The Rent-Price Ratio
for the Aggregate Stock of Owner-Occupied Housing[1]

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Abstract: We construct a quarterly time series of the rent-price ratio for the aggregate stock of owner-occupied housing in the United States, starting in 1960, by merging micro data from the last five Decennial Censuses of Housing surveys with price indexes for house prices and rents. We show that the rent-price ratio ranged between 5 and 5-1/2 percent between 1960 and 1995, but rapidly declined after 1995. By year-end 2006, the rent-price ratio reached an historic low of 3-1/2 percent. For the rent-price ratio to return to its historical average over, say, the next five years, house prices likely would have to fall considerably.

Keywords: House Prices, Housing, Rents, CMHPI, Capitalization Rates

JEL Codes: E01, G12, R0, R21, R31

Introduction: In this paper we develop a quarterly time-series, starting in the first quarter of 1960 and extending to mid-year 2007, of the ratio of imputed rents of homeowners to the value of owner-occupied housing. That is, we construct a quarterly estimate of the "rent-price ratio" for the aggregate stock of owner-occupied housing in the United States.

Little work has been done to estimate a long and continuous time series of the rent-price ratio for the aggregate stock.[2] Yet knowledge of the rent-price ratio could be key to understanding the behavior of the total returns to housing. There are two related reasons for this. First, the total return to any asset is the sum of the dividend yield and the capital gain, and the dividend yield to housing *is* the rent-price ratio. Thus, knowledge of the rent-price ratio allows us to compute the historical returns to owner-occupied housing in the aggregate in the United States.

A simple example illustrates the importance of this point. Consider two assets, the first one with constant capital gains of 4 percent per year and a second with constant capital gains of 5 percent per year. Without knowledge of the dividend yield, it might appear as if the asset appreciating more rapidly pays a higher rate of return. However, if the dividend yield on the first asset is 8 percent and the dividend yield on the second asset is 7 percent, then both assets pay the same total rate of return of 12 percent per year.

[1]For comments and suggestions, we would like to thank Josh Gallin, Jonathan Heathcote, Michael Palumbo and Steve Oliner. The views in this paper are solely the responsibility of the authors and do not necessarily reflect the views of the Board of Governors of the Federal Reserve System or its staff. Contact author: Morris A. Davis, 5261 Grainger Hall, 975 University Avenue, Madison, WI 53706, phone and fax: 608 262-8775, email: mdavis@bus.wisc.edu

[2]In previous studies such as Meese and Wallace (1996) and Cutts et. al. (2005), authors have derived a rent-price ratio for specific metro areas at one or two points in time. Gallin (2004) constructs a quarterly *index* of prices relative to rents, but does not identify the level of the ratio at any point in time. Crone et. al. (2004) use American Housing Survey data to derive a biennial estimate of the aggregate rent-price ratio from 1985-1999.

Second, and related, the dividend yield is informative about expectations about the future growth rate of prices. Returning to the example in the previous paragraph, suppose we observe that the dividend yield on a first asset is 8 percent, the dividend yield on a second asset is 7 percent, and we know that the market discount rate on all assets is 12 percent per year. Then, we can solve for the expected growth rate of prices of the assets held by market participants: 4 percent for the first asset and 5 percent for the second. Campbell et. al. (2007) use this intuition to estimate a time-series of expected future growth in house prices that is based on the rent-price ratio we develop in this paper.

Thus, knowledge of the dividend yield for housing – the rent-price ratio – is crucial to (a) understanding the true historical return to housing and (b) estimating market participants' expectations about the future capital gains to housing. Although data on historical capital gains to housing are publicly available, to our knowledge we are the first authors to compute and make publicly available the dividend yield to owner-occupied housing in the aggregate United States over a long time period.[3]

In the rest of this note we discuss our procedure to estimate the rent-price ratio and then we conclude by describing our results. In our description of the results, we focus on two regimes: 1960-1995 (when the ratio of rents to prices fluctuated in a fairly narrow range) and 1995-2006 (when the ratio decreased substantially). Using the same logic as in the examples above, the dramatic decline in the 1995-2006 period may have occurred either because the discount rate on housing dividends declined, or because expected future capital gains on housing increased, or both. If the rent-price ratio were to rise from its level at the end of 2006 up to about its historical average value of 5 percent by mid-2012, house prices might fall by 3 percent per year, depending on rent growth over the period.

Summary of Methods: We employ a two-step procedure to estimate the rent-price ratio from 1960:1 to 2007:2. First, we use micro data from the last five Decennial Census of Housing (DCH) surveys, 1960-2000 every 10 years, to develop benchmark estimates of aggregate average imputed rents to homeowners, average prices of owned homes, and the aggregate rent-price ratio for the owner-occupied stock. Second, we use quarterly rent- and house price- indexes to interpolate rents and prices, respectively, between DCH benchmarks as well as extrapolate past the 2000 DCH.

Benchmark DCH Estimates: In each DCH from 1960-2000, a 1 percent sample of household-level data is available on rents paid by renters and the market value of housing units for homeowners.[4] For each DCH, we regress log gross rents of renters (contract rent plus costs for utilities) on a set of dummy variables that capture variation in the quantity of housing services provided by each unit.[5] These hedonic variables account for variation in building age, number of bedrooms, MSA of residence (when reported), and state of residence. Using the coefficient estimates from the hedonic regressions, we predict gross rents for each owner-occupied property in the sample and subtract reported utilities costs of owner-occupiers to compute net rent. Our estimates of gross rents, utilities expenses, net rents, average prices, and

[3] The data we generate are available for download at *http://morris.marginalq.com/*.

[4] These data are available at the Integrated Public Use Microdata Series ("IPUMS") web site, *http://www.ipums.org/usa/*.

[5] In each year, we exclude non-permanent-site housing units (such as mobile homes, trailers, boats, tents, and vans) from all of our calculations.

the resulting rent-price ratios (annual rate) are shown in columns (1) through (6) of Table 1.

These calculations are straightforward in principle, but a few additional details are worth noting:

- In the 1970 DCH, the owner-assessed market value of owner-occupied housing units in multi-family buildings is not collected. For this year, in Table 1 we report imputed average monthly and annual rents and average home prices for single-family attached and detached housing units. Note that single-family units account for about 93 percent of our sample owner-occupied stock in the 1960, 1970, and 1980 DCH, and imputed rents and prices for the single-family owner-occupied stock for 1960 and 1980 are almost identical to imputed rents and prices for the entire owner-occupied stock.

- The 1980, 1990, and 2000 DCH include information on the annual cost of home heating fuel, gas, electricity, and water for owner-occupiers. For these DCH, we report the average monthly expenditures on utilities for the owner-occupiers in column (2) of Table 1.[6]

  The 1970 DCH does not include data on the utilities costs for owner-occupiers. For renters who pay utilities, we calculate the average utility cost by type of housing unit (single-family attached, single-family detached, etc.). For each type of housing unit, we impute the average utility costs of homeowners by assuming they are identical to the average utility costs of renters.

  In the 1960 DCH, utilities expenditures are not reported. For 1960, we assume utilities expenditures are equal to 24 percent of gross rent. In other DCH surveys, utilities expenditures represent 24 (1970), 30 (1980), 24 (1990), and 22 (2000) percent of gross rents.

- House prices are top-coded in each DCH, and the top-code values are $35K in 1960, $50K in 1970, $200K in 1980, $400K in 1990, and $1M in 2000. For top-coded house values in 1990 and 2000, we assign values of $679K and $1.83M; based on confidential data from the 1991 and 2001 Survey of Consumer Finances, these are the average values of houses worth more than the top-coded amount. For 1960, 1970, and 1980, we assume the true but unreported value of a top-coded house is 1.5 times the top-code.

Interpolating Rents: We use the quarterly index for the rent of primary residence, as published by the Bureau of Labor Statistics (BLS), to interpolate average net rent between DCH benchmarks and to extrapolate beyond 2000.[7] The first column of the top-half of Table 2 reports average annual growth in average net rents from the DCH, the middle column shows average annual growth in the tenant rent index, and the last column reports the percentage point difference between the two.[8] To interpolate net rents between DCH observations, we adjust the observed quarterly

[6] In 1990 and 2000, our calculated expenditures on utilities are approximately 10 percent higher than the reported expenditures on utilities (excluding "Telephone Services") of owner-occupiers from the Consumer Expenditure Survey (CEX).

[7] The BLS rent index is available at *http://data.bls.gov/PDQ/outside.jsp?survey=cu*. The BLS reports monthly index numbers; we average the monthly readings to the quarterly frequency.

[8] Because the CPI rent index captures changes in constant-quality rents, in principle, the last column reflects growth in the average quality of housing units as well as any bias in the CPI (Lebow and Rudd 2003).

changes in the CPI tenant rent index so that the series passes through the DCH benchmark levels. To extrapolate beyond 2000, we use the same procedure and assume that improvements in quality occur at the same rate as from 1990 through 2000.

Interpolating House Prices: We use the repeat-sales house price index published by Freddie Mac (CMHPI) to interpolate average house prices quarterly between Census years and to extrapolate beyond 2000.[9] Because the CMHPI is not available before 1970, from 1960 to 1970 we interpolate using the median price of new homes sold.[10] The bottom half of Table 2 reports changes in average house prices as measured in the DCH and by the CMHPI, and their difference. As with rents, we adjust quarterly changes in the CMHPI so that the series passes through the DCH benchmark prices.

Results: Figure 1 graphs our estimate of the aggregate rent-price ratio as the solid line, with the DCH estimates from Table 1 directly marked on the graph with asterisks. A reasonable characterization of the rent-price ratio over the 1960-1995 period is that the ratio hovered between 5 and 5-1/2 percent at an annual rate, except for a brief period in the early 1970s. House prices and rents both appreciated in real terms over this period, and at approximately the same rates. Over the 1995-2006 period, the rent-price ratio fell by 1.5 percentage points, and by year-end 2006 the rent-price ratio achieved an historically low rate of 3.5 percent at an annual rate. In the first two quarters of 2007, the rent-price ratio increased from its historical low, and incoming data suggest that the rent-price ratio has continued to increase throughout 2007.

In the second printing of his book *Irrational Exuberance*, Shiller (2005) compiles house-price data for the United States from 1890-2005, and argues that the behavior of house prices since 1997 has no precedent in the twentieth century. The decline in the rent-price ratio over the 1995-2006 period illustrates that the appreciation of house prices relative to rents is also unprecedented since 1960.

Using the accounting framework outlined by Campbell and Shiller (1988), Campbell et. al. (2007) show that almost all of the decline in the rent-price ratio is attributable to either a steep decline in the risk premium paid to housing over and above a 10-year Treasury bond, or an increase in the expected rate of growth of house prices, or some combination of these two factors. The unprecedented and steep decline in the rent-price ratio, and associated change in the risk-premium paid to housing and/or growth expectations of house prices, led Shiller (2005) to conclude that the United States experienced a sizeable housing bubble over the 1995-2005 period.

If the risk premium to housing and the expected rate of growth of house prices were to return to their historical norms, we can use the rent-price ratio to gauge the size of the potential adjustment to house prices. Assuming nominal

[9] The CMHPI data are available at *http://www.freddiemac.com/finance/cmhpi/*.

[10] This data source begins in 1963:1. To extend the estimates back to 1960, we assume that median new house prices increased at a constant rate from 1960 to 1963, such that total growth of our interpolated price series from 1960 to 1970 equals total growth of average home prices according to the 1960 and 1970 DCH.

rents were to increase by 4 percent per year, about the average since 2001, a decline in nominal house prices of about 3 percent per year would bring the rent-price ratio up to its historical average, 5 percent, by mid-2012. That said, this is more of a back-of-the-envelope calculation than an actual forecast for house prices because we do not have a fully satisfactory model of the rent-price ratio.

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Table 1: Measures of Housing Valuation from the Decennial Census of Housing

DCH	Average monthly gross rents	Average monthly utilities expenses	Average monthly net rents	Average annual net rents	Average price	Average rent-price ratio (percent)
	(1)	(2)	(3)=(1)-(2)	(4)=12×(3)	(5)	(6)=100×(4)÷(5)
1960	$90	$22*	$68	$816	$14,566	5.6%
1970**	$133	$32	$101	$1,212	$20,867	5.8%
1980	$341	$101	$240	$2,880	$59,059	4.9%
1990	$620	$149	$471	$5,652	$117,693	4.8%
2000	$826	$184	$642	$7,704	$165,556	4.6%

* This is an assumed value. ** Single-family units only. All dollar values are nominal.

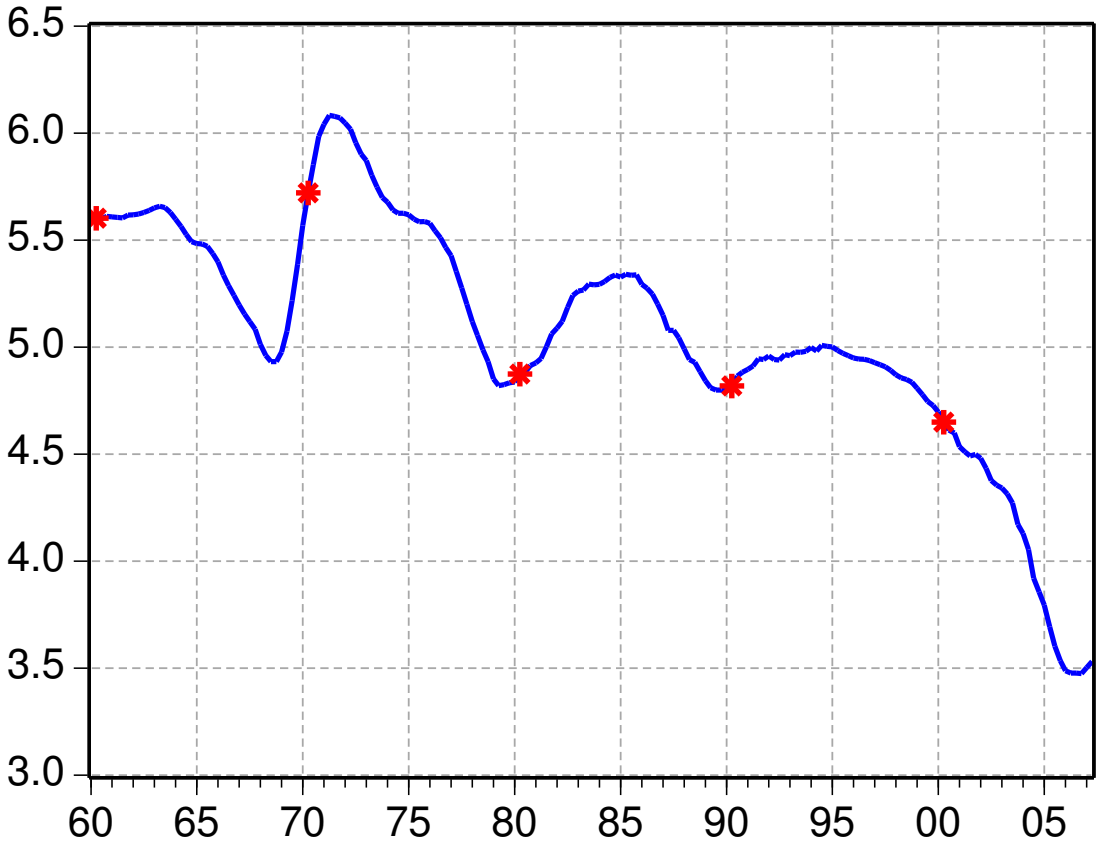
Table 2: BLS Tenant Rent Index and CMHPI vs. DCH Benchmarks

Years	Net rents, DCH (annual percent change)	BLS rent index* (annual percent change)	Difference (percentage points)
1960 to 1970	4.0%	1.8%	2.2
1970 to 1980	9.0%	5.6%	3.4
1980 to 1990	7.0%	5.6%	1.4
1990 to 2000	3.1%	2.9%	0.3

Years	Average price, DCH (annual percent change)	CMHPI* (annual percent change)	Difference (percentage points)
1960 to 1970	3.7%	NA	NA
1970 to 1980	10.8%	8.2%	2.6
1980 to 1990	7.1%	5.1%	2.0
1990 to 2000	3.5%	3.7%	-0.2

* Decade-to-decade growth is calculated from Q2 of year t through Q2 of year $t + 10$. The BLS index is for "Rent of Primary Residence." The CMHPI is available starting in 1970:1.

Figure 1: Ratio of Annual Rents to Prices (Percent), 1960:1 - 2007:2



Note: Starred points indicate direct observations from DCH: See Table 1.