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SUBSIDIES FOR REHABILITATING SINGLE-FAMILY DWELLINGS: A BENEFIT-COST ANALYSIS

BY

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A BENEFIT-COST ANALYSIS

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George C. Galster

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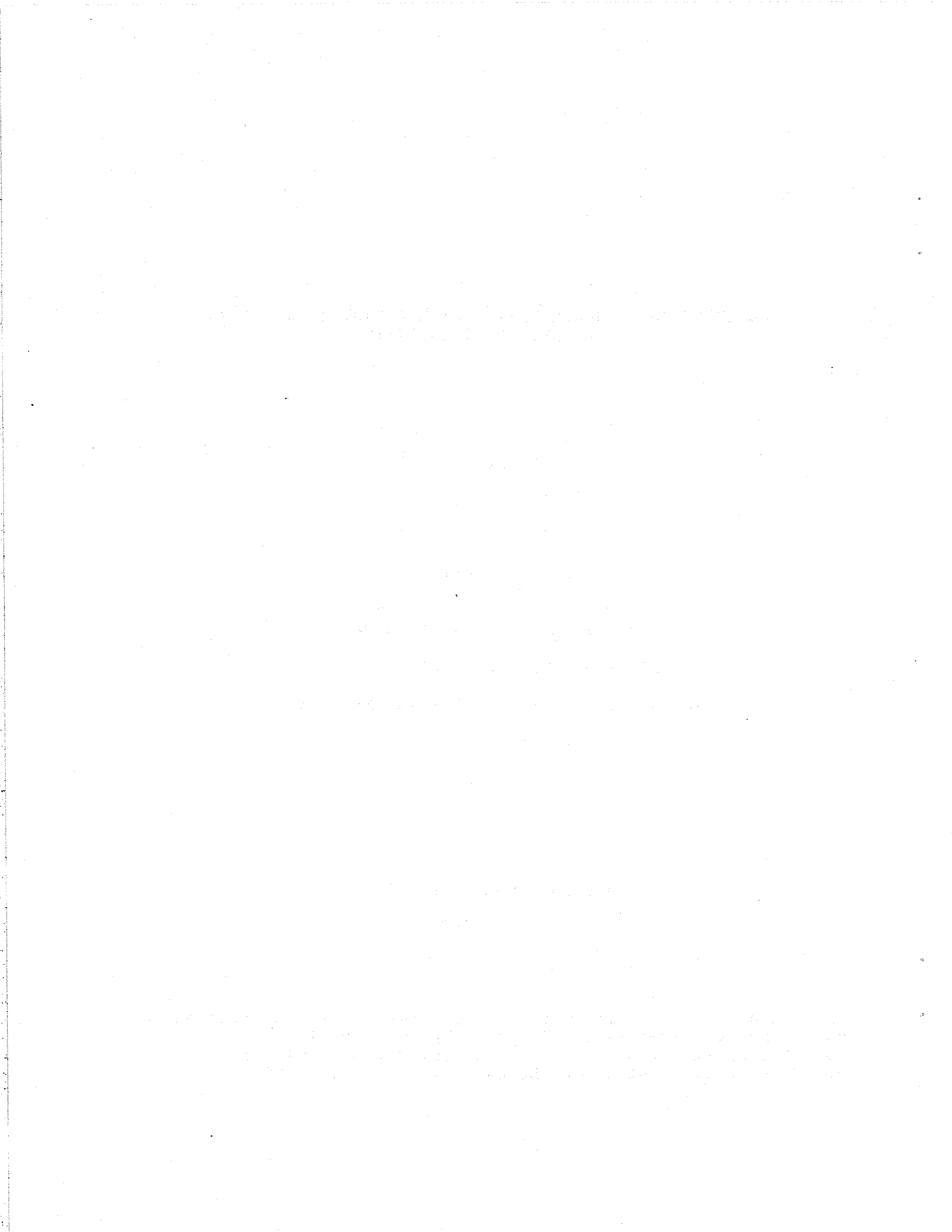
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Abstract

Subsidies for Rehabilitating Single Family Dwellings:

A Benefit-Cost Analysis

The research investigates the impact of two single-family
home rehabilitation subsidy programs administered by Minneapolis
from 1976-1980: grants and low-interest loans. Multivariate
statistical analysis of sampled homeowners reveals that for each
dollar of grant and loan received, ceteris paribus, participants
spent $1.62 and $0.345 more, respectively, of their own funds on
home upkeep, all expressed as annual averages for the period.
Nontrivial indirect effects on proximate homeowners' confidence in
the neighborhood and concomitant upkeep expenditures are also
observed: from $.10-.38 per dollar subsidy received by others on
the same block. These improvements in upkeep, in turn, create an
additional aesthetic externality benefit of perhaps as much as
$.50 per dollar subsidy.

Benefit-cost analyses employing alternative parameter values
are conducted. Results show that from the perspective of the
local public sector:

1. The grants program generally was net beneficial, with a
    plausible range of benefit/cost ratios of 2:1 to 10:1.

2. The no-interest, deferred repayment loan program
    generally was not net beneficial, unless loans were
    repaid within a few years. Only if one makes extremely

liberal benefit assumptions can one conclude that such
loans were net beneficial if repaid much beyond ten
years.

3. The low-interest, periodic repayment loan program
    generally was net beneficial, even when loans were repaid
    over a twenty year period, unless one makes extremely
    conservative assumptions about benefits.

4. The grants program was significantly superior in
    budgetary efficiency to any sort of deferred loan program
    in which loans were repaid over four years or more.
    Low-interest loans with periodic repayments up to ten
    years were superior in budgetary efficiency to grants,
    but only if very conservative assumptions are not made
    about leveraging and externality effects on property
    values. If interest on such loans was 8% and discount
    rates stayed in single digit ranges, loans repaid up to
    20 years were superior to grants, regardless of benefit
    assumptions.

Based on these findings, a variety of recommendations for formu-
lating housing rehabilitation policy are made, the central one
being a strategy for the optimal mixing of grant and loan packages
for recipients.

Subsidies for Rehabilitating Single Family Dwellings

A Benefit-Cost Analysis

There have been few rigorous analyses of the comparative benefits and costs of policies for subsidizing the rehabilitation of residential properties, in spite of the widespread sponsorship of such policies at all levels of government.[1] The cost of these subsidies is easy to quantify, but the benefits are more difficult to assess. Typically, the measure of "program productivity" employed has been the number of dwellings rehabilitated or private rehabilitation per dollar of public expenditure (Poister and Magoun, 1979; Swanson and Dukes, 1980; U.S. Dept. of H.U.D., 1984). Such conventional measures fail to consider, however, the degree to which: a) rehabilitation may have been forthcoming from private sources, even in the absence of public subsidies, and b) positive externalities and abetted investment optimism for neighbors proximate to the rehabilitated dwellings may have been generated.

The first goal of research reported here is to quantify for the first time these heretofore overlooked factors via regression analysis and then to employ them in a formal benefit-cost analysis. Subsidy policies employed by the city of Minneapolis, Minnesota, during the late 1970s to encourage homeowners to improve their dwellings are investigated for this purpose. Our second goal is to identify the conditions under which these

policies prove net beneficial, both from a social perspective and a local public sector budgetary perspective. Our third goal is to draw implications from these findings for the design of efficient housing rehabilitation subsidy programs.

I. HOUSING REHABILITATION SUBSIDY PROGRAMS IN MINNEAPOLIS

Although there were dozens of distinct housing-related programs operating in Minneapolis during the 1976-1980 study period,[2] this research focuses only on the six locally administered programs designed to encourage homeowners to rehabilitate their property: two involved grants, four involved loans.[3] In general, all programs were limited to correcting code violations, although a few in "targeted" areas could include energy conservation, exterior painting and other limited categories of improvements.[4] Eligibility for most programs was city-wide, except for a few administered under the aegis of CDBG which were focused only on Neighborhood Strategy Areas (NSAs). All programs had owner income eligibility guidelines, typically with a $18,000-$19,250 ceiling (approximately 80-85% of the city's mean income).

The grants were for a maximum of $6,000. The exception was the NSA "fix and paint" program, which specified a $100-$2,000 matching grant on projects from $200-$4,000. Loan maxima varied considerably across programs, with no loans made in excess of home market value less mortgage outstanding. Repayment schedules also varied programmatically; typically interest rates were 8% maximums but were income-graduated. About half of all loans were in the 6%-7% range through 1980 (MHRA 1980: Figure IV).[5]

Although an explicit delineation of the goals established specifically for the grants/loans program by the city of Minneapolis cannot be found in written form, other documents clearly suggest that the preeminent goal was the reduction in the number of substandard dwellings. Representative is the following statement by the Planning Department (City of Minneapolis 1980:26):

> Neighborhood appearance is important to Minneapolis residents. City policies should be directed toward remedying the problems identified in the [city-sponsored 1979] homeowner survey within each neighborhood... Concentrated programs targeted to these neighborhoods where the assessment [of the neighborhood as] "poor" was common are needed to combat relatively isolated conditions of blight.

In this paper we assume the same goal, and assess the social benefits of the grants/loans program in terms of its success in generating residential property rehabilitation and enhancing property values.

II. DATA BASE AND SAMPLING PROCEDURES

In order to analyze the impact of these rehabilitation subsidy policies, a multistage random sample of homeowners within the city of Minneapolis was drawn.[6] All 5079 blocks in the city were first identified. Then three exhaustive subsamples were designated according to whether the area encompassing the given block: a. had previously received urban renewal and/or CDBG funds; b. was eligible for CDBG funds but never had received such; or c. was never eligible for CDBG funds. Between 20 and 32 blocks were randomly selected from the three subsamples, corresponding to the proportion of the full sample each subsample represented.[7]

Eight owner-occupied homes were selected from each sample

block, using a consistently applied geographic sampling algorithm. The household heads of these dwellings were interviewed personally during the period July 1 to October 1, 1980. The questionnaire employed requested data about the occupying household's dwelling, personal characteristics, evaluations and expectations of the neighborhood, home maintenance/improvement history during the past five years, and participation in the aforementioned rehabilitation subsidy programs. 1980 Census data about the tract in which each dwelling was located were appended to the questionnaire data.

Restriction of the sample to homeowners in single-family dwellings and exclusion of missing response items provided a final sample of 434. Of these, 7.4% and 9%, respectively, received one of the aforementioned rehabilitation grants or loans during the previous five years. The average value of the reported grants received was $6,300; of loans it was $18,055.

III. ESTIMATING THE IMPACT OF REHABILITATION SUBSIDIES

    A. Program Benefits to Recipients and Non-Recipients

        1. Direct Leveraging Effects

        Clearly, one wishes to know the degree to which public subsidies serve to stimulate additional private rehabilitation investments. But this is impossible without first ascertaining what homeowners would have invested in the absence of the subsidy.[8] Such was accomplished here through the estimation of a multivariate regression model for the aforementioned sample which explains cross-homeowner variations in annual property upkeep expenditures.

The dependent variable in the model is the annual expenditure on home repairs and improvements.[9] Although the particular independent variables employed in the model are listed in detail in Table 1, suffice it to note here that numerous characteristics of the homeowner, the dwelling, and the surrounding neighborhood were included.[10] Of particular interest here are two variables denoting the average annual dollar value of rehabilitation grants and loans received by the homeowner during the past five years. Their coefficients will reveal the stimulation effect, if any, that these subsidies had on home upkeep expenditures. As reported in Table 1, the relevant coefficients, 2.62 and .345, respectively, indicate that homeowners spent $2.62 more for each $1 in grants they received and $.345 for each $1 in subsidized loans they received, ceteris paribus.[11] These figures are calculated as annual averages over the prior five year period (or for however long the owner had resided there, if less).

The stimulation effect implicit in these coefficients must be interpreted differently, depending on whether a grant or a loan is being considered. In the case of grants, the test is whether the coefficient is (significantly) greater than one. If the coefficient is less than one it means that the grant (partially) substituted for private investments that would have been forthcoming had the grant not replaced them. If the coefficient equals one it means that the homeowners spent the grant plus their originally intended expenditures, with no stimulation of private investment. But here the 2.62 coefficient means that the homeowners spent $1.62 more of personal funds (plus $1 of public funds) for each

dollar of grant received.

The average grant had an annual value of $1260, thus the average stimulus in _private_ upkeep spending was $2041 annually.[12] This is, indeed, a sizable direct "leveraging" effect.

In the case of loan recipients, the stimulation effect is revealed by a coefficient that is greater than zero. Because the loans (presumably) are repaid, they ultimately represent _private_ expenditures. As shown by Galster (forthcoming: Ch. 12) a subsidized loan encourages recipients to shift their intertemporal pattern of expenditures toward nearer-term periods, but does not increase the total amount of financial resources available over their entire planning horizon, as does a grant. Thus, if this intertemporal switching effect is minimal each dollar borrowed from the city will simply substitute on a one-for-one basis for homeowners' savings or loans from other sources, and the coefficient will be zero. But here the .345 coefficient indicates that for each dollar homeowners were able to borrow from the city they spent $.345 more on upkeep than if this option was unavailable to them. Since the average annual value of a subsidized loan was $3611, it produced an average annual private expenditure of $4857.[13]

That the coefficient for the loan variable proves statistically significant here means that three (non-mutually exclusive) possibilities transpired for recipients:

> 1. Some who otherwise would have undertaken only modest maintenance activities during the period were convinced to undertake major rehabilitation activities;

2. Some who otherwise would have undertaken upward
   conversion only during some future, unobserved period
   were convinced to advance spending toward the near-term
   and undertake it during the period under observation;

3. Some who otherwise would have undertaken rehabilitation
   during the period in any event re-invested some of the
   money they saved from the low-interest loan in other home
   upkeep activities during the period.

These conclusions correspond with the implications drawn from
Rafter's (1985) opinion survey of recipients of low-interest home
improvement loans in Wisconsin. He found that 50% of the recipi-
ents would have "delayed work" and 18% "never would have done the
work" in the absence of the subsidized loan. By contrast, only
13-14% would have used a private bank loan and 7% would have used
their own savings otherwise. In sum, there indeed appears to be a
substantial direct private upkeep stimulus generated by the loans
strategy that would not have been present in its absence.

2. Indirect Leveraging Effects

The previous section indicated that both grants and
loans succeeded in encouraging recipient homeowners to invest more
of their own funds in their homes than they would have otherwise.
But there may be an additional payoff from these policies which
manifests itself via the altered behavior of homeowners who do not
directly receive subsidies but live near those who do. Goetze
(1976), for example, has argued that "neighborhood confidence" can
promote home rehabilitation. To discover whether the Minneapolis

grant and loan programs succeeded in doing so, a separate regression model is specified. The dependent variable is a three item scale of pessimism concerning how the homeowner views the quality of the neighborhood changing in the next 1-2 years: 1=changes for the better, 2=no changes or offsetting changes, 3=changes for the worse. Independent variables attempt to proxy for a large number of characteristics of the homeowner and the neighborhood (see Table 2).[14]

Of central concern here is the dummy variable indicating if the neighborhood has been deemed eligible for Community Development Block Grant funding. Given income eligibility criteria for the Minneapolis rehabilitation subsidy programs, it is likely that virtually all qualifying homeowners will reside in these areas. Put differently, the coefficient of this variable will indicate whether residents in areas in which some homeowners are receiving rehabilitation grants are more or less pessimistic about their neighborhood, ceteris paribus.[15]

Ordinary least-squares estimates of this regression model are presented in Table 2. They indicate that pessimism is somewhat lower in areas which contain homeowners being granted rehabilitation subsidies.[16] And, as shown in Table 1, this alteration in outlook can be predicted to yield higher home upkeep investments. The combined result is that homeowners in areas where rehabilitation subsidies are being awarded demonstrate a $65 higher annual average of upkeep expenditures. Unfortunately, these results do not allow one to quantify precisely how the neighborhood expectations of one homeowner is related to the number and location of

rehabilitation grant/loan recipients in the surrounding area. But they do suggest that nontrivial sums of private expenditures may also be leveraged indirectly from those living near homeowners who participate in a moderately scaled public program, via their enhanced confidence in the future quality of the neighborhood.

Suppose, for illustration, that only one homeowner receiving a grant or a loan was sufficient to generate and maintain boosted optimism for other homeowners on the block, by the above amount witnessed across all aided areas. Given a block-face consisting of 15 homes, the above figures suggest an aggregate indirect leveraging of $910 annually per block, or $.38 per $1 grant or loan on that block.[17] If one is more conservative and assumes that it takes "targeting" of three aided homeowners before block-wide confidence is boosted (Swanson and Dukes, 1980; Varady, 1986), then one obtains an indirect leveraging effect of $.10 per $1 subsidy; a figure comparable to that estimated by Ginsberg (1983) and McConney (1985).

3. Property Value Effects from Leveraging

The prior two sections have indicated how sizeable amounts of private dollars are leveraged both directly and in-directly through the provision of housing rehabilitation subsi-dies. But in order to quantify their ultimate benefit their impact on enhancing property values must be considered. The means for doing so here involves first assessing how property values are affected by the presence of certain home defects, then estimating

how much expenditure would be required for the repair of such defects.

The former assessment is accomplished using yet another regression, in which Minneapolis single-family home property values[18] are regressed on the corresponding dwelling and neighborhood characteristics listed in Table 3. This is the conventional "hedonic" technique for disaggregating home values into its contributing components (see Diamond and Tolley, 1982). Focus here is on three dummy variables which denote the presence of home defects which typically are the intended target of rehabilitation subsidies: severe interior cracks or holes, exterior structural damages or peeling paint, and absence of central heat.

Parameters estimated via ordinary least-squares (see Table 3) reveal that a given property's value is reduced: 1) 21% by severe interior cracks or holes, 2) 5% by peeling paint or exterior structural damages, 3) 19% by the absence of central heat.[19] Using a representative $45,000 dwelling as benchmark[20], the above translate into a range of $2,000-9,000.

Precise information is not available to assess precisely the costs of repairing the above shortcomings. But general cost estimates suggest that the most conservative reasonable assumption would be that $1 worth of repairs of the above items improves the property's value by $1. The most liberal assumption would be that this ratio of repair/value dollars is 1:3.[21]

The alternative estimation of how repair expenditure is translated into increments in property value (call it M) may be combined with the alternative estimates of leveraging effects

(call it D) to give a plausible range of values for the leveraging benefits derived from the subsidies. This matrix of alternative parameter values is presented in Table 4. Using the most conservative assumptions (i.e., M=1:1 and D=direct leveraging effect only) each dollar of grants produced $2.62 in property value gains, and each dollar of loans produced $.345 in property value gains. The corresponding figures using the most liberal parameters (i.e., M=1:3 and D=direct plus indirect leveraging effects) are $9.00 and $2.175, respectively.

4. Property Value Effects from Externalities

The previous three sections have discussed programmatic benefits in terms of enhanced property values stemming from induced rehabilitation expenditures. There may be additional property value benefits as well which flow from the fact that such expenditures of both private and public funds undoubtedly have improved the physical quality of the residential environment. These positive externalities may also be measured via the regression model summarized in Table 3. Note that a 10 percentage point higher proportion of dwellings on the blockface needing exterior repairs and/or repainting would be associated with a 2.7% decrease in the value of each single-family home nearby. Taking as illustration a hypothetical blockface consisting of fourteen $45,000 homes and a fifteenth evidencing severe exterior deterioration, the model suggests that rehabilitating the latter home's exterior would yield an increase in aggregate blockface property values of $8505, or $3.54 per dollar subsidy, on average.[22]

Of course, virtually all the grants received by sampled homeowners were earmarked for correcting code violations, which typically do little for enhancing exterior condition. While more flexible in allocation, it is also unclear precisely how often subsidized loans were used to completely rehabilitate home exteriors, thereby generating the maximum positive externalities. Given this and the average size of subsidy received, we believe it reasonable to posit that externality benefits are, at most, $.50 in aggregate property value enhancement per $1 subsidy, and probably are considerably less (Varady, 1982; 1986).

5. Property Values and Social Benefits

Normally in a benefit-cost analysis involving the evaluation of a public capital project, one estimates the annual flow of benefits over the project's useful lifetime, then capitalizes the stream so as to obtain a present discounted value of benefits. In the case of home rehabilitation subsidies the task is simpler because the aforementioned increments to property values are precisely the desired proxy for present values of social benefits.

The ultimate social benefit here is the improved quality of life for the (present and future) occupants of the rehabilitated dwellings and their neighbors. Such improvements generate a fillip in housing demand for properties in the rehabilitated area which, in turn, is reflected in higher real property values. It is precisely the market's evaluation of the present discounted value of the enhanced stream of residential benefits flowing from

the rehabilitated areas that is represented in the observed increment in real property values.[23]   This use of property value gains as a proxy for social benefits is well established in the field; see, e.g., Rothenberg (1967), Chung (1973), Pines and Weiss (1976), Segal (1979), Diamond and Tolley (1982) and Brueckner (1983).[24]

In sum, the per subsidy dollar benefits (B) from either a grant or a loan may be expressed:

(1) $B = (V + W) + E = (M \times D) + E$

where V is the increment in value of the rehabilitated home per \$ subsidy received, W is the increment (per \$ subsidy) in aggregate values of neighboring homes whose owners invest more due to abetted optimism stemming from the subsidy program, D is the increment in aggregate home upkeep expenditure per \$ subsidy (i.e., the sum of direct and indirect leveraging effects), M is the increment in home value per \$ upkeep expenditure, and E is the increment in aggregate neighboring property values generated via rehabilitation externalities per \$ subsidy.

B. Program Costs to Society and the Local Public Sector

How one computes the costs of a public policy depends on one's frame of reference. When considering a broad, societal perspective a policy's costs are the opportunity costs of the real human and non-human resources which are consumed by the policy. In the context of home rehabilitation subsidies, social costs would involve primarily the labor and raw materials which were devoted to the actual rehabilitation actions, all valued at their

full social (i.e., market) value.[25] The distinction between

private vs. public <u>financing</u> of such resources becomes irrelevant.

On the other hand, if one takes the perspective of a budget-

conscious local public official, financing becomes of central

importance. From such a local public sector "budgetary view" the

cost is the ultimate budgetary allocation to the program.[26] Any

additional private funds which can be leveraged are counted as

"benefits." What is more, loans do not "cost" as much as grants,

since they are repaid and thus ultimately represent a smaller

budgetary impact.

More specifically, the budgetary cost (C) to the local public

sector of <u>each $1</u> rehabilitation loan with a simple interest rate

of I as applied to N equal principal repayment installments over T

periods (when first repayment occurs in period T-N+1) is:

$$(2) \qquad C = 1 - \sum_{t=T-N+1}^{T} ((1+I)^t/N)/(1+R)^t$$

where R is the discount rate... the opportunity cost of funds

loaned out. Ideally, R would represent the "maximum social

return" available from all alternative uses of the public funds.

Practically, this figure might be set at the interest rate which

could be earned by the local public sector should it invest in

safe financial instruments.

Although the budgetary cost of a loan is less than for a

grant since the former funds can be reinvested subsequent to

repayment, the present value of the repaid funds is reduced by the

difference in discount rate vs. loan interest rate. Thus, the

most "expensive" loan from the local public sector's perspective

is the deferred loan (when the only repayment is at the time of
home sale at T) at zero interest. In such a case (2) simplifies
to: $1 - 1/(1 + R)^T$. Perhaps the least "expensive" policy which
might still be considered a "subsidized loan" would be a loan at
8% repayable in T annual installments. These two extrema will be
employed to bound the estimates in the following benefit-cost
analyses. They are also representative of the range of programs
operating in Minneapolis in 1980. A more typical, "moderately
expensive" loan policy is also analyzed below: T annual install-
ments at 5% simple interest.

Both social and public sector views of costs have their own
validity, depending on the frame of reference chosen. Both will
be considered below in the benefit-cost analyses.

IV. BENEFIT-COST ANALYSES OF MINNEAPOLIS REHABILITATION PROGRAMS

A. The Social Perspective

From the perspective of the entire society, the benefit-
cost analysis is simple. Any program that encourages resource
investments in home rehabilitation will be net beneficial if the
aggregate gain in property values due to rehabilitation outweighs
the rehabilitation expenditures, i.e., if social benefits exceed
the value of the resources devoted. Symbolically, net benefits
will be positive if (M + E) is greater than one, i.e., if per
dollar of upkeep investment the aggregate value of the rehabili-
tated and adjacent properties increases by more than one dollar.

Given that the aforementioned range of estimates for M was
one or more, and for E was positive, the conditions for adjudging

both Minneapolis grants and loans programs as socially net benefi-
cial are fulfilled. Of course, one can not infer that such
programs represented the "best" use of resources, since other
housing programs (e.g., new construction subsidies) may have
proven even more net beneficial.[27]

B. The Local Budgetary Perspective

Of course, from the perspective of the local public
official, the above social benefit-cost analysis overlooks the
central question of relevance: which policy yields the biggest
programmatic "bang" per budgetary "buck." To answer this question
we must employ the differential leveraging benefits and the
differential costs of both grants and loans, as described in
section III above.

1. Grants

Since the budgetary cost of each dollar of rehabilita-
tion grant awarded during the current period is simply $1, the net
benefit estimation becomes an assessment of whether B in (1) is
greater than unity. Even if one is extremely conservative and
assumes: 1) rehabilitation expenditure translates into property
value at a one-for-one ratio (i.e., $M = 1$), 2) there are no
indirect leveraging effects (i.e., $D = 2.62$ = direct effect only),
and 3) there are no externality effects (i.e., $E = 0$), one obtains
benefit-cost ratios of over 2:1. The precise net benefits from
any particular grant will vary according to how the money is
expended; exterior improvements will abet E, but some interior
improvements better enhance the dwelling's own value per dollar

expended. In any case it seems safe to conclude that grants were extremely net beneficial from the perspective of the City of Minneapolis.

2. Loans

A somewhat more complicated benefit-cost analysis must be conducted for alternative types of loans, based on the benefits shown in Table 4 and the costs as given by equation (2). For each type, three alternative payback periods (T = 5, 10, 20 years), four alternative discount rates (R = .06, .09, .12, .15) and three alternative benefit estimates (B = .345, 1.50, 2.675) are considered. The benefit estimates range from those produced by most conservative assumptions (one-for-one expenditure to value ratios, no indirect leveraging, no externalities) to most liberal assumptions (M = 3, D = .725, E = .5, respectively), with a moderate estimate included for comparison as well.

First consider the benefit/cost ratios for the "expensive" (no interest, deferred) loan policy, as shown in panel A of Table 5. Estimates suggest that with a "moderate" benefit estimate (B = 1.5) such loans would not prove net beneficial if the loan was repaid over 10 years or more, unless discount rates were near 6%. Even with the most liberal assumptions about benefits, no-interest deferred loans repayed in 20 years would unlikely be net beneficial, unless discount rates were extremely low.

By contrast, the loans involving T repayments at either 5% or 8% simple interest have a much wider parameter range of net benefits.[28] Moderate benefit assumptions produce net benefits even with 20 year repayment schedules, given single-digit discount

rates (see panels B, C, Table 5).

The foregoing indicates that no definitive claims about the net benefits of any type of loan can be made without a clearer estimate of an appropriate discount rate. In terms of the situation facing the City of Minneapolis during the 1976-1980 study period, the opportunity cost of funds as represented by U.S. Treasury Department 3-5 year bond returns[29] ranged from 6.7%-11.6%, with an average of 8.6%.

So assuming a 9% discount rate was _apropos_, it is clear from Table 5A that, unless extremely liberal benefit assumptions are applied, no-interest deferred loans which were repaid much after 5 years were probably _not_ net beneficial.[30] On the other hand, the "moderately expensive" loans appeared to be net beneficial even when repaid over 20 years, unless extremely conservative benefits are assumed. And of course the "inexpensive" loans (Table 5C) appeared to produce large net benefits, regardless of benefit assumptions and repayment schedules.

3. Comparing the Relative Efficiency of Grants vs. Loans

The final benefit-cost analysis does not consider the absolute benefit/cost ratios of an individual policy, but rather contrasts the ratios for grants to those for loans. Such an analysis would be useful when, e.g., it has been determined that both programs are net beneficial, and the policy-maker is interested in "packaging" the mix so as to obtain the greatest pay-off.[31] The approach here is to take the ratio of the benefit/cost ratio (BC) for the grants policy (G) to the comparable ratio

for a particular loan policy (L). Symbolically:

$$(3) \quad BC(G/L)=[(MD_G+E)/(MD_L+E)] \ [1 - \sum_{t=T-N+1}^{T} ((1+I)^t/N)/(1+R)^t]$$

The expression (3) has strong intuitive appeal. It indicates that grants will only be superior to the given loan program if the higher direct leveraged expenditures of the former are not out-weighed by its higher budgetary costs. Values of BC greater than one indicate the relative superiority of grants.

The results of these comparative benefit/cost ratios given by (3) when grants are contrasted with the "expensive" loan program are presented in Table 6, panel A. Two sets of estimates are shown. One assumes no indirect leveraging or externalities,[32] the other (parenthetical) one assumes most liberal values for all parameters. Assuming a discount rate of 9% and conservative benefit assumptions, the analysis shows that during the 1976-80 period grants had a 2.66-6.24 times higher benefit/cost ratio (depending on period of repayment) than an interest-free, deferred loan. Even with liberal benefit assumptions which most favor such "expensive" loans[33], they only appear more efficient than grants when they are repaid in 1-3 years.

The results of the comparative analysis when grants are contrasted with the "moderately expensive" loan program are presented in panel B of Table 6. This shows a considerably larger region of superiority for loans, although it is highly sensitive to benefit assumptions. Assuming a 9% discount rate and liberal benefits most favorable to loans, grants are inferior unless the loans are not repaid within 18 years. The comparable repayment

period is only 7 years if indirect leveraging and externality effects are assumed to be nil, however. As for the "inexpensive" loan policy as shown in Table 6C, it appears relatively superior to grants, regardless of benefit assumptions and repayment schedules (assuming a 9% discount rate).

The conclusion is clear. Interest bearing/periodic repayment loans can be significantly superior to grants in producing net benefits to the local public sector, but such superiority is sensitive to the terms of the loan and to the assumptions made about leveraging and externality benefits. The more conservative one is about estimating any program benefits beyond those of direct recipients, the higher the interest rate the loan must carry (or, to a lesser extent, the faster it must be repaid) in order to remain superior to grants. Since most Minneapolis rehabilitation loans carried terms of 5-8% interest and 15-20 year repayment periods, it is likely that those involving the most generous repayment terms were a slightly inferior use of public funds compared to similarly sized grants (assuming moderate benefits and a 9% discount rate).

This conclusion provides a cautionary note to a conventional wisdom: loans are "cheaper" for the local public sector since the money is repaid and available for subsequent lending. Indeed, loans are "cheaper" in this sense, but they are also much less "beneficial" in terms of extra amount of private rehabilitation investment which they directly induce, over and above what would have been forthcoming in the absence of the policy. The superior cost characteristics of loans only outweigh their inferior benefit

characteristics when the loans are repaid over a short period and/or when they carry an interest rate near the discount rate. Otherwise, the future repayment streams are discounted too heavily to affect sufficiently the present values of the funds. Our estimates suggest that, in the case of Minneapolis in the late 1970s, loans with terms of at least 6% interest and 15-year or less repayment schedules were superior to grants, unless extremely small indirect benefits are assumed.

V. IMPLICATIONS FOR DESIGNING HOME REHABILITATION SUBSIDY POLICY

The programmatic implications echo from the analysis above. From a social perspective, either grants or loans likely produce comparable net benefits. From a local public sector budgetary perspective, however, the two do not produce equivalent results for the same expenditure. Neighborhood policy-makers should thus consider developing an "integrated" rehabilitation grant/loan program wherein the mix of grants and loans for individual applicants is varied so as to enhance public sector efficiency. The central principle of the scheme suggested here is to require that subsidy recipients who can afford to do so take out loans on terms which are more net-beneficial than grants, before any grants are given to the recipient.

Such a program might be administered as follows. First, as is typically done now, income eligibility guidelines and types of eligible property improvements would be established and a maximum interest rate and repayment period for rehabilitation loans set. Then, for each rehabilitation subsidy applicant one would need to

ascertain not only eligibility but also (presumably via the same documentation): 1. total value of eligible home repairs, or maximum subsidy (S) and 2. the maximum extra periodic payment s/he could "afford" (P). One reasonable guideline would be to set P so that total periodic housing expenses (utilities, mortgage payments, taxes, etc. plus P) equalled 30% of periodic income.

Now if P was not positive,[34] the entire expense (S) of requested (eligible) property improvements should be met by grants. Only a deferred loan would not exceed the periodic affordability constraint, yet Table 6A shows that such a loan package would more than likely offer inferior net benefits to a comparable grant. If P was larger, one would need to investigate whether any loan packages involving interest rate (I) and repayment period (T) could be designed which simultaneously: 1. did not exceed programmatic maxima for I and T; 2. produced periodic repayments of principal and interest less than P; and 3. involved (I,T) terms such that the relative benefit/cost ratio of the loan package exceeded that of a grant for the same principal (see Table 6). Obviously, if S was relatively small and P relatively large, it should be possible for the entire amount of the subsidy S to become the principal in a loan package which neither exceeded the affordability constraint of the recipient nor was so generous in terms that it rendered the loan inferior to a grant. For intermediate cases assessing the options would become somewhat more complicated, since the loan's principal, interest rate and repayment periods all could be varied so as to render a periodic repayment less than P and still satisfy the other two constraints.

If the resulting principal was less than the eligible subsidy S, the remainder would be tendered in the form of a grant.

The above administrative principles can be illustrated by a simplified hypothetical scenario. Suppose that a loan repayment period T has been fixed, with each of T periodic repayments consisting of that fraction of the subsidy loan principle (S_L/T) plus accrued simple interest $(1+I)^t$. Now the net benefit to the local public sector of this loan of amount S_L is simply the difference between per dollar B_L and C, as given in equations (1) and (2), multiplied by total S_L dollars (where $B_L = MD_L + E$):

(4)   Net Loan Benefit = $[B_L - 1 + \sum_{t=1}^{T} ((1+I)^t/T)/(1+R)^t] \, S_L$

Assume that the affordability constraint here is that the loan recipient can repay no more than P(t) dollars in principal and accrued interest on that principal per period t (i.e., a graduated repayment scheme):

(5) Affordability Constraint = $S_L (1+I)^t/T \leq P(t)$

If the policy-maker wishes to extract the maximum net benefits from the subsidy package, the optimal S package mix (S_L, S_G) must be determined. At first blush it might seem obvious to set I equal to program maximum and let $S=S_L$. But such might well produce such a high periodic repayment that (5) was violated. Given (5), the policy-maker must realize that the greater the share of the eligible subsidy devoted to S_L, the lower must be the I charged and, hence, the lower the net benefit gained from S_L. Furthermore, the extra or marginal net loan benefit gained by reducing I enough so that $1 more S_L can be afforded declines as

S_L rises. This can be seen as follows. The marginal net benefit is simply the partial derivative of (4) with respect to S_L, i.e., the bracketed term. But substituting from (5) we can rewrite this constrained marginal net benefit as:

(6) Marginal Net Loan Benefit $= B_L - 1 + \sum_{t=1}^{T} (P(t)/S_L)/(1+R)^t$

To optimize the (S_L, S_G) package the policy-maker should keep allocating dollars to loans until the <u>marginal</u> net benefit from doing so (as given by (6)) no longer exceeds the <u>marginal</u> net benefit gained by allocating a dollar to a grant $(B_G - 1)$.[35]

This algorithm can be usefully explicated with the aid of Figure 1. It shows various possible relationships between $ of marginal net benefits accrued by the local public sector and various sizes of rehabilitation subsidies, depending on whether the subsidy takes the form of a grant or a loan. The marginal net benefits obtained from giving a dollar of grant is shown by line BB; corresponding relationships for loan dollars are shown by the other lines. Line AA represents a situation where P is relatively large and thus each subsidy dollar lent can command a high I; line DD portrays an opposite situation.[36] Now if the relevant loan function was AA and S_4 was the total eligible subsidy, maximization of net benefits would suggest that all subsidy dollars be given as a loan. Since all parameter values except I are predetermined and S_L is now established, the interest rate on this loan could be computed via solving for I in (5). On the other hand, given S_4 but CC, optimization suggests that only S_3 of the total should be allocated to loans, and S_4-S_3 be allocated to grants.

Of course, if the eligible subsidy was lower, say S_2, then even with moderate marginal loan net benefits like CC it would be preferable to loan out the entire amount. Finally consider if affordability constraints were excessive, as in DD. In such a circumstance P would be too small to render a loan of any amount superior to a grant.

In this fashion the "integrated" strategy of grant/loan administration described above attempts to exhaust all possibilities of packaging some or all of the eligible subsidy in the form of a loan that is more net beneficial than a grant, before any grant component is given. Note the key difference here from the way grant/loan programs have been administered traditionally. Instead of dealing with recipient affordability constraints by making loan terms more generous, the above does so by tendering appropriate amounts of the subsidy as a grant. The clear advantage of doing so is that it avoids the issuance of loans which are inferior to grants in terms of net benefits to the local public sector.

Of course, other issues besides the above enhancement of benefit-cost ratios for the local public sector are relevant in the development of an optimal grant/loan policy. One is the degree of homeowner participation. Obviously, the success of any program depends on widespread participation by eligible homeowners. As would be suggested from above, the neediest applicants would receive a rehabilitation subsidy package comprised primarily of grants; and thus would likely evidence high participation rates. Survey evidence suggests that such grant programs are, in

fact, widely praised by lower income homeowners (Ahlbrandt and Cunningham 1979: Chapter 8). For subsidy packages involving larger loan components participation may be more problematic, and policy-makers should realize the inherent tradeoff here indicated by the benefit-cost analysis. Enhancing the attractiveness of the package (and thus, likelihood of participation) by extending repayment terms and reducing interest charges conflicts with the net benefit gained from such a loan. Experimentation is suggested in order to ascertain the appropriate tradeoff in each locale. There may be, in particular, a problem of nonparticipation among elderly homeowners, especially if they qualify only for predominantly loan packages. As shown by Galster (forthcoming: Ch. 8), their "asset-enhancing" motive for home investments is often eroded by their more frequent plan to "reside in the dwelling until death" and by their unwillingness to accrue more debt. One programmatic option may be to extend eligibility for grants by redefining "affordability" if the applicant is elderly.[37]

A second (and closely related) programmatic concern is political feasibility. Local fiscal austerity measures are so predominant that policy-makers may be reluctant to consider initiating or expanding the scope of housing rehabilitation grant/loan programs. But the foregoing benefit-cost analysis suggests strongly that a well-designed program can be touted as a fiscally prudent strategy. If the increases in program-generated property values are reflected in higher property tax assessments and, ultimately, revenues, it is not inconceivable that a rehabilitation program could be "self-financing." As illustration,

taking the most conservative assumption about grants benefits (B = $2.62), a reasonable assumption about property depreciation rates (3%),[38] the current Minneapolis effective property tax rate (3.8%), and a 9% discount rate, the present discounted value of the incremented stream of property tax revenues derived from each dollar of rehabilitation grant equals unity in 40 years. That is, if one takes a 40-year time horizon, each dollar of grant "repays itself." If one boosts the benefit assumption above to a modest B = $5, the pay-back period drops to less than ten years. Alternatively, the grants still could be self-financing over a longer period if properties were not reassessed upwards equal to B. Of course, capturing all program benefits via higher taxes may be fiscally enticing, but may once agin dampen program participation if pursued too vigorously (see Peterson et al., 1973). Ideally, grant/loan strategies could be pursued wherein benefit-cost ratios were so high that self-financing could occur while capturing only a fraction of the gain to homeowners.

A final concern is the appropriate scale of the rehabilitation policy. On the one hand, it is obvious that there is some logical point where "programmatic diminishing returns" set in and both the direct and indirect leveraging impacts and the neighborhood externalities wane as the most egregious home defects are rehabilitated. On the other hand, it is clear that in Minneapolis there remained substantial numbers of eligible homeowners with major rehabilitation needs which were not served by the program at its current scale. And the estimates provided by this research

suggest that there are opportunities for expanding grant/loan programs well beyond conventional scales which would nevertheless be significantly net beneficial and potentially self-financing.

These results contribute heavily to resolving the long-standing debate over the merits of housing improvement subsidies. Ahlbrandt and Brophy (1975)[39] and Clay (1979:79 and Ch. 7), e.g., have argued for the efficacy of this strategy. But others have suggested that this approach, by concentrating on a "four-walls" view of the residential environment, overlooks other key components of residential satisfaction and, hence, overall upkeep levels; see Ahlbrandt and Cunningham (1979: Ch. 12) and Leven, et al. (1976: Ch. 10).

The findings of this study reject the latter criticisms. Certainly, other contextual factors affect the individual home-owner's residential satisfaction,[40] but grants and loans nevertheless stimulate significant amounts of new upkeep activity independently of these contextual factors. Even more importantly, in a dynamic context this intensification of upkeep efforts should physically enhance and abet optimism about the overall neighborhood environment, thereby providing positive externalities beyond the "four walls" of the individual aid recipient. In summary, subsidized grants and low-interest loans for home improvements appear to be in a large number of contexts an efficacious strategy for stimulating homeowner upkeep efforts, if one may generalize from the results in Minneapolis.

VI. SUMMARY AND CONCLUSIONS

This paper first analyzed theoretically how the impacts of various rehabilitation grants and loan programs would vary, depending on the particular characteristics of the policy, the participants and their dwellings. Empirical estimates indicated that, in the case of the policies pursued by Minneapolis during 1976-1980, these impacts were to stimulate additional private upkeep expenditure over and above what would have been forthcoming in the absence of the subsidy. For each dollar of grant received, participating homeowners spent $1.62 more of their own funds, both expressed as annual averages. The comparable figure for loans was $.345. Besides this "direct leveraging" effect, the awarding of grants/loans to some homeowners in a neighborhood stimulated other nearby homeowners to augment their upkeep investments by an annual average of $65, since their confidence in the future quality of the neighborhood was abetted thereby. In addition, positive externalities were created for nearby households. Thus, it is transparent that, both directly and indirectly, grant and loan policies for subsidizing home rehabilitation can have significant effects on neighborhood quality.

Whether such policies represent a wise use of public funds was investigated through several cost-benefit analyses. From a broad societal perspective, both grants and loans seem to generate equal net benefits, with benefits outweighing costs by a probable maximum ratio of 3:1. From the perspective of the local public sector trying to maximize property values with the least public expenditure, important differences emerge between grants and

loans, however. From the analysis of the single-family housing rehabilitation grants and loans programs sponsored by Minneapolis during 1976-1980 one may conclude that:

1. The grants program generally was net beneficial, with a plausible range of benefit/cost ratios of 2:1 to 10:1.

2. The no-interest, deferred repayment loan program generally was not net beneficial, unless loans were repaid within a few years. Only if one makes extremely liberal benefit assumptions can one conclude that such loans were net beneficial if repaid much beyond ten years.

3. The low-interest, periodic repayment loan program generally was net beneficial, even when loans were repaid over a twenty year period, unless one makes extremely conservative assumptions about benefits.

4. The grants program was significantly superior in budgetary efficiency to any sort of deferred loan program in which loans were repaid over four years or more. Low-interest loans with periodic repayments up to ten years were superior in budgetary efficiency to grants, if very conservative assumptions are not made about leveraging and externality effects on property values. If interest on such loans was 8% and discount rates stayed in single digit ranges, loans repaid in up to 20 years were superior to grants, regardless of benefit assumptions.

If one can generalize from these results, they suggest that a

common view that loans are a more "fiscally responsible" means of stimulating neighborhood reinvestment is only true for a subset of loans possessing a certain range of repayment terms. What policy-makers should consider is developing an "integrated" rehabilita-tion grant/loan program wherein the mix of grants and loans for individual applicants is varied so as to enhance budgetary alloca-tive efficiency. The central principle of the scheme should be to require that subsidy recipients who can afford to do so take out loans on terms which are more net-beneficial than grants, before any grants are awarded. In such a fashion the subsidy can be "packaged" so as to enhance program net benefits per budgetary dollar, while simultaneously considering aspects of affordability and program participation.

FIGURE 1

Illustrative Marginal Net Benefit Functions for Grants and Loans
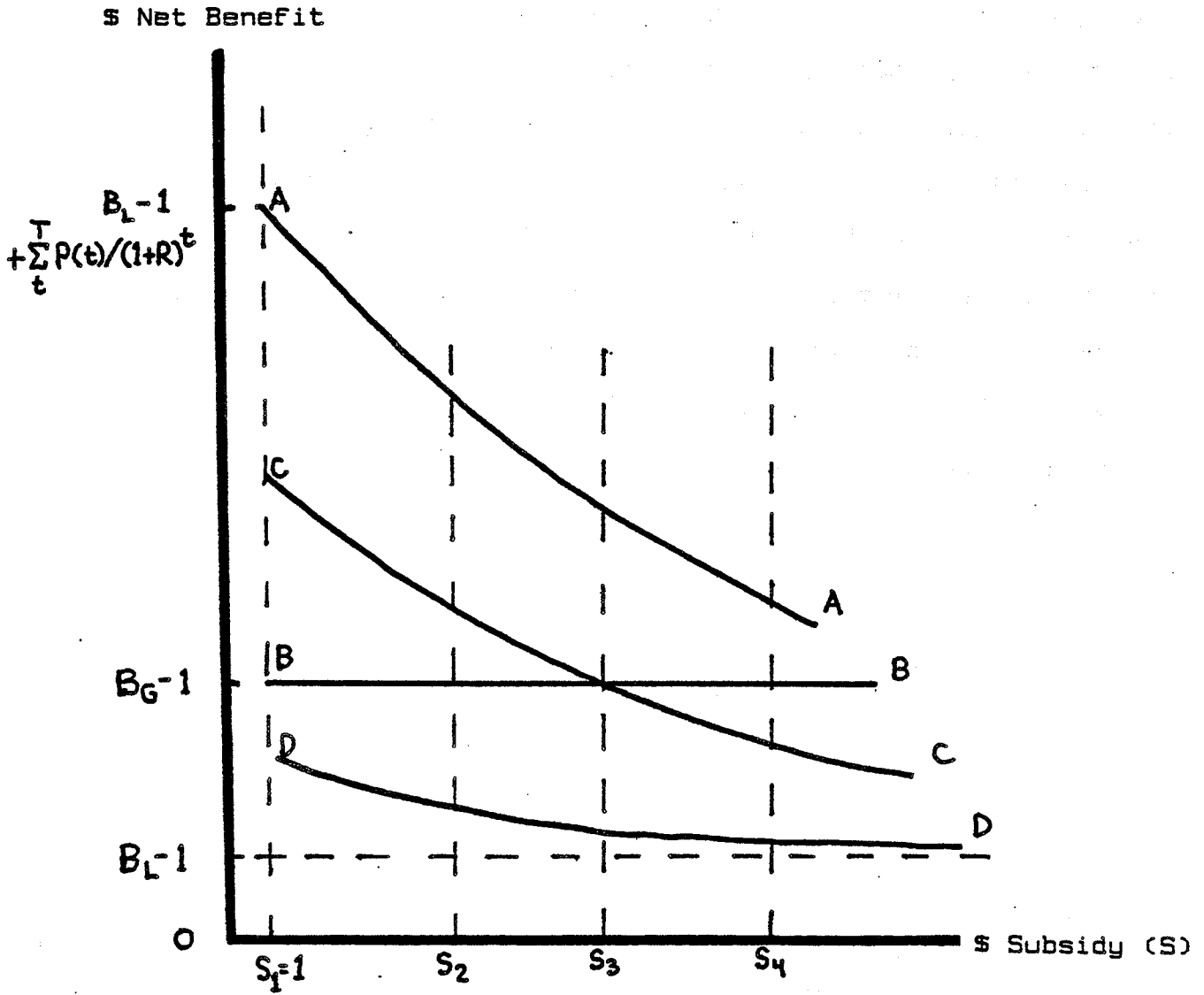### For Determining Optimal Grant/Loan Package

TABLE 1

Regression Results for Home Upkeep Expenditure Model

(Dependent Variable = annual average value of expenditures on home repairs, maintenance and improvements)

Homeowner Characteristic	Coefficient (t-statistic)	Neighborhood Characteristic	Coefficient (t-statistic)
Oldest Child in Home=0-4 yrs.	652.8 (1.33)*	Index of Block-face SES/Property Value	-123.0 (0.60)
Oldest Child in Home=5-14 yrs.	152.7 (0.30)	Index of Tract SES/Property Value	-232.0 $(1.71)^c$*
Oldest Child in Home=15+ yrs.	-203.3 (0.35)	Nonresidential Land Uses on Block-face	125.8 (1.53)*
Head Aged 45+ yrs.; No Child in Home	-712.1 $(1.65)^b$	Index of % Residing 10+ Years, Tract and Block	-210.7 (1.27)*
Income (less Mortgage Payments)	.024 $(3.23)^a$	Index of % Black in Block and Tract (White Respondents)	- 27.6 (0.83)
Education (Years Schooling)	58.3 $(1.30)^c$	Index of % Black in Block and Tract (Black Repsondents)	- 81.2 (1.32)*
Black Head of Household	452.6 (0.41)	Both Respondent and Aggregate Neighborhood:	
Married head of Household	674.9 $(1.91)^b$	Share Solidarity Sentiments	31.5 $(1.43)^c$
Female Head of Household	301.0 (0.66)	Have High Social Interaction	- 7.1 (0.24)
Total Number in Household	-283.0 $(2.54)^b$*		
Plans to Move in Next 2 yrs.	-328.5 (0.51)	Subsidy Policy Characteristic	
Plans to Move in 3-10 yrs.	346.0 (0.63)	Amount of Rehab. Grant Received (Average $/yr.)	2.62 $(8.21)^a$
Plans to Reside Here Permanently	111.8 (0.20)	Amount of Rehab. Loan Received (Average $/yr.)	.345 $(4.32)^a$
Professional Contractors Used for Upkeep	687.7 $(2.69)^a$		
Pessimism Index of Property Values	- 32.5 (0.20)		
Ibid., but Low Value Neighborhoods Only	-500.0 (0.90)	Intercept	1560. (1.11)
Pessimism Index of Neighborhood Changes	-553.6 $(2.03)^b$	R^2	.454
Ibid., but Low Value Neighborhoods Only	329.4 (0.41)	F (29,409)	9.6

a,b,c = coefficient statistically significant at 1%, 5%, 10% levels, respectively (one-tailed test)

* = two-tailed test if no predicted sign or opposite predicted sign

TABLE 2

Regression Results for Neighborhood Pessimism Model

(Dependent Variable = 3 item scale of pessimism regarding neighborhood changes)

Homeowner Characteristic	Coefficient (t-statistic)	Neighborhood Characteristic	Coefficient (t-statistic)
Oldest Child in Home=0-4 yrs.	-.597 $(2.31)^{b}$*	Index of Block-face SES/Property Value	.051 (1.39)*
Oldest Child in Home=5-14 yrs.	-.434 $(1.73)^{c}$*	Index of Tract SES/Property Value	.016 (0.43)
Oldest Child in Home=15+ yrs.	-.156 (1.51)*	Nonresidential Land uses on Block-face	-.361 $(2.30)^{b}$*
Head Aged 45+ yrs.; No Child in Home	.024 (0.29)	Index of % Residing 10+ Years, Tract and Block	.062 $(1.90)^{c}$*
Index of Alienation	-.011 (1.05)	Index of % Black in Block and Tract (White Respondents)	.009 (1.12)
Income (less Mortgage Payments)	7.8 E-7 (0.49)	Index of % Black in Block and Tract (Black Respondents)	.005 (0.38)
Education (Years Schooling)	-.006 (0.68)	Index of Aggregate Group Solidarity Sentiments (Block)	-.022 (0.30)
Black Head of Household	-.088 (0.41)	Index of Aggregate Group Social Interaction (Block)	-.030 (0.39)
Married Head of Household	.030 (0.44)		
Female Head of Household	-.002 (0.03)	Subsidy Policy Characteristic	
Index of Solidarity Sentiments w/ Neighbors	-.001 (0.04)	Area Qualifies for CDBG	-.166 $(2.12)^{b}$
Index of Social Interaction w/ Neighbors	-.022 (0.91)	Head Received Rehab. Grant	-.078 (0.89)
		Head Received Rehab. Loan	-.076 (1.08)
		Intercept	1.82 $(5.90)^{a}$*
		R^2	.097
		$F_{(24,414)}$	1.61

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a,b,c = coefficient statistically significant at 1%, 5%, 10% levels, respectively
    (one-tailed test)
* = two-tailed test if no predicted sign or opposite predicted sign

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TABLE 3

Regression Results for Property Value Model

(Dependent Variable = natural log of owner-assessed property value)

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Dwelling Characteristic	Coefficient (t-statistic)	Block-face Characteristic	Coefficient (t-statistic)
Central Air Conditioning	.022 (0.84)	Nonresidential Land Uses Present	.103 (1.29)*
Wood Clapboard Exterior	-.046 (1.61)^c	% Black	-.002 (2.89)^a
Lacks Central Heat	-.188 (3.03)^a	Mean Persons per Household	-.089 (2.48)^b*
Lot Size (1,000 ft.^{2})	.026 (3.55)^a	% Homeowners Residing 10+ Years Here	-.006 (4.54)^a*
Interior Holes or Cracks	-.211 (3.38)^a	% Dwellings Needing Exterior Repairs/Repainting	-.003 (3.12)^a
Enclosed Garage	.087 (2.47)^a		
Bathrooms (total #)	.113 (4.39)^a		
Exterior Damages, Peeling Paint	-.046 (1.13)		
Age of Dwelling (decades)	-.019 (3.33)^a		
Number of Rooms (excl. bathrooms)	.066 (7.29)^a		
Length of Occupancy by Owners (yrs.)	-.003 (3.71)^a		

		Intercept	10.11 (96.2)^a*
		R^2	.483
		F (18,536)	27.8

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a,b,c = coefficient statistically significant at 1%, 5%, 10% levels, respectively
        (one-tailed test)
* = two-tailed test if no predicted sign or opposite predicted sign

TABLE 4

Comparative Leveraging Benefit Assumptions: Grants and Loans

(Leveraging Benefit = M x D per $ Subsidy)

Increment in Home Upkeep $ Per $ Subsidy (D)

Increment in Value per $ Expenditure (M)	Grants		Loans	
	$2.62*	$3.00**	$.345*	$.725**
$1	$2.62	$3.00	$.345	$.725
$3	$7.86	$9.00	$1.035	$2.175

* Estimated direct leveraging effect only
**Estimated direct plus indirect leveraging effects = $.38

TABLE 5

Budgetary Benefit/Cost Ratios For Alternative Loan Policies
(Under Various Benefit Assumptions)*

A. "Expensive" Loans (assuming 1 loan repayment, at interest rate = 0)

Public Discount Rate (R)

Repayment Period (T)		.06	.09	.12	.15
5 Years Benefit:	.345	0.55	0.32	0.21	0.15
	1.50	2.3	1.37	0.92	0.67
	2.675	4.23	2.45	1.63	1.19
10 Years Benefit:	.345	0.31	0.19	0.13	0.10
	1.50	1.36	0.83	0.58	0.44
	2.675	2.42	1.49	1.04	0.79
20 Years Benefit:	.345	0.20	0.13	0.10	0.08
	1.50	0.87	0.59	0.44	0.36
	2.675	1.55	1.04	0.79	0.64

B. "Moderately Expensive" Loans (assuming T loan repayments, at interest rate = 5%)

Public Discount Rate (R)

Repayment Period (T)		.06	.09	.12	.15
5 Years Benefit:	.345	4.22	0.92	0.46	0.29
	1.50	18.33	3.98	2.02	1.28
	2.675	32.69	7.10	3.60	2.28
10 Years Benefit:	.345	2.34	0.53	0.28	0.18
	1.50	10.16	2.30	1.22	0.80
	2.675	18.11	4.11	2.17	1.42
20 Years Benefit:	.345	1.26	0.31	0.18	0.12
	1.50	5.49	1.35	0.76	0.53
	2.675	9.78	2.41	1.36	0.95

C. "Inexpensive" Loans (assuming T loan repayments, at interest rate = 8%)

Public Discount Rate (R)

Repayment Period (T)		.06	.09	.12	.15
5 Years Benefit:	.345	**	3.53	0.79	0.41
	1.50	**	15,36	3.41	1.77
	2.675	**	27.39	6.09	3.15
10 Years Benefit:	.345	**	1.96	0.45	0.24
	1.50	**	8.50	1.97	0.91
	2.675	**	15.17	3.52	1.89
20 Years Benefit:	.345	**	1.06	0.27	0.15
	1.50	**	4.59	1.15	0.66
	2.675	**	8.19	2.06	1.18

* Social planning horizon assumed = 20 years
**"Negative cost" policy since R < I

TABLE 6

Relative Budgetary Benefit/Cost Ratios: Grants vs. Loans*

A. "Expensive" Loans (assuming 1 loan repayment, at interest rate = 0)

Public Discount Rate (R)

	.06	.09	.12	.15
5 Years	1.92	2.66	3.21	3.65
	(.90)	(1.24)	(1.54)	(1.79)
10 Years	3.35	4.39	5.15	5.72
	(1.57)	(2.05)	(2.41)	(2.67)
20 Years	5.23	6.24	6.81	7.13
	(2.44)	(2.92)	(3.18)	(3.33)

B. "Moderately Expensive" Loans (assuming T loan repayments, at interest rate = 5%)

Public Discount Rate (R)

	.06	.09	.12	.15
5 Years	0.21	0.80	1.31	1.77
	(.10)	(.37)	(.61)	(.83)
10 Years	0.38	1.38	2.18	2.83
	(.18)	(.64)	(1.02)	(1.32)
20 Years	0.71	2.35	3.47	4.25
	(.33)	(1.10)	(1.62)	(1.99)

C. "Inexpensive" Loans (assuming T loan repayments, at interest rate = 8%)

Public Discount Rate (R)

	.06	.09	.12	.15
5 Years	**	0.21	0.78	1.28
	(**)	(.10)	(.36)	(.60)
10 Years	**	0.37	1.34	2.13
	(**)	(.17)	(.63)	(1.00)
20 Years	**	0.69	2.30	3.40
	(**)	(.32)	(1.07)	(1.59)

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* Assuming: M = 1, E = 0 and indirect leveraging effects = 0;
   parenthetical terms assume: M = 3, E = .5, indirect leveraging = .38

** Loan superior to grant since loan has negative cost (R < I)
   Note: calculations assume 20 year public sector time horizon and $E_L = E_G$

Notes

[1] For a description and analysis of some of these programs, see, e.g., Ahlbrandt and Cunningham (1979), Goetze (1979), Clay (1979), Struyk and Soldo (1980), U.S. Dept. of H. U. D. (1984), Vasady (1986).

[2] See M.H.R.A., 1980.

[3] Details of the six programs are available upon request from the first author.

[4] The grant programs are funded by both Minneapolis City (via C.D.B.G.) and the Minnesota Housing Finance Agency (M.H.F.A.) with the former being responsible for about two-thirds of total disbursements through 1980. The loan programs were funded by the above two sources, as well as the federal H.U.D. section 312 program, with disbursement ratios of 2:1:1, respectively, through 1980.

[5] In total, these grant and loan programs injected substantial funds into the Minneapolis housing market prior to the time of the survey. By the end of 1980, 8306 loans had been approved, totalling $59.5 million or $7,158 per loan, on average. A total of 3836 grants were made of $18 million cumulative value, or $4,685 per grant, on average.

[6] Details of this procedure are presented in Galster (forthcoming: chapter 4).

[7] Warwick and Lininger (1975) and Babbie (1973) indicate such sizes are sufficient for minimizing sampling error.

[8] For a microeconomic theoretical analysis of the impact of such subsidies on homeowner's housing investment behavior, see Galster (forthcoming: chapter 12).

[9] This is estimated from the survey as the previous year's expenditure on repairs plus one-fifth of the expenditures on improvements over the last five years (or pro-rated appropriately if the owner had resided there less than five years). Over 98% of the surveyed homeowners indicated positive upkeep expenditures by this measure.

[10] A fuller theoretical justification for these variables, a discussion of empirical findings, and a review of previous models of home upkeep is provided by Galster (forthcoming: chapter 9).

[11] Econometric tests were conducted to ascertain whether there was a significant degree of simultaneity between the grants/loans variables and the dependent variable of upkeep expenditure. Such might be the case if, e.g., unusually high expenditures observed in the early part of the sample period proxied for an (unmeasured) "proclivity to rehabilitate an exceptional degree" which, in turn, also resulted in the homeowner more aggressively searching out and obtaining rehabilitation subsidies. In such a circumstance the regression error terms would not be independent and coefficients of the subsidy variables would be biased. The test proposed by Hausman (1978) indicated, however, that the OLS specification was not inappropriate here.

[12] I.e., (2.62 x $1,260 grant) - $1,260 grant

[13] I.e., $3,611 loan + $1,246 induced private spending, where $1,246 = .345 x $3,611

[14] A fuller theoretical justification for these variables and discussion of empirical results is provided by Galster (forthcoming: chapter 7). Although OLS results are reported here, the model was also estimated using PROBIT techniques, and the quantitative results were nearly identical; op. cit.

[15] It is important to note that there is not a confounding effect provided by the impact of neighborhood-wide CDBG infrastructure investments on expectations. Preliminary analyses revealed that there was no difference in pessimism between homeowners in areas which had received sizeable CDBG infrastructure investments and those in areas eligible for such investments but not yet receiving any at the time of survey (see Galster, forthcoming: chapter 7). Thus, the only policy-related difference between CDBG-eligible areas and others was the amounts of rehabilitation grants/loans afforded to individual homeowners within them.

[16] Although the direct receipt of a subsidy does not abet the homeowner's confidence, however.

[17] I.e., $65/home x 14 homes affected = $910. The average per parcel expenditure for both grants and loans combined was $2,400.

[18] As assessed by the homeowner.

[19] These estimates are similar to those obtained in other research. Coefficients of hedonic index studies conducted for several cities (e.g., Butler, 1980; Galster, 1982) suggest that inadequate plumbing/heating or exterior dilapidation can reduce a single family home's value by at least 20% and 10% respectively.

[20] This represents the median of the lowest-valued third of

the sampled Minneapolis housing stock in 1980, and presumably is a typical value for a unit receiving a rehabilitation subsidy.

[21] Obviously, certain repairs and improvements manifest higher value enhancement/cost ratios than others; figures assumed here are for generic averages of repairs accomplished under the auspices of the Minneapolis programs. Note that the conventional belief that idiosyncratic, personalized home improvements need not necessarily translate into equivalent increments of value is not applicable here; we are dealing with basic repairs that typically involve correcting code violations.

[22] I.e., $607.50 per dwelling x 14 dwellings, with an average subsidy of $2,400 for the rehabilitated unit. Of course, the model is cross-sectional, and it is risky to infer from it to implicitly intertemporal projections. Indeed, Varady's (1982) review of the externalities generated by actual rehabilitation projects suggests that the magnitudes are considerably smaller than that estimated here.

[23] To the extent that information and capital markets are not perfectly efficient, the enhanced values will tend to understate the true benefits.

[24] Bartik (1986) has argued that tenants' benefits in improved areas must also be included, distinct from property value changes. Given their possible psychological ties to the area, tenants may not choose to move out even if areal quality (and associated rents) increases via rehabilitation beyond the optimal quantity they would choose to consume. As a result, there is a real loss in well-being for them. On the other hand, if the pre-rehabilita-

tion quality of the area was below their optimum, the quality increase could raise their welfare. Bartik shows that the sign and magnitude of these effects depend on renter preferences and initial neighborhood conditions. His simulations reveal that per tenant losses up to $35 annually and gains of over $24 annually are possible. Unfortunately, in the present model there are insufficient data to estimate this "Bartik effect," so it is assumed to be nil.

[25] Technically such social costs would also include the human effort involved in policy formulation and administration.

[26] Perhaps, even more narrowly, those funded only by local revenues.

[27] Randall (1976), e.g., found that new construction in Scotland generated a superior benefit-cost ratio than rehabilitation subsidies.

[28] The double asterisk values in column one of panel C indicate "negative cost" loans where they earn more interest than the discount rate ... a hypothetical possibility only.

[29] Such bonds are assumed to represent "riskless" investment opportunities.

[30] This result is ironic since the Minneapolis deferred loan program embodied an incentive whereby if the owner did not sell the home (and hence repay the loan) within 7 years after receiving the subsidy, only 50% of the principle need be repaid.

[31] Such is also relevant when a pool of funding has previously been earmarked for housing rehabilitation, but the allocation between grants and loans has not been established.

32 In which case the value assumed for M cancels out of (3), whatever it was assumed to be.

33 Since direct leveraging represents such a large fraction of total benefits for grants, the assumption of smaller indirect leveraging and externality effects works to favor grants over loans. In all calculations a public sector time horizon of 20 years and $E_L=E_G$ is assumed.

34 Or below some minimal amount below which one would not bother making a loan.

35 This principle is analagous to the situation of a price-discriminating monopolist selling in two separate markets, and is formally proven in any intermediate microeconomics text.

36 The marginal net benefit of loan function is not defined for $S_L=0$. But at $S_L=1$ it takes the value $B_L-1+ P(t)/(1+R)^t$. At high values of S_L the function approaches B_L-1 asymptotically.

37 A fuller treatment of options for aiding the elderly in home upkeep is given by Struyk and Soldo (1980: Chapter 8).

38 See Chinloy (1980).

39 The loans and grants supported by Ahlbrandt and Brophy (1975) are applied within the context of a Neighborhood Housing Services framework.

40 See, e.g., Galster and Hesser (1981) and Galster (forthcoming: chapter 6).

References

Ahlbrandt, Roger and Paul Brophy. (1975) <u>Neighborhood Revitalization</u>. Lexington: D.C. Heath/Lexington.

---------- and James Cunningham. (1979) <u>A New Public Policy for Neighborhood Preservation</u>. New York: Praeger.

Babbie, Earl. (1973) <u>The Practice of Social Research</u>. Belmont, CA: Wadsworth.

Bartik, Timothy. (1986) "Neighborhood Revitalization Effects on Tenants and The Benefit-Cost Analysis of Government Neighborhood Programs." <u>Journal of Urban Economics</u> 19 (March), 234-248.

Brueckner, Jan. (1983) "Property Value Maximization and Public Sector Efficiency." <u>Journal of Urban Economics</u> 14 (July), 1-15.

Butler, Richard. (1980) "Cross-Sectional Variation in the Hedonic Relationship for Urban Housing Markets." <u>Journal of Regional Science</u> 20 (Nov.), 439-453.

Chinloy, Peter. (1980) "The Effect of Maintenance Expenditures on the Measurement of Depreciation in Housing." <u>Journal of Urban Economics</u> 8 (July), 86-107.

Chung, H.C. (1973) <u>The Economics of Residential Rehabilitation</u>. New York: Praeger.

City of Minneapolis. (1980) <u>State of the City, 1979</u>. Minneapolis: Planning Department.

Clay, Phillip. (1979) <u>Neighborhood Revitalization</u>. Lexington: D. C. Heath/Lexington.

Diamond, Douglas and George Tolley, eds. (1982) The Economics of Urban Amenities. New York: Academic Press.

Galster, George. (1982) "Black and White Preferences for Neighborhood Racial Composition." American Real Estate and Urban Economics Association Journal 10 (Spring), 39-66.

----------. (Forthcoming) Homeowners and Neighborhood Reinvestment. Durham, North Carolina: Duke University Press.

---------- and Garry Hesser. (1981) "Residential Satisfaction: Compositional and Contextual Correlates." Environment and Behavior 16 (Nov.), 737-758.

Ginsberg, Ralph. (1983) Offsite Effects: Community Development Strategies Evaluation. Philadelphia: University of Pennsylvania.

Goetze, Rolf. (1976) Building Neighborhood Confidence. Cambridge: Ballinger.

----------. (1979) Understanding Neighborhood Change. Cambridge: Ballinger.

Hausman, Jerry. (1978) "Specification Tests in Econometrics." Econometrica 46 (Nov.), 1251-1270.

Leven, Charles, James Little, Hugh Nourse and R. Reed. (1976) Neighborhood Change: The Dynamics of Urban Decay. New York: Praeger.

McConney, Mary. (1985) "An Empirical Look at Housing Rehabilitation as a Spatial Process," Urban Studies 22 (Feb.), 39-48.

M.H.R.A. (1980) "Status Report." Housing Resource Department, Minneapolis Housing and Redevelopment Authority, City of Minneapolis.

Peterson, George, Arthur Solomon, Hadi Madjid, and William Apgar. (1973) Property Taxes, Housing, and the Cities. Lexington: D.C. Heath/Lexington.

Pines, David and Yoram Weiss. (1976) "Land Improvement Projects and Land Values." Journal of Urban Economics 3 (Jan.), 1-13.

Poister, Theodore and Anne Magoun. (1979) "Local Housing Rehabilitation Programs." Urban Affairs Papers 1 (Fall), 59-80.

Rafter, David. (1985) "Implementing Housing Rehabilitation Programs." Journal of Urban Affairs 7 (Spring), 47-64.

Randall, J. N. (1976) "The Costs and Benefits of Improving Older Houses." Urban Studies 13 (Oct.), 345-348.

Rothenberg, Jerome. (1967) An Economic Evaluation of Urban Renewal. Washington: Brookings Institution.

Segal, David. (1979) The Economics of Neighborhood. New York: Academic Press.

Struyk, Raymond and Beth Soldo. (1980) Improving the Elderly's Housing. Cambridge: Ballinger.

Swanson, D'Ann and Mary Dukes. (1980) "An Evaluation of the Allegheny County Neighborhood Preservation Program." Urban Affairs Papers 2 (Winter), 51-62.

U. S. Department of Housing and Urban Development. (1984) Rehabilitating Rental Housing: The Benefits and Costs of Alternative Approaches. Washington: U.S.G.P.O./H.U.D.-926-PDR(1).

Varady, David. (1982) "Indirect Benefits of Subsidized Housing

    Programs." <u>Journal of American Planning Association</u>. 48

    (Autumn), 432-440.

----------. (1986) <u>Neighborhood Upgrading: A Realistic

    Assessment</u>. Albany: SUNY Press.

Warwick, Donald and Charles Lininger. (1975) <u>The Sample Survey:

    Theory and Practice</u>. New York: McGraw-Hill.