April 8, 2026

New Housing Generates Billions Annually in Sacramento Region, Reports Find

Analysis shows homebuilding boosts local economies, supports jobs and delivers long-term revenue streams to governments

New home construction in the greater Sacramento region is a powerful economic driver that generates billions of dollars in income, supports tens of thousands of jobs and delivers more than $1 billion annually to local governments, the North State Building Industry Association (BIA) reported today.

Four reports analyzing the impact of the more than 10,000 homes and apartments built between June 2024 and June 2025 in Sacramento and Placer counties found that homebuilding generates:

- $4.51 billion in local income
- $1.29 billion in taxes and fees for local governments and
- 45,728 jobs

“For decades, critics have claimed that housing doesn’t pay for itself,” said BIA President & CEO Tim Murphy. “This analysis shows that new housing not only pays its fair share of fees — and then some — but also generates significant economic activity and long-term revenue for local governments.”

Download a table highlighting the impacts here.

A BIA report last year found that area local governments collect an average of $109,000 in fees per new single-family home, costs that are ultimately passed on to buyers and limit housing production and affordability.

The new findings suggest that high development fees and regulatory barriers — including lengthy approval timelines, litigation and growth restrictions — can constrain housing supply and reduce the long-term economic and fiscal benefits for local communities.

"If local governments reduced excessive fees and streamlined the approval process, they would not only improve affordability, but also see greater long-term economic returns," Murphy said.

That's because in addition to the one-time impacts of construction, the reports found that new housing continues to generate economic benefits well after homes are built. On average, homes constructed during the study period will produce annually over the next decade:

- $638.3 million in local income
- $226.7 million in local taxes and
- 7,663 jobs

In addition, Murphy noted that housing is important beyond just the numbers because it provides needed shelter and builds community.

The analysis was conducted by the National Association of Home Builders using its economic impact model, which incorporates data from the U.S. Census Bureau's Census of Governments. The reports evaluated homebuilding activity in Sacramento and Placer counties and its regional impacts across the four-county Sacramento-Roseville-Folsom metropolitan area, which also includes El Dorado and Yolo counties.

*Contact Media Consultant John Frith at **john@twscommunications.com** or 916-765-6533 to obtain copies of the four NAHB reports, which include detailed breakdowns of both costs and benefits for homebuilding in each of the core counties, or to schedule an interview with BIA President & CEO Tim Murphy.*

Economic Benefits of Homebuilding in the Greater Sacramento Region

Construction - First Year

Sacramento County

	Units	Income	Taxes/Fees	Jobs
Single-Family	4,187	$2.46 billion	$714 million	25,164
Mutifamily	2,700	$504 million	$146 million	4,994
Total	**6,887**	**$2.96 billion**	**$860 million**	**30,158**

Placer County

	Units	Income	Taxes/Fees	Jobs
Single-Family	2,339	$1.32 billion	$354.3 million	13,282
Multifamily	850	$228.5 million	$72 million	2,288
Total	**3,189**	**$1.54 billion**	**$426 million**	**15,570**

Total single-family	**6,526**	**$3.78 billion**	**$1.068 billion**	**38,446**
Total multifamily	**3,550**	**$732.5 million**	**$218 million**	**7,282**
Grand total	**10,076**	**$4.51 billion**	**$1.29 billion**	**45,728**

These are local impacts, representing income and jobs for residents of the Sacramento-Roseville-Folsom 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. Local jobs are measured in full-time equivalents—i.e., one reported job represents enough work to keep one worker employed full-time for a year, based on average hours worked per

Outyear Benefits - Annually

Sacramento County

	Income	Taxes/Fees	Jobs
Single-Family	$301 million	$121 million	3,670
Multifamily	$119 million	$27 million	1,370
Total	**$420 million**	**$148 million**	**5,040**

Placer County

	Income	Taxes/Fees	Jobs
Single-Family	$171.3 million	$67.8 million	2,083
Multifamily	$47 million	$10.9 million	540
Total	**$218.3 million**	**$78.7 million**	**2,623**

Total single-family	**$472.3 million**	**$188.8 million**	**5,753**
Total multifamily	**$166 million**	**$37.9 milion**	**1,910**
Grand total	**$638.3 million**	**$226.7 million**	**7,663**

These are ongoing, annual local impacts that result from the new homes becoming occupied, and the occupants paying taxes and otherwise participating in the local economy year after year. The ongoing impacts also include the effect of increased property taxes, based on the difference between the value of raw land and the value of a completed housing unit on a finished lot, assuming that raw land would be taxed at the same rate as the completed housing unit.

The Metro Area Impact of Home Building in Sacramento County, California: Comparing Costs to Revenue for Local Governments

November 2025

Housing Policy Department

NAHB
National Association of Home Builders

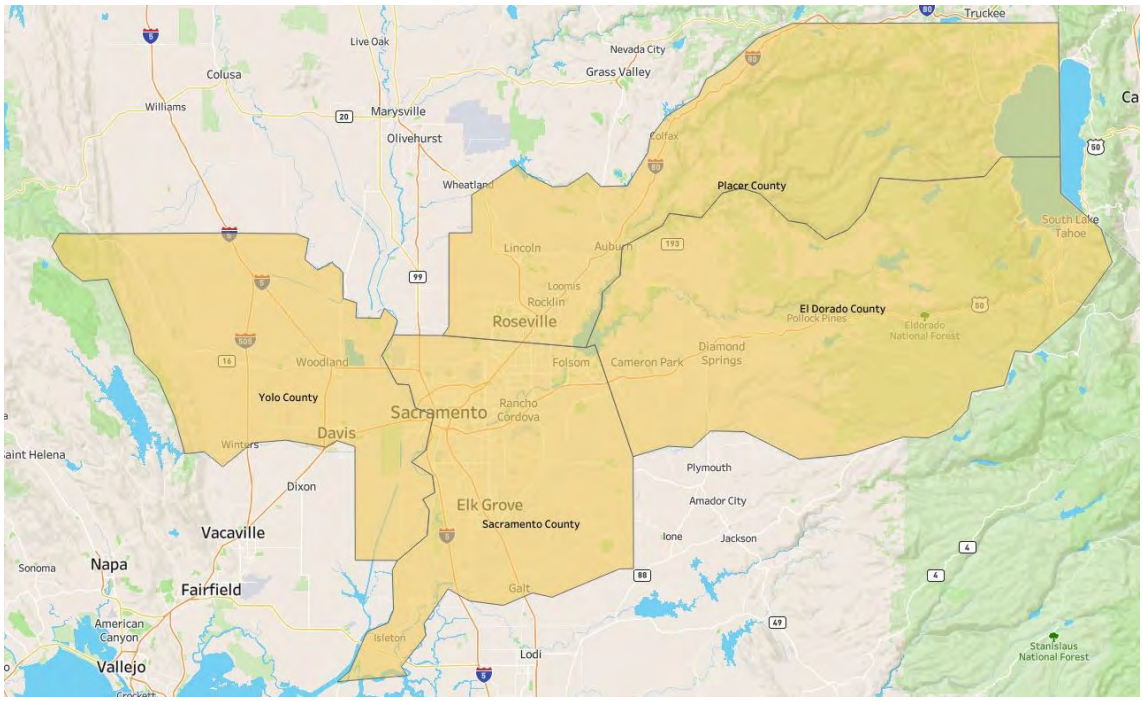
Introduction

Home building generates local economic impacts such as income and jobs for local residents, and revenue for 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 building 4,187 single-family and 2,700 multifamily housing units in Sacramento County, California, based on the number of homes built in the county over the period from June 2024 to June 2025.

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. Sacramento-Roseville-Folsom, California MSA



[1] "The Metro Area Impact of Home Building in Sacramento County, California: Income, Jobs and Taxes Generated," completed by NAHB in November 2025.

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. The local benefits captured by 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 Sacramento-Roseville-Folsom as a metro area consisting of four counties (El Dorado, Placer, Sacramento, and Yolo) in California (see Figure 1).

Therefore, this report presents estimates of the impacts that construction within Sacramento ***County*** has on the economy of the Sacramento ***metro area***. Wherever the term local is used, it refers to the entire, four-county 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 4,187 single-family and 2,700 multifamily housing units built in Sacramento County result in an estimated

- **$934 million** in tax and other revenue for local governments,[2]
- **$27 million** in current expenditures by local government to provide public services to the net new households at current levels, and
- **$118 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 4.11%.[3]

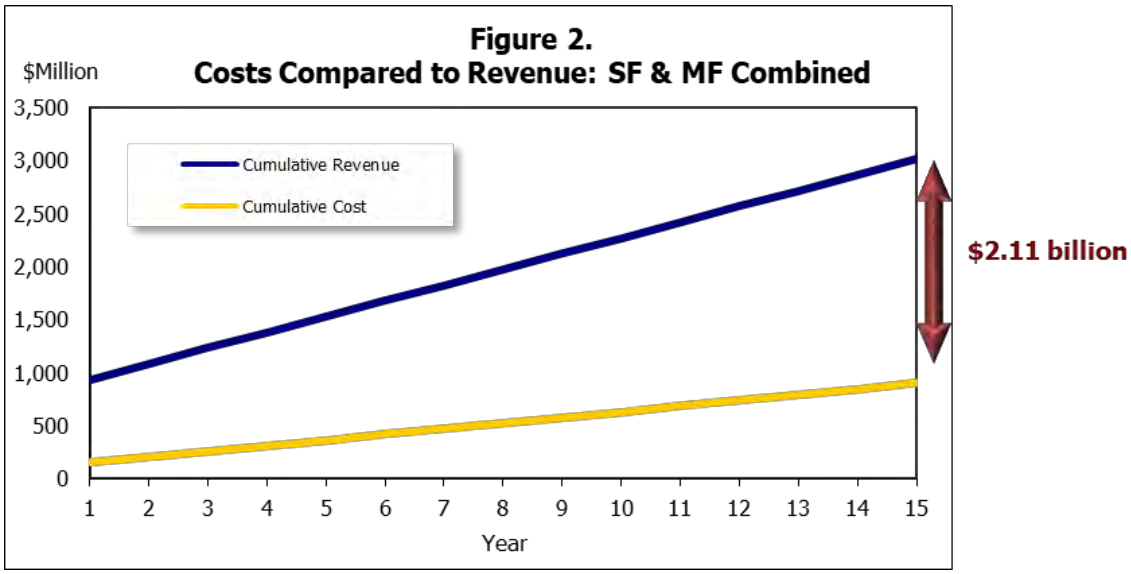
In a typical year after the first, the single-family and multifamily units result in

- **$148 million** in tax and other revenue for local governments, and
- **$53 million** in local government expenditures to continue providing services at current levels

[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. The specific interest rate used here is based on the S&P Municipal Bond 20 Year High Grade Index, Yield to Worst.

The difference between government revenue and current expenditures is defined as an "operating surplus." In this case, the operating surplus generated during the first year is large enough to service and pay off all debt incurred by investing in structures and equipment at the start of the first year 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 **$3.01 billion in revenue** compared to **$900 million in costs**, including annual current expenses, capital investment, and interest on debt (Figure 2).



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 described in the NAHB report, *The Metro Area Impact of Home Building in Sacramento County, California: Income, Jobs and Taxes Generated*.

In the first year, the 4,187 single-family homes built in Sacramento County result in an estimated

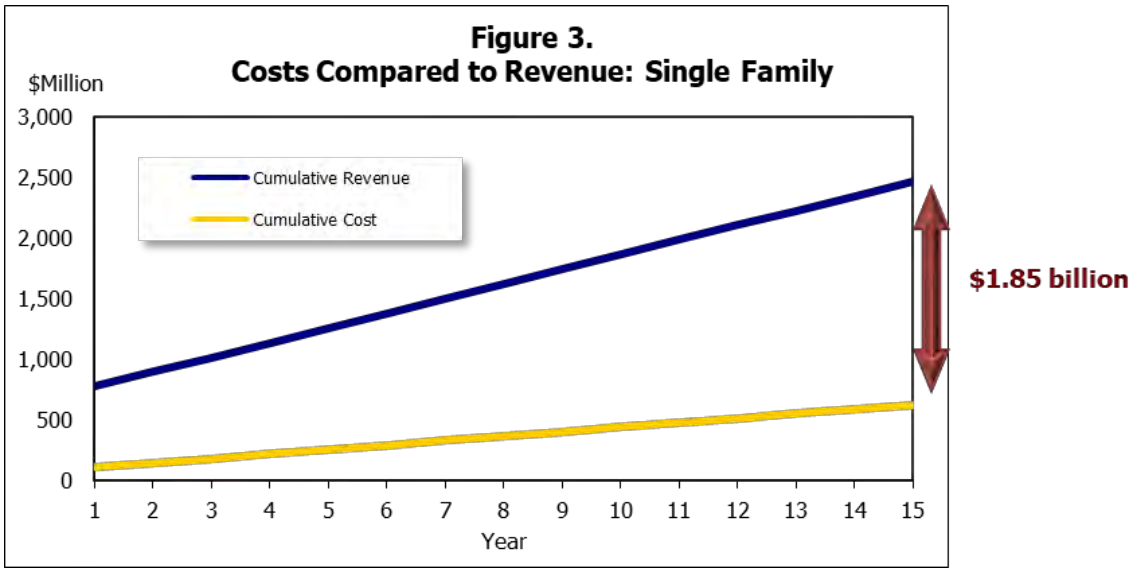
- **$774 million** in tax and other revenue for local governments,
- **$19 million** in current expenditures by local government to provide public services to the net new households at current levels, and
- **$84 million** in capital investment for new structures and equipment undertaken by local governments

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 4,187 single-family homes result in

- **$121 million** in tax and other revenue for local governments, and
- **$37 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 **$2.47 billion in revenue** compared to **$626 million in costs**, including annual current expenses, capital investment, and interest on debt (Figure 3).



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 units built can be found in *The Metro Area Impact of Home Building in Sacramento County, California: Income, Jobs and Taxes Generated*.

In the first year, the 2,700 multifamily housing units built in Sacramento County result in an estimated

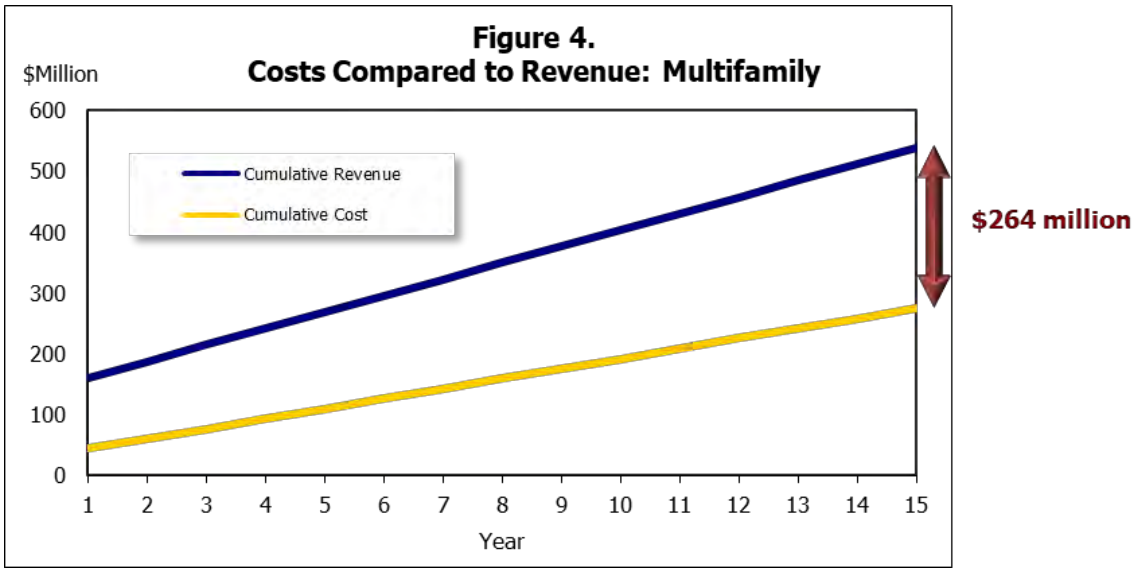
$160 million in tax and other revenue for local governments,
$8 million in current expenditures by local government to provide public services to the net new households at current levels, and
$34 million in capital investment for new structures and equipment undertaken by local governments

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 2,700 multifamily units generate

$27 million in tax and other revenue for local governments, and
$16 million in local government expenditures needed to continue providing services at current levels.

Again, the difference between government revenue and current expenditures is defined as an "operating surplus." As was the case for single-family housing, the first-year operating surplus associated with multifamily construction is large enough to service and ay off all debt incurred by investing in structures and equipment at the beginning of the first year 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 **$538 million in revenue** compared to **$274 million in costs**, including annual current expenses, capital investment, and interest on debt (Figure 4).



Method Used to Estimate Costs

The method for estimating local government revenue generated by home building is explained in the attachment to *The Metro Area Impact of Home Building in Sacramento County, California: Income, Jobs and Taxes Generated*. 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 Sacramento-Roseville-Folsom metro area, and the result used to calculate total annual expenses per single-family and multifamily housing unit (Table 1):

Not surprisingly, cost per housing unit varies substantially across the major service categories. Miscellaneous general government functions account for the largest share of annual expenses, followed by the shares for publicly owned electric utilities and education.

Table 1.
Total Annual Local Government Expenses per Housing Unit

	Single-family	Multifamily
Education	$1,389	$819
Police Protection	$1,000	$727
Fire Protection	$646	$469
Corrections	$540	$393
Streets and Highways	$511	$295
Water Supply	$234	$137
Sewerage	$228	$134
Recreation and Culture	$488	$355
Other General Government	$2,235	$1,625
Electric Utilities	$1,539	$1,119
Gas Utilities	$1	$1
Public Transit	$32	$23
Total	$8,843	$6,095

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. Streets and highway expenses are allocated based on the average number of vehicle trips generated on weekdays. Education is allocated based on the average number of public school children age 5 through 18. The remaining expenses listed in Table 1 are assumed to be proportional to household size and are allocated to single-family and multifamily units based on the average number of persons per household.[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 children going to public schools present in the units. According to the American Community Survey, there is, on average, only a little over one public school child for every three households in the U.S. The number is about 0.4 per household for single-family and under 0.2 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 vehicle trips comes from *Trip Generation Manual, 10th Ed.*, September 2017, Institute of Transportation Engineers: https://www.ite.org/tripgeneration/index.asp. Information about water consumption comes from *Water Demand Trends in the Multifamily Housing Sector,* a study undertaken in 2017 by Jack Kiefer and Lisa Krentz for the Water Research Foundation http://www.waterrf.org/Pages/Index3.aspx. Information about household size and number of public school children comes from the 2016 Public Use Microdata Sample of the American Community Survey, U.S. Census Bureau: https://www.census.gov/programs-surveys/acs/.

Beyond that, state governments typically pay for some public school expenses in the form of intergovernmental transfers. In the latest Census of Governments, local governments in aggregate across the Sacramento-Roseville-Folsom metro area spent about $3.6 billion in current expenses on education. However, over three-fourths of this was offset by nearly $2.8 billion 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.

Table 2.
Local Government Capital per Housing Unit

	Single-family	Multifamily
Schools	$9,733	$5,740
Hospitals	$343	$249
Other Buildings	$1,743	$1,267
Highways and streets	$1,503	$866
Conservation & development	$51	$37
Sewer systems	$2,777	$1,628
Water supply	$888	$520
Other structures	$2,643	$1,921
Equipment	$405	$295
Total	$20,086	$12,523

The process employed by NAHB to estimate capital costs involves several steps. The general approach is to apply parameters from a conventional economic model (a production relationship, where costs are expressed as a function of labor and capital) estimated with state level data to information for a specific local area. State and local government capital in each state can be derived through a procedure that has been established over several decades in the technical literature on public finance (see the technical appendix for details). The parameter estimates 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. Consistent with the approach used to estimate current expenses, the amount of capital in each category is expressed as the amount necessary to accommodate an average single-family or average multifamily housing unit (Table 2).

To implement these numbers, several conservative assumptions are made to avoid understating the 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, the analysis assumes 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. Results for the 4,187 single-family homes are shown in Table 3, for the 2,700 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 analysis assumes 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 considered in isolation—as well as for the more realistic scenario that analyzes both types of construction together—revenue net of costs and interest is positive every year, beginning with the first.

In fact, in all three cases (Tables 3, 4 and 5), revenue net of costs and interest is sufficient to pay off all debt by the end of year one. After that, revenue net of costs generated by the 4,187 single-family and 2,700 multifamily homes is roughly $52.9 million per year.

Net revenue for both structure types falls slightly in year 11, due to a cost that local governments incur at that time as capital equipment purchased at the start of the first year becomes fully depreciated and needs to be replaced. All other capital investment consists of structures of various types, and the effective service life for any type of structure is considerably longer than a single decade.
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[5]The interest rate on municipal bonds is the S&P Municipal Bond 20 Year High Grade Index, Yield to Worst.

Table 3. Results for 4,187 Single-family Homes Buillt in Sacramento County

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	18,512,700	774,269,300	755,756,600	84,098,800	0	3,458,400	668,199,400
2	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
3	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
4	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
5	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
6	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
7	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
8	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
9	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
10	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
11	37,025,300	121,297,600	84,272,300	1,696,400	0	0	82,575,900
12	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
13	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
14	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300
15	37,025,300	121,297,600	84,272,300	0	0	0	84,272,300

Table 4. Results for 2,700 Multifamily Homes Built in Sacramento County

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	8,228,600	159,893,700	151,665,100	33,813,300	0	1,390,500	116,461,300
2	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
3	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
4	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
5	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
6	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
7	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
8	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
9	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
10	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
11	16,457,200	27,045,400	10,588,200	795,200	0	0	9,793,000
12	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
13	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
14	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200
15	16,457,200	27,045,400	10,588,200	0	0	0	10,588,200

Table 5. Combined Results for 4,187 Single-family and 2,700 Multifamily 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	26,741,300	934,163,000	907,421,700	117,912,100	0	4,848,900	784,660,700
2	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
3	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
4	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
5	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
6	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
7	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
8	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
9	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
10	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
11	53,482,500	148,343,000	94,860,500	2,491,600	0	0	92,368,900
12	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
13	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
14	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500
15	53,482,500	148,343,000	94,860,500	0	0	0	94,860,500

Comparing Costs to Revenue for Local Governments

Technical Appendix on Estimating Capital Owned and Maintained by Local Governments

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NAHB
National Association of Home Builders

Technical Appendix on Estimating Local Capital Owned and Maintained by Local Governments

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.

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

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 ξ_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 $k_{st} = k_{s0}(1-\xi_s)^{a_s}$, $k_{et} = k_{e0}(1-\xi_e)^{a_e}$

or, equivalently,

(8) $$k_{s0} = k_{st}(1-\xi_s)^{-a_s},\ k_{e0} = k_{et}(1-\xi_e)^{-a_e}$$

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) $$z = k_{e0}/k_{s0} = k_{et}(1-\xi_e)^{-a_e} k_{st}^{-1}(1-\xi_s)^{a_s}$$

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:

ξ = 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 ξ.
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) $$k^0_{i\,t+1} = k^0_{it}(1-\xi) + v_{it+1}(1->)^6$$

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

The goal is to obtain estimates of parameters $\forall_j$ and 2_q in the following regression relationship:

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

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 $\equiv_{i\,t}$ 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) $$v^0_{it} = k^0_{it-1} (\xi + N_t \hat{=}^0_{it})$$

where $\hat{=}^0_{it}$ 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_{i76} 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_{it} and $\equiv^1_{it}$ for t=1977,…,1999; parameters $\forall^1_j$ and 2^1_q; v^1_{it} for t=54,…,76; and k^2_{i76}. 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_{i76} 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) $$a_{i\,t+1} = [(a_{i\,t}+1)\ k_{it}(1-\xi) + \tfrac{1}{2} vn_{it+1}(1->)^6 + ap_t\ ve_{it+1}(1->)^6]/k^0_{i\,t+1}$$

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:

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

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

$$(15) \qquad a_{mt} = \frac{(a_{mt-1}+1)(1-\delta)+g_t(\delta+N_t\eta_{mt})(1-\varepsilon)^6}{1-\delta+(\delta+N_t\eta_{mt})(1-\varepsilon)^6}$$

Equation (13) can be used to estimate $\equiv_{mt}$ from local relative population growth factors Π_{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_{wr}, and β_{wa} from the cost share equations, capital depreciation rates ξ_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

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

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

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

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

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

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

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

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

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.

The Metro Area Impact of Home Building in Sacramento County, California: Income, Jobs and Taxes Generated

November 2025

Housing Policy Department

NAHB
National Association of Home Builders

The Metro Area Impact of Home Building in Sacramento County, California:

Income, Jobs and Taxes Generated

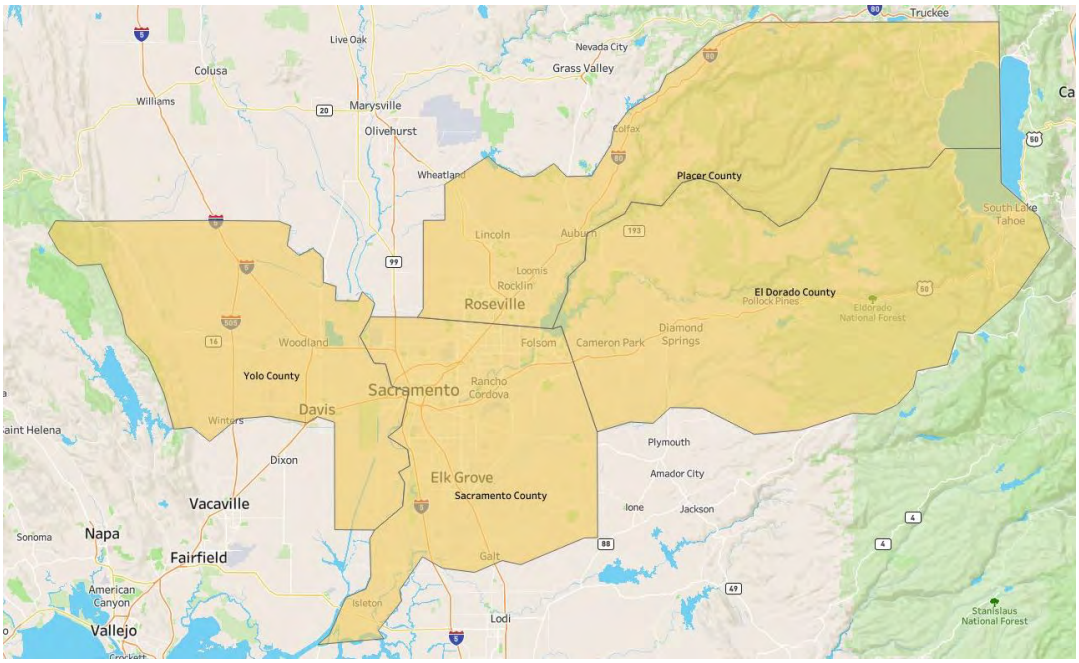
Contents

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 these 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. To fully understand the economic impact residential construction has on a local area, it is important to include the ripple effects and the ongoing benefits. Since the model was initially developed in 1996, NAHB has used it successfully to estimate the impacts of construction in over 800 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 Sacramento County, California. For purposes of the NAHB model, a local area 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) or Metropolitan Division, as defined by the U.S. Office of Management and Budget (OMB). Based on local commuting patterns, OMB has identified the Sacramento-Roseville-Folsom MSA as a metro area consisting of four counties (El Dorado, Placer, Sacramento, and Yolo) in California (see map below).

Sacramento-Roseville-Folsom, California MSA



Therefore, this report presents estimates of the impacts that construction within Sacramento ***County*** has on the economy of the Sacramento ***metro area***. Wherever the term local is used, it refers to the entire, four-county metro area. The report presents estimates of the impacts of building 4,187 single-family and 2,700 multifamily housing units, based on the number of homes built in Sacramento County over the period from June 2024 to June 2025.

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. Aggregate results are summarized below. Subsequent sections of the report show detail by industry and type of tax or fee revenue generated.

Single-family Construction

The estimated one-year metro area impacts of building 4,187 single-family homes in Sacramento County include

$2.46 billion in local income,
$714 million in taxes and other revenue for local governments, and
25,164 local jobs.

These are local impacts, representing income and jobs for residents of the Sacramento-Roseville-Folsom 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. Local jobs are measured in full-time equivalents—i.e., one reported job represents enough work to keep one worker employed full-time for a year, based on average hours worked per week by full-time employees in the industry.

The additional, annually recurring impacts of building 4,187 single-family homes in Sacramento Co301unty include

$301 million in local income,
$121 million in taxes and other revenue for local governments, and
3,670 local jobs.

These are ongoing, annual local impacts that result from the new homes becoming occupied, and the occupants paying taxes and otherwise participating in the local economy year after year. The ongoing impacts also include the effect of increased property taxes, based on the difference between the value of raw land and the value of a completed housing unit on a finished lot, assuming that raw land would be taxed at the same rate as the completed housing unit.

The above impacts were calculated assuming that new single-family homes built in Sacramento County have an average price of $707,000, which includes $107,000 in raw land value and $109,000 in permit, hook-up, impact and other fees paid to local governments, and incur an average property tax of $12,473 per year. The estimates also assume that a local sales tax of 2.35% is charged on construction materials. This information was provided by the North State Building Industry Association.

Multifamily Construction

The estimated one-year local impacts of building 2,700 multifamily units in Sacramento County include

$504 million in local income,
$146 million in taxes and other revenue for local governments, and
4,994 local jobs.

These are local impacts, representing income and jobs for residents of the Sacramento-Roseville-Folsom 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 2,700 multifamily units in Sacramento County include

$119 million in local income,
$27 million in taxes and other revenue for local governments, and
1,370 local jobs.

These are ongoing, annual local impacts that result from the new homes becoming occupied, and the occupants paying taxes and otherwise participating in the local economy year after year. They also represent impacts that have been reduced to account for the natural vacancy rate that tends to prevail in multifamily properties (see page 23 of the Technical Documentation).

These impacts were calculated assuming that new multifamily units built in Sacramento County have an average market value of $225,000, which includes $29,000 in raw land value and $35,000 in permit, hook-up, impact and other fees paid to local governments, and incur an average annual property tax of $2,250 per unit. As with the assumptions underlying the single-family impact estimates, this information was provided by the North State Building Industry Association.

The Metro Area Impact of Home Building in Sacramento County, California:

Income, Jobs and Taxes Generated

Detailed Tables on Single-family Construction

National Association of Home Builders

Impact of Building 4,187 Single-family Homes in Sacramento County, California

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
$2,464,601,300	$685,006,700	$1,779,594,500	$713,620,500	25,164

Phase I: Direct and Indirect Impact of Construction Activity:

Local Income	Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$1,463,860,200	$498,421,300	$965,438,900	$548,630,100	11,997

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
$1,000,741,100	$186,585,400	$814,155,600	$164,990,400	13,166

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
$301,166,900	$64,929,400	$236,237,200	$121,297,600	3,670

[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 4,187 Single-family Homes in Sacramento County, California
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	$1,127,438,600	$384,454,800	$742,983,800	$86,000	8,598
Manufacturing	$116,700	$5,400	$111,300	$65,000	2
Transportation	$70,900	$34,400	$36,500	$45,000	1
Communications	$9,429,900	$3,295,000	$6,134,900	$96,000	64
Utilities	$1,402,500	$302,300	$1,100,200	$164,000	7
Wholesale and Retail Trade	$116,983,800	$25,796,800	$91,187,000	$47,000	1,945
Finance and Insurance	$21,218,100	$798,500	$20,419,600	$145,000	141
Real Estate	$59,546,300	$51,273,800	$8,272,400	$80,000	103
Personal & Repair Services	$5,795,000	$1,380,400	$4,414,600	$64,000	69
Services to Dwellings / Buildings	$3,987,100	$1,538,800	$2,448,300	$61,000	40
Business & Professional Services	$92,925,000	$21,643,300	$71,281,700	$94,000	761
Eating and Drinking Places	$3,344,500	$549,500	$2,795,100	$44,000	64
Automobile Repair & Service	$1,234,700	$371,500	$863,200	$64,000	13
Entertainment Services	$727,700	$69,600	$658,100	$46,000	14
Health, Educ. & Social Services	$131,300	$4,100	$127,200	$52,000	2
Local Government	$4,815,800	$0	$4,815,800	$71,000	68
Other	$14,692,300	$6,903,100	$7,789,200	$74,000	105
Total	$1,463,860,200	$498,421,300	$965,438,900	$80,000	11,997

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$3,300,300	Residential Permit / Impact Fees	$456,383,000
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$40,618,100
General Sales Taxes	$21,693,600	Hospital Charges	$48,600
Specific Excise Taxes	$539,800	Transportation Charges	$2,424,300
Income Taxes	$0	Education Charges	$3,127,100
License Taxes	$724,500	Other Fees and Charges	$19,462,900
Other Taxes	$307,800	TOTAL FEES & CHARGES	$522,064,100
TOTAL TAXES	$26,566,000	TOTAL GENERAL REVENUE	$548,630,100

Impact of Building 4,187 Single-family Homes in Sacramento County, California
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	$50,568,900	$18,716,900	$31,852,100	$86,000	369
Manufacturing	$219,600	$12,000	$207,500	$61,000	3
Transportation	$1,936,400	$939,000	$997,400	$45,000	22
Communications	$45,922,400	$18,920,200	$27,002,300	$106,000	254
Utilities	$7,436,300	$1,604,800	$5,831,500	$164,000	36
Wholesale and Retail Trade	$118,161,500	$20,064,700	$98,096,800	$47,000	2,074
Finance and Insurance	$26,230,000	$1,019,900	$25,210,100	$126,000	200
Real Estate	$81,352,200	$33,717,700	$47,634,500	$80,000	594
Personal & Repair Services	$32,025,700	$11,308,700	$20,717,000	$64,000	324
Services to Dwellings / Buildings	$11,899,500	$4,592,600	$7,306,900	$61,000	120
Business & Professional Services	$118,435,800	$33,686,600	$84,749,200	$81,000	1,040
Eating and Drinking Places	$54,401,500	$10,712,200	$43,689,300	$42,000	1,042
Automobile Repair & Service	$23,667,200	$7,120,900	$16,546,200	$64,000	258
Entertainment Services	$6,566,000	$1,234,500	$5,331,500	$44,000	122
Health, Educ. & Social Services	$130,730,400	$14,277,400	$116,453,000	$99,000	1,178
Local Government	$273,714,200	$0	$273,714,200	$51,000	5,400
Other	$17,473,500	$8,657,300	$8,816,100	$68,000	129
Total	$1,000,741,100	$186,585,400	$814,155,600	$62,000	13,166

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$19,219,900	Residential Permit / Impact Fees	$0
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$99,829,800
General Sales Taxes	$9,097,000	Hospital Charges	$101,700
Specific Excise Taxes	$3,143,400	Transportation Charges	$1,657,400
Income Taxes	$0	Education Charges	$2,137,800
License Taxes	$4,066,200	Other Fees and Charges	$23,944,500
Other Taxes	$1,792,800	TOTAL FEES & CHARGES	$127,671,300
TOTAL TAXES	$37,319,200	TOTAL GENERAL REVENUE	$164,990,400

Impact of Building 4,187 Single-family Homes in Sacramento County, California
Phase III—Ongoing, Annual Effect that Occurs as the Homes 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	$16,851,300	$6,232,600	$10,618,700	$86,000	123
Manufacturing	$62,200	$3,200	$59,000	$63,000	1
Transportation	$378,400	$183,500	$194,900	$45,000	4
Communications	$16,391,500	$6,814,200	$9,577,300	$106,000	90
Utilities	$2,682,300	$578,800	$2,103,500	$164,000	13
Wholesale and Retail Trade	$45,074,000	$7,381,000	$37,692,900	$48,000	792
Finance and Insurance	$10,715,300	$395,800	$10,319,500	$123,000	84
Real Estate	$20,305,600	$8,416,000	$11,889,600	$80,000	148
Personal & Repair Services	$10,419,100	$4,063,000	$6,356,000	$64,000	99
Services to Dwellings / Buildings	$4,021,300	$1,552,000	$2,469,300	$61,000	40
Business & Professional Services	$44,191,400	$13,499,000	$30,692,300	$84,000	367
Eating and Drinking Places	$21,513,200	$4,075,100	$17,438,100	$42,000	420
Automobile Repair & Service	$8,701,800	$2,618,200	$6,083,600	$64,000	95
Entertainment Services	$3,312,200	$569,200	$2,743,000	$43,000	64
Health, Educ. & Social Services	$44,099,000	$5,003,000	$39,096,000	$96,000	406
Local Government	$45,221,600	$0	$45,221,600	$52,000	869
Other	$7,226,700	$3,544,800	$3,681,900	$67,000	55
Total	$301,166,900	$64,929,400	$236,237,200	$64,000	3,670

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$7,352,400	Residential Permit / Impact Fees	$0
Residential Property Taxes	$44,239,800	Utilities & Other Govt. Enterprises	$53,393,400
General Sales Taxes	$3,480,000	Hospital Charges	$58,100
Specific Excise Taxes	$1,202,500	Transportation Charges	$498,800
Income Taxes	$0	Education Charges	$643,400
License Taxes	$1,553,800	Other Fees and Charges	$8,189,600
Other Taxes	$685,800	TOTAL FEES & CHARGES	$62,783,200
TOTAL TAXES	$58,514,400	TOTAL GENERAL REVENUE	$121,297,600

The Metro Area Impact of Home Building in Sacramento County, California:

Income, Jobs and Taxes Generated

Detailed Tables on Multifamily Construction

National Association of Home Builders

Impact of Building 2,700 Multifamily Units in Sacramento County, California

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
$503,777,500	$149,260,600	$354,517,200	$146,371,100	4,994

Phase I: Direct and Indirect Impact of Construction Activity:

Local Income	Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$298,966,700	$111,108,500	$187,858,100	$112,624,700	2,415

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
$204,810,800	$38,152,100	$166,659,100	$33,746,400	2,579

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
$119,223,200	$27,836,000	$91,387,400	$27,045,400	1,370

[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 2,700 Multifamily Units in Sacramento County, California
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	$246,452,400	$94,791,000	$151,661,400	$86,000	1,764
Manufacturing	$16,300	$700	$15,500	$65,000	0
Transportation	$9,400	$4,500	$4,800	$44,000	0
Communications	$1,597,200	$549,700	$1,047,500	$92,000	11
Utilities	$250,800	$54,200	$196,600	$164,000	1
Wholesale and Retail Trade	$27,245,000	$6,011,700	$21,233,300	$45,000	477
Finance and Insurance	$1,457,200	$57,100	$1,400,100	$134,000	10
Real Estate	$6,179,800	$5,321,300	$858,500	$80,000	11
Personal & Repair Services	$1,007,200	$239,400	$767,900	$63,000	12
Services to Dwellings / Buildings	$604,700	$233,400	$371,300	$60,000	6
Business & Professional Services	$11,009,800	$2,691,900	$8,317,900	$90,000	93
Eating and Drinking Places	$313,700	$49,600	$264,100	$43,000	6
Automobile Repair & Service	$227,800	$68,500	$159,300	$63,000	3
Entertainment Services	$95,900	$9,000	$86,900	$46,000	2
Health, Educ. & Social Services	$28,700	$800	$27,900	$52,000	1
Local Government	$722,400	$0	$722,400	$89,000	8
Other	$1,748,400	$1,025,700	$722,700	$72,000	10
Total	$298,966,700	$111,108,500	$187,858,100	$78,000	2,415

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$345,200	Residential Permit / Impact Fees	$94,500,000
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$8,295,500
General Sales Taxes	$4,404,100	Hospital Charges	$9,900
Specific Excise Taxes	$56,500	Transportation Charges	$495,100
Income Taxes	$0	Education Charges	$638,700
License Taxes	$78,700	Other Fees and Charges	$3,768,700
Other Taxes	$32,200	TOTAL FEES & CHARGES	$107,707,900
TOTAL TAXES	$4,916,700	TOTAL GENERAL REVENUE	$112,624,700

Impact of Building 2,700 Multifamily Units in Sacramento County, California
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	$10,339,700	$3,827,100	$6,512,700	$86,000	76
Manufacturing	$45,000	$2,500	$42,500	$60,000	1
Transportation	$396,600	$192,300	$204,300	$44,000	5
Communications	$9,391,100	$3,869,100	$5,522,100	$106,000	52
Utilities	$1,520,600	$328,100	$1,192,400	$164,000	7
Wholesale and Retail Trade	$24,156,500	$4,102,200	$20,054,300	$47,000	428
Finance and Insurance	$5,363,400	$208,500	$5,154,900	$125,000	41
Real Estate	$16,632,100	$6,893,500	$9,738,700	$80,000	121
Personal & Repair Services	$6,549,700	$2,312,300	$4,237,400	$63,000	67
Services to Dwellings / Buildings	$2,434,300	$939,500	$1,494,800	$60,000	25
Business & Professional Services	$24,224,700	$6,889,700	$17,335,000	$81,000	214
Eating and Drinking Places	$11,122,100	$2,190,200	$8,932,000	$41,000	216
Automobile Repair & Service	$4,838,100	$1,455,700	$3,382,400	$63,000	54
Entertainment Services	$1,342,300	$252,400	$1,090,000	$43,000	25
Health, Educ. & Social Services	$26,722,800	$2,918,500	$23,804,300	$99,000	242
Local Government	$56,158,500	$0	$56,158,500	$57,000	979
Other	$3,573,300	$1,770,500	$1,802,800	$68,000	27
Total	$204,810,800	$38,152,100	$166,659,100	$65,000	2,579

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$3,929,600	Residential Permit / Impact Fees	$0
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$20,420,800
General Sales Taxes	$1,859,900	Hospital Charges	$20,800
Specific Excise Taxes	$642,700	Transportation Charges	$339,200
Income Taxes	$0	Education Charges	$437,500
License Taxes	$831,400	Other Fees and Charges	$4,898,000
Other Taxes	$366,500	TOTAL FEES & CHARGES	$26,116,300
TOTAL TAXES	$7,630,100	TOTAL GENERAL REVENUE	$33,746,400

Impact of Building 2,700 Multifamily Units in Sacramento County, California
Phase III—Ongoing, Annual Effect that Occurs as the Homes 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	$3,828,600	$1,447,200	$2,381,500	$86,000	28
Manufacturing	$25,200	$1,300	$23,900	$62,000	0
Transportation	$198,900	$96,500	$102,500	$44,000	2
Communications	$6,595,600	$2,734,100	$3,861,500	$106,000	36
Utilities	$652,900	$141,300	$511,700	$164,000	3
Wholesale and Retail Trade	$19,629,100	$2,930,700	$16,698,400	$51,000	327
Finance and Insurance	$3,604,100	$139,500	$3,464,600	$122,000	28
Real Estate	$22,403,200	$9,285,300	$13,117,800	$80,000	163
Personal & Repair Services	$3,508,800	$1,271,300	$2,237,500	$63,000	36
Services to Dwellings / Buildings	$1,491,700	$575,700	$916,000	$60,000	15
Business & Professional Services	$12,179,800	$3,425,000	$8,754,800	$77,000	114
Eating and Drinking Places	$8,723,100	$1,711,700	$7,011,400	$42,000	168
Automobile Repair & Service	$4,230,300	$1,272,800	$2,957,500	$63,000	47
Entertainment Services	$1,589,100	$216,100	$1,373,000	$42,000	33
Health, Educ. & Social Services	$17,209,900	$1,762,800	$15,447,100	$98,000	158
Local Government	$11,652,600	$0	$11,652,600	$59,000	198
Other	$1,700,300	$824,700	$875,600	$67,000	13
Total	$119,223,200	$27,836,000	$91,387,400	$67,000	1,370

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$3,097,600	Residential Permit / Impact Fees	$0
Residential Property Taxes	$5,291,800	Utilities & Other Govt. Enterprises	$11,914,900
General Sales Taxes	$1,466,100	Hospital Charges	$13,600
Specific Excise Taxes	$506,600	Transportation Charges	$197,400
Income Taxes	$0	Education Charges	$254,700
License Taxes	$654,500	Other Fees and Charges	$3,359,300
Other Taxes	$288,900	TOTAL FEES & CHARGES	$15,739,900
TOTAL TAXES	$11,305,500	TOTAL GENERAL REVENUE	$27,045,400

The Metro Area Impact of Home Building in Sacramento County, California:

Income, Jobs and Taxes Generated

Background and a Brief Description of the Model Used to Estimate the Economic Benefits

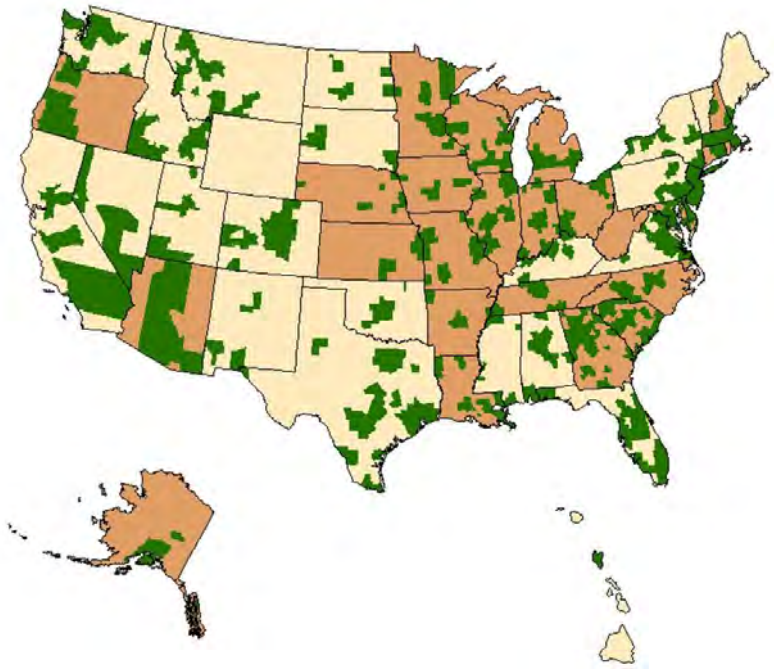
National Association of Home Builders

In 1996, the Housing Policy Department of the National Association of Home Builders (NAHB) developed an economic model to estimate the local economic benefits of home building. Although at first calibrated to a typical metropolitan area using national averages, the model could be adapted to a specific local economy by replacing national averages with specific local data for 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.

Since 1997, NAHB has used the model to produce customized reports on the impact of home building in various parts of the country. As of February 2012, NAHB has produced over 800 of these customized reports, analyzing residential construction in various metropolitan areas, non-metropolitan counties, and states (see map below).

Areas Covered by NAHB Local Impact Studies

The dark green shading indicates studies covering metro areas and non-metro counties; the orange shading studies covering 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, then in 2005 a version of the model that analyzes remodeling.

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/pdf/Newslett-June02.pdf

- The Louisville Affordable Housing Trust Fund (AHTF) used results from the NAHB model to determine the initial one-year impact and the ongoing annual effect that occurs when new homes are occupied. This analysis was performed to help justify the creation of a commission to oversee the newly established AHTF to insure that it works at "finding creative ways to create a sustainable and renewable fund to provide affordable housing opportunities throughout the Louisville community." www.openthedoorlouisville.org/housing-trust/economic-growth

- The Illinois Housing Development Authority used the NAHB model to determine that "the Authority's new construction activity in single and multifamily housing….resulted in the creation of 4,256 full-time jobs in construction and construction-related industries." The Authority also used the NAHB impact model to determine the federal, state and local taxes and fees generated from new construction and substantial rehabilitation activity. www.ihda.org/admin/Upload/Files/94c0ecf7-a238-4be3-90bd-6043cfae81ea.pdf

- The Stardust Center at the Arizona State University used "the model used and developed by the NAHB to assess the immediate economic impacts of affordable housing" by phase including the construction effect, the construction ripple, and on-going impacts. This was done to show "that permanent, affordable and geographically accessible housing provides numerous benefits both to individual families and to the broader community." www.orangecountyfl.net/NR/rdonlyres/efo5wiffiqvqqgn2s35shus5i4lwdgqbcxpck2dddnds3msj5qs26ubzllsfl6s6rrwnmtkq4dypnjrdrdzei2llq5g/Socialeconomicimpacts.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."

  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."

  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."

  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.

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 400 industries and commodities provided in the input-output files, the model uses only 97 commodities and 99 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.

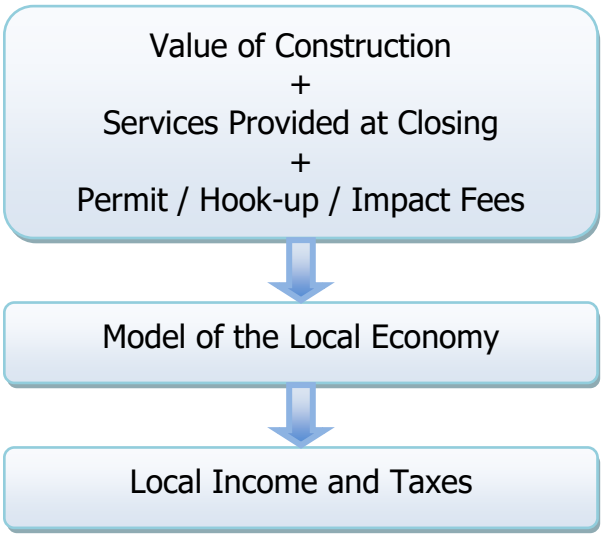
For a particular local area, the model adjusts the indirect business tax section of the national input-output accounts to account for the fiscal structure of local governments in the area. The information used to do this comes primarily from the U.S. Census Bureau's Census of Governments. Wages and salaries 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 each of the 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.

Summary of Phase I



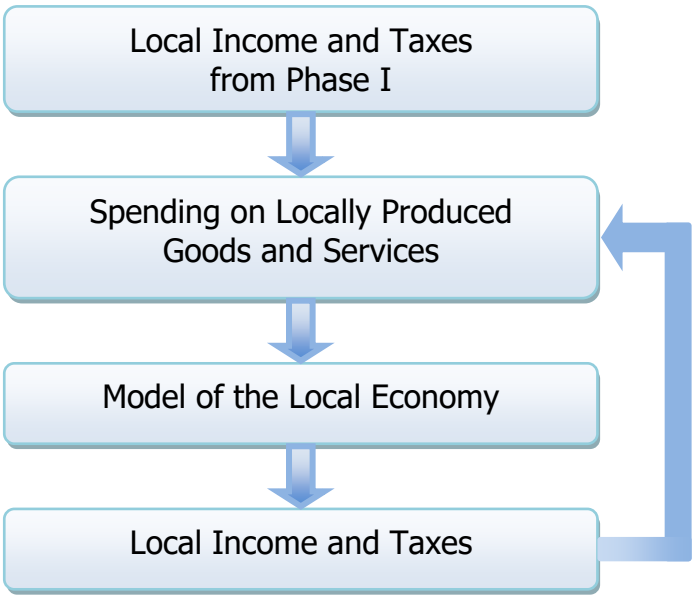
Phase II: The Construction Ripple

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 that 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 that 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 (CE) Survey, 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 52 local commodities. The remainder of the 97 local commodities enter the model only as 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 economics is a straightforward exercise in mathematics.

Summary of Phase II



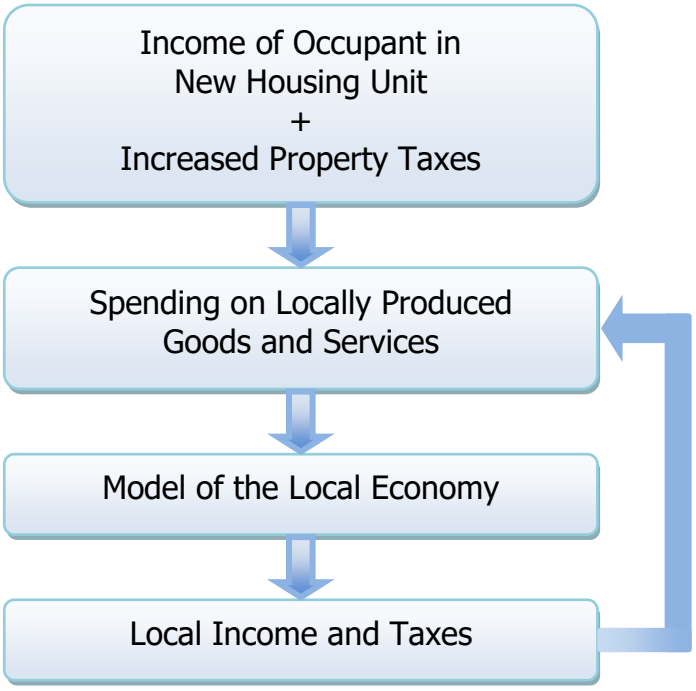
Phase III: Ongoing Impacts

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. The spending tendencies are estimated with CE data in a fashion similar to that described under Phase II. The model also estimates the amount of local taxes the households pay each year. These estimates are based on Census of Governments data with the exception of residential property taxes, which are treated separately, most often with specific information obtained from a local source. Finally, a total ripple effect is computed in a way similar to the procedure outlined above under Phase II.

Summary of Phase III



The details covered here provide 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 Economics and Housing Policy Group:

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Local Impact of Home Building

Technical Documentation for the NAHB Model Used to Estimate Income, Jobs and Taxes

Paul Emrath
Vice President
Survey and Housing Policy

NAHB
National Association of Home Builders

Technical Documentation for the NAHB Model Used to Estimate Income, Jobs and Taxes

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. 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.

The model can be customized to a specific local economy by replacing key housing market variables. This document explains describes the sources of data used and explains how the estimates are generated.

Modeling a Local Economy

In the NAHB model, a local economy is defined as a collection of industries and commodities, selected from the 2007 benchmark input-output accounts produced by the U.S. Bureau of Economic Analysis (BEA). These accounts are generally based on the North American Industry Classification System (NAICS), although BEA combines and otherwise modifies the NAICS categories for purposes of the input-output estimates. NAHB's model uses the most detailed (6-digit) industry codes in order to parse industries and commodities as precisely as possible and include only those that are generally local in nature. BEA's 2007 benchmark input-output tables contain a total of 389 industries at the 6-digit level of detail. NAHB's local economy retains the following 99:

	IO Code	***Detailed Industry Name***
1	111400	Greenhouse, nursery, and floriculture production
2	212310	Stone mining and quarrying
3	221100	Electric power generation, transmission, and distribution
4	221200	Natural gas distribution
5	221300	Water, sewage and other systems
6	230301	Nonresidential maintenance and repair
7	230302	Residential maintenance and repair
8	233210	Health care structures
9	233411	Single-family residential structures
10	233412	Multifamily residential structures
11	323120	Support activities for printing
12	339950	Sign manufacturing
13	420000	Wholesale trade
14	441000	Motor vehicle and parts dealers
15	445000	Food and beverage stores
16	452000	General merchandise stores
17	485000	Transit and ground passenger transportation
18	492000	Couriers and messengers
19	493000	Warehousing and storage
20	511110	Newspaper publishers
21	515100	Radio and television broadcasting
22	515200	Cable and other subscription programming
23	517110	Wired telecommunications carriers
24	517210	Wireless telecommunications carriers (except satellite)
25	518200	Data processing, hosting, and related services

26	519130	Internet publishing and broadcasting and Web search portals
27	524200	Insurance agencies, brokerages, and related activities
28	525000	Funds, trusts, and other financial vehicles
29	531000	Real estate
30	532100	Automotive equipment rental and leasing
31	532400	Commercial and industrial machinery and equipment rental and leasing
32	533000	Lessors of nonfinancial intangible assets
33	541100	Legal services
34	541200	Accounting, tax preparation, bookkeeping, and payroll services
35	541300	Architectural, engineering, and related services
36	541400	Specialized design services
37	541511	Custom computer programming services
38	541512	Computer systems design services
39	541800	Advertising, public relations, and related services
40	541920	Photographic services
41	541940	Veterinary services
42	561100	Office administrative services
43	561200	Facilities support services
44	561300	Employment services
45	561400	Business support services
46	561600	Investigation and security services
47	561700	Services to buildings and dwellings
48	561900	Other support services
49	562000	Waste management and remediation services
50	611100	Elementary and secondary schools
51	621100	Offices of physicians
52	621200	Offices of dentists
53	621300	Offices of other health practitioners
54	621400	Outpatient care centers
55	621600	Home health care services
56	621900	Other ambulatory health care services
57	622000	Hospitals
58	624100	Individual and family services
59	624400	Child day care services
60	711100	Performing arts companies
61	711200	Spectator sports
62	712000	Museums, historical sites, zoos, and parks
63	713100	Amusement parks and arcades
64	713200	Gambling industries (except casino hotels)
65	713900	Other amusement and recreation industries
66	722110	Full-service restaurants
67	722211	Limited-service restaurants
68	811100	Automotive repair and maintenance
69	811200	Electronic and precision equipment repair and maintenance
70	811300	Commercial and industrial machinery and equipment repair and maintenance
71	811400	Personal and household goods repair and maintenance
72	812100	Personal care services
73	812200	Death care services
74	812300	Dry-cleaning and laundry services
75	812900	Other personal services
76	813100	Religious organizations
77	2332A0	Commercial structures, including farm structures
78	2332B0	Other nonresidential structures
79	2334A0	Other residential structures
80	4A0000	Other retail
81	517A00	Satellite, telecommunications resellers, and all other telecommunications
82	5191A0	News syndicates, libraries, archives and all other information services
83	522A00	Nondepository credit intermediation and related activities

84	523A00	Securities and commodity contracts intermediation and brokerage
85	52A000	Monetary authorities and depository credit intermediation
86	532A00	Consumer goods and general rental centers
87	54151A	Other computer related services, including facilities management
88	5419A0	Marketing research & other miscellaneous professional, scientific, & tech. services
89	611B00	Other educational services
90	623A00	Nursing and community care facilities
91	623B00	Residential mental retardation, mental health, substance abuse and other facilities
92	624A00	Community food, housing, and other relief services, including rehabilitation services
93	722A00	All other food and drinking places
94	813A00	Grantmaking, giving, and social advocacy organizations
95	813B00	Civic, social, professional, and similar organizations
96	S00201	State and local government passenger transit
97	S00202	State and local government electric utilities
98	S00203	Other state and local government enterprises
99	S00700	State and local general government

In contrast to the industry categories used in the previous (2002) version of the benchmark input-output tables, the 2007 version shows considerably more detail in the construction sector, and breaks retail trade into several categories.

In the input-output accounts, commodities generally correspond to industries, with the exception of "state and local government passenger transit" and "state and local government electric service," for which there is no distinct commodity (passenger transit and electric services are defined as input-output commodities irrespective of which industry produces them), so the local economy as defined in the NAHB model consists of 99 industries and 97 commodities.

The above list includes industries in trade, construction, finance, transportation, and services—but excludes virtually all manufacturing, mining, and agriculture, under the presumption that the markets for these products are regional—if not national or international—in nature.

The exclusion of many industries is a distinguishing feature of the NAHB local impact model and is consistent with the overall intent of the model: to analyze the impact of locating a housing unit and the household that occupies it in one place rather than another. From this perspective, a house built in Seattle, Washington should not cause additional airplanes to be built or additional software to be produced, even though the occupants of a home built in Seattle may use software produced in Seattle and travel on planes built in Seattle. Because these households would be likely to use these products the same way even if they lived in some other metropolitan area, use of these products is not a function of the home's location. Hence, industries like software publishing and aircraft manufacturing are excluded from the model.

Based on the industries and commodities described above, a "total local requirements" matrix is constructed that shows the total output required from each of the local industries to produce $1 of each local commodities.

To show the derivation of this matrix, let

$\boldsymbol{c}$ = a 97-element column vector of commodity outputs

$\boldsymbol{g}$ = a 99-element column vector of industry outputs

$\boldsymbol{V}$ = a 99×97 subset of the benchmark make table that shows how much of each commodity is produced by each industry

$\boldsymbol{h}$ = a 99-element column vector showing how much scrap is produced by each industry

$\boldsymbol{U}$ = a 97×99 subset of the benchmark use table that shows how much of each commodity used as an input by each industry. Coefficients for the wholesale trade commodity are set to zero, assuming that these transactions are often non-local in nature. The wholesale trade industry produces a considerable amount of the retail trade commodity. The effect of this is to retain retail trade in the model, irrespective of which industry produces it, but to exclude wholesale trade activities.

The following matrices can then be defined through standard input-output algebra:

$\boldsymbol{B} = \boldsymbol{U}\hat{\boldsymbol{g}}^{-1}$ the direct requirements matrix, showing the amount of each commodity needed as a direct input to produce $1 of each industry's output. (The symbol ˆ indicates a matrix created from a vector by placing the vector=s elements on the matrix diagonal.) This is simply the use table scaled by industry output.

$\boldsymbol{j} = \hat{\boldsymbol{g}}^{-1}\boldsymbol{h}$ a vector showing scrap as a fraction of each industry's output. Many of the elements of this vector are zero in the NAHB local impact model, which excludes most of the manufacturing sector.

$\boldsymbol{D} = \boldsymbol{V}\hat{\boldsymbol{c}}^{-1}$ a 99×97 market share matrix, or the make table scaled by commodity output. $\boldsymbol{D}$ shows the fraction of each commodity (excluding scrap) produced by each industry.

$\boldsymbol{F} = (\boldsymbol{I}-\hat{\boldsymbol{j}})^{-1}\boldsymbol{D}$ a 99×97 matrix showing, for $1 worth of each commodity, the fraction produced by each industry. In short, $\boldsymbol{F}$ is $\boldsymbol{D}$ adjusted for scrap. $\boldsymbol{F}$ is often called a transformation matrix, because it can be used to transform commodities into the output of industries and vice versa.

$$\textit{Total Local Requirements} = \boldsymbol{F}(\boldsymbol{I}-\boldsymbol{B}\boldsymbol{F})^{-1}$$

The total local requirements matrix translates local commodities into the output of local industries. The NAHB model is designed to capture only a fraction of the output: the fraction that becomes either income for local households or revenue for local governments. These fractions are estimated from a combination of value added components of the input-output tables, plus information taken from other BEA industry accounts. In the BEA accounts, the final price of a commodity is the sum of intermediate outputs plus value added by the industry. To avoid double counting, the NAHB model retains only the value added in each local industry for further analysis.

BEA's input-output accounts break value added into three components: compensation of employees, taxes on production and imports (TOPI), and gross operating surplus. In the NAHB model, local income is derived from compensation of employees and gross operating surplus. The following table shows information taken from BEA accounts used in this derivation:

	Wages & Salaries per $ of Employee Compensation	Other Corp. as a % of Gross Operating Surplus	Other Non-Corp. as a % of Gross Operating Surplus
Farms	85.98%	77.63%	28.12%
Mining, except oil and gas	82.18%	12.40%	71.60%
Utilities	74.17%	9.32%	84.32%
Construction	83.11%	68.10%	29.88%
Miscellaneous manufacturing	71.19%	10.16%	87.83%
Printing and related support activities	81.90%	11.75%	85.14%
Wholesale trade	85.93%	15.89%	82.08%
Motor vehicle and parts dealers	85.39%	27.06%	69.55%
Food and beverage stores	81.55%	27.06%	69.55%
General merchandise stores	81.30%	27.06%	69.55%
Other retail	84.09%	27.06%	69.55%
Transit and ground passenger transportation	81.66%	76.22%	22.04%
Other transportation and support activities	81.76%	23.56%	74.53%
Warehousing and storage	81.97%	34.38%	63.45%
Publishing industries (includes software)	84.22%	14.36%	84.75%
Broadcasting and telecommunications	81.49%	26.07%	71.94%
Information and data processing services	84.23%	24.24%	74.30%
Federal Reserve banks, credit intermediation, related act.	85.01%	1.98%	87.89%
Securities, commodity contracts, and investments	87.89%	-2.28%	107.02%
Insurance carriers and related activities	84.36%	6.88%	120.64%
Funds, trusts, and other financial vehicles	57.88%	-16.43%	114.13%
Real estate (estimated by NAHB)	85.90%	100.00%	0.00%
Rental & leasing services and lessors of intangible assets	86.04%	32.70%	64.08%
Legal services	84.92%	76.96%	21.03%
Computer systems design and related services	87.90%	42.09%	53.54%
Misc. professional, scientific, and technical services	86.62%	57.56%	40.53%
Administrative and support services	84.67%	57.36%	40.59%
Waste management and remediation services	79.35%	13.44%	84.75%
Educational services	81.12%	39.22%	54.48%
Ambulatory health care services	82.70%	53.75%	42.32%
Hospitals	82.54%	42.00%	45.89%
Nursing and residential care facilities	80.79%	42.00%	45.89%
Social assistance	82.09%	48.30%	47.41%
Performing arts, spectator sports, museums, related act.	86.80%	70.36%	28.48%
Amusements, gambling, and recreation industries	84.18%	8.46%	90.01%
Food services and drinking places	85.50%	38.55%	58.57%
Other services, except government	85.92%	82.52%	15.81%
State and local government enterprises	68.40%	NA	NA
State and local general government	68.17%	NA	NA

Due to data limitations, ratios from relatively broad categories are sometimes applied to more narrowly defined local industries. For example, ratios for the broad categories "farms" is applied to a much more narrowly defined local industry "Greenhouse, nursery, and floriculture production."

Treatment of real estate is less straightforward than it might be, because the input-output accounts provide one set of estimates for real estate with no detail within that relatively broad industry. When analyzing a local housing economy, it is desirable to account for residential real

estate brokers and property managers, each which has well-known distinctive characteristics. NAHB uses data from the U.S. Census Bureau's 2007 Economic Census to estimate a separate set of coefficients for residential real estate brokers. Coefficients derived this way allocate a relatively small 8 percent of value added to wages and salaries, because most realtor offices are organized as a group of businesses where each broker legally counts as proprietor rather than an employee. The modified coefficients are applied to broker fees that arise in the transaction of single-family homes built for sale (as opposed to custom homes built by a general contractor on home owners' land) and individual multifamily condominiums to the ultimate owner-occupants. Any broker fees that that may be charged in the sale of multifamily rental buildings are assumed to be paid to non-local entities and excluded from the model.

Similarly, owners of rental buildings are considered non-local and excluded. However, for obvious reasons, managing the properties needs to be done locally. To handle this, except for the broker fees mentioned above, the NAHB model treats payments made to the real estate sector (primarily rental payments made by tenants in new multifamily buildings) as revenue for non-local property lessors (the federal government's term for what is elsewhere typically called a rental property owner) who then employ local businesses to manage the property. In practice this means subtracting about 57 percent of the rental payment and treating the remaining 43 percent as a local payment for management services. Again, this ratio was computed using detailed industry data from the 2007 Economic Census.

A key feature of the NAHB local impact model is the way it translates the wages and salaries from BEA accounts into local jobs, measured in full-time equivalents (FTEs); i.e., enough work to keep a person employed full-time for a year, based on the hours typically worked by full-time employees in a given industry. Indeed, when users of NAHB's local impact studies cite a single number from one of the studies, it is usually this one.

In general, the translation is accomplished using data on wages per job in each local industry from the Quarterly Census of Employment and Wages (QCEW) produced by the U.S. Bureau of Labor Statistics (BLS). The QCEW provides data for each county in the country, although it may be suppressed in particular cases for some industries due to a small sample size. To reduce the chances of missing data and produce an estimate that can more easily be adjusted for inflation, annual rather than quarterly QCEW data are used. If annual data for a particular industry in a particular local area are missing, they are imputed based on national wages per job in that industry, adjusted by the ratio of local to national wages per job across all industries. If QCEW data are not yet available for the year of construction being analyzed (as is typically the case), wages per job in each industry is inflated using HUD's estimates of median family income, which are available for the current year and for each state and local area in the country. Job counts in the QCEW are based on payroll employment and therefore include part-time as well as full-time workers. The QCEW job counts are converted to FTEs using the ratio of FTEs to jobs in each industry from BEA's national industry accounts.

The estimates of local income in the NAHB model exclude most corporate profits, based on the rationale that ownership of most corporations is national or international in scope. Even if a household living in a particular metropolitan area buys a product manufactured by a corporation located in in that metropolitan area, profits derived from the sale are likely to be distributed to shareholders living in other locations.

The model makes an exception for subchapter S corporations, which tend to be smaller and more local in nature than C corporations. S corporations also tend to be relatively common in particular industries, such as residential construction. The Internal Revenue Service (IRS) provides information on business receipts by form of business and industry, and this is used to decompose corporate profits into profits for S-corporations and C-corporations. The IRS tables provide relatively limited industry detail, so again percentages for a broadly defined industry are sometimes applied to several 6-digit NAICS industries. The S-corporation profits by industry are then counted as part of local income.

In general, local government revenue is estimated industry by industry, as a function of both local income and TOPI. TOPI includes taxes imposed at the federal, state and local level. BEA national accounts show that, in the year of the most recent Census of Governments, 9.2 percent of TOPI is federal (almost all excise taxes and custom duties). The Census of Governments is then used to further decompose TOPI into 42.4 percent collected by state governments and 48.4 collected by local governments (the largest components of state and local TOPI being sales and property taxes). Thus, the NAHB model uses a base of 90.8 or 48.4 percent of TOPI in each local industry as a starting point, depending on whether a state or local economy is being analyzed.

A distinctive feature of the NAHB model is the way it further employs Census of Governments data to customize the government finances to a particular area. Census of Governments data are available for each of the roughly 89,000 units of government in the U.S., and the NAHB model reads in every line item for every government within the local area being analyzed. Aggregated across all local (or state and local) governments in the U.S., the ratio of TOPI to personal income is 2.776 (or 6.595) percent. This ratio is also calculated for the area being analyzed and used to adjust TOPI by industry up or down. Personal income is used as the base of the ratio, because this is a measure that is available for every local area in the country.

There are two substantial exceptions to this procedure, as discussed below in the sections on Phase I and Phase III. In the case of residential property taxes and sales taxes paid on construction materials, specific information is collected for the construction being analyzed and fed into the model instead.

Census of Governments data is also used to customize taxes and fees paid by the workers and local proprietors who receive income as a result of the home building activity, and, where applicable, corporate income taxes to a local area. Aggregated over all local (or state and local) governments in the U.S., taxes and fees paid by individuals sum to 4.198 (or 7.843) percent of personal income. Again, equivalent ratios are calculated for the area being analyzed and used to customize the government revenue estimates.

To the extent that S corporations pay taxes to state and local governments, these taxes are also counted on the assumption that stockholders of S corps reside in the same area as the company income.

The general procedure for customizing government revenue to a specific local area (or state) can be summarized as follows:

Personal taxes =
4.198% (or 7.843%) × Local Personal Income × Local Factor 1

Business taxes =
48.4% (or 90.8%) × TOPI in Local Industries × Local Factor 2 +
6.349% × Corporate Profits in Local Industries × Local Factor 3

where the three local factors are derived on a case by case basis from data in the most recent Census of Governments. In practice, Local Factor 3 will usually be zero, as few local governments impose a tax on corporate profits.

The distinguishing aspect of this procedure is that it preserves the industry structure of the input-output accounts while being consistent with revenue being collected by all governments in the area of analysis, as reported by the governments themselves to the U.S. Census Bureau.

Phase I: Construction

As shown diagrammatically in "Background and a Brief Description of the Model Used to Estimate the Economic Benefits", Phase I of the model feeds the dollar amount of construction and ancillary locally produced items into the income and tax matrices derived from the model total local requirements. Accounting for everything that goes into building a home and delivering it to its customer is more complicated than it may at first appear.

For one thing, the Census Bureau subtracts several items from construction value before providing the numbers to BEA for use in the input-output and related GDP accounts. On new homes built for sale, the Census Bureau subtracts 1.1 percent of the sales price for landscaping, 0.5 percent for appliances, 2.9 percent for realtor and brokers fees, and 2.7 percent for marketing and finance costs. There are equivalent subtractions for custom homes (i.e., homes where the builder functions as a general contractor for a home built on the customer's lot).

However, the landscaping and purchases of appliances and marketing/broker services associated with a newly built home clearly are attributable to the construction of the home. Phase I of the NAHB model therefore accounts for these items as separate purchases of the local construction, retail trade, and real estate industries. For retail trade, only the gross margin of appliance purchases are counted. Gross margins for different types of retailers are available from the Census Bureau's Annual Retail Trade Survey.

In addition, there are settlement or closing costs associated with transferring property from a builder to the ultimate owner. In a typical case, these costs are shared between buyers and sellers. Construction value as defined in the input-output accounts includes closing costs if they are paid by the seller, but not the buyer. When the local impact model was first developed, NAHB verified these details with economists at BEA.

In order to estimate both closing costs as a fraction of the home's price and the share of these costs the buyer pays, the NAHB model uses national average data compiled by the U.S.

Department of Housing and Urban Development.[3] The share of settlement costs paid for by the buyer for loan origination and discount fees, title and private mortgage insurance, and legal fees are counted as output of the local depository credit intermediation, insurance, and legal services industries, respectively.

Another category of closing costs sometimes paid by the buyer is mortgage or deed transfer taxes. Phase I of the NAHB model does not automatically include an amount for transfer taxes. In most (but not all) instances, these taxes are imposed by state, rather than local, governments. To the extent that transfer taxes apply in a specific case, that information needs to be supplied by the local entity requesting the analysis.

The local entity requesting the analysis is also asked to provide information on whether or not sales taxes are imposed on construction materials and supplies; and, if so, the relevant sales tax rate. The model then applies the relevant rate to 34.1 percent of construction value, assuming that materials account for that share of the final value of a housing unit. The figure of 34.1 was calculated from the ratio of materials to construction value for several categories of construction businesses in the Economic Census, including trade contractors. The calculation takes subcontracing into account, as a large fraction of the final construction value of a housing unit is subcontracted to businesses that may also purchase materials.

Phase II: The Construction Ripple

Phase I of the model translates home building activity into income for local workers and business proprietors, and revenue for local governments. This output serves as the input for Phase II, as part of the local income generated will be spent, generating more income, generating more spending, and so on. These spending ripples damp and eventually converge to a limit, which is the ultimate ripple or multiplier effect.

To convert local income to local spending, the model requires information about local household spending tendencies. Detailed spending information at the household level is available from the Consumer Expenditure (CE) Survey, produced by the U.S. Bureau of Labor Statistics (BLS) primarily for the purpose of determining the weights for the Consumer Price Index.[4]

The CE consists of two different types of surveys: 1) an interview survey that collects data on monthly expenditures as well as information on income and household characteristics, and 2) a diary survey that collects data on weekly expenditures of frequently purchased items. These are two separate surveys, each designed individually with weights that aggregate to an estimate of total spending in the U.S. When it estimates aggregate measures of consumer spending, BLS combines results from the two different types of surveys in a manner it does not disclose.

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[3] Report to Congress on the Need for Further Legislation in the Area of Real Estate Settlements, 1981, Exhibits II-1 and II-6.

[4] Technically, in the Consumer Expenditure Survey, the unit of measurement is actually not a household, but a *Consumer Unit*, a group of individuals who live in the same house and make joint purchasing decisions. There may be more than one Consumer Unit in a household.

The NAHB local impact model uses only data from the interview survey, primarily to avoid the need for arbitrary decisions about which spending items to take from which survey. Based on its CE interview survey, BLS produces a public use microdata set consisting of quarterly files with household characteristics (including income), another set of quarterly files with income and other characteristics for each member of the household, and a set of fifty-one annual "EXPN" files with detailed information about various categories of expenditures.

These detailed files allow NAHB to maintain a conservative approach and exclude spending on items that may often be purchased from a vendor outside the local area. For example, BLS collects information on spending while on trips and vacations away from home in a separate "ETRV" and "ETRE" file. The NAHB local impact model does not include any spending information at all from these files. NAHB processes the information from the EXPN files along with information on household characteristics and income to estimate spending tendencies on 52 locally produced commodities, as shown in the following table:

Local Spending Extracted from the CE EXPN Files

	Local commodity	IO Code	CE File	Description of items included in local spending
01	Greenhouse, nursery, and floriculture production	111400	ECRB	Costs of all items and services for planting shrubs or trees, or otherwise landscaping the ground of the housing unit in which the consumer unit lives.
02	Electric power generation, transmission, and distribution	221100	EUTC	Electricity bills for the housing unit in which the consumer unit lives, including if combined with natural gas and/or water, sewerage. This is also the default category for generally combined expenses with particular utility not specified.
03	Natural gas distribution	221200	EUTC	Gas bills for the housing unit in which the consumer unit lives.
04	Water, sewage and other systems	221300	EUTC	Water and/or sewage bills, including water combined with trash collection, for the housing unit in which the consumer unit lives.
05	Residential maintenance and repairs	230302	ECRB	Costs of all items and services associated with building or repairing an addition to the house or a new structure including porch, garage or new wing; finishing a basement or an attic or enclosing a porch; remodeling one or more rooms; building outdoor patios, walks, fences, or other enclosures, driveways, or permanent swimming pools, inside painting or papering; outside painting; plastering or paneling; plumbing or water heating installations and repairs; electrical work; heating or air-conditioning jobs; flooring repair or replacement; insulation; roofing, gutters, or downspouts; siding; installation, repair, or replacement of window panes, screens, storm doors, awnings, etc.; and masonry, brick or stucco work; or other improvements or repairs for the housing unit in which the consumer unit lives.
For the four categories of retail trade, only gross margins rather than total spending is put into the model. Gross margins are applied industry by industry. A single factor is used to reduce the amount to account for loss of business to local retailers to E-commerce and mail order business. The source is the most recent data in the Census Bureau's 2012 Annual Retail Trade Report, released in 2014,				
06	Motor vehicle and parts dealers	441000	EOVB	Purchases of automobiles, including down payment and payment of principle on loans × 17.6% (gross margin for automobile dealers).
07	Food and beverage stores	445000	ETRF	Cost of food or beverages at grocery, convenient or liquor stores during local overnight stays x 27.9% (gross margin for food and beverage stores).

	Local com modity	NAICS Code	EXPN File	Description of items included in local spending
07	Food and beverage stores (cont.)	445000	EXPA	Expenditure for food, non-alcoholic beverages and nonfood items at grocery stores, food and non-alcoholic beverages from places other than grocery stores, and all alcohol to be served at the home × 27.9% (gross margin for food and beverage stores).
08	General merchandise stores	452000	EAPA	50 percent of major appliance purchases (assuming other 50 percent purchased from other retail) x 26.3% (gross margin for general merchandise stores), adjusted for losses to E-commerce and mail order business.
			EAPB	50 percent of purchases of other households appliances and other selected items (assuming other 50 percent purchased from other retail) x 26.3% (gross margin for general merchandise stores), adjusted for losses to E-commerce and mail order business.
			EFRA	50% of purchases of home furnishings (assuming other 50 percent purchased from other retail) x 32.1% (gross margin for department stores), adjusted for losses to E-commerce and mail order business
			ECLA	50% of purchases of clothing and accessories (assuming other 50 percent purchased from other retail) x 32.1% (gross margin for department stores), adjusted for losses to E-commerce and mail order business.
			EENT	50% of purchases of CDs or audio tapes, photographic film, video cassettes or tapes or discs, and books, but not through a mail order club or subscription x 32.1% (gross margin for department stores), adjusted for losses to E-commerce and mail order business.
09	Other retail	4A0000	EUTC	Bills for fuel oil, bottle or tank gas, or fuels not specifically identified, for the home in which the consumer unit lives x 37.8% (gross margin for nonstore retailers).
			ECRA	Purchase of building materials and supplies, either for or not for a specific project x 34.7% (gross margin for building materials and supplies dealers).
			EAPA	50 percent of major appliance purchases (assuming other 50 percent purchased from general merchandise stores) × 28.2% (gross margin for electronics and appliance stores), adjusted for losses to E-commerce and mail order business.
			EAPB	50 percent of purchases of other households appliances and other selected items (assuming other 50 percent purchased from general merchandise stores) × 28.2% (gross margin for electronics and appliance stores), adjusted for losses to E-commerce and mail order business.
			EFRA	50% of purchases of home furnishings (assuming other 50 percent purchased from general merchandise stores) × 46.6% (gross margin for furniture and home furnishing stores), adjusted for losses to E-commerce and mail order business.
			ECLA	50% of purchases of clothing and accessories (assuming other 50 percent purchased from general merchandise stores) × 45.8% (gross margin for clothing and clothing accessories stores), adjusted for losses to E-commerce and mail order business.
			EVOT	Purchases of gasoline and other fuels and fluids used in vehicles × 10.8% (gross margin for gasoline stations)
			EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to purchase prescription drugs and durable medical equipment × 30.0% (gross margin for health and personal care stores), adjusted for losses to E-commerce and mail order business.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for prescription drugs, other nondurable medical products, and durable medical equipment × 30.0% (gross margin for health and personal care stores), adjusted for losses to E-commerce and mail order business.

	Local commodity	NAICS Code	EXPN File	Description of items included in local spending
09	Other retail (cont)	4A0000	EMDB	Direct purchases of glasses, hearing aids, prescription medication, convalescent equipment, or other medical equipment × 30.0% (gross margin for health and personal care stores), adjusted for losses to E-commerce and mail order business.
			EEDA	Purchases of books or other equipment for elementary or high school for members of the consumer unit × 41.6% (gross margin for sporting goods, hobby, book and music stores), adjusted for losses to E-commerce and mail order business.
			EENT	50% of purchases of CDs or audio tapes, photographic film, video cassettes or tapes or discs, and books, but not through a mail order club or subscription (assuming other 50 percent purchased from general merchandise stores) × 41.6% (gross margin for sporting goods, hobby, book and music stores), adjusted for losses to E-commerce and mail order business.
			EMIS	Expenses for flowers, potted plants, pet supplies and medicines, toys, and games, and hobbies, including if combined with computer software for games × 45.4% (gross margin for miscellaneous store retailer), and adjusted for losses to E-commerce and mail order business.
			EXPB	Expenditures for cigarettes and other tobacco products × 29.4% (gross margin for all retailers excluding motor vehicle and parts dealers), adjusted for losses to E-commerce and mail order business.
10	Transit and ground passenger transportation	485000	EXPB	Costs for taxis, limousine service, and public transportation, except while on a trip.
11	Newspaper publishers	511110	EENT	Expenses for newspapers and other periodicals not through a subscription.
12	Wired telecom-munications carriers	517110	EUTA	Bills from telecommunications companies for residential service, internet access, non-telephone rental and purchases, and 71.2% of bills for cable or satellite television service (financial data compiled ions Multimedia Research Group, Inc indicates that satellite had a 28.8% share of the combined cable/satellite market).
			EUTP	Pre-paid phone card or public pay phone services.
			EUTI	Bills from internet service providers for internet connection and service (excluding those away from home), miscellaneous combined expenses, and 71.2% of bills for cable or satellite television service.
13	Wireless tele-communications carriers (except satellite)	517210	EUTA	Bills for mobile/cellular telephone service.
			EUTP	Pre-paid cellular minutes.
14	Satellite, telecommunications resellers, and all other tele-communications	517A00	EUTA	28.8% of the bills from telecommunications for cable or satellite television service, plus bills for Voice over IP service.
			EUTI	Bills from internet service providers for satellite radio, plus 28.8% of the bills for cable or satellite television service.
15	Data processing, hosting, and related services	518200	EUTA	Bills paid to providers of applications, games or ringtones.
16	Monetary authorities and depository credit intermediation	52A000	EHEL	Interest paid on lump sum home equity loans, based only on the home in which the consumer unit lives.

	Local commodity	NAICS Code	EXPN File	Description of items included in local spending
16	Monetary authorities and depository credit intermediation (cont)	52A000	EOPH	Interest paid on home equity lines of credit, based only on the home in which the consumer unit lives.
			EXPB	Charges for safe deposit boxes, checking accounts, and other banking services.
17	Nondepository credit intermediation and related activities	522A00	EOVB	Interest payment on automobile loans.
18	Insurance agencies, brokerages, and other insurance related activities	524200	EINB	Percent of premiums for all types of insurance other than health (percentage based on agent/brokers' share of industry).
			EIHB	Percent of premiums for health insurance (percentage based on agent/brokers' share of industry).
19	Real estate	531000	RNT	Total rental payments for the housing unit in which the consumer unit lives.
			OPI	Ground or land rent, regular HOA fees, special payments for property management services—for the property in which the consumer unit lives.
20	Automotive equipment rental and leasing	532100	ERTV	Expenses for renting vehicles, except if rented while on a vacation.
			ELSD	Expenses for leasing vehicles.
21	Consumer goods and general rental centers	532A00	EAPA	Expenses for renting major appliances.
			EAPB	Expenses for renting other household appliances and selected items.
			EFRB	Expenses for renting furniture.
			ECLD	Expenses for renting clothing.
			EMDB	Expenses for renting convalescent or other medical equipment.
			EENT	Amount paid for rental of Blu-ray Discs, DVDs, or VHS tapes.
22	Legal services	541100	EMIS	Expenses for services of lawyers or other legal professionals.
23	Accounting, tax preparation, bookkeeping, and payroll services	541200	EMIS	Accounting fees.
24	Photographic services	541920	EENT	Amount paid for film processing or printing digital photographs.
			EMIS	Amount paid for professional photography fees.
25	Veterinary services	541940	EMIS	Veterinarian expenses, including if combined with other pet services.
26	Investigation and security services	561600	EMIS	Home security service fees.
27	Services to buildings and dwellings	561700	EAPA	Charges for installing major appliances.

	Local commodity	NAICS Code	EXPN File	Description of items included in local spending
27	Services to buildings and dwellings (cont.)	561700	EEQB	Costs for pest control or repairing and servicing heating and air conditioning equipment.
			EMIS	Gardening or lawn care, housekeeping, or other home services and small repair jobs around the house.
28	Waste manage-ment and remed-iation services	562000	EUTC	Trash/garbage collection bills, including if combined with sewerage, and septic tank cleaning services, for the housing unit in which the consumer unit lives.
29	Elementary and secondary schools	611100	EEDA	Tuition and other expenses for elementary or high school for members of the consumer unit.
30	Offices of physicians	621A00	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for physician and clinical services.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for physician and clinical services.
			EMDB	Direct payments for eye care or physician services.
31	Offices of dentists	621200	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for dental services.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for dental services.
			EMDB	Direct payments for dental care
32	Offices of other health practitioners	621B00	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for other professional services.
			IHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for other professional services.
			EMDB	Direct payments for services by medical professionals other than physicians, lab tests, and other medical care.
33	Home health care services	621600	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for home health care.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for home health care.
34	Hospitals	622000	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for hospital care.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for hospital care.
			EMDB	Direct payments for hospital rooms or services.
35	Nursing and residential care facilities	623000	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for nursing home care.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for nursing home care.
			EMDB	Direct payments for care in convalescent of nursing home.
36	Child day care services	624400	EEDA	Expenses for nursery school or child day care centers for members of the consumer unit.

	Local commodity	NAICS Code	EXPN File	Description of items included in local spending
36	Child day care services	624400	EMIS	Expenses for babysitting, nanny services, or child care in the consumer unit's or someone else's home.
37	Performing arts companies	711100	ESUB	Theater or concert season tickets.
			EENT	Single admissions to movies, theaters, and concerts.
38	Spectator sports	711200	ESUB	Season tickets to sporting events.
			EENT	Single admissions to spectator sporting events.
39	Gambling industries (except casino hotels)	713200	EMIS	Expenses for lotteries and games of chance.
40	Other amusement and recreation industries	713900	EEDA	Recreational lessons and instruction for members of the consumer unit.
			ESUB	Expenses for membership in golf courses. Country clubs, health clubs, fitness centers, or other sports and recreational organizations.
			EENT	Fees for participating in sports.
			ETRF	Amount paid for entertainment or admissions during local overnight stays
41	Full-service restaurants	722110	ETRF	50% of cost of meals, snacks, or beverages at restaurants, bars or fast food places during local overnight stays.
			EXPA	50% of expenditures for food and beverages at restaurants, cafeterias, cafes, drive-ins, etc. or t school for or pre-school for school-age children.
42	Limited-service restaurants	722211	ETRF	50% of cost of meals, snacks, or beverages at restaurants, bars or fast food places during local overnight stays.
			EXPA	50% of expenditures for food and beverages at restaurants, cafeterias, cafes, drive-ins, etc. or t school for or pre-school for school-age children.
43	All other food and drinking places	722A00	EMIS	Food and beverage for catered affairs.
44	Automotive repair and maintenance, except car washes	8111A0	EVEQ	Expenses for vehicle maintenance and repair.
			EVOT	Expenses for towing and automobile repair service policies.
45	Electronic and precision equipment repair and maintenance4	811200	EEQB	Cost for repairs and services to AV equipment (except if installed in a vehicle) and to computers and related equipment.
46	Personal and household goods repair and maintenance	811400	EEQB	Costs for repairing or servicing miscellaneous items such as appliances, tools, photographic, sports, and lawn and garden equipment.
			EFRB	Costs for repairing furniture.
			ECLD	Costs for repairing or altering clothing and accessories, or repairing watches or jewelry.
47	Personal care services	812100	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for other health, residential and personal care services.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures for other health, residential and personal care services.

	Local commodity	NAICS Code	EXPN File	Description of items included in local spending
48	Death care services	812200	EMIS	Expenses for funerals, burials, cremation, and purchase and upkeep of cemetery lots or vaults.
49	Dry cleaning and laundry services	812300	EXPB	Expenses for clothing and other items at sent to drycleaners and laundry, as well as coin operated dry cleaning and laundry machines.
50	Other personal services	812900	ECLD	Costs of clothing storage services.
			EVOT	Fess for vehicle parking, boat docking and plane landing.
			EMIS	Pet services.
			EXPB	Expenses for haircuts, hair styling, manicures, massages, and other salon services.
51	Religious organizations	813100	ECNT	Contributions to religious organizations.
52	Civic, social, professional and similar organizations	813B00	ESUB	Expenses for membership in civic, service, or fraternal organizations.

There is somewhat more detail in a few input-output industries than is available in a spending line from the CE files. For example, the CE files do not distinguish spending in limited service eating places from spending in full service restaurants. According to the 2007 Economic Census, total sales in each category was $182 to $192 billion—close to a 50-50 split. Therefore, half of spending in eating places is allocated to full service restaurants; the other half to the limited service places. Similarly, the CE files don't distinguish items purchased in general merchandise stores from those purchased in more specialized retail outlets. For goods that likely could be purchased in either, again a 50-50 split is used, as shown for local commodities 08 and 09 in the table above.

For all items included under any retail sales category, only the gross margins are included, and in most cases a further adjustment is made to account for loss of local sales to E-commerce and mail order business. These adjustments are based on information in the Census Bureau's Annual Retail Trade Report for 2012. The report includes a table on gross margins by 6-digit NAICS code that can be used directly. The report also contains separate tables on total sales and mail order & E-commerce. An adjustment factor is calculated based on total E-commerce & mail order sales as a fraction of total retail sales, excluding food and beverage service and motor vehicle and parts dealers. For 2012, the adjustment factor is 1-322,543/4,344,140. In the above table, "adjusted for E-commerce and mail order loss" means that particular category of retail spending is multiplied by this factor.

Insurance payments are separated into a share going to brokers and agents and the insurance companies, based on the proportional share of revenue reported in the latest Economic Census. The share going to brokers and agents is counted as local income. However, it is also assumed that the share going to insurance companies comes back in some cases as these companies pay medical costs for policy holders that go to health care providers in the local area. This is estimated using "Personal Health Care Expenditures by object & Source of Payment" reported by the Census Bureau in the Table 138 of the 2012 Statistical Abstract of the United States.
A similar calculation is made for expenses covered by Medicare. The CE data include the number of household members covered by Medicare. Payments made by Medicare to local

health care providers are estimated using statistics on Medicare Enrollees from Table 146 of the 2012 Statistical Abstract, combined with the health care expenditure information from Table 138.

The consumer spending variables used in the model are all in the form of average propensities to consume—that is, average fractions of before-tax income spent on various items. As shown in the table above, The EXPN files generate consumer spending estimates for 52 locally produced commodities. In addition, seven categories of local commodities produced by local government enterprises are appended to the list:

1 Local government electric service
2 Local government natural gas distribution
3 Local government water & sewerage
4 Local government passenger transit
5 Local government liquor stores
6 Local government sanitary services
7 Local government hospitals

Although these seven extra commodities do not increase local spending in total, they allow the model to allocate consumption between the publicly produced and privately produced commodities based on information from the Census of Governments. In this sense, the model is consistent with both national household consumption patterns and revenue collected by all government enterprises in a particular local area.

To this is added one other local commodity, general government, to account for tax and fee payments (computed in Phase II primarily from BEA personal income estimates and Census of Governments revenue data).

The results can be collected in the 2×60 matrix, $\boldsymbol{A}$:

$$\boldsymbol{A} = \begin{bmatrix} a_1 & a_2 & a_3 & \cdots & a_{59} & 0 \\ 0 & 0 & 0 & \cdots & 0 & 1 \end{bmatrix}$$

The elements in the first row of $\boldsymbol{A}$ show the average fraction of income spent on each of the 59 local commodities (including those produced by local government enterprises such as publicly owned utilities or hospitals). The "O"s and "1" in the second row indicates that no taxes are spent directly by the household on any of the first 59 commodities; 100 percent is spent on the local general government commodity. This two-row structure is designed to align with the output from Phase I of the model, which comes in the form of before-tax local income and local tax estimates.

Several other matrices and vectors derived from the above concepts are needed to calculate the Phase II ripple or multiplier effect:

$\boldsymbol{W}$: a 60×99 matrix that translates local commodities into local income,

$\boldsymbol{G}$: a 60×99 matrix that translates local commodities into local government general revenue collected from persons, and

$\boldsymbol{T}$: a 60×99 matrix that translates local commodities into local government general revenue collected from businesses

$\boldsymbol{L} = \begin{bmatrix} \boldsymbol{W} & \boldsymbol{G} & \boldsymbol{T} \end{bmatrix}$ therefore defines a 60×297 matrix

$\boldsymbol{x}$ = a two element column vector containing local income and local taxes generated in Phase I

$$\boldsymbol{Y} = \begin{bmatrix} \boldsymbol{i} & \boldsymbol{0} & \boldsymbol{0} \\ \boldsymbol{0} & \boldsymbol{i} & \boldsymbol{0} \\ \boldsymbol{0} & \boldsymbol{0} & \boldsymbol{i} \end{bmatrix}$$ a 297×3 matrix where $\boldsymbol{i}$ is a 99-element unit column vector,

$$\boldsymbol{Z} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 1 \end{bmatrix}$$

In summary, $\boldsymbol{x}$ is the income and tax output from Phase 1, $\boldsymbol{A}$ translates income and taxes into spending on particular commodities, $\boldsymbol{L}$ translates the detailed commodity spending into income and taxes in each of 99 local industries, and $\boldsymbol{Y}$ and $\boldsymbol{Z}$ are technical devices for summing results. $\boldsymbol{Y}$ collapses the components of a 297-element vector into a 3-element vector of income, personal taxes, and business taxes. $\boldsymbol{Z}$ converts a 3-element vector of this form into a 2-element income and tax vector.

The row vector defined as $\boldsymbol{x}'\boldsymbol{A}$ shows how much, in dollar terms, people who earn income during Phase I spend on each of the 60 local commodities (including local government employees, whose paychecks are supported by taxes and charges for particular government-run enterprises).

The calculation $\boldsymbol{x}'\boldsymbol{ALYZ}$ produces a 2-element local income and local tax vector of the same form as $\boldsymbol{x}'$. Postmultiplying a vector of this type by $\boldsymbol{ALYZ}$ will always produce a similar, 2-element income and tax vector. Either by construction, or by checking that both eigenvalues are smaller than 1, it is possible to show that $\boldsymbol{ALYZ}$ is a contracting matrix. This implies that the rounds below show successively smaller increments of income and taxes added to the local economy:

$$\begin{aligned}
&\textit{Round } 0: \ \boldsymbol{x}' \\
&\textit{Round } 1: \ \boldsymbol{x}'\,\boldsymbol{ALYZ} \\
&\textit{Round } 2: \ \boldsymbol{x}'\,\boldsymbol{ALYZ}\,\boldsymbol{ALYZ} \\
&\textit{Round } 3: \ \boldsymbol{x}'\,\boldsymbol{ALYZ}\,\boldsymbol{ALYZ}\,\boldsymbol{ALYZ} \\
&\qquad\qquad \vdots \\
&\textit{Round } K: \ \boldsymbol{x}' \prod_{k=1}^{K} \boldsymbol{ALYZ}
\end{aligned}$$

The terms of this sequence can be summed in the usual manner to create an infinite series. Because $\boldsymbol{ALYZ}$ is a contracting matrix, the result is a convergent series, the limit of which is

$$\boldsymbol{x'\ [I-ALYZ]^{-1}}$$

This is the final multiplied effect on local income and local taxes at the end of Phase II. The factor $\boldsymbol{[I-ALYZ]^{-1}}$ is a matrix version of the conventional Keynesian spending multiplier. Because $\boldsymbol{x'}$ is reported in Phase I, it is subtracted from the effect reported in Phase II.

For some purposes, especially estimating employment impacts, we are interested in tracking income in Phase II by industry. Calculations to accomplish this are based on the following sequence of 1×297 vectors:

$$\begin{aligned}
&\textit{Round } 1: \ \boldsymbol{x'AL}\\
&\textit{Round } 2: \ \boldsymbol{x'ALYZAL}\\
&\qquad\vdots\\
&\textit{Round } K: \ \boldsymbol{x'AL}\prod_{k=1}^{K-1}\boldsymbol{YZAL}
\end{aligned}$$

Note that sequence begins with the spending vector $\boldsymbol{x'AL}$—that is, it excludes the income and taxes that have already been captured in Phase I. The limit of the series defined based on this sequence is

$$\boldsymbol{x'AL[I-YZAL]^{-1}}$$

This is a 297-element row vector, the first 89 elements containing the final, multiplied effect on local income by industry generated during Phase II. As explained above, income by industry can be separated into business owners' income and wages and salaries, and the wages and salaries converted to full-time job equivalents.

From the standpoint of local governments, it may be desirable to track individual sources of revenue, such as particular fees and taxes. To facilitate this, it is useful to have a three element local income and local tax vector, where the tax revenue is decomposed into taxes collected from persons and taxes collected from businesses.

Consider the following sequence of such 3-element vectors:

$$\begin{aligned}
&\textit{Round } 1: \ \boldsymbol{x'ALY}\\
&\textit{Round } 2: \ \boldsymbol{x'ALY\ ZALY}\\
&\qquad\vdots\\
&\textit{Round } K: \ \boldsymbol{x'ALY}\prod_{k=1}^{K}\boldsymbol{ZALY}
\end{aligned}$$

This sequence begins after *Round 0*, implicitly excluding income earned and taxes paid during Phase I. The limit of the infinite series defined by this sequence is

$$x' ALY[I-ZALY]^{-1}$$

This is the final, multiplied effect on local income, local government revenue collected from persons, and local government revenue collected from businesses in Phase II of the model. The tax structure for a particular local area, derived primarily from Census of Governments data as described above, can be applied to this result in order to decompose local government revenue into particular types of taxes and fees.

Phase III: Ongoing Impacts

Another distinctive feature of the NAHB model is the way it uses CE and other data to model the average behavior of occupants that differs based on the type of housing being built. At present, there are six basic variants of the NAHB model designed to handle the following types of construction:

1. Generic Single-family
2. Generic Multifamily
3. Active Adult
4. Family Low-Income Housing Tax Credit (LIHTC)
5. Elderly LIHTC
6. Remodeling

The remodeling version of the model does not in general incorporate ongoing impacts, so it requires no occupant income estimates. For the other five versions of the model, separate occupant income estimates are derived in a way that vary with location as well as with the type of units being built. The derivations are based on relationships between average income and standard variables that are typically available at the local level. The methods for establishing these relationships are summarized below.

Generic Single-family. Regression of average income of home owners on area median family income and average value of the units using American Community Survey (ACS) microdata.

Generic Multifamily. Regression of average income of home owners on area median family income and average rent using ACS microdata.

Active Adult. Average income of movers into age-restricted owner occupied units and average income of all home buyers are computed from American Housing Survey (AHS) microdata, and the ratio of the two averages is used to adjust home buyers' income for the active adult case.

Family LIHTC. Average incomes of all movers into rental units who have less than 60 percent of median family income for the U.S. as a whole, computed from CE data.

Elderly LIHTC. Average incomes of all elderly movers into rental units who have less than 60 percent of median family income for the U.S. as a whole, computed from CE data.

The ACS is the Census Bureau's replacement for the long form questionnaire that until 2000 was used to collect information on income and structure type in the decennial Census. The AHS, funded by the U.S. Department of Housing and Urban Development (HUD) and conducted by the Census Bureau, is the federal government's primary vehicle for collecting detailed information about housing units and their occupants at the national level.

The ratios and regression results listed above allow the model to be simultaneously customized to a particular area and a particular type of construction by inputting specific local information that is generally available. When customizing to a local area, median family income for that particular area is used. HUD produces median income estimates for all parts of the country in a timely fashion as part of the process it uses to establish income limits for various housing programs.

When it is necessary to translate rents into value or vice versa, the median cap rate from the Rental Housing Finance Survey (RHFS), also funded by HUD and conducted by the Census Bureau, is used.

In addition to average income, estimated spending tendencies for movers into each type of construction are needed. Separate spending vectors are estimated for each using household information available in the CE data. The table on the following page shows average local propensities to consume computed from the 2012 CE.

This modeling of average spending by different types of households soon after they move in is another distinguishing feature of the NAHB local impact model. In addition to the function they serve in the local model, average spending tendencies computed from CE data have also proven to be of interest for their implications at the national level.[5]

Compared to home buyers, renters tend to spend more of their incomes locally—partly due to the tendency of lower-income households to spend a greater fraction of their incomes on necessities, but also due to rental payments that go to a local owner, or owner employing a management company with a local presence. The equivalent housing expense for a home buyer would be a mortgage payment. Because mortgage payments typically are made to non-local owners of the mortgage through non-local servicers, they are excluded from the spending estimates in the NAHB local impact model.

Average propensities to spend on virtually all categories of local health care services are higher for households moving into construction designed for older residents (age-restricted active adult and elderly LIHTC).

As was described in Phase II, seven categories of commodities produced by local government enterprises are added to the model, and a share of local spending (which may be zero) is allocated to these enterprises instead of private producers based on revenues reported in the Census of Governments for each local government enterprises in the area.

[5] See, for example, the December 2008 Special Study "Spending Patterns of Home Buyers," written by Natalia Siniavskaia and published by NAHB in Housing Economics.com.

Average Local Spending Computed from CE Data

	Output of industry purchased locally	All House-holds	New Home Buyers	New Multifamily Renters	Active Adult Buyers	New Family LIHTC	New Elderly LIHTC
1	Greenhouse, nursery, and floriculture production	0.129%	0.172%	0.000%	0.176%	0.000%	0.000%
2	Electric power generation, transmission, and distr.	2.689%	2.410%	0.002%	3.428%	0.000%	0.000%
3	Natural gas distribution	0.674%	0.499%	0.000%	0.723%	0.000%	0.000%
4	Water, sewage and other systems	0.793%	0.802%	0.000%	1.108%	0.000%	0.000%
5	Residential maintenance and repair	3.059%	2.087%	0.000%	3.567%	0.170%	0.072%
6	Motor vehicle and parts dealers	1.218%	1.439%	5.098%	1.447%	1.408%	1.190%
7	Food and beverage stores	4.829%	3.303%	4.446%	3.567%	8.573%	8.793%
8	General merchandise stores	0.745%	0.840%	1.271%	0.723%	1.129%	0.437%
9	Other retail	3.119%	2.494%	3.088%	2.906%	3.896%	4.069%
10	Transit and ground passenger transportation	0.190%	0.030%	0.269%	0.028%	0.990%	0.990%
11	Newspaper publishers	0.027%	0.016%	0.042%	0.042%	0.057%	0.096%
12	Wired telecommunications carriers	2.392%	1.770%	1.878%	2.588%	2.868%	4.441%
13	Wireless telecom. carriers (except satellite)	2.081%	1.809%	3.565%	1.811%	3.323%	2.435%
14	Satellite, telecom. Resellers & all other telecom.	0.323%	0.249%	0.620%	0.335%	0.472%	0.494%
15	Data processing, hosting, and related services	0.003%	0.002%	0.000%	0.002%	0.006%	0.000%
16	Monetary authorities, depository credit intermediation	0.437%	0.298%	0.000%	0.366%	0.000%	0.000%
17	Nondepository credit intermediation+related activities	0.417%	0.616%	0.906%	0.463%	0.381%	0.327%
18	Insurance agencies, brokerages, and related activities	0.407%	0.387%	0.722%	0.462%	0.291%	0.288%
19	Real estate	8.301%	2.048%	27.078%	1.292%	33.130%	34.324%
20	Automotive equipment rental and leasing	0.795%	0.775%	0.000%	0.348%	0.426%	0.000%
21	Consumer goods and general rental centers	0.070%	0.055%	0.041%	0.046%	0.104%	0.030%
22	Legal services	0.335%	1.185%	0.006%	0.163%	0.852%	0.055%
23	Accounting, tax preparation, bookkeeping, and payroll	2.512%	1.939%	0.250%	1.691%	4.895%	0.904%
24	Photographic services	0.045%	0.039%	0.257%	0.017%	0.054%	0.015%
25	Veterinary services	0.236%	0.199%	0.006%	0.209%	0.149%	0.104%
26	Investigation and security services	0.024%	0.042%	0.055%	0.066%	0.009%	0.015%
27	Services to buildings and dwellings	0.385%	0.389%	0.093%	0.666%	0.181%	0.119%
28	Waste management and remediation services	0.219%	0.217%	0.000%	0.283%	0.000%	0.000%
29	Elementary and secondary schools	0.212%	0.314%	0.000%	0.134%	0.060%	0.022%
30	Offices of physicians	4.361%	2.732%	3.879%	5.881%	3.595%	10.321%
31	Offices of dentists	0.787%	0.693%	0.416%	1.036%	0.698%	1.082%
32	Offices of other health practitioners	0.670%	0.387%	0.280%	0.812%	0.453%	1.269%
33	Home health care services	0.884%	0.395%	0.625%	1.123%	0.755%	2.585%
34	Hospitals	3.761%	2.482%	5.133%	5.953%	2.682%	9.324%
35	Nursing and community care facilities	0.974%	0.386%	0.592%	1.140%	0.791%	2.808%
36	Child day care services	0.202%	0.345%	0.632%	0.013%	0.183%	0.000%
37	Performing arts companies	0.191%	0.235%	0.353%	0.403%	0.279%	0.062%
38	Spectator sports	0.070%	0.071%	0.109%	0.020%	0.156%	0.007%
39	Gambling industries (except casino hotels)	0.068%	0.036%	0.005%	0.083%	0.128%	0.351%
40	Other amusement and recreation industries	0.335%	0.490%	1.146%	0.416%	0.350%	0.058%
41	Full-service restaurants	2.415%	1.902%	3.289%	2.020%	4.756%	2.625%
42	Limited-service restaurants	2.415%	1.902%	3.289%	2.020%	4.756%	2.625%
43	All other food and drinking places	0.107%	0.699%	0.007%	2.638%	0.034%	0.008%
44	Automotive repair and maintenance	1.713%	1.289%	2.595%	1.961%	1.799%	1.746%
45	Electronic and precision equip. repair & maintenance	0.022%	0.019%	0.000%	0.031%	0.012%	0.005%
46	Personal and household goods repair & maintenance	0.105%	0.078%	0.027%	0.131%	0.084%	0.154%
47	Personal care services	0.144%	0.070%	0.107%	0.183%	0.121%	0.403%
48	Death care services	0.278%	0.067%	0.029%	0.163%	0.524%	0.259%
49	Dry-cleaning and laundry services	0.264%	0.103%	0.225%	0.116%	0.886%	0.752%
50	Other personal services	0.745%	0.707%	0.678%	0.859%	1.163%	0.988%
51	Religious organizations	0.746%	0.821%	0.746%	1.205%	0.337%	0.415%
52	Civic, social, professional, and similar organizations	0.011%	0.005%	0.000%	0.009%	0.000%	0.002%

Also as described in Phase II, Census of Governments data are used to estimate most categories of tax and fee revenue generated for general (non-enterprise) governments in the area. The exemption is residential property taxes. Perhaps surprisingly, residential and non-residential property taxes are not reported separately. Moreover, some states have restrictions on rate increases, or other laws that tend to make property tax rates different on new construction. Particular developments (for example, those financed by the LIHTC program) may also be granted special forms of property tax relief.

For these reasons, when customizing the local impact model to a specific area, information about property taxes on the units being built must be supplied by the entity requesting the analysis. Phase III of the model counts only property tax on the value of construction. Unless specific information is provided for an individual project or jurisdiction, this is calculated assuming that the raw land would be taxed at the same rate if not developed. Any residential property tax from existing units is treated as unrelated to the new homes being analyzed and excluded from the government revenue impact estimates.

Non-residential property taxes are treated much like other categories of government revenue, except that the aggregate for a jurisdiction to be estimated from a larger aggregate in the government data that does not distinguish residential from non-residential. This is accomplished by subtracting an estimated 53.37 percent from total property taxes to account for residential share of property taxes. The estimate is calculated as follows, from data available for 2012 in the ACS, RHFS and the Census Bureau's Summary of State and Local Government Tax Revenue (SSLGTR):

Aggregate real estate taxes paid by homeowners:	$206.04 billion (ACS)
Estimate for homeowners not reporting:	5.93 billion
Estimated real estate taxes paid on rental housing	41.85 billion (ACS and RHFS)
Total residential real estate taxes	$253.82 billion
Total property taxes	$475.83 billion (SSLGTR)
Residential share	53.37%

The estimate for homeowners not reporting in the ACS is based on the number of non-reporters multiplied by median tax payment for those who do report. The estimate for rental units is based on the number of rental units in the ACS multiplied by median tax per rental unit in the RHFS.

Multifamily Phase III impacts are reduced to account for vacant units. By default, the single-family version of the model assumes that units are intended for owner-occupancy and have negligible vacancies. In the Census Bureau's Housing Vacancy Survey homeowner vacancy rates are usually in the neighborhood of only one percent.

For multifamily units, the average multifamily rental annual vacancy rate over the prior decade and average annual multifamily homeowner vacancy rate over the prior decade are used, depending on whether the units are condominiums or rental apartments. In other respects, Phase III treats condo buyers the same as single-family home buyers (the income and spending tendencies discussed above being based on buyers of owner-occupied housing units, irrespective of structure type).

Although vacancy rates are known to fluctuate, the model estimates annual ongoing impacts that are expected to persist for an extended period, so a long-term "natural" measure of vacancy rates is more appropriate for Phase III than a very current, possibly anomalous, number. The reduction for vacancies is applied to all Phase III multifamily impacts except for property taxes, which are assumed to be paid by the owner of the property, whether the units are occupied or not.

Local spending and taxes (including fees and charges paid to local government entities) generate income for local residents, and this income will be spent and recycled in the local economy, much as in Phase II of the model.

Let $\boldsymbol{x}_{\mathrm{n}}$ denote the initial income and tax column vector for new home occupants, $\boldsymbol{A}_{\mathrm{n}}$ denote the matrix formed from the consumption spending patterns of new home occupants, and otherwise maintain the notation used in Phase II of the model. Then consider the following sequence:

$$
\begin{aligned}
&\textit{Round } 0: \ \boldsymbol{x_n'} \\
&\textit{Round } 1: \ \boldsymbol{x_n' A_n LYZ} \\
&\textit{Round } 2: \ \boldsymbol{x_n' A_n LYZ\ ALYZ} \\
&\textit{Round } 3: \ \boldsymbol{x_n' A_n LYZ\ ALYZ\ ALYZ} \\
&\qquad\qquad \vdots \\
&\textit{Round } K: \ \boldsymbol{x_n' A_n LYZ} \prod_{k=1}^{K} \boldsymbol{ALYZ}
\end{aligned}
$$

The sum of these terms forms an infinite series that converges to the limit

$$\boldsymbol{x_n'\ [I+(A_n - A)LYZ][I-ALYZ]^{-1}}$$

When results are reported for Phase III the income earned by the occupants is subtracted from the final multiplied effect, so that only income generated for occupants of housing units already existing in the area is counted.

Note that, were new home occupants to spend the same fraction of their incomes on the various local commodities as average households, $\boldsymbol{A}_{\mathrm{n}} = \boldsymbol{A}$ and the formula would simplify to

$$\boldsymbol{x_n'\ [I-ALYZ]^{-1}}$$

The formula that produces a 297-element vector, the first 99 of which contain the added income by industry, for Phase III is

$$\boldsymbol{x_n'\ A_n L\ [I-YZAL]^{-1}}$$

Again, the income in each industry can be disaggregated into business owners' income and wages and salaries, and the wages and salaries converted to full-time jobs. These exclude any jobs filled by occupants of the new housing units.

The formula that produces a 3-element vector showing the final, multiplied effect on local income, local government general revenue from persons, and local general government revenue from business generated in Phase III is

$$x_n' A_n LY [I - ZALY]^{-1}$$

As in Phase II, the last two elements of the final 3-element vector can be disaggregated to show revenue generated by particular types of taxes, fees, and charges. The primary difference in Phase III is that the increase in residential property tax revenue (which is introduced into the model as a separate input independent of the Census of Government computations) needs to be subtracted before the decomposition procedure can be applied.

Final Notes

All of the matrix operations in the NAHB local impact model are performed using the O-Matrix package provided by Harmonic Software. The O-Matrix code used to generate Phase III impacts for single-family construction and the code used to compute a local total requirements matrix for a previous iteration of the NAHB model are published on the Harmonic Software web site as notable uses of the O-Matrix package (http://www.omatrix.com/userstories.html).

The technical documentation on the NAHB model used to estimate the local income, jobs, and taxes generated by home building was prepared by Paul Emrath, Vice President of Survey and Housing Policy Research. For questions on the technical documentation, or on NAHB's impact of home building models in general, he may be contacted in NAHB's Economics and Housing Policy Group by phone at 202-266-8449, or by email at pemrath@nahb.org.

The Metro Area Impact of Home Building in Placer County, California: Income, Jobs and Taxes Generated

November 2025

Housing Policy Department

NAHB
National Association of Home Builders

The Metro Area Impact of Home Building in Placer County, California:

Income, Jobs and Taxes Generated

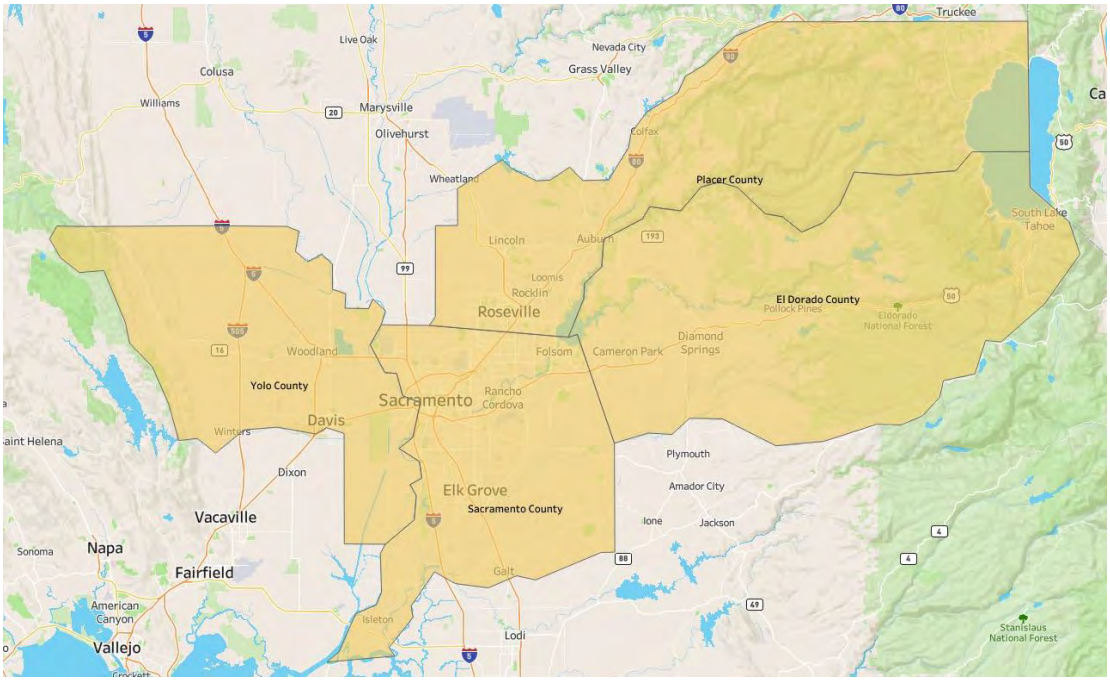
Contents

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 these 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. To fully understand the economic impact residential construction has on a local area, it is important to include the ripple effects and the ongoing benefits. Since the model was initially developed in 1996, NAHB has used it successfully to estimate the impacts of construction in over 800 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 Placer County, California. For purposes of the NAHB model, a local area 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) or Metropolitan Division, as defined by the U.S. Office of Management and Budget (OMB). Based on local commuting patterns, OMB has identified the Sacramento-Roseville-Folsom MSA as a metro area consisting of four counties (El Dorado, Placer, Sacramento, and Yolo) in California (see map below).

Sacramento-Roseville-Folsom, California MSA



In this report, wherever the term local is used, it refers to the entire, four-county metro area. The report presents estimates of the impacts of building 2,339 single-family and 850 multifamily housing units, based on the number of homes built in Placer County over the period from June 2024 to June 2025.

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. Aggregate results are summarized below. Subsequent sections of the report show detail by industry and type of tax or fee revenue generated.

Single-family Construction

- The estimated one-year metro area impacts of building 2,339 single-family homes in Placer County include
    - **$1.32 billion** in local income,
    - **$354.3 million** in taxes and other revenue for local governments, and
    - **13,282** local jobs.

  These are local impacts, representing income and jobs for residents of the Sacramento-Roseville-Folsom 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. Local jobs are measured in full-time equivalents—i.e., one reported job represents enough work to keep one worker employed full-time for a year, based on average hours worked per week by full-time employees in the industry.

- The additional, annually recurring impacts of building 2,339 single-family homes in Placer County include
    - **$171.3 million** in local income,
    - **$67.8 million** in taxes and other revenue for local governments, and
    - **2,083** local jobs.

  These are ongoing, annual local impacts that result from the new homes becoming occupied, and the occupants paying taxes and otherwise participating in the local economy year after year. The ongoing impacts also include the effect of increased property taxes, based on the difference between the value of raw land and the value of a completed housing unit on a finished lot, assuming that raw land would be taxed at the same rate as the completed housing unit.

The above impacts were calculated assuming that new single-family homes built in Placer County have an average price of $745,000, which includes $165,000 in raw land value and $95,000 in permit, hook-up, impact and other fees paid to local governments, and incur an average property tax of $13,150 per year. The estimates also assume that a local sales tax of 1.25% is charged on construction materials. This information was provided by the North State Building Industry Association.

Multifamily Construction

- The estimated one-year local impacts of building 850 multifamily units in Placer County include
    - **$228.5 million** in local income,
    - **$72.0 million** in taxes and other revenue for local governments, and
    - **2,288** local jobs.

  These are local impacts, representing income and jobs for residents of the Sacramento-Roseville-Folsom 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 850 multifamily units in Placer County include
    - **$47.0 million** in local income,
    - **$10.9 million** in taxes and other revenue for local governments, and
    - **540** local jobs.

  These are ongoing, annual local impacts that result from the new homes becoming occupied, and the occupants paying taxes and otherwise participating in the local economy year after year. They also represent impacts that have been reduced to account for the natural vacancy rate that tends to prevail in multifamily properties (see page 23 of the Technical Documentation).

These impacts were calculated assuming that new multifamily units built in Placer County have an average market value of $300,000, which includes $23,500 in raw land value and $58,000 in permit, hook-up, impact and other fees paid to local governments, and incur an average annual property tax of $3,000 per unit. As with the assumptions underlying the single-family impact estimates, this information was provided by the North State Building Industry Association.

The Metro Area Impact of Home Building in Placer County, California:

Income, Jobs and Taxes Generated

Detailed Tables on Single-family Construction

National Association of Home Builders

Impact of Building 2,339 Single-family Homes in Placer County, California

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
$1,315,907,800	$371,065,300	$944,842,000	$354,255,600	13,282

Phase I: Direct and Indirect Impact of Construction Activity:

Local Income	Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$795,096,200	$272,124,900	$522,970,900	$267,306,200	6,499

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
$520,811,600	$98,940,400	$421,871,100	$86,949,400	6,784

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
$171,252,900	$37,037,400	$134,215,500	$67,844,900	2,083

[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 2,339 Single-family Homes in Placer County, California
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	$609,531,200	$207,852,200	$401,679,000	$86,000	4,648
Manufacturing	$63,300	$2,900	$60,400	$65,000	1
Transportation	$38,500	$18,600	$19,800	$45,000	0
Communications	$5,120,500	$1,789,300	$3,331,200	$96,000	35
Utilities	$768,100	$165,600	$602,500	$164,000	4
Wholesale and Retail Trade	$63,336,000	$13,966,300	$49,369,800	$47,000	1,053
Finance and Insurance	$11,697,300	$446,400	$11,250,900	$145,000	78
Real Estate	$35,052,500	$30,182,800	$4,869,600	$80,000	61
Personal & Repair Services	$3,147,900	$750,700	$2,397,200	$64,000	37
Services to Dwellings / Buildings	$2,191,100	$845,600	$1,345,400	$61,000	22
Business & Professional Services	$50,597,000	$11,827,400	$38,769,500	$94,000	414
Eating and Drinking Places	$1,820,700	$299,200	$1,521,500	$44,000	35
Automobile Repair & Service	$670,500	$201,700	$468,700	$64,000	7
Entertainment Services	$395,400	$37,800	$357,600	$46,000	8
Health, Educ. & Social Services	$71,200	$2,200	$68,900	$52,000	1
Local Government	$2,641,900	$0	$2,641,900	$71,000	37
Other	$7,953,100	$3,736,200	$4,217,000	$74,000	57
Total	$795,096,200	$272,124,900	$522,970,900	$80,000	6,499

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$1,850,600	Residential Permit / Impact Fees	$222,205,000
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$22,061,700
General Sales Taxes	$6,658,500	Hospital Charges	$26,400
Specific Excise Taxes	$302,700	Transportation Charges	$1,316,800
Income Taxes	$0	Education Charges	$1,698,500
License Taxes	$405,700	Other Fees and Charges	$10,607,700
Other Taxes	$172,600	TOTAL FEES & CHARGES	$257,916,100
TOTAL TAXES	$9,390,100	TOTAL GENERAL REVENUE	$267,306,200

Impact of Building 2,339 Single-family Homes in Placer County, California
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	$26,830,400	$9,926,200	$16,904,200	$86,000	196
Manufacturing	$112,800	$6,100	$106,700	$61,000	2
Transportation	$991,700	$480,900	$510,800	$45,000	11
Communications	$24,288,100	$10,013,100	$14,275,000	$106,000	134
Utilities	$3,941,200	$850,600	$3,090,600	$164,000	19
Wholesale and Retail Trade	$62,893,100	$10,667,300	$52,225,900	$47,000	1,106
Finance and Insurance	$13,905,600	$541,400	$13,364,100	$126,000	106
Real Estate	$43,259,800	$17,929,700	$25,330,100	$80,000	316
Personal & Repair Services	$16,915,000	$5,997,700	$10,917,200	$64,000	171
Services to Dwellings / Buildings	$6,250,000	$2,412,200	$3,837,800	$61,000	63
Business & Professional Services	$62,396,100	$17,776,800	$44,619,300	$81,000	548
Eating and Drinking Places	$28,931,300	$5,691,300	$23,240,000	$42,000	554
Automobile Repair & Service	$12,617,000	$3,796,200	$8,820,800	$64,000	138
Entertainment Services	$3,494,800	$658,200	$2,836,600	$44,000	65
Health, Educ. & Social Services	$69,759,500	$7,617,900	$62,141,600	$99,000	629
Local Government	$134,982,400	$0	$134,982,400	$51,000	2,659
Other	$9,242,800	$4,574,800	$4,668,000	$68,000	68
Total	$520,811,600	$98,940,400	$421,871,100	$62,000	6,784

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$10,211,100	Residential Permit / Impact Fees	$0
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$52,502,200
General Sales Taxes	$4,833,100	Hospital Charges	$53,200
Specific Excise Taxes	$1,670,000	Transportation Charges	$862,500
Income Taxes	$0	Education Charges	$1,112,600
License Taxes	$2,160,100	Other Fees and Charges	$12,592,200
Other Taxes	$952,500	TOTAL FEES & CHARGES	$67,122,700
TOTAL TAXES	$19,826,700	TOTAL GENERAL REVENUE	$86,949,400

Impact of Building 2,339 Single-family Homes in Placer County, California
Phase III—Ongoing, Annual Effect that Occurs as the Homes 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	$9,611,900	$3,554,800	$6,057,000	$86,000	70
Manufacturing	$35,300	$1,800	$33,500	$63,000	1
Transportation	$213,700	$103,600	$110,100	$45,000	2
Communications	$9,347,900	$3,886,500	$5,461,500	$106,000	52
Utilities	$1,530,100	$330,200	$1,200,000	$164,000	7
Wholesale and Retail Trade	$25,729,300	$4,212,300	$21,517,000	$48,000	452
Finance and Insurance	$6,114,900	$225,800	$5,889,000	$123,000	48
Real Estate	$11,574,700	$4,797,300	$6,777,400	$80,000	85
Personal & Repair Services	$5,938,900	$2,317,900	$3,621,000	$64,000	57
Services to Dwellings / Buildings	$2,290,900	$884,200	$1,406,700	$61,000	23
Business & Professional Services	$25,194,200	$7,699,300	$17,494,900	$84,000	209
Eating and Drinking Places	$12,280,100	$2,325,600	$9,954,500	$42,000	240
Automobile Repair & Service	$4,967,700	$1,494,700	$3,473,000	$64,000	54
Entertainment Services	$1,891,700	$325,100	$1,566,600	$43,000	36
Health, Educ. & Social Services	$25,173,300	$2,856,100	$22,317,200	$96,000	232
Local Government	$25,235,100	$0	$25,235,100	$52,000	485
Other	$4,123,200	$2,022,200	$2,101,000	$67,000	31
Total	$171,252,900	$37,037,400	$134,215,500	$64,000	2,083

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$4,196,100	Residential Permit / Impact Fees	$0
Residential Property Taxes	$23,880,300	Utilities & Other Govt. Enterprises	$30,469,000
General Sales Taxes	$1,986,100	Hospital Charges	$33,200
Specific Excise Taxes	$686,300	Transportation Charges	$283,600
Income Taxes	$0	Education Charges	$365,800
License Taxes	$886,800	Other Fees and Charges	$4,666,400
Other Taxes	$391,400	TOTAL FEES & CHARGES	$35,818,100
TOTAL TAXES	$32,026,800	TOTAL GENERAL REVENUE	$67,844,900

The Metro Area Impact of Home Building in Placer County, California:

Income, Jobs and Taxes Generated

Detailed Tables on Multifamily Construction

National Association of Home Builders

Impact of Building 850 Multifamily Units in Placer County, California

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
$228,500,700	$66,785,400	$161,714,800	$72,013,600	2,288

Phase I: Direct and Indirect Impact of Construction Activity:

Local Income	Business Owners' Income	Local Wages and Salaries	Local Taxes[1]	Local Jobs Supported
$132,765,600	$49,337,400	$83,427,900	$56,467,000	1,073

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
$95,735,100	$17,448,000	$78,286,900	$15,546,600	1,216

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
$46,967,500	$10,939,900	$36,027,700	$10,906,700	540

[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 850 Multifamily Units in Placer County, California
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	$109,452,700	$42,097,900	$67,354,800	$86,000	783
Manufacturing	$7,200	$300	$6,900	$65,000	0
Transportation	$4,200	$2,000	$2,100	$44,000	0
Communications	$709,300	$244,100	$465,200	$92,000	5
Utilities	$111,400	$24,100	$87,300	$164,000	1
Wholesale and Retail Trade	$12,099,900	$2,669,900	$9,430,000	$45,000	212
Finance and Insurance	$646,700	$25,300	$621,400	$134,000	5
Real Estate	$2,736,500	$2,356,400	$380,200	$80,000	5
Personal & Repair Services	$447,300	$106,300	$341,000	$63,000	5
Services to Dwellings / Buildings	$268,500	$103,600	$164,900	$60,000	3
Business & Professional Services	$4,888,800	$1,195,200	$3,693,500	$90,000	41
Eating and Drinking Places	$139,300	$22,000	$117,300	$43,000	3
Automobile Repair & Service	$101,200	$30,400	$70,700	$63,000	1
Entertainment Services	$42,600	$4,000	$38,600	$46,000	1
Health, Educ. & Social Services	$12,800	$400	$12,400	$52,000	0
Local Government	$320,700	$0	$320,700	$89,000	4
Other	$776,500	$455,500	$320,900	$72,000	4
Total	$132,765,600	$49,337,400	$83,427,900	$78,000	1,073

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$153,100	Residential Permit / Impact Fees	$49,300,000
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$3,683,900
General Sales Taxes	$1,074,300	Hospital Charges	$4,400
Specific Excise Taxes	$25,000	Transportation Charges	$219,900
Income Taxes	$0	Education Charges	$283,600
License Taxes	$34,900	Other Fees and Charges	$1,673,500
Other Taxes	$14,300	TOTAL FEES & CHARGES	$55,165,300
TOTAL TAXES	$1,301,700	TOTAL GENERAL REVENUE	$56,467,000

Impact of Building 850 Multifamily Units in Placer County, California
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	$4,725,500	$1,750,000	$2,975,500	$86,000	35
Manufacturing	$21,300	$1,200	$20,100	$60,000	0
Transportation	$188,700	$91,500	$97,200	$44,000	2
Communications	$4,308,100	$1,773,600	$2,534,500	$106,000	24
Utilities	$695,800	$150,200	$545,700	$164,000	3
Wholesale and Retail Trade	$10,998,000	$1,870,300	$9,127,700	$47,000	195
Finance and Insurance	$2,453,600	$95,200	$2,358,300	$126,000	19
Real Estate	$7,580,900	$3,142,000	$4,438,900	$80,000	55
Personal & Repair Services	$3,009,500	$1,057,300	$1,952,200	$63,000	31
Services to Dwellings / Buildings	$1,125,800	$434,500	$691,300	$60,000	11
Business & Professional Services	$11,164,100	$3,168,900	$7,995,200	$81,000	98
Eating and Drinking Places	$5,068,800	$999,300	$4,069,500	$41,000	98
Automobile Repair & Service	$2,198,500	$661,500	$1,537,000	$63,000	24
Entertainment Services	$611,200	$114,700	$496,500	$43,000	11
Health, Educ. & Social Services	$12,129,300	$1,324,800	$10,804,400	$98,000	110
Local Government	$27,817,000	$0	$27,817,000	$57,000	486
Other	$1,639,000	$813,000	$825,900	$68,000	12
Total	$95,735,100	$17,448,000	$78,286,900	$64,000	1,216

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$1,793,000	Residential Permit / Impact Fees	$0
Residential Property Taxes	$0	Utilities & Other Govt. Enterprises	$9,430,300
General Sales Taxes	$848,700	Hospital Charges	$9,700
Specific Excise Taxes	$293,200	Transportation Charges	$158,500
Income Taxes	$0	Education Charges	$204,500
License Taxes	$379,400	Other Fees and Charges	$2,262,000
Other Taxes	$167,200	TOTAL FEES & CHARGES	$12,065,000
TOTAL TAXES	$3,481,600	TOTAL GENERAL REVENUE	$15,546,600

Impact of Building 850 Multifamily Units in Placer County, California
Phase III—Ongoing, Annual Effect that Occurs as the Homes 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	$1,507,400	$569,800	$937,700	$86,000	11
Manufacturing	$9,900	$500	$9,400	$62,000	0
Transportation	$78,600	$38,100	$40,500	$44,000	1
Communications	$2,592,900	$1,074,800	$1,518,100	$106,000	14
Utilities	$257,000	$55,600	$201,400	$164,000	1
Wholesale and Retail Trade	$7,710,800	$1,151,600	$6,559,200	$51,000	128
Finance and Insurance	$1,416,700	$54,800	$1,361,900	$122,000	11
Real Estate	$8,795,700	$3,645,500	$5,150,200	$80,000	64
Personal & Repair Services	$1,380,600	$499,900	$880,600	$63,000	14
Services to Dwellings / Buildings	$587,000	$226,600	$360,500	$60,000	6
Business & Professional Services	$4,794,700	$1,348,100	$3,446,600	$77,000	45
Eating and Drinking Places	$3,427,100	$672,500	$2,754,500	$42,000	66
Automobile Repair & Service	$1,661,400	$499,900	$1,161,500	$63,000	18
Entertainment Services	$623,900	$84,900	$539,100	$42,000	13
Health, Educ. & Social Services	$6,761,600	$692,700	$6,068,900	$98,000	62
Local Government	$4,693,100	$0	$4,693,100	$59,000	80
Other	$669,100	$324,600	$344,500	$67,000	5
Total	$46,967,500	$10,939,900	$36,027,700	$67,000	540

B. Local Government General Revenue by Type

TAXES:		USER FEES & CHARGES:	
Business Property Taxes	$1,217,000	Residential Permit / Impact Fees	$0
Residential Property Taxes	$2,350,300	Utilities & Other Govt. Enterprises	$4,688,900
General Sales Taxes	$576,000	Hospital Charges	$5,300
Specific Excise Taxes	$199,000	Transportation Charges	$77,800
Income Taxes	$0	Education Charges	$100,300
License Taxes	$257,100	Other Fees and Charges	$1,321,300
Other Taxes	$113,500	TOTAL FEES & CHARGES	$6,193,700
TOTAL TAXES	$4,713,000	TOTAL GENERAL REVENUE	$10,906,700

The Metro Area Impact of Home Building in Placer County, California:

Income, Jobs and Taxes Generated

Background and a Brief Description of the Model Used to Estimate the Economic Benefits

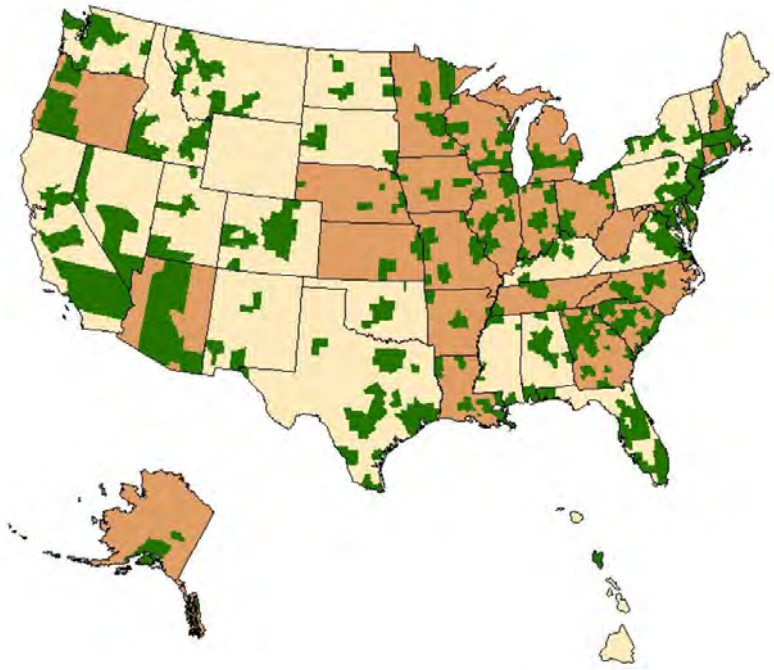
National Association of Home Builders

In 1996, the Housing Policy Department of the National Association of Home Builders (NAHB) developed an economic model to estimate the local economic benefits of home building. Although at first calibrated to a typical metropolitan area using national averages, the model could be adapted to a specific local economy by replacing national averages with specific local data for 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.

Since 1997, NAHB has used the model to produce customized reports on the impact of home building in various parts of the country. As of February 2012, NAHB has produced over 800 of these customized reports, analyzing residential construction in various metropolitan areas, non-metropolitan counties, and states (see map below).

Areas Covered by NAHB Local Impact Studies

The dark green shading indicates studies covering metro areas and non-metro counties; the orange shading studies covering 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, then in 2005 a version of the model that analyzes remodeling.

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/pdf/Newslett-June02.pdf

- The Louisville Affordable Housing Trust Fund (AHTF) used results from the NAHB model to determine the initial one-year impact and the ongoing annual effect that occurs when new homes are occupied. This analysis was performed to help justify the creation of a commission to oversee the newly established AHTF to insure that it works at "finding creative ways to create a sustainable and renewable fund to provide affordable housing opportunities throughout the Louisville community." www.openthedoorlouisville.org/housing-trust/economic-growth

- The Illinois Housing Development Authority used the NAHB model to determine that "the Authority's new construction activity in single and multifamily housing….resulted in the creation of 4,256 full-time jobs in construction and construction-related industries." The Authority also used the NAHB impact model to determine the federal, state and local taxes and fees generated from new construction and substantial rehabilitation activity. www.ihda.org/admin/Upload/Files/94c0ecf7-a238-4be3-90bd-6043cfae81ea.pdf

- The Stardust Center at the Arizona State University used "the model used and developed by the NAHB to assess the immediate economic impacts of affordable housing" by phase including the construction effect, the construction ripple, and on-going impacts. This was done to show "that permanent, affordable and geographically accessible housing provides numerous benefits both to individual families and to the broader community." www.orangecountyfl.net/NR/rdonlyres/efo5wiffiqvqqgn2s35shus5i4lwdgqbcxpck2dddnds3msj5qs26ubzllsfl6s6rrwnmtkq4dypnjrdrdzei2llq5g/Socialeconomicimpacts.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."

- 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."

- 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."

- 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.

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 400 industries and commodities provided in the input-output files, the model uses only 97 commodities and 99 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.

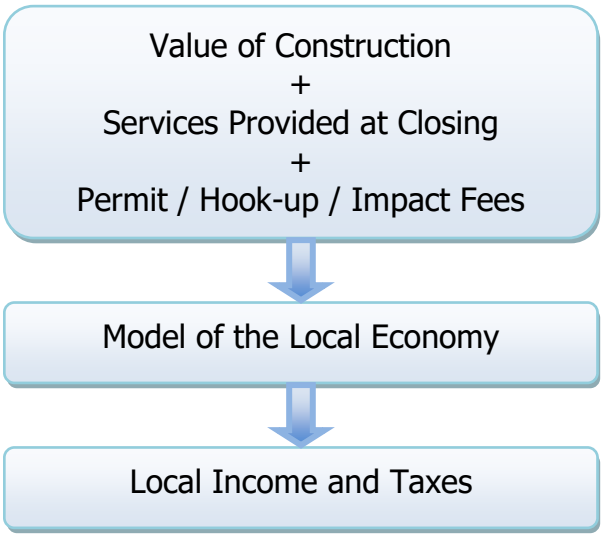
For a particular local area, the model adjusts the indirect business tax section of the national input-output accounts to account for the fiscal structure of local governments in the area. The information used to do this comes primarily from the U.S. Census Bureau's Census of Governments. Wages and salaries 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 each of the 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.

Summary of Phase I



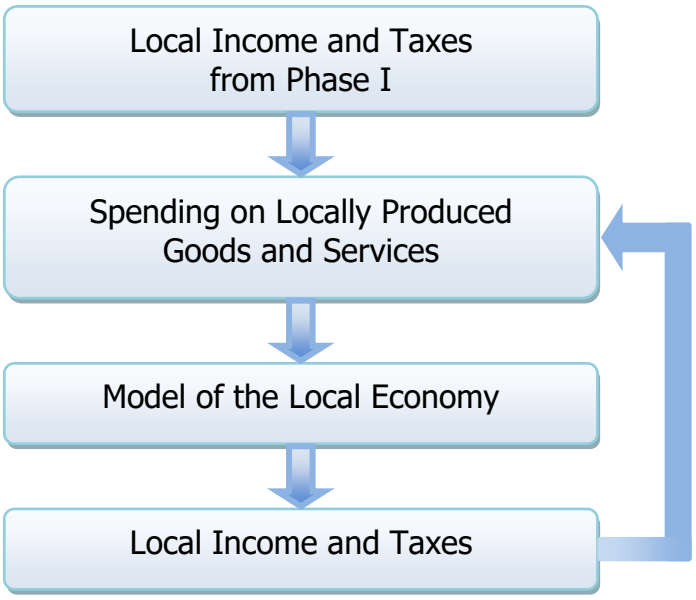
Phase II: The Construction Ripple

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 that 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 that 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 (CE) Survey, 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 52 local commodities. The remainder of the 97 local commodities enter the model only as 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 economics is a straightforward exercise in mathematics.

Summary of Phase II



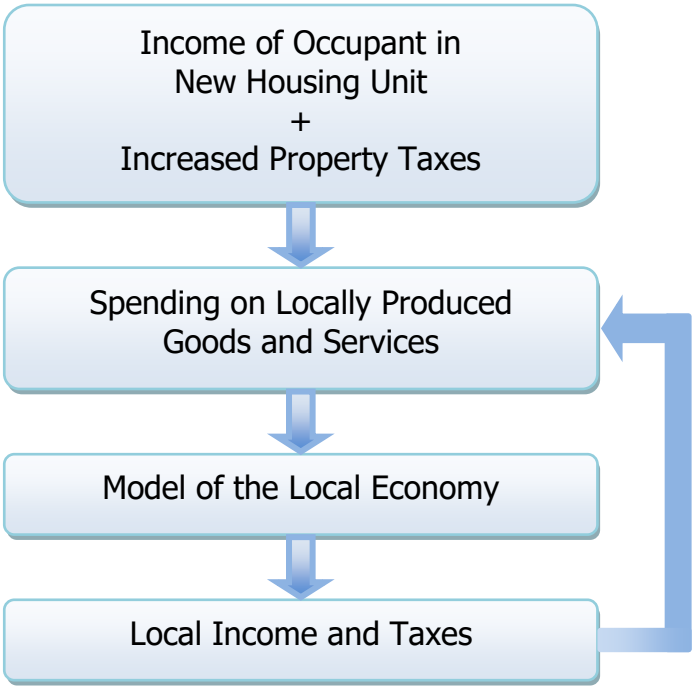
Phase III: Ongoing Impacts

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. The spending tendencies are estimated with CE data in a fashion similar to that described under Phase II. The model also estimates the amount of local taxes the households pay each year. These estimates are based on Census of Governments data with the exception of residential property taxes, which are treated separately, most often with specific information obtained from a local source. Finally, a total ripple effect is computed in a way similar to the procedure outlined above under Phase II.

Summary of Phase III



The details covered here provide 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 Economics and Housing Policy Group:

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Local Impact of Home Building

Technical Documentation for the NAHB Model Used to Estimate Income, Jobs and Taxes

Paul Emrath
Vice President
Survey and Housing Policy

NAHB
National Association of Home Builders

Technical Documentation for the NAHB Model Used to Estimate Income, Jobs and Taxes

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. 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.

The model can be customized to a specific local economy by replacing key housing market variables. This document explains describes the sources of data used and explains how the estimates are generated.

Modeling a Local Economy

In the NAHB model, a local economy is defined as a collection of industries and commodities, selected from the 2007 benchmark input-output accounts produced by the U.S. Bureau of Economic Analysis (BEA). These accounts are generally based on the North American Industry Classification System (NAICS), although BEA combines and otherwise modifies the NAICS categories for purposes of the input-output estimates. NAHB's model uses the most detailed (6-digit) industry codes in order to parse industries and commodities as precisely as possible and include only those that are generally local in nature. BEA's 2007 benchmark input-output tables contain a total of 389 industries at the 6-digit level of detail. NAHB's local economy retains the following 99:

	IO Code	***Detailed Industry Name***
1	111400	Greenhouse, nursery, and floriculture production
2	212310	Stone mining and quarrying
3	221100	Electric power generation, transmission, and distribution
4	221200	Natural gas distribution
5	221300	Water, sewage and other systems
6	230301	Nonresidential maintenance and repair
7	230302	Residential maintenance and repair
8	233210	Health care structures
9	233411	Single-family residential structures
10	233412	Multifamily residential structures
11	323120	Support activities for printing
12	339950	Sign manufacturing
13	420000	Wholesale trade
14	441000	Motor vehicle and parts dealers
15	445000	Food and beverage stores
16	452000	General merchandise stores
17	485000	Transit and ground passenger transportation
18	492000	Couriers and messengers
19	493000	Warehousing and storage
20	511110	Newspaper publishers
21	515100	Radio and television broadcasting
22	515200	Cable and other subscription programming
23	517110	Wired telecommunications carriers
24	517210	Wireless telecommunications carriers (except satellite)
25	518200	Data processing, hosting, and related services

26	519130	Internet publishing and broadcasting and Web search portals
27	524200	Insurance agencies, brokerages, and related activities
28	525000	Funds, trusts, and other financial vehicles
29	531000	Real estate
30	532100	Automotive equipment rental and leasing
31	532400	Commercial and industrial machinery and equipment rental and leasing
32	533000	Lessors of nonfinancial intangible assets
33	541100	Legal services
34	541200	Accounting, tax preparation, bookkeeping, and payroll services
35	541300	Architectural, engineering, and related services
36	541400	Specialized design services
37	541511	Custom computer programming services
38	541512	Computer systems design services
39	541800	Advertising, public relations, and related services
40	541920	Photographic services
41	541940	Veterinary services
42	561100	Office administrative services
43	561200	Facilities support services
44	561300	Employment services
45	561400	Business support services
46	561600	Investigation and security services
47	561700	Services to buildings and dwellings
48	561900	Other support services
49	562000	Waste management and remediation services
50	611100	Elementary and secondary schools
51	621100	Offices of physicians
52	621200	Offices of dentists
53	621300	Offices of other health practitioners
54	621400	Outpatient care centers
55	621600	Home health care services
56	621900	Other ambulatory health care services
57	622000	Hospitals
58	624100	Individual and family services
59	624400	Child day care services
60	711100	Performing arts companies
61	711200	Spectator sports
62	712000	Museums, historical sites, zoos, and parks
63	713100	Amusement parks and arcades
64	713200	Gambling industries (except casino hotels)
65	713900	Other amusement and recreation industries
66	722110	Full-service restaurants
67	722211	Limited-service restaurants
68	811100	Automotive repair and maintenance
69	811200	Electronic and precision equipment repair and maintenance
70	811300	Commercial and industrial machinery and equipment repair and maintenance
71	811400	Personal and household goods repair and maintenance
72	812100	Personal care services
73	812200	Death care services
74	812300	Dry-cleaning and laundry services
75	812900	Other personal services
76	813100	Religious organizations
77	2332A0	Commercial structures, including farm structures
78	2332B0	Other nonresidential structures
79	2334A0	Other residential structures
80	4A0000	Other retail
81	517A00	Satellite, telecommunications resellers, and all other telecommunications
82	5191A0	News syndicates, libraries, archives and all other information services
83	522A00	Nondepository credit intermediation and related activities

84	523A00	Securities and commodity contracts intermediation and brokerage
85	52A000	Monetary authorities and depository credit intermediation
86	532A00	Consumer goods and general rental centers
87	54151A	Other computer related services, including facilities management
88	5419A0	Marketing research & other miscellaneous professional, scientific, & tech. services
89	611B00	Other educational services
90	623A00	Nursing and community care facilities
91	623B00	Residential mental retardation, mental health, substance abuse and other facilities
92	624A00	Community food, housing, and other relief services, including rehabilitation services
93	722A00	All other food and drinking places
94	813A00	Grantmaking, giving, and social advocacy organizations
95	813B00	Civic, social, professional, and similar organizations
96	S00201	State and local government passenger transit
97	S00202	State and local government electric utilities
98	S00203	Other state and local government enterprises
99	S00700	State and local general government

In contrast to the industry categories used in the previous (2002) version of the benchmark input-output tables, the 2007 version shows considerably more detail in the construction sector, and breaks retail trade into several categories.

In the input-output accounts, commodities generally correspond to industries, with the exception of "state and local government passenger transit" and "state and local government electric service," for which there is no distinct commodity (passenger transit and electric services are defined as input-output commodities irrespective of which industry produces them), so the local economy as defined in the NAHB model consists of 99 industries and 97 commodities.

The above list includes industries in trade, construction, finance, transportation, and services—but excludes virtually all manufacturing, mining, and agriculture, under the presumption that the markets for these products are regional—if not national or international—in nature.

The exclusion of many industries is a distinguishing feature of the NAHB local impact model and is consistent with the overall intent of the model: to analyze the impact of locating a housing unit and the household that occupies it in one place rather than another. From this perspective, a house built in Seattle, Washington should not cause additional airplanes to be built or additional software to be produced, even though the occupants of a home built in Seattle may use software produced in Seattle and travel on planes built in Seattle. Because these households would be likely to use these products the same way even if they lived in some other metropolitan area, use of these products is not a function of the home's location. Hence, industries like software publishing and aircraft manufacturing are excluded from the model.

Based on the industries and commodities described above, a "total local requirements" matrix is constructed that shows the total output required from each of the local industries to produce $1 of each local commodities.

To show the derivation of this matrix, let

$\boldsymbol{c}$ = a 97-element column vector of commodity outputs

$\boldsymbol{g}$ = a 99-element column vector of industry outputs

$\boldsymbol{V}$ = a 99×97 subset of the benchmark make table that shows how much of each commodity is produced by each industry

$\boldsymbol{h}$ = a 99-element column vector showing how much scrap is produced by each industry

$\boldsymbol{U}$ = a 97×99 subset of the benchmark use table that shows how much of each commodity used as an input by each industry. Coefficients for the wholesale trade commodity are set to zero, assuming that these transactions are often non-local in nature. The wholesale trade industry produces a considerable amount of the retail trade commodity. The effect of this is to retain retail trade in the model, irrespective of which industry produces it, but to exclude wholesale trade activities.

The following matrices can then be defined through standard input-output algebra:

$\boldsymbol{B} = \boldsymbol{U}\hat{\boldsymbol{g}}^{-1}$ the direct requirements matrix, showing the amount of each commodity needed as a direct input to produce $1 of each industry's output. (The symbol ˆ indicates a matrix created from a vector by placing the vector=s elements on the matrix diagonal.) This is simply the use table scaled by industry output.

$\boldsymbol{j} = \hat{\boldsymbol{g}}^{-1}\boldsymbol{h}$ a vector showing scrap as a fraction of each industry's output. Many of the elements of this vector are zero in the NAHB local impact model, which excludes most of the manufacturing sector.

$\boldsymbol{D} = \boldsymbol{V}\hat{\boldsymbol{c}}^{-1}$ a 99×97 market share matrix, or the make table scaled by commodity output. $\boldsymbol{D}$ shows the fraction of each commodity (excluding scrap) produced by each industry.

$\boldsymbol{F} = (\boldsymbol{I}-\hat{\boldsymbol{j}})^{-1}\boldsymbol{D}$ a 99×97 matrix showing, for $1 worth of each commodity, the fraction produced by each industry. In short, $\boldsymbol{F}$ is $\boldsymbol{D}$ adjusted for scrap. $\boldsymbol{F}$ is often called a transformation matrix, because it can be used to transform commodities into the output of industries and vice versa.

$$\textit{Total Local Requirements} = \boldsymbol{F}(\boldsymbol{I}-\boldsymbol{B}\boldsymbol{F})^{-1}$$

The total local requirements matrix translates local commodities into the output of local industries. The NAHB model is designed to capture only a fraction of the output: the fraction that becomes either income for local households or revenue for local governments. These fractions are estimated from a combination of value added components of the input-output tables, plus information taken from other BEA industry accounts. In the BEA accounts, the final price of a commodity is the sum of intermediate outputs plus value added by the industry. To avoid double counting, the NAHB model retains only the value added in each local industry for further analysis.

BEA's input-output accounts break value added into three components: compensation of employees, taxes on production and imports (TOPI), and gross operating surplus. In the NAHB model, local income is derived from compensation of employees and gross operating surplus. The following table shows information taken from BEA accounts used in this derivation:

	Wages & Salaries per $ of Employee Compensation	Other Corp. as a % of Gross Operating Surplus	Other Non-Corp. as a % of Gross Operating Surplus
Farms	85.98%	77.63%	28.12%
Mining, except oil and gas	82.18%	12.40%	71.60%
Utilities	74.17%	9.32%	84.32%
Construction	83.11%	68.10%	29.88%
Miscellaneous manufacturing	71.19%	10.16%	87.83%
Printing and related support activities	81.90%	11.75%	85.14%
Wholesale trade	85.93%	15.89%	82.08%
Motor vehicle and parts dealers	85.39%	27.06%	69.55%
Food and beverage stores	81.55%	27.06%	69.55%
General merchandise stores	81.30%	27.06%	69.55%
Other retail	84.09%	27.06%	69.55%
Transit and ground passenger transportation	81.66%	76.22%	22.04%
Other transportation and support activities	81.76%	23.56%	74.53%
Warehousing and storage	81.97%	34.38%	63.45%
Publishing industries (includes software)	84.22%	14.36%	84.75%
Broadcasting and telecommunications	81.49%	26.07%	71.94%
Information and data processing services	84.23%	24.24%	74.30%
Federal Reserve banks, credit intermediation, related act.	85.01%	1.98%	87.89%
Securities, commodity contracts, and investments	87.89%	-2.28%	107.02%
Insurance carriers and related activities	84.36%	6.88%	120.64%
Funds, trusts, and other financial vehicles	57.88%	-16.43%	114.13%
Real estate (estimated by NAHB)	85.90%	100.00%	0.00%
Rental & leasing services and lessors of intangible assets	86.04%	32.70%	64.08%
Legal services	84.92%	76.96%	21.03%
Computer systems design and related services	87.90%	42.09%	53.54%
Misc. professional, scientific, and technical services	86.62%	57.56%	40.53%
Administrative and support services	84.67%	57.36%	40.59%
Waste management and remediation services	79.35%	13.44%	84.75%
Educational services	81.12%	39.22%	54.48%
Ambulatory health care services	82.70%	53.75%	42.32%
Hospitals	82.54%	42.00%	45.89%
Nursing and residential care facilities	80.79%	42.00%	45.89%
Social assistance	82.09%	48.30%	47.41%
Performing arts, spectator sports, museums, related act.	86.80%	70.36%	28.48%
Amusements, gambling, and recreation industries	84.18%	8.46%	90.01%
Food services and drinking places	85.50%	38.55%	58.57%
Other services, except government	85.92%	82.52%	15.81%
State and local government enterprises	68.40%	NA	NA
State and local general government	68.17%	NA	NA

Due to data limitations, ratios from relatively broad categories are sometimes applied to more narrowly defined local industries. For example, ratios for the broad categories "farms" is applied to a much more narrowly defined local industry "Greenhouse, nursery, and floriculture production."

Treatment of real estate is less straightforward than it might be, because the input-output accounts provide one set of estimates for real estate with no detail within that relatively broad industry. When analyzing a local housing economy, it is desirable to account for residential real

estate brokers and property managers, each which has well-known distinctive characteristics. NAHB uses data from the U.S. Census Bureau's 2007 Economic Census to estimate a separate set of coefficients for residential real estate brokers. Coefficients derived this way allocate a relatively small 8 percent of value added to wages and salaries, because most realtor offices are organized as a group of businesses where each broker legally counts as proprietor rather than an employee. The modified coefficients are applied to broker fees that arise in the transaction of single-family homes built for sale (as opposed to custom homes built by a general contractor on home owners' land) and individual multifamily condominiums to the ultimate owner-occupants. Any broker fees that that may be charged in the sale of multifamily rental buildings are assumed to be paid to non-local entities and excluded from the model.

Similarly, owners of rental buildings are considered non-local and excluded. However, for obvious reasons, managing the properties needs to be done locally. To handle this, except for the broker fees mentioned above, the NAHB model treats payments made to the real estate sector (primarily rental payments made by tenants in new multifamily buildings) as revenue for non-local property lessors (the federal government's term for what is elsewhere typically called a rental property owner) who then employ local businesses to manage the property. In practice this means subtracting about 57 percent of the rental payment and treating the remaining 43 percent as a local payment for management services. Again, this ratio was computed using detailed industry data from the 2007 Economic Census.

A key feature of the NAHB local impact model is the way it translates the wages and salaries from BEA accounts into local jobs, measured in full-time equivalents (FTEs); i.e., enough work to keep a person employed full-time for a year, based on the hours typically worked by full-time employees in a given industry. Indeed, when users of NAHB's local impact studies cite a single number from one of the studies, it is usually this one.

In general, the translation is accomplished using data on wages per job in each local industry from the Quarterly Census of Employment and Wages (QCEW) produced by the U.S. Bureau of Labor Statistics (BLS). The QCEW provides data for each county in the country, although it may be suppressed in particular cases for some industries due to a small sample size. To reduce the chances of missing data and produce an estimate that can more easily be adjusted for inflation, annual rather than quarterly QCEW data are used. If annual data for a particular industry in a particular local area are missing, they are imputed based on national wages per job in that industry, adjusted by the ratio of local to national wages per job across all industries. If QCEW data are not yet available for the year of construction being analyzed (as is typically the case), wages per job in each industry is inflated using HUD's estimates of median family income, which are available for the current year and for each state and local area in the country. Job counts in the QCEW are based on payroll employment and therefore include part-time as well as full-time workers. The QCEW job counts are converted to FTEs using the ratio of FTEs to jobs in each industry from BEA's national industry accounts.

The estimates of local income in the NAHB model exclude most corporate profits, based on the rationale that ownership of most corporations is national or international in scope. Even if a household living in a particular metropolitan area buys a product manufactured by a corporation located in in that metropolitan area, profits derived from the sale are likely to be distributed to shareholders living in other locations.

The model makes an exception for subchapter S corporations, which tend to be smaller and more local in nature than C corporations. S corporations also tend to be relatively common in particular industries, such as residential construction. The Internal Revenue Service (IRS) provides information on business receipts by form of business and industry, and this is used to decompose corporate profits into profits for S-corporations and C-corporations. The IRS tables provide relatively limited industry detail, so again percentages for a broadly defined industry are sometimes applied to several 6-digit NAICS industries. The S-corporation profits by industry are then counted as part of local income.

In general, local government revenue is estimated industry by industry, as a function of both local income and TOPI. TOPI includes taxes imposed at the federal, state and local level. BEA national accounts show that, in the year of the most recent Census of Governments, 9.2 percent of TOPI is federal (almost all excise taxes and custom duties). The Census of Governments is then used to further decompose TOPI into 42.4 percent collected by state governments and 48.4 collected by local governments (the largest components of state and local TOPI being sales and property taxes). Thus, the NAHB model uses a base of 90.8 or 48.4 percent of TOPI in each local industry as a starting point, depending on whether a state or local economy is being analyzed.

A distinctive feature of the NAHB model is the way it further employs Census of Governments data to customize the government finances to a particular area. Census of Governments data are available for each of the roughly 89,000 units of government in the U.S., and the NAHB model reads in every line item for every government within the local area being analyzed. Aggregated across all local (or state and local) governments in the U.S., the ratio of TOPI to personal income is 2.776 (or 6.595) percent. This ratio is also calculated for the area being analyzed and used to adjust TOPI by industry up or down. Personal income is used as the base of the ratio, because this is a measure that is available for every local area in the country.

There are two substantial exceptions to this procedure, as discussed below in the sections on Phase I and Phase III. In the case of residential property taxes and sales taxes paid on construction materials, specific information is collected for the construction being analyzed and fed into the model instead.

Census of Governments data is also used to customize taxes and fees paid by the workers and local proprietors who receive income as a result of the home building activity, and, where applicable, corporate income taxes to a local area. Aggregated over all local (or state and local) governments in the U.S., taxes and fees paid by individuals sum to 4.198 (or 7.843) percent of personal income. Again, equivalent ratios are calculated for the area being analyzed and used to customize the government revenue estimates.

To the extent that S corporations pay taxes to state and local governments, these taxes are also counted on the assumption that stockholders of S corps reside in the same area as the company income.

The general procedure for customizing government revenue to a specific local area (or state) can be summarized as follows:

Personal taxes =
4.198% (or 7.843%) × Local Personal Income × Local Factor 1

Business taxes =
48.4% (or 90.8%) × TOPI in Local Industries × Local Factor 2 +
6.349% × Corporate Profits in Local Industries × Local Factor 3

where the three local factors are derived on a case by case basis from data in the most recent Census of Governments. In practice, Local Factor 3 will usually be zero, as few local governments impose a tax on corporate profits.

The distinguishing aspect of this procedure is that it preserves the industry structure of the input-output accounts while being consistent with revenue being collected by all governments in the area of analysis, as reported by the governments themselves to the U.S. Census Bureau.

Phase I: Construction

As shown diagrammatically in "Background and a Brief Description of the Model Used to Estimate the Economic Benefits", Phase I of the model feeds the dollar amount of construction and ancillary locally produced items into the income and tax matrices derived from the model total local requirements. Accounting for everything that goes into building a home and delivering it to its customer is more complicated than it may at first appear.

For one thing, the Census Bureau subtracts several items from construction value before providing the numbers to BEA for use in the input-output and related GDP accounts. On new homes built for sale, the Census Bureau subtracts 1.1 percent of the sales price for landscaping, 0.5 percent for appliances, 2.9 percent for realtor and brokers fees, and 2.7 percent for marketing and finance costs. There are equivalent subtractions for custom homes (i.e., homes where the builder functions as a general contractor for a home built on the customer's lot).

However, the landscaping and purchases of appliances and marketing/broker services associated with a newly built home clearly are attributable to the construction of the home. Phase I of the NAHB model therefore accounts for these items as separate purchases of the local construction, retail trade, and real estate industries. For retail trade, only the gross margin of appliance purchases are counted. Gross margins for different types of retailers are available from the Census Bureau's Annual Retail Trade Survey.

In addition, there are settlement or closing costs associated with transferring property from a builder to the ultimate owner. In a typical case, these costs are shared between buyers and sellers. Construction value as defined in the input-output accounts includes closing costs if they are paid by the seller, but not the buyer. When the local impact model was first developed, NAHB verified these details with economists at BEA.

In order to estimate both closing costs as a fraction of the home's price and the share of these costs the buyer pays, the NAHB model uses national average data compiled by the U.S.

Department of Housing and Urban Development.[3] The share of settlement costs paid for by the buyer for loan origination and discount fees, title and private mortgage insurance, and legal fees are counted as output of the local depository credit intermediation, insurance, and legal services industries, respectively.

Another category of closing costs sometimes paid by the buyer is mortgage or deed transfer taxes. Phase I of the NAHB model does not automatically include an amount for transfer taxes. In most (but not all) instances, these taxes are imposed by state, rather than local, governments. To the extent that transfer taxes apply in a specific case, that information needs to be supplied by the local entity requesting the analysis.

The local entity requesting the analysis is also asked to provide information on whether or not sales taxes are imposed on construction materials and supplies; and, if so, the relevant sales tax rate. The model then applies the relevant rate to 34.1 percent of construction value, assuming that materials account for that share of the final value of a housing unit. The figure of 34.1 was calculated from the ratio of materials to construction value for several categories of construction businesses in the Economic Census, including trade contractors. The calculation takes subcontracing into account, as a large fraction of the final construction value of a housing unit is subcontracted to businesses that may also purchase materials.

Phase II: The Construction Ripple

Phase I of the model translates home building activity into income for local workers and business proprietors, and revenue for local governments. This output serves as the input for Phase II, as part of the local income generated will be spent, generating more income, generating more spending, and so on. These spending ripples damp and eventually converge to a limit, which is the ultimate ripple or multiplier effect.

To convert local income to local spending, the model requires information about local household spending tendencies. Detailed spending information at the household level is available from the Consumer Expenditure (CE) Survey, produced by the U.S. Bureau of Labor Statistics (BLS) primarily for the purpose of determining the weights for the Consumer Price Index.[4]

The CE consists of two different types of surveys: 1) an interview survey that collects data on monthly expenditures as well as information on income and household characteristics, and 2) a diary survey that collects data on weekly expenditures of frequently purchased items. These are two separate surveys, each designed individually with weights that aggregate to an estimate of total spending in the U.S. When it estimates aggregate measures of consumer spending, BLS combines results from the two different types of surveys in a manner it does not disclose.

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[3] Report to Congress on the Need for Further Legislation in the Area of Real Estate Settlements, 1981, Exhibits II-1 and II-6.

[4] Technically, in the Consumer Expenditure Survey, the unit of measurement is actually not a household, but a *Consumer Unit*, a group of individuals who live in the same house and make joint purchasing decisions. There may be more than one Consumer Unit in a household.

The NAHB local impact model uses only data from the interview survey, primarily to avoid the need for arbitrary decisions about which spending items to take from which survey. Based on its CE interview survey, BLS produces a public use microdata set consisting of quarterly files with household characteristics (including income), another set of quarterly files with income and other characteristics for each member of the household, and a set of fifty-one annual "EXPN" files with detailed information about various categories of expenditures.

These detailed files allow NAHB to maintain a conservative approach and exclude spending on items that may often be purchased from a vendor outside the local area. For example, BLS collects information on spending while on trips and vacations away from home in a separate "ETRV" and "ETRE" file. The NAHB local impact model does not include any spending information at all from these files. NAHB processes the information from the EXPN files along with information on household characteristics and income to estimate spending tendencies on 52 locally produced commodities, as shown in the following table:

Local Spending Extracted from the CE EXPN Files

	Local commodity	IO Code	CE File	Description of items included in local spending
01	Greenhouse, nursery, and floriculture production	111400	ECRB	Costs of all items and services for planting shrubs or trees, or otherwise landscaping the ground of the housing unit in which the consumer unit lives.
02	Electric power generation, transmission, and distribution	221100	EUTC	Electricity bills for the housing unit in which the consumer unit lives, including if combined with natural gas and/or water, sewerage. This is also the default category for generally combined expenses with particular utility not specified.
03	Natural gas distribution	221200	EUTC	Gas bills for the housing unit in which the consumer unit lives.
04	Water, sewage and other systems	221300	EUTC	Water and/or sewage bills, including water combined with trash collection, for the housing unit in which the consumer unit lives.
05	Residential maintenance and repairs	230302	ECRB	Costs of all items and services associated with building or repairing an addition to the house or a new structure including porch, garage or new wing; finishing a basement or an attic or enclosing a porch; remodeling one or more rooms; building outdoor patios, walks, fences, or other enclosures, driveways, or permanent swimming pools, inside painting or papering; outside painting; plastering or paneling; plumbing or water heating installations and repairs; electrical work; heating or air-conditioning jobs; flooring repair or replacement; insulation; roofing, gutters, or downspouts; siding; installation, repair, or replacement of window panes, screens, storm doors, awnings, etc.; and masonry, brick or stucco work; or other improvements or repairs for the housing unit in which the consumer unit lives.
For the four categories of retail trade, only gross margins rather than total spending is put into the model. Gross margins are applied industry by industry. A single factor is used to reduce the amount to account for loss of business to local retailers to E-commerce and mail order business. The source is the most recent data in the Census Bureau's 2012 Annual Retail Trade Report, released in 2014,				
06	Motor vehicle and parts dealers	441000	EOVB	Purchases of automobiles, including down payment and payment of principle on loans × 17.6% (gross margin for automobile dealers).
07	Food and beverage stores	445000	ETRF	Cost of food or beverages at grocery, convenient or liquor stores during local overnight stays x 27.9% (gross margin for food and beverage stores).

	Local com modity	NAICS Code	EXPN File	Description of items included in local spending
07	Food and beverage stores (cont.)	445000	EXPA	Expenditure for food, non-alcoholic beverages and nonfood items at grocery stores, food and non-alcoholic beverages from places other than grocery stores, and all alcohol to be served at the home × 27.9% (gross margin for food and beverage stores).
08	General merchandise stores	452000	EAPA	50 percent of major appliance purchases (assuming other 50 percent purchased from other retail) x 26.3% (gross margin for general merchandise stores), adjusted for losses to E-commerce and mail order business.
			EAPB	50 percent of purchases of other households appliances and other selected items (assuming other 50 percent purchased from other retail) x 26.3% (gross margin for general merchandise stores), adjusted for losses to E-commerce and mail order business.
			EFRA	50% of purchases of home furnishings (assuming other 50 percent purchased from other retail) x 32.1% (gross margin for department stores), adjusted for losses to E-commerce and mail order business
			ECLA	50% of purchases of clothing and accessories (assuming other 50 percent purchased from other retail) x 32.1% (gross margin for department stores), adjusted for losses to E-commerce and mail order business.
			EENT	50% of purchases of CDs or audio tapes, photographic film, video cassettes or tapes or discs, and books, but not through a mail order club or subscription x 32.1% (gross margin for department stores), adjusted for losses to E-commerce and mail order business.
09	Other retail	4A0000	EUTC	Bills for fuel oil, bottle or tank gas, or fuels not specifically identified, for the home in which the consumer unit lives x 37.8% (gross margin for nonstore retailers).
			ECRA	Purchase of building materials and supplies, either for or not for a specific project x 34.7% (gross margin for building materials and supplies dealers).
			EAPA	50 percent of major appliance purchases (assuming other 50 percent purchased from general merchandise stores) × 28.2% (gross margin for electronics and appliance stores), adjusted for losses to E-commerce and mail order business.
			EAPB	50 percent of purchases of other households appliances and other selected items (assuming other 50 percent purchased from general merchandise stores) × 28.2% (gross margin for electronics and appliance stores), adjusted for losses to E-commerce and mail order business.
			EFRA	50% of purchases of home furnishings (assuming other 50 percent purchased from general merchandise stores) × 46.6% (gross margin for furniture and home furnishing stores), adjusted for losses to E-commerce and mail order business.
			ECLA	50% of purchases of clothing and accessories (assuming other 50 percent purchased from general merchandise stores) × 45.8% (gross margin for clothing and clothing accessories stores), adjusted for losses to E-commerce and mail order business.
			EVOT	Purchases of gasoline and other fuels and fluids used in vehicles × 10.8% (gross margin for gasoline stations)
			EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to purchase prescription drugs and durable medical equipment × 30.0% (gross margin for health and personal care stores), adjusted for losses to E-commerce and mail order business.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for prescription drugs, other nondurable medical products, and durable medical equipment × 30.0% (gross margin for health and personal care stores), adjusted for losses to E-commerce and mail order business.

	Local commodity	NAICS Code	EXPN File	Description of items included in local spending
09	Other retail (cont)	4A0000	EMDB	Direct purchases of glasses, hearing aids, prescription medication, convalescent equipment, or other medical equipment × 30.0% (gross margin for health and personal care stores), adjusted for losses to E-commerce and mail order business.
			EEDA	Purchases of books or other equipment for elementary or high school for members of the consumer unit × 41.6% (gross margin for sporting goods, hobby, book and music stores), adjusted for losses to E-commerce and mail order business.
			EENT	50% of purchases of CDs or audio tapes, photographic film, video cassettes or tapes or discs, and books, but not through a mail order club or subscription (assuming other 50 percent purchased from general merchandise stores) × 41.6% (gross margin for sporting goods, hobby, book and music stores), adjusted for losses to E-commerce and mail order business.
			EMIS	Expenses for flowers, potted plants, pet supplies and medicines, toys, and games, and hobbies, including if combined with computer software for games × 45.4% (gross margin for miscellaneous store retailer), and adjusted for losses to E-commerce and mail order business.
			EXPB	Expenditures for cigarettes and other tobacco products × 29.4% (gross margin for all retailers excluding motor vehicle and parts dealers), adjusted for losses to E-commerce and mail order business.
10	Transit and ground passenger transportation	485000	EXPB	Costs for taxis, limousine service, and public transportation, except while on a trip.
11	Newspaper publishers	511110	EENT	Expenses for newspapers and other periodicals not through a subscription.
12	Wired telecom-munications carriers	517110	EUTA	Bills from telecommunications companies for residential service, internet access, non-telephone rental and purchases, and 71.2% of bills for cable or satellite television service (financial data compiled ions Multimedia Research Group, Inc indicates that satellite had a 28.8% share of the combined cable/satellite market).
			EUTP	Pre-paid phone card or public pay phone services.
			EUTI	Bills from internet service providers for internet connection and service (excluding those away from home), miscellaneous combined expenses, and 71.2% of bills for cable or satellite television service.
13	Wireless tele-communications carriers (except satellite)	517210	EUTA	Bills for mobile/cellular telephone service.
			EUTP	Pre-paid cellular minutes.
14	Satellite, telecommunications resellers, and all other tele-communications	517A00	EUTA	28.8% of the bills from telecommunications for cable or satellite television service, plus bills for Voice over IP service.
			EUTI	Bills from internet service providers for satellite radio, plus 28.8% of the bills for cable or satellite television service.
15	Data processing, hosting, and related services	518200	EUTA	Bills paid to providers of applications, games or ringtones.
16	Monetary authorities and depository credit intermediation	52A000	EHEL	Interest paid on lump sum home equity loans, based only on the home in which the consumer unit lives.

	Local commodity	NAICS Code	EXPN File	Description of items included in local spending
16	Monetary authorities and depository credit intermediation (cont)	52A000	EOPH	Interest paid on home equity lines of credit, based only on the home in which the consumer unit lives.
			EXPB	Charges for safe deposit boxes, checking accounts, and other banking services.
17	Nondepository credit intermediation and related activities	522A00	EOVB	Interest payment on automobile loans.
18	Insurance agencies, brokerages, and other insurance related activities	524200	EINB	Percent of premiums for all types of insurance other than health (percentage based on agent/brokers' share of industry).
			EIHB	Percent of premiums for health insurance (percentage based on agent/brokers' share of industry).
19	Real estate	531000	RNT	Total rental payments for the housing unit in which the consumer unit lives.
			OPI	Ground or land rent, regular HOA fees, special payments for property management services—for the property in which the consumer unit lives.
20	Automotive equipment rental and leasing	532100	ERTV	Expenses for renting vehicles, except if rented while on a vacation.
			ELSD	Expenses for leasing vehicles.
21	Consumer goods and general rental centers	532A00	EAPA	Expenses for renting major appliances.
			EAPB	Expenses for renting other household appliances and selected items.
			EFRB	Expenses for renting furniture.
			ECLD	Expenses for renting clothing.
			EMDB	Expenses for renting convalescent or other medical equipment.
			EENT	Amount paid for rental of Blu-ray Discs, DVDs, or VHS tapes.
22	Legal services	541100	EMIS	Expenses for services of lawyers or other legal professionals.
23	Accounting, tax preparation, bookkeeping, and payroll services	541200	EMIS	Accounting fees.
24	Photographic services	541920	EENT	Amount paid for film processing or printing digital photographs.
			EMIS	Amount paid for professional photography fees.
25	Veterinary services	541940	EMIS	Veterinarian expenses, including if combined with other pet services.
26	Investigation and security services	561600	EMIS	Home security service fees.
27	Services to buildings and dwellings	561700	EAPA	Charges for installing major appliances.

	Local commodity	NAICS Code	EXPN File	Description of items included in local spending
27	Services to buildings and dwellings (cont.)	561700	EEQB	Costs for pest control or repairing and servicing heating and air conditioning equipment.
			EMIS	Gardening or lawn care, housekeeping, or other home services and small repair jobs around the house.
28	Waste manage-ment and remed-iation services	562000	EUTC	Trash/garbage collection bills, including if combined with sewerage, and septic tank cleaning services, for the housing unit in which the consumer unit lives.
29	Elementary and secondary schools	611100	EEDA	Tuition and other expenses for elementary or high school for members of the consumer unit.
30	Offices of physicians	621A00	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for physician and clinical services.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for physician and clinical services.
			EMDB	Direct payments for eye care or physician services.
31	Offices of dentists	621200	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for dental services.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for dental services.
			EMDB	Direct payments for dental care
32	Offices of other health practitioners	621B00	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for other professional services.
			IHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for other professional services.
			EMDB	Direct payments for services by medical professionals other than physicians, lab tests, and other medical care.
33	Home health care services	621600	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for home health care.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for home health care.
34	Hospitals	622000	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for hospital care.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for hospital care.
			EMDB	Direct payments for hospital rooms or services.
35	Nursing and residential care facilities	623000	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for nursing home care.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures used to pay for nursing home care.
			EMDB	Direct payments for care in convalescent of nursing home.
36	Child day care services	624400	EEDA	Expenses for nursery school or child day care centers for members of the consumer unit.

	Local commodity	NAICS Code	EXPN File	Description of items included in local spending
36	Child day care services	624400	EMIS	Expenses for babysitting, nanny services, or child care in the consumer unit's or someone else's home.
37	Performing arts companies	711100	ESUB	Theater or concert season tickets.
			EENT	Single admissions to movies, theaters, and concerts.
38	Spectator sports	711200	ESUB	Season tickets to sporting events.
			EENT	Single admissions to spectator sporting events.
39	Gambling industries (except casino hotels)	713200	EMIS	Expenses for lotteries and games of chance.
40	Other amusement and recreation industries	713900	EEDA	Recreational lessons and instruction for members of the consumer unit.
			ESUB	Expenses for membership in golf courses. Country clubs, health clubs, fitness centers, or other sports and recreational organizations.
			EENT	Fees for participating in sports.
			ETRF	Amount paid for entertainment or admissions during local overnight stays
41	Full-service restaurants	722110	ETRF	50% of cost of meals, snacks, or beverages at restaurants, bars or fast food places during local overnight stays.
			EXPA	50% of expenditures for food and beverages at restaurants, cafeterias, cafes, drive-ins, etc. or t school for or pre-school for school-age children.
42	Limited-service restaurants	722211	ETRF	50% of cost of meals, snacks, or beverages at restaurants, bars or fast food places during local overnight stays.
			EXPA	50% of expenditures for food and beverages at restaurants, cafeterias, cafes, drive-ins, etc. or t school for or pre-school for school-age children.
43	All other food and drinking places	722A00	EMIS	Food and beverage for catered affairs.
44	Automotive repair and maintenance, except car washes	8111A0	EVEQ	Expenses for vehicle maintenance and repair.
			EVOT	Expenses for towing and automobile repair service policies.
45	Electronic and precision equipment repair and maintenance4	811200	EEQB	Cost for repairs and services to AV equipment (except if installed in a vehicle) and to computers and related equipment.
46	Personal and household goods repair and maintenance	811400	EEQB	Costs for repairing or servicing miscellaneous items such as appliances, tools, photographic, sports, and lawn and garden equipment.
			EFRB	Costs for repairing furniture.
			ECLD	Costs for repairing or altering clothing and accessories, or repairing watches or jewelry.
47	Personal care services	812100	EIHB	Share of health insurance premiums, after broker/agent share is subtracted, used to pay for other health, residential and personal care services.
			EIHC	Number of persons covered by Medicare if in a senior household x Medicare expenditure per enrollee x the share of Medicare expenditures for other health, residential and personal care services.

	Local commodity	NAICS Code	EXPN File	Description of items included in local spending
48	Death care services	812200	EMIS	Expenses for funerals, burials, cremation, and purchase and upkeep of cemetery lots or vaults.
49	Dry cleaning and laundry services	812300	EXPB	Expenses for clothing and other items at sent to drycleaners and laundry, as well as coin operated dry cleaning and laundry machines.
50	Other personal services	812900	ECLD	Costs of clothing storage services.
			EVOT	Fess for vehicle parking, boat docking and plane landing.
			EMIS	Pet services.
			EXPB	Expenses for haircuts, hair styling, manicures, massages, and other salon services.
51	Religious organizations	813100	ECNT	Contributions to religious organizations.
52	Civic, social, professional and similar organizations	813B00	ESUB	Expenses for membership in civic, service, or fraternal organizations.

There is somewhat more detail in a few input-output industries than is available in a spending line from the CE files. For example, the CE files do not distinguish spending in limited service eating places from spending in full service restaurants. According to the 2007 Economic Census, total sales in each category was $182 to $192 billion—close to a 50-50 split. Therefore, half of spending in eating places is allocated to full service restaurants; the other half to the limited service places. Similarly, the CE files don't distinguish items purchased in general merchandise stores from those purchased in more specialized retail outlets. For goods that likely could be purchased in either, again a 50-50 split is used, as shown for local commodities 08 and 09 in the table above.

For all items included under any retail sales category, only the gross margins are included, and in most cases a further adjustment is made to account for loss of local sales to E-commerce and mail order business. These adjustments are based on information in the Census Bureau's Annual Retail Trade Report for 2012. The report includes a table on gross margins by 6-digit NAICS code that can be used directly. The report also contains separate tables on total sales and mail order & E-commerce. An adjustment factor is calculated based on total E-commerce & mail order sales as a fraction of total retail sales, excluding food and beverage service and motor vehicle and parts dealers. For 2012, the adjustment factor is 1-322,543/4,344,140. In the above table, "adjusted for E-commerce and mail order loss" means that particular category of retail spending is multiplied by this factor.

Insurance payments are separated into a share going to brokers and agents and the insurance companies, based on the proportional share of revenue reported in the latest Economic Census. The share going to brokers and agents is counted as local income. However, it is also assumed that the share going to insurance companies comes back in some cases as these companies pay medical costs for policy holders that go to health care providers in the local area. This is estimated using "Personal Health Care Expenditures by object & Source of Payment" reported by the Census Bureau in the Table 138 of the 2012 Statistical Abstract of the United States.
A similar calculation is made for expenses covered by Medicare. The CE data include the number of household members covered by Medicare. Payments made by Medicare to local

health care providers are estimated using statistics on Medicare Enrollees from Table 146 of the 2012 Statistical Abstract, combined with the health care expenditure information from Table 138.

The consumer spending variables used in the model are all in the form of average propensities to consume—that is, average fractions of before-tax income spent on various items. As shown in the table above, The EXPN files generate consumer spending estimates for 52 locally produced commodities. In addition, seven categories of local commodities produced by local government enterprises are appended to the list:

1 Local government electric service
2 Local government natural gas distribution
3 Local government water & sewerage
4 Local government passenger transit
5 Local government liquor stores
6 Local government sanitary services
7 Local government hospitals

Although these seven extra commodities do not increase local spending in total, they allow the model to allocate consumption between the publicly produced and privately produced commodities based on information from the Census of Governments. In this sense, the model is consistent with both national household consumption patterns and revenue collected by all government enterprises in a particular local area.

To this is added one other local commodity, general government, to account for tax and fee payments (computed in Phase II primarily from BEA personal income estimates and Census of Governments revenue data).

The results can be collected in the 2×60 matrix, $\boldsymbol{A}$:

$$\boldsymbol{A} = \begin{bmatrix} a_1 & a_2 & a_3 & \cdots & a_{59} & 0 \\ 0 & 0 & 0 & \cdots & 0 & 1 \end{bmatrix}$$

The elements in the first row of $\boldsymbol{A}$ show the average fraction of income spent on each of the 59 local commodities (including those produced by local government enterprises such as publicly owned utilities or hospitals). The "O"s and "1" in the second row indicates that no taxes are spent directly by the household on any of the first 59 commodities; 100 percent is spent on the local general government commodity. This two-row structure is designed to align with the output from Phase I of the model, which comes in the form of before-tax local income and local tax estimates.

Several other matrices and vectors derived from the above concepts are needed to calculate the Phase II ripple or multiplier effect:

$\boldsymbol{W}$: a 60×99 matrix that translates local commodities into local income,

$\boldsymbol{G}$: a 60×99 matrix that translates local commodities into local government general revenue collected from persons, and

$\boldsymbol{T}$: a 60×99 matrix that translates local commodities into local government general revenue collected from businesses

$\boldsymbol{L} = \begin{bmatrix} \boldsymbol{W} & \boldsymbol{G} & \boldsymbol{T} \end{bmatrix}$ therefore defines a 60×297 matrix

$\boldsymbol{x}$ = a two element column vector containing local income and local taxes generated in Phase I

$$\boldsymbol{Y} = \begin{bmatrix} \boldsymbol{i} & \boldsymbol{0} & \boldsymbol{0} \\ \boldsymbol{0} & \boldsymbol{i} & \boldsymbol{0} \\ \boldsymbol{0} & \boldsymbol{0} & \boldsymbol{i} \end{bmatrix}$$ a 297×3 matrix where $\boldsymbol{i}$ is a 99-element unit column vector,

$$\boldsymbol{Z} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 1 \end{bmatrix}$$

In summary, $\boldsymbol{x}$ is the income and tax output from Phase 1, $\boldsymbol{A}$ translates income and taxes into spending on particular commodities, $\boldsymbol{L}$ translates the detailed commodity spending into income and taxes in each of 99 local industries, and $\boldsymbol{Y}$ and $\boldsymbol{Z}$ are technical devices for summing results. $\boldsymbol{Y}$ collapses the components of a 297-element vector into a 3-element vector of income, personal taxes, and business taxes. $\boldsymbol{Z}$ converts a 3-element vector of this form into a 2-element income and tax vector.

The row vector defined as $\boldsymbol{x}'\boldsymbol{A}$ shows how much, in dollar terms, people who earn income during Phase I spend on each of the 60 local commodities (including local government employees, whose paychecks are supported by taxes and charges for particular government-run enterprises).

The calculation $\boldsymbol{x}'\boldsymbol{ALYZ}$ produces a 2-element local income and local tax vector of the same form as $\boldsymbol{x}'$. Postmultiplying a vector of this type by $\boldsymbol{ALYZ}$ will always produce a similar, 2-element income and tax vector. Either by construction, or by checking that both eigenvalues are smaller than 1, it is possible to show that $\boldsymbol{ALYZ}$ is a contracting matrix. This implies that the rounds below show successively smaller increments of income and taxes added to the local economy:

$$\begin{aligned}
&\textit{Round } 0: \ \boldsymbol{x}' \\
&\textit{Round } 1: \ \boldsymbol{x}'\,\boldsymbol{ALYZ} \\
&\textit{Round } 2: \ \boldsymbol{x}'\,\boldsymbol{ALYZ}\,\boldsymbol{ALYZ} \\
&\textit{Round } 3: \ \boldsymbol{x}'\,\boldsymbol{ALYZ}\,\boldsymbol{ALYZ}\,\boldsymbol{ALYZ} \\
&\qquad\qquad \vdots \\
&\textit{Round } K: \ \boldsymbol{x}' \prod_{k=1}^{K} \boldsymbol{ALYZ}
\end{aligned}$$

The terms of this sequence can be summed in the usual manner to create an infinite series. Because $\boldsymbol{ALYZ}$ is a contracting matrix, the result is a convergent series, the limit of which is

$$\boldsymbol{x'\ [I-ALYZ]^{-1}}$$

This is the final multiplied effect on local income and local taxes at the end of Phase II. The factor $\boldsymbol{[I-ALYZ]^{-1}}$ is a matrix version of the conventional Keynesian spending multiplier. Because $\boldsymbol{x'}$ is reported in Phase I, it is subtracted from the effect reported in Phase II.

For some purposes, especially estimating employment impacts, we are interested in tracking income in Phase II by industry. Calculations to accomplish this are based on the following sequence of 1×297 vectors:

$$\begin{aligned}
&\textit{Round } 1: \ \boldsymbol{x'AL}\\
&\textit{Round } 2: \ \boldsymbol{x'ALYZAL}\\
&\qquad\vdots\\
&\textit{Round } K: \ \boldsymbol{x'AL}\prod_{k=1}^{K-1}\boldsymbol{YZAL}
\end{aligned}$$

Note that sequence begins with the spending vector $\boldsymbol{x'AL}$—that is, it excludes the income and taxes that have already been captured in Phase I. The limit of the series defined based on this sequence is

$$\boldsymbol{x'AL[I-YZAL]^{-1}}$$

This is a 297-element row vector, the first 89 elements containing the final, multiplied effect on local income by industry generated during Phase II. As explained above, income by industry can be separated into business owners' income and wages and salaries, and the wages and salaries converted to full-time job equivalents.

From the standpoint of local governments, it may be desirable to track individual sources of revenue, such as particular fees and taxes. To facilitate this, it is useful to have a three element local income and local tax vector, where the tax revenue is decomposed into taxes collected from persons and taxes collected from businesses.

Consider the following sequence of such 3-element vectors:

$$\begin{aligned}
&\textit{Round } 1: \ \boldsymbol{x'ALY}\\
&\textit{Round } 2: \ \boldsymbol{x'ALY\ ZALY}\\
&\qquad\vdots\\
&\textit{Round } K: \ \boldsymbol{x'ALY}\prod_{k=1}^{K}\boldsymbol{ZALY}
\end{aligned}$$

This sequence begins after *Round 0*, implicitly excluding income earned and taxes paid during Phase I. The limit of the infinite series defined by this sequence is

$$x' ALY[I-ZALY]^{-1}$$

This is the final, multiplied effect on local income, local government revenue collected from persons, and local government revenue collected from businesses in Phase II of the model. The tax structure for a particular local area, derived primarily from Census of Governments data as described above, can be applied to this result in order to decompose local government revenue into particular types of taxes and fees.

Phase III: Ongoing Impacts

Another distinctive feature of the NAHB model is the way it uses CE and other data to model the average behavior of occupants that differs based on the type of housing being built. At present, there are six basic variants of the NAHB model designed to handle the following types of construction:

1. Generic Single-family
2. Generic Multifamily
3. Active Adult
4. Family Low-Income Housing Tax Credit (LIHTC)
5. Elderly LIHTC
6. Remodeling

The remodeling version of the model does not in general incorporate ongoing impacts, so it requires no occupant income estimates. For the other five versions of the model, separate occupant income estimates are derived in a way that vary with location as well as with the type of units being built. The derivations are based on relationships between average income and standard variables that are typically available at the local level. The methods for establishing these relationships are summarized below.

Generic Single-family. Regression of average income of home owners on area median family income and average value of the units using American Community Survey (ACS) microdata.

Generic Multifamily. Regression of average income of home owners on area median family income and average rent using ACS microdata.

Active Adult. Average income of movers into age-restricted owner occupied units and average income of all home buyers are computed from American Housing Survey (AHS) microdata, and the ratio of the two averages is used to adjust home buyers' income for the active adult case.

Family LIHTC. Average incomes of all movers into rental units who have less than 60 percent of median family income for the U.S. as a whole, computed from CE data.

Elderly LIHTC. Average incomes of all elderly movers into rental units who have less than 60 percent of median family income for the U.S. as a whole, computed from CE data.

The ACS is the Census Bureau's replacement for the long form questionnaire that until 2000 was used to collect information on income and structure type in the decennial Census. The AHS, funded by the U.S. Department of Housing and Urban Development (HUD) and conducted by the Census Bureau, is the federal government's primary vehicle for collecting detailed information about housing units and their occupants at the national level.

The ratios and regression results listed above allow the model to be simultaneously customized to a particular area and a particular type of construction by inputting specific local information that is generally available. When customizing to a local area, median family income for that particular area is used. HUD produces median income estimates for all parts of the country in a timely fashion as part of the process it uses to establish income limits for various housing programs.

When it is necessary to translate rents into value or vice versa, the median cap rate from the Rental Housing Finance Survey (RHFS), also funded by HUD and conducted by the Census Bureau, is used.

In addition to average income, estimated spending tendencies for movers into each type of construction are needed. Separate spending vectors are estimated for each using household information available in the CE data. The table on the following page shows average local propensities to consume computed from the 2012 CE.

This modeling of average spending by different types of households soon after they move in is another distinguishing feature of the NAHB local impact model. In addition to the function they serve in the local model, average spending tendencies computed from CE data have also proven to be of interest for their implications at the national level.[5]

Compared to home buyers, renters tend to spend more of their incomes locally—partly due to the tendency of lower-income households to spend a greater fraction of their incomes on necessities, but also due to rental payments that go to a local owner, or owner employing a management company with a local presence. The equivalent housing expense for a home buyer would be a mortgage payment. Because mortgage payments typically are made to non-local owners of the mortgage through non-local servicers, they are excluded from the spending estimates in the NAHB local impact model.

Average propensities to spend on virtually all categories of local health care services are higher for households moving into construction designed for older residents (age-restricted active adult and elderly LIHTC).

As was described in Phase II, seven categories of commodities produced by local government enterprises are added to the model, and a share of local spending (which may be zero) is allocated to these enterprises instead of private producers based on revenues reported in the Census of Governments for each local government enterprises in the area.

[5] See, for example, the December 2008 Special Study "Spending Patterns of Home Buyers," written by Natalia Siniavskaia and published by NAHB in Housing Economics.com.

Average Local Spending Computed from CE Data

	Output of industry purchased locally	All House-holds	New Home Buyers	New Multifamily Renters	Active Adult Buyers	New Family LIHTC	New Elderly LIHTC
1	Greenhouse, nursery, and floriculture production	0.129%	0.172%	0.000%	0.176%	0.000%	0.000%
2	Electric power generation, transmission, and distr.	2.689%	2.410%	0.002%	3.428%	0.000%	0.000%
3	Natural gas distribution	0.674%	0.499%	0.000%	0.723%	0.000%	0.000%
4	Water, sewage and other systems	0.793%	0.802%	0.000%	1.108%	0.000%	0.000%
5	Residential maintenance and repair	3.059%	2.087%	0.000%	3.567%	0.170%	0.072%
6	Motor vehicle and parts dealers	1.218%	1.439%	5.098%	1.447%	1.408%	1.190%
7	Food and beverage stores	4.829%	3.303%	4.446%	3.567%	8.573%	8.793%
8	General merchandise stores	0.745%	0.840%	1.271%	0.723%	1.129%	0.437%
9	Other retail	3.119%	2.494%	3.088%	2.906%	3.896%	4.069%
10	Transit and ground passenger transportation	0.190%	0.030%	0.269%	0.028%	0.990%	0.990%
11	Newspaper publishers	0.027%	0.016%	0.042%	0.042%	0.057%	0.096%
12	Wired telecommunications carriers	2.392%	1.770%	1.878%	2.588%	2.868%	4.441%
13	Wireless telecom. carriers (except satellite)	2.081%	1.809%	3.565%	1.811%	3.323%	2.435%
14	Satellite, telecom. Resellers & all other telecom.	0.323%	0.249%	0.620%	0.335%	0.472%	0.494%
15	Data processing, hosting, and related services	0.003%	0.002%	0.000%	0.002%	0.006%	0.000%
16	Monetary authorities, depository credit intermediation	0.437%	0.298%	0.000%	0.366%	0.000%	0.000%
17	Nondepository credit intermediation+related activities	0.417%	0.616%	0.906%	0.463%	0.381%	0.327%
18	Insurance agencies, brokerages, and related activities	0.407%	0.387%	0.722%	0.462%	0.291%	0.288%
19	Real estate	8.301%	2.048%	27.078%	1.292%	33.130%	34.324%
20	Automotive equipment rental and leasing	0.795%	0.775%	0.000%	0.348%	0.426%	0.000%
21	Consumer goods and general rental centers	0.070%	0.055%	0.041%	0.046%	0.104%	0.030%
22	Legal services	0.335%	1.185%	0.006%	0.163%	0.852%	0.055%
23	Accounting, tax preparation, bookkeeping, and payroll	2.512%	1.939%	0.250%	1.691%	4.895%	0.904%
24	Photographic services	0.045%	0.039%	0.257%	0.017%	0.054%	0.015%
25	Veterinary services	0.236%	0.199%	0.006%	0.209%	0.149%	0.104%
26	Investigation and security services	0.024%	0.042%	0.055%	0.066%	0.009%	0.015%
27	Services to buildings and dwellings	0.385%	0.389%	0.093%	0.666%	0.181%	0.119%
28	Waste management and remediation services	0.219%	0.217%	0.000%	0.283%	0.000%	0.000%
29	Elementary and secondary schools	0.212%	0.314%	0.000%	0.134%	0.060%	0.022%
30	Offices of physicians	4.361%	2.732%	3.879%	5.881%	3.595%	10.321%
31	Offices of dentists	0.787%	0.693%	0.416%	1.036%	0.698%	1.082%
32	Offices of other health practitioners	0.670%	0.387%	0.280%	0.812%	0.453%	1.269%
33	Home health care services	0.884%	0.395%	0.625%	1.123%	0.755%	2.585%
34	Hospitals	3.761%	2.482%	5.133%	5.953%	2.682%	9.324%
35	Nursing and community care facilities	0.974%	0.386%	0.592%	1.140%	0.791%	2.808%
36	Child day care services	0.202%	0.345%	0.632%	0.013%	0.183%	0.000%
37	Performing arts companies	0.191%	0.235%	0.353%	0.403%	0.279%	0.062%
38	Spectator sports	0.070%	0.071%	0.109%	0.020%	0.156%	0.007%
39	Gambling industries (except casino hotels)	0.068%	0.036%	0.005%	0.083%	0.128%	0.351%
40	Other amusement and recreation industries	0.335%	0.490%	1.146%	0.416%	0.350%	0.058%
41	Full-service restaurants	2.415%	1.902%	3.289%	2.020%	4.756%	2.625%
42	Limited-service restaurants	2.415%	1.902%	3.289%	2.020%	4.756%	2.625%
43	All other food and drinking places	0.107%	0.699%	0.007%	2.638%	0.034%	0.008%
44	Automotive repair and maintenance	1.713%	1.289%	2.595%	1.961%	1.799%	1.746%
45	Electronic and precision equip. repair & maintenance	0.022%	0.019%	0.000%	0.031%	0.012%	0.005%
46	Personal and household goods repair & maintenance	0.105%	0.078%	0.027%	0.131%	0.084%	0.154%
47	Personal care services	0.144%	0.070%	0.107%	0.183%	0.121%	0.403%
48	Death care services	0.278%	0.067%	0.029%	0.163%	0.524%	0.259%
49	Dry-cleaning and laundry services	0.264%	0.103%	0.225%	0.116%	0.886%	0.752%
50	Other personal services	0.745%	0.707%	0.678%	0.859%	1.163%	0.988%
51	Religious organizations	0.746%	0.821%	0.746%	1.205%	0.337%	0.415%
52	Civic, social, professional, and similar organizations	0.011%	0.005%	0.000%	0.009%	0.000%	0.002%

Also as described in Phase II, Census of Governments data are used to estimate most categories of tax and fee revenue generated for general (non-enterprise) governments in the area. The exemption is residential property taxes. Perhaps surprisingly, residential and non-residential property taxes are not reported separately. Moreover, some states have restrictions on rate increases, or other laws that tend to make property tax rates different on new construction. Particular developments (for example, those financed by the LIHTC program) may also be granted special forms of property tax relief.

For these reasons, when customizing the local impact model to a specific area, information about property taxes on the units being built must be supplied by the entity requesting the analysis. Phase III of the model counts only property tax on the value of construction. Unless specific information is provided for an individual project or jurisdiction, this is calculated assuming that the raw land would be taxed at the same rate if not developed. Any residential property tax from existing units is treated as unrelated to the new homes being analyzed and excluded from the government revenue impact estimates.

Non-residential property taxes are treated much like other categories of government revenue, except that the aggregate for a jurisdiction to be estimated from a larger aggregate in the government data that does not distinguish residential from non-residential. This is accomplished by subtracting an estimated 53.37 percent from total property taxes to account for residential share of property taxes. The estimate is calculated as follows, from data available for 2012 in the ACS, RHFS and the Census Bureau's Summary of State and Local Government Tax Revenue (SSLGTR):

Aggregate real estate taxes paid by homeowners:	$206.04 billion (ACS)
Estimate for homeowners not reporting:	5.93 billion
Estimated real estate taxes paid on rental housing	41.85 billion (ACS and RHFS)
Total residential real estate taxes	$253.82 billion
Total property taxes	$475.83 billion (SSLGTR)
Residential share	53.37%

The estimate for homeowners not reporting in the ACS is based on the number of non-reporters multiplied by median tax payment for those who do report. The estimate for rental units is based on the number of rental units in the ACS multiplied by median tax per rental unit in the RHFS.

Multifamily Phase III impacts are reduced to account for vacant units. By default, the single-family version of the model assumes that units are intended for owner-occupancy and have negligible vacancies. In the Census Bureau's Housing Vacancy Survey homeowner vacancy rates are usually in the neighborhood of only one percent.

For multifamily units, the average multifamily rental annual vacancy rate over the prior decade and average annual multifamily homeowner vacancy rate over the prior decade are used, depending on whether the units are condominiums or rental apartments. In other respects, Phase III treats condo buyers the same as single-family home buyers (the income and spending tendencies discussed above being based on buyers of owner-occupied housing units, irrespective of structure type).

Although vacancy rates are known to fluctuate, the model estimates annual ongoing impacts that are expected to persist for an extended period, so a long-term "natural" measure of vacancy rates is more appropriate for Phase III than a very current, possibly anomalous, number. The reduction for vacancies is applied to all Phase III multifamily impacts except for property taxes, which are assumed to be paid by the owner of the property, whether the units are occupied or not.

Local spending and taxes (including fees and charges paid to local government entities) generate income for local residents, and this income will be spent and recycled in the local economy, much as in Phase II of the model.

Let $\boldsymbol{x}_{\mathrm{n}}$ denote the initial income and tax column vector for new home occupants, $\boldsymbol{A}_{\mathrm{n}}$ denote the matrix formed from the consumption spending patterns of new home occupants, and otherwise maintain the notation used in Phase II of the model. Then consider the following sequence:

$$
\begin{aligned}
&\textit{Round } 0: \ \boldsymbol{x_n'} \\
&\textit{Round } 1: \ \boldsymbol{x_n' A_n LYZ} \\
&\textit{Round } 2: \ \boldsymbol{x_n' A_n LYZ\ ALYZ} \\
&\textit{Round } 3: \ \boldsymbol{x_n' A_n LYZ\ ALYZ\ ALYZ} \\
&\qquad\qquad \vdots \\
&\textit{Round } K: \ \boldsymbol{x_n' A_n LYZ} \prod_{k=1}^{K} \boldsymbol{ALYZ}
\end{aligned}
$$

The sum of these terms forms an infinite series that converges to the limit

$$\boldsymbol{x_n'\ [I+(A_n - A)LYZ][I-ALYZ]^{-1}}$$

When results are reported for Phase III the income earned by the occupants is subtracted from the final multiplied effect, so that only income generated for occupants of housing units already existing in the area is counted.

Note that, were new home occupants to spend the same fraction of their incomes on the various local commodities as average households, $\boldsymbol{A}_{\mathrm{n}} = \boldsymbol{A}$ and the formula would simplify to

$$\boldsymbol{x_n'\ [I-ALYZ]^{-1}}$$

The formula that produces a 297-element vector, the first 99 of which contain the added income by industry, for Phase III is

$$\boldsymbol{x_n'\ A_n L\ [I-YZAL]^{-1}}$$

Again, the income in each industry can be disaggregated into business owners' income and wages and salaries, and the wages and salaries converted to full-time jobs. These exclude any jobs filled by occupants of the new housing units.

The formula that produces a 3-element vector showing the final, multiplied effect on local income, local government general revenue from persons, and local general government revenue from business generated in Phase III is

$$x_n' A_n LY [I - ZALY]^{-1}$$

As in Phase II, the last two elements of the final 3-element vector can be disaggregated to show revenue generated by particular types of taxes, fees, and charges. The primary difference in Phase III is that the increase in residential property tax revenue (which is introduced into the model as a separate input independent of the Census of Government computations) needs to be subtracted before the decomposition procedure can be applied.

Final Notes

All of the matrix operations in the NAHB local impact model are performed using the O-Matrix package provided by Harmonic Software. The O-Matrix code used to generate Phase III impacts for single-family construction and the code used to compute a local total requirements matrix for a previous iteration of the NAHB model are published on the Harmonic Software web site as notable uses of the O-Matrix package (http://www.omatrix.com/userstories.html).

The technical documentation on the NAHB model used to estimate the local income, jobs, and taxes generated by home building was prepared by Paul Emrath, Vice President of Survey and Housing Policy Research. For questions on the technical documentation, or on NAHB's impact of home building models in general, he may be contacted in NAHB's Economics and Housing Policy Group by phone at 202-266-8449, or by email at pemrath@nahb.org.

The Metro Area Impact of Home Building in Placer County, California: Comparing Costs to Revenue for Local Governments

November 2025

Housing Policy Department

NAHB
National Association of Home Builders

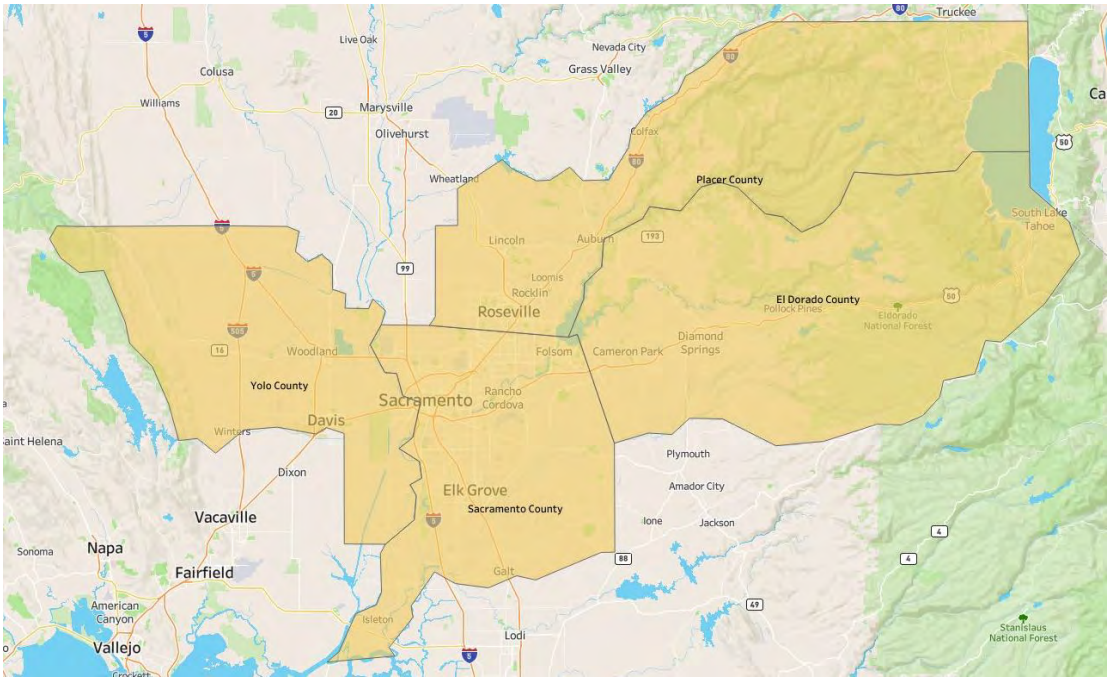
Introduction

Home building generates local economic impacts such as income and jobs for local residents, and revenue for 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 building 2,339 single-family and 850 multifamily housing units in Placer County, California, based on the number of homes built in the county over the period from June 2024 to June 2025.

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. Sacramento-Roseville-Folsom, California MSA



[1] "The Metro Area Impact of Home Building in Placer County, California: Income, Jobs and Taxes Generated," completed by NAHB in November 2025.

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. The local benefits captured by 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 Sacramento-Roseville-Folsom as a metro area consisting of four counties (El Dorado, Placer, Sacramento, and Yolo) in California (see Figure 1). In this report, wherever the term local is used, it refers to the entire, four-county 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 2,339 single-family and 850 multifamily housing units built in Placer County result in an estimated
  - **$465.6 million** in tax and other revenue for local governments,[2]
  - **$12.9 million** in current expenditures by local government to provide public services to the net new households at current levels, and
  - **$57.6 million** in capital investment for new structures and equipment undertaken by local governments

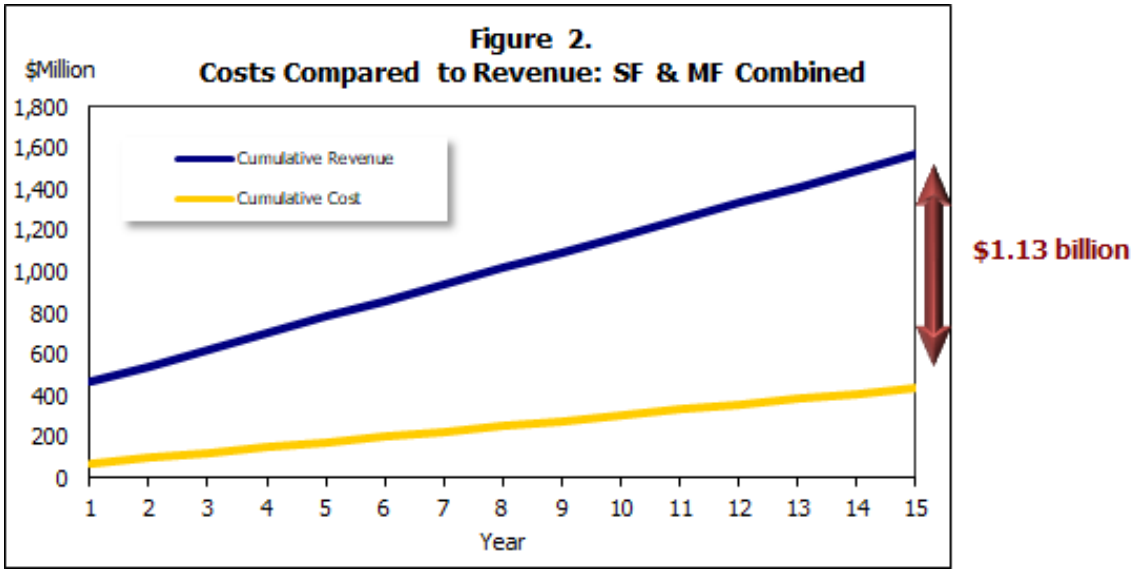
  The analysis assumes that local governments finance the capital investment by borrowing at the current municipal bond rate of 4.11%.[3]

- In a typical year after the first, the single-family and multifamily units result in
  - **$78.8 million** in tax and other revenue for local governments, and
  - **$25.9 million** in local government expenditures to continue providing services at current levels

[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. The specific interest rate used here is based on the S&P Municipal Bond 20 Year High Grade Index, Yield to Worst.

- The difference between government revenue and current expenditures is defined as an "operating surplus." In this case, the operating surplus generated during the first year is large enough to service and pay off all debt incurred by investing in structures and equipment at the start of the first year 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 **$1.57 billion in revenue** compared to **$436.2 million in costs**, including annual current expenses, capital investment, and interest on debt (Figure 2).



Costs Compared to Revenue: Single-family Construction

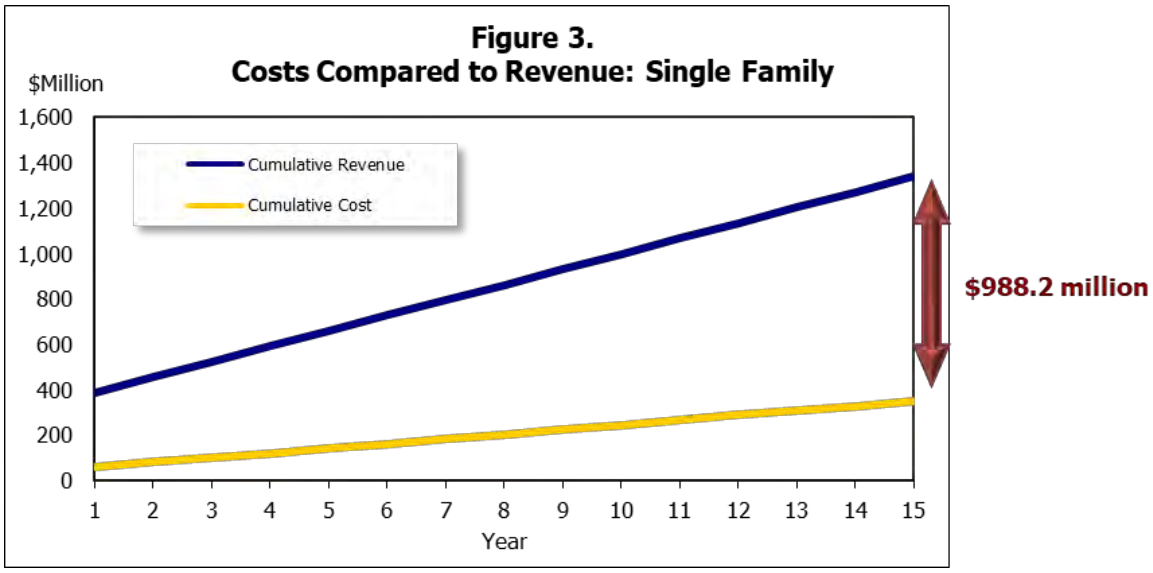
This section summarizes results for single-family construction only. The relevant assumptions about the single-family homes built (including their average price, property tax payments, and construction-related fees incurred) are described in the NAHB report, *The Metro Area Impact of Home Building in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

- In the first year, the 2,339 single-family homes built in Placer County result in an estimated
  - **$388.2 million** in tax and other revenue for local governments,
  - **$10.3 million** in current expenditures by local government to provide public services to the net new households at current levels, and
  - **$47.0 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.

- In a typical year after the first, the 2,339 single-family homes result in
  - **$67.8 million** in tax and other revenue for local governments, and
  - **$20.7 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 **$1.34 billion in revenue** compared to **$349.8 million in costs**, including annual current expenses, capital investment, and interest on debt (Figure 3).



Costs Compared to Revenue: Multifamily Construction

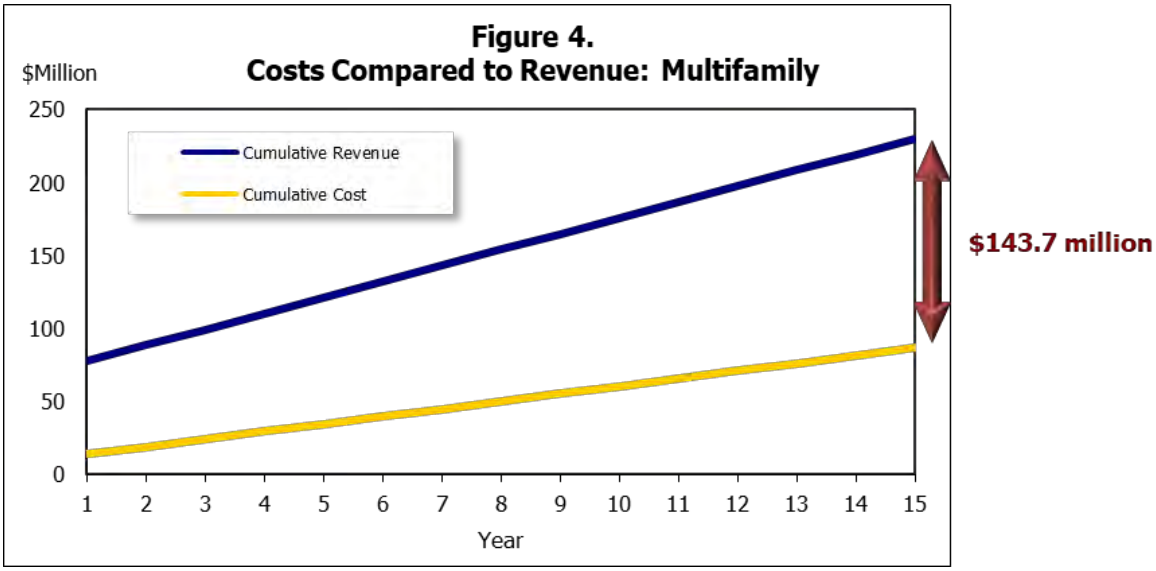
This section summarizes results for multifamily construction only. As with the section on single-family construction, relevant assumptions about the units built can be found in *The Metro Area Impact of Home Building in Placer County, California: Income, Jobs and Taxes Generated*.

- In the first year, the 850 multifamily housing units built in Placer County result in an estimated
  - **$77.5 million** in tax and other revenue for local governments,
  - **$2.6 million** in current expenditures by local government to provide public services to the net new households at current levels, and
  - **$10.6 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 850 multifamily units generate
  - **$10.9 million** in tax and other revenue for local governments, and
  - **$5.2 million** in local government expenditures needed to continue providing services at current levels.

- Again, the difference between government revenue and current expenditures is defined as an "operating surplus." As was the case for single-family housing, the first-year operating surplus associated with multifamily construction is large enough to service and ay off all debt incurred by investing in structures and equipment at the beginning of the first year 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 **$230.2 million in revenue** compared to **$86.5 million in costs**, including annual current expenses, capital investment, and interest on debt (Figure 4).



Method Used to Estimate Costs

The method for estimating local government revenue generated by home building is explained in the attachment to *The Metro Area Impact of Home Building in Placer County, California: Income, Jobs and Taxes Generated*. 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 Sacramento-Roseville-Folsom metro area, and the result used to calculate total annual expenses per single-family and multifamily housing unit (Table 1):

Table 1.
Total Annual Local Government Expenses per Housing Unit

	Single-family	Multifamily
Education	$1,389	$819
Police Protection	$1,000	$727
Fire Protection	$646	$469
Corrections	$540	$393
Streets and Highways	$511	$295
Water Supply	$234	$137
Sewerage	$228	$134
Recreation and Culture	$488	$355
Other General Government	$2,235	$1,625
Electric Utilities	$1,539	$1,119
Gas Utilities	$1	$1
Public Transit	$32	$23
Total	$8,843	$6,095

Not surprisingly, cost per housing unit varies substantially across the major service categories. Miscellaneous general government functions account for the largest share of annual expenses, followed by the shares for publicly owned electric utilities and education.

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. Streets and highway expenses are allocated based on the average number of vehicle trips generated on weekdays. Education is allocated based on the average number of public school children age 5 through 18. The remaining expenses listed in Table 1 are assumed to be proportional to household size and are allocated to single-family and multifamily units based on the average number of persons per household.[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 children going to public schools present in the units. According to the American Community Survey, there is, on average, only a little over one public school child for every three households in the U.S. The number is about 0.4 per household for single-family and under 0.2 per household for multifamily. So, education

[4] Information about vehicle trips comes from *Trip Generation Manual, 10th Ed.*, September 2017, Institute of Transportation Engineers: https://www.ite.org/tripgeneration/index.asp. Information about water consumption comes from *Water Demand Trends in the Multifamily Housing Sector,* a study undertaken in 2017 by Jack Kiefer and Lisa Krentz for the Water Research Foundation http://www.waterrf.org/Pages/Index3.aspx. Information about household size and number of public school children comes from the 2016 Public Use Microdata Sample of the American Community Survey, U.S. Census Bureau: https://www.census.gov/programs-surveys/acs/.

costs per housing unit are lower than costs per pupil, simply because there is less than one pupil per household.

Beyond that, state governments typically pay for some public school expenses in the form of intergovernmental transfers. In the latest Census of Governments, local governments in aggregate across the Sacramento-Roseville-Folsom metro area spent about $3.6 billion in current expenses on education. However, over three-fourths of this was offset by nearly $2.8 billion 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.

Table 2.
Local Government Capital per Housing Unit

	Single-family	Multifamily
Schools	$9,733	$5,740
Hospitals	$343	$249
Other Buildings	$1,743	$1,267
Highways and streets	$1,503	$866
Conservation & development	$51	$37
Sewer systems	$2,777	$1,628
Water supply	$888	$520
Other structures	$2,643	$1,921
Equipment	$405	$295
Total	$20,086	$12,523

The process employed by NAHB to estimate capital costs involves several steps. The general approach is to apply parameters from a conventional economic model (a production relationship, where costs are expressed as a function of labor and capital) estimated with state level data to information for a specific local area. State and local government capital in each state can be derived through a procedure that has been established over several decades in the technical literature on public finance (see the technical appendix for details). The parameter estimates 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. Consistent with the approach used to estimate current expenses, the amount of capital in each category is expressed as the amount necessary to accommodate an average single-family or average multifamily housing unit (Table 2).

To implement these numbers, several conservative assumptions are made to avoid understating the 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, the analysis assumes 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. Results for the 2,339 single-family homes are shown in Table 3, for the 850 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 analysis assumes 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 considered in isolation—as well as for the more realistic scenario that analyzes both types of construction together—revenue net of costs and interest is positive every year, beginning with the first.

In fact, in all three cases (Tables 3, 4 and 5), revenue net of costs and interest is sufficient to pay off all debt by the end of year one. After that, revenue net of costs generated by the 2,339 single-family and 850 multifamily homes is roughly $52.9 million per year.

Net revenue for both structure types falls slightly in year 11, due to a cost that local governments incur at that time as capital equipment purchased at the start of the first year becomes fully depreciated and needs to be replaced. All other capital investment consists of structures of various types, and the effective service life for any type of structure is considerably longer than a single decade.

[5]The interest rate on municipal bonds is the S&P Municipal Bond 20 Year High Grade Index, Yield to Worst.

Table 3. Results for 2,339 Single-family Homes Built in Placer County

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	10,341,700	388,178,000	377,836,300	46,980,400	0	1,932,000	328,923,900
2	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
3	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
4	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
5	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
6	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
7	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
8	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
9	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
10	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
11	20,683,400	67,844,900	47,161,500	947,700	0	0	46,213,800
12	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
13	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
14	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500
15	20,683,400	67,844,900	47,161,500	0	0	0	47,161,500

Table 4. Results for 850 Multifamily Homes Built in Placer County

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	2,590,500	77,467,000	74,876,500	10,644,900	0	437,700	63,793,900
2	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
3	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
4	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
5	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
6	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
7	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
8	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
9	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
10	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
11	5,181,000	10,906,700	5,725,700	250,300	0	0	5,475,400
12	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
13	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
14	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700
15	5,181,000	10,906,700	5,725,700	0	0	0	5,725,700

Table 5. Combined Results for 2,339 Single-family and 850 Multifamily 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	12,932,200	465,645,000	452,712,800	57,625,300	0	2,369,700	392,717,800
2	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
3	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
4	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
5	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
6	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
7	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
8	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
9	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
10	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
11	25,864,400	78,751,600	52,887,200	1,198,000	0	0	51,689,200
12	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
13	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
14	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200
15	25,864,400	78,751,600	52,887,200	0	0	0	52,887,200

Comparing Costs to Revenue for Local Governments

Technical Appendix on Estimating Capital Owned and Maintained by Local Governments

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Technical Appendix on Estimating Local Capital Owned and Maintained by Local Governments

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}.

[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.

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

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 ξ_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 $k_{st} = k_{s0}(1-\xi_s)^{a_s}$, $k_{et} = k_{e0}(1-\xi_e)^{a_e}$

or, equivalently,

(8) $$k_{s0} = k_{st}(1-\xi_s)^{-a_s},\ k_{e0} = k_{et}(1-\xi_e)^{-a_e}$$

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) $$z = k_{e0}/k_{s0} = k_{et}(1-\xi_e)^{-a_e} k_{st}^{-1}(1-\xi_s)^{a_s}$$

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:

ξ = 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 ξ.
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) $$k^0_{i\,t+1} = k^0_{it}(1-\xi) + v_{it+1}(1->)^6$$

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

The goal is to obtain estimates of parameters $\forall_j$ and 2_q in the following regression relationship:

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

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 $\equiv_{i\,t}$ 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) $$v^0_{it} = k^0_{it-1} (\xi + N_t \hat{=}^0_{it})$$

where $\hat{=}^0_{it}$ 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_{i76} 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_{it} and $\equiv^1_{it}$ for t=1977,…,1999; parameters $\forall^1_j$ and 2^1_q; v^1_{it} for t=54,…,76; and k^2_{i76}. 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_{i76} 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) $$a_{i\,t+1} = [(a_{i\,t}+1)\ k_{it}(1-\xi) + \tfrac{1}{2} vn_{it+1}(1->)^6 + ap_t\ ve_{it+1}(1->)^6]/k^0_{i\,t+1}$$

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:

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

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

$$(15) \qquad a_{mt} = \frac{\left(a_{mt-1}+1\right)\left(1-\delta\right)+g_t\left(\delta+N_t\eta_{mt}\right)\left(1-\varepsilon\right)^6}{1-\delta+\left(\delta+N_t\eta_{mt}\right)\left(1-\varepsilon\right)^6}$$

Equation (13) can be used to estimate $\equiv_{mt}$ from local relative population growth factors Π_{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_{wr}, and β_{wa} from the cost share equations, capital depreciation rates ξ_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

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

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

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

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

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

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

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

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

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.