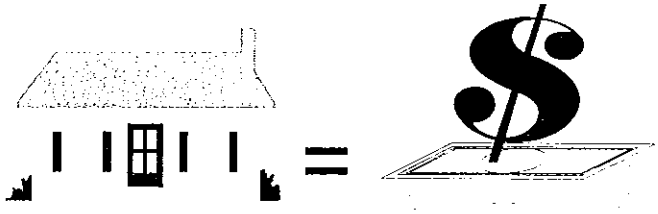
NAHB

THE METRO AREA IMPACT OF HOME BUILDING IN CHESTERFIELD COUNTY, VIRGINIA

INCOME, JOBS, AND TAXES GENERATED



Prepared by the Housing Policy Department

November 2007

National Association of Home Builders
1201 15th Street, NW
Washington, DC 20005
202-266-8398

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COMPARING COSTS TO REVENUE FOR LOCAL GOVERNMENTS

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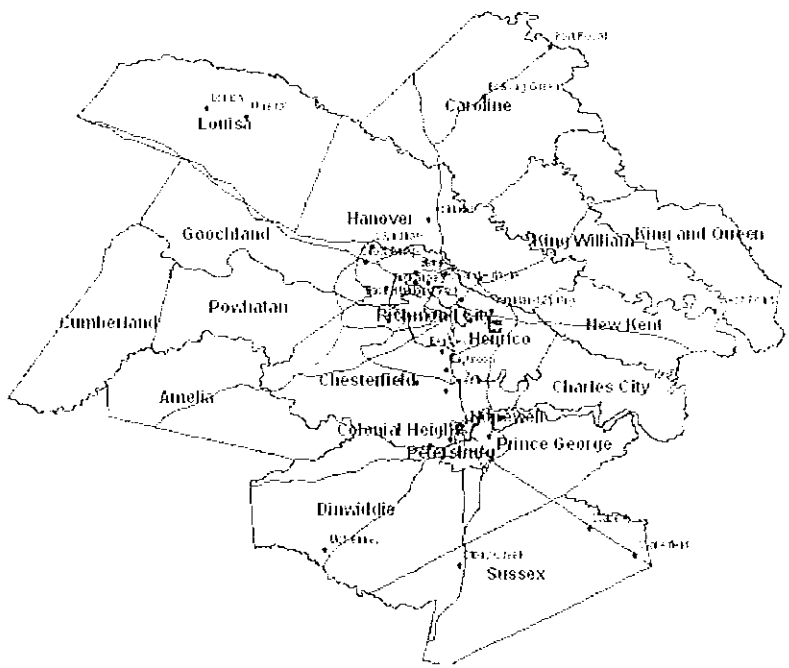
Introduction

Home building generates local economic impacts such as income and jobs for local residents, and revenue to local governments. It also typically imposes costs on local governments—such as the costs of providing primary and secondary education, police and fire protection, and water and sewer service. Not only do these services require annual expenditures for items such as teacher salaries, they typically also require capital investment in buildings, other structures, and equipment that local governments own and maintain.

This report presents estimates of the metro area impacts of home building in Chesterfield County, Virginia. The report presents estimates of the impacts of building 2,014 single family and 426 multifamily housing units, based on the level of construction in Chesterfield County in 2006.

The local economic benefits generated by this level of home construction activity are reported in a separate NAHB document.[1] This report presents estimates of the costs—including current and capital expenses—that new homes impose on jurisdictions in the area and compares those costs to the revenue generated. The results are intended to answer the question of whether or not, from the standpoint of local governments in the area, residential development pays for itself.

Figure 1. Richmond MSA



[1] "The Metro Area Impact of Home Building in Chesterfield County, Virginia: Income, Jobs and Taxes Generated," completed by NAHB in November 2007.

The comprehensive nature of the NAHB model requires a local area large enough to include the labor and housing market in which the homes are built. Local benefits in the model, including revenue generated for local governments, include the ripple impacts of spending and taxes paid by construction workers and new residents, which occur in an economic market area. For a valid comparison, costs should be calculated for the same area. A local labor and housing market generally corresponds to a Metropolitan Statistical Area (MSA) as defined by the U.S. Office of Management and Budget (OMB).

Based on local commuting patterns, OMB has identified the Richmond MSA as a metro area consisting of sixteen counties (Amelia, Caroline, Charles City, Chesterfield, Cumberland, Dinwiddie, Goochland, Hanover, Henrico, King and Queen, King William, Louisa, New Kent, Powhatan, Prince George, and Sussex) and four independent cities (Colonial Heights, Hopewell, Petersburg, and Richmond) in Virginia (see Figure 1 on previous page). In this report, wherever the term local is used, it refers to the entire metro area.

Costs Compared to Revenue: Total

This section summarizes results for both single family and multifamily construction. Detail by structure type follows, but for many purposes a combined analysis of both types may be most appropriate. Market areas generally require a mix of housing types to accommodate residents of different income levels, different occupations, and who are at different stages in their professional careers. Although it's possible to analyze single family and multifamily construction separately, such an approach does not reflect the typically integrated character of residential development.

- In the first year, the 2,014 single family and 426 multifamily housing units built in Chesterfield County result in an estimated
  - **$58.4 million** in tax and other revenue for local governments[2]
  - **$4.7 million** in current expenditures by local government to provide public services to the net new households at current levels
  - **$41.0 million** in capital investment for new structures and equipment undertaken by local governments

  The analysis assumes that local governments finance the capital investment by borrowing at the current municipal bond rate of 4.40 percent.[3]

- In a typical year after the first, the single family and multifamily units result in
  - **$15.1 million** in tax and other revenue for local governments
  - **$9.4 million** in local government expenditures to continue providing services at current levels

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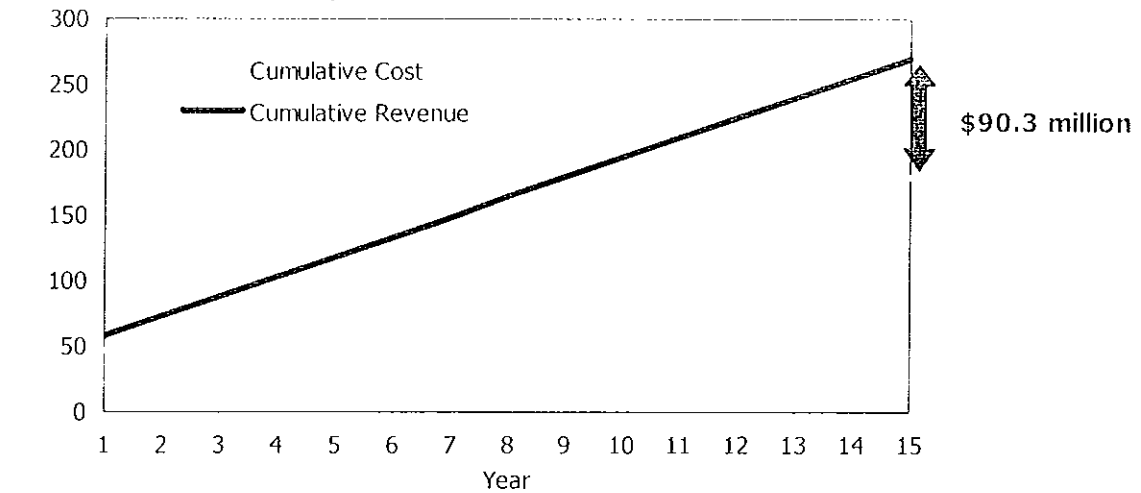
[2] This assumes that homes are occupied at a constant rate during the year, so that the year captures one-half of the ongoing, annual revenue generated as the result of increased property taxes and the new residents participating in the local economy.

[3] The analysis assumes that there is currently no excess capacity, that local governments invest in capital before the homes are built, and that no fees or other revenue generated by construction activity are available to finance the investment, so that all capital investment at the beginning of the first year is financed by debt. This is a conservative assumption that results in an upper bound estimate on the costs incurred by local governments. For information about the particular interest rate on municipal bonds used, see page 2 of the technical appendix.

- The difference between government revenue and current expenditures is defined as an "operating surplus." If it is assumed that the operating surplus is used first to service and then to pay down the debt, all debt incurred by investing in structures and equipment at the start of the first year can be entirely paid off by the end of the first year. After that, future operating surpluses will be available to finance other projects or reduce taxes. After 15 years, the homes will generate a cumulative **$269.9 million in revenue** compared to only **$179.6 million in costs**, including annual current expenses, capital investment, and interest on debt (Figure 2).

Figure 2.
Costs Compared to Revenue: SF & MF Combined



Costs Compared to Revenue: Single Family Construction

This section summarizes results for single family construction only. The relevant assumptions about the single family homes built (including their average price, property tax payments, and construction-related fees incurred) are contained in the NAHB report, *The Metro Area Impact of Home Building in Chesterfield County, Virginia: Income, Jobs and Taxes Generated.*

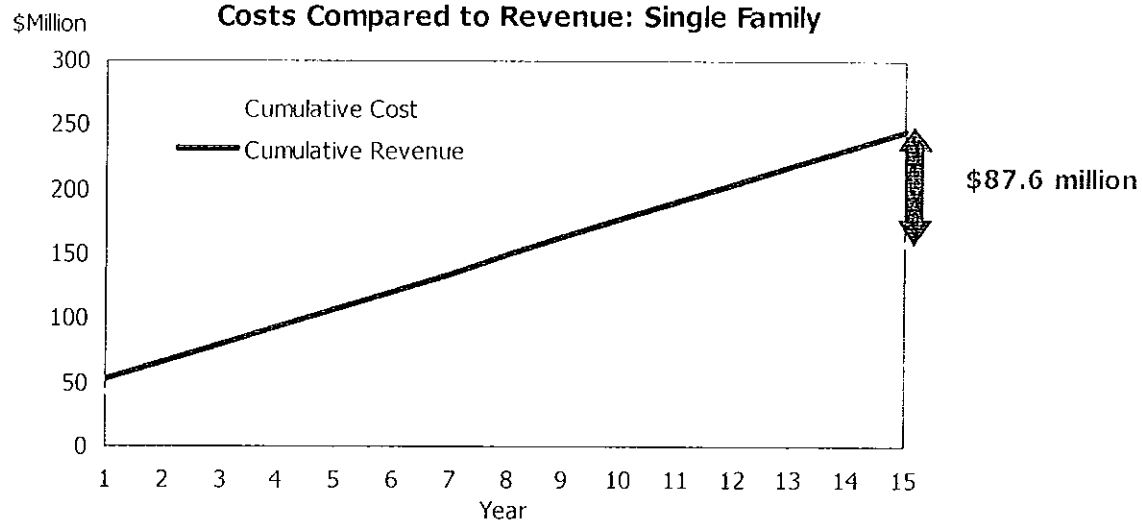
- In the first year, the 2,014 single family homes built in Chesterfield County result in an estimated
  - **$52.9 million** in tax and other revenue for local governments
  - **$4.1 million** in current expenditures by local government to provide public services to the net new households at current levels
  - **$36.3 million** in capital investment for new structures and equipment undertaken by local governments

  The analysis assumes that local governments finance the capital investment by borrowing at the current municipal bond rate.

- In a typical year after the first, the 2,014 single family homes result in
  - **$13.8 million** in tax and other revenue for local governments
  - **$8.3 million** in local government expenditures needed to continue providing services at current levels.

- The difference between government revenue and current expenditures is defined as an "operating surplus." If is assumed that the operating surplus is used first to service and then to pay down the debt, all debt incurred by investing in structures and equipment at the beginning of the first year can be entirely paid off by the end of the first year. After that, the operating surpluses will be available to finance other projects or reduce taxes. After 15 years, the homes will generate a cumulative **$245.6 million in revenue** compared to only **$158.0 million in costs**, including annual current expenses, capital investment, and interest on debt (Figure 3).

Figure 3.
Costs Compared to Revenue: Single Family



Costs Compared to Revenue: Multifamily Construction

This section summarizes results for multifamily construction only. As with the section on single family construction, relevant assumptions about the type units built can be found in *The Metro Area Impact of Home Building in Chesterfield County, Virginia: Income, Jobs and Taxes Generated.*

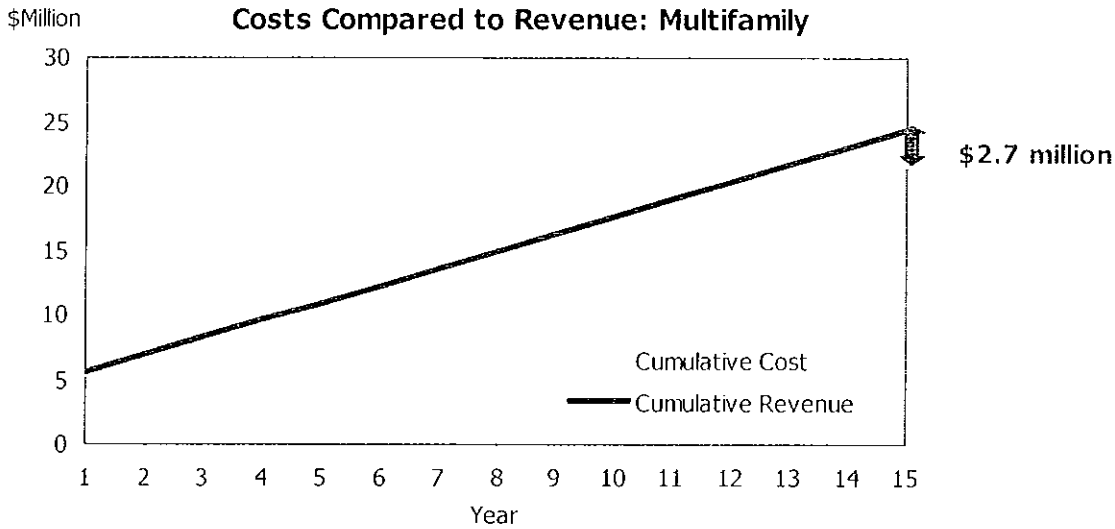
- In the first year, the 426 multifamily housing units built in Chesterfield County result in an estimated
  - **$5.6 million** in tax and other revenue for local governments
  - **$578,000** in current expenditures by local government to provide public services to the net new households at current levels
  - **$4.7 million** in capital investment for new structures and equipment undertaken by local governments

  The analysis assumes that local governments finance the capital investment by borrowing at the current municipal bond rate.

- In a typical year after the first, the 426 multifamily units generate
  - **$1.3 million** in tax and other revenue for local governments
  - **$1.2 million** in local government expenditures needed to continue providing services at current levels.

- The difference between government revenue and current expenditures is defined as an "operating surplus." If it is assumed that the operating surplus is used first to service and then to pay down the debt, all debt incurred by investing in structures and equipment at the beginning of the first year can be entirely paid off by the end of the first year. After that, future operating surpluses will be available to finance other projects or reduce taxes. After 15 years, the units will generate a cumulative **$24.4 million in revenue** compared to only **$21.7 million in costs**, including annual current expenses, capital investment, and interest on debt (Figure 4).

Figure 4.
Costs Compared to Revenue: Multifamily



Method Used to Estimate Costs

The method for estimating local government revenue generated by home building is explained in the NAHB documents, *The Metro Area Impact of Home Building in Chesterfield County, Virginia: Income, Jobs and Taxes Generated* and *NAHB's Local Impact of Home Building Model: Technical Documentation*. This section describes how costs are estimated.

The general approach is to assume local jurisdictions supply residents of new homes with the same services that they currently provide, on average, to occupants of existing structures. The amount that any jurisdiction spends is available from the Census of Governments, where all units of government in the U.S. report line item expenses, revenues, and intergovernmental transfers once every five years to the Governments Division of the U.S. Census Bureau. Census of Governments accounts can be aggregated for every local government in the Richmond metro area and then used to produce total annual expenses per single family and multifamily housing unit (Table 1):

Table 1.
Total Annual Local Government Expenses per Housing Unit
(in 2006 Dollars)

	Single Family	Multifamily
Education	$1,721	$1,001
Police Protection	$468	$348
Fire Protection	$273	$203
Corrections	$214	$159
Water Supply	$164	$86
Sewerage	$105	$55
Health Services	$262	$195
Recreation and Culture	$207	$154
Other General Government	$519	$386
Electric Utilities	$1	$1
Gas Utilities	$141	$105
Public Transit	$22	$16
Total	$4,096	$2,709

Not surprisingly, cost per housing unit varies substantially across the major service categories. Education accounts for the largest share of annual expenses, but the shares for police protection and miscellaneous general government are also substantial.

In deriving the above estimates, water supply and sewerage expenses are allocated based on gallons of water consumed per day by single family and multifamily households. Education is allocated based on average number of children age 5 through 18. The other government services listed in Table 1 are assumed to be proportional to population, so costs associated with those services are allocated based on household size.[4]

There are several factors present in most parts of the country that tend to reduce education expenses per housing unit. The first is the average number of school-aged children present in the units. According to the American Housing Survey, there is, on average, only a little over one school-aged child for every two households in the U.S. The number is about 0.6 per household for single family and under 0.4 per household for multifamily. So education costs per housing unit are lower than costs per pupil, simply because there is less than one pupil per household.

[4] Information about water consumption comes from *Analysis of Summer Peak Water Demands,* a study undertaken by the City of Westminster, Colorado Department of Water Resources and Aquacraft, Inc. Water Engineering and Management. Information about household size and number of children comes from the American Housing Survey, conducted by the U.S. Census Bureau for the Department of Housing and Urban Development.

Beyond that, a share of households typically send their children to private schools. According to the National Center for Education Statistics (NCES), the share is 12.6 percent of all school-aged children nationally. As public monies are very rarely used to pay for private instruction, this tends to further reduce K-12 public school expenses, although the extent to which that occurs varies from place to place. Moreover, according to the NCES another 1.7 percent of students nationwide, ages 5 to 17, with a grade equivalent of kindergarten through grade 12, are homeschooled, which further acts to reduce the cost of public education.

Finally, state governments in the form of intergovernmental transfers pay for some public school expenses. In the latest Census of Governments, local governments in aggregate across the Richmond metro area spent about $1.2 billion in current expenses on education. However, 51 percent of this was offset by $619 million in state-to-local intergovernmental transfers for education.

In addition to current expenses, providing services to residents requires that local governments make capital expenditures for items such as schools and other buildings, equipment, roads, and other structures.

Estimating capital costs is in general a more difficult and complicated than estimating current expenses. The approach used here is to estimate a conventional economic model (one where costs are expressed as a function of labor and capital), with state level data, for which information about the capital stock can be derived (for more detail, see the technical appendix). The results are then applied to a local area, where information is available for every variable except capital. The local capital stock then emerges as a residual in the calculation. As with current expenses, the amount of capital in each category is the amount necessary to accommodate an average single family or average multifamily housing unit (Table 2).

Table 2.
Local Government Capital per Housing Unit
(in 2006 Dollars)

	Single Family	Multifamily
Schools	$10,272	$5,976
Hospitals	$779	$580
Other Buildings	$2,134	$1,588
Conservation & development	$29	$22
Sewer systems	$1,994	$1,044
Water supply	$1,761	$922
Other structures	$853	$635
Equipment	$205	$152
Total	$18,028	$10,918

To implement these numbers, several conservative assumptions are made to avoid understating costs. In contrast to the way current expenses were handled, intergovernmental transfers are generally not taken into account here—it is assumed that local governments undertake all capital investment without any help from the states. The exception is highways and streets, for

which the amount of current expenditures per dollar of capital is typically quite low. It is further assumed that none of this demand for capital can be met through current excess capacity. Instead, local governments invest in new structures and equipment at the start of the first year, before any homes are built. To the extent that this is not true—that, for instance, some revenue from impact or other fees is available to fund part of the capital expenditures—interest costs would be somewhat lower than reported here.

To compare the streams of costs and revenues over time, we assume that half of the current expenses and half of the ongoing, annual revenues are realized in the first year. This would be the case if construction and occupancy took place at an even rate throughout the year. Revenues in the first year also include all of the one-time construction impacts such as impact and permit fees.

The difference between revenues and current expenses in a given year is an operating surplus. At the start of the first year, capital investment is financed through debt by borrowing at the current municipal bond interest rate,[5] and the interest accrues throughout the year. Each year after that, the operating surplus is used first to pay the interest on the debt, if any exists, then to pay off the debt at the end of the year. The results are shown for the 2,014 single family homes in Table 3, for the 426 multifamily units in Table 4, and for single family and multifamily combined in Table 5.

The difference between revenues (the third column) and all costs, including interest on the debt, is shown in the last column. Again, the assumption is that any operating surplus is being used to service the debt, and then to retire as much debt as possible at the end of the year. For either single family or multifamily construction analyzed separately, revenue net of costs and interest is always positive, beginning in year one.

As a result, revenues are sufficient to pay off all debt by the end of year one for single family construction analyzed separate, for multifamily construction analyzed separately, and for the combined case that analyzes single family and multifamily construction together. After that, revenue net of costs generated by the 2,014 single family and 426 multifamily units is roughly $5.7 million per year.

Net revenue for both structure types falls due to a slight cost increase that occurs in year 11, because capital equipment purchased at the start of the first year becomes fully depreciated and needs to be replaced at that time. All other capital investment consists of structures of various types, for which the service lives are much longer than a single decade.

[5]The interest rate on municipal bonds is the monthly Bond Buyer 20-year General Obligation Municipal Bond Index available on the Federal Reserve Board's Web site: http://www.federalreserve.gov/releases/h15/data/Monthly/H15_SL_Y20.txt.

Table 3. Results for 2,014 Single Family Homes

Year	Current Expenses	Revenue	Operating Surplus	Capital Investment Start of Year	Debt Outstanding End of Year	Interest on the Debt	Revenue Net of Costs and Interest
1	4,125,000	52,876,281	48,751,281	36,307,000	0	1,597,810	10,846,471
2	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
3	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
4	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
5	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
6	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
7	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
8	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
9	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
10	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
11	8,250,000	13,762,014	5,512,014	412,000	0	0	5,100,014
12	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
13	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
14	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014
15	8,250,000	13,762,014	5,512,014	0	0	0	5,512,014

Table 4. Results for 426 Multifamily Housing Units

Year	Current Expenses	Revenue	Operating Surplus	Capital Investment Start of Year	Debt Outstanding End of Year	Interest on the Debt	Revenue Net of Costs and Interest
1	577,500	5,552,367	4,974,867	4,652,000	0	204,727	118,140
2	1,155,000	1,343,861	188,861	0	0	0	188,861
3	1,155,000	1,343,861	188,861	0	0	0	188,861
4	1,155,000	1,343,861	188,861	0	0	0	188,861
5	1,155,000	1,343,861	188,861	0	0	0	188,861
6	1,155,000	1,343,861	188,861	0	0	0	188,861
7	1,155,000	1,343,861	188,861	0	0	0	188,861
8	1,155,000	1,343,861	188,861	0	0	0	188,861
9	1,155,000	1,343,861	188,861	0	0	0	188,861
10	1,155,000	1,343,861	188,861	0	0	0	188,861
11	1,155,000	1,343,861	188,861	65,000	0	0	123,861
12	1,155,000	1,343,861	188,861	0	0	0	188,861
13	1,155,000	1,343,861	188,861	0	0	0	188,861
14	1,155,000	1,343,861	188,861	0	0	0	188,861
15	1,155,000	1,343,861	188,861	0	0	0	188,861

Table 5. Combined Results for 2,014 Single Family and 426 Multifamily Units

Year	Current Expenses	Revenue	Operating Surplus	Capital Investment Start of Year	Debt Outstanding End of Year	Interest on the Debt	Revenue Net of Costs and Interest
1	4,702,500	58,428,648	53,726,148	40,959,000	0	1,802,537	10,964,611
2	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
3	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
4	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
5	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
6	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
7	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
8	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
9	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
10	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
11	9,405,000	15,105,874	5,700,874	477,000	0	0	5,223,874
12	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
13	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
14	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874
15	9,405,000	15,105,874	5,700,874	0	0	0	5,700,874

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COMPARING COSTS TO REVENUE FOR LOCAL GOVERNMENTS

TECHNICAL APPENDIX ON ESTIMATING CAPITAL OWNED AND MAINTAINED BY LOCAL GOVERNMENTS

Technical Appendix on Estimating Local Capital

This appendix explains the method used to estimate the age and dollar value of local government capital by function (education, water and sewer services, etc.). The general approach is to estimate economic relationships using state-level data and then apply parameters from the state-level estimates to local data.

First, a cost share equation based on conventional production theory is described for the structures associated with each function of government. In the equations age of capital is used as a proxy for technologic change. Age of capital, in turn, is estimated as a function of population growth.

The following derivations apply to any one of the ten categories of state and local government capital—e.g., highways or school buildings—tracked in the Bureau of Economic Analysis (BEA) wealth data files. For simplicity, the notation suppresses an explicit reference to capital type. In cases where some detail of the model pertains to a particular type of capital or function of local governments, the text will make that clear.

Let y = output; L= labor, w = the price of labor, and r = the price of capital, and consider a general translog cost function:[6]

$$(1)\quad c_{it} = \beta_0 + \beta_w \ln w_{it} + \beta_r \ln r_{it} + \beta_y \ln y_{it} + \beta_a a_{it} + \tfrac{1}{2}\beta_{ww}(\ln w_{it})^2 + \beta_{wr} \ln w_{it} \ln r_{it} + \tfrac{1}{2}\beta_{rr}(\ln r_{it})^2 + \beta_{wy} \ln w_{it} \ln y_{it} + \beta_{ry} \ln r_{it} \ln y_{it} + \beta_{wa} a_{it} \ln w_{it} + \beta_{ra} a_{it} \ln r_{it} + \beta_{yy}(\ln y_{it})^2 + \beta_{ya} a_{it} \ln y_{it} + \beta_{aa} a_{it}^2$$

In the case where the firm is a government, y_{it} is essentially unmeasurable, so it seems reasonable to assume linear homogeneity in output. This simplifies the translog specification considerably:

$$(2)\quad c_{it} = \beta_0 + \beta_w \ln w_{it} + \beta_r \ln r_{it} + \ln y_{it} + \beta_a a_{it} + \tfrac{1}{2}\beta_{ww}(\ln w_{it})^2 + \beta_{wr} \ln w_{it} \ln r_{it} + \tfrac{1}{2}\beta_{rr}(\ln r_{it})^2 + \beta_{wa} a_{it} \ln w_{it} + \beta_{ra} a_{it} \ln r_{it} + \beta_{aa} a_{it}^2$$

Specification (2) still requires an estimate of $\ln y_{it}$. However, application of Shephard's Lemma generates the following two-equation system:

$$(3)\quad s_{L,it} = w_{it} L_{it} / c_{it} = \partial \ln c_{it} / \partial \ln w_{it} = \beta_w + \beta_{ww} \ln w_{it} + \beta_{wr} \ln r_{it} + \beta_{wa} a_{it}$$

$$(4)\quad s_{k\,it} = r_{it} k_t / c_{it} = \partial \ln c_{it} / \partial \ln r_{it} = \beta_r + \beta_{wr} \ln w_{it} + \beta_{rr} \ln r_{it} + \beta_{ra} a_{it}$$

By estimating cost shares rather than the cost function itself, the ability to estimate β_0, β_a, and β_{aa} (essentially nuisance parameters) is lost. Also lost is some precision, in the sense that a lower-order approximation is being estimated.[7] The advantage is relief from the need to supply values for the unobservable y_{it}.

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[6] See, for example, Walter Diewert and Terry Wales (1987), "Flexible Functional Forms and Global Curvature Conditions," *Econometrica*, 55, 43-68.

[7] See Henri Theil, *The System-Wide Approach to Microeconomics*, University of Chicago Press, 1980, page 151.

Economic theory implies several restrictions.

Symmetry: β_{wr} is the same in both equations
Linear homogeneity in input prices: $\beta_w + \beta_r = 1$; $\frac{1}{2}\beta_{ww} + \beta_{wr} + \frac{1}{2}\beta_{rr} = 0$; $\beta_{wa} + \beta_{ra} = 0$.

The restrictions are imposed in the usual way. One of the factor prices (w_{it}) is used as a numeraire; and only one share equation ($s_{L,it}$) is estimated, leaving parameters of the second, if needed, to be recovered by simple algebra. The resulting estimating equation is

$$(5) \qquad s_{L,it} = w_{it} L_{it} / (w_{it} L_{it} + r_{it} k_t) = \beta_w + \beta_{wr} \ln (r_{it}/w_{it}) + \beta_{wa} a_{it} + \boldsymbol{\beta}_I' \boldsymbol{I}_{it}$$

where $\boldsymbol{I}_{it}$ is a vector of indicator variables that may be added to equations for some government functions to account for outliers among specific states and time periods. More detail is provided when the regression results are discussed.

Model (5) can be estimated with any standard regression package, provided state-level annual data for L, w, and r can be specified. Series beginning in 1987 for the first two are available from the Government Division of the U.S. Census Bureau. For r, standard practice is followed by assuming cost of capital is the sum of three terms: maintenance (meaning, in this case, all non-labor operating costs), interest, and depreciation.

$$(6) \qquad r_{it} = x_{it}/k_{it} + \phi_{it} + *_t$$

where x_{it} is the difference between total current expenditures and labor costs, ϕ_{it} is an interest rate for appropriate types of tax-exempt public-purpose government bonds, and $*_t$ is the national depreciation rate from BEA's wealth accounts.

To estimate the cost share equations, the same annual interest rate series ϕ_t is used for all states. Because the preferred series not available until 1990, two different sources are used to construct the 1987–2001 annual interest rate series ϕ_t. From 1987 through to the end of 1989, the JP Morgan Revenue Bond Index (RBI) is used. The JP Morgan RBI data are monthly. An annual interest rate is constructed by taking the average of the 12 monthly observations for each calendar year.

From 1990 to the present the Merrill Lynch 20 Year AAA GO series is used. The Merrill Lynch data are provided weekly. An annual interest rate is constructed by taking the average of the 52 observations in each calendar year.

To insure that there is no discontinuity in the series, the annual interest rate from the JP Morgan RBI index for the years 1987 1988 and 1989 is multiplied by the average of the annual ratio of the Merrill Lynch 20 Year AAA GO series divided by the JP Morgan RBI index the for the years 1990 to the present. That ratio turned out to be 0.93. The reason the ratio is less than one is largely because the Merrill Lynch index has a duration that is on average 5 years shorter than the JP Morgan RBI Index.

The final index was chosen following consultation with bonds specialists at both JP Morgan and Merrill Lynch. Although there are hundreds of thousands of unique muni-bonds, and most are rarely if ever traded, the experts felt that a 20 year maturity seemed appropriate and that the ML GO AAA series was probably best for this purpose.

In order to make the cost share equations operational, it's necessary to apportion equipment among the other nine types of capital for which it's possible to approximately match capital with expense and employment data by function of government. In general, a year-zero approach is employed, basing the analysis on the ratio of structures to equipment when both are brand new.

Suppressing the cross-sectional (state) subscript, capital k required for a specific local government function is the sum of structures k_s and equipment k_e:

(7) $$k_t = k_{st} + k_{et}$$

where $$k_{st} = k_{s0}(1-*_s)^{\partial_s}, \quad k_{et} = k_{e0}(1-*_e)^{\partial_e}$$

or, equivalently,

(8) $$k_{s0} = k_{st}(1-*_s)^{-\partial_s}, \quad k_{e0} = k_{et}(1-*_e)^{-\partial_e}$$

Brand new equipment is allocated to brand new structures based on the relative total year-zero values of structures. From this, a ratio z can be derived, which will be the same for all local government functions (or structure types):

(9) $$z = k_{e0}/k_{s0} = k_{et}(1-*_e)^{-\partial_e} k_{st}^{-1}(1-*_s)^{\partial_s}$$

The average z ratio for 50 states plus the District of Columbia in the most recent year for which we can compute it (1998) is .11642. This number is used below to help derive estimates of government-owned equipment and structures for a particular local area.

The blended ages and depreciation rates for total capital (structures and equipment) were used to compute the independent variables in the estimating equations. The nine equations (one for each function of government) were estimated, using data for the period where complete state-level government employment and finance data were available—1987 through 1998. The procedure converged quickly (in four iterations). Results are shown in Table 3.

Fit of the model was improved by including a number of indicator variables, up to three per equation. These are identified as I1, I2, and I3 in Table A1 and defined in Table A2.

Not all of the cost equations contain an indicator variable, and each indicator captures only a small number of states. Several variables simply indicate that an observation is for the state of Alaska, and it seems reasonable to suppose that the technology of providing some government services in Alaska would be different than in many other states. In the case of housing, New York appears to be an isolated outlier, and again that is not especially surprising. Other indicators capture a small number of states in New England or the Rocky Mountain area. The conservation series showed a clear break between 1991 and 1992 in Arizona. The Census Bureau instituted some procedural changes involving the collection and reporting of government finance data beginning in 1992.

Table A1. Regression Results: Cost Share Equations

	β_w	β_{wr}	β_{wa}	I1	I2	I3	Adj R^2
Residential	-0.5454	-0.1082	0.0051	0.1531	0.2150		.453
	(.0001)	(.0001)	(.0158)	(.0001)	(.0001)		
Education	-0.3801	-0.1391	0.0156				.545
	(.0001)	(.0001)	(.0001)				
Hospital	0.5682	-0.1413	-0.0247	-0.1793			.506
	(.0001)	(.0001)	(.0001)	(.0001)			
Other Buildings	0.3970	-0.1655	-0.0368				.784
	(.0001)	(.0001)	(.0001)				
Streets & Highways	-0.0345	-0.0723	-0.0110	0.2072			.598
	(.4529)	(.0001)	(.0001)	(.0001)			
Conservation	0.1846	-0.0524	-0.0017	0.3443	-0.2017	0.1210	.483
	(.0165)	(.0001)	(.6021)	(.0001)	(.0001)	(.0001)	
Sewer	-0.4148	-0.0861	0.0018				.522
	(.0001)	(.0001)	(.1985)				
Water	-0.0336	-0.1077	-0.0169				.413
	(.5780)	(.0001)	(.0001)				
Other Structures	-0.2342	-0.1112	-0.0111	0.39629			.566
	(.0021)	(.0001)	(.0004)	(.0001)			

Table A2: Indicator Variables for Cost Share Equations

Capital type	Variable	Condition for I=1
Residential	I1	state=AK
	I2	state=NY
Hospital	I1	state=AZ, NH, or VT
Streets & Highways	I1	state=AK
Conservation	I1	state=AK
	I2	state =NY or CT; or state=AZ and year < 1992
	I3	state=ID, MT, ND, or WY
Other Structures	I1	state= NE, NY, or WA

In the equations above, age of the capital stock appears as an explanatory variable. This is not readily available, even at the state level. A commonly used approach employs perpetual accounting, investment, and depreciation rates to base-year estimates.[8] The procedure used here begins with that approach, but then relates the investment rates to population growth rates, one of the few items for which consistent time series are available for individual U.S. counties.

From BEA national wealth data, the following are available or can easily be computed:

$*$ = real annual rate of depreciation (defined broadly, as BEA does, to include a normal rate of obsolescence and retirement of assets)
$>$ = monthly depreciation rate, a simple algebraic transformation of $*$.
N_t = real, net (of depreciation) rate of investment in year t, t=1946,...,2000.

[8] As in Douglas Holtz-Eakin, "State-Specific Estimates of State and Local Government Capital," *Regional Science and Urban Economics*, Vol. 23, No. 2, April 1993, pp. 185-210.

From data compiled by the Governments Division of the Census Bureau, and ratios employed by BEA to analyze this data, the following can be computed for state i and t=1977,...,1999:

vn_{it} = real investment in new assets state i in year t.
ve_{it} = real investment in existing assets state i in year t.
v_{it} = real investment in state i in year $t = vn_{it} + ve_{it}$.
x_{it} = current expenditures associated with the relevant type of capital state i in year t.

From standard Census Bureau data it is possible to compute
Π_{it} = population growth in the state relative to the national rate; i.e.,

$$\Pi_{it} = \frac{\Delta\rho_{it}}{\rho_{it-1}}\left[\frac{\sum_i \Delta\rho_{it}}{\sum_i \rho_{it-1}}\right]^{-1}$$

The starting point consists of initial end-of-year estimates of the real capital stock, k^0_{i76}, determined by allocating capital to each state according to its share of current expenditure, x_{i77}. This procedure, the one employed for example by Holtz-Eakin (1993), is used here only for the purpose of supplying initial values to be modified in subsequent iterations.

Perpetual inventory accounting can be used to calculate the following recursively for t=1977,...,1999:

(10) $\qquad k^0_{i\,t+1} = k^0_{it}(1-*) + v_{it+1}(1->)^6$

This assumes that investment made during period t+1 depreciates an average of 6 months by the end of the period. Then relative (to the national rate) net real rates of investment can also be computed:

(11) $$\equiv^0_{it} = \left[\frac{v_{it} - \delta\, k^0_{it-1}}{k^0_{it-1}}\right] N_t^{-1}$$

The goal is to obtain estimates of parameters γ_j and ϑ_q in the following regression relationship:

(12) $$\equiv^0_{it} = \sum_{j=1}^{J} \alpha^0_j \rho^0_{it-j} + \sum_{q=1}^{Q} \vartheta_q D_q$$

where J is the longest lag considered and the D_q are indicator (dummy) variables. The hypothesis underlying this specification is that a state's rate of investment (relative to the national rate) is a function of past rates of its population growth (also relative to the national rate), with indicator variables to account for anomalies in some states due to peculiarities that are difficult to observe and quantify. Inspection of the pair wise correlations between $\equiv_{it}$ and Π_{it-j} reveal that they begin to decline at or before the lag reaches eight years, depending on the type of capital. Thus, model specification for each type of capital began by tentatively considering population growth effects up to J=8. The final specification varies from case to case.

As a practical matter, the final specifications employ averages of population growth rates lagged over several years. Over the course of several experiments, the sum of the coefficients on the population variables never changed substantially when an average was substituted for a series of individual lags. Coefficients on individual lags tended to fluctuate widely and lack statistical significance, due to collinearity. The use of averages thus aids interpretation without impacting the marginal impacts predicted by the equations in a meaningful way.

Three indicator variables were used in all but the hospital capital equation, which employed four. In most cases, indicator variables flag relatively few states (Table A3).

Table A3: Indicator Variables for Relative Investment Rate Equations

Capital Category	DVERYHI=1	DHIGH=1	DLOW=1	DVERYLOW=1
1 Equipment	DC, WY	AZ, CO, MT, UT	AR, NH, RI	
2 Residential Buildings	DC, HI, MA, NY	CT, DE, RI	CO, FL, ID, NM, TX, UT, VT, WY	
3 Educational Buildings	WY	HI, NM, TX	CA, VT, WI	
4 Hospital Buildings	WY	AL, FL, GA, HI, IA, ID, KS, NY, OH, WA	AR, CT, DE, IL, KY, ME, OR, UT, WI, WV	AZ, VT
5 Other Buildings	DC, WY	HI, MD	AR	
6 Highways and Streets	WY	DC, IA, MN, MT, ND, NE	AR, ME, NH, SC, VT	
7 Conservation & Development	HI, WY	AZ, LA, MT	AL, NY, OK, TN, VA	
8 Sewer Systems & Structures	DC, NY, WA	MA, MD, NJ, OH, RI, WI	AR, NC	
9 Water Supply Facilities	CO, DC, SD, WY	FL, NV	DE, NH	
10 Other Structures	DC	NE	NH	

Given initial estimates, it's possible to begin the perpetual inventory accounting process at an earlier date. If we assume that the World War II period was atypical and restrict ourselves to post-war population data, an 8-year lag in (12) implies that 1954 is the first year for which we can obtain state investment estimates. Hence, state capital stocks in 1953 are estimated by allocating the national capital stock in that year according to its share of the U.S. population, then estimating state investment in the years from 1954 through 1976 recursively according to

$$(13) \qquad V^0_{it} = K^0_{it-1} (* + N_t \equiv^0_{it})$$

where $\equiv^0_{it}$ is estimated from (12). In words, (13) says that investment is enough to cover depreciation, plus another term which is the net national rate of investment multiplied by a relative factor specific to state i. It is then possible to combine (13) with (10) to derive estimates of the capital stock for the years 1954 through 1976 in most states. (Lack of complete data for in earlier years pushes the first estimate for Alaska forward to 1962.)

In this way revised estimates $K^1_{i,76}$ are derived, and these can be used to restart the process by repeating steps (10) through (13). This results in successively revised estimates $K^1_{i,t}$ and $I^1_{i,t}$ for t=1977,...,1999; parameters β^1_i and σ^1_{oi}; $V^1_{i,t}$ for t=54,...,76; and $K^2_{i,76}$. This ends the first iteration.

This process can be repeated until either a convergence criterion is satisfied. The particular criterion used was an average absolute percentage change in the $k_{i,76}$ no greater than 10^{-10} between iterations.

The procedure was carried out for all 10 BEA categories of state and local government capital. Each of the ten equations converged in fewer than 10 iterations. The final estimates are shown in Table A4.

Table A4. Final Regression Results: Dependent Variable=Relative Investment Rate

	Equipment	Residential	Education	Hospital	Buildings nec
Iterations to Convergence	8	6	6	6	6
Final Regression Coefficients (p-values):					
Constant	-0.2590	0.5460	-0.0227	0.3663	0.5439
	(.0003)	(.0001)	(.8295)	(.0001)	(.0001)
Lagged relative population growth rates:					
Population lag 1	0.4337		0.3852		0.1336
	(.0001)		(.0001)		(.0001)
Population lag 2-5	0.1707	0.0662			
	0.0212	(.1225)			
Population lag 2-8			0.6865		0.0961
			(.0001)		(.0002)
Population lag 6-8		0.0805		0.1270	
		(.0532)		(.0009)	
State indicator variables:					
DVeryhi	5.6639	2.9842	7.2485	4.1282	1.7082
	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)
DHigh	1.2733	0.7862	1.6538	1.4240	1.3839
	(.0002)	(.0001)	(.0001)	(.0001)	(.0001)
DLow	-1.3392	-0.8119	-1.2254	-0.8407	-0.6383
	(.0001)	(.0001)	(.0003)	(.0001)	(.0001)
DVerylow				-1.7778	
				(.0001)	
Adjusted R^2	.432	.426	.311	.323	.402

Table A4. Continued

	Streets	C&D	Sewer	Water	Other
Iterations to Convergence	6	6	6	6	8
Final Regression Coefficients (p-values):					
Constant	0.8370	0.0938	0.4386	0.2036	0.2754
	(.0001)	(.0617)	(.0001)	(.0001)	(.0016)
Lagged relative population growth rates:					
Population lag 1				0.1967	0.2253
				(.0001)	(.0030)
Population lag 2		0.0950			
		(.0371)			
Population lag 2-5	0.2462				
	(.0001)				
Population lag 5			0.0516		
			(.1461)		
Population lag 2-8				0.4270	0.5368
				(.0001)	(.0001)
Population lag 3-8		0.2653			
		(.0001)			
Population lag 6-8	0.0770		0.0701		
	(.0318)		(.0594)		
State indicator variables:					
DVeryhi	4.955	2.387	1.348	2.270	13.405
	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)
DHigh	1.340	1.223	1.025	0.396	5.981
	(.0001)	(.0001)	(.0001)	(.0206)	(.0001)
DLow	-0.684	-0.785	-0.745	-0.126	-2.172
	(.0006)	(.0001)	(.0001)	(.0001)	(.0001)
Adjusted R^2	.502	.338	.268	.496	.528

The estimated pre-1977 investment series can be spliced onto the 1977-1999 data and the results used to estimate the average age of capital, by type, in each state. The procedure is as follows. First, set the average age of capital in state equal to the national average for 1953. Then, use perpetual accounting to recursively calculate the average age in subsequent years:

(14) $$a_{i\,t+1} = [(a_{i\,t}+1)\ k_{it}(1-*) + \tfrac{1}{2} vn_{it+1}(1->)^6 + ap_t\ ve_{it+1}(1->)^6]/k^0_{i\,t+1}$$

where ap_t is the average age of the relevant type of private capital, in accord with the method used by BEA which assumes that existing assets purchased by governments are "typical".

The process of deriving estimating capital stock estimates for a particular local area begins by adapting the average age equation (14) to location m:

$$a_{mt} = [(a_{mt-1}+1)\ k_{mt-1}(1-*) + g_t\ v_{mt}(1->)^6]/[k_{mt-1}(1-*) + v_{mt}(1->)^6]$$

where $g_t = \dfrac{.5\sum_i vn_{it} + pa\sum_i ve_{it}}{\sum_i v_{it}}$, that is, the average end-of-the year age of total assets (including both new and used) purchased by all states in the country during the period.

Then (13) is substituted into the average age formula and the capital factor is eliminated in order to obtain

$$(15) \qquad a_{mt} = \frac{(a_{mt-1}+1)(1-\delta)+g_t(\delta+N_t\eta_{mt})(1-\varepsilon)^n}{1-\delta-(\delta+N_t\eta_{mt})(1-\varepsilon)^n}$$

Equation (13) can be used to estimate η_{mt} from local relative population growth factors N_{mt}. Starting with the national average age for 1954 as initial estimate of the average age of the capital stock in m, (15) can be applied to calculate a_{mt} recursively for subsequent years.

The result is a recipe for estimating the age of the capital stock for a particular local area. To be implemented, the recipe requires only data on local population growth.

Given the age estimate—along with estimates of the parameters β_w, β_{ww}, and β_{wa} from the cost share equations, capital depreciation rates $*_t$ from BEA, a current rate on tax-exempt bonds ϕ_{mt} , and values for w_{mt}, L_{mt}, and x_{mt} that can be obtained for any unit of government from data bases maintained by the U.S. Census Bureau—capital k_{mt} is the only unknown in the local cost share equation

$$(16) \quad [w_{mt}L_{mt} + x_{mt} + (\phi_{mt}+*_t)\,k_{mt}]\cdot[\beta_w + \beta_{ww}\ln((x_{mt}/k_{mt}+\phi_{mt}+*_t)/w_{mt}) + \beta_{wa}\,a_{mt} + \boldsymbol{\beta}_I'\boldsymbol{I}_{mt}] = w_{mt}L_{mt}$$

However, it's necessary to account for the fact that capital in (16) consists of both structures and equipment. Equations (7), (8), and (9) imply that

$$(17) \qquad k_{mt,s} = \gamma_{mt}k_{mt} \quad \text{and} \quad k_{mt,e} = (1-\gamma_{mt})\,k_{mt} \quad \text{where}$$

$$(18) \qquad \gamma_{mt} = [1 + z(1-*_e)^{a_{mt,e}}(1-*_s)^{-a_{mt,s}}]^{-1}$$

By using the 1998 state average value (.11642) for z, it's possible to compute γ_{mt} from BEA's depreciation rates and the estimated ages of structures and equipment. In turn, γ_{mt} can be used to compute

$$(19) \qquad a_{mt} = a_{mt,s}\,k_{mt,s}/k_{mt} + a_{mt,e}\,k_{mt,e}/k_{mt} = \gamma_{mt}\,a_{mt,s} + (1-\gamma_{mt})\,a_{mt,e}$$

and

$$(20) \qquad *_{mt} = \gamma_{mt}\,*_{t,s} + (1-\gamma_{mt})\,*_{t,e}$$

for the blended age and depreciation rate of capital, respectively. Substitution into (16) yields a formula that can be applied in practice:

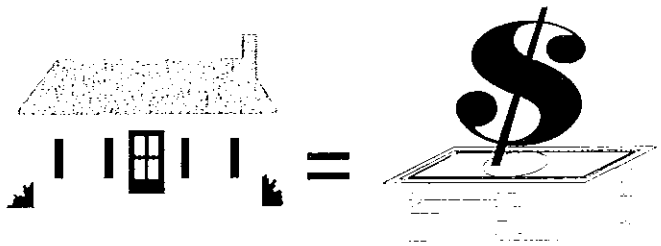
$$(21) \quad [w_{mt}L_{mt} + x_{mt} + (\phi_{mt}+\gamma_{mt}*_{t,s} + (1-\gamma_{mt})*_{t,e})\,k_{mt}]\cdot[\beta_w + \beta_{ww}\ln((x_{mt}/k_{mt}+\phi_{mt}+\gamma_{mt}*_{t,s}+(1-\gamma_{mt})*_{t,e})/w_{mt})] + \beta_{wa}(\gamma_{mt}\,a_{mt,s} + (1-\gamma_{mt})\,a_{mt,e}) + \boldsymbol{\beta}_I'\boldsymbol{I}_{mt}] = w_{mt}L_{mt}$$

This is the formula used to estimate k_{mt}, the dollar value of a particular type of government capital in a particular local area. Because capital appears twice in the nonlinear expression, a closed form solution for it does not exist. Finding the solution is a one-dimensional problem, however, so k_{mt} can be recovered through elementary numerical methods.

NAHB
NATIONAL ASSOCIATION OF HOME BUILDERS

THE METRO AREA IMPACT OF HOME BUILDING IN CHESTERFIELD COUNTY, VIRGINIA

INCOME, JOBS, AND TAXES GENERATED



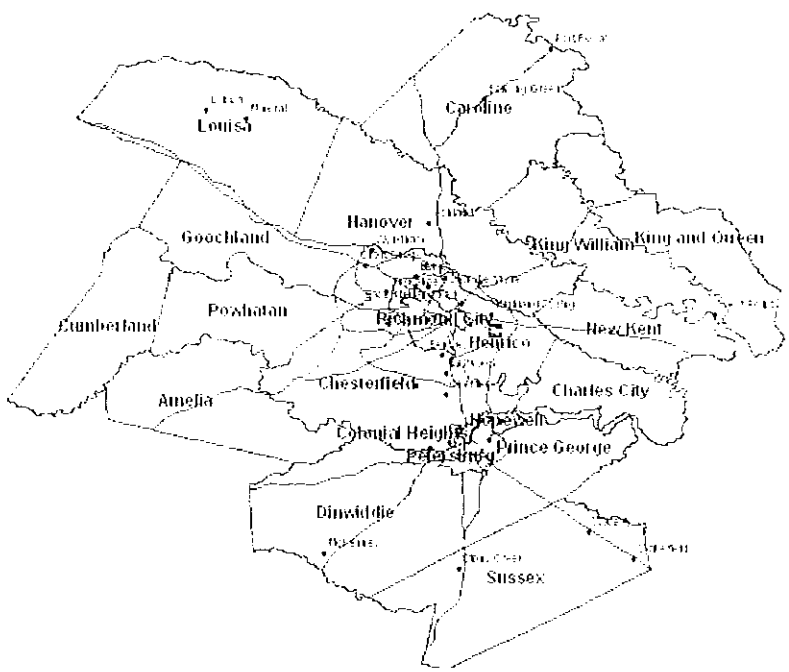
CONTENTS

EXECUTIVE SUMMARY

Home building generates substantial local economic activity, including new income and jobs for residents, and additional revenue for local governments. The National Association of Home Builders has developed a model to estimate the economic benefits. The model captures the effect of the construction activity itself, the ripple impact that occurs when income earned from construction activity is spent and recycles in the local economy, and the ongoing impact that results from new homes becoming occupied by residents who pay taxes and buy locally produced goods and services. In order to fully appreciate the positive impact residential construction has on a community, it's important to include the ripple effects and the ongoing benefits. Since the NAHB model was initially developed in 1996, it has been successfully applied to construction in over 450 projects, local jurisdictions, metropolitan areas, non-metropolitan counties, and states across the country.

This report presents estimates of the metro area impacts of home building in Chesterfield County, Virginia. The comprehensive nature of the NAHB model means that the local area over which the benefits are spread must be large enough to include the places where construction workers live and spend their money, as well as the places where the new home occupants are likely to work, shop, and go for recreation. In practice, this usually means a Metropolitan Statistical Area (MSA), as defined by the U.S. Office of Management and Budget (OMB). Based on local commuting patterns, OMB has identified the Richmond MSA as a metro area consisting of sixteen counties (Amelia, Caroline, Charles City, Chesterfield, Cumberland, Dinwiddie, Goochland, Hanover, Henrico, King and Queen, King William, Louisa, New Kent, Powhatan, Prince George, and Sussex) and four independent cities (Colonial Heights, Hopewell, Petersburg, and Richmond) in Virginia (see map below).

Richmond, Virginia MSA



In this report, wherever the terms local or Richmond are used, they refer to the entire metro area. The report presents estimates of the impacts of building 2,014 single family and 426 multifamily housing units, based on the level of construction activity in Chesterfield County in 2006.

The NAHB model produces impacts on income and employment in 16 industries and local government, as well as detailed information about taxes and other types of local government revenue. The key results are summarized below. Additional details are contained in subsequent sections.

Single Family Construction

- The estimated one-year metro area impacts of building 2,014 single family homes in Chesterfield County include
  - $485.7 million in local income,
  - 46.0 million in taxes and other revenue for local governments, and
  - 9,116 local jobs.

  These are **local impacts**, representing income and jobs for residents of the Richmond MSA, and taxes (and other sources of revenue, including permit fees) for all local jurisdictions within the metro area. They are also **one-year impacts** that include both the direct and indirect impact of the construction activity itself, and the impact of local residents who earn money from the construction activity spending part of it within the local area.

- The additional, annually recurring impacts of building 2,014 single family homes in Chesterfield County include
  - $70.7 million in local income,
  - $13.8 million in taxes and other revenue for local governments, and
  - 1,455 local jobs.

  These are **ongoing, annual local impacts** that result from the new homes being occupied, and the occupants paying taxes and otherwise participating in the local economy year after year. In order to fully understand the impact residential construction has on a community, it's important to consider the ongoing benefits as well as the one-time effects.

- The above impacts were calculated assuming that the new single family homes built in Chesterfield County in 2006 have an average price of $386,336; are built on a lot for which the average value of the raw land is $18,000; require the builder and developer to pay an average of 10,593 in impact, permit, and other fees to local governments; and incur an average property tax of $3,111 per year. This information was provided by the Budget and Management Department of Chesterfield County.

Multifamily Construction

- The estimated one-year local impacts of building 426 multifamily units in Chesterfield County include
  - $27.8 million in local income,
  - $4.9 million in taxes and other revenue for local governments, and
  - 565 local jobs.

  These are **local impacts**, representing income and jobs for residents of the Richmond metro area, and taxes (and other sources of revenue, including permit fees) for all local jurisdictions within the MSA. They are also **one-year impacts** that include both the direct and indirect impact of the construction activity itself, and the impact of local residents who earn money from the construction activity spending part of it within the metro area.

- The additional, annually recurring impacts of building 426 multifamily units in Chesterfield County include
  - $10.5 million in local income,
  - $1.3 million in taxes and other revenue for local governments, and
  - 183 local jobs.

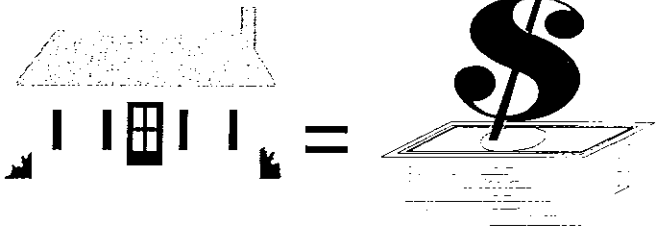
  These are **ongoing, annual local impacts** that result from the new homes being occupied, and the occupants paying taxes and otherwise participating in the local economy year after year.

- These impacts were calculated assuming that new multifamily units built in Chesterfield County in 2006 have an average market value of $91,189; embody an average raw land value of $9,359; require the builder and developer to pay an average of $8,343 in impact, permit, and other fees per unit to local governments; and incur an average annual property tax of $734 per unit. As with the assumptions underlying the single family impact estimates, these numbers were provided by the Budget and Management Department of Chesterfield County.

NAHB

THE METRO AREA IMPACT OF HOME BUILDING IN CHESTERFIELD COUNTY, VIRGINIA

INCOME, JOBS, AND TAXES GENERATED



DETAILED TABLES ON SINGLE FAMILY CONSTRUCTION

IMPACT OF BUILDING 2,014 SINGLE FAMILY HOMES IN CHESTERFIELD COUNTY, VIRGINIA

SUMMARY

Total One-Year Impact: Sum of Phase I and Phase II:

Local Income	Local Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$485,662,000	$143,283,000	$342,380,000	$45,995,000	9,116

Phase I: Direct and Indirect Impact of Construction Activity:

Local Income	Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$327,524,000	$92,208,000	$235,317,000	$32,950,000	6,047

Phase II: Induced (Ripple) Effect of Spending the Income and Taxes from Phase I:

Local Income	Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$158,138,000	$51,075,000	$107,063,000	$13,045,000	3,069

Phase III: Ongoing, Annual Effect that Occurs When New Homes are Occupied:

Local Income	Local Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$70,735,000	$20,902,000	$49,833,000	$13,762,000	1,455

[1] The term local taxes is used as a shorthand for local government revenue from all sources: taxes, fees, fines, revenue from government-owned enterprises, etc...

IMPACT OF BUILDING 2,014 SINGLE FAMILY HOMES IN CHESTERFIELD CO., VA
PHASE I -- DIRECT AND INDIRECT IMPACT OF CONSTRUCTION ACTIVITY

A. Local Income and Jobs by Industry

Industry	Local Income	Local Business Owners' Income	Local Wages and Salaries	Wages & Salaries per Full-time Job	Number of Local Jobs Supported
Construction	$228,462,000	$59,047,000	$169,415,000	$40,000	4,277
Manufacturing	$643,000	$78,000	$565,000	$38,000	15
Transportation	$1,735,000	$198,000	$1,537,000	$25,000	62
Communications	$3,233,000	$1,140,000	$2,093,000	$58,000	36
Utilities	$1,740,000	$1,274,000	$466,000	$67,000	7
Wholesale and Retail Trade	$34,503,000	$5,275,000	$29,228,000	$32,000	918
Finance and Insurance	$6,065,000	$691,000	$5,374,000	$67,000	80
Real Estate	$5,591,000	$4,875,000	$717,000	$39,000	19
Personal & Repair Services	$2,916,000	$2,542,000	$374,000	$48,000	8
Services to Dwellings / Buildings	$1,497,000	$501,000	$996,000	$27,000	37
Business & Professional Services	$37,480,000	$14,409,000	$23,071,000	$43,000	533
Eating and Drinking Places	$671,000	$83,000	$588,000	$17,000	35
Automobile Repair & Service	$881,000	$714,000	$167,000	$45,000	4
Entertainment Services	$218,000	$74,000	$144,000	$38,000	4
Health, Educ. & Social Services	$25,000	$9,000	$16,000	$32,000	0
Local Government	$42,000	$42,000	$0	$43,000	0
Other	$1,823,000	$1,255,000	$568,000	$46,000	12
Total	$327,524,000	$92,208,000	$235,317,000	$39,000	6,047

Note: Business & professional services include architectural and engineering services. The "other" category consists mostly of landscaping services, and the production of greenhouse and nursery products.

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$747,000	Residential Permit / Impact Fees	$21,334,000
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$4,093,000
General Sales Taxes	$2,843,000	Hospital Charges	$1,049,000
Specific Excise Taxes	$185,000	Transportation Charges	$541,000
Income Taxes	$0	Education Charges	$297,000
License Taxes	$133,000	Other Fees and Charges	$1,069,000
Other Taxes	$659,000	TOTAL FEES & CHARGES	$28,383,000
TOTAL TAXES	$4,567,000	TOTAL GENERAL REVENUE	$32,950,000

IMPACT OF BUILDING 2,014 SINGLE FAMILY HOMES IN CHESTERFIELD CO., VA
PHASE II-INDUCED EFFECT OF SPENDING INCOME AND TAX REVENUE FROM PHASE I

A. Local Income and Jobs by Industry

Industry	Local Income	Local Business Owners' Income	Local Wages and Salaries	Wages & Salaries per Full-time Job	Number of Local Jobs Supported
Construction	$2,323,000	$385,000	$1,938,000	$40,000	49
Manufacturing	$568,000	$70,000	$498,000	$38,000	13
Transportation	$1,585,000	$159,000	$1,426,000	$27,000	54
Communications	$8,928,000	$3,482,000	$5,446,000	$58,000	93
Utilities	$3,655,000	$1,777,000	$1,878,000	$67,000	28
Wholesale and Retail Trade	$22,027,000	$3,602,000	$18,425,000	$27,000	675
Finance and Insurance	$6,948,000	$912,000	$6,035,000	$58,000	105
Real Estate	$24,519,000	$21,377,000	$3,143,000	$39,000	81
Personal & Repair Services	$9,701,000	$5,105,000	$4,596,000	$29,000	157
Services to Dwellings / Buildings	$2,262,000	$757,000	$1,505,000	$27,000	56
Business & Professional Services	$14,260,000	$5,783,000	$8,477,000	$38,000	221
Eating and Drinking Places	$6,264,000	$1,242,000	$5,022,000	$17,000	302
Automobile Repair & Service	$4,517,000	$2,204,000	$2,313,000	$55,000	42
Entertainment Services	$2,817,000	$1,017,000	$1,800,000	$32,000	57
Health, Educ. & Social Services	$16,101,000	$2,937,000	$13,164,000	$39,000	335
Local Government	$26,217,000	$0	$26,217,000	$43,000	607
Other	$5,447,000	$268,000	$5,179,000	$27,000	193
Total	$158,138,000	$51,075,000	$107,063,000	$35,000	3,069

Note: Business & professional services include architectural and engineering services. The "other" category consists mostly of landscaping services, and the production of greenhouse and nursery products.

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$3,729,000	Residential Permit / Impact Fees	$0
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$4,121,000
General Sales Taxes	$993,000	Hospital Charges	$506,000
Specific Excise Taxes	$922,000	Transportation Charges	$266,000
Income Taxes	$0	Education Charges	$146,000
License Taxes	$110,000	Other Fees and Charges	$1,172,000
Other Taxes	$1,080,000	TOTAL FEES & CHARGES	$6,211,000
TOTAL TAXES	$6,834,000	TOTAL GENERAL REVENUE	$13,045,000

IMPACT OF BUILDING 2,014 SINGLE FAMILY HOMES IN CHESTERFIELD CO., VA
PHASE III-ONGOING, ANNUAL EFFECT THAT OCCURS BECAUSE UNITS ARE OCCUPIED

A. Local Income and Jobs by Industry

Industry	Local Income	Local Business Owners' Income	Local Wages and Salaries	Wages & Salaries per Full-time Job	Number of Local Jobs Supported
Construction	$1,373,000	$238,000	$1,135,000	$40,000	29
Manufacturing	$283,000	$35,000	$248,000	$38,000	6
Transportation	$619,000	$63,000	$556,000	$27,000	21
Communications	$4,467,000	$1,746,000	$2,721,000	$58,000	47
Utilities	$2,079,000	$1,017,000	$1,062,000	$67,000	16
Wholesale and Retail Trade	$11,354,000	$1,857,000	$9,497,000	$27,000	348
Finance and Insurance	$4,040,000	$513,000	$3,527,000	$57,000	62
Real Estate	$6,711,000	$5,851,000	$860,000	$39,000	22
Personal & Repair Services	$3,744,000	$2,052,000	$1,692,000	$30,000	56
Services to Dwellings / Buildings	$1,245,000	$417,000	$829,000	$27,000	31
Business & Professional Services	$7,094,000	$2,907,000	$4,187,000	$39,000	107
Eating and Drinking Places	$3,139,000	$622,000	$2,517,000	$17,000	152
Automobile Repair & Service	$2,543,000	$1,266,000	$1,277,000	$52,000	24
Entertainment Services	$1,423,000	$502,000	$921,000	$31,000	30
Health, Educ. & Social Services	$8,179,000	$1,577,000	$6,602,000	$39,000	169
Local Government	$8,483,000	$0	$8,483,000	$43,000	197
Other	$3,959,000	$239,000	$3,720,000	$27,000	139
Total	$70,735,000	$20,902,000	$49,833,000	$34,000	1,455

Note: Business & professional services include architectural and engineering services. The "other" category consists mostly of landscaping services, and the production of greenhouse and nursery products.

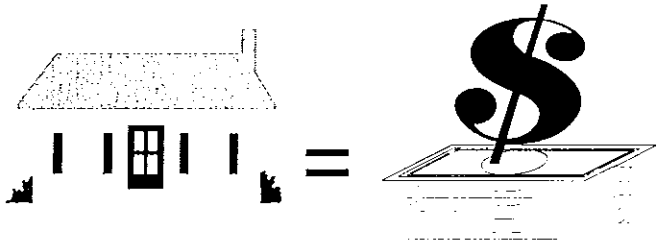
B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$1,664,000	Residential Permit / Impact Fees	$0
Residential Property Taxes	$5,973,000	Utilities & Other Govt. Enterprises	$3,337,000
General Sales Taxes	$443,000	Hospital Charges	$694,000
Specific Excise Taxes	$412,000	Transportation Charges	$119,000
Income Taxes	$0	Education Charges	$65,000
License Taxes	$49,000	Other Fees and Charges	$523,000
Other Taxes	$482,000	TOTAL FEES & CHARGES	$4,739,000
TOTAL TAXES	$9,023,000	TOTAL GENERAL REVENUE	$13,762,000

NAHB

THE METRO AREA IMPACT OF HOME BUILDING IN CHESTERFIELD COUNTY, VIRGINIA

INCOME, JOBS, AND TAXES GENERATED



DETAILED TABLES ON MULTIFAMILY CONSTRUCTION

IMPACT OF BUILDING 426 MULTIFAMILY UNITS IN CHESTERFIELD COUNTY, VIRGINIA

SUMMARY

Total One-Year Impact: Sum of Phase I and Phase II:

Local Income	Local Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$27,792,000	$6,199,000	$21,593,000	$4,880,000	565

Phase I: Direct and Indirect Impact of Construction Activity:

Local Income	Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$17,184,000	$3,276,000	$13,908,000	$4,105,000	353

Phase II: Induced (Ripple) Effect of Spending the Income and Taxes from Phase I:

Local Income	Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$10,608,000	$2,923,000	$7,685,000	$775,000	212

Phase III: Ongoing, Annual Effect that Occurs When New Homes are Occupied:

Local Income	Local Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$10,538,000	$4,407,000	$6,130,000	$1,344,000	183

[1] The term local taxes is used as a shorthand for local government revenue from all sources: taxes, fees, fines, revenue from government-owned enterprises, etc...

IMPACT OF BUILDING 426 MULTIFAMILY UNITS IN CHESTERFIELD CO., VA
PHASE I -- DIRECT AND INDIRECT IMPACT OF CONSTRUCTION ACTIVITY

A. Local Income and Jobs by Industry

Industry	Local Income	Local Business Owners' Income	Local Wages and Salaries	Wages & Salaries per Full-time Job	Number of Local Jobs Supported
Construction	$12,314,000	$1,505,000	$10,808,000	$40,000	273
Manufacturing	$24,000	$3,000	$21,000	$38,000	1
Transportation	$52,000	$6,000	$46,000	$25,000	2
Communications	$157,000	$58,000	$99,000	$58,000	2
Utilities	$77,000	$54,000	$23,000	$67,000	0
Wholesale and Retail Trade	$1,186,000	$180,000	$1,005,000	$32,000	31
Finance and Insurance	$231,000	$25,000	$206,000	$62,000	3
Real Estate	$270,000	$235,000	$35,000	$39,000	1
Personal & Repair Services	$139,000	$132,000	$6,000	$37,000	0
Services to Dwellings / Buildings	$89,000	$30,000	$59,000	$27,000	2
Business & Professional Services	$2,526,000	$945,000	$1,581,000	$42,000	38
Eating and Drinking Places	$21,000	$19,000	$1,000	$17,000	0
Automobile Repair & Service	$49,000	$43,000	$6,000	$35,000	0
Entertainment Services	$8,000	$3,000	$5,000	$35,000	0
Health, Educ. & Social Services	$1,000	$0	$1,000	$34,000	0
Local Government	$1,000	$1,000	$0	$43,000	0
Other	$40,000	$36,000	$4,000	$30,000	0
Total	$17,184,000	$3,276,000	$13,908,000	$39,000	353

Note: Business & professional services include architectural and engineering services. The "other" category consists mostly of landscaping services, and the production of greenhouse and nursery products.

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$37,000	Residential Permit / Impact Fees	$3,554,000
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$174,000
General Sales Taxes	$134,000	Hospital Charges	$55,000
Specific Excise Taxes	$9,000	Transportation Charges	$28,000
Income Taxes	$0	Education Charges	$16,000
License Taxes	$7,000	Other Fees and Charges	$56,000
Other Taxes	$34,000	TOTAL FEES & CHARGES	$3,884,000
TOTAL TAXES	$222,000	TOTAL GENERAL REVENUE	$4,105,000

IMPACT OF BUILDING 426 MULTIFAMILY UNITS IN CHESTERFIELD CO., VA
PHASE II-INDUCED EFFECT OF SPENDING INCOME AND TAX REVENUE FROM PHASE I

A. Local Income and Jobs by Industry

Industry	Local Income	Local Business Owners' Income	Local Wages and Salaries	Wages & Salaries per Full-time Job	Number of Local Jobs Supported
Construction	$133,000	$22,000	$111,000	$40,000	3
Manufacturing	$32,000	$4,000	$28,000	$38,000	1
Transportation	$91,000	$9,000	$82,000	$27,000	3
Communications	$511,000	$199,000	$312,000	$58,000	5
Utilities	$209,000	$102,000	$107,000	$67,000	2
Wholesale and Retail Trade	$1,260,000	$206,000	$1,054,000	$27,000	39
Finance and Insurance	$398,000	$52,000	$345,000	$58,000	6
Real Estate	$1,403,000	$1,223,000	$180,000	$39,000	5
Personal & Repair Services	$555,000	$292,000	$263,000	$29,000	9
Services to Dwellings / Buildings	$129,000	$43,000	$86,000	$27,000	3
Business & Professional Services	$816,000	$331,000	$485,000	$38,000	13
Eating and Drinking Places	$358,000	$71,000	$287,000	$17,000	17
Automobile Repair & Service	$258,000	$126,000	$132,000	$55,000	2
Entertainment Services	$161,000	$58,000	$103,000	$32,000	3
Health, Educ. & Social Services	$921,000	$168,000	$753,000	$39,000	19
Local Government	$3,059,000	$0	$3,059,000	$43,000	71
Other	$312,000	$15,000	$296,000	$27,000	11
Total	$10,608,000	$2,923,000	$7,685,000	$36,000	212

Note: Business & professional services include architectural and engineering services. The "other" category consists mostly of landscaping services, and the production of greenhouse and nursery products.

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$213,000	Residential Permit / Impact Fees	$0
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$248,000
General Sales Taxes	$57,000	Hospital Charges	$34,000
Specific Excise Taxes	$53,000	Transportation Charges	$18,000
Income Taxes	$0	Education Charges	$10,000
License Taxes	$7,000	Other Fees and Charges	$72,000
Other Taxes	$64,000	TOTAL FEES & CHARGES	$381,000
TOTAL TAXES	$394,000	TOTAL GENERAL REVENUE	$775,000

IMPACT OF BUILDING 428 MULTIFAMILY UNITS IN CHESTERFIELD CO., VA

***PHASE III*-ONGOING. ANNUAL EFFECT THAT OCCURS BECAUSE UNITS ARE OCCUPIED**

A. Local Income and Jobs by Industry

Industry	Local Income	Local Business Owners' Income	Local Wages and Salaries	Wages & Salaries per Full-time Job	Number of Local Jobs Supported
Construction	$114,000	$16,000	$98,000	$40,000	2
Manufacturing	$37,000	$5,000	$32,000	$38,000	1
Transportation	$123,000	$12,000	$110,000	$27,000	4
Communications	$450,000	$170,000	$281,000	$59,000	5
Utilities	$150,000	$73,000	$77,000	$67,000	1
Wholesale and Retail Trade	$1,291,000	$211,000	$1,080,000	$27,000	39
Finance and Insurance	$422,000	$53,000	$369,000	$58,000	6
Real Estate	$2,824,000	$2,462,000	$362,000	$39,000	9
Personal & Repair Services	$777,000	$408,000	$369,000	$29,000	13
Services to Dwellings / Buildings	$146,000	$49,000	$97,000	$27,000	4
Business & Professional Services	$951,000	$378,000	$573,000	$38,000	15
Eating and Drinking Places	$451,000	$89,000	$362,000	$17,000	22
Automobile Repair & Service	$388,000	$194,000	$193,000	$51,000	4
Entertainment Services	$258,000	$92,000	$166,000	$31,000	5
Health, Educ. & Social Services	$1,034,000	$185,000	$850,000	$39,000	22
Local Government	$784,000	$0	$784,000	$43,000	18
Other	$337,000	$11,000	$327,000	$27,000	12
Total	$10,538,000	$4,407,000	$6,130,000	$33,000	183

Note: Business & professional services include architectural and engineering services. The "other" category consists mostly of landscaping services, and the production of greenhouse and nursery products.

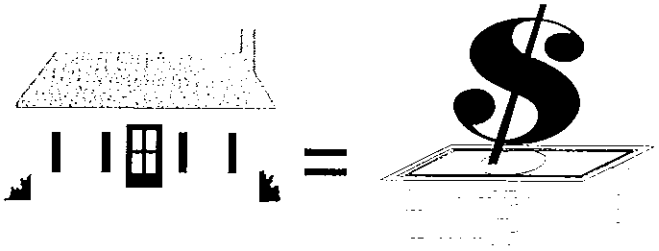
B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$283,000	Residential Permit / Impact Fees	$0
Residential Property Taxes	$281,000	Utilities & Other Govt. Enterprises	$333,000
General Sales Taxes	$75,000	Hospital Charges	$102,000
Specific Excise Taxes	$70,000	Transportation Charges	$18,000
Income Taxes	$0	Education Charges	$10,000
License Taxes	$8,000	Other Fees and Charges	$85,000
Other Taxes	$80,000	TOTAL FEES & CHARGES	$546,000
TOTAL TAXES	$797,000	TOTAL GENERAL REVENUE	$1,344,000

NAHB

THE METRO AREA IMPACT OF HOME BUILDING IN CHESTERFIELD COUNTY, VIRGINIA

INCOME, JOBS, AND TAXES GENERATED



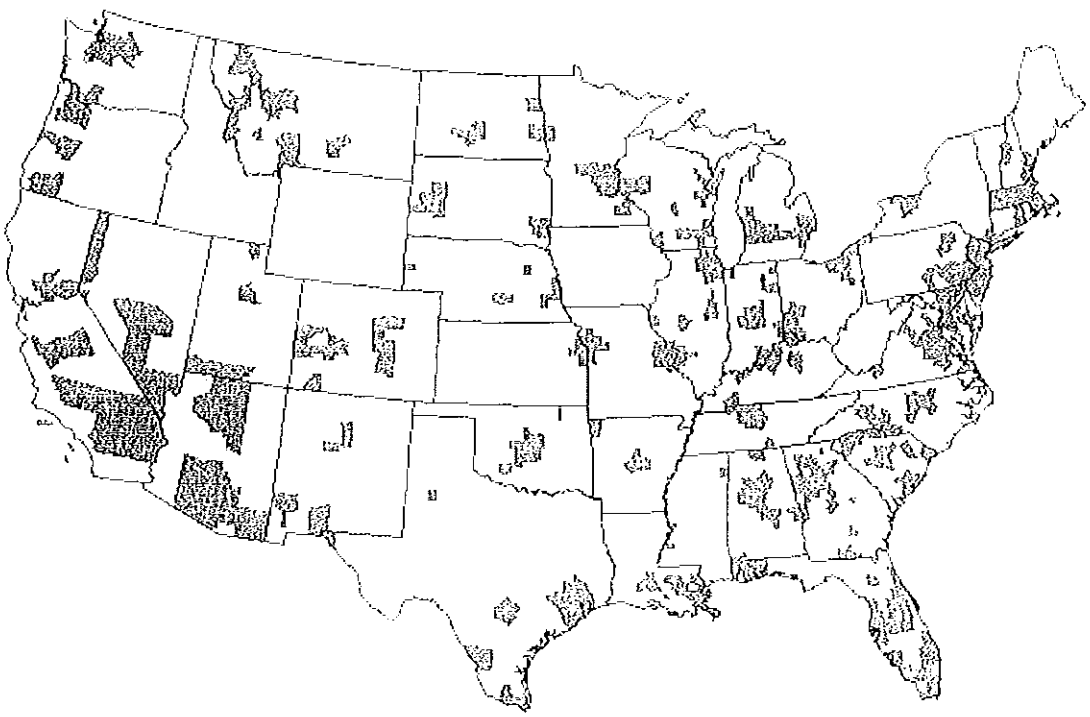
BACKGROUND AND A BRIEF DESCRIPTION OF THE MODEL USED TO ESTIMATE THE ECONOMIC BENEFITS

The Housing Policy Department of the National Association of Home Builders (NAHB) maintains an economic model that it uses to estimate the local economic benefits of home building. Originally developed in 1996, the model was at first calibrated to a typical metropolitan area using national averages, but from the beginning was capable of being adapted to a specific local economy by replacing key housing market variables. The initial version of the model could be applied to single family construction, multifamily construction, or a combination of the two.

In March of 1997, NAHB began customizing the model to various areas around the country on a routine basis, primarily at the request of its local affiliated associations. As of July 2007, the Housing Policy Department has produced over 450 of these customized reports analyzing residential construction in various metropolitan areas, non-metropolitan counties, and states across the country (see map below).

Areas Covered by NAHB Local Impact Studies

The darkest shading indicates studies that covered metro areas and non-metro counties; the somewhat lighter shading indicates studies that were produced for an entire state.



The reports have analyzed the impacts of specific housing projects, as well as total home building in areas as large as entire states. In 2002, NAHB developed new versions of the model to analyze active adult housing projects and multifamily development financed with the Low-Income Housing Tax Credit. In 2005 a version of the model that analyzes residential remodeling was added to the mix.

Results from NAHB's local impact model have been used by outside organizations such as universities, state housing authorities and affordable housing agencies:

- The Shimburg Center for Affordable Housing at the University of Florida used results from the NAHB model to establish that "the real estate taxes paid year after year are the most obvious long-term economic benefit to the community. Probably the second most obvious long-term economic benefit is the purchases made by the family occupying the completed home." www.shimberg.ufl.edu/pdfs/Newslett-June02.pdf

- The Center for Applied Economic Research at Montana State University used "results from an input-output model developed by the National Association of Home Builders to assess the impacts to local areas from new home construction." The results show that "the construction industry contributes substantially to Montana's economy accounting for 5.5 percent of Gross State Product." www.msubillings.edu/caer/The%20Impact%20of%20Home%20Construction%20in%20Montana.pdf

- The Housing Education and Research Center at Michigan State University also adopted the NAHB approach: "The underlying basis for supporting the implementation of this [NAHB] model on Michigan communities is that it provides quantifiable results that link new residential development with commercial and other forms of development therefore illustrating the overall economic effects of residential growth." www.canr.msu.edu/cm/herc/h5over.html

- The Center for Economic Development at the University of Massachusetts found that "Home building generates substantial local economic activity, including income, jobs, and revenue for state and local governments. These far exceed the school costs-to-property-tax ratios. ...these factors were evaluated by means of a quantitative assessment of data from the National Association of Home Builder's Local Impact of Home Building model" www.donahue.umassp.edu/publications/housing/7-economicco.html

- Similarly, the Association of Oregon Community Development Organizations decided to base its analysis of affordable housing on the NAHB model, stating that "This model is widely respected and utilized in analyzing the economic impact of market rate housing development," and that, compared to alternatives, it "is considered the most comprehensive and is considered an improvement on most previous models." www.aocdo.org/docs/EcoDevoStudyFinal.pdf

- The Boone County Kentucky Planning Commission included results from the NAHB model in its 2005 Comprehensive Report. The Planning Commission used values from the impact model to quantify the increase in local income, taxes, revenue, jobs, and overall local economic impacts in the Metro Area as a result of new home construction. http://www.boonecountyky.org/pc/2005CompPlan.aspxv

A Brief Description of the Model

The NAHB model is divided into three phases. Phases I and II are one-time effects. Phase I captures the effects that result directly from the construction activity itself and the local industries that contribute to it. Phase II captures the effects that occur as a result of the wages and profits from Phase I being spent in the local economy. Phase III is an ongoing, annual effect that includes property tax payments and the result of the completed unit being occupied.

Phase I: Local Industries Involved in Home Building

The jobs, wages, and local taxes (including permit, utility connection, and impact fees) generated by the actual development, construction, and sale of the home. These jobs include on-site and off-site construction work as well as jobs generated in retail and wholesale sales of components, transportation to the site, and the professional services required to build a home and deliver it to its final customer.

Phase II: Ripple Effect

The wages and profits for local area residents earned during the construction period are spent on other locally produced goods and services. This generates additional income for local residents, which is spent on still more locally produced goods and services, and so on. This continuing recycling of income back into the community is usually called a ***multiplier*** or ***ripple*** effect.

Phase III: Ongoing, Annual Effect

The local jobs, income, and taxes generated as a result of the home being occupied. A household moving into a new home generally spends about three-fifths of its income on goods and services sold in the local economy. A fraction of this will become income for local workers and local businesses proprietors. In a typical local area, the household will also pay 1.25 percent of its income to local governments in the form of taxes and user fees, and a fraction of this will become income for local government employees. This is the first step in another set of economic ripples that cause a permanent increase in the level of economic activity, jobs, wages, and local tax receipts.

Modeling a Local Economy

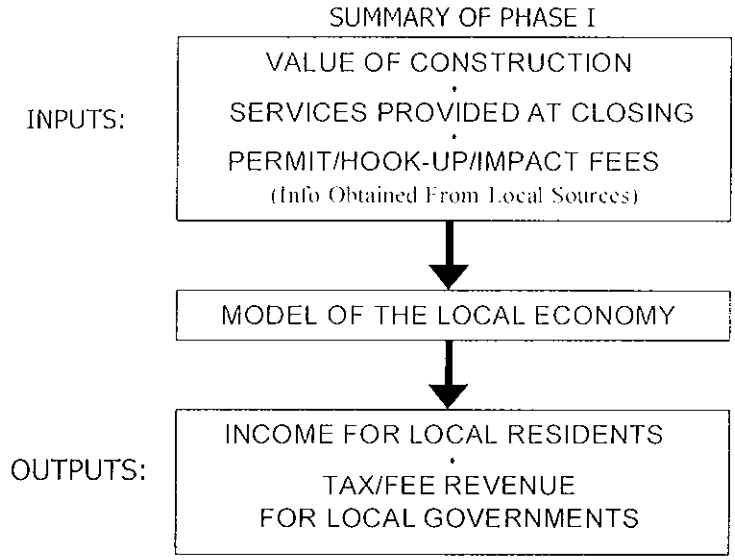
The model defines a local economy as a collection of industries and commodities. These are selected from the detailed benchmark input-output tables produced by the U.S. Bureau of Economic Analysis. The idea is to choose goods and services that would typically be produced, sold, and consumed within a local market area. Laundry services would qualify, for example, while automobile manufacturing would not. Both business-to-business and business-to-consumer transactions are considered. In general the model takes a conservative approach and retains a relatively small number of the available industries and commodities. Of the roughly 600 industries and commodities provided in the input-output files, the model uses only 93 commodities and 95 industries.

The design of the model implies that a local economy should include not only the places people live, but also the places where they work, shop, typically go for entertainment, etc. This corresponds reasonably well to the concepts of Metropolitan Statistical Areas and Metropolitan Divisions, areas defined by the U.S. Office of Management and Budget based on local commuting patterns. Outside of these officially defined metropolitan areas, NAHB has determined that a county will usually satisfy the model's requirements.

For a particular local area, the model adjusts the indirect business tax section of the national input-output accounts to account for the fiscal structure of local governments in the area. The information used to do this comes primarily from the U.S. Census Bureau's Census of Governments. Wages and salaries are extracted from the employee compensation section of the input-output accounts on an industry-by-industry basis. In order to relate wages and salaries to employment, the model incorporates data on local wages per job published by the Bureau of Economic Analysis.

Phase I: Construction

In order to estimate the local impacts generated by home building, it is necessary to know the sales price of the homes being built, how much raw land contributes to the final price, and how much the builder and developer pay to local area governments in the form of permit, utility connection, impact, and other fees. This information is not generally available from national sources and in most cases must be provided by representatives from the area in question who have specialized knowledge of local conditions.

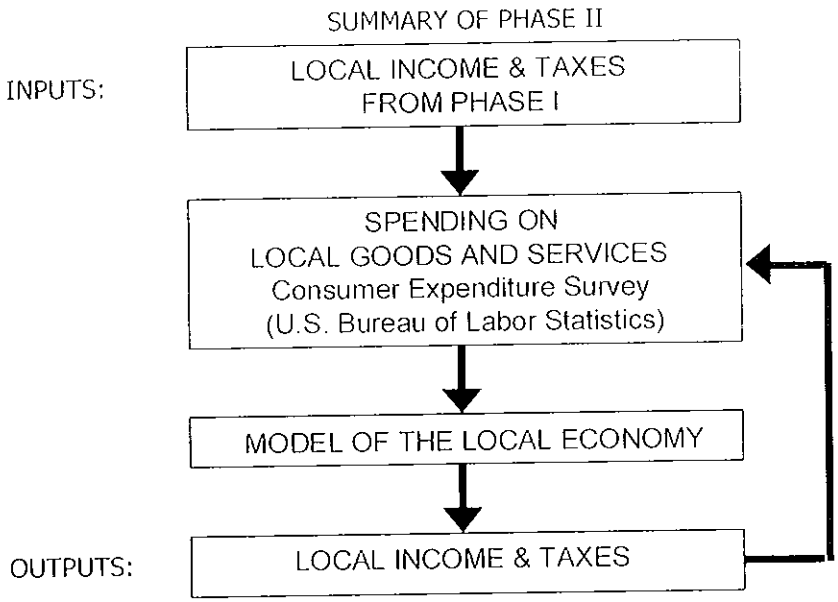


The model subtracts raw land value from the price of new construction and converts the difference into local wages, salaries, business owners' income, and taxes. This is done separately for all 95 local industries. In addition, the taxes and fees collected by local governments during the construction phase generate wages and salaries for local government employees. Finally the number of full time jobs supported by the wages and salaries generated in each private local industry and the local government sector is estimated.

Phase II: The Construction Ripple

Clearly, the local residents who earn income in Phase I will spend a share of it. Some of this will escape the local economy. A portion of the money used to buy a new car, for example, will become wages for autoworkers who are likely to live in another city, and increased profits for stockholders of an automobile manufacturing company who are also likely to live elsewhere. A portion of the spending, however, will remain within, and have an impact on, the local economy. The car is likely to be purchased from a local dealer and generate income for a salesperson who lives in the area, as well for local workers who provide cleaning, maintenance, and other services to the dealership. Consumers also are likely to purchase many services locally, as well as to pay taxes and fees to local governments.

This implies that the income and taxes generated in Phase I become the input for additional economic impacts analyzed in what we call Phase II of the model. Phase II begins by estimating how much of the added income households spend on each of the local commodities. This requires detailed analysis of data from the Consumer Expenditure Survey (CES), which is conducted by the U.S. Bureau of Labor Statistics primarily for the purpose of determining the weights for the Consumer Price Index. The analysis produces household spending estimates for 56 local commodities (the remainder of the 93 local commodities entering the model exclusively through business-to-business transactions).



The model then translates the estimated local spending into local business owners' income, wages and salaries, jobs, and taxes. This is essentially the same procedure applied to the homes sold to consumers in Phase I. In Phase II, however, the procedure is applied simultaneously to 56 locally produced and sold commodities.

In other words, the model converts the local income earned in Phase I into local spending, which then generates additional local income. But this in turn will lead to additional spending, which will generate more local income, leading to another round of spending, and so on. Calculating the end result of these economic is a straightforward exercise in mathematics.

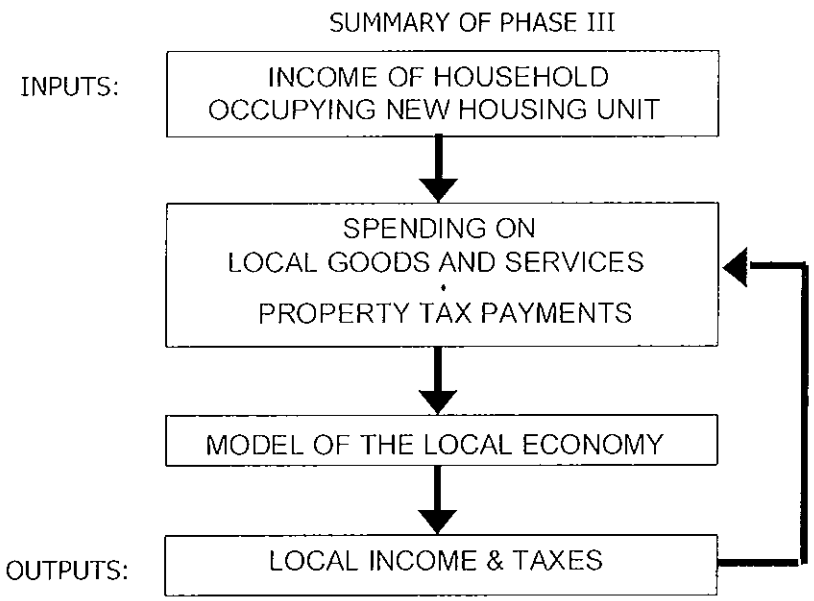
Phase III: The Ongoing Impacts

Like Phase II, Phase III involves computing the sum of successive ripples of economic activity. In Phase III, however, the first ripple is generated by the income and spending of a new household (along with the additional property taxes local governments collect as a result of the new structure). This does not necessarily imply that all new homes must be occupied by households moving in from outside the local area. It may be that an average new-home household moves into the newly constructed unit from elsewhere in the same local area, while average existing-home household moves in from outside to occupy the unit vacated by the first household. Alternatively, it may be that the new home allows the local area to retain a household that would otherwise move out of the area for lack of suitable housing.

In any of these cases, it is appropriate to treat a new, occupied housing unit as a net gain to the local economy of one household with average characteristics for a household that occupies a new home. This reasoning is often used, even if unconsciously, when it is assumed that a

new home will be occupied by a household with average characteristics—for instance, an average number of children who will consume public education.

To estimate the impact of the net additional households, Phase III of the model requires an estimate of the income of the households occupying the new homes. The information used to compute this estimate comes from several sources, but primarily from an NAHB statistical model based on decennial census data. Phase III of the local impact model then estimates the fraction of income these households spend on various local commodities. This is done with CES data and is similar to the procedure described under Phase II. The model also calculates the amount of local taxes the households pay each year. This is done with Census of Governments data except in the case of residential property taxes, which are treated separately, and for which specific information must usually be obtained from a local source. Finally, a total ripple effect is computed, using essentially the same procedure outlined above under Phase II.

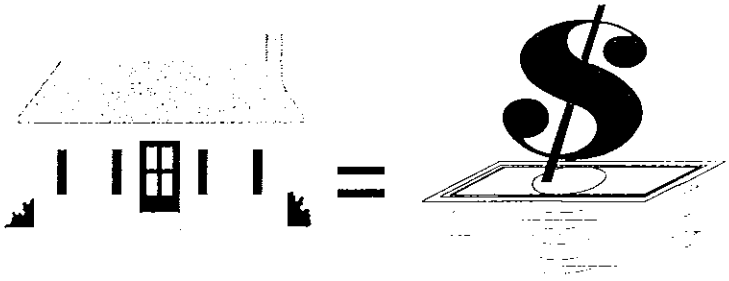


The details covered here provide only a brief description of the model NAHB uses to estimate the local economic benefits of home building. For a more complete description, see the technical documentation at the end of the report. For additional information about the model, or questions about applying it to a particular local area, contact one of the following in NAHB's Housing Policy Department:

- David Crowe, Senior Staff Vice President (202) 266-8383
- Paul Emrath, Assistant Staff Vice President (202) 266-8449
- Elliot Eisenberg, Housing Policy Economist (202) 266-8398

NAHB

NAHB'S LOCAL IMPACT OF HOME BUILDING MODEL



TECHNICAL DOCUMENTATION

A Hard Copy of the Technical Documentation
is Available on Request from
NAHB's Housing Policy Department.