

THE CRUMBLING FOUNDATION OF U.S. House Prices

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Our research indicates that home prices could decline over 40% from the levels observed at the end of 2008. This outlook is meaningfully more negative than most current expectations. Significant declines in mortgage borrowing rates near the end of 2008 may have decreased the downside in home prices somewhat, but our analysis lends support to current efforts by government officials to intervene even more forcefully in the mortgage markets.

While almost every investor is aware of the significant increase in U.S. consumer debt over the last several decades, the underlying drivers of the increase have not been adequately examined. We analyzed data back to 1952 with an objective of determining how consumer borrowing patterns might have changed. As usual, there were some serious data limitations, especially related to home prices (refer to note 3 at the end of this paper). Having said that, we reached some surprising conclusions that we believe offer predictive power.

We outline the research and our findings as follows:

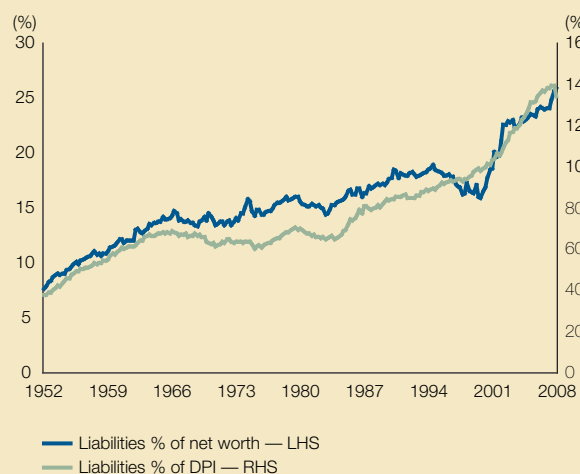
- Section 1: The evolution of consumer borrowing in the United States since the early 1950s.
- Section 2: The relationships among changes in aggregate U.S. residential real estate value, mortgage borrowing growth, and the level of home prices.
- Section 3: Predicting home prices for the next 18 months.
- Section 4: Longer-term scenario analysis.
- Section 5: Policy implications.

Section 1

The evolution of consumer borrowing in the United States since the early 1950s

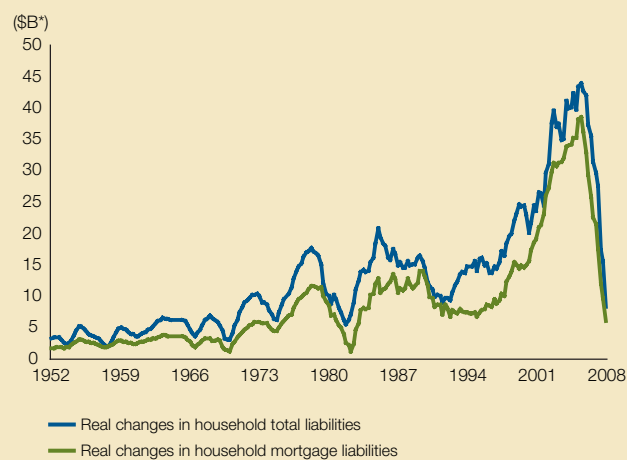
Consumer leverage as a percentage of both household net worth and disposable income has been increasing consistently over the last 50 years, as shown in Exhibit 1.

EXHIBIT 1: LIABILITIES AS A PERCENTAGE OF NET WORTH AND DISPOSABLE PERSONAL INCOME (DPI)



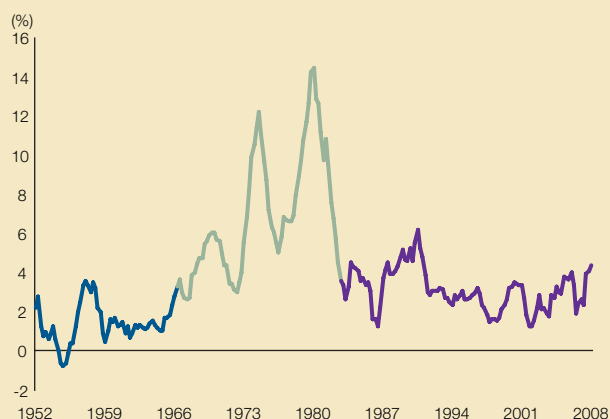
Changes in real (inflation-adjusted) consumer borrowing have also been trending upwards over the last 50 years. The most dramatic increase in real borrowing happened between 1993 and 2006, where the real rate of annual growth in debt increased almost five-fold, as shown in Exhibit 2.

EXHIBIT 2: REAL CHANGES IN U.S. HOUSEHOLD LIABILITIES



Mortgage borrowing was the key driver of increase in total consumer leverage (again, see Exhibit 2). While the composition of consumer debt was relatively stable from the early 1950s to the late 1980s, after that consumers shifted borrowing from other sources of credit (primarily personal loans and credit cards) toward mortgages. From 1952 to as late as 1988, the percentage of consumer borrowing comprised of mortgage debt ranged between 62% and 67%. After the passage of tax reforms in 1997, mortgage borrowing increased to as much as 76% of total debt; other forms of consumer credit (primarily auto loans, credit cards, and personal loans) declined to only 18% of borrowings by 2008, after being contained in a range between 25% and 33% of total debt for about three decades.¹

As shown in Exhibit 3, the period we examined includes three distinct eras from the perspective of inflation. From 1952 to the mid-1960s (blue line), the United States enjoyed low and stable inflation. From the mid-1960s through 1980 (green line), inflation increased significantly into the mid-teens on a year-over-year basis. The period from 1980 onward (purple line) represented a secular era of disinflation, culminating once more in low and stable rates.

EXHIBIT 3: INFLATION*

As of 30 June 2008

Source: Bureau of Labor Statistics, Bloomberg

* Year-over-year CPI

Looking more closely at the high-inflation era from the mid-1960s through the early 1980s, the United States endured a volatile geopolitical environment in addition to economic woes. Throughout this period, many financial assets performed poorly, often delivering negative real returns. Residential real estate, however, was a more resilient store of value. Therefore, we can infer that during this period there was a shift in consumer perspective towards viewing the home not simply as a place to live, but also as an investment.

Section 2

The relationships among changes in aggregate U.S. residential real estate value, mortgage borrowing growth, and the level of home prices

We also argue that the view of the home as an investment, together with a number of additional factors, accelerated a shift in consumer preference towards mortgage debt. This shift toward mortgage borrowing culminated in an extraordinary borrowing cycle beginning in the mid-1990s, which ultimately translated into a “positive feedback loop” (refer to Figure 1). This loop describes the linkage between changes in the total value of all U.S. residential real estate, changes in aggregate mortgage borrowing, and levels of home prices (all inflation-adjusted).

In Sections 2a and 2b, we break this cycle down into two components: the first one describes the relationship between changes in U.S. residential real estate values and subsequent changes in aggregate mortgage borrowing; the second one shows the impact of the changes in mortgage borrowing on the level of U.S. house prices.

Section 2a

Increases in household real estate assets drive increases in aggregate mortgage borrowing

Increased willingness to borrow

The shift in preference toward mortgage debt can be ascribed to a number of variables, but perhaps the most important driver is how the consumer thinks of the home as an asset. Consumer psychology appears to have shifted meaningfully since the early 1970s, such that consumers now view the home as an investment as well as a place to live. Over the last 30 years, the home achieved a prestigious status in the mind of the typical consumer, as it was considered a no-lose investment. After all, nominal home values increased in almost all economic environments: periods of stable and low inflation, rising inflation, and disinflation (see Exhibit 4a). Real home prices experienced periods of decline (see Exhibit 4b), but even then they were more resilient than most other investments.² As consumers learned that home prices almost always increased in nominal terms, they developed a higher propensity to allocate capital to their homes. So, even as home prices declined about 16% in real terms from 1979 to 1982, after the tumultuous experience of the 1970s consumers could be forgiven for a temporary period of money illusion in which the real declines in value were overlooked, and the nominal increases of 18% were the focus of attention.

As U.S. households increasingly considered their home a source of wealth as well as a shelter, and to the extent that the market value of this asset increased, we think that homeowners may have felt more comfortable increasing their leverage in response to the appreciation in their portfolio of assets.⁴ This is supported by evidence from Exhibit 5, in which we see a significant positive correlation between real changes in mortgage loans and real changes in household real estate assets over the sample period.

FIGURE 1: THE POSITIVE FEEDBACK LOOP

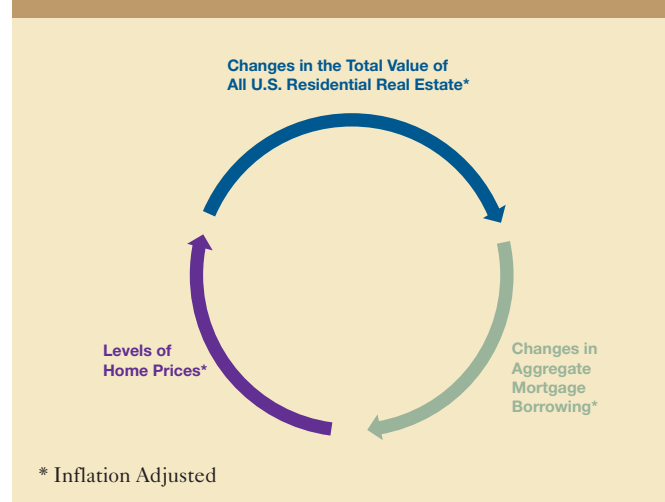
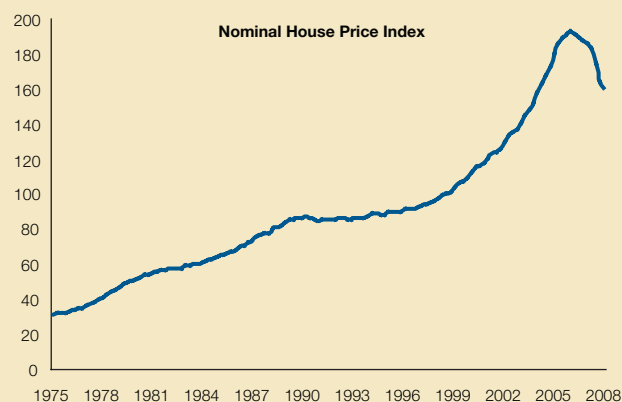
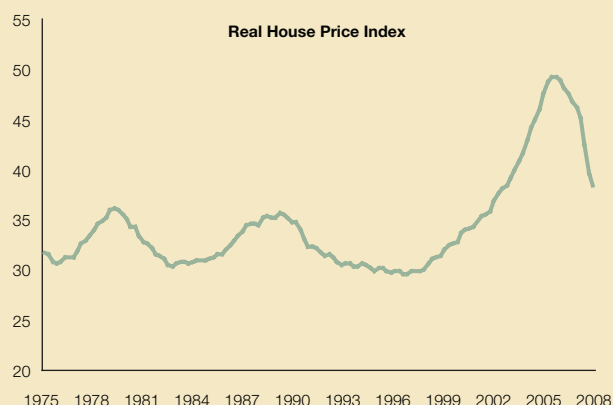


EXHIBIT 4a AND 4b: NOMINAL AND REAL HOUSE PRICE INDICES³

As of 30 June 2008

Source: OFHEO, Standard & Poor's/Case-Shiller Home Price Indices, Bureau of Labor Statistics, Bloomberg

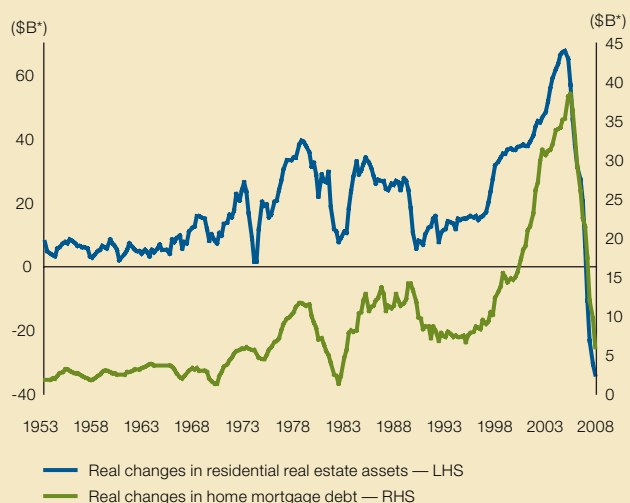


Increased willingness to lend

While homeowners may thus have had a higher propensity to borrow, based on the consistently upward trajectory of nominal home prices, they are only one part of the story. What was the perspective of lenders? Until recently, mortgage finance was easily obtainable, signaling equal enthusiasm from the financing side. Given that the nominal value of residential real estate always increased in aggregate, the mortgage was seen as the safest way to lend to a consumer. Moreover, as values

increased, financiers could provide more credit without necessarily increasing the leverage underlying any given property (e.g., as value increased, the loan could sustain the same loan-to-value ratio even with more debt outstanding).

In other words, it is imperative to recognize that in collateral-based lending, nominal, rather than real, values drive underwriting assumptions. The belief that home prices always increase in nominal terms strengthened the symbiotic relationship between residential real estate values and mortgage borrowing.

EXHIBIT 5: REAL CHANGES IN HOME MORTGAGE DEBT AND RESIDENTIAL REAL ESTATE ASSETS

As of 30 June 2008

Source: Board of Governors of the U.S. Federal Reserve System, Flow of Funds Accounts of the United States, Section B.100 Balance Sheet of Households and Nonprofit Organizations

Seasonal adjustments were made using a linear moving average.

* Inflation adjusted and indexed to 1952 dollars

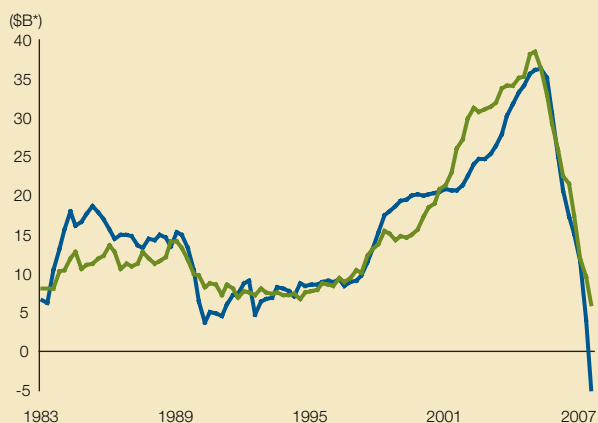
Lagged relationship between real changes in residential real estate values, and real changes in mortgage borrowing

Thus, the strong relationship we found between real changes in the value of residential real estate and real changes in mortgage borrowing is not surprising. Moreover, our analysis found that this relationship holds all the way back to the 1950s, and that the correlation is strongest in particular at a 3-quarter lag (e.g., increases in real estate assets predict increases in mortgage borrowing three quarters later) over the last 25 years. Exhibit 6 shows a regression model of 3-quarter lagged changes in mortgage borrowing on changes in real estate assets, indicating that approximately 85% of the changes in mortgage borrowing are explained by the earlier changes in real estate assets.

This observation supports the notion that households view their homes as part of their investment portfolio, and “trade up” to more valuable real estate assets (with commensurate increases in mortgage borrowing) as they observe their house values increase.⁵

Our conclusion that consumers have increasingly considered the home as an investment has been accentuated by a range of additional, qualitative observations.

EXHIBIT 6: CHANGES IN HOME MORTGAGE DEBT CAN BE EXPLAINED BY CHANGES IN REAL ESTATE ASSETS FROM THREE QUARTERS EARLIER



As of 30 June 2008

Source: Board of Governors of the U.S. Federal Reserve System, Flow of Funds Accounts of the United States, Section B.100 Balance Sheet of Households and Nonprofit Organizations

Seasonal adjustments were made using a linear moving average. Predicted changes in mortgage debt based on a single-factor linear regression model developed by Emma Rasiel.⁶

* Inflation adjusted and indexed to 1952 dollars

Taxes

- **Favorable tax treatment on capital gains from home sales versus other assets.** Prior to 1997, the entire gain from the sale of a primary residence was tax-free, assuming all of the proceeds were redeployed to another primary residence within a fixed period of time. In 1997, tax rules were changed to allow tax-free gains of up to \$500,000 per couple, or \$250,000 per individual, for a primary residence occupied for at least two of the prior five years. While the tax changes in 1997 might have had some impact on how consumers perceive after-tax returns on investing in housing, the simple truth is that, in either tax regime, the vast majority, if not all, of the gain from selling a primary residence was tax free in most instances. This preferential treatment certainly created an incentive to allocate capital to the home relative to most other opportunities where all gains were taxed.
- **Tax deductibility of mortgage debt.** No other major asset class offers tax-deductible leverage to retail investors. This is particularly important considering that mortgage financing has been driven by the nominal value of collateral, which

did not decline (in nominal terms) on a national basis for over 70 years, up until the last few years. In simple terms, mortgage finance has always been amongst the easiest to obtain, and tax incentives to increase such borrowing make it even more attractive to “invest in housing.”

Interest rates

- **Interest rates have been trending downward.** The decline in inflation and interest rates over the last 25 years has led to lower, more affordable monthly debt service payments.
- **Asymmetric risk-reward payoff profile for home and mortgage debt.** Perhaps the most interesting element of investing in housing is that the structure of borrowing in the United States made such investing lucrative for borrowers. The typical borrower has a 30-year fixed-rate mortgage. If inflation is high and then decreases, the borrower has the right to prepay the mortgage and refinance into lower payments. This can occur even while the nominal value of the home might continue to increase, as the carrying cost per dollar of home purchase price declines with interest rates. If inflation is low but then increases severely, the 30-year, fixed-rate mortgage stays unchanged, but the home price increases in nominal terms. As shown in Exhibits 4a and 4b, during the most recent instance of high inflation (the only instance in 50 years, in the 1970s), home prices increased 18% in nominal terms over a 4-year period, even while decreasing 16% in real terms. For a leveraged investor, the trade worked well; if the home value increased 18%, and the borrower had 20% equity, he earned a 90% return in nominal terms.

Mortgage loan terms and conditions

- **Favorable loan default treatment on homes.** Unlike unsecured debt, a mortgage borrower can default on a specific asset without recourse to other assets. The United States is somewhat unique in terms of mortgage borrowing in that consumers borrow against the specific asset. This compares to other countries, in which the consumer is the obligor and must still satisfy the loan repayment terms even if the home is inadequate to repay the debt.
- **Loosening of underwriting terms and conditions.** Particularly in the period from 2002 onward, lenders eased terms to drive demand for loans. Increasingly easy loan terms, such as adjustable rates with teasers, low- and no-documentation loans, no down payments, and so forth, became more common; nontraditional loans comprised \$1 trillion of the \$3 trillion of total U.S. residential mortgage loan originations per annum both in 2005 and in 2006.⁷ The explosive growth in these nontraditional loans was driven largely by the global institutional investors’ search for increased yield and duration on loan assets in low interest rate environments.⁸

Increased complexity and lack of transparency

- **Difficulty assessing risk of future payment increases.** As products evolved well beyond the traditional 30-year, fixed-rate mortgage, increasingly complex loan structures made it impractical, if not impossible, for many borrowers to properly estimate the extent to which their future payments may increase. Thus, homeowners may well have overestimated their ability to continue to service their loans when the rates re-set.

Section 2b

Homeowners' increased willingness to borrow drove up residential property prices in the last decade

The final factor in the feedback loop is real home price levels.⁹ Since aggregate U.S. home price data in comparable terms going back to the 1950s is not available, we have chosen to focus on the relationship between changes in mortgage borrowing and the level of home prices in the most recent 25-year period of low inflation, from 1983 to 2008.

Levels (as opposed to changes) of aggregate real mortgage debt increased steadily over the last 25 years, while house prices remained in a relatively stable cycle (in real terms) for much of this period, appreciating dramatically only in the latter part of the 1990s (see Exhibit 7).

To explain this apparent anomaly, we must return to an examination of changes in real mortgage debt, which have been strongly correlated with real house prices over the last 25

EXHIBIT 7: AGGREGATE REAL U.S. HOUSEHOLD MORTGAGE DEBT VERSUS REAL U.S. HOUSE PRICES.

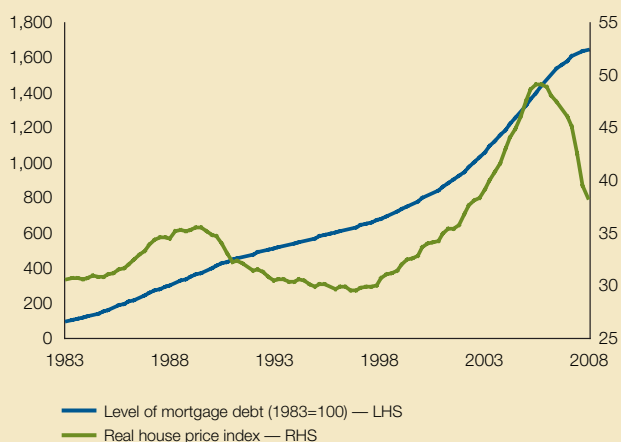
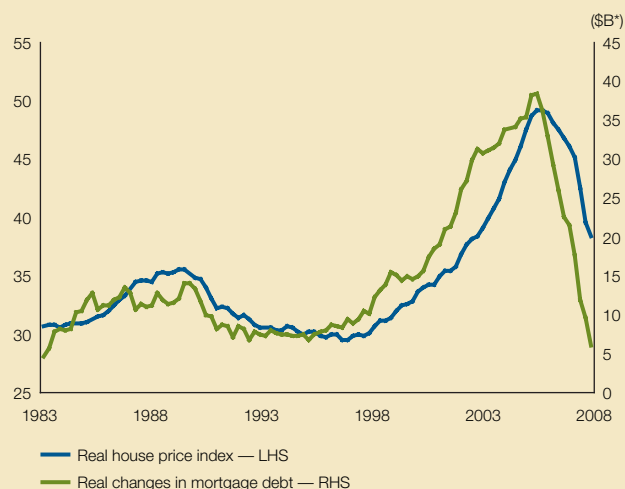


EXHIBIT 8: REAL HOUSE PRICE INDEX & REAL CHANGE IN MORTGAGE DEBT

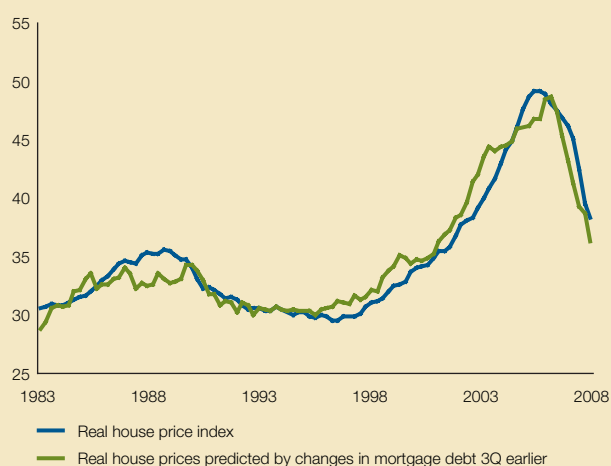


years (see Exhibit 8). House prices appear to trail changes in mortgage debt by approximately three quarters throughout this period, reflecting the time needed by the increased housing demand to feed through the relatively “sticky” housing market. (Compare Exhibit 8 with Exhibit 5, in which we see changes in mortgage debt trailing changes in residential real estate assets. Note that we have completed the feedback loop, where changes in residential real estate assets drive changes in mortgage debt, which in turn drive home prices.)

It appears that changes in mortgage debt are a good predictor of U.S. house price levels three quarters later. Exhibit 9 shows both the real house price index, and house prices as predicted by real changes in mortgage debt three quarters earlier. This regression model indicates that more than 90% of house price changes are explained by the changes in mortgage debt three quarters earlier. (Compare this with Exhibit 6, where we regressed lagged mortgage borrowing on real estate assets and found a similar level of explanatory power.)

This analysis suggests that steady increases in demand for residential housing would be adequately fulfilled by increased supply in the form of new houses built by the construction industry. However, in the early part of this decade, the rate of change of mortgage debt increased, reflecting accelerated

EXHIBIT 9: REAL HOUSE PRICES CAN BE EXPLAINED BY CHANGES IN MORTGAGE DEBT THREE QUARTERS EARLIER



As of 30 June 2008

Source: Board of Governors of the U.S. Federal Reserve System, Flow of Funds Accounts of the United States, Section B.100 Balance Sheet of Households and Nonprofit Organizations, OFHEO, Standard & Poor's/Case-Shiller Home Price Indices, Bureau of Labor Statistics, Bloomberg

Seasonal adjustments were made using a linear moving average.³

Predicted changes in mortgage debt based on a single-factor linear regression model developed by Emma Rasiel.¹⁰

demand for new housing—demand that perhaps the new home construction industry did not anticipate, and could not quickly or easily fulfill. We can infer that it was this supply-demand imbalance, fueled by the feedback loop of increases in the value of residential real estate assets, which led to increases in mortgage borrowing that then led to higher home prices.¹¹

Our analysis found strong predictive power among the three key variables, changes in residential real estate assets, changes in mortgage borrowing, and levels of home prices. What we think is most interesting, however, is that the relationship between the variables had remained nicely balanced from the early 1970s to the mid-1990s. It appears that until the mid-1990s, real home prices on a per unit basis were largely range-bound, implying that the increase in the value of residential real estate was driven almost exclusively by demographics rather than real unit price increases.

The feedback loop appears to have become a major driver of the upward spiral of real home prices starting in the mid- to late-1990s. Our theory is that the continued transition to a state of mind where homeowners consider the house as an investment, combined with other factors, triggered an upward spiral and a severe state of disequilibrium, which is currently

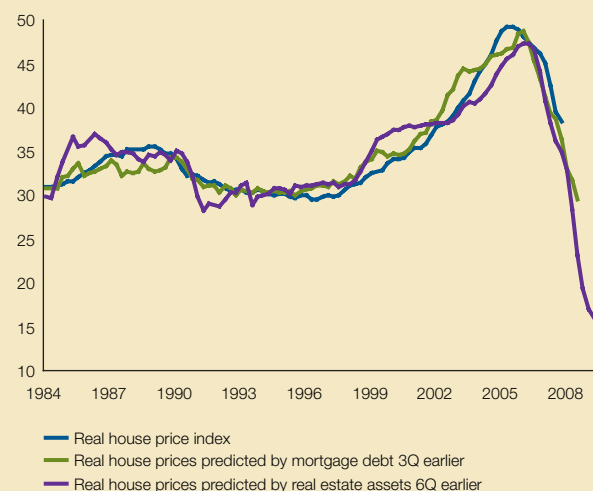
experiencing a correction. Among the other coincidental factors, including some listed previously, we note:

- A sustained period of historically low interest rates, which increased consumer buying power vis-à-vis homes
- The 2000-2001 recession, during which consumers were, once again, reminded of the benefits of holding physical, rather than financial, assets
- Easing of terms and conditions in the guise of affordability and nontraditional products in the period from 2002 to 2007.

Section 3 Forecasting house prices over the next 18 months

Based on the relationships we have established between changes in residential real estate asset values, changes in mortgage borrowing, and levels of home prices, we can project our expectations of home prices as far as six quarters forward, based on observed household real estate values, reported through the second quarter of 2008. With the positive feedback loop now broken, the outlook for real home prices appears dire, even starting from already-reduced levels.

EXHIBIT 10: REAL HOUSE PRICE INDEX VS HOUSE PRICE PREDICTED BY REAL ESTATE ASSETS AND MORTGAGE LIABILITIES



As of 30 June 2008

Source: Board of Governors of the U.S. Federal Reserve System, Flow of Funds Accounts of the United States, Section B.100 Balance Sheet of Households and Nonprofit Organizations, OFHEO, Standard & Poor's/Case-Shiller Home Price Indices, Bureau of Labor Statistics, Bloomberg

Seasonal adjustments were made using a linear moving average.³

Predicted changes in mortgage debt based on a single-factor linear regression model developed by Emma Rasiel.

Exhibit 10 compares *observed* house prices through the second quarter of 2008 (the blue line), with *predicted* house prices through the first quarter of 2009 (the green line), based on *observed* changes in mortgage liabilities. We also show *predicted* house prices through the fourth quarter of 2009 (the purple line), based on mortgage liability changes *predicted* from *observed* household real estate assets.

To clarify, we predict real house price levels both three quarters ahead based on changes in mortgage borrowing, and six quarters ahead based on changes in household real estate assets. When we predict real home price levels based on changes in mortgage borrowing, we would expect to see prices decline by almost 40% from the peak levels by the end of the first quarter of 2009. When we predict real home prices based on the changes in household real estate assets, we would expect to see prices decline by 66% from the highs by the end of 2009.

Based on these estimates, we could expect home prices to decline by an additional 54% relative to the second quarter of 2008. These declines are unprecedented and would exceed most expectations in the market today. We have since observed that home prices declined approximately 4% in the third quarter of 2008 and continued to decline early in the fourth quarter.

Section 4 Long-term Scenario Analysis

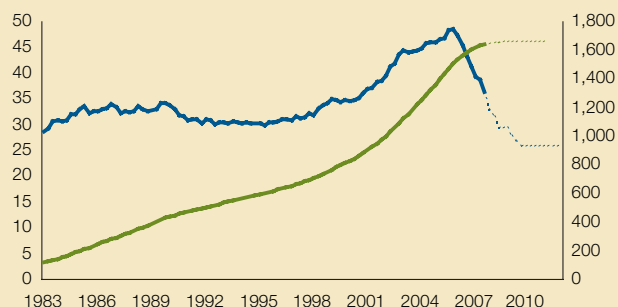
While our models may suggest certain well-defined relationships, it is important to recognize the nature of mortgage debt and the stickiness of home prices. Consumers may wish to reduce mortgage debt, but this is not necessarily a simple task. In a period of declining home prices (real and nominal), the relationships we observed between residential real estate values, mortgage borrowing, and home prices might change in terms of how these variables respond to one another. We have built three scenarios to take into account the degree to which the markets might not behave in a symmetrical manner in a downward trend. We have used a three-year time horizon for each of these scenarios, but one could argue for an even longer period given the degree of home price excess.

Scenario 1. The extent of households' real mortgage debt increase tapers off by mid 2009, remaining approximately stable thereafter (see Exhibit 11a). This stability contrasts with the declines in mortgage borrowing we would expect under the relationship to changes in residential real estate values in the past. In this case, house prices stabilize by early 2010, at

EXHIBITS 11a, 11b AND 11c: REAL HOUSE PRICE INDEX PROJECTIONS

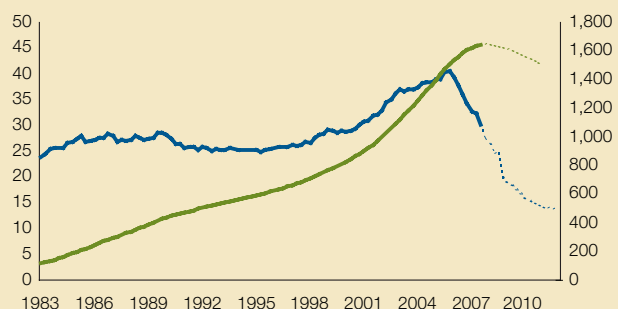
Scenario 1

When mortgage debt tapers off.



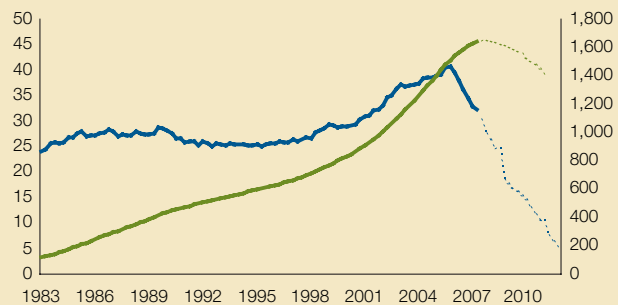
Scenario 2

When mortgage debt falls at 1/4 of the rate of increase during housing bubble.



Scenario 3

When mortgage debt falls at 1/2 of the rate of increase during housing bubble.



— Real house prices predicted by mortgage debt 3Q earlier — LHS
 Projection
 — Real Level of mortgage debt (1983=100) — RHS
 Projection

As of 30 June 2008

Source: Board of Governors of the U.S. Federal Reserve System, Flow of Funds Accounts of the United States, Section B.100 Balance Sheet of Households and Nonprofit Organizations, OFHEO, Standard & Poor's/Case-Shiller Home Price Indices, Bureau of Labor Statistics, Bloomberg

Seasonal adjustments were made using a linear moving average.³ Predicted changes in mortgage debt based on a single-factor linear regression model developed by Emma Rasiel.

close to 1983 levels in real terms and 28% below the level observed at the end of the second quarter of 2008.

Scenario 2. Households' mortgage debt begins to fall in real terms, decreasing at approximately one-fourth of the rate at which mortgage debt rose during the house price bubble of the 2002–2006 period (see Exhibit 11b). In this scenario, house prices do not begin to stabilize until 2013, when they are at a level nearly 40% below house prices in 1983 and 54% below the level observed at the end of the second quarter of 2008.

Scenario 3. Households' mortgage debt again begins to fall, this time decreasing at around one-half the rate at which mortgage debt rose during the house price bubble. In this scenario, house prices fall dramatically, and by 2012 they are more than 70% lower than the levels in 1983 (see Exhibit 11c). This scenario assumes an extreme deterioration of home prices. The logic here is that the credit crunch becomes entrenched such that lenders reconsider their risk appetite for mortgage exposure at the same time when consumers re-evaluate the home as an investment choice.

While we included Scenario 3 for completeness, we view it as highly improbable.

Section 5 Summary and Considerations

- We have shown how, historically, increases in the change in value of household real estate assets tended to predict subsequent increases in aggregate mortgage borrowing. Meanwhile, inflation-adjusted house prices remained stable in the face of stable growth in mortgage debt, but were subject to run-ups when mortgage debt growth accelerated. We hypothesized that increases in mortgage debt growth may have resulted in unanticipated changes in demand for new housing, leading to supply-demand imbalances as the construction industry was slow to respond, resulting in the dramatic increase in real house prices.
- Similarly, we have seen that a pattern of deceleration in mortgage debt (i.e., mortgage debt still growing, but more slowly) led to a reduction in house price levels, as excess supply pushed down the value of individual homes. The recent dramatic reduction in house prices has likely been exacerbated by foreclosures, as borrowers are unable to service their loans, leading to still further excess supply.
- Our model suggests that the policy of seeking to ease mortgage lending terms being pursued by the Federal Reserve and Department of the Treasury could help stabilize house

prices, if it leads to increased volumes of mortgage loans, as shown in Exhibit 11a. However, if households' real estate assets continue to shrink in value, we suggest that easing mortgage terms may not be sufficient to generate increased mortgage borrowing, as homeowners look to changes in their current property value to determine whether to “trade up” to a bigger property (and bigger mortgage), thus bringing much-needed demand back to the housing market.

- To identify the best way to intervene in the housing markets is beyond the scope of this paper. Having stated that, our models suggest that the intervention to date has been inadequate. To the extent there is concern regarding excessive intervention, we view the risk of our projections coming to fruition to be far more dangerous, particularly considering the secondary and tertiary ramifications of these projections relative to consumer spending and overall GDP in the United States.

While the relationships we have established are credible and strong, we would highlight two important factors to consider that might change how home price levels evolve in the future relative to our expectations.

1. The United States has not experienced a sustained period of meaningfully declining home prices on a national basis since the Great Depression. Hence, while our data appears predictive in an environment of stable to increasing nominal home prices, it has not been assessed in a period of sustained, meaningfully decreasing nominal home prices.
2. The government has taken significant action to attempt stemming the decline of home prices. The measures that have already proven to be the most effective involve direct intervention in the mortgage financing markets. On November 25, 2008, the Federal Reserve announced it would purchase up to \$500 billion of GSE-backed mortgage-backed securities (MBS) and \$100 billion of debt issued directly by the GSEs. From the announcement date to the end of 2008, conforming mortgage rates fell by over 125 basis points. We calculate that every 10 basis points of change in mortgage borrowing rates impact the mortgage payment by approximately 100 basis points. Put another way, if mortgage rates decline 100 basis points, the end purchaser of the home sees a decline in monthly payment of 10%, reducing the price decline required for the home itself.

While we derive some comfort from the impact of interest rates on the potential decline in real home prices, we see the risk related to home prices evidenced by our research to be too elevated to rely on declining interest rates alone.

NOTES:

- 1 Source: Board of Governors of the Federal Reserve System, Flow of Funds Accounts of the United States, Section B.100 Balance Sheet of Households and Nonprofit Organizations.
- 2 During the period of high inflation from 1975 to 1982, house prices appreciated steadily at a rate of approximately 9.0% per annum in nominal terms (see Exhibit 4a). By contrast, the S&P 500 Index provided lower average nominal returns of 7.7% per annum over the same period, with considerably greater volatility (including two years of negative returns). Bond market investments declined in value over the period.
- 3 Aggregated U.S. house price data were obtained from two sources, the Office of Federal Housing Enterprise Oversight (OFHEO) (<http://www.ofheo.gov/hpi.aspx>), and the Case-Shiller Home Price Index (available from Robert Shiller's website: <http://www.econ.yale.edu/~shiller/>). The OFHEO data begins in the first quarter of 1975, while the Case-Shiller Index begins in 1987. We chose to merge the two series, because the Case-Shiller Index provides a more pessimistic (and, we think, more accurate) assessment of U.S. house prices over the last few quarters. We used a simple regression model to "backdate" the Case-Shiller Index from its starting point in 1987 back to the OFHEO data starting point in 1975.
- 4 The total value of U.S. residential real estate takes into account the number of units and the value of each unit. Given population growth, one would expect the real value of U.S. residential real estate to increase each year even if real home prices themselves were unchanged. Referring back to Exhibit 4b, it is notable that real home prices were range-bound for over 20 years from the mid-1970s to the mid-1990s. This stability would imply that the growth in residential real estate assets during that 20-year period was entirely due to the growth in the number of units.
- 5 Note that mortgage borrowing encompasses all residential real estate loans including second homes and home equity loans. Home equity loans have accounted for between 6.8% and 10.8% of overall mortgage loans over the last 18 years. Hence, the dramatic increases in the total loans outstanding do not appear to be primarily driven by home equity loans.
- 6 Linear regression equation: $EMD(t) = 0.82 + 0.53 \cdot REA(t-3)$; where $EMD(t)$ = *Estimated* change in Mortgage Debt in quarter t ; $REA(t-3)$ = change in Real Estate Assets 3 quarters earlier; R-squared = 0.85; t -stat = 23.7.
- 7 Source: Inside Mortgage Finance.
- 8 For more information on this topic, refer to previous Investment Research papers published by Lazard Asset Management, including "Prime & Subprime Mortgage Foreclosure Analysis," written in collaboration with Duke University, and "Clarifying the U.S. Mortgage Crisis: Context and Consequences."
- 9 When focusing on home prices, we excluded the impact of the number of units, implicitly disaggregating the first component of the discussion thus far (i.e., residential real estate assets) into a real home price index (measured by a hybrid adaptation of the OFHEO and Case-Shiller home price indices) and a separate element, the number of units.
- 10 Linear regression equation: $EHP(t) = 26.02 + 0.59 \cdot MD(t-3)$; where $EHP(t)$ = *Estimated* house price index in quarter t ; $MD(t-3)$ = change in Mortgage Debt 3 quarters earlier; R-squared = 0.92; t -stat = 34.8.
- 11 All variables inflation-adjusted.

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