January 15, 2007

Federal Reserve Bank of Cleveland

Home Price Derivatives

by O. Emre Ergungor

The fast-paced appreciation of home prices in recent years made residential real estate the second-largest class of assets owned by U.S. households in 2006, comprising 34 percent of their assets (by comparison, stocks comprised 27 percent and bonds 39 percent that year), up from 24 percent in 2000. Typically, real estate holdings are also highly leveraged, so fluctuations in housing prices result in much bigger fluctuations in homeowners' net worth. If home prices decline, as some predict, homeowners may have considerable exposure to the real estate market's downside risks, yet they can do little to protect themselves from such volatility.

This is about to change. On May 16, 2006, the Chicago Mercantile Exchange began trading two new derivatives contracts, a futures contract and an option on the futures contract, which create the ability to invest in residential real estate without having to actually buy or sell a house. The value of these two new derivatives is based on the Case–Shiller Home Price Indices, developed by Karl Case and Robert Shiller in the 1980s. There are 20 regional indices and a composite index that is calculated using the regional indices. The regional indices follow the value of home prices in 20 large U.S. metropolitan areas (Atlanta, Boston, Charlotte, Chicago, Cleveland, Dallas, Denver, Detroit, Las Vegas, Los Angeles, Miami, Minneapolis, New York, Phoenix, Portland, San Diego, San Francisco, Seattle, Tampa, and Washington, D.C.) by tracking the resale values of homes in each market. At this time, derivatives contracts are available for only 10 of the metro areas, but they will eventually be available for all areas. Other companies (Moody's, for example) calculate home price indices for other regions using the Case–Shiller methodology as well.

In this *Economic Commentary*, I explain how these indices are constructed and why they are better at tracking housing prices than some alternative measures cited in the financial media. I also explain how derivatives based on the indices—and some potential products which financial firms might use the derivatives to create, including home equity insurance, can protect homeowners against the volatility of residential real estate prices.

Until recently, homeowners had no way to protect the value of their homes against losses that could result from housing market downturns. With the derivatives contracts introduced by the CME last year, homeowners now have some means of protection, and new and better products are more likely to follow from them.

Case–Shiller Home Price Indices: The Basics

At the simplest level, the Case–Shiller Indices are based on changes in individual single-family home prices as observed through the repeat sale of the same structures over time.

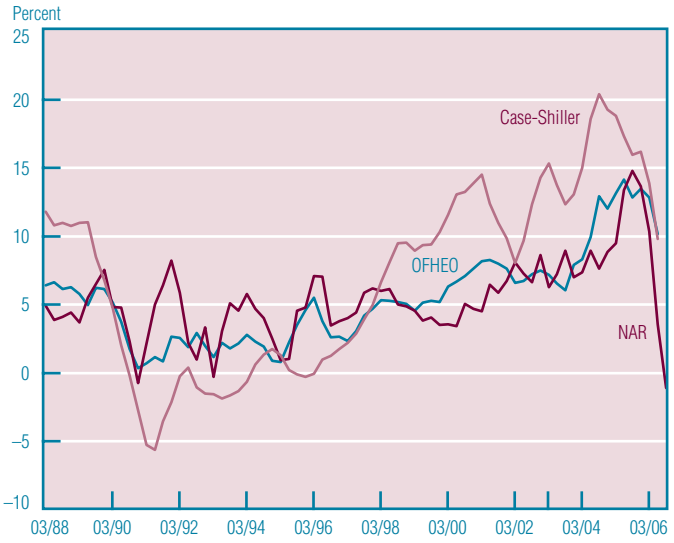
Box 1 contains a simple example of how the index can be calculated for Anytown, USA. Between 2001 and 2003, three single-family homes have been sold in Anytown. House A was purchased in 2001 for $300,000, but its owner put it on the market again the following year and sold it for $310,000, a 3 percent gain. (All growth rates are rounded to the nearest full percentage point.) Since this is the only instance of a repeat sale (that is, two observable sale transactions for the same house) in our sample from the 2001–02 period, we will assume that all home prices rose 3 percent between 2001 and 2002. Houses B and C were also on the market in 2001 and were sold for $250,000 and $640,000, respectively. We cannot observe their values in 2002 directly, but the index calculation assumes that their value increased 3 percent in the first year after the sale transaction. Both houses were put back on the market and sold in 2003, and we have direct observations of their resale values ($280,000 and $730,000, respectively). Given the first-year appreciation of 3 percent, House B must have appreciated 8 percent between 2002 and 2003 to reach its $280,000 resale value. Similarly, House C must have appreciated 10 percent during the same period to reach its $730,000 resale value. We now have two estimates of the 2002–03 appreciation rate, 8 percent and 10 percent. In calculating our index, we will take the average and assume that home prices in Anytown appreciated 9 percent in 2002–03. Setting our index to 100 in 2001, our reference year, we can now calculate the index values in later years, namely, 103 in 2002 (3 percent growth) and 113 in 2003 (an additional 9 percent growth).

Data Quality

Building an index is never as simple as the example above suggests. The problem is that although the house-price indices are meant to capture the market value change of all homes in a specific

ISSN 0428-1276

FIGURE 1 YEAR-OVER-YEAR CHANGE IN OFHEO AND NAR NATIONAL HOME PRICE INDICES AND THE CASE–SHILLER COMPOSITE INDEX



Sources: Office of Federal Housing Enterprise Oversight; National Association of Realtors; and Standard &Poor's S&P Case-Shiller Home Price Indices.

area, the calculations must be based on the observed changes in the value of a small group of recently purchased homes. A statistician who tries to infer the marketwide price change from the sale of one house faces a major issue: What fraction of the observed change in the house's value results from market factors and what fraction from house-specific factors? For example, how do we know that an observed decline in the value of a house is the result of deteriorating market conditions rather than the poor maintenance of that particular house? Because the condition of the house cannot be inferred from the sale records, one could easily make errors by generalizing from a few sales to the entire market. Or consider the case of a father who is transferring the title of his second home to his newly married son. Although the transaction may show up as a sale in the title records, the father may have set the price at a deep discount relative to the market value as a wedding present. The problem in this case is that the transaction data do not show the motives of the buyer and the seller, yet including this price in the index calculations would clearly be misleading. So the challenge is to identify the wrong or misleading observations and to figure out what to do with them.

This is a big challenge. Some problems can be solved relatively easily. For example, if the buyer and the seller have the same last name, the sale is probably among family members and the price does not reflect the house's market value as it would be set by a buyer and a seller who are acting in their own best economic interest. Some other problems, such as the lack of information about the house's condition, can be alleviated by statistical means but never fully resolved.

Despite their potential weaknesses, the Case–Shiller Indices are still an improvement over other house price indices commonly cited in the media, one published by the Office of Federal Housing Enterprise Oversight (OFHEO) and another by the National Association of Realtors (NAR). (Freddie Mac also has an index that is very similar to the one published by OFHEO.)

■ Other Price Indices

The Case–Shiller, OFHEO, and NAR indices differ in fundamental ways. The NAR Index does not use a repeat sales methodology but tracks existing homes' median value—the value at which half of the home values in an area are worth more and half are worth less. But the median can easily be biased by new housing construction in an area. New homes for high-income people will pull the median up, while new homes for low-income people will push it down. As a result, the index will capture changes in the median price that are related not to changes in home values but to changes in the composition of the housing stock.

The OFHEO Index resembles the Case–Shiller Indices in that it utilizes the repeat sales methodology; that is, it tracks the value of individual homes that are resold over time. Its weakness is that it is based solely on houses whose mortgages are purchased by Fannie Mae and Freddie Mac. This prevents the index from representing the entire housing stock of the community. For example, the mortgage of the house that is being followed must be less than Fannie and Freddie's conforming loan limit—$417,000 for a single-family home in 2006. To put this limit into perspective, note that the median home price in New York City is around $450,000. With 10 percent down, the median house would require a $405,000 mortgage. So the OFHEO Index for New York City could conceivably ignore almost half the housing units in the area. An even larger share of housing units would be left out of the calculations in San Francisco, where the median price is about $750,000.

These differences in methodology have a significant impact on the behavior of each index (figure 1). Relative to the OFHEO and NAR indices, the Case–Shiller Composite Index indicates a much more severe decline in home prices in the early 1990s and a much stronger appreciation in the late 1990s and early 2000s. Note that the Case–Shiller Composite Index is not a national index, because it includes only 10 metro areas. However, the indices for individual metro area also show the same trend.

■ Home Price Derivatives

Because the housing futures and options that are being traded on the CME are based on a more accurate price index, they offer investors and homeowners new opportunities that did not exist before. But the opportunity to hedge against the loss of a home's value may not come to homeowners by buying the derivatives directly. Instead, homeowners are more likely to find new products, like home-equity insurance, available to them, which have been made possible by the availability of the derivatives to financial intermediaries. To see why, let's take a closer look at the CME's

Box 1: Home Sales in Anytown, USA

Transaction Prices

Home	2001	2002	2003
A	$300,000	$310,000	
B	$250,000		$280,000
C	$640,000		$730,000

Estimated Growth Rates

Home	2001–2002	2002–2003
A	3%	
B		8%
C		10%

Anytown Home Price Index

2001	2002	2003
100	103	113

futures contracts. (For the sake of brevity, I will not discuss options here. For information on the various applications and pricing of futures, options, and options on futures contracts, see the recommended readings.)

In a futures contract, the issuer and the holder mutually promise to exchange a fixed quantity of the underlying asset at a predetermined date (delivery or settlement date) and a predetermined (futures) price. If the asset's market price exceeds the futures price on the delivery date, the contract holder receives the asset at a below-market price and makes a profit. If the market price is lower, the contract holder is still obligated to buy the asset at the futures price, in which case the issuer makes money. In practice, these contracts are settled using cash in lieu of the asset. So if a homeowner sold a futures contract on his house and home values fall, he would receive a sum of cash equivalent to the profit he would have made by selling his house at the futures price; in other words, the contract protects him against price declines in the spot market. On the other hand, if home values rise, he must pay the contract holder the difference between the market price and the futures price.

The important observation that arises from this discussion is that a homeowner who lives in one of the 10 major metropolitan areas covered by the Case–Shiller Indices could insure himself against a *marketwide* price decline by issuing a futures contract based on the regional index covering his city. Because the Case–Shiller Indices track entire metropolitan areas and not individual neighborhoods, they will not be perfectly correlated with the value of any particular house. For example, if a golf course in a Boston suburb is turned into a strip mall, it may depress home prices in the area, but on a larger scale, Boston metropolitan prices are unlikely to register any significant drop for that single reason. Consequently, a homeowner in the Boston area gets only partial protection by issuing the Boston futures contract.

As the market develops, more customized contracts may be created, but it will still be prohibitively expensive to create nonstandard market-traded securities that cater to each homeowner's particular needs. According to finance theory, this is where financial intermediaries (in this case, insurance companies) come in. Intermediaries position themselves between financial markets that can only trade in standardized (metropolitan area-level) contracts and individuals who need contracts with highly idiosyncratic payoff structures. They transform standardized contracts in the financial markets into retail financial products for end-users.

Consider an insurance product that gives the Boston homeowner complete protection if home values in his neighborhood deteriorate at a time when his house is on the market. Now, suppose that the insurance company sold this product to thousands of homeowners in Boston. Obviously, some home prices will increase and some will decline; however, because the insurer has such widespread exposure to the overall market, the vagaries of individual home prices will cancel each other out and the insurer's liabilities will closely track price movements at the metropolitan level. Now the insurer can cap its downside risk at any desired level by issuing a CME futures contract based on the Boston index. If home prices drop in Boston, the futures contract will pay the insurer compensation proportional to the level of the decline and will limit the insurer's losses. If home prices rise, the premiums paid by homeowners will compensate the insurer for his losses in the futures market. So while the new derivatives are an imperfect answer to homeowners' needs, financial intermediaries have the ability to use standardized derivatives contracts to create retail insurance products for homeowners.

Room for Growth

Despite the many benefits of the home-price derivatives identified in this *Commentary*, the trading volume in this nascent market is still tiny. The notional value of all outstanding futures contracts (the value of the underlying assets at the spot price) was slightly above $77 million in August 2006.

The market's growth should depend partly on the speed with which insurance companies can create and sell retail products to end-users (homeowners), which would in turn stimulate insurance companies' demand for derivative securities to use for hedging purposes. Developing retail insurance products, obtaining regulatory approval, and marketing these products to consumers will obviously take time. The encouraging news for the market is that experiments in home-equity protection began well before the creation of derivative contracts. In 2002, Syracuse, New York, joined forces with local and national nonprofit community development organizations, financial institutions, and the Yale School of Management to create a local home-equity-protection product funded by a HUD grant. Given the effort that has already gone into the development and local testing of the product, it seems possible that flyers advertising home equity insurance may soon be showing up in your mailbox.

Footnotes

1. With larger down payments and piggyback secondary mortgages, the first mortgage of homes priced much higher than $450,000 could be brought below the conforming mortgage limit. In that case, the OFHEO Index would capture a greater share of the housing stock. Still, the problem remains.

Recommended Reading

Andrew Caplin, William Goetzmann, Eric Hangen, Barry Nalebuff, Elisabeth Prentice, John Rodkin, Matthew Spiegel, and Tom Skinner. 2003. "Home Equity Insurance: A Pilot Project," Yale ICF Working Paper No. 03-12.

Federal Reserve Bank of Cleveland
Research Department
P.O. Box 6387
Cleveland, OH 44101

Return Service Requested:
Please send corrected mailing label to the above address.

PRSRT STD
U.S. Postage Paid
Cleveland, OH
Permit No. 385

John Carlson, William Melick, and Erkin Sahinoz. 2003. "An Option for Anticipating Fed Action," Federal Reserve Bank of Cleveland, *Economic Commentary*, September 1.

Karl E. Case, Robert J. Shiller, and Allan N. Weiss. 1991. "Index-Based Futures and Options Markets in Real Estate," Cowles Foundation, Discussion Paper No. 1006.

Ben Craig. 2002. "Options and the Future: What Do Markets Think?" Federal Reserve Bank of Cleveland, *Economic Commentary*, October 1.

Ed Nosal. 2001. "How Well Does the Federal Funds Futures Rate Predict the Future Federal Funds Rate?" Federal Reserve Bank of Cleveland, *Economic Commentary*, October 1.

Ed Nosal, and Tan Wang. 2004. "Arbitrage: The Key to Pricing Options," Federal Reserve Bank of Cleveland, *Economic Commentary*, January 1.

Robert J. Shiller, and Karl E. Case. 1989. "The Efficiency of the Market for Single-Family Homes," American Economic Review 79, pp. 125–37.

Robert J. Shiller, and Allan N. Weiss. 1999. "Home Equity Insurance," *Journal of Real Estate Finance and Economics* 29, pp. 21–47.

O. Emre Ergungor is an economist in the Research Department at the Federal Reserve Bank of Cleveland.

Economic Commentary *is published by the Research Department of the Federal Reserve Bank of Cleveland. To receive copies or to be placed on the mailing list, e-mail your request to* 4d.subscriptions@clev.frb.org *or fax it to* 216-579-3050. Economic Commentary *is also available at the Cleveland Fed's site on the World Wide Web:* www.clevelandfed.org/research.

We invite comments, questions, and suggestions. E-mail us at editor@clev.frb.org.