Appendix – Not For Publication

Appendix A: Proofs & Other Notes on the Model

Proofs

Proof of Proposition 1. From the budget constraint of the pivotal voter, $C_i = \frac{I+\frac{A}{L}-\frac{p_G}{L}G}{p_C}$. Substituting it in the utility function, taking the derivative, and assuming symmetric equilibrium ($G^* = NG_i^*$) we get $F = -\frac{p_G}{Lp_C}U_C\left(\frac{I+\frac{A}{L}-\frac{p_G}{L}NG_i^*}{p_C}, G_i^*\right) + U_G\left(\frac{I+\frac{A}{L}-\frac{p_G}{L}NG_i^*}{p_C}, G_i^*\right) = 0$. Using the implicit function theorem, $\frac{\partial G_i^*}{\partial A} = -\frac{\frac{\partial F}{\partial A}}{\frac{\partial F}{\partial G_i^*}} =$

$= -\frac{-\frac{p_G}{L^2p_C^2}U_{CC}+\frac{1}{Lp_C}U_{CG}}{\frac{Np_G^2}{L^2p_C^2}U_{CC}-\frac{p_G}{Lp_C}U_{CG}-\frac{Np_G}{Lp_C}U_{CG}+U_{GG}} = \frac{\frac{p_G}{L^2p_C^2}U_{CC}-\frac{1}{Lp_C}U_{CG}}{\frac{Np_G^2}{L^2p_C^2}U_{CC}-\frac{(1+N)p_G}{Lp_C}U_{CG}+U_{GG}}$. Then, $\frac{\partial(p_GG^*)}{\partial A} = p_GN\frac{\partial G_i^*}{\partial A} = \frac{\frac{Np_G^2}{L^2p_C^2}U_{CC}-\frac{Np_G}{Lp_C}U_{CG}}{\frac{Np_G^2}{L^2p_C^2}U_{CC}-\frac{(1+N)p_G}{Lp_C}U_{CG}+U_{GG}}$. From here, we conclude that $\frac{\partial(p_GG^*)}{\partial A} > 0$ since $U_{CC} < 0$, $U_{CG} > 0$, and $U_{GG} < 0$. Also, $\frac{\partial(p_GG^*)}{\partial A} < 1$ since $\frac{Np_G^2}{L^2p_C^2}U_{CC} - \frac{(1+N)p_G}{Lp_C}U_{CG} + U_{GG} < \frac{Np_G^2}{L^2p_C^2}U_{CC} - \frac{Np_G}{Lp_C}U_{CG} < 0$. ■

Proof of Proposition 2. Just like in the proof of Proposition 1, the first order condition for the maximization problem of the pivotal voter is $F = -\frac{p_G}{Lp_C}U_C\left(\frac{I+\frac{A}{L}-\frac{p_G}{L}NG_i^*}{p_C}, G_i^*\right) + U_G\left(\frac{I+\frac{A}{L}-\frac{p_G}{L}NG_i^*}{p_C}, G_i^*\right) = 0$. Using the implicit function theorem, $\frac{\partial G_i^*}{\partial N} = -\frac{\frac{\partial F}{\partial N}}{\frac{\partial F}{\partial G_i^*}} =$

$= -\frac{\frac{p_G^2G_i^*}{L^2p_C^2}U_{CC}-\frac{p_GG_i^*}{Lp_C}U_{CG}}{\frac{Np_G^2}{L^2p_C^2}U_{CC}-\frac{p_G}{Lp_C}U_{CG}-\frac{Np_G}{Lp_C}U_{CG}+U_{GG}} = \frac{-\frac{p_G^2G_i^*}{L^2p_C^2}U_{CC}+\frac{p_GG_i^*}{Lp_C}U_{CG}}{\frac{Np_G^2}{L^2p_C^2}U_{CC}-\frac{(1+N)p_G}{Lp_C}U_{CG}+U_{GG}}$. Then, $\frac{\partial(p_GG^*)}{\partial N} = p_G\frac{\partial\left(NG_i^*\right)}{\partial N} =$

$p_G\left(G_i^* + N\frac{\partial G_i^*}{\partial N}\right) = p_G\left(G_i^* + \frac{-\frac{Np_G^2G_i^*}{L^2p_C^2}U_{CC}+\frac{Np_GG_i^*}{Lp_C}U_{CG}}{\frac{Np_G^2}{L^2p_C^2}U_{CC}-\frac{(1+N)p_G}{Lp_C}U_{CG}+U_{GG}}\right) =$

$$p_G\frac{\frac{Np_G^2G_i^*}{L^2p_C^2}U_{CC}-\frac{(1+N)p_GG_i^*}{Lp_C}U_{CG}+G_i^*U_{GG}-\frac{Np_G^2G_i^*}{L^2p_C^2}U_{CC}+\frac{Np_GG_i^*}{Lp_C}U_{CG}}{\frac{Np_G^2}{Lp_C}U_{CC}-\frac{(1+N)p_G}{Lp_C}U_{CG}+U_{GG}} =$$

$$= p_G\frac{G_i^*U_{GG}-\frac{p_GG_i^*}{Lp_C}U_{CG}}{\frac{Np_G^2}{Lp_C}U_{CC}-\frac{(1+N)p_G}{Lp_C}U_{CG}+U_{GG}} > 0 \text{ since } U_{CC} < 0,\ U_{CG} > 0, \text{ and } U_{GG} < 0. \quad ■$$

Outcomes Under Majority Rule

Model

In this section, we solve the model numerically, using the minimum winning coalition concept discussed in Baron (1991), instead of the universalism solution concept in the paper. As in Baron (1991), there are representatives from N districts. One representative is chosen randomly and asked to make a proposal on the total amount G of the public good and its allocation among the districts. After the proposal is made, each representative votes for or against the proposal. If the majority vote for the proposal, it passes. If the majority vote against the proposal, it fails, and the game repeats in the next period with a potentially new representative randomly chosen to make a proposal.

In order to solve for the amount of public good, we take the utility function of each representative to be constant elasticity of substitution: $U(C_i, G_i) = (\alpha_1 G_i^{\rho} + a_2 C_i^{\rho})^{1/\rho}$. The budget constraint is $I + A/L = p_C C_i + \frac{1}{L} p_G G$. We now introduce a discount factor between periods of the proposing game, δ.

Solution

The representative who makes a proposal (representative 1 without loss of generality) needs support of only $\frac{N-1}{2}$ other representatives. Therefore, he allocates G_1 to his district, G_2 to a randomly chosen $\frac{N-1}{2}$ other representatives, and 0 to the remaining $\frac{N-1}{2}$ representatives. Thus, our goal is to find the optimal G_1 and G_2 for representative 1 to propose.

Representatives who are allocated G_2 will vote for the proposal only if their utility from G_2 exceeds their utility from rejecting the proposal and going into the next period of the proposing game. The utility from accepting G_2 is $U(G_2, C)$. The utility of postponing the choice into the next period is discounted by δ and consists of three parts. First, with probability $1/N$ this representative might be chosen to make the proposal, thus, getting $U(G_1, C)$. Second, with probability $\frac{N-1}{2}\frac{1}{N}$, the representative will again get to vote for G_2, thus receiving $U(G_2, C)$. Third, with the remaining probability $\frac{N-1}{2}\frac{1}{N}$, the representative will not be chosen to receive the public good, thus obtaining utility $U(0, C)$. Note, that C is the same for all districts, since $C = \frac{I + A/L - \frac{1}{L} p_G G}{p_C}$ and depends only on the total amount of public good G. In equilibrium the proposed G_2 will be just enough to make the $\frac{N-1}{2}$ representatives receiving it vote for the proposal. This means that their utility today must be at least as large as tomorrow's utility:

$$U(G_2, C) = \delta \left(\frac{1}{N} U(G_1, C) + \frac{N-1}{2N} U(G_2, C) + \frac{N-1}{2N} U(0, C) \right). \tag{1}$$

The optimization problem that the proposing representative faces is to maximize $U(G_1, C)$ subject to (1). Ideally, one would be able to express G_2 in terms of G_1 from (1), then substitute this G_2 into C and maximize $U(G_1, C)$ as a function of only G_1. However, equation (1) involves the summation of three terms each in the power $\frac{1}{\rho}$ rendering the analytic solution impossible. To have some sense of the results, we solve the model numerically.

Numerical Results

For the numerical computation, we fix a number of parameters. We set $\alpha_1 = \alpha_2 = 1$ (equal weight is put on public and private goods in the utility function), $p_C = p_G = 1$ (the prices of private and public good are identical); $I = 100$ (income per capita is normalized to 100), $L = 10$ (population is 10), and $\delta = 0.97$ (discount rate is 0.97). For different values of ρ we compute the total amount of public good $G = G_1 + \frac{N-1}{2} G_2$ and let N, A and ρ vary. For fixed ρ, we examine council sizes (N) 3 to 19 and grant sizes (A) 10 to 100 (by 10). The resulting grid allows us to approximate the derivative of interest, $\frac{\partial^2 G}{\partial A \partial N}$, and check its sign.

We start with the case $\rho = -3$ (public and private goods are closer to being complements), presented in Appendix Table 1. Each cell in this table shows the total amount of public goods provided when $\rho = -3$ for a given combination of N and A. We can use these results to approximate the derivative $\frac{\partial G}{\partial A}$. To do so, for a given N, we subtract the value of G at $A = k$ from the value of G at $A = k + 10$. This is equivalent to subtracting the left column from the right column for each N. For a given N the values of this derivative are almost identical (subject to computation errors). This means that $\frac{\partial^2 G}{\partial A^2} = 0$, and so we report only one value for each N. The first row of Appendix Table 2 reports these values.

As N increases, $\frac{\partial G}{\partial A}$ increases, so $\frac{\partial^2 G}{\partial A \partial N}$ is positive, just like in Proposition 3 in the paper. We present the results for the same exercise when $\rho = -0.5$ in the second row of Appendix Table 2. Again, $\frac{\partial^2 G}{\partial A^2} = 0$ so we present only one value for each N. As when $\rho = -3$, $\frac{\partial G}{\partial A}$ increases with N, and thus $\frac{\partial^2 G}{\partial A \partial N}$ is positive. The final row of the table examines the case of $\rho = 0.5$. In this case, as N increases, $\frac{\partial G}{\partial A}$ decreases, and $\frac{\partial^2 G}{\partial A \partial N}$ is negative. Experimentation with other values of ρ suggests that $\frac{\partial^2 G}{\partial A \partial N}$ is positive for negative ρ and is negative for positive ρ. However, given that we examined only a limited set of parameter values, we do not claim to have proved this result analytically.

What does this dependence on ρ mean? As the number of districts increases, the representative making a proposal must divide the total amount of public good G among more districts, so his share of the public good, G_1, as well as the share that he allocates to other representatives, G_2, decreases. However, G_2 is allocated to a larger number of districts as their number increases, so the total amount of public good, $G = G_1 + \frac{N-1}{2} G_2$, could increase or decrease in N. In this minimal winning coalition framework, whether G increases or decreases depends on the elasticity of substitution in the CES utility function ($\varepsilon = 1/(1-\rho)$, so dependent solely on ρ).

When ρ is negative ($\varepsilon < 1$), the public and private goods are more complementary. Therefore, as the number of districts increases, the optimal choice for the proposing representative is to have C and G_1 move together, so as G_1 goes down, so does C. Since consumption decreases, the representative can afford not to bring down G_1 and G_2 by too much, and the total amount of public good increases with the number of districts.

When ρ is positive ($\varepsilon > 1$), the public and private goods are more substitutable. Therefore, as the number of districts increases, the first representative compensates for the decrease in G_1 by increasing C. Since consumption increases, both G_1 and G_2 decline further than they do for the case of negative ρ. In fact, they decrease so much that the total amount of public good, G, also decreases as the number of districts increases.

Appendix B: Verifying the Block Grant Formula

In order to verify that the CDBG program follows the legislated formula, we replicate annual grant allocations using the same publicly available data the Department of Housing and Urban Development (HUD) does in its own calculations. To do this, we relied heavily on HUD's excellent reports that detail the formula (Neary and Richardson, 1995; Richardson et al., 2003; Richardson, 2005).

We compare our constructed allocations to the "actual" data, both the annual designation of entitlement and the annual allocation for entitled cities and counties from the beginning of the program in 1975 to 2004. These actual data come from HUD: from 1975-2001 courtesy of Todd Richardson, and from 1993-2004 from a file on the HUD website (http://www.hud.gov/offices/cpd/about/budget/budget01/index.cfm).

First we attempt to identify entitlement jurisdictions. A city becomes an entitled city if it either (a) is in a metropolitan area and has a population over 50,000 in a given year[1], (b) is the principal city of a metropolitan area, or (c) has ever been an entitled city in the past for two consecutive years (after 1989 only).[2] This first population and metropolitan area criteria is measurable using decennial census data from 1975 to 1990 (see below for information on when data become available to HUD), combined with MSA status by county.[3] From 1990 to the present, the population and MSA status cutoff is measurable using Census population estimates for cities, which are publicly available. We do not use these data before 1990 because annual population estimates for cities are not available before 1990. The second condition, whether a city is a primary city of a metropolitan area, is not verifiable with publicly-available data. The census does not publish primary cities by metropolitan areas

[1]As does HUD, we use "metropolitan area" to refer to the variously-named Office of Management and Budget-defined metropolitan agglomerations, variously known as Metropolitan Statistical Areas, Core-Based Statistical Areas, New England Town Areas, etc.

[2]In practice, cities that receive grants once only very very rarely lose their entitlement status (email from Miller).

[3]For New England, MSAs are defined by town.

historically (they are defined by county for most of the country), nor are the employment data by city, which would be necessary for us to replicate the designation, publicly available.[4]

Using only the population criteria, we can correctly identify roughly three-quarters of actual entitled cities across all the sample years. Appendix Table 7 presents annually our ability to verify entitlement status for cities and counties. Though the total number of entitled cities has grown from 525 in 1975 to 913 in 2004, we consistently identify roughly 75 percent using the population-metro area criteria. Over time, our ability to idenfity entitled counties with the population criteria decreases from from 98 to 73 percent. For the rest of the verification process, we take entitlement status (as measured by HUD) as given, and construct allocations only for entitled jurisdictions.

To calculate the amount of the allocation for each jurisdiction, we begin with the total amount allocated by Congress (from Richardson (2005) for 1975-2002; HUD online data for 2003 and 2004). From 1982 onward, seventy percent of the total allocation was legislated for entitlement jurisdictions. Before 1982, the share mandated for entitlement jurisdictions was usually eighty percent, though it is unclear exactly what it was in each year. We assume eighty percent for all pre-1982 years. Our task is then to divide up this total allocation for entitled jurisdictions among entitled cities and counties. Though our paper does not focus on counties, we cannot calculate city shares without also calculating county shares as they both take pieces from the same pie.

Each entitled city and county's share is assigned via a formula. From 1975 to 1977, there was a single formula that allocated each entitled jurisdiction's share of the pie as

$$\text{grant}_c = \left((1/2)\frac{\text{pov}_c}{\text{pov}_{MA}} + (1/4)\frac{\text{pop}_c}{\text{pop}_{MA}} + (1/4)\frac{\text{ov crwd}_c}{\text{ov crwd}_{MA}}\right)$$

[4] Counties are entitled when they have a population of 200,000, excluding the population of entitled cities. In addition, there are six counties that received entitlement designation through special tweaks to the designation rules (Richardson 2003 p. C-1).

The index $c \in \{1, ..., C\}$ denotes a city (though this formula is identical for counties), and MA denotes all metropolitan areas (sum of values for all MSAs). The variables are *pov*, the total number of people with income less than the poverty line, *pop*, the total population, and *ov crwd*, or the number of people living in housing with less than 1.01 rooms per person.

Also from 1975 to 1977, actual allocations included grandfathered receipts from the prior program of application-based grants. We do not include these grandfathered amounts in our constructed allocations.

Starting in 1978, and continuing to the present, cities and counties were assigned grants based on the maximum of two formulae:

$$\text{grant}_{A,c} = \left((1/2)\frac{\text{pov}_c}{\text{pov}_{MA}} + (1/4)\frac{\text{pop}_c}{\text{pop}_{MA}} + (1/4)\frac{\text{ov crwd}_c}{\text{ov crwd}_{MA}} \right)$$

$$\text{grant}_{B,c} = \left((2/10)\frac{\text{growth lag}_c}{\text{growth lag}_{EC}} + (3/10)\frac{\text{pov}_c}{\text{pov}_{MA}} + (1/2)\frac{\text{age}_c}{\text{age}_{MA}} \right).$$

Here EC denotes all entitled cities.[5] The new variables are *age*, the number of housing units built before 1940, and *growth lag*, which is the lack of growth since 1960fs. During the two-formula era, a city's share is the maximum of the two shares above: $\max(\text{grant}_{A,c}, \text{grant}_{B,c})$.

HUD detests the growth lag variable because it is difficult to calculate and relies on information that must sometimes be estimated. It is meant to capture how much a city has deviated from the mean growth of all cities since 1960. We make our best approximation from publicly available data without reconstructing municipal border changes (which is what HUD does). In any given year, the numerator $growth\ lag_c$ for a city c is calculated by

$$\text{difference}_c = (1960 \text{ pop}_c * \frac{1}{C}\sum_{c=1}^{C} \text{growth rate}_c) - \text{pop}_c, \text{ and}$$

[5] Counties use the same formula, with the exception of the denominator for growth lag, which is replaced by the total growth lag in all entitled jurisdictions (cities and counties) (Richardson et al. (2003), p. 5).

$$\text{growth lag}_c = \begin{cases} \text{difference}_c & \text{if difference}_c \geq 0 \\ 0 & \text{if difference}_c < 0 \end{cases} .$$

An individual city's rate of growth is $(\text{pop}_c - 1960\ \text{pop}_c)/1960\ \text{pop}_c$. If a city's population in a given year is larger than its 1960 population times the average growth rate, it receives a growth lag value of zero. If a city's population in a given year is smaller than its 1960 population times the average growth rate, growth lag measures the number of extra people the city would have had, had it grown at the average rate since 1960.

The denominator for the growth lag variable for cities, $growth\ lag_{EC}$, is

$$\sum_{c=1}^{C} 1960\ \text{pop}_c * \frac{1}{C}\sum_{c=1}^{C} \text{growth rate}_c - \sum_{c=1}^{C} \text{pop}_c\ .$$

If a city has zero population in 1960, it has zero growth lag. Cities with no growth lag – those with no population in 1960 – do not go into calculating the denominator of the growth lag equation.

For counties, the growth lag situation is somewhat more complicated. Each county's initial 1960 population is the county's 1960 population minus cities that would have been entitled in 1960. The current year population is the county population minus the population residing in entitled cities. The mean growth rate is the growth rate of all entitled communities (unlike for cities, which just uses the mean city growth rate). Parallel to the cities, if a county grows more than the mean of all entitlement communities, it receives a growth lag value of is zero (Richardson et al. (2003), p. 5 and p. 56-7 for details). Note that county funds are to be spent on unentitled or unincorporated jurisdictions within the county.

These formulae assign a share of the grant pie in each year. In the years with the dual formula system, this system assigns more than the entire pie, so HUD reduces each entitled community's share, keeping the relative shares constant. Specifically, assignment is done following

$$\text{grant}_c = \left(\frac{\max\left(\text{grant share}_{A,c}, \text{grant share}_{B,c}\right)}{\sum_{j=1}^{C} \max\left(\text{grant share}_{A,j}, \text{grant share}_{B,j}\right)} \right) * \text{allocation} \tag{2}$$

The grant amount awarded, shown in Equation 2, is the city's grant share times the total allocation made available to entitled cities and counties by Congress. Since 1982, legislation guarantees entitled cities and counties 70 percent of the total CDBG allocation; before 1982, this share was 80 percent.

Following the description in Richardson et al. (2003), we use census data in the third year after the decennial census with which it is associated. For example, allocations in 2000, 2001 and 2002 are based on 1990 census data; only in 2003 are allocations updated with the 2000 census data. Because this accords with the majority of allocation updates (though not all), we keep this method. This method leaves less than one percent of actual entitled jurisdictions without data.

In rare cases, some cities choose to decline entitled city status in order to receive funds with an entitled urban county – usually this occurs when the county would fail to receive funds without the city's population. In general, cities are loath to do this, because there is no guarantee the county will allocate the city as much money as it would have gotten on its own. Six cities which would otherwise be entitled and receive grants choose to be part of entitled urban counties: Palm Bay, FL; Duluth, MN; Pharr, TX; West Jordan, UT; Bremerton, WA; Vancouver, WA; and Rapid City, SD. We calculate grants for these cities when they are entitled cities, but we drop them in all of our analytical work.

Our constructed allocations give a quite good match to the actual allocations for entitled cities, as shown in Appendix Table 8. Only in the first two years, which include some grandfathered allocations, is the correlation between the constructed allocation and the actual allocation less than 0.97. The average correlation across the thirty years of the sample is 0.98. We do not do quite as well for matching county allocations, but this is not a challenge to the estimation as the county allocations merely change the amount of funds available to entitled cities, not cities' relative shares.

Panels A and B of Figure 1 show the quality of the match for two years on a log scale so that all cities can be viewed. For both graphs, the line is the metaphorical 45-degree line, where all cities would lie if our constructed grant exactly matched the actual grant. The top panel of the figure shows our match in 1976, the year in which our constructed allocation is least correlated with the actual allocation. This is not entirely unexpected as this year – and the first 6 years of the program – included grandfathering from previous programs consolidated into the CDBG. Even so, in 1976 the correlation between the true and constructed grant is 0.88.[6] In 1995, shown in the bottom panel, the correlation is even stronger, at 0.98.[7]

The structure of the data suggest two potentially useful discontinuities for estimation: the introduction of new data in the formula, and the entry of new cities into the program. The first, a regression discontinuity approach as in Gordon (2004), would rely on plausibly exogenous changes in grants are caused by the introduction of new information to the grant formula when updated census information is introduced into the grant calculation. Unfortunately, this is not a productive route to examine changes in CDBG funds, as the size of changes induced by census updates averages only 2 percent of the grant. Changes in years affected by census updates are, on average, smaller than changes in non-affected years. The second approach would be to analyze program entrants separately. This also turns out not to be a promising margin along which to find variation. As Appendix Table 3 shows, most entrants arrive in the later years of the program, when both average funding and variation in funding are low.

Consolidated cities (e.g., Athens-Clarke County, GA or Nashville-Davidson, TN) receive

[6] The points along the x-axis are cities to which HUD allocated funds, but for which we do not observe information to construct an allocation.

[7] Further details on the quality of the match are in Appendix B.

funds as entitled cities.

Appendix C: Data Sources

Our dataset is at the city-year level, with observations from 1975 to 2004. Data comes from the sources listed below.

The decennial census data serve as the frame to which all other data are added

- Census

  - Decennial Censuses: City- and County-Level Data

    1970 Census , ICPSR 8109, 8107, 8129

    1980 Census Summary File 3A, ICPSR 8071

    1990 Census Summary File 3A, ICPSR 9782, save CA which is damaged; used file from UCLA ATS

    2000 Census Summary File 3, ICPSR 13342-13392

    Demographic information by Census place, and county

  - Decennial Censuses: Metropolitan Area-Level Data

    1970 Census , ICPSR 8109, 8107, 8129

    1980 Census Summary File 3C, ICPSR 8038

    1990 Census Summary File 3C, ICPSR 6054

    2000 Census Summary File 3 National, ICPSR 13396

    Demographic information by metropolitan area

  - Decennial Census, via City and County Databook

    1960 Census City-Level Data, cities 25000+ population, ICPSR 7735

    Demographic information by city and county

  - Annual Survey of Government Finances, Census of Government Finances

    Consistent-definition file received from Governments Division, Census Bureau

  - Population Estimates

Population estimates for cities (1990 onward) and counties (1975-2004), Census Bureau Population Estimates Division, http://www.census.gov/popest/estimates.php

  - Metropolitan Area Definitions

    Used definitions (counties/town for each MSA) used to report decennial census data

    Definitions dated April 27, 1973 (for 1970 Census), June 30, 1981 (for 1980 Census), June 30, 1990 (for 1990 Census), June 30, 1999 (for 2000 Census)

  - Municipal Institutional Characteristics

    Information on council size and other municipal institutional characteristics

    1987 Census of Governments, Organization File, Municipal Level

- Consumer Price Index

  Bureau of Labor Statistics, All Urban Consumers

- Tax and Expenditure Limits

  Advisory Commission on Intergovernmental Relations, 1995. *Tax and Expenditure Limits on Local Government.* Washington, D.C.

  Mullins, Daniel R. and Wallins, Bruce A., 2004. "Tax and Expenditure Limits: Introduction and Overview." *Public Budgeting and Finance* 24(2): 2-15.

- Community Development Block Grant Data Entitlement Jurisdictions

  - Annual Allocations, 1975-2001

    With thanks to Todd Richardson, HUD

  - Annual Allocations, 1993-2004

    http://www.hud.gov/offices/cpd/about/budget/budget01/index.cfm

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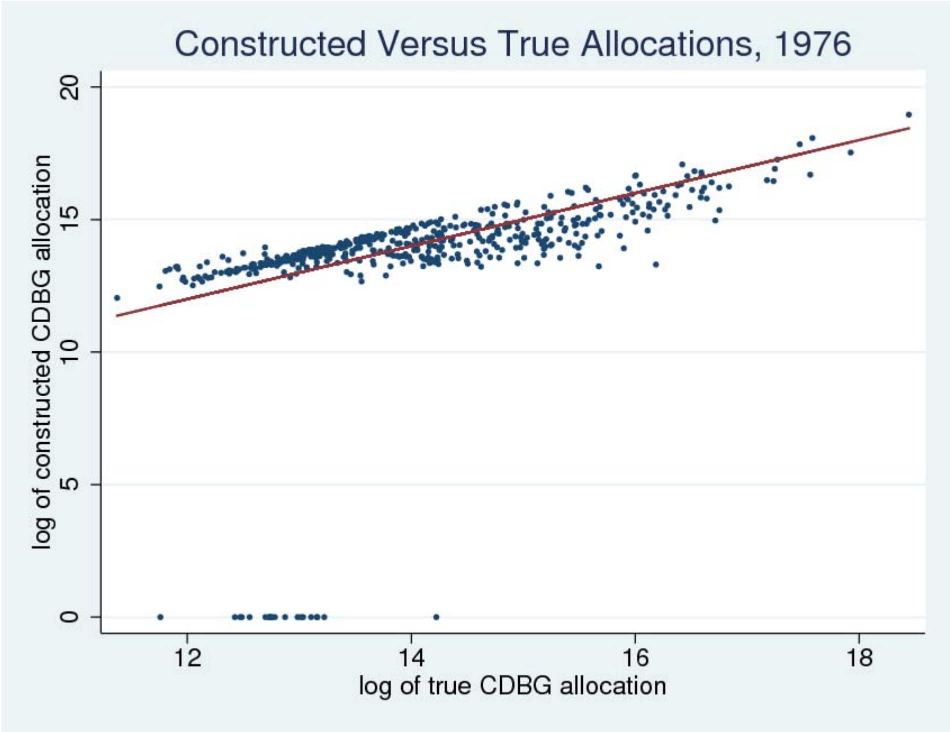
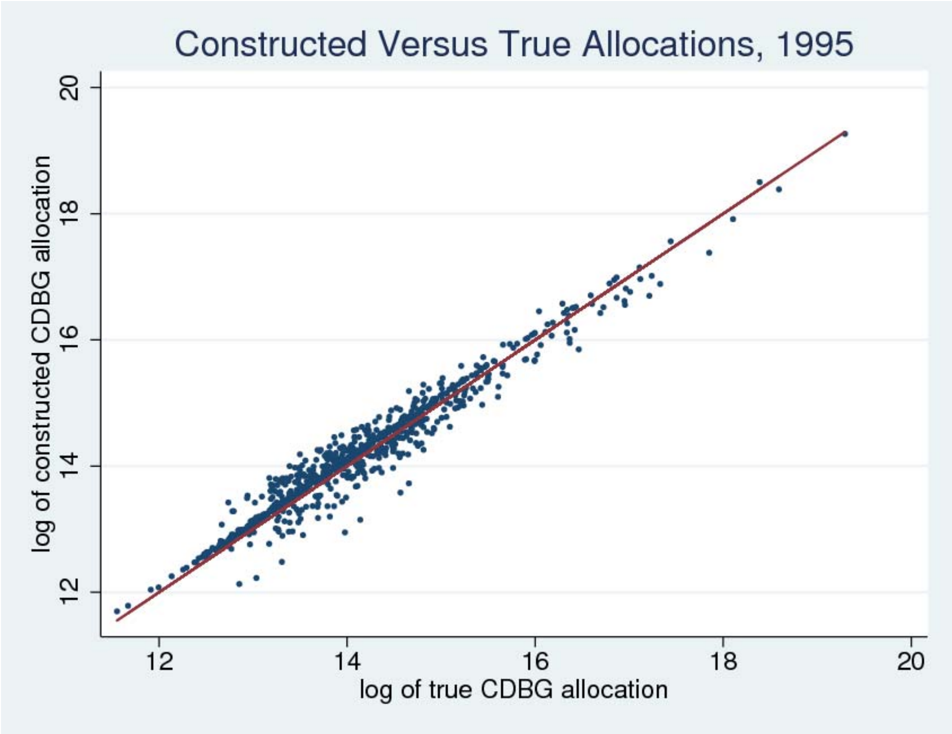
Conversations and emails with Sue Miller, Director, Entitlement Communities Division, Office of Block Grant Assistance, HUD, proved invaluable in understanding the workings of the CDBG program.

Appendix Figure 1: Verifying that CDBG Allocations Follow HUD's Formula

A



B



Notes: Constructed allocations are our estimates of a city's CDBG funds in a given year; "true" allocations are the grant funds reported by the Department of Housing and Urban Development.
Sources: See Appendix B.

Appendix Table 1 – Public Goods by Grant Level and Council Size

	Grant Amount (A)									
Council Size (N)	10	20	30	40	50	60	70	80	90	100
3	247	250	252	255	257	260	262	265	267	269
5	332	336	339	342	345	349	352	355	359	362
7	403	407	411	415	419	423	427	431	435	439
9	462	466	471	475	480	485	489	494	498	503
11	510	515	521	526	531	536	541	546	551	556
13	551	557	562	568	573	579	584	589	595	600
15	586	592	597	603	609	615	621	626	632	638
17	616	622	628	634	640	646	652	658	664	670
19	641	648	654	660	667	673	679	686	692	699

Notes: Results from numerical simulation of model under minimal winning coalition assumption and parameter values as detailed in Appendix A.

Appendix Table 2 – Change in Public Good Levels by Grant Size and Council Size

	Council Size (N)								
ρ	3	5	7	9	11	13	15	17	19
-3	0.25	0.33	0.40	0.46	0.51	0.55	0.58	0.61	0.64
-0.5	0.66	0.89	0.96	0.98	0.99	0.99	0.99	1.00	1.00
0.5	0.85	0.82	0.80	0.79	0.78	0.77	0.77	0.76	0.76

Note: This table presents $\partial G/\partial A$ for positive and negative values of ρ.

Appendix Table 3 – Grant Size and Recipients

	(1)	(2)	(3)	(4)
	per capita			
year	CDBG	Total Revenue	CDBG cities	Mean Population
1975	79.91	1,433.54	522	151.4
1976	80.51	1,537.98	523	151.3
1977	81.51	1,614.77	535	149.4
1978	76.97	1,639.66	547	148.0
1979	67.45	1,574.81	550	147.6
1980	57.84	1,435.62	560	142.9
1981	49.91	1,429.66	570	142.5
1982	40.66	1,450.17	621	134.8
1983	38.73	1,473.00	621	135.7
1984	35.75	1,529.13	669	129.3
1985	34.37	1,594.30	687	127.9
1986	28.63	1,675.94	692	128.3
1987	27.65	1,704.85	693	129.0
1988	24.92	1,676.15	717	127.7
1989	24.67	1,710.39	718	128.4
1990	22.36	1,705.94	722	128.5
1991	23.65	1,684.22	735	128.5
1992	24.08	1,727.89	736	129.7
1993	27.23	1,736.78	736	130.9
1994	28.35	1,766.61	781	127.2
1995	28.39	1,764.11	786	128.0
1996	26.69	1,822.40	791	128.7
1997	25.32	1,786.69	809	128.5
1998	24.00	1,911.58	814	129.2
1999	23.54	1,941.49	815	130.4
2000	22.46	1,953.79	830	130.1
2001	22.63	2,088.93	828	131.7
2002	21.88	1,882.69	837	132.6
2003	20.96	2,063.15	840	133.2
2004	19.86	2,136.20	900	128.4

Notes: Results are means for all CDBG recipient cities in a given year.

Sources: See Appendix B.

Appendix Table 4 – Distribution of Council Size

(1) Council Size	(2) Number of Cities	(3) Share of All Cities	(4) Cumulative Share
2	2	0.002	0.002
3	1	0.001	0.004
4	70	0.083	0.087
5	178	0.212	0.299
6	107	0.128	0.427
7	190	0.226	0.653
8	59	0.070	0.723
9	97	0.116	0.839
10	27	0.032	0.871
11	23	0.027	0.899
12	16	0.019	0.918
13	17	0.020	0.938
14	9	0.011	0.949
15	12	0.014	0.963
16	8	0.010	0.973
17	2	0.002	0.975
18	2	0.002	0.977
19	3	0.004	0.981
20	3	0.004	0.985
21	1	0.001	0.986
22	1	0.001	0.987
23	1	0.001	0.988
24	2	0.002	0.990
27	1	0.001	0.992
29	2	0.002	0.994
30	1	0.001	0.995
36	1	0.001	0.996
40	1	0.001	0.998
50	2	0.002	1.000
Total	839	1	

Appendix Table 5: Robustness – Grant Receipts and Total Revenues

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CDBG per capita	1.210***	1.228***	1.370***	1.157***	1.341***	1.214***	1.121***
	(0.304)	(0.303)	(0.252)	(0.270)	(0.252)	(0.304)	(0.297)
p-value, CDBG per capita equal 1	0.491	0.453	0.142	0.562	0.176	0.483	0.683
R squared	0.899	0.899	0.918	0.932	0.921	0.899	0.899
Obs	21,531	21,531	21,531	13,971	23,012	21,531	21,531
Maximal Covariates from Table 2	x	x	x	x	x	x	
Population to the 2nd, 3rd and 4th Power		x					
Other Intergovernmental Revenue			x				
Only Always-CDBG Recipients				x			
Maximal Sample					x		
Binding Tax & Expenditure Limits						x	
All Formula Variables to 2nd, 3rd, and 4th Powers							x

*** Significant at the 0.1% level. ** Significant at the 1% level. * Significant at the 5% level.
Standard errors in parentheses.

Notes: Standard errors are clustered at the city level. Set of maximal covariates are as described in the notes for Table 2.

Appendix Table 6: Impact of Alternative Institutional Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Power of the Mayor Relative to the Council			Type of Municipality	For Home Rule Cities Only			
		Form of Government						
	1 if Mayor is Directly Elected	1 if city is Council-Manager	1 if City is Mayor-Council	1 if City is Home Rule	Year of First Home Rule	Number of Council Members	At-Large Share of Council	1 if City is Mayor-Council
Interaction Specification								
CDBG pc	1.687***	1.464**	0.919**	1.462*	4.674	0.097	1.629**	1.226***
	(0.364)	(0.532)	(0.335)	(0.580)	(12.612)	(0.596)	(0.500)	(0.315)
CDBG * interaction var	-0.649	-0.517	0.584	-0.525	-0.002	0.131*	-0.93	-0.475
	(0.533)	(0.612)	(0.621)	(0.632)	(0.007)	(0.065)	(0.675)	(0.566)
Coefficient Comparison Specification								
<= 25th Percentile	n/a	n/a	n/a	n/a	1.353***	0.209	1.566*	1.226***
					(0.266)	(0.501)	(0.616)	(0.315)
> 25th Percentile					0.629	1.411***	0.889**	0.751
					(0.463)	(0.275)	(0.313)	(0.479)
p-value, difference					0.168	0.033	0.325	0.402
<= 50th Percentile					0.925**	0.807	1.663***	1.226***
					(0.338)	(0.425)	(0.427)	(0.315)
> 50th Percentile					1.280*	1.664***	0.628	0.751
					(0.504)	(0.417)	(0.400)	(0.479)
p-value, difference					0.553	0.148	0.076	0.402
<= 75th Percentile					1.150***	1.043***	n/a	n/a
					(0.290)	(0.315)		
> 75th Percentile					0.418	1.574*		
					(0.588)	(0.621)		
p-value, difference					0.259	0.442		
Observations	21,531	21,531	21,531	21,531	11,465	11,493	11,493	11,493

+ Significantly different from zero at the 10% level. *** Significantly different from zero at the 0.1% level. ** Significantly different from zero at the 1% level. * Significantly different from zero at the 5% level. Standard errors in parentheses.
Notes: See notes for Table 3.

Appendix Table 7 – Verifying Entitlement Status

	Entitled Cities			Entitled Counties		
year	Predicted	Actual	Predicted/Actual	Predicted	Actual	Predicted/Actual
1975	390	525	0.743	73	74	0.986
1976	393	526	0.747	74	76	0.974
1977	395	538	0.734	76	79	0.962
1978	397	550	0.722	77	82	0.939
1979	398	553	0.720	79	85	0.929
1980	397	564	0.704	79	86	0.919
1981	400	574	0.697	80	87	0.920
1982	401	625	0.642	80	97	0.825
1983	469	626	0.749	87	99	0.879
1984	474	678	0.699	90	105	0.857
1985	484	694	0.697	94	108	0.870
1986	490	697	0.703	96	117	0.821
1987	497	698	0.712	96	116	0.828
1988	503	722	0.697	98	122	0.803
1989	512	723	0.708	99	122	0.811
1990	520	727	0.715	99	126	0.786
1991	526	743	0.708	101	126	0.802
1992	537	743	0.723	101	132	0.765
1993	576	741	0.777	102	134	0.761
1994	580	785	0.739	102	136	0.750
1995	593	791	0.750	102	139	0.734
1996	600	798	0.752	104	140	0.743
1997	611	816	0.749	104	142	0.732
1998	619	821	0.754	107	146	0.733
1999	627	822	0.763	109	148	0.736
2000	632	837	0.755	110	150	0.733
2001	639	839	0.762	111	153	0.725
2002	645	844	0.764	112	159	0.704
2003	693	853	0.812	121	160	0.756
2004	701	913	0.768	121	165	0.733

Appendix Table 8 – Evaluating the Match

	Cities				Counties			
Year	Entitled	Allocation Constructed	Share Calculated	Corr: Constructed & Actual Allocation	Entitled	Allocation Constructed	Share Calculated	Corr: Constructed & Actual Allocation
1975	525	504	0.960	0.869	74	52	0.703	0.633
1976	526	505	0.960	0.882	76	55	0.724	0.759
1977	538	515	0.957	0.958	79	57	0.722	0.899
1978	550	550	1	0.991	82	63	0.768	0.639
1979	553	553	1	0.993	85	64	0.753	0.709
1980	564	564	1	0.994	86	66	0.767	0.766
1981	574	574	1	0.994	87	66	0.759	0.779
1982	625	625	1	0.994	97	74	0.763	0.791
1983	626	626	1	0.986	99	76	0.768	0.950
1984	678	678	1	0.993	105	80	0.762	0.965
1985	694	694	1	0.992	108	82	0.759	0.966
1986	697	697	1	0.992	117	88	0.752	0.965
1987	698	698	1	0.992	116	87	0.750	0.964
1988	722	722	1	0.992	122	94	0.770	0.955
1989	723	723	1	0.991	122	94	0.770	0.955
1990	727	727	1	0.994	126	97	0.770	0.957
1991	743	743	1	0.994	126	97	0.770	0.954
1992	743	743	1	0.994	132	100	0.758	0.952
1993	741	741	1	0.979	134	100	0.746	0.945
1994	785	785	1	0.977	136	103	0.757	0.940
1995	791	791	1	0.984	139	104	0.748	0.961
1996	798	798	1	0.984	140	106	0.757	0.964
1997	816	816	1	0.983	142	108	0.761	0.964
1998	821	821	1	0.984	146	112	0.767	0.965
1999	822	822	1	0.983	148	114	0.770	0.968
2000	837	837	1	0.991	150	113	0.753	0.978
2001	839	839	1	0.990	153	115	0.752	0.983
2002	844	844	1	0.989	159	123	0.774	0.984
2003	853	852	0.999	0.979	160	127	0.794	0.979
2004	913	910	0.997	0.979	165	128	0.776	0.983