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EVIDENCE ON THE EFFICIENCY AND DISTRIBUTION OF MORTGAGE REVENUE BOND SUBSIDIES: THE EFFECTS OF BEHAVIORAL RESPONSES TO THE SUBSIDIES

BY

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OF MORTGAGE REVENUE BOND SUBSIDIES:
THE EFFECTS OF BEHAVIORAL RESPONSES TO THE SUBSIDIES

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ABSTRACT

Mortgage revenue bond (MRB) programs are frequently justified on the basis that they provide subsidies that enable low-and-moderate income households to purchase houses that they could not otherwise afford. The benefits of the program are in the form of interest rates that are two-to-four percentage points below the market rates for fixed-rate mortgages.

This paper analyzes buyer and seller responses to the MRB subsidies. It is specifically concerned with the questions of whether sellers are able to capitalize some or all of the value of MRB subsidies and whether the households receiving the subsidies purchase more housing services than they would have bought without the subsidy. The paper argues that the capitalization and consumption effects reduce the benefits of MRB programs because they are a portion of the subsidies that are not provided to marginal buyers to make home ownership more affordable. Also these effects have negative distributional consequences: there seems to be no justification for giving public subsidies to sellers simply because they sell houses to a target population. Horizontal inequities are created if one group of moderate income households receive subsidies to purchase more housing services than is purchased by unsubsidized households with the same socio-economic characteristics.

The empirical results of the paper are that in one urban market in 1983 about ten to fourteen percent of the after-tax value of MRB subsidies was capitalized and households with MRB loans spent $800 to $1600 more on housing services than comparable households without subsidies. The results indicate that over twenty percent—and as much as fifty percent—of the value of MRB subsidies was either capitalized by sellers or used by subsidy recipients to purchase additional housing services.

The analysis supports the conclusion that inefficient shopping of house buyers with MRB subsidies contributed to the capitalization. An attempt to determine if treatment of MRB subsidies as loan buydowns also contributed to capitalization yielded inconclusive results.
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Introduction

The policy debate about mortgage revenue bond programs has addressed both the efficiency and distribution of the loan subsidies. Strong theoretical arguments (CBO 1979; Peterson 1979; Tuccillo and Weicher 1979; and Laurie 1982) and some empirical evidence (GAO 1983; California Legislative Analyst 1985; Gainer 1984) have supported the conclusion that MRB programs are inefficient, yielding less in benefits than they cost. Also a small amount of empirical research (GAO 1983; California Legislative Analyst 1985; and Durning 1985) has shown that a majority of the subsidies has been distributed to households with above-median incomes.1

To date, studies of the efficiency and distribution of MRB subsidies have ignored the potential effect of the subsidies on decisions of house buyers and sellers. It seems quite possible that MRB subsidies influence consumer behavior in a way that reduces the efficiency of the programs and creates distributional inequities. Microeconomic theory clearly demonstrates that subsidies affect consumer demand through income and substitution effects, and the Experimental Housing Allowance Program (EHAP) identified the behavioral response of renters to various types of subsidies (see Friedman and Weinberg 1982).
This paper suggests that MRB subsidies may be analogous to either the percent-of-rent voucher used in the EHAP program or to loan buydowns common in creative finance. If either model is correct, the subsidies will induce changes in buyer or seller behavior that result in capitalization of some of the subsidy value. If the percent-of-rent voucher model describes reality, the subsidies will also stimulate consumption of additional housing services.

The following summarizes the hypothesized relationships among the characteristics of the subsidy, the expected changes in consumer behavior, and the related market changes:

<table>
<thead>
<tr>
<th>Subsidy Model</th>
<th>Change in Consumer Behavior</th>
<th>Market Results of Behavior Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Subsidy is analogous to percent-of-rent voucher</td>
<td>Less efficient shopping by buyers</td>
<td>Capitalization of portion of subsidy value</td>
</tr>
<tr>
<td></td>
<td>Purchase of more housing services in response to the subsidy</td>
<td>Increased housing consumption by buyers receiving MRB loans and higher house prices in the short run</td>
</tr>
<tr>
<td>2: Subsidy is analogous to loan buy-downs</td>
<td>Buyers bid more and sellers charge more for houses financed with MRB loans</td>
<td>Capitalization of a portion of the subsidy value</td>
</tr>
<tr>
<td>3: Null Model</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

MRB programs are analogous to percent-of-rent vouchers if the loans are distributed by a neutral mechanism such as "first come, first serve" or a lottery before the end of the buyer's housing search. A recipient of this subsidy may view it as a
voucher that permits purchase of a house with payments a certain percentage less than would be paid with a market rate loan.

If MRB subsidies are like percent-of-rent vouchers, the EHAP results (Weinberg and Friedman 1982 and Merrill 1983) indicate that buyers with the loans may shop less efficiently than buyers with market rate loans, and thus will pay a higher price for housing services. As a result, a portion of the subsidy value will be capitalized into house prices. Also, households will respond to the reduced monthly payments by purchasing more housing services than they (or comparable households) would without the subsidy.  

MRB programs are analogous to loan buy-downs if institutional arrangements give sellers control of access to the subsidies. In this case, both buyers and sellers will change their behavior. Buyers will bid for the favorable financing, driving up the price paid for houses with MRB subsidies; sellers will act to capture as much of the value of the financing as possible.

If, for example, only houses constructed by particular builders may be financed with MRB loans, the builders may treat the subsidy as if it were a buy-down loan. The literature on creative financing has shown that sellers capitalize some (e.g., Agarwal and Phillips 1984; Durning and Quigley 1985) or all (e.g., Rosen 1984; Strathman, DeLacy and Dueker 1984) of the value of below-market creative financing such as buy downs into house prices.

The null model suggests that MRB subsidies are not similar to percent-of-rent vouchers or buy-downs, and that they cause no particular changes in consumer behavior or the market. In this
situation, loans are distributed and regulated so that neither buyers or sellers perceive them as subsidies.

The null model depends on naive buyers and sellers who are unable to place a value on MRB subsidies, or on a highly targeted program. Perhaps the ambiguity and complexities of the MRB program confuse buyers and sellers so that they do not perceive that subsidies reduce the cost of housing, or, at least, buyers may underestimate the subsidy value because of uncertainty about future interest rates and their expected tenure in the house to be purchased. Or perhaps program guidelines strictly target the subsidies so that they are spent only to increase home ownership.

The effects of capitalization and increased consumption on the efficiency and distribution of MRB Subsidies

If we assume that the primary purpose of MRB subsidies is to enable some households to buy houses rather than be renters, the subsidies provide benefits only if they go to marginal buyers to enable them to purchase houses. The benefit of a subsidy is maximized if the entire amount is the difference between the amount marginal buyer could pay for a house and what he would have to pay without the subsidy.

For example, if we assume a buyer could pay, say, 28 percent of his monthly income for house payments (e.g., $500), but that the purchase of house x would requires 32 percent of monthly income ($571), the MRB subsidy is maximized if it pays no more than this difference ($71). No dollar of subsidy in addition to this difference contributes to increased home ownership.

Capitalization diverts a portion of the subsidies from households being assisted to obtain home ownership to sellers.
Thus, capitalization clearly reduces the benefits going to intended recipients, reducing the efficiency of the program. Also capitalization has negative distributional effects: there are no good justifications for providing public subsidies to a subset of sellers simply because society wants to help certain buyers.

To the extent that a housing subsidy stimulates an increase in the amount of housing services consumed, the subsidy is not going to a marginal buyer to pay the difference between what he can pay and must pay for a house. Instead, a portion of the subsidy finances the purchase of more housing services than would be bought in the absence of the subsidy.

The use of MRB subsidies to increase consumption of housing services would be justified if the additional housing services were required for a household to purchase a standard rather than substandard house. However, MRB loans are rarely provided to low income households who would live in substandard houses in the absence of the MRB subsidy.

If MRB subsidies enable buyers to consume more housing services than they could have purchased with a market rate loan (and the alternative is not a substandard house), horizontal inequities are created unless all households meeting the requirements for the subsidies receive them. The subsidy enables one set of households to purchase more housing services than similar households without the subsidies.7

Plan of the Paper

This paper examines whether capitalization and increased consumption occur when households receive MRB subsidies, and
explores the behavioral causes of these effects. The paper begins with a test for capitalization of subsidies in 1983 in one urban market. Since the results show evidence of capitalization, the second part of the paper uses a variety of methods to investigate if buyer shopping inefficiency (subsidies as percent-of-rent vouchers) or buyer/seller behavior (subsidies as buy-downs) better explains capitalization. The third part of the paper examines whether MRB loan recipients consume more housing services than comparable households. The paper concludes with a summary of findings and a discussion their implications.
The Capitalization of MRB Subsidies

Some early critics of MRB loans programs such as the National League of Savings Institutions (Savings and Loan News 1979) maintained that the value of MRB loan subsidies would be capitalized into house prices, driving up the price of houses financed with these loans. At first glance, however, capitalization of MRB subsidies seems unlikely. Most of these subsidies are administered by individual lenders who are third parties to the transactions between buyers and sellers. The house sales price should not be affected by the terms of third-party financing; a seller should not be concerned with the interest rate paid by a buyer. Whatever the interest rate, the seller will be cashed out of the property by the loan; that is, he or she will be paid the sales price in one lump sum.

A closer examination of MRB loans shows a more complicated situation than the usual third-party financing. MRB loans do provide a subsidy, and these subsidies may affect the behavior of buyers or sellers. Recent research has shown that in two housing markets part of the value of mortgage subsidy bond loans was capitalized into house prices. Durning and Quigley (1985) found that in early 1982 between 18 and 25 percent of the present value of MRB loan subsidies in the Greater Little Rock area was capitalized. A study by Strathman, DeLacy and Dueker (1984) observed that loans made in 1982 through the Oregon veteran's loan program (financed with funds from general obligation bonds) commanded a premium over other houses.

Both of these studies used samples of transactions in 1982,
a year in which housing sales had fallen to about half the sales in 1978. In the markets investigated by these studies there may have been too few transactions for the market to operate efficiently. Thin markets (few buyers and sellers) may have created the capitalization because buyers and sellers were not able to determine the market value of properties.

A question to be investigated is whether capitalization of MRB subsidies takes place in a more "normal" market than existed when these 1982 studies were conducted (i.e., are the results of these two studies duplicated in markets in which sales are near the decade averages and in which institutions—rather than sellers—are the main source of mortgage finance?). A hedonic price model is used to investigate if capitalization occurred during 1983 in the Greater Little Rock, Arkansas area.

The Model

The model used to estimate capitalization of below-market MRB loans is a straight-forward extension of the standard hedonic price model used in studies of creative finance capitalization. The standard model (see Jaffe 1984 and Rosen 1984) is as follows:

\begin{equation}
S = \sum \alpha_i x_i + BF
\end{equation}

where, \( S \) is the sales price of a house, \( x_i \) is the \( i \)th characteristic of the house, \( F \) represents the before-tax value of the financial terms, and \( \alpha_i \) and \( \beta \) are parameters to be estimated.

The value of \( F \) in (1a) is usually calculated without estimating the effects of income taxes. As a result, the estimated value of MRB financing is greater than its actual value. A
household can deduct interest payments from taxable income. With an MRB loan, the household pays less mortgage interest than with a market-rate loan, and therefore has less to deduct from its income. Thus the value of the payment savings from an MRB loan is reduced by larger tax payments. Equations (1b) and (1c) include the effects of the income tax on the value of the financing:

\[(1b) \quad S = \sum \alpha_i x_i + \beta (1-t) F, \text{ or} \]
\[(1c) \quad S = \sum \alpha_i x_i + \beta F_a \]

where t is each household's marginal tax rate and $F_a$ is the after-tax value of the below-market financing.

The value of $F_a$ for each house is calculated as follows:

\[(2) \quad F_a = (1-t) (PDV_c - PDV_m) \]

where, $PDV_c$ is the present value of the payments at the contractual rate and $PDV_m$ is the present value of the flow of payments discounted by the market interest rate. It is assumed a household's marginal tax rate will be constant for the term of the loan.9

The estimation of (1c) can done directly. Both $PDV_c$ and $PDV_m$ can be calculated using data from individual mortgages, a knowledge of market interest rates and each household's marginal tax rate. However, this estimation creates a statistical complication that may cause biased estimates of $\beta$.10 By definition, the sales price of each house is equal to the down payment (d) plus the present value of the payment stream at the contractual rate:

\[(3) \quad S = d + PDV_c \]

and substitution of (3) and (2) into (1b) yields:

\[(4) \quad S = \sum \alpha_i x_i + \beta (1-t) (S-d-PDV_m) \]

The spurious correlation introduced by including S on the
right hand side of (4) means that ordinary least squares regression will yield biased and inconsistent estimates of capitalization effects. This problem can be corrected by subtracting $S$ from both sides of (4) and solving for $S$. This correction of simultaneity bias follows the suggestions of Johnston (1972) who shows that $\beta$ will be biased upwards if estimated using equation (1b).

The reduced form model is:

\[(5) \quad S = \sum \alpha_i x_i + \delta [z(1-t)(-d-PDv_m)], \quad \text{where}\]

\[(6) \quad \delta = \delta/1-\beta+\beta t, \quad \text{and}\]

$z$ is a dummy variable equal to 1 if the loan is a MRB loan and 0 if it is a market rate loan.\(^{11}\)

The reduced form model, equation (5), will produce consistent estimates of the parameters of (4) by ordinary least squares estimation of (5) and solving for $\alpha_i$ and $\beta$. A consistent estimate of the capitalization effect is:

\[(8) \quad \beta = \delta/1+\delta-t\delta.\]

A large sample t-ratio can be estimated for $\beta$ using a Taylor expansion series as described in Kmenta (1971:444).
Data

The empirical analysis of capitalization is based upon observations of 148 sales of single family dwellings in the Greater Little Rock, Arkansas area (Pulaski County) during 1983. Each observation includes information about (a) the house characteristics, (b) the financial terms of the loan, and (c) the income and other characteristics of the borrower.

Of the 148 observations, 76 are MRB loans made by the Arkansas Housing Development Agency (AHDA) in 1983 between March and October. The AHDA provided information about the financial terms of the loans (e.g. loan amount and term) and the borrower characteristics. The description of house characteristics for this set of houses was obtained from either Multiple Listing Service (MLS) records or from house descriptions on file in the County Assessor's office.

The remaining 72 houses were purchased with market rate loans, including conventional fixed rate, variable rate and graduated equity mortgages; Federal Housing Administration (FHA)-insured loans; and Veteran's Administration-guaranteed loans. The information about the loan terms were obtained from mortgages on file in the Pulaski County courthouse; the house characteristics were copied from MLS or county assessor records. Borrower incomes and other characteristics were supplied on a confidential basis by five mortgage lenders in Pulaski County.

The sample of market rate loan transactions includes only houses priced below the maximum amount that could be paid for a house purchased with an MRB loans ($71,640 for new and $65,670
for existing houses. The intent was to have in this sample only houses that could have been purchased with MRB loans.

Greater Little Rock is a metropolitan area of about 200,000 people. Little Rock is the state capital and trade center of the state of Arkansas. This area is a good site for the analysis of capitalization. Little Rock is in many ways typical of cities in which MRB loans are especially popular. The city has been growing moderately and has house prices about 85 to 90 percent of national averages. For example, in the 1980 census the median owner-specified house value in Greater Little Rock was $40,100 compared to the national median of $47,100.

While Little Rock is unlike large coastal metropolitan centers, it is representative of most other areas using MRB loans. In 1983 the average MRB loan in Greater Little Rock was about $49,110. Nationally, the average was $51,931 (Council of State Housing Agencies 1984). The results of the study of the Greater Little Rock area should be generalizable to other MRB programs, except those in the largest metropolitan areas.

The MRB loans in this sample were available from one of two bond issues by the Arkansas Housing Development Agency (AHDA), the only agency in Arkansas authorized to issue bonds to finance single family house purchases. The first bond issue, completed in April, raised $26.4 million. The Agency sold the bonds as market rates fell to their bottom for the year. As a result, during the Summer of 1983 the AHDA offered fixed-rate mortgage loans with an interest rate of 9.625%, about four percentage points below market rates.

The second bond issue (raising $50 million) was completed in
June. The mortgage loans financed by this issue had an interest rate of 10.2%.

These mortgage loans required a minimum downpayment of five percent of the sales price. In addition, a payment of 5.5 points (5.5 percent of the mortgage amount) had to be made to the lender when the loan was made.

The main restrictions on MRB loans were that households receiving the loans could have an annual income of no more than $40,000, plus $2,000 for each dependent, and 90% of the loans must be made to first-time buyers (households that had not owned a house in the previous three years). As mentioned earlier, the maximum purchase price was $65,670 for existing and $73,150 for new houses.

Table 1 is a summary of the financing, house and borrower characteristics for the 148 observations, plus, separately, the characteristics for market rate and MRB loans. Buyers with MRB loans purchased slightly smaller, more expensive houses, but have lower monthly payments than borrowers with market rate loans.

The borrowers receiving MRB loans had a slightly higher average income ($29,880) than the buyers with market rate loans ($29,592). They tended to be younger. And they paid a smaller portion of their income for housing payments and total debt payments (including housing).

The Results

Table 2 presents the parameter estimates for the financial variables (the FHA loan dummy and the MRB financing variable, δ) in equation (5), and the estimated capitalization rate (β).
<table>
<thead>
<tr>
<th>Financial Characteristics</th>
<th>All Houses (N=148)</th>
<th>Market Loans (N=72)</th>
<th>MRB Loans (N=76)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Price</td>
<td>$51,861 (13,109)</td>
<td>$50,667 (15,223)</td>
<td>$52,991 (10,713)</td>
</tr>
<tr>
<td>Mortgage Amount</td>
<td>47,088 (11,933)</td>
<td>44,954 (13,083)</td>
<td>49,110 (10,419)</td>
</tr>
<tr>
<td>Monthly Payment</td>
<td>445.46 (118.21)</td>
<td>470.84 (137.79)</td>
<td>421.41 (90.61)</td>
</tr>
<tr>
<td>FHA/VA (yes=1)</td>
<td>0 (.45)</td>
<td>.72 (.45)</td>
<td>0</td>
</tr>
<tr>
<td>House Char.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House Size (sq. ft.)</td>
<td>1352 (270)</td>
<td>1416 (316)</td>
<td>1292 (201)</td>
</tr>
<tr>
<td>Lot Size (sq. ft.)</td>
<td>8847 (4014)</td>
<td>9317 (4598)</td>
<td>8403 (3330)</td>
</tr>
<tr>
<td>House Age (years)</td>
<td>15.9 (17.8)</td>
<td>17.7 (17.2)</td>
<td>14.2 (18.4)</td>
</tr>
<tr>
<td>New (yes=1)</td>
<td>.37 (.48)</td>
<td>.26 (.44)</td>
<td>.46 (.50)</td>
</tr>
<tr>
<td>Borrower Char.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income (monthly)</td>
<td>$2,469 (740)</td>
<td>$2,476 (872)</td>
<td>$2,490 (595)</td>
</tr>
<tr>
<td>Age of Householder</td>
<td>30.6 (8.2)</td>
<td>33.0 (10.2)</td>
<td>28.3 (4.5)</td>
</tr>
<tr>
<td>House Pymt-to-Income Ratio</td>
<td>.220 (.06)</td>
<td>.246 (.06)</td>
<td>.200 (.05)</td>
</tr>
<tr>
<td>Debt Pymt-to-Income Ratio</td>
<td>.318 (.09)</td>
<td>.343 (.10)</td>
<td>.295 (.07)</td>
</tr>
</tbody>
</table>

(Standard deviations in parentheses.)
The parameter estimates are provided for two scenarios: first, the loans will be held by all borrowers for the full terms (thirty years); and, second, all loans will be kept by borrowers for seven years and then will be paid off.\textsuperscript{12} The entire regression results are in appendix 1.

The control variables include important house characteristics (e.g., house size, lot size, number of garages), location (by zip code area) and a proxy for neighborhood (median house price in the area minus median house price in the census district). All of the coefficients of the control variables have the expected signs except for lot size which is sometimes negative. However, the lot size parameter is not statistically different from zero in any of the estimated models. Definitions of the independent variables are provided in appendix 1.

The estimates of the MRB financing variable coefficients are statistically significant at a 5 percent level.\textsuperscript{13} The regression explains about three-fourths of the variations in house prices. The estimated capitalization rate is 11.5 percent if the loans are held their full terms. If loans are kept for only seven years, the estimated capitalization rate is reduced by roughly one percentage point. These results indicate that for every dollar of MRB subsidy, a buyer pays a house price that is ten to twelve cents higher than he would have paid if he had a market-rate loan.\textsuperscript{14} The capitalization estimates are statistically significant at a 5 percent level.
Table 2
REGRESSION COEFFICIENTS FOR FINANCIAL VARIABLES
AND ESTIMATED CAPITALIZATION RATES
Greater Little Rock, 1983
(n=148)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Thirty Year Holding Period</th>
<th>Seven Year Holding Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHA Dummy</td>
<td>-416.60 (−.18)</td>
<td>-397.07 (−.18)</td>
</tr>
<tr>
<td>MRB Finance Variable*</td>
<td>-0.126 (−2.16)</td>
<td>-0.114 (−2.17)</td>
</tr>
<tr>
<td>Corrected R-Sq.</td>
<td>.732</td>
<td>.732</td>
</tr>
<tr>
<td>Capitalization Rate**</td>
<td>.115 (2.00)</td>
<td>.105 (2.02)</td>
</tr>
</tbody>
</table>

*MRB finance variable is [(z)(1−t)(−d−PDVm)]; see equation (5)
**The t-ratio is estimated by a Taylor expansion series.

The dependent variable is the contract sales price plus points. T-ratios are in parentheses. See appendix 1 for complete regression results.

One potential difficulty with these estimates is that about three-fourths of the market loans are FHA-insured loans. It is likely that the FHA sales prices include financing premiums because, during 1983, lenders were charging four to six points for FHA financing, but borrowers could pay a maximum of one point. Thus sellers were paying a substantial number of points if buyers were financing their purchases with FHA loans. According to accumulated research evidence (e.g., Zerbst and Bruggeman 1977; Colwell, Guntermann and Sirmans 1979) a major portion of these points is capitalized into house prices.

Though a control variable for FHA financing was included in the regression model, this variable may not be adequate to account fully for the effect of FHA point capitalization on esti-
mates of MRB subsidy capitalization. The influence of FHA financing on the MRB subsidy capitalization estimate was tested by repeating the regression with a sample that included only MRB and conventional loans (n=95). The estimates of the MRB financial variable coefficients are presented in table 3. (See appendix 1 for the complete regression results.) The estimated capitalization rates are about two percentage points higher than the estimates for the original sample. The safest interpretation of tables 2 and 3 is that an after-tax capitalization of ten to fourteen percent occurs.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>ESTIMATED COEFFICIENTS FOR FINANCIAL VARIABLES AND CAPITALIZATION RATES</th>
<th>Conventional and MRB Loans Only (n=95)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thirty Year Holding Period</td>
<td>Seven Year Holding Period</td>
</tr>
<tr>
<td>MRB Finance Variable*</td>
<td>-.151 (-2.79)</td>
<td>-.138 (-2.81)</td>
</tr>
<tr>
<td>Corrected R-Sq.</td>
<td>.722</td>
<td>.722</td>
</tr>
<tr>
<td>Capitalization Rate**</td>
<td>.136 (2.56)</td>
<td>.125 (2.58)</td>
</tr>
</tbody>
</table>

*The MRB variable is (z)(1-t)(-d-PDVm); see equation (5)
**The t-ratio is estimated by a Taylor expansion series.

The dependent variable is the contract sales price plus points. T-ratios are in parentheses. See appendix 1 for complete regression results.

According to these results, capitalization reduces the average after-tax subsidy, if loans are held their full term, by about $1240. If loans are kept for only seven years, the capitalization reduces the average after-tax subsidy value by about seven hundred dollars.15
Why Does Capitalization Occur?

This part of the paper explores the question of why a portion of the MRB subsidies was capitalized. As mentioned earlier, a possible cause of capitalization in early 1982 of MRB subsidies was the existence of a thin market. Since the subsidies were provided at a time of economic recession and extremely high interest rates, relatively few houses were sold (in 1982, for example, the Greater Little Rock MLS service reported less than 3,000 sales, compared with 4,646 in 1983) and, the argument goes, the housing market may have been inefficient.

The evidence of capitalization in 1983, a time the Greater Little Rock housing market was quite active, casts doubts on the thin market hypothesis. Since MRB subsidy capitalization continued as housing activity increased, a thin market does not seem to explain adequately the existence of capitalization.

The remainder of this section examines whether inefficient shopping or a buydown effect better explains the capitalization of MRB subsidies.

Inefficient Shopping

A home buyer with an unrestricted voucher to pay a portion of her mortgage payment—like a renter with a voucher to pay a percent of his rent—may exert less effort in a search for housing. This voucher reduces the private rewards (the dollars going into the buyer's wallet) of a more intensive search. Whereas a buyer with a market-rate loan would save a dollar for each dollar reduction in house price produced by locating a better bargain, the buyer with a voucher will not receive the full savings. For
a subsidized buyer, the private return is less: he gets $1 - r in every dollar of savings ($r$ is the percentage reduction in present discounted value of the house price resulting from the MRB subsidy).

Courant (1978) suggests that a buyer continues her search for a house if the expected increase in utility (measured in dollars) from the search is greater than the marginal cost of the search. If this model describes reality, a buyer with an MRB loan may stop searching before a buyer with a market rate loan because the subsidy will reduce the expected increase in utility (private returns) of the search, but will not reduce search costs.

Are the MRB loans made by the AHDA equivalent to percent-of-rent vouchers? The answer to that question is not clear. The AHDA's MRB loans are distributed to individual households by mortgage lenders based on their lending criteria and MRB program guidelines. Borrowers do not have equal access to the loans, though most of the loans may be made on a first-come, first serve basis. It is certain that lenders do not dispense vouchers, they make mortgage loans. In other words, a household goes to a mortgage lender for an MRB loan to purchase a specific house, not to obtain a pledge for MRB financing of any house.

The buyer’s perception of MRB subsidies may, however, not depend only on the administration of the loans by mortgage lenders. The situation is complicated by the role of real estate brokers in the housing search process. While a potential buyer may not have a lender’s pledge to provide an MRB subsidy, a real
estate broker may advise the buyer that he is eligible for such a subsidy and likely to get one if he acts promptly. The search process may proceed as if the the buyer had a voucher because he presumes—based on the broker's advice—that he will get a below-market MRB loan.17

In absence of adequate a priori understanding about how buyers perceive MRB subsidies, the next step is to examine the data to find out if they indicate inefficient shopping contributed to the capitalization.

Method of Investigation

Since inefficient shopping is an unobserved variable, the approach is to test for its existence with a model that uses the sales price-asking price ratio (S/AP) as the dependent variable. The expectation is that, other things being equal (including the characteristics of the seller side of the market), S/AP will increase as shopping efficiency decreases.

This expected relationship between S/AP and shopping effect is quite reasonable if it is assumed that sellers set their asking prices without knowing in advance the source of financing that the buyer will use. We can think of the asking price (AP) as the function of the characteristics (vector $x_i$ in equation 1a) that are being purchased, a bargaining buffer ($b$), and errors the seller makes in estimating the value ($e$):

$$ AP = (1+b+e) \sum \alpha_i x_i $$

In an efficient market, the sales price will be equal to the sum of the values of the characteristics: $S = \sum \alpha_i x_i$.

The hypothesis is that households with MRB subsidies will
shop inefficiently. This inefficient shopping implies that the households will pay some percentage increment \((v)\) over the value of the characteristics, so the sales prices for houses financed with MRB loans \((S_b)\) will be greater than the market value:

\[
S_b = (1+v) \sum \alpha_i x_i, \quad v > 0.
\]

For efficient shoppers the \(S/AP\) ratio is:

\[
S/\text{AP} = \sum \alpha_i x_i / (1+b+e) \sum \alpha_i x_i = 1/(1+b+e).
\]

For buyers with MRB loans, the \(S_b/\text{AP}\) ratio is:

\[
S_b/\text{AP} = (1+v)/(1+b+e)
\]

So, \((S_b/A) > (S/\text{AP})\) if \(v > 0\). In this case, \((v)\) is the price paid for inefficient shopping.

Factors contributing to inefficient shopping may include characteristics of the buyer as well as the existence of a subsidy. A younger household may lack experience in evaluating the value of houses or may not be skilled in bargaining. A more affluent household might place a higher value on the marginal time spent searching for a house, and therefore conduct a less intensive (i.e. time consuming) search than a poorer household that places less of a value on leisure time. Also house buyers may have personal characteristics that affect their ability or willingness to bargain, for example they may be impatient, impetuous, or dumb.

Of course, sellers may have the same characteristics that contribute to their failure to obtain the full market value of their houses. Buyers, in these cases, may obtain bargains.

The following models to be estimated test the hypothesis that the \(S/\text{AP}\) ratio is higher for buyers with subsidies because of the shopping effects of the subsidies:
\[(12a)\] \[S/AP = \alpha + \beta_1 Y + \beta_2 A + \beta_3 \text{FHA} + \beta_4 \text{Bond} + U\]
\[(12b)\] \[S/AP = \alpha + \beta_1 Y + \beta_2 A + \beta_3 \text{FHA} + \beta_4 \text{Fa} + U\]
\[(12c)\] \[S/AP = \alpha + \beta_1 Y + \beta_2 A + \beta_3 \text{FHA} + \beta_4 \text{Bond} + \beta_5 R + U\]
\[(12d)\] \[S/AP = \alpha + \beta_1 R\]

where \(Y\) is household income, \(A\) is the age of the householder, FHA is a dummy variable with a value of one for households receiving FHA-insured loans, Bond is a dummy variable with a value of one for households receiving MRB loans, Fa is the after-tax MRB subsidy and \(R\) is the residual in the estimation of equation (5). \(\beta_i\) and \(\alpha\) are parameters to be estimated.

Equation (12a) estimates the effect of having an MRB loan on the S/AP ratio, holding constant age and income. The FHA dummy variable controls for the effects of the payment of four-to-six points by sellers whose houses are purchased with FHA-insured loans.\(^{18}\)

Equation (12b) substitutes the after-tax MRB subsidy value for the bond dummy variable. The coefficient of the variable should reflect whether inefficient shopping (as reflected in the S/AP ratio) increases as the amount of the subsidy increases.

Equation (12c) makes use of the residuals resulting from estimating equation (5) using a 30-year holding period. This residual (\(R\)) is the difference between the predicted house value (the estimated market value) and the actual sales price. If the hedonic regression were perfectly specified and all relevant variables included, \(R\) would be the effects of inefficient shopping: the payment in addition to the market value. However, since there are omitted variables in equation (6), \(R\) consists of
the inefficient shopping effects and other elements.\textsuperscript{19} \textit{R} is used as a proxy variable in (12c) for omitted personal characteristics that affect shopping efficiency and for the interactions of the other independent variables that are not represented in the linear model.\textsuperscript{20}

Equation (12d) examines the independent effects of the residual on the $S/AP$ ratio. If the coefficient of this variable were statistically significant, it might be argued that the residual does, in fact, consist largely of the effects of inefficient shopping.

\textbf{The Results}

An examination of the average sales price/asking price ratios for market rate loans and MRB loans (table 4) shows a difference of about two percentage points.\textsuperscript{21} The average $S/AP$ for all houses with three or fewer bedrooms sold in 1983 through MLS listings was .952. The average $S/AP$ for a sample of houses financed with MRB loans was .978.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|}
\hline
\multicolumn{3}{|c|}{\textbf{Table 4}} \\
\multicolumn{3}{|c|}{\textbf{Comparison of Asking Price/Sales Price Ratios}} \\
\multicolumn{3}{|c|}{\textbf{Greater Little Rock Housing Market}} \\
\multicolumn{3}{|c|}{1983} \\
\hline
\textbf{Houses Sold Through MLS Listings* (n=3764)} & \textbf{Sample Houses Financed With Market Rate Loans (n=38)} & \textbf{Sample Houses Financed With Bond Loans (n=57)} \\
\hline
\textbf{Avg. Sales Price (S)} & $57.2$ & $49.5$ & $52.9$ \\
\textbf{Avg. Asking Price (AP)} & $60.1$ & $51.6$ & $54.0$ \\
\textbf{Ratio S/AP} & .952 & .959 & .978 \\
\hline
\end{tabular}
\caption{Comparison of Asking Price/Sales Price Ratios for Greater Little Rock Housing Market in 1983} \\
*includes only houses with three or fewer bedrooms.
\end{table}
The S/AP ratios for MRB loans may be higher because sellers with houses to be financed with MRB loans set asking prices closer to values of housing characteristics than did other sellers. However, such behavior would make little sense—there are no incentives for such pricing decisions, and it is unlikely, with a few exceptions, that persons with a house for sale knew how the future buyer would finance the purchase. A regression of house characteristics and dummy variables for type of financing on asking price shows a negative sign on the bond dummy coefficient, but the coefficient is not statistically different from zero (a t-ratio of less than 1). Thus there is no evidence that the higher S/AP ratio is a result of sellers systematically setting lower asking prices for houses financed with MRB loans.

To investigate further the effects of bond financing on the S/AP ratio, regression models (12a,b,c,d) were estimated. The results (presented in table 5) indicate that bond financing is associated with a higher S/AP ratio, holding income and age constant. Also, increases in the S/AP ratio are positively related to increases in the subsidy amounts.

The residual parameter estimates in (12c) were positive and statistically significant. Including the residual in equation 12c almost doubles the explanatory power of the model while having no effect of the bond loan coefficient. The residual variable has an independent effect on the S/AP ratio.
Table 5
REGRESSION RESULTS FOR MODELS TESTING FOR INEFFICIENT SHOPPING EFFECTS

Dependent variable: Sales Price/Asking Price

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>.00001</td>
<td>.00001</td>
<td>.08-E4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.00)</td>
<td>(1.67)</td>
<td>(1.19)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.002</td>
<td>.0017</td>
<td>.0018</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.98)</td>
<td>(1.74)</td>
<td>(1.74)</td>
<td></td>
</tr>
<tr>
<td>FHA Loan</td>
<td>.049</td>
<td>.033</td>
<td>.049</td>
<td></td>
</tr>
<tr>
<td>(1=yes)</td>
<td>(2.07)</td>
<td>(1.67)</td>
<td>(2.41)</td>
<td></td>
</tr>
<tr>
<td>Bond Loan</td>
<td>.059</td>
<td>.059</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1=yes)</td>
<td>(2.55)</td>
<td>(2.55)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bond Savings</td>
<td></td>
<td>.05-E4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.38)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual</td>
<td></td>
<td></td>
<td>.024-E4</td>
<td>.027-E4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2.68)</td>
<td>(3.04)</td>
</tr>
<tr>
<td>Intercept</td>
<td>.82</td>
<td>.85</td>
<td>.84</td>
<td>.97</td>
</tr>
<tr>
<td></td>
<td>(18.1)</td>
<td>(21.9)</td>
<td>(19.3)</td>
<td>(191.3)</td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>.09</td>
<td>.08</td>
<td>.15</td>
<td>.08</td>
</tr>
<tr>
<td>F-value</td>
<td>2.93</td>
<td>3.15</td>
<td>4.40</td>
<td>9.27</td>
</tr>
</tbody>
</table>

(t-ratio in parentheses)

These results provide some support for the hypothesis that shopping inefficiency resulting from MRB subsidies contributes to the capitalization of the subsidies. Given that this is a cross sectional analysis and that a large component of the S/AP is random, it is not surprising that the coefficient of determination is small. The F-value is significant at the .05 level for model 1 and at the .01 level for the remaining models.
MRB Loans as Buy-Downs

If MRB loans are controlled by sellers rather than distributed directly to borrowers, buyers may be willing to pay for the MRB subsidies and sellers may attempt to charge for them by increasing the prices for houses financed with the MRB loans. The situation is analogous to loan buydowns or assumptions. Assume, for example, that 5000 houses are listed for sale through the MLS, but only 200 buyers will receive MRB subsidies. Further assume that a few real estate brokers can designate which 200 houses will be financed with MRB loans. Buyers could obtain subsidized interest rates only if they purchased one of these 200 houses.

If the subsidies are available only with the purchase of particular houses, buyers should be willing to pay more for houses with the subsidies than for comparable houses that would be financed at market rates. A buyer could bid a higher price for houses with MRB subsidies and still have lower house payments each month because of the subsidy. In an efficient market, the competition of potential buyers should result in the after-tax value of the subsidy being included in the price of the house. At that point, the buyer would gain or lose nothing by purchasing the house with the subsidy.

The buydown analogy also suggests that house sellers will act consciously to include the value of financing in the sales price. Buydowns have been used extensively by builders to help sell their properties in times of high mortgage interest rates. Typically, a builder pays a lender a lump sum so that the lender
will make a below-market loan to the household that buys a particular house.

In this situation, the builder knows the value of the financing because her firm paid for it. She would be expected to try to recover the value of the buydown by including the payments for the financing in the house sales price, then making the decision to sell the house only after she has concluded that she has recovered as much of the value of the financing as possible.

The Arkansas Housing Development Agency allows builders to reserve up to one-fourth of the MRB funds by paying a specified number of points. These reserved funds are then available only to borrowers who purchase the houses offered for sale by the builder. Thus, it is clear that builders have some control over who receives a portion of the MRB subsidies.

It is uncertain if the remainder of MRB loans are controlled directly or indirectly by real estate brokers or builders. Formal rules of the MRB program do not permit real estate brokers to reserve money for their customers, but they may informally be able to have favorable access to money through their standing relationships with lenders (i.e., they may know that they have first claim on available subsidies). As the adviser to sellers, a real estate broker may be able use informal control of subsidies to help the seller capture some of the value of the subsidy. Since a real estate broker typically receives a percentage of a house sales price as this commission, he increases his fee if the subsidy value is capitalized.

Because implementation the AHDA MRB program is decentralized, it is difficult to determine if builders and real estate
brokers are able to control loans. This section of the paper tests empirically whether the capitalization seems explained by the buydown model.

**Method of Investigation**

An indirect method must be used to investigate whether MRB subsidy capitalization is the result of seller control of subsidies. The approach is to exploit the fact that builders may directly reserve MRB subsidies for particular newly-built houses, but real estate firms cannot reserve money for existing houses. The expectation is that since builders have to pay a fee to reserve funds and have explicit control over the loans, they are likely to treat the loans as buy-downs. Since real estate brokers do not have similar formal control, they should be less able to capitalize the value.

The sample used in the first part of the paper to test for capitalization is used to determine if loans for new houses are capitalized at a greater rate than loans for resales houses. Since the prices paid \( (x_i) \) for the housing characteristics \( (x_i) \) should be the same for both new and existing houses (a Chow test indicates that we cannot reject the hypothesis that the differences in the coefficients are zero), the financing variables can be included in the regression model as separate variables. Thus the model is as follows:

\[
(13) \quad SP = \sum \alpha_i x_i + \beta_1 FHA + \beta_2 F_n + \beta_3 F_e,
\]

where \( F_n \) is the after-tax finance variable for new houses and \( F_e \) is the after-tax finance variable for existing houses. The parameters to be estimated are \( \alpha_i \) and \( \beta_i \).
Possible results and their interpretation are as follows:

(1) if MRB subsidies for new houses are capitalized, but MRB subsidies for existing houses are not, then it might be concluded that MRB subsidy capitalization is a result primarily of builders treating MRB loans as buydowns.

(2) if MRB subsidies for new houses are capitalized at a substantially greater rate than MRB subsidies for existing houses, then it might be concluded that a buydown effect contributes to the capitalization for MRB subsidies for new houses and that buydown effect may or may not contribute to the capitalization of subsidies for existing houses.

(3) if MRB subsidies for existing houses are capitalized at a greater rate than subsidies for new houses, then the rejection of the buydown hypothesis is supported.

(4) if the capitalization rates are the same for both MRB subsidies for new and existing houses, then no conclusions may be drawn. The capitalization rates may be the same because the buydown effect is equal for both groups, or because a buydown effect does not exist.

**The Results**

The regression estimates of the financial variable parameters in equation (13) are presented in table 6. The complete regression results are shown in appendix 2.

The estimated capitalization rate for resale houses is larger than the capitalization rate for new houses. However, a test of the null hypothesis that $F_e = F_n$ cannot be rejected ($t = .75$). Thus, the results indicate that there is no statistically significant difference between capitalization rates for new and resale houses.
### Table 6
ESTIMATED COEFFICIENTS FOR FINANCIAL VARIABLES AND CAPITALIZATION RATES:
Separate Estimates for New and Existing Houses

<table>
<thead>
<tr>
<th>Financial Variable</th>
<th>Thirty Year Holding Period</th>
<th>Seven Year Holding Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHA Loans (1=yes)</td>
<td>-513.6 (-0.22)</td>
<td>-499.8 (-0.22)</td>
</tr>
<tr>
<td>MRB Loan Variable (New Houses Only)*</td>
<td>-0.100 (-1.47)</td>
<td>-0.090 (-1.47)</td>
</tr>
<tr>
<td>MRB Loan Variable Resales Houses Only)*</td>
<td>-0.148 (-2.26)</td>
<td>-0.135 (-2.27)</td>
</tr>
<tr>
<td>Adjusted R-Square</td>
<td>.73</td>
<td>.73</td>
</tr>
</tbody>
</table>

| Capitalization Rate (New Houses Only)** | .093 (1.37) | .084 (1.37) |
| Capitalization Rates (Resale Housing Only)** | .134 (2.08) | .123 (2.08) |

*The variable is \([z(1-t)(-d-PD)\], see equation 5.
**The \(t\)-ratio is calculated using a Taylor expansion series.

The dependent variable is sales price plus points. \(t\)-ratios in parentheses.

The analysis in this section does not support or disprove the hypothesis that a buydown effect contributes to capitalization. The regression results provide some evidence that the subsidies for purchase of both new and existing houses are capitalized are the same rates. We have too little data to determine if a buy-down effect results in capitalization of subsidies for both new and existing houses, or if no buydown effect exists.
Do Households Receiving MRB Subsidies Purchase More Housing Services?

Recall it is presumed that the main purpose of MRB subsidies is to increase home ownership by paying the increment between what a household could pay (and presumably the maximum society thinks the household should pay) for a house, and what it would have to pay with a market rate loan. An effective subsidy reduces the household’s monthly payment to a percentage of its monthly income that is affordable and is considered appropriate by society for middle income families. The subsidy is supposed to induce a household to purchase a house while paying no more than a reasonable amount of its monthly income for the housing.

If the MRB subsidy is so carefully targeted so that it represents only the difference between unsubsidized and subsidized mortgage payments (plus capitalization), no part of the subsidy is used to increase housing consumption. However, if the MRB subsidy is distributed like a percent of rent voucher, a portion of the subsidy will be spent on additional housing. The subsidy reduces the price of housing, and will have both income and substitution effects.

This section is concerned with the question of whether MRB subsidies result in additional housing consumption (and thus have the characteristics of percent-of-rent vouchers). Any portion of the subsidy spent on additional housing consumption is not used to increase home ownership, thus decreasing the benefits of the subsidies. Also, the use of subsidies to increase housing consumption creates horizontal inequities. The few households re-
ceiving MRB loans are able to consume more housing that households with the same socio-economic characteristics who do not get the subsidies.

This examination of the housing consumption effects of MRB subsidies ignores the question of how the remainder of the subsidy is spent. The convenient and conservative assumption is that the remainder of the subsidy increases income only to the extent that households will spend no more than a socially-desirable percent of its monthly income on housing payments. The belief that households should pay only a certain percentage of income on housing implies that the rest of the income should be available to spend on other goods.

The Approach

Two methods are used to estimate the consumption effects—if any—of MRB subsidies. The first method is to determine the difference in sales prices paid by buyers with MRB loans and buyers with market rate loans, holding incomes constant. The difference in means is calculated using a paired sample.

Since sales price is equal to the amount of housing services \( (H) \) purchased by a household times the price of housing services \( (P_h) \), an increase in sale price indicates a proportional increase in \( H \) since unit prices are the same in a single market. However, since MRB buyers pay for a portion of the value of the subsidy, they will pay a higher sales price for a fixed amount of housing services. Thus, to determine if MRB buyers purchase more housing services than comparable buyers with market rate loans, sales prices must be adjusted to reflect the capitalized value of the
MRB subsidy.

The second approach is to estimate the income elasticity of demand in the Greater Little Rock housing market for buyers with market-rate loans, and then use the estimated elasticity parameter to predict the sales prices that households with MRB loans would have paid without the subsidies. The income elasticity, according to Mayo (1981), may be estimated by regressing the log of income on the log of sales prices:26

\[(13) \ln P_h H = \ln S = \alpha + \beta \ln Y\]

where \(P_h\) is the unit price of houses, \(H\) is the amount of housing services, and \(Y\) is income.

If the predicted sales prices—after accounting for capitalization—are greater than the actual sales prices, it may be concluded that households with MRB loans consume more housing services than households with the same incomes who do not have loan subsidies.

Income and price elasticities are further investigated using the methodology of the EHAP research by Friedman and Weinberg (1982). They exploit the fact that households in the percent-of-rent voucher program were assigned different percentage subsidies, or to a control group that had no subsidy. Thus, the percent of rent paid by the program—the subsidy \((\lambda)\)—varied from household to household. Following Friedman and Weinberg, the following model is used to estimate income and price elasticity for all households in the sample:

\[(14) \ln (P_h H) = \ln S = \alpha + \beta_1 \ln (Y) + (1 + \beta_2) \ln (P_h) + \beta_2 (1-\lambda);\]

Since \(P_h\) is unknown, but \(Y\) and \(\lambda\) are known, this model can
be estimated by:

\[(15) \quad \ln S = \alpha_1 + \beta_1 \ln Y + \beta_2 \ln (1-\lambda), \text{ where}\]

\[(16) \quad \alpha_1 = \alpha + 1 + \beta_2 \ln (P_h), \text{ and}\]

\[(17) \quad \lambda = 1 - (1-t)PDV_c / (1-t)PDV_m \geq 0\]

If the unit price of housing \((P_h)\) is constant and \(Y\) and \(1-\lambda\) are independent of \(P_h\), equation (16) may be estimated by OLS.\(^{27}\)

These assumptions appear reasonable for the sample used in this study. The loans were made during a limited period of time (within 1983), so \(P_h\) should not be changing due to shifts in market supply and demand that would be expected over a longer time. The value of \((1-\lambda)\) varies with the monthly changes in discount rate used to estimate the present discounted value of the subsidy. Thus, the subsidy value should be independent of the \(P_h\) unless \(P_h\) varies systematically with the market interest rate.

The Results

The first step in investigating whether MRB subsidies induce the purchase of more housing services was a comparison of average house sales prices for a sample matched by incomes. The results, shown in table 7, indicate that—holding incomes constant—households with MRB subsidies paid $2,894 more for houses (including the payment of points) than households with market-rate loans. The difference is statistically different from zero at a 10 percent level. Without including the points as part of the sales price, the difference is $569, but this result is not statistically different from zero.\(^{28}\)
Table 7  
DIFFERENCE IN MEANS OF MATCHED PAIRS  
Incomes and House Prices

<table>
<thead>
<tr>
<th>Variable</th>
<th>Market Loans</th>
<th>Mortgage Rev. Bond Loans</th>
<th>Mean Diff.</th>
<th>T-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Household Income (average)</td>
<td>$2,539 (684)</td>
<td>$2,540 (679)</td>
<td>$1.14 (42.8)</td>
<td>.26</td>
</tr>
<tr>
<td>House Price With Points (average)</td>
<td>$53,796 (14,727)</td>
<td>$56,692 (11,236)</td>
<td>$2,896 (1616)</td>
<td>1.79</td>
</tr>
<tr>
<td>House Price Without Points (average)</td>
<td>$53,179 (14,339)</td>
<td>$53,748 (10,639)</td>
<td>$569 (1550)</td>
<td>.37</td>
</tr>
</tbody>
</table>

If households with MRB loans pay—as indicated in the matched pairs—about $2,896 more for houses, capitalization of MRB subsidies accounts for a maximum of $1240 of this amount. Thus, these matched pairs indicate that buyers with MRB loans purchase housing services worth at least $1600 more than housing services purchased by buyers (with comparable incomes) who obtain market-rate loans.

These results with matched pairs can be tested with regression analysis. Estimating equation (13) with a sample consisting only of buyers with market-rate loans (N=72) yields the following coefficient estimates, t-ratios and R-square:

\[
\ln S = 5.964 + .6249 \ln Y
\]

(11.6) (9.42)

R-square= .56

The estimate of the sale price \( (P_{nH}) \) that would have been paid by households with an MRB loan in the absence of the subsidy is obtained by using the above coefficient estimates. Given the
coefficient estimates and the income of MRB buyers, the predicted sale prices can be calculated.

The predicted average sales price for MRB borrowers is $51,572 while the actual average sales price is $53,678, a difference of $2,106 (both predicted and actual include the payment of points). With a maximum of $1,240 paid to buyers for the loan subsidies (through capitalization), MRB buyers purchase over $800 more in housing services than other households.

Thus both the matched pairs and regression analysis support the conclusion that households with MRB loans respond to the subsidy by purchasing at least $800 to $1600 in additional housing services. Including the capitalization of the subsidy, households with an MRB loan pay an average of between $2,100 and $2,800 more for a house than they would have paid with a market rate loan.

The results of estimating equation (15) are as follows:

\[
\ln S = 6.56 + 0.547 \ln Y - 0.279 \ln (1 - \lambda) \\
(15.50) \quad (10.01) \quad (-2.25)
\]

These coefficients show a price elasticity of -.28 and an income elasticity of .55. This price elasticity is remarkably similar to the price elasticity in the EHAP precent-of-rent voucher research (see footnote 3). This similarity of price elasticities supports the conclusion that MRB subsidies are analogous to percent-of-rent vouchers.
Conclusion

This paper has addressed the question of whether behavioral responses to MRB subsidies lead to a decreased efficiency and a less equitable distribution of the subsidies. Specifically, the investigation examined whether a portion of the MRB subsidies is capitalized and whether the subsidy induces households to purchase a greater amount of housing services.

The first finding was that between 10% and 14% of the value of MRB subsidies was capitalized during 1983 in one urban market. The existence of capitalization in 1983 indicates that MRB subsidy capitalization in early 1982 in the same market was not the result of an inefficient "thin market;" capitalization continued after the number of transactions had returned to levels near the average for the preceding decade.

Further analysis showed evidence that the capitalization was at least partly the result of inefficient shopping by MRB loan recipients, indicating that the MRB subsidies have characteristics similar to percent-of-rent vouchers. The research is inconclusive about the question of whether a portion of the capitalization of subsidies can be attributed to the treatment of some MRB subsidies as buydowns.

The research results also show that households receiving MRB subsidies purchase more housing services than households with the same income who are provided no subsidies. This increased consumption, combined with the evidence of inefficient shopping, support the conclusion that the MRB subsidies are similar to percent of rent vouchers in their effects on the behavior of
consumers.

At least two policy implications can be drawn from these findings:

(1) MRB subsidies provide fewer home ownership benefits and have worse distributional inequities than previous research indicated. The behavioral responses to these subsidies tend to work against the stated purpose of increasing home ownership. Because of the capitalization and consumption effects, fewer households are assisted to become home owners and less of the money goes to "deserving" households--those marginal household actually needing assistance.

The results of this study indicate that over twenty percent--and as much as fifty percent--of the value of the MRB subsidies goes either to sellers or to buyers for purchase of housing services in excess of what they would have acquired with a market rate loan. Future evaluations of MRB programs should factor in the effects of capitalization and increased consumption when determining the benefits of the program. Also, the horizontal inequities resulting from the subsidies should be considered in the evaluations.

(2) It will be difficult to devise an MRB subsidy distribution system that does not have unwanted behavioral effects. If builders and real estate brokers control them, at least a portion of the value will be capitalized. If the subsidies are distributed through a neutral mechanism, they become like percent-of-rent vouchers, causing inefficient shopping and undesirable increases in consumption.
Perhaps the only way to reduce these effects is through some complicated and explicit regulation of subsidies so that they are given only to marginal buyers for purchase of a certain amount of housing services. Such regulation is contrary to the public-private arrangements for implementing the MRB programs, and might require much larger transactions costs.

In summary, the results of this research indicate that MRB subsidies serve less of a public purpose than previously indicated. The cost-benefit ratios previously calculated and subjected to heated debate overstated the program benefits because they did not include the effects of the subsidies on the behavior of consumers.
Footnotes

1. The Council of State Housing Agencies (CSHA) vigorously disputes the GAO conclusions that the costs of MRB programs far exceed benefits. The CSHA uses a different set of assumptions about the tax revenues lost through the tax deduction of interest on mortgage revenue bonds to produce estimates that, in fact, MRB program benefits exceed costs. See CSHA (1983).

2. The percent-of-rent voucher simply provides a subsidy \( s \) equal to a specified percent of a household's rent. The monthly subsidy amount is equal to:

\[ s = rR, \text{ where } r \text{ is the percent of the rent paid by the voucher and } R \text{ is the monthly rent.} \]

By definition, a household with a voucher may use it to subsidize any housing unit that the household chooses to rent (perhaps, limited by the requirement that the housing unit meet some minimum standards). Thus, the household can select the housing services that best satisfies its needs and is affordable.

A loan buydown is a type of creative house finance that has been used frequently in the 1980s. Typically, a builder makes a lump sum payment that prepays (buys down) the interest charges on a loan to purchase a house constructed by the builder. Most often, the lump sum payment reduces the interest rate paid by the buyer for a period of three years; in some cases, the interest rate is bought down for the entire loan term.

Like other forms of creative house finance the buydown loan is used to attract buyers. Both builders and sellers were more likely to offer favorable financing than to lower house prices to attract buyers.

3. The EHAP experiment showed a price elasticity of about -.21 for renters receiving a percent-of-rent voucher (see Friedman and Weinberg 1983:131). Since the price of housing services was reduced with the subsidy, households with percent-of-rent vouchers purchased additional housing services.

The effects of inefficient shopping were different in the two experiment sites, Pittsburgh and Phoenix. In Pittsburgh the estimated effect of inefficient shopping was about 7.2% of the house expenditure. The estimated effect in Phoenix was 17% of the house value (see Merrill 1983:151-154). These estimates are derived from an analysis of the residuals from hedonic price equations. Hanushek and Quigley (1982) question whether the data are sufficient to support these findings.

4. In California, it has not been rare for MRBs to be issued to finance the purchase of houses constructed by only one builder. See project descriptions in Connerly and Associate (1982).
5. An analysis of congressional hearings on mortgage revenue bond programs shows that the justification for the programs mentioned most frequently by supporters was that the programs help low and moderate income families buy houses. Other program justifications include: MRB programs (1) create jobs, (2) stimulate the house building industry, (3) stabilize/increase the local tax base, (4) conserve the housing stock, and (5) help meet the demand for affordable housing.

See U.S. House of Representatives, Committee on Ways and Means 1983 and U.S. Senate, Committee on Finance, Subcommittee on Taxation and Debt Management 1983.

6. Targeting the subsidy to the difference in what a household could pay and would have to pay presents many practical difficulties. For example, we have to determine how much a household could (or is willing to) pay each month for housing.

7. Note that if the MRB subsidy lowers the price of housing (i.e., neither the null model or buydown model describes reality), income and substitution effects will cause an increase in the consumption of housing and other goods.

This paper makes the following assumptions: (1) society prefers that moderate income households not spend more than some percentage, say 30, of its monthly income on house payments, and (2) that MRB subsidies reduce house payments from a level that was too expensive for individual households and required—from a social standpoint—that the household spend too much of its income on housing.

If we accept that there is some socially desirable maximum that a moderate-income household should spend on housing, we must accept the obverse: there is a socially desirable minimum percentage of income that should be available for non-housing goods and services. The convenient presumption of this paper is that the non-housing goods purchased as the result of any price subsidy do not create equity problems.

8. Would the seller charge the buyer a higher price or would the buyer be willing to pay a higher price if the buyer were able to find a "bargain" lender who would make a loan at 10 percent rather than a market rate of, say, 11.5 percent?

9. The assumption of a stable marginal tax rate implies that the buyer's assessment of the value of the MRB subsidy is based on his present tax rate, not the marginal tax rate for his permanent income. This assumption was more realistic in 1983 than in 1980 due to legislation that cut income taxes over a three year period and indexed the tax rates.

Each household's net taxable household income was calculated using gross household income, minus adjustments for the number of dependents and estimated non-housing deductions. Given the estimate of net taxable household income, the marginal tax rate
was obtained from the 1983 IRS schedule of tax rates for single and married households.

10. Clauretie (1984) notes the problem of simultaneity bias for seller financing. He points out the amount of the owner-financed loan (and thus the subsidy) is a function of the sales price. This model suggests the simultaneity exists for all types of below-market mortgage financing.

11. The dummy variable z sets the value of the after-tax MRB financing variable at zero for all market-rate loans. The purpose of this model is to estimate the change in sales price resulting from a one dollar change in the after-tax value of an MRB subsidy, holding constant other factors. The financial terms of market rate loans (except for the payment of FHA points by sellers) are not expected to affect the sales price. An FHA dummy variable controls for the effects of seller payment of FHA points on the house price.

12. The discount rate used in this study is the three-month moving average of the interest rate on fixed-rate conventional mortgages for new houses as reported in the FHA opinion survey. The three-month moving average was chosen because house purchase transactions are started well before the closing date of the loan. By including the two months prior to the loan closing it is possible to capture more precisely the market interest rates perceived by buyers.

The FHA survey is used instead of interest rates reported by the Federal Home Loan Bank Board (FHLBB) because of problems with the accuracy of the FHLBB rate during the period under study. Before September 1983, the FHLBB data on contract interest rates mixed both fixed and variable rates. Thus the rate any one month reflected not only changes in market rates, but also changes in the mix of fixed and variable loans. The FHA survey included only fixed-rate market loans.

In the early stages of this research, an alternative discount rate (Bank of America's mortgage interest rate for 30-year fixed-rate loans) was used. The regression results were consistently close to the results with the FHA survey discount rate.

The key to choosing a discount rate is to make sure that the rate reflects month to month changes in market rates. A close look at the effect of alternative discount rates on estimated capitalization rates shows that parameter estimates are robust across a wide range of discount rates (see Schwartz and Kapplin 1984).

13. Two alternative functional forms of the model were tested along with the linear form. Both log-linear and semi-log models were estimated. The capitalization parameter estimates for the semi-log model are consistent with the results from the linear model. However, the estimates of capitalization for the log-linear model are not statistically different from zero.
14. The capitalization rates estimated using the standard model (equation 1) are much higher than the capitalization rates estimated by the reduced form model. The standard model capitalization coefficients are as follows:

1. Cap. Rate (30-year holding period): 44%
   (t-ratio: 2.133; adjusted R-square: .73)

2. Cap. Rate (7-year holding period): .70%
   (t-ratio: 2.12; adjusted R-square: .73).

These estimates were made using the same control variables, including the FHA dummy, as in the reduced form model described in this part of the paper.

15. The average after-tax present discounted value of an MRB subsidy was $9,090 for loans held the full 30-year term and $5,624 for loans held for 7-years.

16. The program rules of the Arkansas Housing Development Agency permits builders to reserve for use of their customers up to 25% of the total bond loans.

17. Offers to buy a house may be made contingent on receiving MRB loans. Thus, buyers may offer higher prices for houses with MRB loans without committing themselves to pay the higher price if the purchase is financed with a market-rate loan.

18. In 1983, buyers with FHA-insured loans had high loan-to-value ratios and slightly favorable mortgage rates. Lenders, to obtain returns comparable to market rate loans, typically charged four to six points for making the FHA-insured loans. Since FHA rules prohibited buyers from paying more than one point, sellers had to pay additional points. Evidence supports the conclusion that sellers charged higher house prices to compensate for payment of these points (see Zerbst and Bruggeman 1977).

Zerbst and Bruggeman used the S/AP ratio as the dependent variable in their research into the capitalization of points paid by FHA sellers. The results of this paper are consistent with their findings.

19. Weinberg and Friedman (1982) and Merrill (1983) use the residuals from a hedonic price equation to investigate whether inefficient shopping exists. If the hedonic price equation is correctly specified and has all relevant variables, the residual is the portion of the price paid for the house that is more or less than the market value. A positive residual in this case is the payment in excess of the market value. A negative residual is an indication of a bargain—payment less than the market value.

Since it is quite likely some variables are omitted from the hedonic price model, the residual consists of two elements:
inefficient shopping and the marginal value of the omitted variables. Weinberg and Friedman attempt to separate the two effects.

20. The residual (as a proxy for shopping effect) is measured with error (i.e., it includes the effects of omitted variables), thus including the residual as an independent variable introduces bias into the coefficient estimations.

21. The results are affected by the capitalization of FHA points. The mean differences are understated because the capitalization of FHA points inflates the sales prices of housing financed by market rate loans.

22. The data used for the estimates in this section are a subsample of the data described in the first part of the paper. Only loans for which the asking price is known (n=95) were included in the sample.

23. Reserving funds from the AHDA is not the same as a buydown. The builder would pay to a lender about 1 percent of the amount of the MRB loan funds to be used by his or her customers. This money may be recovered from the borrower.

24. The null hypothesis is that $F_e - F_n = 0$, or simply that the parameter difference is equal to zero. The hypothesis would be rejected at a 5% significance level if $t_{0.025, 119} > 1.96$. See the discussion in Kmenta 1971:372.

25. The comparative capitalization of MRB subsidies for new and resale housing was also estimated with stratified samples. Separate regressions were completed using a sample with only resale houses (n=94) and a sample with new houses (n=54). The estimated capitalization rate for new houses was about 40 percent greater than the rate for existing houses. However, the capitalization rate for new houses was not statistically different from zero at a .10 level. The estimated capitalization rate for resale houses was statistically significant at the .10 level.

26. Mayo (1981:105) shows that equation (13) is derived from a Stone-Geary demand function. Citing Polinsky (1977), he points out that the elasticity estimates are subject to downward specification bias for intraurban data.

27. See the discussion in Friedman and Weinberg (1983:130) and Hanushek and Quigley (1981).

28. This estimate suffers from the continuing complications of FHA point capitalization. In the absence of this capitalization, the mean differences in house sales prices would be larger.
APPENDIX 1

The following are definitions of the variables used in the hedonic regression analyses:

Living area: square feet of enclosed space (excluding garage).
Lot size: size of the lot in square feet.
Age: age of the house in years.
Fireplace*: one or more fireplaces.
Extra garage*: two-car garage.
No garage*: no garage or carport.
Air conditioning*: central air conditioning.
Condominium*: dwelling unit is part of a condominium.
Baths: number of bathrooms.

Zip code*: dummy variables for location by zip code.
  72205: Little Rock suburbs near city center
  72207: Little Rock suburbs further from city center
  72218: North Little Rock central residential areas
  72209: Older Little Rock neighborhoods near central city
  72076: City of Jacksonville, northern Pulaski County
  72203: Mabelvale area; moderate income housing near major Little Rock shopping centers
  72216: City of Sherwood
  72211: Rapidly growing Little Rock fringe area.
  72204: Central Little Rock residential areas

Value: median house price in the census district in which the house is located. This variable accounts for the effect of the neighborhood on the house price.

Cedar*: house has a cedar exterior.
Brick veneer*: house has a brick exterior.
Siding*: house is covered by siding.

May–June*: house sale was completed during the May or June, 1983.
July–Aug.*: house sale was completed during these months.
Sept–Dec.*: house sale was completed after September.

FHA*: house sale was financed with an FHA-insured loan.
MRB finance variable: \([z(1-t)(-d-PDv_{m})]\)

*Dummy variables
## Estimated Coefficients

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**Estimated Capitalization**

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(t-ratios in parentheses)

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Estimated capitalization

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