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The Impact of House Price Appreciation on Portfolio Composition and Savings

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Executive Summary

Recent Federal policy initiatives have sought to aggressively boost homeownership in the United States. This is clear in the newly passed "American Dream Act" that provides downpayment assistance for low-income and first-time homebuyers. It is also clear in regulations calling for a significant increase in the percentage of Fannie Mae and Freddie Mac lending that must be targeted at underserved borrowers and communities. These efforts have been prompted by a variety of goals, including concerns about unequal access to mortgage credit, the hope that homeownership will strengthen neighborhoods by encouraging families to invest in their communities, and the further hope that homeownership will enhance the ability of individual families to accumulate wealth.

Implicit in this latter goal is the assumption that homeowners save rather than consume wealth generated through housing capital gains. In contrast, however, Chairman Greenspan of the Federal Reserve has attributed much of the strength in consumer spending during the recent recession to the propensity of homeowners to cash out and spend from their house price appreciation.

Against this backdrop, the primary goal of this paper is to evaluate the following two questions. First, to what extent do households save or consume in response to house price appreciation? Second, how does house price appreciation affect household portfolios of assets and debts? This paper examines these questions using data from the Survey of Consumer Finances from 1983 to 2001, and also from the National Longitudinal Survey of Youth over most of that same period.

Results from the analysis provide support for both views of the impact of house price appreciation on savings and consumption. First, consistent with arguments by Chairman Greenspan, evidence indicates that homeowners spend an important fraction of their housing capital gains on consumer goods. Among both low- and high-income families, for each dollar of house price appreciation, households take on up to 15 cents additional debt, most of which appears to be used to finance the purchase of consumer goods as opposed to the acquisition of financial assets. That finding is broadly consistent with existing literature that tends to show that house price appreciation has relatively little effect on household portfolios of financial assets. These findings also are consistent with previous studies that show that the propensity to consume out of housing wealth is markedly higher than the propensity to consume out of stock market wealth.

From a policy perspective, the most important finding is that homeowners typically save at least 80 percent of their house price appreciation. Because house prices can fall, this does not ensure that homeownership facilitates the accumulation of wealth for any given family. Nevertheless, to the extent that real house prices tend to rise over time, the tendency of homeowners to save most of their housing capital gains is consistent with the view that homeownership helps families to accumulate wealth, and as such, lends support to recent policy initiatives designed to expand access to homeownership.

I. Introduction

Over the last decade, government policy makers along with private industry have made aggressive efforts to increase homeownership, especially among low-income and minority households. That trend continues today.[1] Such initiatives are prompted by a variety of goals. On the one hand, cultural norms favor homeownership for its own sake. This is clear in the title of the recently passed Federal "American Dream Act."[2] In addition, it has been argued that homeownership helps to stabilize neighborhoods. This is because homeowners have a financial stake in their neighborhoods and, therefore, have incentives to behave in ways that improve the neighborhood and their property values (DiPasquale and Glaeser (1997), Rosenthal (2004)).[3] A third goal often used to promote homeownership, is that owning a home is good for the homeowners themselves. On this point, a small literature has investigated whether homeownership improves child outcomes such as school achievement and health (e.g. Green and White (1997) and Haurin and Haurin (2002).[4] Others have suggested that homeownership enhances opportunities for saving through housing capital gains, and in so doing, helps families to accumulate wealth.

A primary goal of this paper is to evaluate the viability of this last claim for households in general, and for low-income families in particular. Specifically, we examine the following two questions: To what extent do households save or consume in response to house price appreciation, and how does house price appreciation affect household portfolios of assets and debts? The answers to these questions are important for on-going efforts to promote homeownership. For example, if households are found to save most of their house price appreciation that would strengthen arguments that encouraging homeownership serves to boost household savings and wealth. These questions are also

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1 In November 2004, for example, the Department of Housing and Urban Development (HUD) established regulations calling for a significant increase in the percentage of Fannie Mae and Freddie Mac lending that must be targeted at underserved borrowers and communities. The new targets would require Fannie Mae and Freddie Mac to purchase a larger share of their loans from lower-income borrowers and in underserved areas. For low- and moderate-income activity the targets would rise from the current 50 percent goal in place since 2001, to 56 percent by 2008. For underserved areas, the goal would increase from 36 percent to 39 percent by 2008.

2 The American Dream Act was signed into lay by President Bush in the spring of 2004. The Act provides downpayment assistance for first-time and low-income homebuyers.

3 DiPasquale and Glaeser (1997) show that homeowners are more likely to know the name of their congressional representative, they are more likely to volunteer, they are more likely to garden, and in general, they are more likely to behave in civic minded ways. Rosenthal (2004) shows that the presence of homeowners significantly elevates the future economic status of a neighborhood even after controlling for a host of other attributes of the neighborhood, including the distribution of income, race, education, age, and much more.

4 Results from these studies suggest that children of homeowners do better in school, have better health, and more. A challenge in addressing these issues, however, is that to become a homeowner families must clear certain financial and social hurdles. Families capable of navigating such obstacles are more likely to be overachievers relative to their observable attributes, and as a result, have motivated children who do well by a variety of outcome measures. Thus, homeownership is potentially endogenous to a child's outcomes. The studies by Green and White (1997) and Haurin and Haurin (2002) are aware of that difficulty.

central to a closely related issue that has received prominent attention in recent years. Namely, is it possible that house price appreciation could strengthen the national economy by boosting consumer spending among homeowners? To clarify, consider the following.

Implicit in the view that housing capital gains increase a family's level of wealth is the assumption that the propensity to use home price appreciation to finance consumer expenditures is low. That assumption, however, is potentially contrary to statements by Alan Greenspan, Chairman of the Federal Reserve. In a recent briefing to Congress, Greenspan stated that:

> *"… the extraction of equity from homes has been a significant support to consumption during a period when other asset prices were declining sharply. Were it not for this phenomenon, economic activity would have been notably weaker in the wake of the decline in the value of household financial assets."*
>
> *Federal Reserve Chairman Alan Greenspan, testimony to the Joint Economic Committee, Congress, November 13, 2002.*

In these and related remarks, Chairman Greenspan has argued that consumer expenditures have remained high because families have been spending out of their housing capital gains following the run-up in house prices that began in the mid-1990s.[5] Whether the propensity to spend out of house price appreciation is low or high clearly has important implications for both the impact of homeownership on household wealth, and for the economy overall. A second goal of this paper, therefore, is to shed light on the degree to which households adjust their level of consumption expenditures in response to housing capital gains, and further, whether that response differs for low- versus high-income families.

Despite the importance of these issues, the links between house price appreciation, consumer expenditures, and wealth are not well understood. Recent work on house price appreciation and consumption, for example, has tended to use aggregate time series data from the gross domestic product (GDP) accounts for which measures of consumption are available (e.g. Peek (1983), Case, Quigley and Shiller (2003), Benjamin, Chinloy, and Jud (2003)). Peek (1983) argues that failing to control for net capital gains of both housing and other durables causes one to misrepresent household savings and that this has important implications for measures of the U.S. savings rate. Benjamin, Chinloy, and Jud (2003) analyze time series aggregate data for the national economy and conclude that the marginal propensity to consume out of housing wealth is roughly 15 percent, markedly higher than their estimate of the marginal propensity to consume out of financial assets (e.g. stocks and bonds) which is just 2 percent. The most prominent of these sorts of studies is that of Case, Quigley, and Shiller (2003). They analyze time series aggregates for individual states throughout the U.S. and also across countries. In all of their specifications and for both sets of data they find that the elasticity of consumer expenditures with respect to housing wealth is much higher relative to the elasticity with respect to financial assets.[6]

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[5] Between 1995 and 2001 real single family house prices increased over 20 based in total on the repeat sales house price index reported by Freddie Mac at their website.

[6] Comparing across countries, Case, Quigley, and Shiller (2003) estimate that the elasticity of consumption with respect to housing wealth ranges from 0.11 to 0.17, while comparing across states, the range is 0.05 to

Although much has been learned from these exercises, aggregate data potentially obscure the manner in which housing contributes to a household's portfolio of assets and debts, and therefore, how the individual household responds to house price appreciation. For example, Chetty and Szeidl (2004) use instrumental variables methods to analyze the impact of mortgage debt on the composition of financial assets in the household's portfolio. Their study draws on household level data for a panel of families over the 1990 to 1996 period as obtained from the Survey of Income and Program Participation (SIPP). Results indicate that as families occupy more valuable homes, each one dollar increase in mortgage debt causes households to shift 50 to 70 cents from stock market assets to bonds. The explanation for this pattern is that housing often entails a long-term commitment to pay off a mortgage debt obligation, and that families facing such commitments are more risk averse.

Analogously, in response to house price appreciation, homeowners could rebalance their portfolios by increasing mortgage debt, investing further in financial assets, or increasing expenditures on non-durable consumer goods. Moreover, in the event that homeowners choose to extract equity from their homes, this can be accomplished by refinancing or through home equity lines of credit. Nothaft and Chang (2003) and Canner, Dynan, and Passmore (2002) analyze the determinants of refinance activity. Both find that interest rate movements are hugely important: homeowners are more likely to refinance when current mortgage rates fall below their contract mortgage rate. But Canner, Dynan, and Passmore (2002) further investigate the tendency of homeowners to refinance in order to extract equity from their homes. They find that refinancers who cash out home equity use roughly 33 percent of the cash for home improvements, 26 percent to pay off other debt, 16 percent for consumer expenditures, and 11 percent to invest in stocks. These results are suggestive that when homeowners extract equity from their homes they do so primarily to finance current and future consumer expenditures including improvements to their homes. In contrast, homeowners appear to be more reticent about using home equity to finance investments in financial assets. In some respects, this pattern is consistent with the results of Case, Quigley, and Shiller (2003) and also Benjamin, Chinloy, and Jud (2003) that the propensity to consume out of housing wealth exceeds the propensity to consume out of financial wealth.[7] In none of these studies, however, is there any attempt to consider whether low- and high-income homeowners might respond differently to house price appreciation.[8]

We investigate these issues using two surveys that provide detailed information on individual households. First, we pool data from the Survey of Consumer Finances surveys for the years 1983, 1989, 1992, 1995, 1998, and 2001. Each of these survey years is based on a different cross-section of

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0.09. In a simple OLS model, the elasticity of consumption with respect to financial wealth is about 2 percent in the cross-country analysis and close to zero in the cross-state exercise. These estimates vary somewhat when alternative specifications are employed, but in all cases the elasticity of consumption with respect to housing wealth is markedly higher relative to the elasticity with respect to financial wealth.

[7] See also Engelhardt (1996) and Jones (1994) for a further discussion of related issues.

[8] A small literature has also investigated whether households may be averse to selling their homes for less than the nominal value at which the home was originally purchased (e.g. Genosove and Mayer (2001) and Englehardt (2003)). In the present context, this suggests that household responses to house price appreciation may be asymmetric with regard to whether the nominal value of the home is rising or falling. Case, Quigley, and Shiller (2003) examine that possibility in their analysis as well.

households and includes roughly 4,000 families.[9] Although the SCF is well-known for over-sampling high-income and high-wealth households, it nevertheless contains sufficient numbers of lower-income families to allow for careful analysis of such households. In addition, the SCF provides near complete information on the household's balance sheet, including the original purchase price of the home and the owner's assessment of current house value.

We also examine the influence of house price appreciation on household wealth and portfolio composition using the National Longitudinal Survey of Youth (NLSY). The NLSY surveys follow individuals over a 21-year history covering the period 1979 to 2000. The 1979 survey included over 10,000 respondents ages 14 to 21. This design makes the survey particularly valuable for studies of younger individuals – such as first-time and prospective homeowners. In addition, African Americans, Hispanics, and low-income households were over-sampled in 1979, permitting better statistical analysis of these groups. Most important, the NLSY also collects information on household wealth, although the components contributing to household wealth are not as detailed as in the SCF. In addition, although the NLSY does not report the original purchase price of the house, in each survey year, homeowners report their assessment of the current house value. This allows us to examine the influence of house price appreciation from one survey year to the next, typically a period of two years for most homes in the NLSY.

Throughout the analysis we subtract the value of the primary residence from assets and net wealth, with the subsequent measures referred to as non-housing assets and non-housing net wealth hereafter. It should also be emphasized that mortgage debt is included in our measure of household debt. We construct our measures of assets and debt in this manner because our goal is to identify the impact of house price appreciation on those components of the household's portfolio that homeowners can modify. Whereas the value of the home is largely dictated by the market, families can readily adjust their level of mortgage debt as well as other components of the household's portfolio.

Bearing these definitions in mind, families can use their house price appreciation to finance consumer expenditures in one of two ways: families can take on more debt or they can divert funds from financial assets, both of which serve to reduce non-housing net wealth. On the other hand, if the propensity to spend out of house price appreciation is zero, then housing capital gains should have no impact on non-housing net wealth. Later in the paper we draw on these ideas to establish two principles that guide interpretation of our results. First, we show that the impact of housing capital gains on non-housing net wealth is approximately equal to the impact of housing capital gains on consumption. Moreover, consumption in this case includes non-durable goods as well as the flow of services from consumer durables. As an example, suppose that a $10,000 capital gain on the home causes non-housing net wealth to decline by $2,000. Then we would conclude that the family consumed $2,000 of the capital gain and saved the remaining portion. Suppose further that the capital gain had little effect on household financial assets: this is consistent with evidence from some of the studies noted above and also with results to be presented later in this paper. Then the $2,000 of consumption must have been financed primarily by taking on additional debt. In this case, the impact of housing capital gains on the household's level of debt is approximately equal to the impact of

[9] The 1983 and 1989 surveys actually contain a subset of households that are followed across the two years. That panel component was eliminated by the Federal Reserve after the 1989 survey.

house price appreciation on consumer expenditures for non-durable and durable goods. The precise conditions under which these principles hold are outlined later in the paper and also in the Appendix.

From a methodological standpoint, our primary challenge in analyzing the impact of housing capital gains on wealth and portfolio composition is the possibility that the level of house price appreciation may be endogenous. This is because expensive homes are owned primarily by wealthy families and, for any given rate of house price appreciation, the magnitude of the capital gain (or loss) will be larger for expensive homes. As a result, in a rising market, wealthy families would be more likely to occupy homes that experience large capital gains. To allow for that possibility, we estimate both ordinary least squares and two-stage least squares models. In the latter case, our instrument for housing capital gains is the average annual rate of house price appreciation of the home. Under the assumption that housing markets are efficient, the average annual rate of house price appreciation should not vary systematically with house price level, an assumption that is supported by evidence presented later in the paper. Otherwise, builders and other investors would have incentives to invest disproportionately in that segment of the market in which house prices appreciate most rapidly.[10]

The key results from our analysis can be summarized as follows. Findings support implicit claims by Chairman Greenspan that the propensity to spend out of house price appreciation is relatively high, especially as compared to the propensity to consume out of stock market appreciation. But findings also support advocates of homeownership who argue that housing capital gains increase household wealth. Among higher-income families (families with income over $50,000 in year 2001 dollars), one dollar of house price appreciation leads to an increase in household debt of over 15 cents, most of which appears to be used to finance non-durable consumption. Among low- and moderate-income families (with incomes below $25,000 and between $25,000 and $50,000, respectively), a similar pattern emerges. For these households, one dollar of housing capital gains encourages families to take on up to 18 cents additional debt, nearly all of which appears to be used to finance other non-housing assets. Of that amount, we document that 3 cents is used to finance automobiles, while evidence from the SCF suggests that most of the remaining debt is used to purchase non-housing durable goods.

To clarify these and related results, the remainder of the paper is organized as follows. Section II outlines our analytical approach. Section III describes the data and presents summary measures. Section IV presents the results, and Section V concludes.

[10] Such behavior, of course, would tend to arbitrage away differences in returns across different segments of the housing market. A further implication of efficient asset markets, however, is that risky assets yield higher expected returns than safe assets. Our argument above, therefore, is based implicitly on the assumption that the level of risk associated with investment in different segments of the housing market (e.g., low- versus high-priced housing) is similar. Although we do not test that assumption, as a first approximation it seems reasonable.

II. Analytical Approach

We begin with an accounting identity. Non-housing net wealth, defined here and throughout the paper as net wealth less the value of the primary residence, is denoted by W_t^{NonH}. By definition, this is equal to the difference between non-housing assets and debt,

$$W_t^{NonH} = A_t^{NonH} - D_t \tag{1}$$

where A_t^{NonH} denotes the current level of non-housing assets, and D_t denotes the current balance on all outstanding debt (including mortgage debt). Each of these terms is observable in our data, along with various sub-categories that make up the larger components of assets and debts.

Next, we define the capital gain on the home as the change in house value between the current survey date (*t*) and the last period in which the price for the home was reported (*t-k*). For the SCF, that prior period is the year in which the home was purchased and the previous price is the purchase price of the home. In the SCF data that we use, the median value for that elapsed period of time is ten years. For the NLSY, the prior period is the previous survey year and the previous price is the homeowner's assessment of house value in that prior survey year. The median value for the elapsed time between these price observations is two years.

Bearing these points in mind, housing capital gains between the prior period and the survey date are given by $Y_{t,t-k}^H$. Differentiating W_t^{NonH} with respect to housing capital gains,

$$\frac{\partial W_t^{NonH}}{\partial Y_{t,t-k}^H} = \frac{\partial A_t^{NonH}}{\partial Y_{t,t-k}^H} - \frac{\partial D_t}{\partial Y_{t,t-k}^H} \quad . \tag{2}$$

This says that the influence of housing capital gains on current non-housing net wealth is equal to the impact of housing capital gains on non-housing assets (first term) less the impact on debt (second term). As will become apparent, we are able to estimate each of the derivatives in equation (2). The question then is how to interpret those measures?

Estimates from equation (2) provide a direct measure of the impact of housing capital gains on non-housing wealth, non-housing assets, and debt. This is valuable. But it is also of interest to clarify the extent to which households spend out of house price appreciation. In considering this issue, recall that consumer *expenditures* include purchases of both non-durable and durable consumer goods. This is the focus of Chairman Greenspan's comments noted at the beginning of the paper. This differs from household *consumption*, which includes non-durable goods but only the flow of services from durables, not the stock.

Consider first the impact of house price appreciation on consumption (E^C) between periods *t* and *t-k*. In the Appendix, we show that this can be approximated by the impact of house price appreciation on the current level of non-housing net wealth adjusted for the impact on accumulated net income over the period,

$$\frac{\partial E^{c}_{t,t-k}}{\partial Y^{H}_{t,t-k}} = \left(\frac{\partial D_t}{\partial Y^{H}_{t,t-k}} - \frac{\partial A_t^{NonH}}{\partial Y^{H}_{t,t-k}} \right) + \left(\frac{\partial Y^{A}_{t,t-k}}{\partial Y^{H}_{t,t-k}} - \frac{\partial E^{d}_{t,t-k}}{\partial Y^{H}_{t,t-k}} \right) \quad . \tag{3}$$

In equation (3), accumulated unearned income between *t* and *t-k* is given by $Y^{A}_{t,t-k}$ while accumulated debt payments are given by $E^{d}_{t,t-k}$. The second bracketed term in (3), therefore, represents the impact of housing capital gains on accumulated net unearned income between *t* and *t-k*. Note that when *k* is small, so too will be the second bracketed term. In that case, the impact of housing capital gains on consumption is approximately equal to the first bracketed term, the impact of house price appreciation on the current level of non-housing net wealth.

Consider next the impact of house price appreciation on consumer expenditures (X^c). In this case, it is necessary to decompose non-housing assets into financial ($A_t^{Financial}$) and non-housing non-financial ($A_t^{NonHDurables}$) assets. This is because the former is not counted as a consumer expenditure but generates unearned income, while the reverse is true for the latter.[11] Decomposing in this manner and rearranging expression (3), we obtain,

$$\frac{\partial X^{c}_{t,t-k}}{\partial Y^{H}_{t,t-k}} = \left(\frac{\partial D_t}{\partial Y^{H}_{t,t-k}} - \frac{\partial E^{d}_{t,t-k}}{\partial Y^{H}_{t,t-k}} \right) - \left(\frac{\partial A_t^{Financial}}{\partial Y^{H}_{t,t-k}} - \frac{\partial Y^{A}_{t,t-k}}{\partial Y^{H}_{t,t-k}} \right) \quad , \tag{4a}$$

where $X^{c}_{t,t-k} \equiv E^{c}_{t,t-k} + A_t^{NonHDurables}$ denotes consumer expenditures. This says that the impact of house price appreciation on consumer expenditures is equal to the impact on debt less accumulated payments, less the impact on financial assets less accumulated unearned income. In the empirical work to follow, evidence from the SCF suggests that housing capital gains have little impact on financial assets. This implies that the second bracketed term is close to zero. Moreover, note that when *k* is small, accumulated debt payments are few and the first bracketed term is dominated by the impact of house price appreciation on the current level of debt. Under these conditions, equation (4a) simplifies to,

$$\frac{\partial X^{c}_{t,t-k}}{\partial Y^{H}_{t,t-k}} \approx \frac{\partial D_t}{\partial Y^{H}_{t,t-k}} \quad . \tag{4b}$$

This says that the impact of house price appreciation on consumer expenditures is approximately equal to the impact of housing capital gains on the current level of household debt.

[11] For example, suppose that a family uses their house price appreciation to debt finance the purchase of a new car. In equation (3), with *k* small, there is little impact on wealth and consumption because the car appears in the asset column of the family balance sheet and offsets the newly acquired debt. On the other hand, purchase of the car clearly counts as a consumer expenditure in the national income accounts.

How accurate is the approximation in (4b)? As noted earlier, the median values for *k* in the NLSY and SCF samples are 2 and 10 years, respectively. Especially for the NLSY, this suggests that (4b) is a good approximation. For the SCF, because *k* is somewhat larger, accumulated debt payments between *t* and *t-k* will also be larger. For both samples, however, to further refine our approximation, in the empirical work to follow we include *k* as a regressor in all of the regressions. This controls for the tendency of households to pay down their mortgage debt over time. As a first approximation, therefore, we are able to infer the impact of house price appreciation on consumer expenditures from the impact of housing capital gains on debt.

III. Data and Summary Measures

We investigate the relationship between house price appreciation and savings using existing owner-occupiers from two surveys. First, we pool data from the Survey of Consumer Finances surveys for the years 1983, 1989, 1992, 1995, 1998, and 2001. Each of these surveys is based on a different cross-section of households and includes roughly 4,000 families. Analysis based on the five surveys indicates that a total of roughly 10,000 homeowners are present that satisfy various criteria used to clean the samples.[12] Of these households, roughly 2,500 have annual real incomes below $25,000 (in 2001 dollars). Thus, although the SCF is well-known for over-sampling high-income and high-wealth households, it nevertheless contains sufficient numbers of lower income families to allow for careful analysis of such households. In addition, the SCF provides near complete information on the household's balance sheet, including the original purchase price of the home and the owner's assessment of current house value. These features of the data make the SCF an excellent dataset to study questions related to the influence of home price appreciation on household wealth and portfolio composition. At the same time, the SCF has its limitations, most importantly, it does not follow households over time and, therefore, it is not possible to observe wealth and the various components of the household's portfolio from prior years. The important exception in this regard is that households indicate retrospectively the price paid for the home and the date of purchase, along with the current value of the home. This makes it possible to measure the perceived capital gain on the home up to the survey date.

We also examine the influence of house price appreciation on portfolio composition using the National Longitudinal Survey of Youth (NLSY). The NLSY surveys follow individuals over a 21-year history covering the period 1979 to 2000. Surveys are annual through 1994, then biannual. The 1979 survey included over 10,000 respondents ages 14 to 21. The attrition rate has been only about 15 percent in the survey period. Blacks, Hispanics, and low-income households were over-sampled in 1979, permitting better statistical analysis of these groups. The survey collects a very wide range of information including tenure status, wealth, income, and socio-demographic characteristics. Wealth data are reported beginning in 1986 except for the 1991 survey, which we omit. We begin our analysis in 1990 when respondents were ages 25 to 32, and the number of homeowners is sufficient for our analysis. Household mobility was identified by the Ohio State University Center for Human Resource Research (the survey home) based on a survey-to-survey comparison of geocoded respondent location.

Relative to the SCF, the longitudinal structure of the NLSY allows one to follow individuals over time. The NLSY also allows for a particularly careful analysis of young, lower-income, and minority households. The wealth data in the NLSY are in many ways comparable to that in the SCF and house price appreciation can be measured in a similar way. On the other hand, the detailed information on portfolio composition in the SCF is unparalleled and the over-sampling of high-wealth and high-income families in the SCF allows for more careful analysis of that segment of the population. From the SCF, in addition to the current house value, the different subcategories of assets and debt used in the analysis to follow include the following:

[12] The criteria used to clean the sample are discussed in detail below.

(i) Net wealth less the value of the primary residence
(ii) Total debts
(iii) Total assets less the value of the primary residence
(iv) Total value of all mortgage debt
(v) Total value of home equity lines of credit
(vi) Total value of first and second mortgages.
(vii) Total value of cars in the household
(viii) Total value of luxury vehicles (e.g. boats, planes)
(ix) Total non-financial assets less the value of the primary residence
(x) Taxable Stocks, Bonds, and Mutual Funds
(xi) IRA and Keogh accounts
(xii) Total financial assets

A similar, though less extensive set of dependent variables is available in the NLSY.[13]

In both surveys, also available are a wide range of standard demographic variables that help explain individual-specific differences in the level of wealth and portfolio composition. These measures include race, marital status, divorce status, age, gender, education, and earned income. In addition, the estimated models to follow control for the number of years since home purchase. In the SCF this is based on the years since home purchase because both purchase year and purchase price for the home are reported. In the NLSY, the year of home purchase and purchase price are not reported. However, given the panel nature of the survey, we can observe the survey year in which the homeowner first reports owner-occupying the home. In addition, in each survey year the homeowner reports their assessment of house value. For the NLSY, therefore, we measure the number of years between surveys that report homeowner assessment of house value, contingent on the household remaining in the same house. These measures are important because mortgage debt tends to decline with the length of stay in the home as families pay down their mortgage. Finally, in all of the models we include fixed effects for the survey year in order to control for business cycle effects and other temporal phenomena that may affect household wealth and portfolio composition in different time periods.

We compute house price appreciation by differencing the reported value of the primary resident as of the survey date and the most recently reported price (assessment) on the home. For the SCF, this is the purchase price of the home. For the NLSY, it is the most recent reported homeowner assessment. In all cases, all dollar-valued variables are specified in year 2001 dollars using the CPI-U as obtained from the Bureau of Labor Statistics (BLS) website. Note that 2001 is the last survey year in our samples for both the SCF and the NLSY.

Finally, for the SCF, we exclude families with wealth (including the value of the primary residence) greater than one million dollars or less than negative $250,000. Also excluded are families whose average annual rate of nominal house price appreciation since home purchase is less than negative 50 percent or greater than positive 50 percent. We further exclude families whose home purchase price was less than $1,000 (in year 2001 dollars), families for whom the current value of the home is less

[13] As will become apparent, in the NLYS, we do not observe home equity lines of credit, the value of luxury vehicles, and in addition, our ability to separate out financial from non-financial assets is limited.

than $500, families that have been in the home less than one year, and finally, families for whom the current mortgage loan-to-value ratio is in excess of two. An analogous set of filters is used to drop observations from the NLSY.

Lastly, the public use version of the SCF includes five implicates for the survey years from 1989 to 2001. Each implicate is essentially a replicate of the original data file, but select values of different variables have been imputed using slightly different imputation procedures. This helps to address missing values in the data, but especially, is used to obscure values that might reveal the identity of respondents. This is particularly important in the SCF since the survey over-samples high-wealth and high-income families and does not top code the data. To simplify use of the data, in all of the analysis to follow, we used just the first implicate of the data file. Moreover, for the 1983 survey this issue does not arise since the implicate structure was adopted by the Federal Reserve beginning in 1989.

Summary Statistics

Table 1a provides summary measures on the distribution of values for several key variables that are used in the analysis to follow. It is worth emphasizing that both here and in all of the tables to follow, we focus only on owner-occupiers. The first four rows of Table 1a report values for the NLSY sample. The second four rows report values for a subset of the SCF sample in which households are restricted to the same age-cohort as in the NLSY. The last four rows of the table report values for the full SCF sample. Note that in all cases summary measures are not weighted and, for that reason, are influenced by the different sampling strategies in the NLSY and SCF: the NLSY over-samples low-income and minority households, while the SCF over-samples high-wealth families. In addition, it is important to remember that housing capital gains in the NLSY are measured based on the change in house value between the current and prior survey years, while housing capital gains in the SCF are measured since home purchase.

Consistent with the different sampling strategies in the two surveys, the SCF sample is wealthier, holds less debt, and occupies more expensive homes.[14] In addition, families in the SCF report higher levels of housing capital gains. These differences are apparent in various places in Table 1a. Note, for example, that for the full sample of the NLSY, the median level of non-housing net wealth is negative $24,990 as compared to positive $31,150 in the SCF. Note also, however, that when we restrict the SCF sample to individuals that belong to the same age cohort as in the NLSY, the summary measures for low wealth families are remarkably similar. This is apparent when comparing the 25th percentile for the SCF age-restricted sub-sample to the 25th percentile values in the NLSY. Non-housing net wealth in these groups are negative $60,070 in the NLSY and negative $48,050 in the SCF. Debt levels are roughly $40,000 in both cases, while non-housing assets are roughly $20,000 and house values are roughly $65,000. On balance, these summary measures make clear two key points that should be kept in mind as we go forward. First, the NLSY is a less wealthy, younger sample, and second, when the SCF is restricted to low-wealth families belonging to the same age

[14] In considering the table, recall that non-housing net-wealth can be negative if durable assets such as housing have fallen sufficiently far in value.

cohort as in the NLSY the summary measures for the variables noted in Table 1a become quite similar.[15]

Tables 1b, 1c, and 1d repeat the summary measures from the NLSY and SCF for three different subgroups in the populations, households with real (year 2001 dollars) total income under $25,000, households with real total income $25,000 to $50,000, and households with income over $50,000. That sample stratification is carried through to the regression analyses to follow in order to highlight the differential effects of house price appreciation on families of different income levels.

Once again, several broad patterns are apparent in the summary tables that have implications for interpretation of the regressions results to follow. First, note that there is considerable variation in the real level of housing capital gains in both samples. Among low-income families (Table 1b), for example, in the NLSY capital gains vary from - $6,960 at the 25th percentile to $4,710 at the 75th percentile. Analogous numbers for the SCF are - $14,130 and $16,630, respectively. Among high-income families (Table 1d), in the NLSY capital gains vary from -7,550 at the 25th percentile to $11,030 at the 75th percentile. Analogous numbers for the SCF in this instance are – $11,380 and $40,360, respectively. It is noteworthy that while many families enjoy positive real capital gains, many incur loses. In addition, the variation in capital gains reflects both cross-sectional and temporal variation in house price appreciation. The considerable variation in capital gains in our samples is critical to the research effort since without such variation it would be impossible to identify the influence of house price appreciation on wealth and consumption.

Observe also in Table 1b that compared to the NLYS, the typical low-income family in the SCF is not poor. The SCF families have a median level of non-housing net wealth of $11,470, rising to $62,780 at the 75th percentile. In the NLSY, the analogous values are negative $9,950 and positive $3,370. Analogous differences are evident with regard to debt, non-housing assets, and house value as well. In comparison to the NLSY, low-income families in the SCF hold relatively little debt per dollar of income, and have relatively high levels of non-housing assets. To reiterate, therefore, when we restrict the age-distribution of the SCF sample to match the age-cohort of the NLSY sample – as in Table 1a – among low-income/low-wealth families the two samples look very similar. However, when we consider the broader set of low-income families in the SCF – as in Table 1b – it is clear that such households are not necessarily poor, whereas low-income families in the NLSY have few financial resources to draw upon. That difference is in part explained by summary measures provided in Table 2. In that table, note that the average age among low-income families in the SCF is 60.93 years, while the average age in the NLSY sample is 34.46 years. Thus, many of the low-income families in the SCF are retirees living on accumulated savings from their working years. In contrast, low-income families in the NLSY are working poor at an early stage in their occupations.

[15] We attempted to run all of the SCF models restricting the sample to the same age cohort as in the NLSY. However, especially when we subdivided the sample by income groups in a manner to be indicated below, this resulted in very small sample sizes and unreliable estimates.

Table 1a
Distribution of Wealth, Portfolio Composition, and Housing Capital Gains Among Owner-Occupiers in the SCF and NLSY
(Dollar values are in year-2001)

	Percentiles and Mean	Net Wealth Less House Value in $1,000	Total Debt Owed in $1,000	Total Assets Less House Value in $1,000	House Value in $1,000	Housing Capital Gains Since Last Price Observation in $1,000	Percent Avg. Annual Rate of House Price App. Since Last Price Observation
NLSY Full Sample (Obs = 9,752)	25th	-60.07	41.24	18.13	63.29	-6.96	-3.88
	50th	-24.99	75.26	38.07	97.83	-0.73	-0.57
	75th	8.02	115.20	80.82	148.81	9.00	6.04
	Mean	-18.59	85.51	66.92	112.86	1.61	1.36
SCF Restricted to NLSY Age-Cohort (Obs = 1,474)	25th	-48.05	38.22	22.38	70.00	-5.70	-1.53
	50th	-2.96	83.51	64.10	113.60	5.08	1.18
	75th	65.66	131.60	168.82	180.00	23.22	6.25
	Mean	35.54	98.79	134.33	141.40	12.23	3.34
SCF Full Sample (Obs = 10,401)	25th	-14.07	1.85	25.04	65.79	-11.95	-1.32
	50th	31.15	35.91	79.41	107.12	3.91	0.49
	75th	159.35	93.26	222.52	177.81	29.30	3.66
	Mean	95.33	65.23	160.57	140.27	11.94	2.06

Table 1b
Distribution of Wealth, Portfolio Composition, and Housing Capital Gains Among Owner-Occupiers in the SCF and NLSY
Total Household Annual Income Less Than $25,000
(Dollar values are in year-2001)

	Percentiles and Mean	Net Wealth Less House Value in $1,000	Total Debt Owed in $1,000	Total Assets Less House Value in $1,000	House Value in $1,000	Housing Capital Gains Since Last Price Observation in $1,000	Percent Avg. Annual Rate of House Price App. Since Last Price Observation
NLSY Sample (Obs = 1,028)	25th	-40.49	6.85	4.27	21.47	-6.96	-8.65
	50th	-9.95	29.55	11.24	47.89	-1.16	-2.38
	75th	3.37	61.80	26.20	82.47	4.71	6.71
	Mean	-15.19	40.88	25.68	61.25	-1.40	-0.74
SCF Sample (Obs = 2,399)	25th	-1.24	0.00	6.44	34.86	-14.13	-1.53
	50th	11.47	8.43	22.37	64.27	0.55	0.08
	75th	62.78	19.69	72.05	100.98	16.63	2.55
	Mean	48.29	17.51	65.79	80.39	0.73	1.38

Table 1c
Distribution of Wealth, Portfolio Composition, and Housing Capital Gains
Among Owner-Occupiers in the SCF and NLSY
Total Household Annual Income $25,000 to $50,000
(Dollar values are in year-2001)

	Percentiles and Mean	Net Wealth Less House Value in $1,000	Total Debt Owed in $1,000	Total Assets Less House Value in $1,000	House Value in $1,000	Housing Capital Gains Since Last Price Observation in $1,000	Percent Avg. Annual Rate of House Price App. Since Last Price Observation
NLSY Sample	25th	-53.10	27.84	12.37	47.62	-6.17	-4.49
(Obs = 3,014)	50th	-23.88	55.12	23.12	76.40	-0.88	-1.00
	75th	2.26	82.14	42.70	105.43	7.02	6.18
	Mean	-22.84	59.52	36.68	81.92	0.06	1.05
SCF Sample	25th	-20.37	2.00	19.23	57.79	-11.09	-1.48
(Obs = 2,969)	50th	19.87	25.24	51.39	88.91	2.12	0.39
	75th	119.73	63.68	149.96	133.36	23.27	3.56
	Mean	73.25	41.57	114.82	107.49	6.80	1.85

Table 1d
Distribution of Wealth, Portfolio Composition, and Housing Capital Gains
Among Owner-Occupiers in the SCF and NLSY
Total Household Annual Income Greater Than $50,000
(Dollar values are in year-2001)

	Percentiles and Mean	Net Wealth Less House Value in $1,000	Total Debt Owed in $1,000	Total Assets Less House Value in $1,000	House Value in $1,000	Housing Capital Gains Since Last Price Observation in $1,000	Percent Avg. Annual Rate of House Price App. Since Last Price Observation
NLSY Sample	25th	-69.05	62.89	30.90	87.63	-7.55	-3.66
(Obs = 5,710)	50th	-29.76	95.24	57.32	123.65	-0.27	-0.10
	75th	16.29	138.14	110.11	172.62	11.03	5.82
	Mean	-16.95	107.26	90.31	138.49	2.97	1.90
SCF Sample	25th	-21.64	28.26	61.79	99.97	-11.38	-1.13
(Obs = 4,990)	50th	68.56	77.12	153.90	151.07	7.92	0.85
	75th	250.87	135.80	348.48	232.42	40.36	4.21
	Mean	130.78	101.94	232.72	188.14	20.32	2.52

Table 2
Sample Means of Covariates in the SCF and NLSY
(Dollar Valued Variables Are in Year-2001)

	Full Sample		Total Annual Income < $25,000		Total Annual Income $25,000 to $50,000		Total Annual Income > $50,000	
	SCF	NLSY	SCF	NLSY	SCF	NLSY	SCF	NLSY
Housing Capital Gains in $1,000 since home purchase (SCF) or last reported assessment (NLSY)	11.94	1.61	0.73	-1.40	6.80	0.06	20.32	2.97
Years since home purchase (SCF) or first assessment (NLSY)	13.82	4.28	19.56	4.02	13.96	4.31	11.02	4.32
White	0.850	0.658	0.790	0.511	0.844	0.629	0.882	0.700
African American	0.082	0.146	0.140	0.258	0.083	0.155	0.054	0.120
Hispanic	0.041	0.145	0.049	0.195	0.049	0.174	0.032	0.121
Other Non-White Race	0.028	0.051	0.021	0.036	0.024	0.042	0.033	0.059
Married	0.695	0.804	0.397	0.428	0.661	0.716	0.858	0.921
Divorced	0.099	0.080	0.147	0.226	0.142	0.122	0.052	0.031
Age of Household Head	51.37	34.52	60.93	34.46	50.86	34.19	47.13	34.70
Male Household Head	0.738	0.511	0.500	0.430	0.711	0.516	0.867	0.524
Head Has More Than High School	0.516	0.527	0.253	0.290	0.425	0.403	0.695	0.637
Head Has High School Degree	0.296	0.404	0.310	0.537	0.377	0.502	0.241	0.327
Head Has Less Than High School	0.188	0.069	0.437	0.173	0.197	0.095	0.064	0.036
Household Earned Inc. in $1,000	46.9	56.9	6.5	13.4	27.4	35.6	77.9	76.0
Year: 1983	0.198	-	0.221	-	0.214	-	0.180	-
Year: 1989	0.142	-	0.150	-	0.143	-	0.138	-
Year: 1992	0.152	0.118	0.155	0.113	0.145	0.136	0.155	0.110
Year: 1993	-	0.142	-	0.159	-	0.166	-	0.127
Year: 1994	-	0.171	-	0.182	-	0.171	-	0.169
Year: 1995	0.177	-	0.181	-	0.179	-	0.175	-
Year: 1996	-	0.181	-	0.181	-	0.183	-	0.180
Year: 1998	0.166	0.190	0.152	0.159	0.164	0.172	0.175	0.205
Year: 2000	-	0.198	-	0.207	-	0.173	-	0.209
Year: 2001	0.166	-	0.141	-	0.156	-	0.177	-
Number of Observations	10,401	9,752	2,399	1,028	2,969	3,014	4,990	5,710

A further and final point is that as income in the SCF increases from Table 1b to Table 1d, the level of non-housing net wealth, debt, and non-housing assets rises as well. In the NLSY, debt and non-housing assets also increase with income. But importantly, non-housing net wealth largely does not. This indicates that even among higher income families, in the NLSY most households simply do not have much wealth to draw upon. However, as income increases, families in the NLSY take on more debt and acquire additional non-housing assets. These differences too will help to interpret the regression results to follow.

A final set of summary measures of the data are provided in Table 2, where sample means for all of the variables used in the regressions to follow are provided for each of the income subgroups from each survey. As should be the case given the sample designs of the two surveys, the NLSY households are much younger than in the SCF. For the full samples (the first two columns of the table), the average age of the NLSY household head is 34.5 years compared to 51.4 years in the SCF. In addition, note that African Americans and Hispanics account for 12.3 percent of the SCF sample (8.2 percent and 4.1 percent for African Americans and Hispanics, respectively). In the NLSY, these groups are equally represented and account for a total of 29.1 percent of the sample. Moreover, among low-income families, these differences become even more dramatic. In the NLSY, African Americans and Hispanics make up 45.3 and 32.9 percent of the low- and moderate-income subgroups, while in the SCF the analogous numbers are 18.9 and 13.2 percent.

Summarizing, the NLSY sample is relatively young, has little wealth, and contains a high share of minority households, even allowing for the fact that our sample is composed only of owner-occupiers. In contrast, the SCF sample is much older, has considerable wealth even among "low-income" families and contains a much smaller share of minorities.

IV. Results

Endogenous Housing Capital Gains

Before turning to the regression results, a remaining critical issue must be addressed: the endogenous character of house price appreciation. Endogeneity occurs because homes that experience large capital gains and loses in levels (not percentage terms) tend to be expensive, and expensive homes are owned primarily by high-wealth families. For all of the models to follow, therefore, we repeat our estimation twice, first using ordinary least squares (OLS), and then again using two-stage least squares (2SLS). A key feature of the 2SLS approach, of course, is the instrument used in the analysis for housing capital gains. In all cases, our primary instrument is the average annual rate of house price appreciation between the current and prior dates when house price is observed. This is calculated by forming the difference in house values for periods when house value is observed, and then dividing by the number of years between the two dates. Under the assumption that housing markets are efficient, the average annual rate of house price appreciation should be unrelated to house price levels. If this were not the case, high- and low-valued segments in the housing market would increasingly diverge in relative values. Moreover, speculative investors would profit from investing primarily in that portion of the market that appreciates most quickly. Both phenomena seem at odds with the character of most housing markets.

As a check on the validity of the our instrument, Table 3 presents R^2 values from a series of regressions in which a key dependent variable is regressed on a constant, the average annual rate of house price appreciation, its square, and its cube. The dependent variables are the level of housing capital gains and house value, all in year 2001 dollars. In addition, the regressions were conducted separately for the SCF and NLSY. For each survey, regressions were run for the full sample, and three sub-samples stratified by total annual household income (in year 2001 dollars): families with income below $25,000, income between $25,000 and $50,000, and income above $50,000.

Table 3
Goodness of Fit (R^2) In Regressions of the Annual Rate of House Price Appreciation on Housing Capital Gains and House Value
(Estimating Equation: $Y = \beta_0 + \beta_1 g + \beta_2 g^2 + \beta_3 g^3$)[a]

	Housing Capital Gains		House Value	
	SCF	NLSY	SCF	NLSY
Full Sample	0.261	0.510	0.063	0.046
Income < $25,000	0.181	0.341	0.065	0.066
Inc. $25k to $50k	0.228	0.473	0.073	0.064
Income > $50,000	0.327	0.621	0.059	0.033

[a]Y denotes the dependent variable, either housing capital gains or house value, while *g* denotes the average annual rate of house price appreciation between current and prior price dates.

In Table 3, observe that for both the SCF and NLSY, the R^2 values for the regressions are all relatively high when the dependent variable is the level of housing capital gains: in the full sample

regressions, the R^2 values for the SCF and NLSY are 26.1 percent and 51.0 percent, respectively. In addition, for both samples, R^2 is higher for the high-income sub-groups, and for all of the income sub-groups, the NLSY regressions always have higher R^2 values. This confirms that the average annual rate of house price appreciation is a strong predictor of housing capital gains, as would be expected.

A completely different story is apparent when house value is regressed on housing capital gains. For the full sample regressions, R^2 equals 6.3 percent and 4.6 percent for the SCF and NLSY surveys, respectively. The R^2 values are also quite low for the different income-related sub-groups. These results confirm that there is little systematic relationship between the rate of house price appreciation and house value. This finding is consistent with the view that housing markets are largely efficient, and provides support for the use of the average annual rate of house price appreciation as the identifying instrument in the 2SLS procedure.

Regression Results

Tables 4a and 4b present estimates of two-stage least squares (2SLS) and ordinary least squares (OLS) regressions for both the SCF (Table 4a) and the NLSY (Table 4b) samples. In each case, the t-ratios in parentheses are based on robust standard errors and separate regressions are reported for each of the following dependent variables: non-housing net wealth, debt, and non-housing assets. Note also that in each of these tables only the full sample regressions are reported while results from regressions stratified by income sub-groups will be presented later. Finally, all of the regressions include controls for a variety of standard household socio-economic and demographic attributes, as well as survey year fixed effects that control for underlying business cycle effects that vary from year to year.

Several patterns are immediately apparent in the tables. First, it is clear that for variables other than housing capital gains, the 2SLS and OLS coefficients are nearly identical in both tables. That similarity also is evident for all of the coefficients on housing capital gains in the NLSY models, and for the estimated impact of housing capital gains on debt in the SCF. In the remaining regressions with the SCF in which non-housing net wealth and non-housing assets are the dependent variables, the 2SLS and OLS point estimates differ, but the differences do not appear to be significant. These patterns are mirrored in regressions based on the three income sub-groups noted earlier (under $25,000, $25,000 to $50,000, and over $50,000).[16] Accordingly, in the discussion to follow, we present just the 2SLS results for all of the remaining regressions. Before discussing those results, however, a few comments regarding the other covariates in the model are in order.

[16] Especially for the NLSY, the similarity of the 2SLS and OLS estimates of the impact of housing capital gains is suggestive that housing capital gains are not broadly endogenous, at least for that sample. This likely reflects the fact that even among higher income families, in the NLSY most households have relatively little net wealth.

Table 4a
SCF Estimates of the Impact of Housing Capital Gains on Wealth, Debt, and Assets
(Dollar values are in year-2001; t-ratios are based on robust standard errors)

	Net Wealth Less House Value in $100,000		Total Debt Owed in $100,000		Total Assets Less House Value in $100,000	
	2SLS	OLS	2SLS	OLS	2SLS	OLS
Housing Capital Gains ($100,000)	-0.070	-0.252	0.126	0.124	0.056	-0.128
	(-1.58)	(-1.40)	(5.55)	(4.65)	(1.26)	(-0.71)
Years since home purchase	0.013	0.013	-0.016	-0.016	-0.003	-0.003
	(6.06)	(6.03)	(-22.30)	(-22.31)	(-1.40)	(-1.32)
African American	-0.497	-0.514	-0.035	-0.035	-0.532	-0.549
	(-10.52)	(-10.22)	(-1.77)	(-1.78)	(-11.79)	(-11.40)
Hispanic	-0.423	-0.414	0.041	0.041	-0.383	-0.374
	(-5.67)	(-5.51)	(1.05)	(1.05)	(-5.11)	(-4.92)
Other Non-White Race	-0.348	-0.345	0.208	0.208	-0.140	-0.137
	(-2.70)	(-2.68)	(2.87)	(2.87)	(-1.11)	(-1.09)
Married	0.284	0.292	0.065	0.065	0.350	0.357
	(5.59)	(5.90)	(2.93)	(2.93)	(6.83)	(7.18)
Divorced	-0.058	-0.057	-0.014	-0.014	-0.072	-0.071
	(-1.03)	(-1.01)	(-0.57)	(-0.57)	(-1.24)	(-1.22)
Age of Household Head	0.038	0.038	-0.001	-0.001	0.037	0.037
	(19.94)	(21.51)	(-1.70)	(-1.70)	(19.16)	(20.68)
Male Household Head	0.269	0.278	0.029	0.029	0.298	0.307
	(5.72)	(5.88)	(1.53)	(1.55)	(6.24)	(6.41)
Head Has High School Degree	-0.396	-0.411	-0.251	-0.252	-0.648	-0.663
	(-9.33)	(-10.06)	(-15.31)	(-15.43)	(-14.96)	(-15.92)
Head Has Less Than High School	-0.938	-0.956	-0.263	-0.263	-1.201	-1.220
	(-18.87)	(-20.76)	(-15.13)	(-15.30)	(-23.88)	(-26.28)
Household Earned Inc. ($100k)	0.395	0.418	0.624	0.624	1.019	1.041
	(5.79)	(5.55)	(15.42)	(15.48)	(14.42)	(13.34)
Earned Income Squared	-0.027	-0.028	-0.043	-0.043	-0.070	-0.070
	(-3.00)	(-3.05)	(-5.14)	(-5.14)	(-5.96)	(-5.94)
Year: 1983	-1.160	-1.167	0.571	0.571	-0.589	-0.596
	(-11.82)	(-12.28)	(13.87)	(13.88)	(-5.87)	(-6.13)
Year: 1989	-1.398	-1.386	0.614	0.614	-0.785	-0.772
	(-12.56)	(-12.10)	(12.97)	(12.91)	(-6.95)	(-6.63)
Year: 1992	-1.457	-1.471	0.733	0.733	-0.724	-0.738
	(-13.37)	(-14.13)	(14.71)	(14.76)	(-6.58)	(-6.99)
Year: 1995	-1.419	-1.435	0.776	0.776	-0.643	-0.659
	(-13.24)	(-14.13)	(17.06)	(17.13)	(-6.02)	(-6.49)
Year: 1998	-1.436	-1.443	0.778	0.778	-0.658	-0.665
	(-13.99)	(-14.13)	(16.09)	(16.12)	(-6.38)	(-6.45)
Year: 2001	-1.400	-1.392	0.775	0.775	-0.625	-0.617
	(-12.72)	(-12.47)	(16.27)	(16.22)	(-5.67)	(-5.50)
Observations	10,401	10,401	10,401	10,401	10,401	10,401
R-squared	-	0.304	-	0.533	-	0.493
Root Mean Squared Error	1.837	1.832	0.774	0.774	1.856	1.850

Table 4b
NLSY Estimates of the Impact of Housing Capital Gains on Wealth, Debt, and Assets
(Dollar values are in year-2001; t-ratios are based on robust standard errors)

	Net Wealth Less House Value in $100,000		Total Debt Owed in $100,000		Total Assets Less House Value in $100,000	
	2SLS	OLS	2SLS	OLS	2SLS	OLS
Housing Capital Gains ($100,000)	-0.041	-0.059	0.113	0.131	0.072	0.072
	(-1.28)	(-1.83)	(4.58)	(5.11)	(2.38)	(2.37)
Years since first assessment	0.029	0.029	-0.031	-0.031	-0.002	-0.002
	(9.45)	(9.40)	(-16.40)	(-16.46)	(-0.74)	(-0.74)
African American	-0.133	-0.133	-0.099	-0.098	-0.231	-0.231
	(-6.85)	(-6.88)	(-6.89)	(-6.86)	(-13.38)	(-13.38)
Hispanic	-0.239	-0.239	0.105	0.105	-0.134	-0.134
	(-11.24)	(-11.25)	(6.12)	(6.14)	(-6.72)	(-6.72)
Other Non-White Race	0.027	0.027	0.047	0.046	0.073	0.073
	(0.67)	(0.68)	(1.71)	(1.70)	(1.77)	(1.77)
Married	-0.089	-0.089	0.011	0.011	-0.078	-0.078
	(-3.73)	(-3.72)	(0.70)	(0.69)	(-3.59)	(-3.59)
Divorced	-0.109	-0.110	0.081	0.082	-0.029	-0.029
	(-3.42)	(-3.44)	(3.44)	(3.47)	(-0.97)	(-0.97)
Age of Household Head	0.010	0.010	0.008	0.008	0.018	0.018
	(2.77)	(2.76)	(3.31)	(3.33)	(5.43)	(5.43)
Male Household Head	0.020	0.019	0.025	0.025	0.044	0.044
	(1.23)	(1.23)	(2.22)	(2.22)	(2.94)	(2.94)
Head Has High School Degree	0.025	0.025	-0.138	-0.138	-0.113	-0.113
	(1.49)	(1.49)	(-11.65)	(-11.65)	(-6.98)	(-6.98)
Head Has Less Than High School	0.029	0.029	-0.226	-0.226	-0.197	-0.197
	(1.18)	(1.17)	(-9.96)	(-9.94)	(-8.38)	(-8.38)
Household Earned Inc. ($100k)	0.107	0.108	1.051	1.050	1.158	1.158
	(1.93)	(1.97)	(28.24)	(28.20)	(20.06)	(20.10)
Earned Income Squared	0.017	0.016	-0.132	-0.132	-0.116	-0.116
	(1.10)	(1.07)	(-11.33)	(-11.26)	(-6.44)	(-6.44)
Year: 1992	-0.737	-0.737	0.218	0.218	-0.519	-0.519
	(-6.27)	(-6.27)	(2.69)	(2.69)	(-4.72)	(-4.72)
Year: 1993	-0.677	-0.677	0.139	0.138	-0.539	-0.539
	(-5.67)	(-5.66)	(1.68)	(1.67)	(-4.85)	(-4.85)
Year: 1994	-0.665	-0.664	0.222	0.221	-0.443	-0.443
	(-5.37)	(-5.36)	(2.63)	(2.61)	(-3.84)	(-3.84)
Year: 1996	-0.642	-0.641	0.233	0.231	-0.410	-0.410
	(-4.96)	(-4.95)	(2.60)	(2.58)	(-3.41)	(-3.41)
Year: 1998	-0.545	-0.542	0.215	0.212	-0.330	-0.330
	(-4.03)	(-4.00)	(2.27)	(2.24)	(-2.62)	(-2.62)
Year: 2000	-0.512	-0.507	0.206	0.201	-0.306	-0.306
	(-3.55)	(-3.52)	(2.05)	(2.01)	(-2.28)	(-2.28)
Observations	9,752	9,752	9,752	9,752	9,752	9,752
R-squared	-	0.102	-	0.742	-	0.538
Root Mean Squared Error	0.780	0.780	0.546	0.546	0.738	0.738

In both Tables 4a and 4b, observe that the longer the family has been in their home, the lower their level of outstanding debt and the higher their non-housing net wealth. This reflects the strong tendency of households to pay down their mortgage debt as they remain in their home. Observe also that non-white households have substantially less non-housing wealth as is well known. In addition, wealth increases with the age of the household head, male headed households have more wealth, as do households with higher levels of earned income. These results are all consistent with priors and robust across the two surveys.

In both the SCF and NLSY, the level of debt and non-housing assets increases with education. In the NLSY, those effects offset somewhat, resulting in an insignificant effect of education on non-housing net wealth. However, in the SCF, additional education has a positive and significant influence on the family's non-housing net wealth. In addition, in the SCF, married families have more debt, non-housing assets, and non-housing wealth, but in the NLSY married households have lower levels of non-housing assets and non-housing net wealth.[17]

Table 5a presents estimates of the impact of housing capital gains on non-housing net wealth, debt, and non-housing assets, for four different samples from both the SCF and the NLSY. These are the full sample and the three income sub-groups noted earlier, under $25,000 total annual household income, $25,000 to $50,000, and over $50,000, where all dollars are in year 2001 values. In each case, the model specification includes all of the covariates reported in Tables 4a and 4b. However, just the coefficients on housing capital gains are presented in order to conserve space. In addition, as noted earlier, only the 2SLS results are provided, and all t-ratios are based on robust standard errors.

Several results stand out in this table. First, in the full sample regressions, there is considerable similarity in the SCF and NLSY estimates. Observe that one dollar of housing capital gains increases non-housing assets by 5.6 and 7.2 cents in the SCF and NLSY, respectively, although only the NLSY estimate is significant. The increase in non-housing assets appears to be financed by an increase in debt of 12.6 and 11.3 cents per dollar of capital gains in the two surveys, respectively. The remaining portion of that debt is apparently spent on non-durable consumption, resulting in an estimated reduction in non-housing wealth of 7 cents per dollar of housing capital gains in the SCF and 4.1 cents in the NLSY, although these estimates are not statistically significant.

The remaining rows of Table 5a present estimates for the three income sub-groups. For both surveys, among low- and moderate-income households the estimated impact of housing capital gains on non-housing net wealth is small and not significantly different from zero. However, among higher income families in the SCF the impact of housing capital gains on non-housing net wealth is higher, averaging 11.5 percent with a t-ratio of 1.84, while analysis of the NLSY finds the impact to be smaller and not significant (4.4 percent with a t-ratio of 1.05). In the SCF, much of the implied consumption appears to be debt financed: for high-income families in the SCF, each dollar of house

[17] To the extent that marriage is initially costly but generates additional income in the future, these latter results could reflect the older age structure of the SCF.

price appreciation increases household debt by 15.5 cents. In the NLSY, the debt response of high-income families is somewhat less, just 8 cents per dollar of house price appreciation.[18]

Table 5a
House Price Appreciation and Portfolio Composition – 2SLS Estimates
(Dollar values are in year-2001; t-ratios are based on robust standard errors)

	Net Wealth Less House Value in $100,000		Total Debt Owed in $100,000		Total Assets Less House Value in $100,000	
	SCF	NLSY	SCF	NLSY	SCF	NLSY
All Households						
Housing Capital Gains in $100,000	-0.070	-0.041	0.126	0.113	0.056	0.072
(Obs: SCF = 10,041; NLSY = 9,752)	(-1.58)	(-1.28)	(5.55)	(4.58)	(1.26)	(2.38)
Income < $25,000						
Housing Capital Gains in $100,000	0.036	-0.027	0.025	0.179	0.061	0.152
(Obs: SCF = 2,399; NLSY = 1,028)	(0.43)	(-0.33)	(0.76)	(2.16)	(0.72)	(1.85)
$25,000 <= Income < $50,000						
Housing Capital Gains in $100,000	0.038	-0.032	0.072	0.172	0.111	0.140
(Obs: SCF = 2,969; NLSY = 3,014)	(0.50)	(-0.58)	(2.68)	(3.59)	(1.38)	(2.92)
Income >= $50,000						
Housing Capital Gains in $100,000	-0.115	-0.044	0.155	0.080	0.040	0.036
(Obs: SCF = 4,990 ; NLSY = 5,710)	(-1.84)	(-1.05)	(4.48)	(2.64)	(0.67)	(0.93)

Where the two surveys differ more substantially is the response of low- and moderate-income families to housing capital gains. In the SCF, low-income families display little response to housing capital gains, although moderate-income families hold 7.2 cents additional debt per dollar of capital gains and likely use that debt to finance the estimated 11.1 cent increase in non-housing assets. In the NLSY the response of these families to house price appreciation is stronger. In this case the low- and moderate-income families behave in a very similar way. For both groups, families hold between 17 and 18 cents additional debt per dollar of housing capital gain and use that debt to finance between 14 and 15 cents additional purchases of non-housing assets.

Table 5b presents estimates of the influence of housing capital gains on various sub-components of household debt and non-housing assets. Observe first that housing capital gains has a positive and significant effect on mortgage debt, consistent with the total debt estimates discussed above. In the SCF, the mortgage effect increases with household income, both with respect to HELOC debt and

[18] It is temping to speculate about why the debt response to house price appreciation is much stronger in the SCF than in the NLSY. However, that comparison is deferred to later in the paper when a more robust person-fixed effect model is presented using the NLSY data.

Table 5b
House Price Appreciation and Portfolio Composition – 2SLS Estimates
(Dollar values are in year-2001 $100,000 units; t-ratios are based on robust standard errors)

	Total Mortgage Debt		HELOC Accts.	1st & 2nd Mort-gages	Value of All Cars		Lux. Vehicles	Non-Fin. Assets Less House Value	Stocks, Bonds, Mutual Funds	IRA and Keogh Accts.	Fin. Assets
	SCF	NLSY	SCF	SCF	SCF	NLSY	SCF	SCF	SCF	SCF	SCF
All Households											
Housing Capital Gains in $100,000	0.084	0.097	0.008	0.076	0.008	0.018	0.006	0.056	0.017	-0.005	0.001
(Obs: SCF = 10,041; NLSY = 9,752)	(4.39)	(4.64)	(3.54)	(4.06)	(3.25)	(3.71)	(2.93)	(1.00)	(0.49)	(-0.56)	(0.02)
Income < $25,000											
Housing Capital Gains in $100,000	0.010	0.181	0.003	0.007	0.023	0.037	0.002	0.035	0.013	0.002	0.026
(Obs: SCF = 2,399; NLSY = 1,028)	(0.32)	(2.46)	(1.49)	(0.23)	(4.08)	(1.79)	(0.43)	(0.54)	(0.78)	(0.14)	(0.51)
$25,000 <= Income < $50,000											
Housing Capital Gains in $100,000	0.043	0.129	0.001	0.041	0.011	0.029	0.003	0.050	0.006	0.003	0.060
(Obs: SCF = 2,969; NLSY = 3,014)	(1.83)	(3.20)	(0.54)	(1.78)	(2.41)	(3.02)	(1.28)	(0.72)	(0.33)	(0.30)	(1.50)
Income >= $50,000											
Housing Capital Gains in $100,000	0.103	0.073	0.012	0.090	0.003	0.012	0.007	0.034	0.044	-0.001	0.007
(Obs: SCF = 4,990 ; NLSY = 5,710)	(3.68)	(2.83)	(3.52)	(3.32)	(0.96)	(2.12)	(2.55)	(0.35)	(0.66)	(-0.12)	(0.09)

also the outstanding balance on first and second mortgages. In the NLSY, the impact of housing capital gains on mortgage debt is substantial for both low- and high-income families, 18.1 cents per dollar of capital gains for low-income families with somewhat lesser effects for moderate-income families.

The impact of housing capital gains on the value of automobiles owned by the family is largest for lower income families in both surveys: for low-income families, automobile values increase by 2.3 cents per dollar of housing capital gain in the SCF and by 3.7 cents per dollar of capital gain in the NLSY. In contrast, in the SCF, one dollar of housing capital gains increases the value of luxury vehicles (e.g. boats and private airplanes) most for higher income families for whom the estimated effect is 0.7 cents per dollar.[19]

Finally, in the SCF we also have the opportunity to investigate the influence of housing capital gains on various financial assets, including taxable stocks, bonds, and mutual funds, as well as tax sheltered discretionary retirement accounts (IRAs and Keoghs). Observe that for the full sample as well as for all income groups, the impact of housing capital gains on financial assets is small and clearly insignificant. This is important as it supports the approximation outlined earlier in regards to equation (4b). Recall that if housing capital gains have little impact on financial assets, then the impact of house price appreciation on debt is a good approximation to the impact of housing capital gains on consumer expenditures.

NLSY Fixed Effect Models

As a last exercise, we draw further on the panel structure of the NLSY and estimate 2SLS models with household fixed effects. This is accomplished by differencing off all of the household specific mean values from the variables used in the regressions (including the instruments), and running the 2SLS model in the traditional manner.[20] This has the effect of differencing away all time-invariant person-specific effects. In principle, this approach provides a cleaner set of estimates to the extent that unobserved household-specific attributes (e.g. wealth, employment history, labor market skills, location) are stripped away. Differencing also has the effect of eliminating much of the variation in the data, making identification difficult.

In Table 6, we present results for the 2SLS non-housing net wealth, debt, and non-housing asset regressions.[21] For the full sample models, the magnitudes of the estimated coefficients are somewhat larger than in Table 5a. For each dollar of housing capital gains, families take on 15.7 cents additional debt. Roughly one-quarter of that amount is used to finance non-housing assets, while the

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[19] Note that in the SCF, even though house price appreciation has a significant effect on the value of automobiles and luxury vehicles held by individual families, housing capital gains does not have a statistically significant effect on the total value of all non-financial assets held by the household.

[20] The standard errors were also adjusted to allow for the implicit inclusion of the person-specific fixed effects in the model.

[21] Estimates from the automobile regressions are also presented but are not emphasized in the discussion to follow.

rest is devoted to non-durable consumption, reducing non-housing net wealth by 11.1 cents. It should also be noted that although the estimated impact on assets is not significant, estimates from the net wealth and debt regressions are highly significant.

Table 6
NLSY House Price Appreciation and Portfolio Composition
With Person Fixed Effects – 2SLS Estimates
(Dollar values are in year-2001; t-ratios are based on robust standard errors)[a]

	Net Wealth Less House Value in $100,000	Total Debt Owed in $100,000	Total Assets Less House Value in $100,000	Value of All Cars
All Households				
Housing Capital Gains in $100,000	-0.111	0.157	0.047	-0.002
(Obs = 8,831; Person FE = 3,691)[b]	(-3.40)	(7.56)	(1.40)	(-0.46)
Income < $25,000				
Housing Capital Gains in $100,000	-0.015	0.023	0.008	0.020
(Obs = 877; Person FE = 489)[b]	(-0.12)	(0.24)	(0.06)	(1.13)
$25,000 <= Income < $50,000				
Housing Capital Gains in $100,000	-0.011	0.118	0.106	0.012
(Obs = 2,785; Person FE = 1,322)[b]	(-0.18)	(3.05)	(1.80)	(1.82)
Income >= $50,000				
Housing Capital Gains in $100,000	-0.151	0.168	0.016	-0.006
(Obs = 5,169; Person FE = 1,880)[b]	(-3.86)	(6.71)	(0.41)	(-1.59)

[a]Only observations that appear in the full sample in at least two different survey years were used to estimate these models.

[b]t-ratios have been adjusted for the number of implicit person fixed effects. This was done by multiplying the "OLS" t-ratios by $\sqrt{n-k_1-k_2}\Big/\sqrt{n-k_1}$. In this expression, *n* is the number of person-year observations as noted above, k_1 is the number of regressors included directly in the model and is equal to 19 as in Table 4b, and k_2 is equal to the number of implicit person-specific fixed effects as also noted above.

Among the income sub-groups, the estimated effects of housing capital gains on low-income households largely disappear. This could arise because the variation in the data has been effectively differenced away. But we also cannot rule out the possibility that low-income families are not particularly responsive to housing capital gains, consistent with the SCF estimates from Table 5a.

For the moderate-income families, the estimated effects are close to those previously reported in Table 5a: moderate-income families take on roughly 12 cents additional debt with each dollar of housing capital gains, and use that debt to finance purchases of non-housing assets. Moreover, the point estimates in this case also match closely those of the SCF as reported earlier.

Among high-income families, the effects are most pronounced, especially relative to those previously reported in Table 5a. Observe that for each dollar of house price appreciation, high-income families take on nearly 17 cents additional debt while reducing their non-housing net wealth by 15 cents. Once again, this result is consistent with estimates from the SCF reported earlier.

Interpretations

When interpreting the patterns in Tables 5a through 6, recall that the impact of housing capital gains on debt is a good approximation to the impact of house price appreciation on consumer expenditures provided two conditions hold. First, we must control for the time between house price observations (k in expression (4b)). Second, housing capital gains must not affect financial assets. We control for the first factor by including k directly in the models. In addition, evidence from the SCF confirms that there is little discernible effect of housing capital gains on financial assets, at least for the SCF sample.[22]

Bearing these points in mind, the following stylized facts emerge. For high-income families, there is compelling evidence that with each dollar of housing capital gains, households take on a substantial amount of additional debt. Given the limited impact on non-housing assets, this suggests that most of the increase in debt is used to finance non-durable consumption.

Among moderate-income families, there is clear evidence from both surveys that house price appreciation encourages families to debt-finance additional purchases of durable consumer goods. This is documented explicitly in the case of automobiles, but may also occur for home maintenance and other consumer durables (e.g. furniture) that are not separated out in our data.[23]

For low-income families the results are mixed. However, careful consideration of the nature of the samples used in the various exercises suggests that here too housing capital gains affect household

[22] Using the 1999 and 2001 SCF, Canner et al (2002) report that among households that refinance their home, those families that equity out of their house use roughly 11 percent of the extracted equity to financie stock market investmenets. This is consistent with the view that homeowners tend not to spend much of their house price appreciation on financial assets.

[23] Canner et al (2002), for example, report that refinancers taking cash out of their home devote roughly 35 percent of the extracted equity to home improvements. The nature of these "improvements," however, is not identified in their data, which uses the 1999 and 2001 SCF.

behavior. In the SCF low-income families are older and often have significant levels of wealth. This could mute their response to housing capital gains. In the NLSY, the sample of low-income families is of limited size (under 900), and controlling for person fixed effects removes much of the variation in the data. This could make identification difficult. In contrast, when we use the NLSY and do not difference away the person-specific effects, the estimated response to housing capital gains of low-income families is nearly identical to that of the moderate-income group: house price appreciation has a substantial impact on household debt. Moreover, that additional debt appears to be used primarily to finance expenditures on non-housing durable goods.

V. Conclusions

In the past decade, both the Clinton and George W. Bush administrations have made concerted efforts to boost access to homeownership, especially among low-income and minority households. These efforts have been prompted in part by the belief that homeownership provides a mechanism for saving and facilitates the accumulation of wealth. That argument hinges on the assumption that the propensity to spend out of house price appreciation is relatively low. At the same time, Chairmen Greenspan of the Federal Reserve has argued that the willingness of families to consume out of recent housing capital gains accounts for the surprisingly robust levels of consumer expenditures experienced during the recent recession (in 2001 to 2003). That argument hinges on the assumption that the propensity of families to spend out of house price appreciation is relatively high.[24]

This paper has examined these issues using both the Survey of Consumer Finances (SCF) and the National Longitudinal Survey of Youth (NLSY). Results support both arguments above. On the one hand, for both surveys, among higher-income families, one dollar of house price appreciation causes families to take on between 8 and 17 cents more debt, most of which appears to be used to finance non-durable consumption as opposed to investment in financial and non-housing durable assets. Among low- and moderate-income families, estimates suggest that housing capital gains increase household debt by 12 to 18 cents on the dollar, most of which appears to be used to finance purchases of non-housing durable goods.

On balance, these findings support claims that families consume an important fraction of their house price appreciation. It is also clear that homeowners nevertheless save at least 80 percent of their housing capital gains. This latter result is consistent with the view that homeownership facilitates the accumulation of wealth, and lends support to recent policy initiatives designed to expand access to homeownership. Our main caveat in this regard, is that roughly half of the families in the NLSY and one-quarter of the families in the SCF experienced real capital loses on their homes. Thus, the propensity of homeowners to save most of their housing capital gains does not in itself ensure that they will accumulate wealth.

[24] See Case, Quigley, and Shiller (2003) for related work on the impact of house price appreciation on consumption.

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Appendix
The Propensity to Consume Out of House Price Appreciation

This appendix clarifies the relationship between the impact of house price appreciation on household wealth and the impact of house price appreciation on household consumption. We begin by modeling the change in the level of household wealth (W) between the time the home was purchased and the current date. Let W_t be the level of net worth in the current period, while W_{t-k} denotes the level of net worth at time *t-k* when the home was purchased. Then,

$$W_t = W_{t-k} + \sum_{t-k}^{t} Y_s - \sum_{t-k}^{t} E_s \qquad \text{(A.1)}$$

where Y_s is total income in period *s* and is equal to the sum of earned and unearned income, including interest payments, capital gains, loses, and depreciation. The term E_s denotes expenditures in period *s*, and is equal to the sum of current consumption and payments on outstanding debt. Expression (A.1) is an accounting identity and says that the change in wealth between *t* and *t-k* is equal to the difference between all sources of income and expenditures over the period.

To highlight the influence of house price appreciation on (A.1), *Y* is decomposed into three parts, the appreciation on the home between *t-k* and *t*, the sum of unearned income on non-housing assets over the period (including capital gains, loses, and depreciation), and the sum of earned income over the period. We also decompose expenditures into debt payments (*d*) and consumption (*c*). This yields,

$$W_t = W_{t-k} + H_{t-k} g_{t,t-k} + \sum_{t-k}^{t} A_s a_s + \sum_{t-k}^{t} y_s - \sum_{t-k}^{t} d_s - \sum_{t-k}^{t} c_s \qquad \text{(A.2)}$$

where H_{t-k} is the value of the primary residence (in current dollars) at the time the home was purchased, and $g_{t,t-k}$ is the rate of house price appreciation between *t-k* and *t*. Non-housing assets (*A*) vary from year to year as the household rebalances its portfolio and also because of interest payments, capital gains, loses, and depreciation. Income generated from these assets in a given year is given by $A_s a_s$. Income earned from labor effort in a given year is denoted by y_s.

To simplify notation, (A.2) is re-written as

$$W_t = W_{t-k} + Y^H_{t,t-k} + Y^A_{t,t-k} + Y^y_{t,t-k} - E^d_{t,t-k} - E^c_{t,t-k} \qquad \text{(A.3)}$$

where Y^X and E^X correspond to their respective components of income and expenditures in (A.2).[25] It is also useful to recall that net wealth in period *t* includes the value of the home as of the purchase date along with housing capital gains, the sum of which is equal to current house value. Accordingly,

[25] To be precise, $Y^H_{t,t-k} = H_{t-k} g_{t,t-k}$, $Y^A_{t,t-k} = \sum_{t-k}^{t} A_s a_s$, and $Y^y_{t,t-k} = \sum_{t-k}^{t} y_s$.

$$W_t = W_t^{NonH} + H_{t-k} + Y_{t,t-k}^H \tag{A.4}$$

where W_t^{NonH} is wealth in period *t* less the value of the primary residence. Subtracting H_{t-k} from both sides of (A.3), substituting from (A.4) and rearranging,

$$W_t^{NonH} = W_{t-k}^{NonH} + Y_{t,t-k}^A + Y_{t,t-k}^y - E_{t,t-k}^d - E_{t,t-k}^c . \tag{A.5}$$

This says that non-housing wealth in period *t* is equal to its level in *t-k*, adjusted for the different components of income and expenditures over the period.

Consider now the impact of housing capital gains on the change in non-housing wealth. This is obtained by differentiating (A.5) with respect to house price appreciation,

$$\frac{\partial \Delta W_t^{NonH}}{\partial Y_{t,t-k}^H} = \frac{\partial Y_{t,t-k}^A}{\partial Y_{t,t-k}^H} + \frac{\partial Y_{t,t-k}^y}{\partial Y_{t,t-k}^H} - \frac{\partial E_{t,t-k}^d}{\partial Y_{t,t-k}^H} - \frac{\partial E_{t,t-k}^c}{\partial Y_{t,t-k}^H} \quad , \tag{A.6}$$

where $\frac{\partial W_{t-k}^{NonH}}{\partial Y_{t,t-k}^H}$ equals zero since W_{t-k}^{NonH} is predetermined. From this expression, it is clear that the influence of housing capital gains on wealth can proceed through at least four different channels: the impact of $Y_{t,t-k}^H$ on investment in non-housing assets and related unearned income over the period from *t-k* to *t* ($Y_{t,t-k}^A$); the impact of $Y_{t,t-k}^H$ on labor supply and related effects on earned income ($Y_{t,t-k}^y$); the impact of $Y_{t,t-k}^H$ on the level of debt and related payments ($E_{t,t-k}^d$), and finally, the impact of $Y_{t,t-k}^H$ on consumption between *t-k* and *t* ($E_{t,t-k}^c$).

In our analysis, we do not measure $Y_{t,t-k}^A, Y_{t,t-k}^y, E_{t,t-k}^d,$ and $\mathrm{E}_{t,t-k}^c$ although we do measure W_t^{NonH}. Absent additional information, the impact of housing capital gains on non-housing wealth reflects the sum of the four derivatives on the right-hand side of equation (A.6). However, it seems likely that labor supply is quite inelastic to housing capital gains. We tested that assumption with the SCF by estimating the impact of housing capital gains on current earned income. Results were consistent with our prior: among all but the highest earning families, house price appreciation does not have a significant influence on earnings. Among very high earning families, the relationship is small in magnitude and positive rather than negative. Based on this evidence, we set $\frac{\partial Y_{t,t-k}^y}{\partial Y_{t,t-k}^H}$ to zero and simplify (A.6) by expressing the influence of housing capital gains on non-housing wealth as,

$$\frac{\partial \Delta W_t^{NonH}}{\partial Y_{t,t-k}^H} = \left(\frac{\partial Y_{t,t-k}^A}{\partial Y_{t,t-k}^H} - \frac{\partial E_{t,t-k}^d}{\partial Y_{t,t-k}^H} \right) - \frac{\partial E_{t,t-k}^c}{\partial Y_{t,t-k}^H} \quad . \tag{A.7}$$

In viewing (A.7), the bracketed term represents the influence of housing capital gains on accumulated net income between *t* and *t-k*, equal to the impact of house price appreciation on unearned income less debt payments.[26] Substituting (2) from the text into (A.7) yields an expression for the impact of housing capital gains on consumption, as shown in equation (3) in the text.

[26] It is also important to recognize that debt is valuable to the household only to the extent that it facilitates current or future consumption. This implies that if $\frac{\partial E^{d}_{t,t-k}}{\partial Y^{H}_{t,t-k}}$ is positive, $\frac{\partial E^{c}_{t,t-k}}{\partial Y^{H}_{t,t-k}}$ will also be positive to the extent that the extra debt is used to finance consumption. Similarly, if the extra debt is used to finance investments in interest bearing funds (e.g. stocks and bonds) that ultimately are converted into future consumption (see Jones (1997), for example), the expected value of $\frac{\partial Y^{A}_{t,t-k}}{\partial Y^{H}_{t,t-k}}$ over time would also be positive.