed effects?	N	N	Y	Y	Y

Table VII.
Heterogeneity in the Spending Response to Home Purchase

Cumulative Dollar Spending Around Home Purchase in Month t
(Sum of marginal spending responses, t-3 and t+12)

Time Period or Sample Restriction	Home Durables	Home Improvement and Maintenance
Time Period		
Housing boom (2001-2006)	2,544	3,069
Housing bust (2007-2013)	1,923	4,699
Home Size		
Two or fewer Bedrooms	1,596	2,447
Three Bedrooms	2,499	2,075
Four or more Bedrooms	2,566	5,902
Home Value		
Below Median (≤ $175,000)	1,583	408
Above Median (> $175,000)	3,114	6,125
Home Age		
Less than three years old	6,139	7,198
Three to ten years old	2,853	2,658
Ten or more years old	1,317	3,127
Residency at purchased property?		
Yes; primary residence	2,340	3,400
No; vacation or investment property	1,486	801
Homeowner Age		
Thirty-five or younger	1,462	1,901
Thirty-six or older	2,964	4,517
Household Income		
Below Median (≤ $57,000)	1,799	1,806
Above Median (> $57,000)	2,740	4,645

Table VIII.
Aggregate Effect of Home Purchase Channel in Great Recession

	Home Durables	Non-Home Durables	Total Durables	Home Improve-ments	Home Mainten-ance	Home Improvements and Maintenance	Total Durables, Improvements and Maintenancet
2000–2005	8.9%	-0.6%	1.4%	8.7%	9.9%	8.8%	3.7%
2001–2005	8.5%	-0.6%	1.6%	7.4%	61.9%	8.4%	3.8%
2002–2005	8.8%	-0.8%	1.9%	9.3%	-139.9%	10.9%	4.8%
2005–2008	35.0%	-1.3%	3.6%	19.9%	32.3%	21.0%	9.1%
2005–2009	23.1%	-1.4%	3.4%	13.3%	37.4%	14.5%	7.9%
2005–2010	33.5%	-1.0%	2.7%	13.3%	16.7%	13.7%	6.6%
2005–2011	39.3%	-1.3%	3.3%	15.7%	9.7%	14.5%	7.8%

Note: 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), NIPA (for home improvements, and this same deflator is also used for maintenance, which does not have its own deflator), or a combination of CPI and NIPA (for the last column). 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 using CE 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 IX.
Heterogeneity in the Spending Response to Home Purchase

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

Note: We report estimates of the elasticities of retail spending to home purchases and home prices. The data on annual spending, which are at the metropolitan area level, come from the 2002, 2007 and 2012 Economic Census. 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

Note: Both series are normalized by their maximum value. Home sales, in blue on 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 on 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 to Home Purchase

A. Log(Home Durable Spending) Relative to Home Purchase
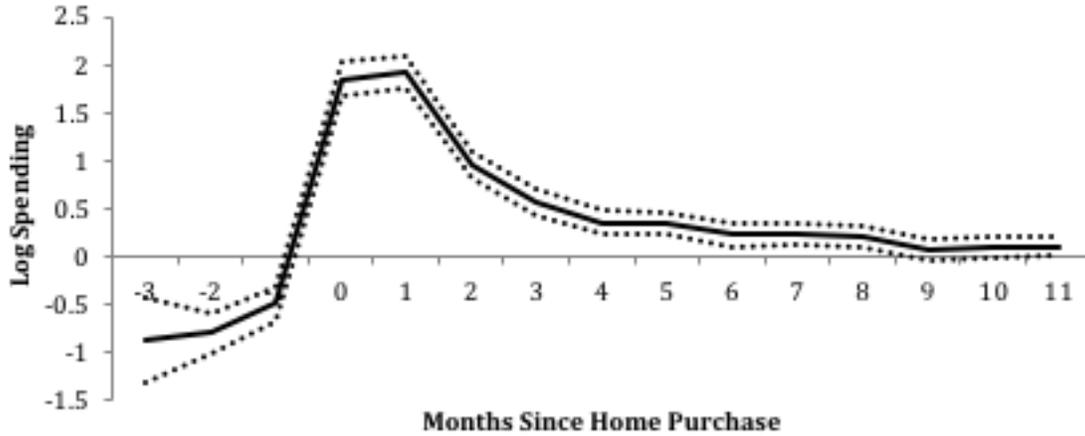
B. Home Durable Spending Relative to Home Purchase

48
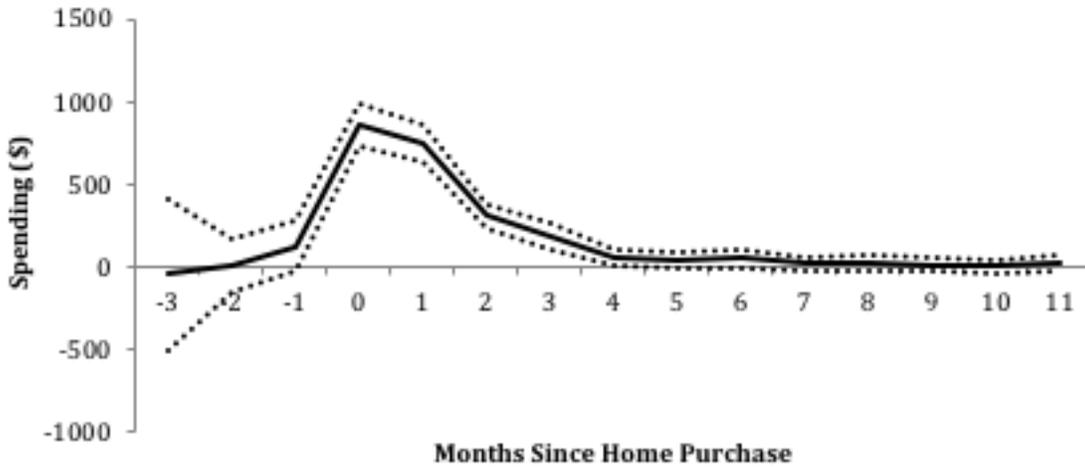
C. Incidence of Home Durable Spending Relative to Purchase
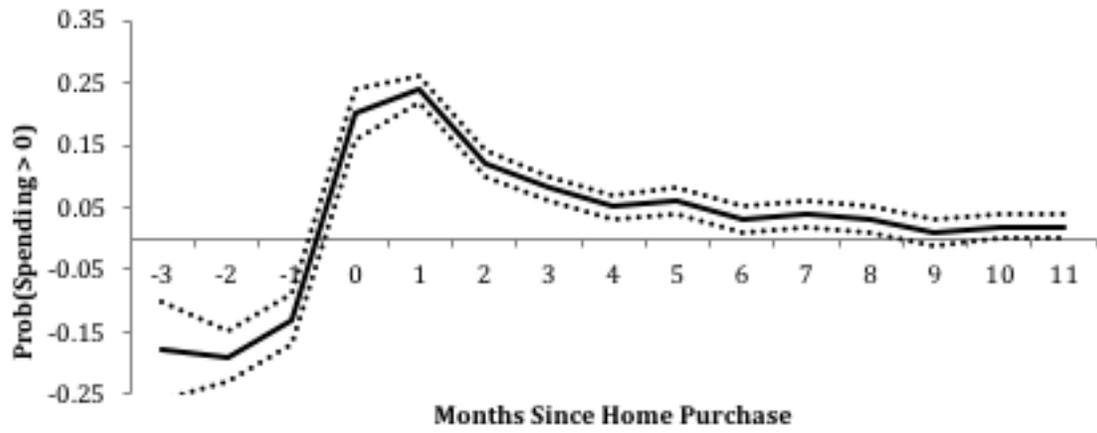
Figure III.
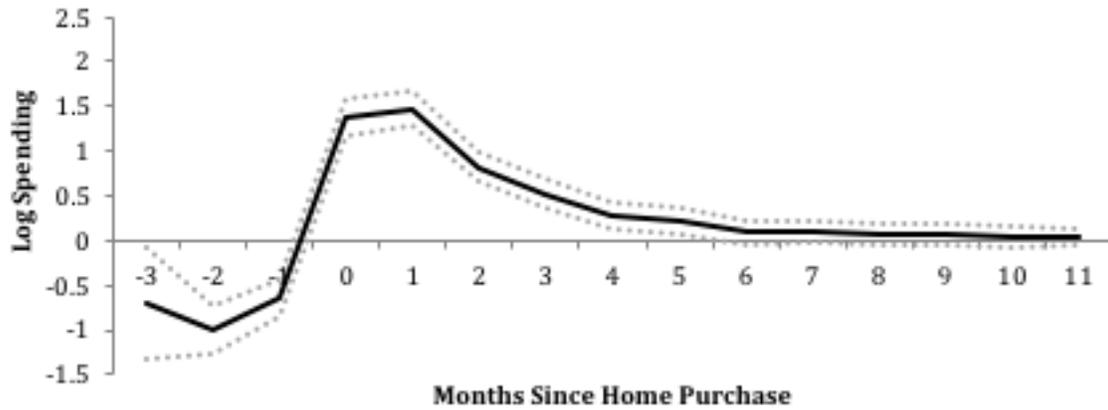**Home Improvement and Maintenance Impulse Response to Home Purchase**

A. Log(Home Improvement Spending) Relative to Purchase

B. Home Improvement Spending Relative to Home Purchase
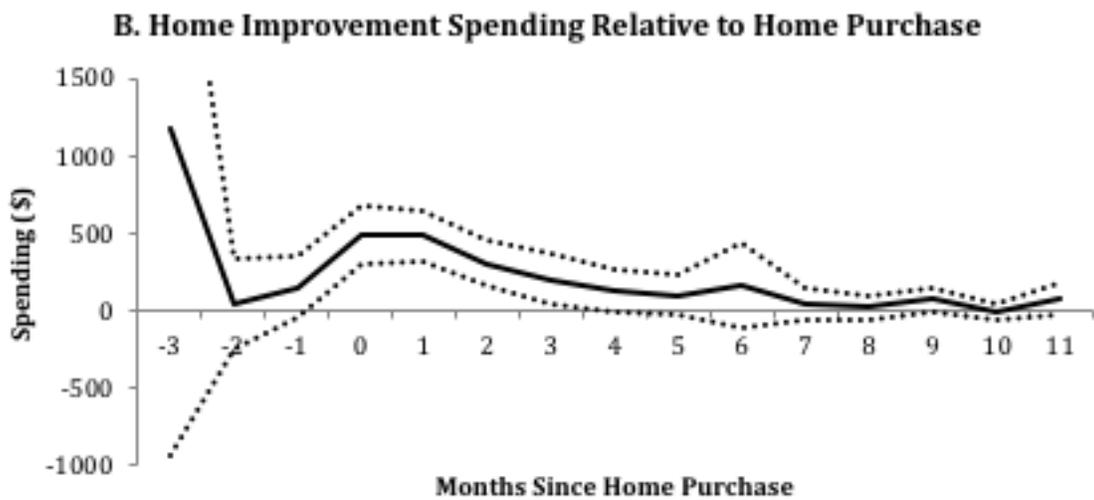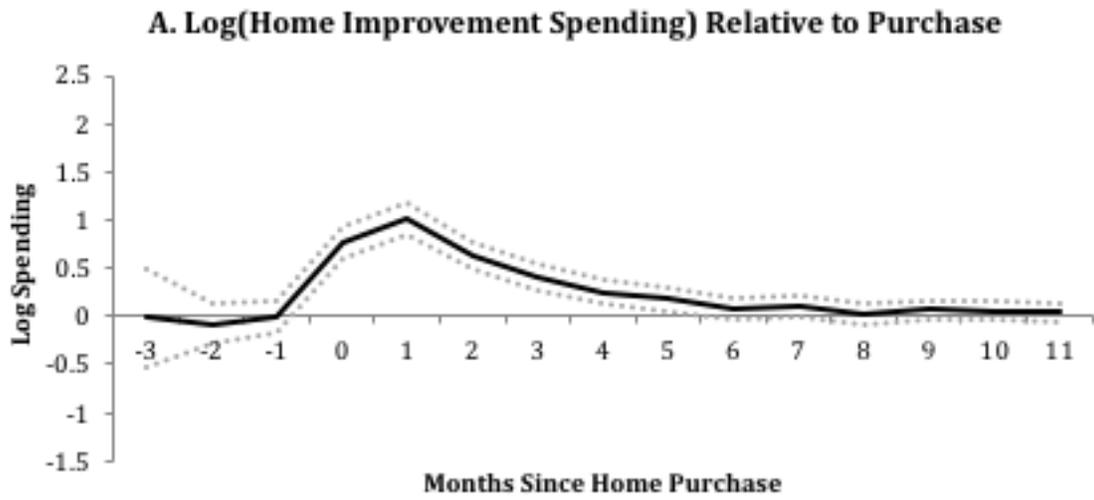
C. Incidence of Home Improvement Spending Relative to Purchase
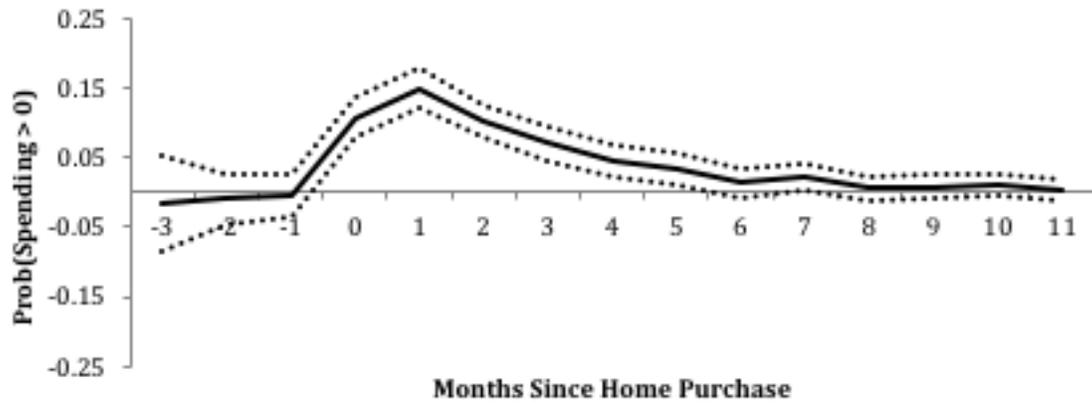
Figure IV.
Total Durable, Improvement, and Maintenance Spending Impulse Response

A. Log(Durable and Improvement Spending) Following Home Purchase

## B. Total Durable and Improvement Spending Following Purchase

Incidence of Durable or Improvement Spending Following Purchase
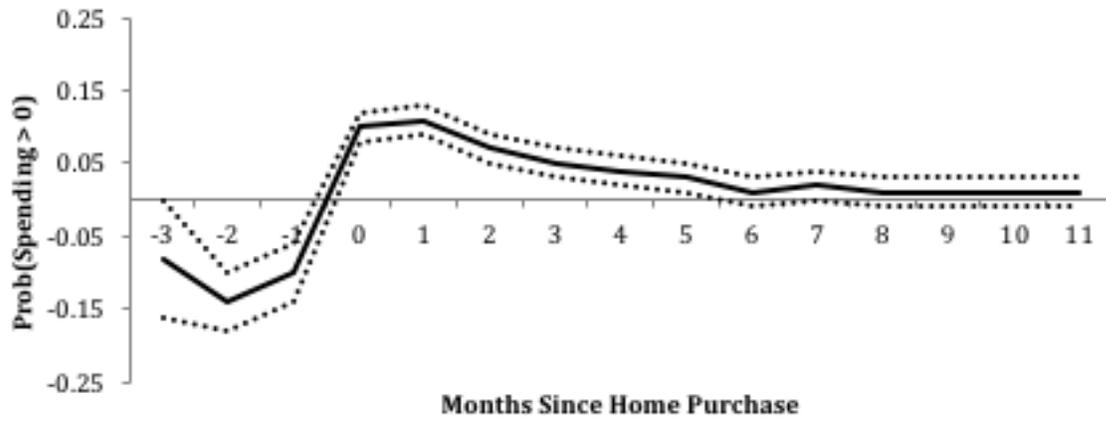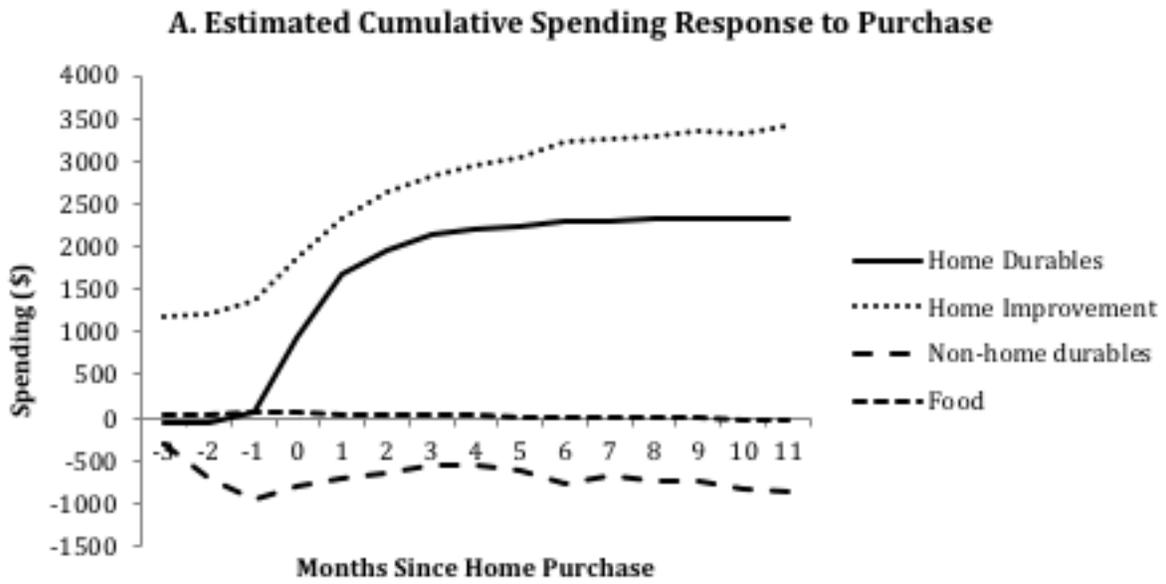
Figure V.
Non-Home Durables, Food, and Entertainment Responses to Purchase

A. Log(Non-home Durable Spending) Relative to Home Purchase

B. Log(Food Spending) Following Home Purchase
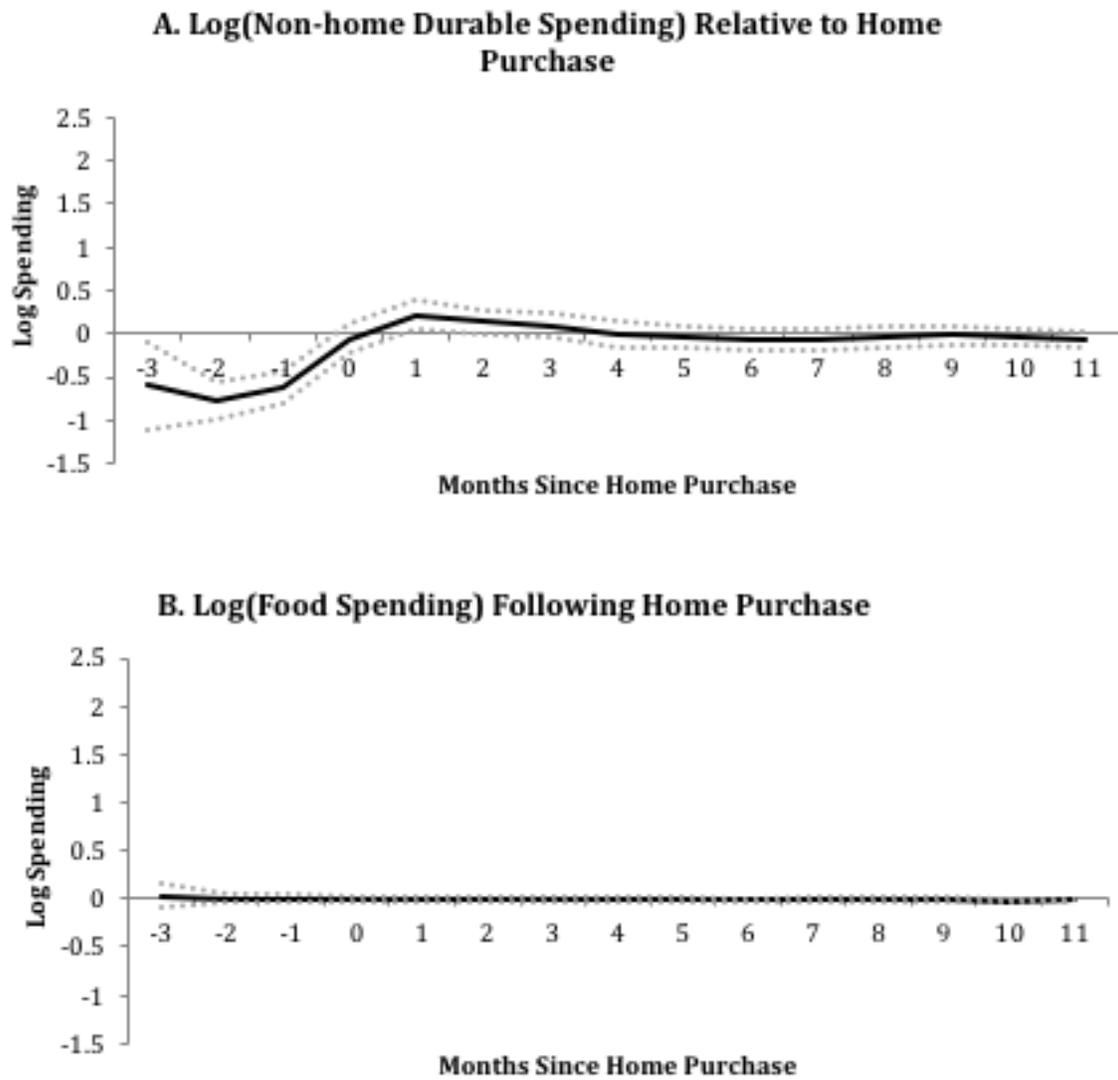
C. Log(Entertainment Spending) Relative to Home Purchase
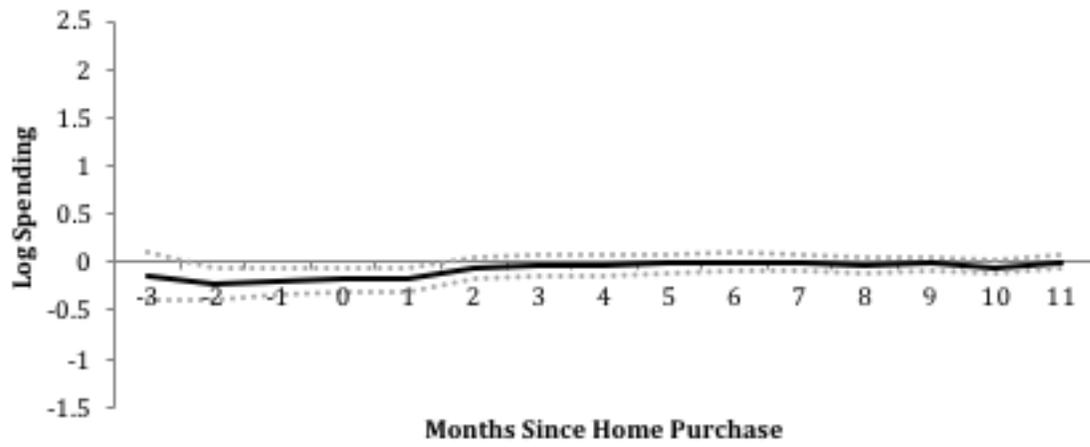
Figure VI.
Summary of Cumulative Effect of Home Purchase by Category

A. Estimated Cumulative Spending Response to Purchase

Appendix A: The Relationship Between House Prices and Sales Volume

The literature has focused largely on how changes in housing wealth driven by price movements affects consumption. The home purchase channel we describe is complementary to this channel because change in house prices are highly correlated with changes in sales volume.

Figure A.1 shows the relationship between several measures of home prices and home sales from 1968 to 2013. The price series, which include the National Association of Realtors (NAR) median sales price (1968–2013), the CoreLogic national house price index (1976–2013), and the Federal Housing Finance Authority all transactions price index (1975–2013), are all aggregated to quarterly, seasonally adjusted (by the data producer), and adjusted for inflation using the CPI and normalized to one in 1990. The sales series is the NAR single-family home sales series (1968–2013). We use only single-family sales rather than all sales because single-family sales are available for a much longer panel than all sales. To minimize seasonality in this series, which is not seasonally adjusted by the data provider, we show a one-year average around the plotted date. Panel A of Figure A.1 shows the series in levels, while panel B shows the series in annual log changes.

The price series are highly correlated with the sales volume series, although sales volume is somewhat more volatile. Indeed, the correlation of the price series with the sales series ranges between 0.75 and 0.86, depending on the index. Beyond this correlation, the figure reveals that in both the early 1980s and the late 1980s, when nationwide house prices fell modestly, and in the Great Recession, sales volume fell much more than prices. Sales volume appears to lead price changes, but only by a few quarters. In log changes, there is still a fairly strong correlation between sales and prices, although sales volume is far more

volatile. Nonetheless, in annual log changes, the correlations between the sales series and prices are 0.47 for the NAR median price series. 0.39 for the CoreLogic Price Index, and 0.43 for the FHFA price index.

Figure A.1.
Relationship Between Price and Sales Volume

A. Price Versus Sales Volume in Levels
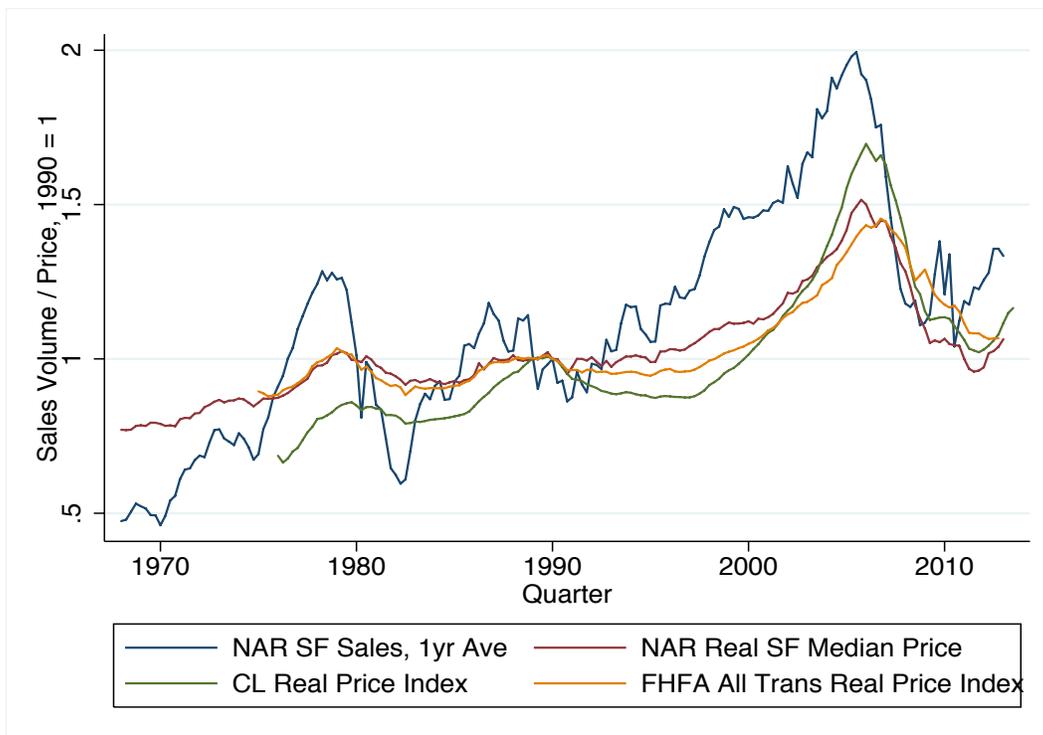
B. Price Versus Sales Volume in Log Changes