

Lest We Forget, a Short History of Housing in the United States

James D. Lutz, Lawrence Berkeley National Laboratory

ABSTRACT

Many changes in historical housing practices and demographics may be surprising to people looking at the current housing situation and may help us understand the sort of changes that have occurred and the speed at which significant change is possible. Beginning in 1940, the decennial census survey started asking questions about the housing stock in the United States. By examining the questions and answers, we can see how housing has changed in the past 60 years.

The art and practice of indoor plumbing took nearly a century to develop, starting in about the 1840s. In 1940 nearly half of houses lacked hot piped water, a bathtub or shower, or a flush toilet. Over a third of houses didn't have a flush toilet. As late as 1960, over 25% of the houses in 16 states didn't have complete plumbing facilities.

Half of all households heated with coal in 1940, and another quarter heated with wood. By 2000 the fraction of houses that heated with wood or coal was below 5%. By 1960, fuel oil and natural gas were the primary heating fuels. The number of houses that used fuel oil peaked that year and has declined in national importance ever since. The use of electricity as a heating fuel has climbed while fuel oil has declined. These changes in choice of main heating fuel coincide with an expansion of the population in the West and South, helped by the advent of air-conditioning.

Another significant change has been the number of people per household and the size of housing units. The average number of people per household has declined while at the same time new houses are getting bigger and have more rooms.

In 1900 the average household was over 4.5 people, in 1940 it was about 3.5, and by 1990 it had declined to less than 2.5. In 1940, the percent of households consisting of people living alone was less than 10%, since 1990 over a quarter of households have been single-person.

At the same time new houses have been getting larger. Over the past 15 years the median floor area of new homes has increased 25%. A quarter of new homes now have 4 bedrooms, up from just over 10% 25 years ago. Now 80% of new homes have 2 or more bathrooms, compared to half of new homes with only one bathroom in 1975.

During the past quarter century, when the housing stock was changing so much, surveys of the overall happiness of the American population show no increase and possibly even a decline.

Looking at these long-term, large scale changes can remind us that the housing stock is dynamic and may help us better understand what influences it.

Plumbing

Nineteenth Century

Modern plumbing in the United States started when the Croton Aqueduct to New York City was completed in 1842. This meant pressurized water, primarily intended for fire hydrants,

was now available. Three years later the city allowed sanitary sewers from buildings to be connected to the public storm drain sewers. By the 1850s indoor plumbing was starting to be installed for the wealthy. However the principals of venting still weren't understood. There were many unpleasant back-pressure events. Double doors were common between add-on bathrooms and the main living areas to prevent sewer odors from entering the living space. In the 1860s the water supplies for multistory tenements were hydrants in the yard, while sanitation was accomplished with privies over waterproof vaults in the back yard. (George, 2001)

The method of venting sewers to allow waste to flow freely without causing back-pressure events was introduced at the Master Plumbers conference in New York in 1875. By the 1900s the large industrial cities had enacted codes requiring toilet rooms in every unit in tenements. (George, 2001)

At the same time water heating was developing to the point where hot piped water became common. In the 1870s coils to heat water were added to the back of coal-burning cooking stoves. The advent of gas utility services in large cities in the 1890s and 1900s led to automatic water heaters and plumbed hot water. Temperature and pressure relief valves were added later to prevent spectacular, unfortunate accidents. (George, 2001; Watts Regulator Co, 1940).

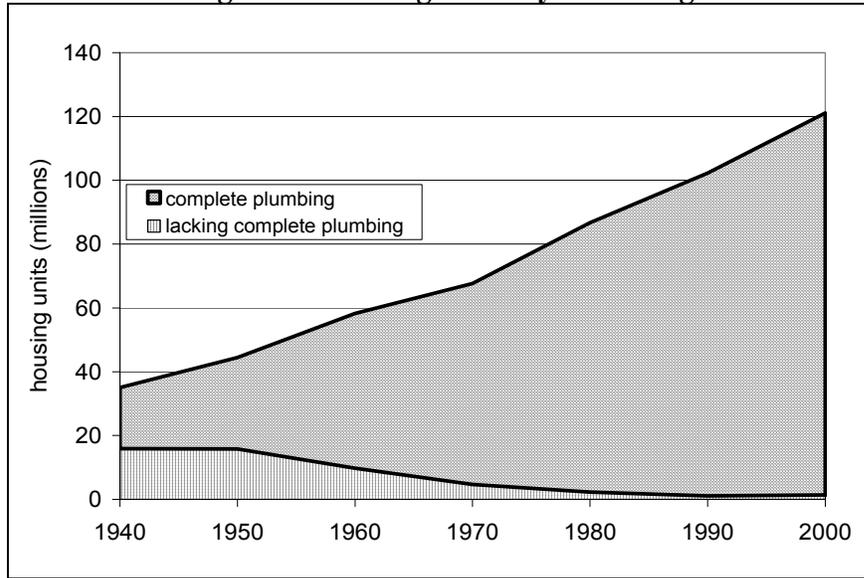
Twentieth Century Sees Development of Plumbing Codes

In 1920 only 1% of U.S. homes had electricity and indoor plumbing. Herbert Hoover, then Secretary of Commerce, started the Materials and Structures Division of the National Bureau of Standards (NBS) and appointed Dr. Roy Hunter to the plumbing division. (George, 2001) Dr. Hunter conducted a series of studies researching how to best handle various aspects of plumbing. (U.S. Department of Commerce, 1940) These studies, published in the 1930s and 1940s, form the basis of modern plumbing codes, which have changed surprisingly little since then. House construction trends, combined with declining household membership, as discussed later in this paper, may necessitate re-examination of the sizing guidelines in the plumbing codes.

Impact on Housing

Once the plumbing codes were developed, nearly all new housing has been built with complete plumbing facilities, defined as hot and cold piped water, a bath-tub or shower, and a flush toilet. And since 1950, the number of households lacking complete plumbing facilities has declined to just a few percent nationally, as the plumbing in existing older houses is upgraded. (U.S. Census, 2002) See Figure 1.

Figure 1. Housing Units by Plumbing



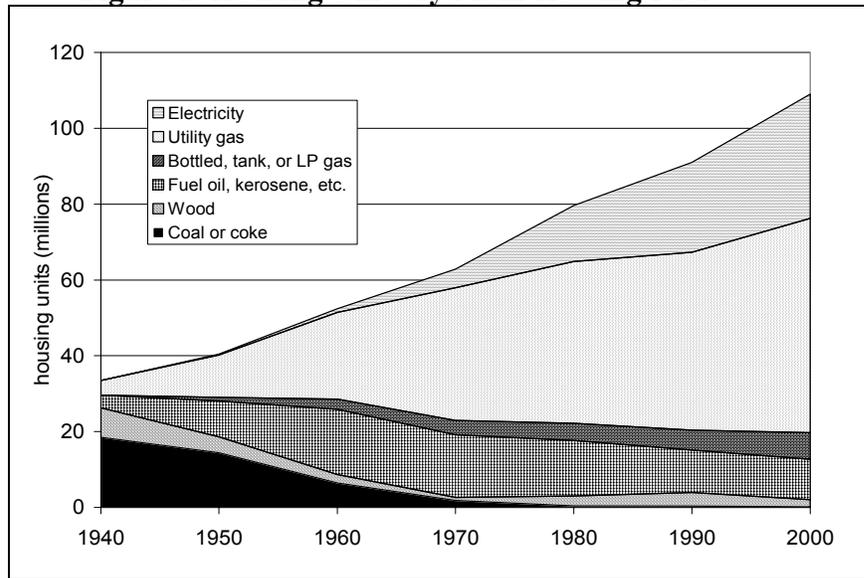
Source: U.S. Census 2002a

Heating

The story of heating fuel choice also shows significant changes over the past half century. In the 1940 Census over half of housing units used coal as their primary heating source and another quarter of housing units heated with wood. Since that time coal has gone into a steady decline as a home heating fuel. From 1970 on, it has been used as a heating source by a very small percentage of homes. The decline reflects conversions to fuel oil or gas in existing homes. Since 1960 the number of homes that heat with fuel oil has also been declining.

The big growth in home heating fuel has been natural gas and, beginning in 1960, electricity. (U.S. Census, 2002b) These trends, choosing fuels with less and less carbon content (coal → oil → natural gas) means house heating fuel is being de-carbonized. These trends can be clearly seen in Figure 2.

Figure 2. Housing Units by Main Heating Fuel



Source: U.S. Census 2002b

The trend toward natural gas and electricity, and away from coal and fuel oil, as home heating fuels coincides with a shift of population and home construction away from New England and the Northern states.

Expanding West and South

The Census data also report the age of existing houses. By plotting the percent of housing stock by age in each state, the historic pattern of population movements and expansion can be seen.

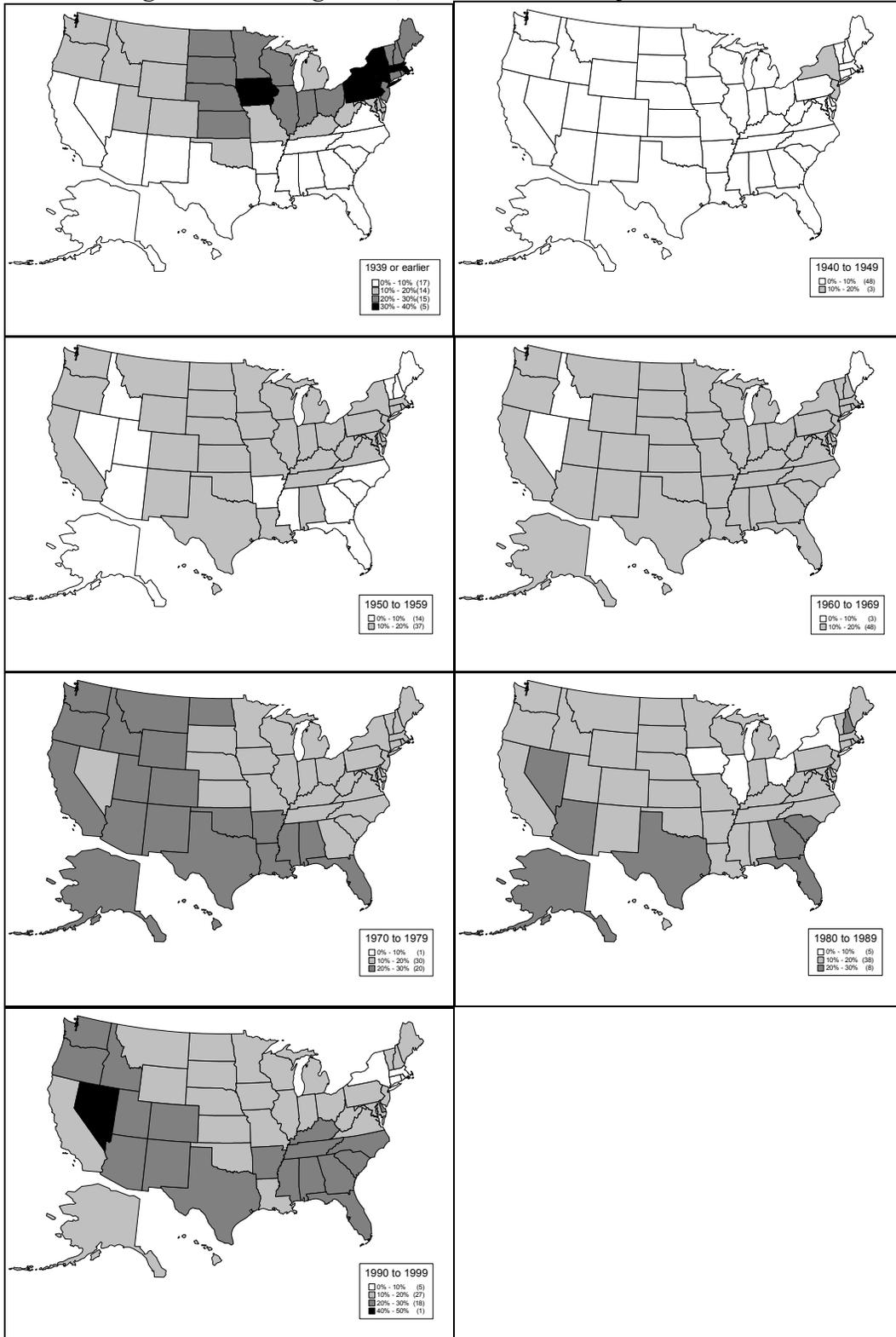
The following figures display the percent of the current housing stock in each state by the decade it was built. This shows how housing built before 1940 is primarily in the North, and in New England.

Housing from the 40s represents a much smaller fraction of today's stock than housing in more recent decades. This is probably because housing construction was very limited during World War II.

The advent of air conditioning in the 1950s and 1960s encouraged the expansion of housing in the South. Housing built in the decades of the 50s and 60s is fairly evenly spread across all the states. The trend of toward the West and the South accelerated in the 1970s.

By the 90s economic conditions led to a boom in the construction industry in the West, especially in Nevada, and the South.

Figure 3. Housing Stock, Percent in State by Decade Built

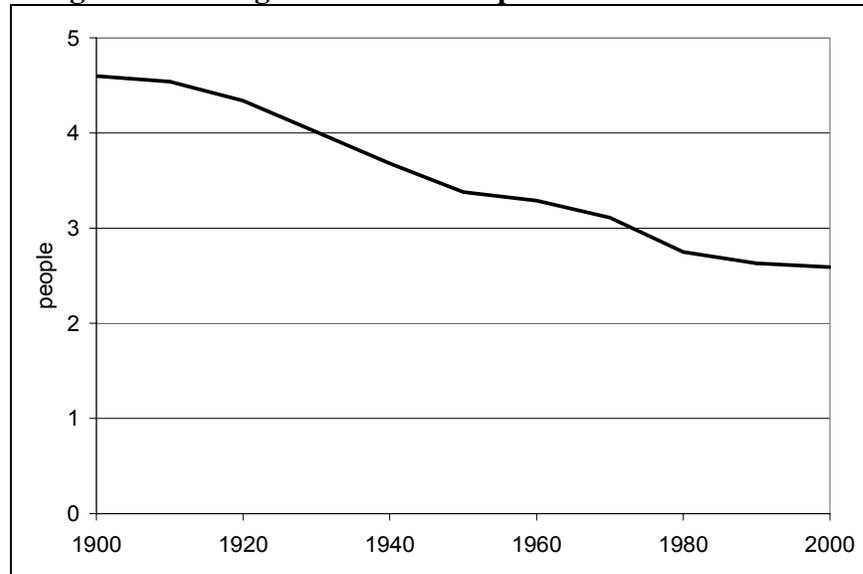


Source: U.S. Census 2000

Size of Households

In addition to changes in housing characteristics and geographic region, the number of people per household has also declined dramatically over the past century. It has been a rather constant decline although it may be leveling out at around 2.5 people per household. There's a small but noticeable deviation from the constant decline from 1960 to 1970. This corresponds to the years when "Baby Boom" families were the largest.

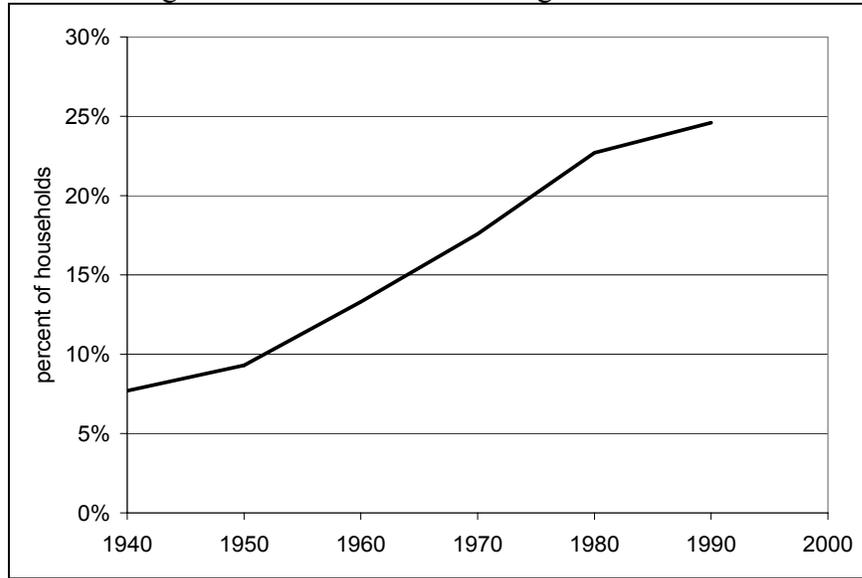
Figure 4. Average Number of People Per Household



Source: U.S. Census, 2004

As expected, with the average number of people per household declining as it has, the percentage of households of people living alone has climbed dramatically. In the past 6 decades, the percent of households of people living alone has risen from less than 10% in 1940 to 25% in 2000. Figure 5 shows a graph of households consisting of one person since 1940.

Figure 5. Households Consisting of One Person



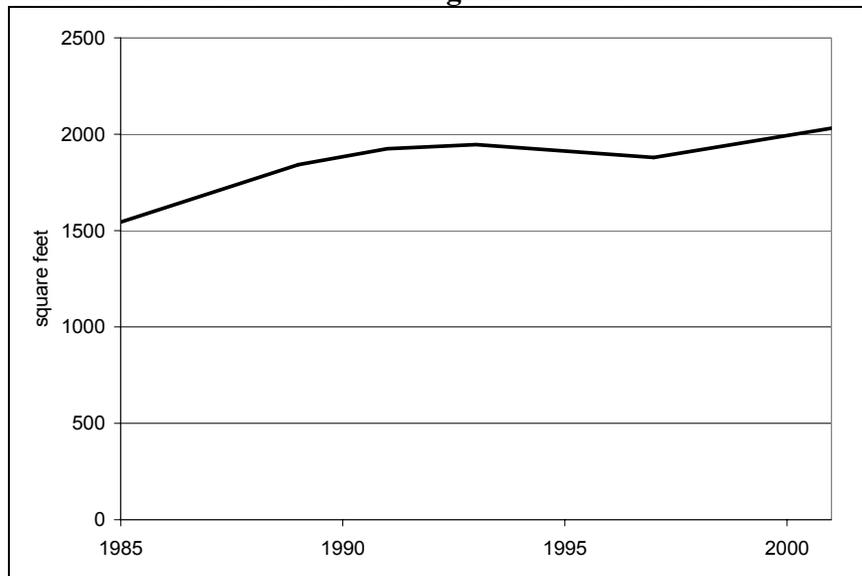
Source: U.S. Census, 2002c

Size of Housing

Even as the number of people per household has been declining, houses have been getting bigger. Not only are new houses getting bigger, they have more bedrooms and bathrooms.

Figure 6 shows the growth of median floor area of single detached and mobile homes since 1985. The median size for new construction of these types of housing units has grown almost 25% in the past 15 years.

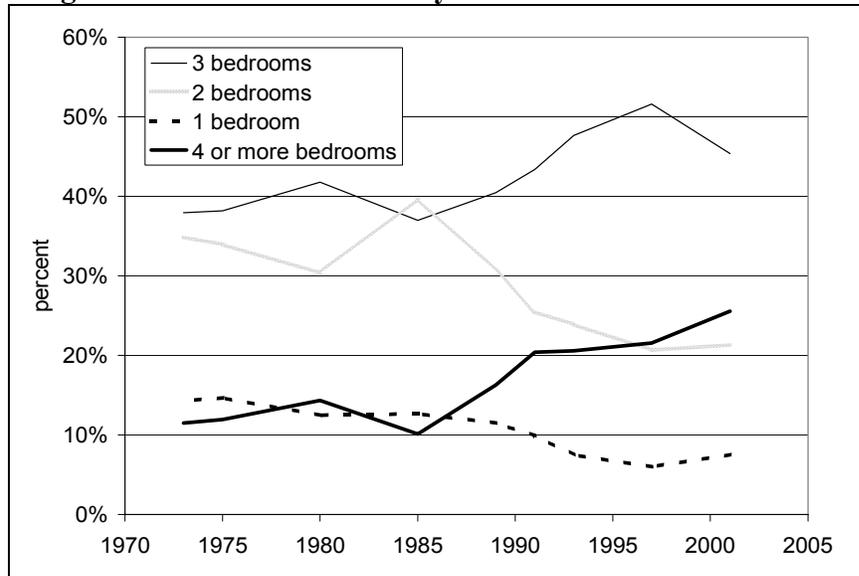
Figure 6. Median Floor Area of New Single Detached and Mobile Homes



Source: U.S. Census, American Housing Survey (various years)

Figure 7 shows the percent of housing units by number of bedrooms in new construction. The percent of housing units with 1 and 2 bedrooms have been steadily declining, while the percent with 3 and 4 bedrooms has been climbing.

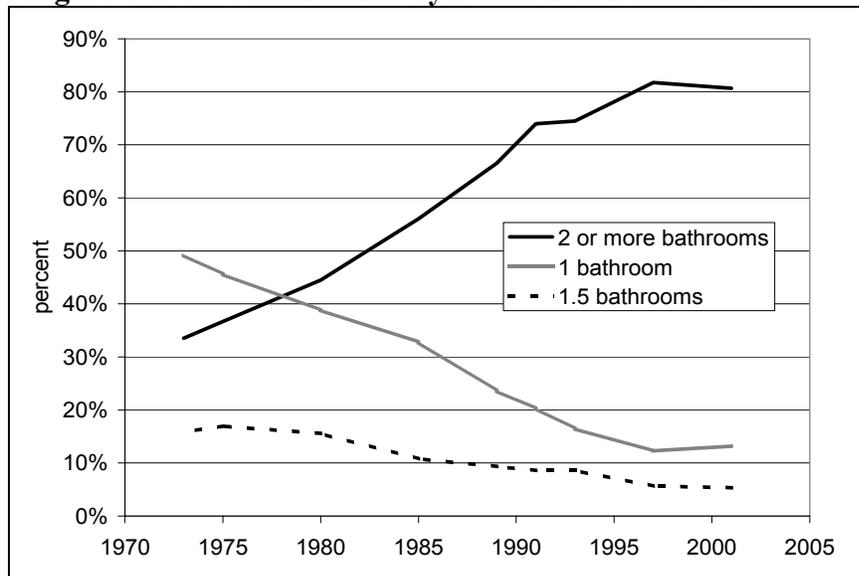
Figure 7. New Construction by Number of Bedrooms



Source: U.S. Census, American Housing Survey (various years)

The number of bathrooms shows a similar trend. Housing units with single bathrooms have declined from almost half of new construction in 1973, to a bit over 10% as of 2001. During the same period, the number of housing units with 2 or more bathrooms has climbed to over 80% of new construction. The presence of one and a half bathrooms has never been very popular and has become less so over the past 3 decades. Now fewer than 10% of housing units in new construction have 1½ bathrooms. (A half bathroom is one without bathing facilities.)

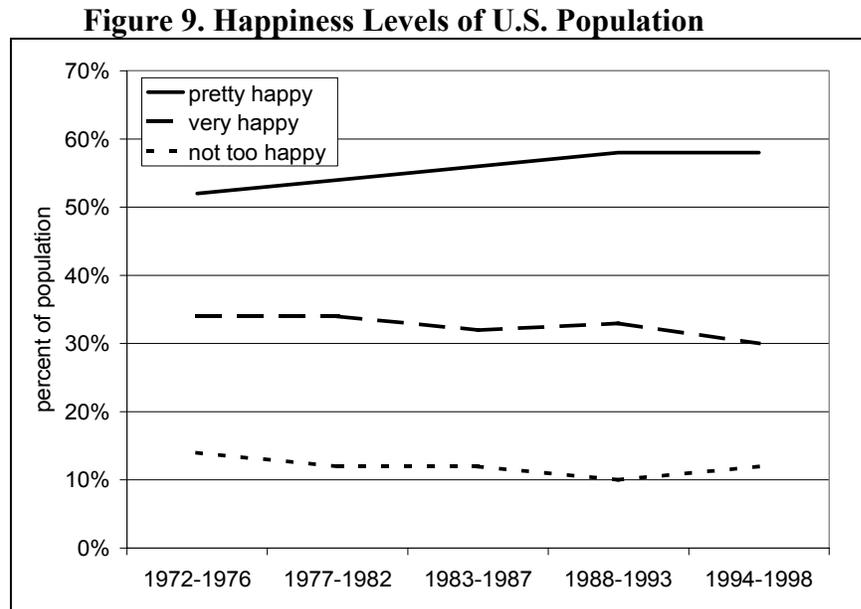
Figure 8. New Construction by Number of Bathrooms



Source: U.S. Census, American Housing Survey (various years)

Happiness

Ironically, while the size of houses has increased in the United States, and especially on a per capita basis, surveys show the overall level of happiness of the population has not risen in the past quarter century, and in fact may have declined. According to microeconomic happiness equations, one of the stronger correlations of happiness is with being married. (Blanchflower and Oswald, 2002) So in some way this stagnation of happiness levels for the population may be tied to the growing number of single-person households. The results of the surveys of overall happiness are shown in Figure 9.



Source: Blanchflower and Oswald, 2002

Conclusions

The housing stock in the U.S. is dynamic. Large scale changes have occurred in the past several decades. Some of these changes have come about in response to technological developments or changes to codes. Other changes, sometimes just as dramatic, have been driven by social reasons. Given the uneven housing growth patterns, programs for increasing stringency of building codes and better enforcement, should not be spread uniformly across all states, but rather concentrated in those with the fastest housing growth.

The increasing number of bathrooms per person means the plumbing codes may also be due for changes. The trend to increasing amounts of house space per person means that reducing energy use and carbon emissions will be difficult.

The declining rates of overall happiness suggest an opportunity for lifestyle changes which might drive such changes. Even though houses are larger, with air-conditioning, heating, and indoor plumbing, people aren't happier. Could we be equally happy in smaller efficient and sustainable homes, that were comfortable, aesthetic, and safe.

Past changes in housing stock indicate that dramatic changes are possible. Understanding these changes may help us better understand what influences the housing stock.

References

- Blanchflower, David G. and Andrew J. Oswald. 2002. "Well-Being Over Time in Britain and the USA." *Journal of Public Economics* 88: 1359-1386. Available online: <http://www2.warwick.ac.uk/fac/soc/economics/staff/faculty/oswald/finaljpubecwellbeingjune2002.pdf>.
- R. L. C. George. 2001. "The History of Plumbing." *Plumbing Engineer* (March): 45-53.
- U.S. Census Bureau. 1975. *Current Housing Reports Series H-150-73A, Annual Housing Survey: 1973*. Available online: <http://www2.census.gov/prod2/ahsscans/h150-73A.pdf>.
- U.S. Census Bureau. 1977. *Current Housing Reports Series H-150-75A, Annual Housing Survey: 1975*. Available online: <http://www2.census.gov/prod2/ahsscans/h150-75a.pdf>.
- U.S. Census Bureau. 1982. *Current Housing Reports Series H-150-80A, Annual Housing Survey: 1980*. Available online: <http://www2.census.gov/prod2/ahsscans/h150-80a.pdf>.
- U.S. Census Bureau. 1988. *Current Housing Reports Series H-150-85A, American Housing Survey for the United States in 1985*. Available online: <http://www2.census.gov/prod2/ahsscans/h150-85.pdf>.
- U.S. Census Bureau. 1991. *Current Housing Reports Series H-150/89, American Housing Survey for the United States in 1989*. Available online: <http://www2.census.gov/prod2/ahsscans/h150-89.pdf>.
- U.S. Census Bureau. 1993. *Current Housing Reports Series H-150/91, American Housing Survey for the United States in 1991*. Available online: <http://www2.census.gov/prod2/ahsscans/h150-91.pdf>.
- U.S. Census Bureau. 1995. *Current Housing Reports Series H-150/93, American Housing Survey for the United States in 1993*. Available online: <http://www.census.gov/prod/1/constr/h150/h150-93m.pdf>.
- U.S. Census Bureau. 2000. *Current Housing Reports Series H-150/97, American Housing Survey for the United States in 1997*. Available online: <http://www.census.gov/prod/99pubs/h150-97.pdf>.
- U.S. Census Bureau. 2000. *American FactFinder, Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data, H34. YEAR STRUCTURE BUILT [10] - Universe: Housing units, Data Sets with Detailed Tables, All States*. Available online: <http://factfinder.census.gov/>.
- U.S. Census Bureau. 2002a. *Historical Census of Housing Tables: Data from 1940-1990 by state. Plumbing Facilities*. Available online: <http://www.census.gov/hhes/www/housing/census/historic/plumbing.html>.

- U.S. Census Bureau. 2002b. *Historical Census of Housing Tables: Data from 1940-1990 by state. House Heating Fuel*. Available online: <http://www.census.gov/hhes/www/housing/census/historic/fuels.html>.
- U.S. Census Bureau. 2002c. *Historical Census of Housing Tables: Data from 1940-1990 by state. Living Alone*. Available online: <http://www.census.gov/hhes/www/housing/census/historic/livalone.html>.
- U.S. Census Bureau. 2002d. *Current Housing Reports Series H-150/01, American Housing Survey for the United States: 2001*. Available online: <http://www.census.gov/prod/2002pubs/h150-01.pdf>.
- U.S. Census Bureau. 2004. *Statistical Abstract of the United States: Mini Historical Statistics, Households by Type and Size*. Available online: <http://www.census.gov/statab/hist/02HS0012.xls>.
- U.S. Department of Commerce, National Bureau of Standards. 1940. *Plumbing Manual, Building Materials and Structures Report BMS66*.
- Watts Regulator Co. 1940. *Where Danger Lurks, (a movie for sales representatives)*. North Andover, MA: