The great turn-of-the-century housing boom

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Introduction and summary

In the last ten years, residential investment as a share of gross domestic product (GDP) has reached levels not seen since the 1950s. At the same time, the homeownership rate has climbed to levels never before achieved. This article discusses the forces underlying these developments and argues that they are connected.

Figure 1 shows the ratio of nominal residential investment to GDP from 1947 to 2005, with shaded regions indicating years in which the economy was in recession. The spending share of residential investment is clearly highly cyclical, but in the last ten years it has seemed relatively immune to macroeconomic disturbances. Indeed, from a near historic low below 3.5 percent in 1991, residential investment spending has grown rapidly, passing 6 percent of nominal GDP in 2005.

Figure 2 shows the history of the homeownership rate from 1890 to 2004. The homeownership rate equals the number of owner-occupied housing units divided by the number of occupied housing units. Between 1890 and 1940, the homeownership rate varied between 43 percent and 48 percent. After World War II, the homeownership rate rose rapidly, and by the mid-1960s it had surpassed 64 percent. Upward progress in homeownership stalled in the 1970s and even fell in the 1980s. It began growing again in the mid-1990s and by 2005 had reached a new high of 69 percent.

Understanding why residential investment and homeownership have reached such unusually high levels is useful from a policymaking standpoint. For example, monetary policy has been traditionally viewed as having a strong influence over new home construction. Have the high levels of residential investment been driven by unusually loose monetary policy? Another concern of policymakers is that the unusually high level of spending on new housing reflects speculation and is not driven by underlying fundamentals. The increase of rates of homeownership has long been an announced goal of policymakers. Indeed, both Presidents Clinton and George W. Bush have touted the rising levels of homeownership as accomplishments of their administrations. So, understanding why homeownership rates have risen should help in the development of policies directed at establishing socially and economically desirable levels of homeownership.

Much has been said in the press about high levels of house prices and the possibility of a house price bubble. Figure 3 displays the median sales price of existing single family homes, converted into real terms by dividing total sales price by the Consumer Price Index (CPI) for all urban consumers. This figure shows that indeed the real price of single-family homes, after being roughly stable from the early 1980s to the mid-1990s has grown considerably since. This article does not address house prices directly. Rather, it seeks to understand recent developments by focusing on quantities. To the extent that the quantities can be understood by considering the underlying economic fundamentals, such as productivity growth and the evolution of the mortgage market, then the recent growth in house prices is probably not due to excessive speculation in the housing market, such as occurs in a bubble. We argue that our findings point toward the high prices being driven by fundamentals.

The article begins by describing the evolution of key variables that should influence residential investment. While informative, this discussion has the drawback that it is difficult to distinguish the truly exogenous factors driving the spending. For example, showing that real interest rates have been relatively

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low as residential investment has surged beyond its trend level does not establish that unusually loose monetary policy is to blame. Consequently, the next phase of the analysis involves an econometric study of the effects of identified exogenous shocks to the economy. This study focuses on the roles of technological change and monetary policy.

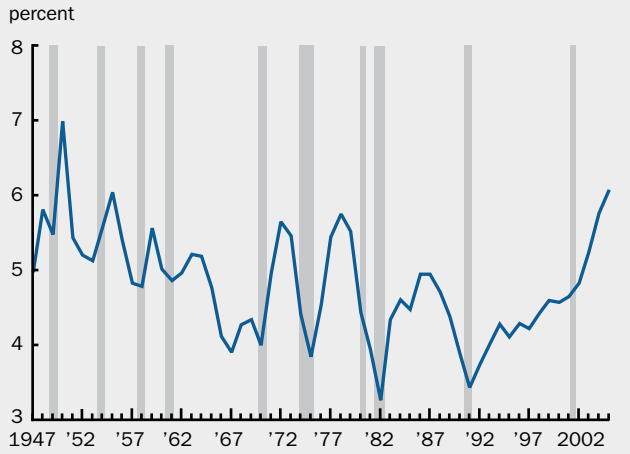
We then turn to the homeownership issue. We begin by describing how homeownership rates have changed across various racial, generational, educational, and income categories. Then we address the question of how much of the increase in homeownership can be explained by changes in the distribution of the population across these categories. For example, older people have higher homeownership rates than younger people, so, all else being equal, an aging population tends to increase the homeownership rate. By accounting for all easily measurable factors, this analysis provides a bound on what needs to be explained by other, more difficult to measure factors, such as the increased use of new mortgage products.

The final part of the article connects the overall increase in residential investment with the increase in homeownership. This analysis focuses on the impact of the rapid growth of the subprime mortgage market.

Our main findings are as follows. First, it appears that the housing boom has not been driven by unusually loose monetary policy. This is not to say that monetary policy has not been unusually loose, but that to the extent it has been loose, this is not what has been driving spending on housing. Second, the current levels of spending on housing are largely explained by the wealth created by dramatic technological progress over the previous decade. Third, changes in the demographic, income, educational, and regional structure of the population account for only one-half of the increase in homeownership. That is, without any other developments, the homeownership rate is likely to have gone up anyway, but not by nearly as much as it has done. The last finding is that substitution away from rental housing made possible by technology-driven developments in the mortgage market, such as subprime lending, could account for a significant fraction of the increase in residential investment and homeownership. The current spending boom thus may be a temporary transition toward an era with higher homeownership rates and a share of spending on housing that is nearer historical norms.

FIGURE 1

Nominal GDP share of residential investment, 1947–2005

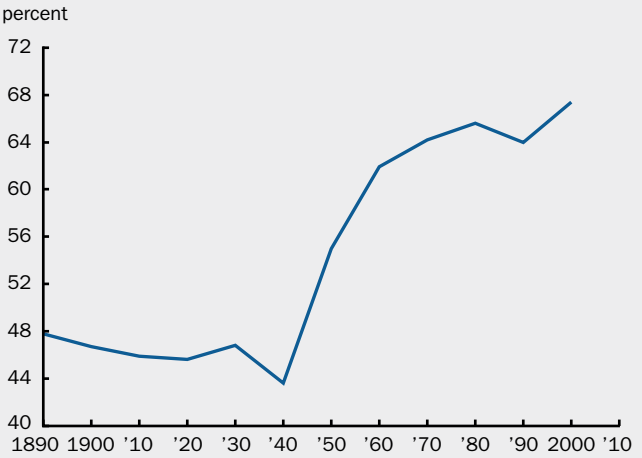


Note: Shaded areas indicate recessions as determined by the National Bureau of Economic Research.

Source: U.S. Bureau of Economic Analysis, national income and product accounts data, from Haver Analytics.

FIGURE 2

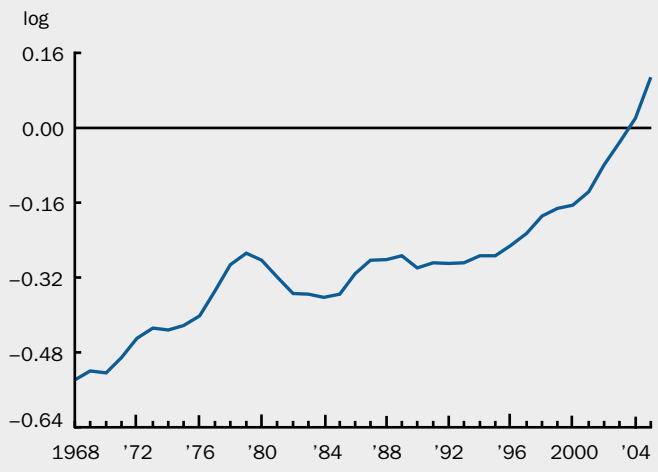
U.S. homeownership rate, 1890–2004



Sources: U.S. Census Bureau, *Decennial Census*, and the U.S. Bureau of Labor Statistics, *Current Population Survey/Housing Vacancy Survey*, Series H-111, reports, Washington, DC, from Haver Analytics.

FIGURE 3

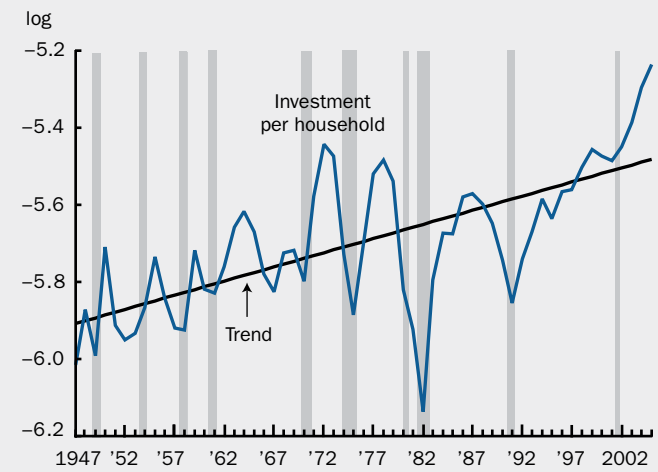
Log real median sales price of existing single family homes



Sources: Authors' calculations based on data from the National Association of Realtors, Economics and Research Division, "Home sales," report, and the U.S. Bureau of Labor Statistics, Consumer Price Index, report, from Haver Analytics.

FIGURE 4

Log residential investment per household



Note: Shaded areas indicate recessions as determined by the National Bureau of Economic Research.

Sources: Authors' calculations based on data from the U.S. Bureau of Economic Analysis, national income and product accounts data, and the U.S. Bureau of Labor Statistics, *Current Population Survey*, report, from Haver Analytics.

Factors affecting residential investment

Figure 4 is helpful as a starting point for gauging whether residential investment is currently at unusual levels. The figure displays the log of real residential investment per household from 1947 to 2005 along with a trend line. While certainly subject to large cyclical variations, residential investment seems to follow a linear trend quite closely. So while investment grew rapidly after 1991 until the latter part of the decade, this was largely a return to trend. Only after the 2001 recession has spending grown substantially above trend. By 2005, it was roughly as far above trend as occurred during the boom part of the boom–bust cycle of the 1970s and the early 1980s. The dramatic swings in residential investment in the 1970s and early 1980s contributed significantly to three recessions. From this perspective, the current levels of residential investment may seem alarming. In the remainder of this section, we consider some of the factors that may underlie the current high levels of residential investment.

Household formation

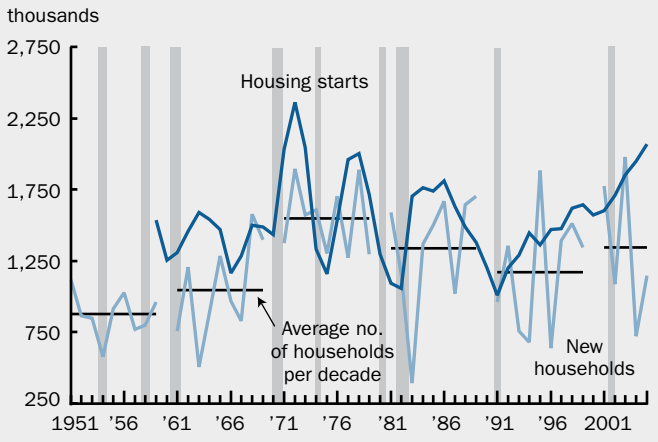
Household formation, to the extent that it is governed primarily by long-term social and demographic developments, is the most basic determinant of home building and residential investment.[1] Indeed, if vacancy rates were constant and houses were never torn down to be replaced by new residential structures, new home building would be exactly proportional to new household formation.[2] Figure 5 shows the evolution of new households and housing starts since 1960. The light blue lines indicate the number of new households in a given year, the black lines indicate the average number of new households per year for each decade, and the dark blue line indicates the level of housing starts. In the 1970s, 1980s, and 1990s, there seems to be a close association between home building and household formation. The increases in household formation and home building over the 1970s are an example of the strong influence of demographic factors—this is when the baby boom generation moved out on its own. The close association of home building with household formation is less true of the 1960s, when home building is near its 1980 levels, but new household formation is much lower. Since the 2001 recession, housing starts have also risen to levels that do not seem closely tied to new household formation.

Migration

Another factor determining new home building is migration. With migration, the number of households can stay fixed while there is still a demand for new homes. In the region where households migrate from, vacancy rates go up, while in the region where households migrate to, houses need to be built. To assess the possible impact of migration, consider figure 6. Panel A shows the shares of national population increases attributable to the four census regions from 1982 to 2005. Panel B displays the corresponding shares of all housing starts. In each case, a rising or falling share indicates that either population or housing starts are increasing faster in the region than for the nation as a whole. This figure shows that the relative shares of housing starts generally correspond to the relative population shares. Some of the trends seem to correspond as well. For example, the dip in the share of housing starts for the South in the 1980s is associated with a downward trend in the population share as well. Of particular interest is the uptick in the population share of the South from 2000 to 2005. Consistent with a role for migration in the current housing boom, the share of housing starts also picked up, although with a delay.

FIGURE 5

New households and housing starts



Note: Shaded areas indicate recessions as determined by the National Bureau of Economic Research.

Sources: U.S. Census Bureau, *Decennial Census*, report, and the U.S. Bureau of Labor Statistics, *Current Population Survey*, report, from Haver Analytics.

Interest rates

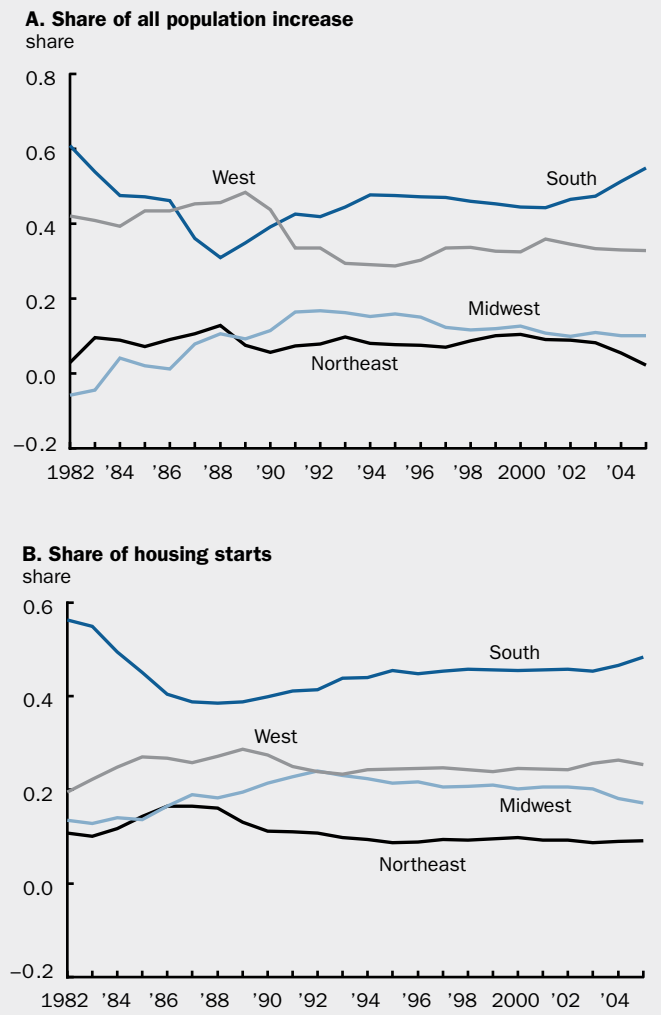
The discussion until now has focused on relatively long-term developments. As is evident from figures 1 and 2, home building historically has been highly cyclical. The conventional wisdom on why this is so is that the demand for housing is sensitive to movements in mortgage rates. If mortgage rates are unusually low, then this could fuel unusually high rates of residential investment. Figure 7 displays a measure of the nominal effective mortgage rate along with an estimate of the corresponding real rate. The term "effective" means that the mortgage rate incorporates the various points, fees, and other closing costs associated with a mortgage. These have generally been declining since the early 1980s. The real rate is equal to the nominal rate less an estimate of the expected rate of inflation. The inflation rate used for this figure is equal to the inflation rate in the national income and product accounts (NIPA) personal consumption expenditure deflator over the previous year. This probably overstates actual changes in the expectations relevant for determining housing demand.[3] Figure 7 shows that both real and nominal mortgage rates were low in the 1990s compared with the 1980s. This presumably contributed to the return to trend of residential investment over this period. Interestingly, the period when home building accelerated beyond its trend level was also a time when nominal and real rates were falling even further. While over the last two years nominal mortgage rates have started creeping up, real rates have continued to fall because inflation expectations have been rising. These considerations suggest that sustained low interest rates, possibly driven by unusually loose monetary policy, could be fueling the housing boom.

Wealth

The final factor affecting home building that we consider is household wealth. All else being equal, the richer households are, the more housing they demand. The latter half of the 1990s was a period of rapid wealth accumulation. For example, according to the *Survey of Consumer Finances*, average family net worth increased by 72 percent between 1995 and 2001. These increases in wealth were primarily due to the large increases in stock values over this period. As a consequence, housing and other nonfinancial assets' average share of total assets, fell from 63.3 percent in 1995 to 58 percent in 2001. If the share in 1995 was "normal" or close to the "desired" household allocation of nonfinancial assets in households' portfolios, then it is to be expected that the share

FIGURE 6

New households and housing starts, by region



Sources: U.S. Census Bureau, *Decennial Census*, report, and the U.S. Bureau of Labor Statistics, *Current Population Survey*, report, from Haver Analytics.

would eventually start rising again. Indeed, by 2004, nonfinancial assets' share of total assets had risen to 64.3 percent, near its 1995 level. While the share of housing in total assets, in the form of primary residences, rose faster over this period, the behavior of nonfinancial assets as a whole suggests that much of the acceleration in residential investment after the 2001 recession might be due to households rebalancing their portfolios. That is, it may be a natural consequence of the stock market boom of the 1990s.[4]

The macroeconomic shocks driving residential investment

The foregoing discussion suggests various factors that may be influencing the high levels of residential investment, but the underlying causes remain unclear. Determining the causes of macroeconomic fluctuations is notoriously difficult because essentially all the variables of interest are endogenous—no single variable moves independently and drives movements in other variables. The traditional approach to assessing the causes of fluctuations is to posit that the economy is subject to exogenous random disturbances, which are called shocks. Macroeconomists have formulated methods for identifying three kinds of shocks—two kinds of shocks to technological possibilities and one kind of monetary policy shock.[5] The procedure for identifying these shocks involves specifying a statistical model of the variables of interest and making a series of identification assumptions that make it possible to extract the exogenous shocks from the statistical model. Once the shocks have been identified, it is possible to determine how much of the growth in residential investment from 1995 to 2005 can be attributed to these shocks using what is called a *historical decomposition*. The strategy for identifying the technology shocks builds on Fisher (2006) and the monetary policy shock identification builds on Christiano, Eichenbaum, and Evans (2005).

Identifying the exogenous shocks

We begin by supposing that the economy evolves according to the following vector autoregression (VAR):

$$1) \qquad Aq_t = \Gamma(L)q_{t-1} + \varepsilon_t,$$

where q_t is a vector of variables of interest to be specified in a moment, ε_t is a vector of fundamental shocks, and A is a matrix of coefficients conformable with q_t. The term $\Gamma(L)$ is called a *lag polynomial*. It specifies how many lags of q_t appear in equation 1 and is defined as

$$\Gamma(L) = \Gamma_0 + \Gamma_1 L + \Gamma_1 L^2 + \cdots + \Gamma_M L^M,$$

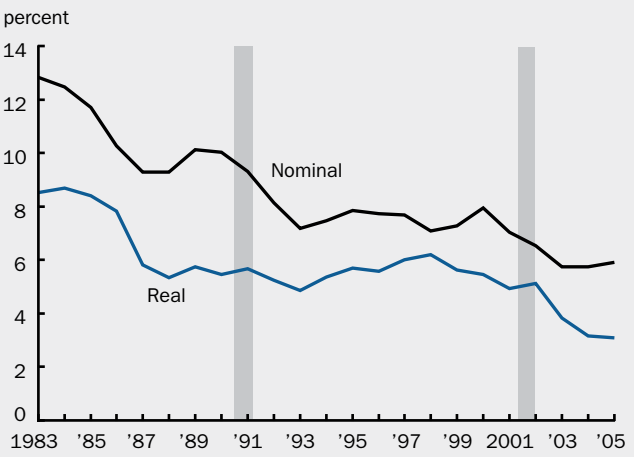
where the Γ_i, $i = 1,2,..., M$ are matrices of the same dimensions as A, and L is a *lag operator*. Lag operators have the property that $L^n x_t = x_{t-n}$, for any variable x_t. Equation 1 specifies the exogenous shocks that drive fluctuations in the variables in q_t and how these variables interact contemporaneously and dynamically. We suppose that

$$q_t = [\Delta p_t, \Delta y_t, \pi_t, R_t, h_t]',$$

where p_t is the log real price of capital equipment, y_t is the log of real per capita GDP, π_t is inflation, R_t is the federal funds rate, h_t is the log ratio of nominal residential investment to nominal GDP, and Δx_t for some variable x_t, such as p_t or y_t, is shorthand for writing $x_t - x_{t-1}$.[6] We use a series of instrumental variables regressions to estimate A, $\Gamma(L)$, and the fundamental shocks, and simulate equation 1 with the identified shocks to determine how these shocks have influenced residential investment. The equations were estimated using data from the third quarter of 1982 to the fourth quarter of 2005 with four lags.

FIGURE 7

Nominal and real effective mortgage rates



Note: Shaded areas indicate recessions as determined by the National Bureau of Economic Research.

Sources: Federal Housing Finance Board data and U.S. Bureau of Economic Analysis, national income and product accounts data, from Haver Analytics.

The assumptions used to identify the two technology shocks are derived from growth theory. In particular, we assume that all growth and wealth accumulation derive from two kinds of exogenous random technological change. One source of technological change increases the quality and efficiency of capital equipment, that is, it is embodied in new capital equipment. Shocks to the rate of accumulation of this kind of technology are called investment-specific technology shocks. For simplicity, we will call them "I-shocks." To identify these shocks, we assume that they are the only disturbances which have a long-run impact on the real price of capital equipment. The other source of technological change improves the economy's ability to produce all kinds of goods. Shocks to the rate of accumulation of this kind of technology are called neutral technology shocks, "N-shocks" for short. To identify these shocks, we assume that, along with I-shocks, they are the only shocks that affect output in the long run.

Our strategy for identifying the monetary policy shock, an "R-shock," has been widely applied in the empirical macroeconomic literature. The basis of this strategy is the assumption that the Federal Reserve follows a simple rule for setting the federal funds rate. This rule is subject to shocks, which can be thought of as randomness in the deliberations of the Federal Open Market Committee or factors uncorrelated with the variables in the rule that affect decisions on how to set the federal funds rate. Examples of the latter might be a hurricane or a terrorist attack. We assume that the Fed looks at contemporaneous values of the equipment price, output and inflation, as well as lags of q_t when setting the federal funds rate.

The three sets of identifying assumptions can be translated into assumptions about the structure of equation 1. First, consider the assumption used to identify the I-shock. To apply this assumption we use the first regression of equation 1, which can be written

$$2) \quad \Delta p_t = \Gamma_{pp}(L)\Delta p_{t-1} + \Gamma_{py}(L)\Delta y_t + \Gamma_{p\pi}(L)\pi_t + \Gamma_{pR}(L)R_t + \Gamma_{ph}(L)h_t + \varepsilon_{it},$$

where the $\Gamma_{xy}(L)$ values here and below are the relevant lag polynomials plucked from $\Gamma(L)$. From this equation we can see that the contemporaneous effects of all non-ε_{it} shocks influence Δp_t through Δy_t, π_t, R_t, and h_t. Our assumption for identifying the I-shocks implies that the long-run multipliers from these variables to p_t are zero. The long-run multiplier associated with a variable in equation 2 is given by the sum of the lag coefficients for that variable. This sum can be calculated by evaluating the lag polynomial associated with that variable at $L = 1$. So the identifying assumption for the I-shock is equivalent to assuming

$$\Gamma_{py}(1) = \Gamma_{p\pi}(1) = \Gamma_{pR}(1) = \Gamma_{ph}(1) = 0.$$

This means that each $\Gamma_{pj}(L), j = y, \pi, R, h$ can be written, $\Gamma_{pj}(L) = \tilde{\Gamma}_{pj}(L)(1-L)$. So, by imposing the I-shock identifying assumption, equation 2 becomes

$$3) \quad \Delta p_t = \Gamma_{pp}(L)\Delta p_{t-1} + \tilde{\Gamma}_{py}(L)\Delta^2 y_t + \tilde{\Gamma}_{p\pi}(L)\Delta\pi_t + \tilde{\Gamma}_{pR}(L)\Delta R_t + \tilde{\Gamma}_{ph}(L)\Delta h_t + \varepsilon_{it}.$$

In general, disturbances to Δp_t affect the contemporaneous values of Δy_t, π_t, R_t, and h_t. That is, ε_{vt} is correlated with the other right-hand side variables in equation 3. Consequently, equation 3 cannot be estimated by ordinary least squares. However, assuming ε_{vt} is exogenous means this shock is independent of all variables dated $t-1$ and earlier. So equation 3 is estimated by instrumental variables, using M lags of q_t as instruments. The coefficients of the first regression of equation 1 are found by unraveling the resulting regression coefficients from the instrumental variables estimation. The residuals from equation 3 are our estimates of $\varepsilon_{vt}, \hat{\varepsilon}_{it}$.

By a similar argument used with the first regression, the assumptions used to identify the N-shocks imply the long-run multipliers from π_t, R_t, and h_t are zero in the second regression of equation 1. It follows that this second regression can be written

$$4) \quad \Delta y_t = \Gamma_{yp}(L)\Delta p_t + \Gamma_{yy}(L)\Delta y_{t-1} + \tilde{\Gamma}_{y\pi}(L)\Delta\pi_t + \tilde{\Gamma}_{yR}(L)\Delta R_t + \tilde{\Gamma}_{yh}(L)\Delta h_t + \varepsilon_{nt},$$

where the $\tilde{\Gamma}_{yj}(L), j = h, q$ are defined in the same way as the similar terms in equation 3. As before, this equation is estimated by instrumental variables, and the resulting coefficient estimates are used to assign values to the second row of coefficients in equation 1. The instruments are $\hat{\varepsilon}_{it}$ and M lags of q_t. The residuals from equation 4, $\hat{\varepsilon}_{nt}$, are our estimates of ε_{nt}. Including $\hat{\varepsilon}_{it}$ as an instrument ensures $\hat{\varepsilon}_{nt}$ is uncorrelated with the I-shock within the sample period.

We estimate the remaining regressions of equation 1 sequentially by instrumental variables, using the residuals from the previously estimated regressions and M lags of q_t as instruments. We do not formally identify the residuals of the third and fifth regressions with any particular shock, since, unlike the other residuals, we do not have a theory to justify doing so. Without loss of generality, in the third regression we assume that inflation does not respond to contemporaneous movements in R_t. The fourth regression of equation 1 can be written

$$R_t = \Gamma_{Rp}(L)\Delta p_t + \Gamma_{Ry}(L)\Delta y_t + \Gamma_{R\pi}(L)\pi_t + \Gamma_{RR}(L)R_{t-1} + \Gamma_{Rh}(L)h_{t-1} + \varepsilon_{rt}.$$

This is our hypothesized monetary policy rule, which incorporates our assumption that it depends on contemporaneous values of p_t, y_t, and π_t. The residuals from this equation are our estimates of the monetary policy shocks, $\hat{\varepsilon}_{rt}$.

The effects of the identified shocks

To build intuition for our historical decomposition of the path of residential investment after 1995, it is helpful to study some impulse response functions. An impulse response function describes how a variable, for example, residential investment, responds to a hypothetical exogenous shock with all other shocks set to zero. To the extent that the impulse response functions make sense, we can have confidence in the quality of the historical decompositions. Responses of output (per capita GDP in consumption units), the real equipment price, and per capita residential investment in consumption units to positive one standard deviation I-, N-, and R-shocks are displayed in figure 8. The units of the responses are percentage deviations from the path that would have been followed absent the shock. The magnitude of the response of a variable to a given shock indicates that shock's importance to the variable's fluctuations around trend.

The responses to the I-shock show the equipment price falling to its new long-run level, output rising to its new long-run level, and residential investment initially falling and then rising to the same long-run level as output.[7] The long-run responses of these variables are predicted by theory. Cheaper equipment encourages capital accumulation, which, in turn, raises labor productivity and output. The short-run response of residential investment makes sense because, until capital and wealth accumulate and increase the demand for housing, a fall in the equipment price should induce substitution away from other capital goods, including housing.

The increases in output, the equipment price, and residential investment after an N-shock are, at least qualitatively, also consistent with theory. An N-shock raises productivity, thereby encouraging capital accumulation, higher employment, and an increase in output. Since an N-shock directly affects output, while an I-shock affects output indirectly through capital accumulation, the N-shock has a faster impact on output. The equipment price responds by only a small amount. Qualitatively, it rises after the shock and then returns to its pre-shock level. This makes sense if the N-shock

encourages a short-run increase in the demand for investment goods relative to consumption goods, which it does in many theoretical models. Output rises toward its new long-run level. Residential investment initially surges, then falls back toward zero, before rising toward its long-run level. This kind of response is more difficult to reconcile with existing theories. However, the initial surge in residential investment is consistent with the rise in output, if housing demand is increasing in income.

The R-shock responses show that output and the equipment price respond by very little, but residential investment responds strongly, falling by about 1 percent. That residential investment is particularly sensitive to a monetary policy shock is consistent with traditional views about the monetary transmission mechanism.

The historical decomposition of the path of residential investment from 1995 to 2005 is displayed in figure 9. The historical decomposition for a given shock is based on simulating equation 1 with the estimated values of the coefficients, assuming all other shocks are equal to zero and that the given shock is equal to its estimate for each period of the decomposition. The contributions of the individual shocks, $\hat{\varepsilon}_{It}, \hat{\varepsilon}_{Nt}, \hat{\varepsilon}_{Rt}$, plus the two unidentified residuals add up to the observed path of residential investment. Consequently, figure 9 can be used for assessing which shocks contributed the most to the dynamics of residential investment. In the figure, the dark blue line represents the trend path of residential investment implied by the VAR when all the shocks are set to zero, the black line is the empirical path, and the light blue line is the path corresponding to the shock(s) indicated in the header of the individual panels of the figure.

Figure 9, panel A reveals that the investment-specific technological change of the late 1990s acted as a drag on residential investment. However, by 2004, the capital accumulation generated by this technological change meant that households were wealthier than otherwise.

FIGURE 8

Responses to shock

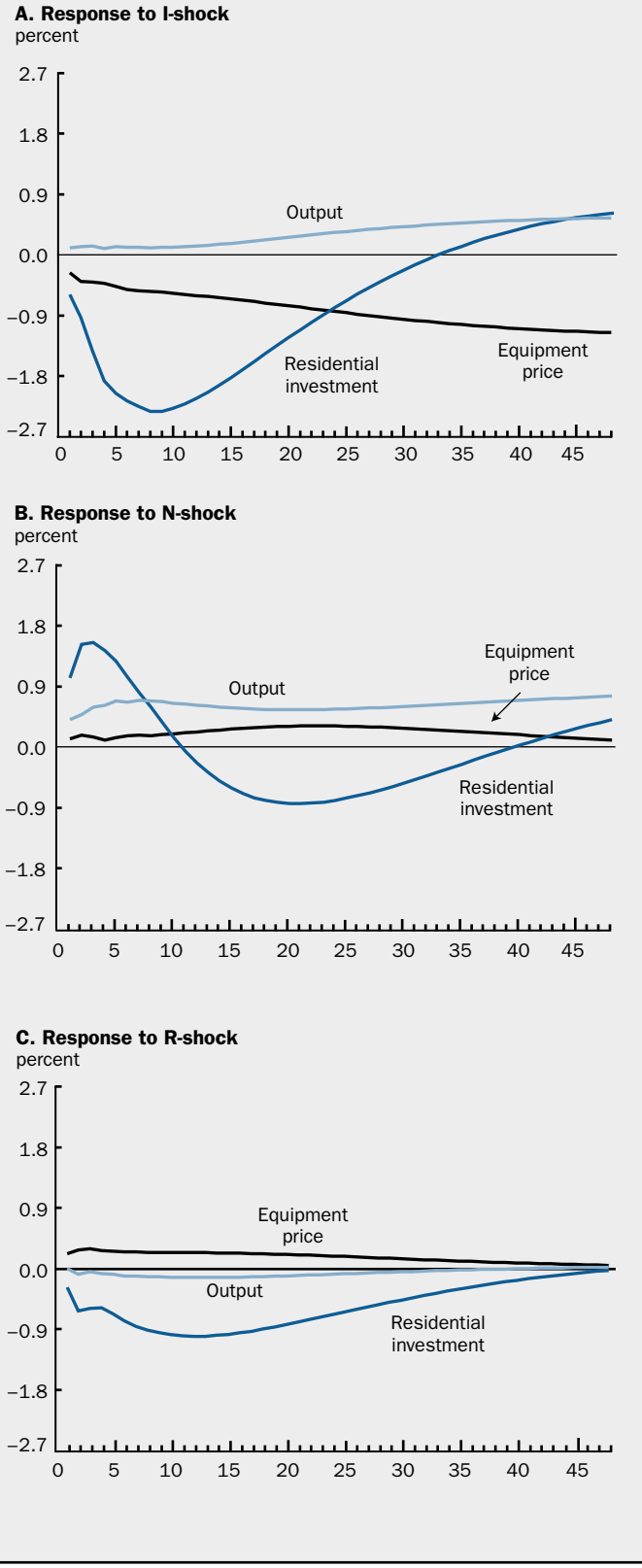
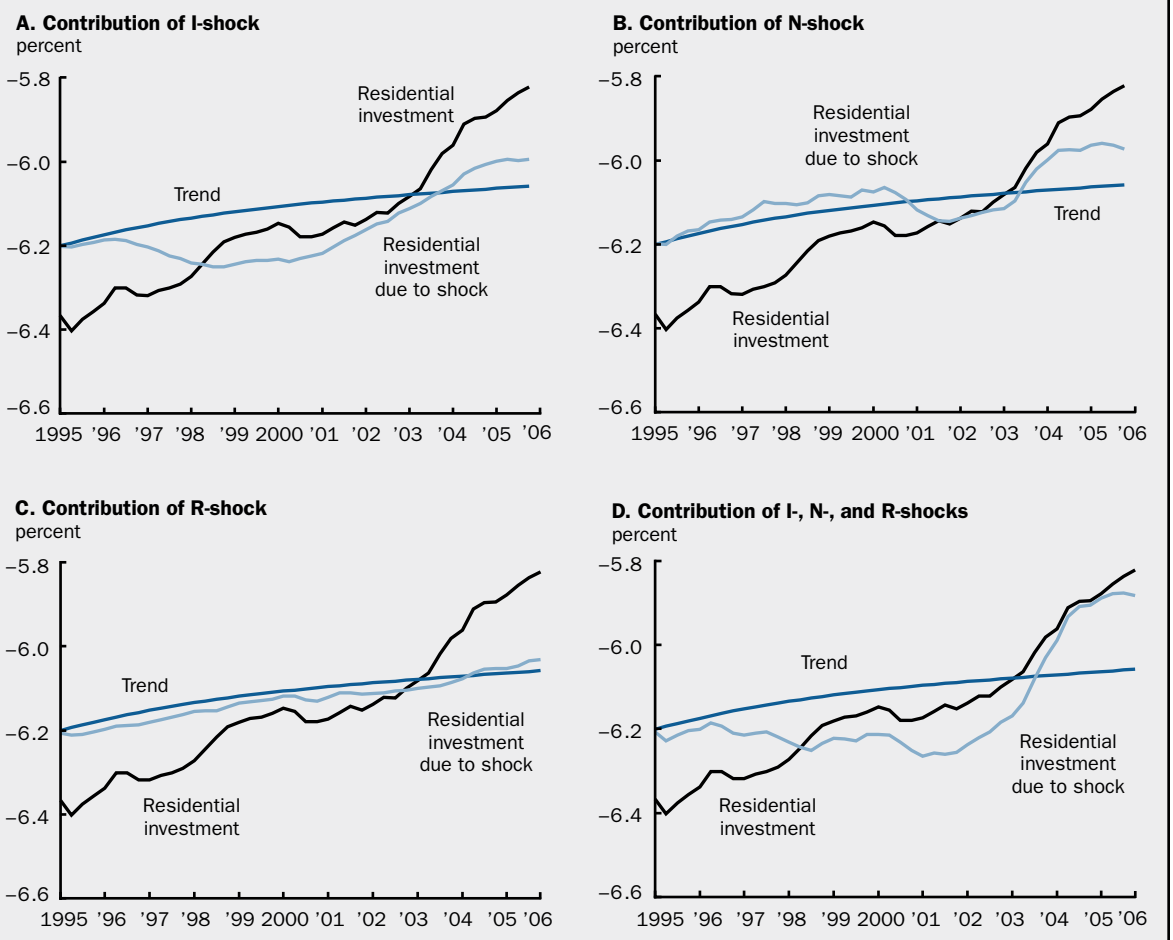


FIGURE 9

Residential investment, 1995:Q1–2005:Q4



Consequently, residential investment is eventually driven above its trend by the end of the sample. Panel B shows that N-shocks have had relatively little impact on residential investment, except during the 2001 recession and that recession's slow recovery. However, these shocks began exerting a strong positive influence toward the end of 2003. The mechanism for this is similar to that for I-shocks—technological change increases capital accumulation and wealth. From panel C, we see that monetary policy, through the R-shocks, seems to have had very little impact. Toward the end of the sample, these shocks exert a small positive influence, however. Panel D shows that the three identified shocks together account for almost all the surge of residential investment above its trend toward the end of the sample. Given the small contribution of the R-shocks around this time, this result suggests that the unusually high levels of residential investment in recent years may just be the direct result of the wealth accumulation from previously high rates of technological progress. In other words, according to the econometric analysis, the recent high rates of residential investment appear to have been driven mostly by fundamentals and not unusually loose monetary policy or speculative building.

The increase in homeownership

We now turn to the homeownership rate. Recall from figure 3 that the homeownership rate rose from about 64 percent in 1995 to about 69 percent in 2005. In this section, we describe how homeownership has changed along various demographic, income, educational, and regional lines. It then addresses the question of how much of the overall increase in homeownership can be attributed to changes in the distribution of households among these different categories. This is

TABLE 1

Homeownership rates and percent of population for various household characteristics

	Percent of population			Homeownership rates		
	1993	2003	Change 1993–2003	1993	2003	Change 1993–2003
Overall				64.68	68.39	3.71
Race of household head						
White	84.50	82.69	–1.81	68.62	72.32	3.70
Black	11.77	12.31	0.60	42.96	47.58	4.62
Other	3.73	4.99	1.26	44.04	54.53	10.49
Age of household head						
18–24	4.90	4.81	–0.09	12.43	15.91	3.48
25–29	8.55	7.20	–1.35	34.63	39.64	5.01
30–34	11.49	9.88	–1.61	50.98	54.75	3.77
35–39	12.08	10.06	–2.02	61.55	64.59	3.04
40–44	11.03	11.37	0.34	69.05	70.96	1.91
45–54	17.35	20.79	3.44	75.42	76.02	0.60
55–74	25.01	25.35	0.34	80.63	81.71	1.08
>74	9.59	10.54	0.95	72.54	78.48	5.94
Gender of household head						
Male	70.68	70.50	–0.18	70.95	74.31	3.36
Female	29.32	29.50	0.18	49.51	54.21	4.70
Marital status of household head						
Married, spouse present	54.02	51.51	–2.51	79.41	83.37	3.96
Unmarried, or spouse absent	45.98	48.49	2.51	47.38	52.47	5.09
Children in the household						
None	61.28	62.77	1.49	64.77	68.17	3.40
One	15.73	15.48	–0.25	63.36	68.04	4.68
Two	14.59	13.76	–0.83	67.59	71.26	3.67
Three	5.84	5.65	–0.19	64.98	68.00	3.02
Four or more	2.57	2.34	–0.23	53.50	60.42	6.92
Adults in the household						
One	30.87	32.54	1.67	45.65	52.27	6.62
Two	54.34	52.47	–1.87	71.88	75.47	3.59
Three	10.61	10.64	0.03	77.32	78.55	1.23
Four or more	4.18	4.35	0.17	79.40	78.67	–0.73
Region						
North East	19.85	18.66	–1.19	62.16	64.64	2.48
North Central	23.89	23.12	–0.77	67.85	73.14	5.29
South	35.54	37.00	1.46	66.33	70.08	3.75
West	20.72	21.22	0.50	60.69	63.79	3.10
Education of household head						
Less than high school	19.33	17.44	–1.89	58.77	57.75	–1.02
High school graduate	35.50	28.35	–7.15	64.67	68.52	3.85
Some college	19.88	27.26	7.38	63.20	67.71	4.51
College graduate	14.08	17.30	3.22	67.25	73.25	6.00
Postgraduate	11.20	9.64	–1.56	74.35	80.40	6.05

Source: American Housing Survey.

useful for assessing the extent to which other factors, including the introduction of new mortgage products, are needed to account for the increase in homeownership. The analysis in this section borrows from Segal and Sullivan (1998). The data underlying the analysis are from the American Housing Survey (AHS).[8]

Cross-sectional changes in homeownership

Table 1 displays how homeownership has changed between 1993 and 2003 along various demographic, educational, and regional lines, and table 2 does the same for income deciles. When referring to an individual characteristic, the unit of analysis is the household head. Also contained in these tables is the change

TABLE 2

Homeownership rate, by income deciles

1993 income decile	Percent of population: Change 1993–2003	Homeownership rates: 1993	2003	Change 1993–2003
1	–0.33	0.39	0.43	0.04
2	–1.67	0.45	0.49	0.04
3	–0.81	0.52	0.52	0.00
4	0.75	0.54	0.58	0.04
5	–1.29	0.63	0.61	–0.02
6	–1.25	0.64	0.67	0.03
7	0.18	0.72	0.75	0.03
8	–0.55	0.79	0.82	0.03
9	0.90	0.86	0.88	0.02
10	4.06	0.92	0.93	0.01

Source: American Housing Survey.

in the proportion of household heads that belong to each category. We do not discuss all the entries in these tables, but instead focus on two features of the tables that play roles in the analysis to follow.

The first and most important observation is that all but two categories in both tables display an increase in homeownership rates between 1993 and 2003. The two categories with declining homeownership rates are households with four or more adults, and household heads with less than a high school education. That the increase in homeownership cuts across so many different categorizations suggests that the overall homeownership rate is not merely reflecting changes in the distribution of the population among the categories. Something fundamental about the homeownership process has changed.

The second key observation is that among the different age groups, younger household heads experienced larger increases than middle-aged household heads. Consistent with the large increases in homeownership rates of younger household heads, single household heads have larger increases in homeownership rates than married household heads and other households with more than one adult. The pattern of homeownership among the young is a striking reversal of a trend seen between 1978 and 1993. Between 1978 and 1993, homeownership rates dropped for household heads under 40. This drop in homeownership rates coincided with a fall in marriage rates and the fraction of households with children for household heads under 40. This is consistent with the fact that starting a family has traditionally been one of the main instigators of homeownership. From this perspective, the increase in homeownership among younger household heads from 1993 and 2003 suggests that there might have been a reversal in rates of family formation among the young. Yet, marriage rates and the likelihood of a household having children by age of household head are about the same for 2003 and 1993. Clearly some other factor is driving homeownership among younger household heads.

The impact of changes in the distribution of households

Tables 1 and 2 show that there were noticeable changes between 1993 and 2003 in the distribution of household heads among the various categories. For example, the share of younger household heads fell, while that of older household heads has risen. Since older household heads tend to have higher homeownership rates than their younger counterparts, this change in distribution raises the economy-wide homeownership rate. Next, we consider, a decomposition of the overall homeownership rate into parts due to changes in the household head distribution and changes in the homeownership rate.

The basis for the decomposition is a simple linear probability model. This relates the probability that a household head owns her house as a linear function of household characteristics. Specifically,

$$h(x_i, t) = x_i'\beta_t, \qquad t = 1993, 2003,$$

where x_i is a column vector of dummy variables for household i corresponding to each of the characteristics in tables 1 and 2, and β is a column vector of coefficients. For example, if the household head is

TABLE 3

Contributions to 1993–2003 change in homeownership rate

Included variables	Base year 1993: Δh	1993: Δw	2003: Δh	2003: Δw
Age only	2.56	1.14	2.45	1.25
Demographic + regional	3.51	0.20	3.51	0.19
Demographic + regional + ed. + inc.	1.86	1.84	1.94	1.76

Notes: The figures reflect actual 1993–2003 data. The change in the homeownership rate is 3.70.

between the ages of 18 and 24, then the dummy corresponding to this characteristic is set equal to one and the dummies corresponding to the other age categories are equal to zero. We estimate two linear probability models, one using data from the 1993 AHS and one using data from the 2003 AHS.

The linear probability model is related to the overall homeownership rate in year t, $\bar{h}_t$, as follows:

$$\bar{h}_t = \sum_{i \in N_t} w_i h(x_i, t), \qquad t = 1993, 2003,$$

where w_i is the sample weight (the number of households in the population that each individual household in the sample represents divided by the total number of households in the population) for household i, and N_t is the year t sample. Given this relationship, the change in the overall homeownership rate can be decomposed into two parts. In addition, there are two ways to construct this decomposition, depending on the choice of the base year.

The decomposition is

$$\begin{aligned}\bar{h}_{2003} - \bar{h}_{1993} &= \left[\sum_{i \in N_B} w_i \left(h(x_i, 2003) - h(x_i, 1993)\right)\right] \\ &+ \left[\sum_{i \in N_{2003}} w_i h(x_i, \sim B) - \sum_{i \in N_{1993}} w_i h(x_i, \sim B)\right] \\ &= \Delta h + \Delta w.\end{aligned}$$

Here, B denotes the base year for the decomposition, and $\sim B$ means "not the base year." So if B is 1993, then $\sim B$ is 2003, and vice versa. The term Δh corresponds to the first term in square brackets and Δw corresponds to the second term. These variables correspond to the two channels through which the homeownership rate changes. The term Δh captures the part due to changes in the household-level homeownership rates, holding fixed the sample weights. The term Δw captures the part due to holding fixed the individual-level homeownership rates, but allowing the sample weights, that is, the household distribution, to change. Since the sample weights and their changes depend on the choice of base year, the decomposition also depends on which base year is chosen. Without a compelling reason to choose one base year over the other, we consider decompositions based on each base year.

The decomposition for the two possible choices of base year is shown in table 3. Each row of the table corresponds to different sets of variables in the linear probability model. The table shows that when the income and education variables are excluded from the model (the first two rows), then the Δh term accounts for most of the overall change in homeownership. If true, this would mean that factors influencing individual homeownership rates, and not changes in the characteristics of the population, are by far the most important factor underlying the overall change in homeownership. However, once the education and income variables are included in the model (the third row), then the share attributable to the change in weights rises to about one-half. This result is driven primarily by the income variables due to the fact that the shares of the higher income household heads have risen, and higher levels of income are associated with higher levels of homeownership.

Table 4 decomposes the effects of the changes in weights (the Δw terms) into the effects of the main groups of characteristics. This verifies that age and income are the main factors driving this component of the change in homeownership. An older and higher income population will tend to have a higher overall homeownership rate without any other changes in the economy. Still, table 3 indicates that part of the increase in homeownership remains unexplained. In the next section, we consider this unexplained portion of the rise in homeownership and relate it to the high levels of residential investment.

Connecting the booms in residential investment and homeownership

Here, we connect the boom in homeownership with the boom in residential investment. We argue that developments in the mortgage market have led to a large expansion of the pool of potential homeowners by lowering borrowing constraints.[9] Suppose a householder in 1995 would have preferred to buy at terms available in 2005 but, because these terms were

TABLE 4

Effects of changes in distribution of household characteristics

	Base year	
	1993	2003
Demographic and regional	0.48	0.47
Age	1.15	1.29
Sex	0.01	0.01
Marital status	–0.35	–0.36
Household size and composition	–0.13	–0.21
Race	–0.22	–0.27
Region	0.02	0.01
Education and income	1.36	1.29
Education	0.15	0.06
Income	1.21	1.24

not available in 1995, chose to rent. If rental housing is not perfectly substitutable with owned housing in the short run, as is likely the case because of moral hazard considerations, then the availability of 2005 mortgage terms increases the demand for owned housing. All else being equal, this should increase the quantity of housing supplied and raise the share of residential investment in GDP. In the long run, rental and owned housing are essentially perfect substitutes. As the homeownership rate reaches its new, less borrowing-constrained, equilibrium level, we would expect residential investment as a share of GDP to return to "normal" levels. The remainder of this section considers the possible connection between mortgage innovation and homeownership and residential investment in more detail.

The dramatic rise in residential investment and homeownership has coincided with equally dramatic developments in the mortgage market. Over the past ten years to 15 years, the mortgage market has developed substantially in four areas. First, technological progress has reduced the cost of approving a mortgage under a standardized set of lending guidelines, in part by allowing more precise measurement of a borrower's credit risk. Second, mirroring developments in financial markets more generally, many new kinds of mortgages have become available. Third, the secondary mortgage market has grown and matured so that many kinds of mortgages can now be packaged and sold as mortgage-backed securities. Fourth, the mortgage market has become more specialized, as firms concentrate on different pieces of the market, including origination, servicing, and securitization.

Of these developments, the second is most important for our argument. We think that the main impact of the other three developments is to increase competition and lower transactions costs. Also, the development of the secondary mortgage market probably improved the risk–return tradeoff between mortgage-backed securities and other financial instruments. This would have the effect of increasing the supply of capital to mortgage markets. All these developments drive down mortgage rates. Historically, we have seen large swings in mortgage rates without large changes in the homeownership rate. So we conclude that the cost reductions and increases in the supply of capital to the mortgage market are likely to have had a relatively small impact on homeownership.

In contrast, the development and dissemination of many new mortgage products have made it possible for large numbers of people to acquire mortgages who would have been unable to previously. Before the 1990s, the standard kind of mortgage required the potential home buyer to satisfy a relatively rigid set of criteria on loan-to-value ratios, income, and other measures of creditworthiness. This rigidity was necessary for the development of the secondary market for mortgages. While beneficial in this respect, it effectively shut many potential homeowners out of the market. By reducing the remaining rigidities, the new mortgage products have expanded the pool of potential homeowners.

Two developments seem to have had a particularly large impact along this dimension. One development involves the so-called combo loan. These mortgages reduce or even eliminate entirely the need for a down payment. The second involves mortgages aimed at the "subprime" market. Subprime borrowers are individuals with low credit ratings. Subprime lending allows borrowers who, in the past, would not have qualified for a mortgage to qualify by paying higher interest rates and offering more equity or lower loan-to-value ratios. Before the development of the combo loan, potential buyers had to accumulate sufficient savings to afford the necessary down payment. Before the development of the subprime market, most borrowers with poor credit would not have been able to get a mortgage at all. It is easy to see how these developments have lowered borrowing constraints and made it possible for potential buyers to buy earlier or buy at all.

The information on mortgages collected by the AHS which is consistent with the above interpretation of how new kinds of mortgages have affected the choices available to households. For instance, among first-time home buyers with a mortgage, 7.9 percent report that no down payment was required in 1993, and 12.1 percent report this in 2003. It is not possible to determine from the AHS data whether a borrower has a subprime mortgage. However, the survey does report the interest rate paid on the primary mortgage. We use this to compute the coefficient of skewness of interest rates in 1993 and 2003. A large positive skewness coefficient indicates that the distribution of interest rates includes a larger fraction of relatively high interest rates. In 1993, the skewness coefficient is 0.59. In 2003, it is 1.84. This increase in skewness is consistent with a greater fraction of mortgages being high interest subprime mortgages, although it could also arise with an increased usage of adjustable rate mortgages.[10]

What impact have these changes had on home buying? Since the most constrained home buyers are first-time buyers and first-time buyers are typically young, we can use table 1 to assess the possible impact of the changes in the structure of mortgages. Table 1 shows that homeownership rates for young

buyers have risen by much more than for older buyers, except for the oldest buyers (>74). So, for buyers under 40 the changes in homeownership rates are all greater than 3 percent, while for buyers from age 40 to age 74 the changes are all less than 2 percent.

The evidence so far is consistent with the mortgage developments increasing the pool of buyers. The last question we address is whether this increase in the pool is large compared to the recently high levels of residential investment and homeownership. Given the paucity of data we have to work with at this time, our calculations are rough and tentative. We first make a rough estimate of the additional homeowners due to the subprime lending. Our hypothesis is that these homeowners come from the ranks of renters, so we compare this magnitude with changes in the rental vacancy rate. To assess the potential impact on residential investment and homeownership, we also compare our calculated increase in the number of new homeowners due to subprime lending with changes in the number of housing completions and the unexplained portion of the increase in homeownership displayed in table 3.

Using data on the volume of home purchase mortgage originations in 2002 (from the Mortgage Bankers Association), the average loan amount in 2002 (Federal Housing Finance Board), and the fact that 10 percent of such originations were subprime mortgages (Gramlich, 2005), we calculate that about 673,000 subprime mortgages were issued for home purchases in 2002. In 1994, 76 percent of new originations were for home purchases (Federal Housing Finance Board). Combining this information with numbers on the volume of the subprime mortgage market and the average loan amount in 1994 (Gramlich, 2005), we calculate that about 242,000 subprime mortgages were issued for home purchases in 1994. So between 1994 and 2002, there was an increase of 431,000 subprime home purchases.

Assuming that the home buyers using these subprime mortgages would previously have been excluded from the mortgage market, this increase in subprime purchases must be accompanied by a reduction of similar scale in renting households (assuming no substitution between rental and owned housing units and no impact on the formation of new households). In this case, we should have seen an increase in the rental vacancy rate. In fact, between 1994 and 2002, there was an increase of 1.5 percentage points in the rental vacancy rate (U.S. Census Bureau). This increase in the vacancy rate translates into 570,000 additional vacant rental units in 2002.[11] By this calculation, the additional subprime lending accounts for 76 percent (431,000/570,000) of the increase in the rental vacancy rate. Additionally, the magnitude of the new subprime lending accounts for about 72 percent of the roughly 600,000 additional housing completions (U.S. Census Bureau) in 2005 compared with 1995.

According to table 3, about 1.75 percent of the increase in homeownership between 1995 and 2005 remains unexplained by changes in the cross-sectional characteristics of the population. With 113 million households in 2005, this translates into two million additional homeowners in 2005, or an average of 200,000 additional homeowners each year between 1995 and 2005. The volume of subprime lending we calculated for 1994 is much higher in the years afterward (Gramlich, 2005). Consequently, by our calculations, the subprime market can easily account for the additional homeowners unaccounted for by changes in the cross-sectional characteristics of the population.

We conclude that substitution away from rental housing made possible by developments in the mortgage market, such as subprime lending, could account for a significant fraction of the increase in residential investment and homeownership. The current spending boom thus may be a temporary transition toward an era with higher homeownership rates and spending on housing, which will ultimately move nearer to historical norms.

It may appear that the role of mortgage markets in accounting for the increase in residential investment contradicts our finding earlier in this article that the current levels of spending on housing are largely explained by technology-driven factors. We do not view this as a contradiction, because the kind of technological change that made the mortgage market developments possible affected many parts of the economy. In particular, much of the technological change underlying our previous finding can be attributed to firms finally working out how to take advantage of innovations in information technology. The advances we have in mind have found uses in all sectors of the economy, including the financial services industry, and so can be viewed as neutral technological change. In addition, much of the decline in the equipment price underlying our estimates of the investment-specific shocks can be attributed to information technology. So investment-specific technological change has also contributed to the evolution of the mortgage market.

Conclusion

This article has attempted to explain two features of the turn of the twenty-first century U.S. economy: high levels of residential investment and homeownership rates. Our main findings are as follows. First, it appears that the housing boom has not been driven by unusually loose monetary policy. This is not to say the monetary policy has not been unusually loose, but that to the extent it has been loose, this is not what has been driving spending on housing. Second, the current levels of spending on new housing are largely explained by technology-driven wealth creation over the previous decade. Third, changes in the demographic, income, educational, and regional structure of the population account for about one-half of the increase in homeownership. That is, without any other developments, the homeownership rate is likely to have gone up anyway, but not by as much as it has done. The last finding is that substitution away from rental housing made possible by developments in the mortgage market, such as subprime lending, could account for a significant fraction of the increase in residential investment and homeownership.

We view our findings as supporting the view that the current housing boom may be a temporary transition toward an era with higher homeownership rates in which spending is temporarily higher than historical norms but will eventually return to such norms. While we have so far mostly avoided discussing housing prices, our findings do suggest that to the extent that house prices have grown considerably in recent years, this is not due to unusually excessive speculation in the housing market, such as would occur in a bubble. Instead, our findings point toward the high prices being driven by fundamentals.

NOTES

[1]Home building and residential investment are not quite the same thing, since average home size and quality as well as construction costs vary over time. However, they are closely related, and this article will use the terms interchangeably.

[2]Household formation is also affected by conditions in the housing market. For example, high house prices or rental rates may induce singles to remain at home rather than find a place of their own. The discussion here implicitly assumes that these factors are overwhelmed by social developments, such as declines in marriage rates among the young, and demographic developments, such as the baby boom.

[3]If households typically stay in a house five years before they move, then the relevant expected inflation rate is over five years. Expectations of inflation over five years should be slower to change than expectations over one year.

[4]Median wealth has risen less than average wealth, indicating that wealth has become more unevenly distributed. Suppose the demand for housing is an inferior good, so that demand for it grows less than in proportion to growth in wealth. Think Bill Gates. In this case, greater dispersion in wealth should lead to a decline in the share of housing in the aggregate portfolio.

[5]Progress has been made in identifying fiscal shocks. See, for example, Burnside, Eichenbaum, and Fisher (2004). However, there is much less consensus on the viability of the available identification strategies.

[6]The real price of capital equipment is measured as the NIPA deflator for equipment and software divided by a consumption deflator derived from the NIPA deflators for consumer nondurables and services. Real GDP is measured in consumption units by dividing nominal GDP by the consumption deflator. Time t inflation is the difference between the date t and $t - 1$ values of the log of the consumption deflator.

[7]The response of output to a shock is the accumulated response of Δy_t. The response of residential investment is the response of h_t plus the response of output.

[8]The AHS is a survey that asks questions about the quality of housing in the United States. In gathering information, the U.S. Census Bureau interviewers visit or telephone the household occupying each housing unit in the sample. For unoccupied units, they obtain information from landlords, rental agents, or neighbors. The data used for this article is taken from the national survey (there is also a metropolitan area survey). The national survey is conducted during a three-month to seven-month period during which interviewers gather information on housing throughout the country. The survey covers about 55,000 housing units every two years, in odd-numbered years, and is available only through 2003.

[9]Chambers, Garriga, and Schlagenhauf (2005) make a similar argument in the context of a formal model of the life cycle.

[10]Note that looking at average down payments as a fraction of price is not very informative about the relaxation of borrowing constraints, since combo loans involve smaller down payments and subprime loans involve larger down payments, compared to conventional mortgages.

[11]In 2002, 32.1 percent of households rented and the vacancy rate was 8.9 percent. With 108.2 million occupied housing units, the number of vacant units equals 0.321×108.2 million $/ 0.911 = 38$ million. Thus, 1.5 percent of 38 million is 0.57 million.

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