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The Costs and Hidden Benefits of New Housing Development in Massachusetts

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THE COSTS AND HIDDEN BENEFITS OF NEW HOUSING DEVELOPMENT IN MASSACHUSETTS

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ABSTRACT

Frequently, local opposition to new housing development is based on fiscal concerns. Previous research (Nakosteen et al., 2003; Nakajima et al., 2007; Burnet et al., 2012) has found that these concerns are frequently misplaced since they assume that the additional expenses will be equal to per capita local cost associated with new residents, particularly the costs associated with K-12 education, rather than the marginal cost. This working paper builds upon this work by revisiting six of the eight communities examined by Nakajima et al. (2007) and examining whether the state fiscal impacts of new housing development are large enough to offset negative local fiscal impacts when they do occur. Our analysis of these six cases finds that, in the aggregate, the six new developments generated considerably more state tax revenue than any actual local revenue shortfalls. Overall, we find that only 31 percent of the net new state tax revenue generated by the developments would be needed to completely offset the negative fiscal impacts experienced by three of the six communities. This suggests that the positive state fiscal benefits of new housing development are more than sufficient to support a state fund to guarantee that communities will be made financially whole in the event they allow the development of housing that meets regional and statewide needs, but find themselves fiscally disadvantaged as a result. These findings also imply that more thoughtful and evidence-based local and regional planning could minimize the chance of negative local fiscal outcomes associated with new housing development.

Keywords: Housing policy; economic impact analysis; education finance; public policy

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Introduction

For well over a decade, housing production in Massachusetts has not kept up with population changes, resulting in significant affordability problems across the state.[1] One thing that stands in the way of the state's residential housing market is the Commonwealth's archaic zoning and land-use regulations.[2] These regulations, along with the centuries-old New England tradition of local control over land use, allow communities to readily resist the development of new housing, notwithstanding larger regional and statewide needs for more housing production.

Frequently, local opposition to new housing development is based on concerns about fiscal impacts, particularly the impact on school enrollment and the expected costs of providing municipal services to new residents and their children. However, the common assumption that new housing development results in a net fiscal loss for cities and towns is not always borne out in the actual experiences of the Massachusetts communities that have agreed (or have been required through state laws like Chapter 40B) to develop affordable and market-rate housing.[3]

Admittedly, this seems very counter-intuitive. After all, new housing means new residents, those new residents consume municipal services, and those services are not free. In an environment in which per pupil expenditures in many communities are well in excess of the average property tax payment, how could it be otherwise?

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[1] See Koshgarian et al., *Foundation for Growth: Housing and Employment in 2020,* UMass Donahue Institute (2009). http://www.massgrowth.net/writable/resources/document/foundationforgrowth_scopea_final_10_29_10.pdf

[2] For an in-depth discussion of consequences of these regulations, see Glaeser, Schuetz, and Ward, *Regulation and the Rise of Housing Prices in Greater Boston,* Rappaport Institute for Greater Boston (2006).http://www.hks.harvard.edu/content/download/68821/1248094/version/1/file/regulation_housingprices.pdf

[3] See https://malegislature.gov/Laws/GeneralLaws/PartI/TitleVII/Chapter40B (especially chapter 20-23)

Part of the answer is that the cost of providing services to each additional resident isn't always equal to the per capita cost, but rather the marginal cost of providing these services.[4] In other words, adding new students to the school system only costs more money if you need to expand the capacity of your schools to serve those students. If you have extra seats in your classrooms and on your school buses, the marginal costs to the community of serving additional students are significantly less than the per capita costs.[5]

This, of course, does not mean that adding additional housing, residents, and school-age children will never require additional funds to meet the service needs of the new members of the community (see Sidebar: Assessing district capacity to accept new students). In these cases, it seems reasonable to expect that the state should step forward and help to "make them whole" financially if it expects them to approve new housing developments. The relevant provisions of Massachusetts

Enrollment and Expenditures in Massachusetts

District enrollment capacity matters. When we define capacity as the ability of the district to add more students without hiring additional teachers or increasing class size*, we find that:

- The effect of school enrollment on district expenditures has a *statistically significant dependence* on whether or not the school district is operating at or above its enrollment capacity (p-value = 0.02).
- On average, a 1% increase in enrollment in a school district **without capacity** is associated with a 0.91% increase in expenditures.
- On average, a 1% increase in enrollment in a school district **with capacity** is associated with a 0.65% increase in expenditures.
- **Key message:** The cost of adding new students to school districts with capacity is lower than in those without capacity. This is important to consider when assessing the net fiscal impact of proposed new housing developments.

* this was operationalized by the presence of a lower district level enrollment in Academic Year (AY) 13/14 than in AY 03/04, and a district level student-teacher ratio below the state average in AY 13/14.

[4] For a detailed discussion, see Nakosteen et.al., *The Fiscal Impact of New Housing Development in Massachusetts* (2003). https://www.chapa.org/about-chapa/chapa-publications/fiscal-impact-new-housing-development-massachusetts-critical-analysis

[5] For the statistical analysis modeling the relationship between expenditures, enrollment, and capacity, the town of Shrewsbury was removed since it is an extreme outlier and exerts a disproportionate influence on the estimation of the regression equation.

General Laws Chapters 40R and 40S[6] (when properly funded) were designed in part for this purpose. However, as currently written they essentially accept the false premise that new housing developments always create a net negative fiscal cost for cities and towns and that communities must be "paid off" in order to accept new developments.

A more effective policy would guarantee payments if a community that developed housing that met a regional or statewide need, but the development had a demonstrable net negative fiscal impact on the community. This would ensure that the Commonwealth was not paying communities to create housing that would have been developed anyway and would make a real difference for communities that were truly fiscally burdened by new housing development. Significantly, it would eliminate a major obstacle to the development of much needed new housing in Massachusetts. This working paper explores the feasibility of such a policy by expanding on the results of previous studies on the actual fiscal and economic impacts of new housing in Massachusetts. Using these studies as a starting point, we investigated whether the economic and fiscal benefits of new housing that accrue to the state government could support a dedicated, as-of-right local-aid funding stream for communities that can demonstrate actual net negative fiscal impacts.

[6] See https://malegislature.gov/Laws/GeneralLaws/PartI/TitleVII/Chapter40R and https://malegislature.gov/Laws/GeneralLaws/PartI/TitleVII/Chapter40S

The state and local fiscal benefits of new housing development in Massachusetts

Over the past decade, a number of studies have been conducted that directly examine the economic and fiscal impact of housing development in Massachusetts at the state and local level.[7] Significantly, these studies are based on the actual fiscal experiences of Massachusetts communities and use state-of-the-art approaches to model the economic activity and fiscal impacts associated with new housing developments.

Presently, the Commonwealth's local aid funding formula is not growth neutral. In other words, it does not reward municipalities with additional funding when they develop new housing, even though it can generate positive statewide economic impacts. Consequently, local debates over the fiscal impact of proposed new housing developments typically only consider expected local tax receipts when considering municipal costs and benefits. As will be demonstrated below, the construction of new housing generates significant tax revenue at both the local and state level.

In their 2010 analysis of the economic impact of Chapter 40B developments, Koshgarian et al. [8] found that:

- Between 2000 and 2010, 21,861 housing units were constructed (8,140 of which qualified as "affordable").
- The development of these new units required over $5 billion in direct spending, which supported over 20,000 jobs.
- The direct spending on these developments spurred just under $4 billion in additional economic activity and supported an additional 27,475 jobs.

[7] Op.cit, Nakajima et. al. (2007); Nakosteen et. al (2003); Koshgarian et.al. (2009), Koshgarian et. al. *Economic Contributions of Housing Permitted through Chapter 40B* (2010), and Burnet et.al. *Benefits and Costs of Increasing Housing Production in Massachusetts.* Abt & Associates (2012)

[8] Op.cit.

- The residents of these new units directly spent an estimated $1.86 billion, which spurred over $600 million in additional spending. Overall, the direct and indirect spending of the residents of 40B units supported an estimated 11,587 jobs in Massachusetts.

- While local property tax revenues averaged an estimated $2,825 per unit, when one considers the multiplier effect of household spending, the estimated average state sales and income tax receipts per unit were $1,043 and $4,313 respectively (or $5,356 in total state tax payments).

These findings demonstrate that even though the costs associated with many of the public services delivered to new residents are borne by municipalities, there are also significant tax revenue benefits generated by the average 40B unit accrue to state government.[9] However, a closer look at the marginal added costs of providing local services to new residents in these developments is warranted given that Massachusetts school districts spent an average of $14,021 per pupil in 2013[10] and that the average 40B unit generates an estimated average state and local tax payment of only $8,181.

The local fiscal costs and benefits of new housing development in Massachusetts

In 2007, the UMass Donahue Institute (UMDI) conducted a detailed retrospective analysis[11] of eight 40B developments[12] in different regions across the Commonwealth. A primary purpose of this study was to evaluate whether communities with these developments were spending more on municipal services for their new residents than they received in local tax receipts. The eight

[9] There is every reason to believe that an analysis of non-40B housing developments would reveal a similarly disproportionate split of total tax benefits but, thanks to their higher property tax valuations and higher income residents, the total tax receipts would likely be higher.

[10] See http://profiles.doe.mass.edu/profiles/finance.aspx?orgcode=00000000&orgtypecode=0&

[11] Nakajima, E., Modzelewski, K., & Dale, A. (2007, May). The fiscal impact of mixed-income housing development on Massachusetts municipalities: A report for Citizens' Housing and Planning Association. Hadley, MA: Donahue Institute, University of Massachusetts. Retrieved from http://www.massbenchmarks.org/publications/studies/pdf/UMDI_FiscalImpact.pdf

[12] According to the authors they, "randomly selected 20 communities out of a possible 100 cities and towns that met our selection criteria" (page 4). These criteria included, size, region, and the presence of relevant developments under construction between 1990 and 2003. For more detail see Nakajima, et.al, 2007.

developments they examined are described in the following table, which is taken from the original study (page 5).

Figure 2

Table 1: Profile of Case Study Mixed-Income Developments

Town	Project	Total Units (Total:SHI*)	Year Built	Total Students	Total Development Population
Brookline	Kendall Crescent	35:5	1999-2001	5	70
Falmouth	Nickey Lane	6:2	1998-99	3	16
Falmouth	Fresh Pond Farms	21:6	2002-04	10	39
Northampton	Pine's Edge	38:6	1992	3	63
Peabody	Stoneybrook	86:22	1990	5	129
Sandwich	Sherwood Forest	36:9	2002	40	125
Wellesley	Edgemoor Circle	12:3	2003	4	27
Wilmington	Buckingham Estates	23:6	1996	23	73

*SHI: Massachusetts Subsidized Housing Inventory
Source: UMass Donahue Institute, 2006.

The UMDI analysis relied on a number of different local and state data sources and extensive fieldwork in selected communities. As they describe it, they:

> …used a case study approach to analyze the historical fiscal impact of mixed-income homeownership developments constructed in Massachusetts during the past fifteen years…UMDI collected complete information for eight developments located in seven towns. The fieldwork for the project was conducted over the course of six months and included a mixture of interviews, primary data collection from municipal records and the use of online state databases. The interviews included local school and town officials while the data included school enrollment data by project and household, individual assessor's records, special permit decisions, municipal census records and public safety data. State data included expenditure and revenue data from the Massachusetts Department of Revenue, and educational data from the Massachusetts Department of Education (Nakajima, et.al, 2007, page 4).

UMDI researchers used these various sources of data to systematically evaluate the fiscal impact of each of the eight developments examined using three alternative methods:

- The per-capita method - Which assumes the cost of the local services each new resident receives is equal to the average cost per community resident.

- The marginal cost method - Which relies upon data obtained from and interviews with municipal and school department officials to arrive at a customized estimate of the costs of delivering services to the development's residents.

- The "fair share" method: A novel approach developed by the authors which, "allocates municipal expenditures equally to each housing unit in town based on the proposition that every household has an equal stake, either as a resident, current or future consumer of town services, in the provision of town services" (page 22)[13].

As expected the magnitudes of the impacts varied depending on the method used. It is noteworthy that in some cases the net impact was financially positive while in others it was net negative. In all cases, the overall fiscal impact of these individual developments, whether positive or negative, was modest.

The UMDI study also underscores the critical importance of thoughtful planning as a tool for balancing community and regional needs against the fiscal constraints facing Massachusetts' cities and towns. This includes consideration of the mix of affordable and market-rate units and the size of the new units, with respect to the number of bedrooms. As Nakajima et al.(2007) concluded:

> The fiscal potential of mixed-income developments is that the market-rate units within a project can contribute sufficient property tax revenue to offset the negative impact of affordable housing units. As this study shows, fiscal balance can likely be achieved in many projects. The extension of this point is that proposed projects throughout a community may be able to achieve fiscal balance in the aggregate. An affordable or workforce housing development located in one neighborhood may have a negative fiscal impact that is offset by luxury housing in another neighborhood. A transit-oriented development in the center of town may contain a mix of commercial and residential construction that offsets the fiscal impact of scattered site development in the community (page 18).

[13] This approach recognizes that municipal service costs are not allocated to residents on a fee for service basis (e.g., all property owners must help underwrite educational costs even if they do not have students attending the schools). It also highlights the reality that, in many communities, local property taxes for many existing homes generate lower tax receipts than their "fair share" of municipal costs. In practice, in many communities, high value residential and commercial property taxpayers pay well in excess of their "fair share". Thus, in a very real sense, a minority of existing taxpayers subsidize local services enjoyed by both long-time community members and new residents.

Do state tax impacts offset local marginal costs?

While the UMDI study (Nakajima et al., 2007) offers us a number of important insights into the practical fiscal realities and planning implications for cities and towns considering new housing developments, it only considered the local tax receipts generated by the developments and not the associated tax benefits that accrue to the state government.

As noted earlier, Koshgarian et al. (2010) demonstrated that the state's share of the economic and tax impacts of the over 21,000 40B units constructed between 2000 and 2010 can be substantial. This suggests that on the whole, the overall net benefits of new housing developments are positive when state fiscal impacts are considered. To test this proposition, we revisited the eight UMDI communities and used an input-output approach to estimate the state-level tax impacts for the developments studied by Nakajima et.al (2007).

Housing unit values were based on 2005 assessed values rather than sales prices, which allowed for temporal consistency. Two developments (Fresh Pond Farms and Edgemoor Circle) were excluded from our analysis because historical unit-level assessment data were unavailable. The remaining developments that we examined included: Kendall Crescent in Brookline, Nickey Lane in Falmouth, Pine's Edge in Northampton, Stoneybrook in Peabody, Sherwood Forest in Sandwich, and Buckingham Estates in Wilmington.

We then estimated the household income of the residents of these developments. This income is the critical input to the model and it is the basis upon which estimates of household spending and associated sales tax, income tax, and state fee collection are developed. Housing units that are designated as "affordable" under Chapter 40B are limited to residents with income no higher than 80 percent of the HUD Metropolitan Statistical Area (MSA) median for the applicable household size. Therefore, we assumed for the analysis that households in affordable

units earn 80 percent of area median income, adjusted by household size using data from the Nakajima (2007). This allowed us to estimate the aggregate household incomes of the residents of the affordable units in each of the developments we examined.

Estimates of the household incomes of residents of market-rate units were derived from the assessed property values. Sales prices for affordable units in 40B projects are set assuming a five percent down payment and monthly housing costs of no more than 30 percent of income. We used these criteria for estimating income in market-rate units. To estimate the monthly housing cost, we used the maximum and minimum assessment values for each development, the annual average interest rate offered by Freddie Mac (5.87 percent) in 2005, a five percent down payment, and an assumed 30-year term, which were inputted into Freddie Mac's online mortgage calculator.[14] These housing cost figures were used to calculate the associated monthly income, using the constraint that housing costs may not exceed 30 percent of household income. These monthly income values were translated into annual income values. The midpoints of the annual incomes for market units were multiplied by the number of units in the development. The result was our estimated aggregate household income for market-rate households in each development.

We used IMPLAN's input-output model[15] to estimate the annual tax impacts of the expenditures of 40B and market-rate households. The IMPLAN model allowed us to organize the income data by household income bracket in order to systematically account for important differences in the spending, saving, and tax paying behavior of households at different income levels. Household incomes ranged from $48,309.06 to $140,704.60, and the aggregate income

[14] http://calculators.freddiemac.com/response/lf-freddiemac/calc/home02
[15] For more information, see http://implan.com/

entered into the IMPLAN model was just under $19.8 million.[16] Incomes were adjusted for inflation from 2005 to 2013 dollars prior to inclusion in the IMPLAN model.

Figure 3: IMPLAN Inputs (Annual 2013 Dollars)

IMPLAN Bracket	Bracket Income Range	Total Annual Income of Development Residents (2013 dollars)
1	$10,000 to $15,000	0
2	$15,000 to $25,000	0
3	$25,000 to $35,000	0
4	$35,000 to $50,000	$289,854.36
5	$50,000 to $75,000	$4,471,939.53
6	$75,000 to $100,000	$8,209,270.90
7	$100,000 to $150,000	$6,810,479.44
8	More than $150,000	0

The IMPLAN model generated estimates of annual state tax impacts including revenue from the state's income tax, sales tax, licenses (motor vehicle, fishing and hunting), fines and fees. As can be seen in Figure 4, aggregate state tax impacts were an estimated $563,721.00 or an average of $2,516.61 in state tax payments per unit. Note that outputs were adjusted back to 2005 dollars.

[16] Estimated total aggregate income totaled $19,781,544.23.

Figure 4: IMPLAN Outputs (Annual 2005 Dollars)

Description	Tax on Production and Imports	Households	Corporations	Category Total (2005 dollars)
Dividends	N/A	N/A	$2,243	$2,243.00
Sales Tax	$238,250	N/A	N/A	$238,250.00
Motor Vehicle License	$5,283	N/A	N/A	$5,283.00
Severance Tax	N/A	N/A	N/A	$0.00
Other Taxes	$31,785	N/A	N/A	$31,785.00
NonTaxes	$873	N/A	N/A	$873.00
Corporate Profits Tax	N/A	N/A	$65,509	$65,509.00
Personal Tax: Income Tax	N/A	$198,142	N/A	$198,142.00
Personal Tax: NonTaxes (Fines/Fees)	N/A	$16,314	N/A	$16,314.00
Personal Tax: Motor Vehicle License	N/A	$4,776	N/A	$4,776.00
Personal Tax: Other Tax (Fish/Hunt)	N/A	$546	N/A	$546.00
Total State Tax Impact	**$276,191**	**$219,778**	**$67,752**	**$563,721.00**

As we suspected, the estimates of the state tax impacts associated with the examined developments are significantly higher than the fair share costs of providing local services to the residents of these new developments, as estimated by Nakajima et al. (2007). In fact, these estimates imply that just under 8 percent of the state tax benefits associated with residents in these developments would be required to make the three communities that experienced financial losses (Falmouth, Sandwich, and Wilmington) financially whole (see Figure 5).

Figure 5: Development Impacts (in 2005 dollars)

Project	Town	Total Units	Total Property Tax	Total Local Costs	Local Revenue Gain or Loss (A)	State Revenue* (B)	Net Fiscal Impact (A+B)	% of Total State Revenue to Break Even
Kendall Crescent	Brookline	35	$148,359	$112,997	$35,362	$22,020	$57,382	-
Nickey Lane	Falmouth	6	$9,765	$14,596	-$4,831	$3,829	-$1,002	3%
Pine's Edge	Northampton	38	$77,472	$65,255	$12,217	$24,247	$36,464	-
Stoneybrook	Peabody	86	$218,460	$157,814	$60,646	$54,876	$115,522	-
Sherwood Forest	Sandwich	36	$85,292	$119,457	-$34,165	$22,971	-$11,194	24%
Buckingham Estates	Wilmington	23	$72,580	$78,404	-$5,824	$14,676	$8,852	4%
TOTAL	**TOTAL**	**224**	**$611,928**	**$548,523**	**$63,405**	**$142,933**	**$206,338**	**31%**

However, in practice not every new housing unit is occupied by a net new resident of the state. An analysis of county-to-county migration data[17] revealed that, on average, 25 percent of new Massachusetts residents originate from out-of-state locations. To help ensure that our tax revenue estimates reflected net *new* revenues to the state, we discounted the total state revenue estimated by the IMPLAN model by 75 percent. This resulted in a much more conservative estimate of net new state revenue of $140,930. Notably, even at this reduced level, the net negative fiscal impacts documented by Nakajima et al. (2007) in three of their study communities represents only 31 percent of the total net new state tax revenue generated by the 6 developments we analyzed. In other words, the local tax revenue shortfall experienced by some communities could have been offset by the redirection of a portion of the state's net new tax receipts on aggregate. While the present analysis does not allow comparison of the new state revenue to new state costs, it does suggest that the net impact of new developments, when state revenue is considered, is substantially more positive than typically assumed.

[17] 2008-2012 American Community Survey: County-to-County Migration Flows. Retrieved from https://www.census.gov/hhes/migration/data/acs/county-to-county.html

Policy Implications

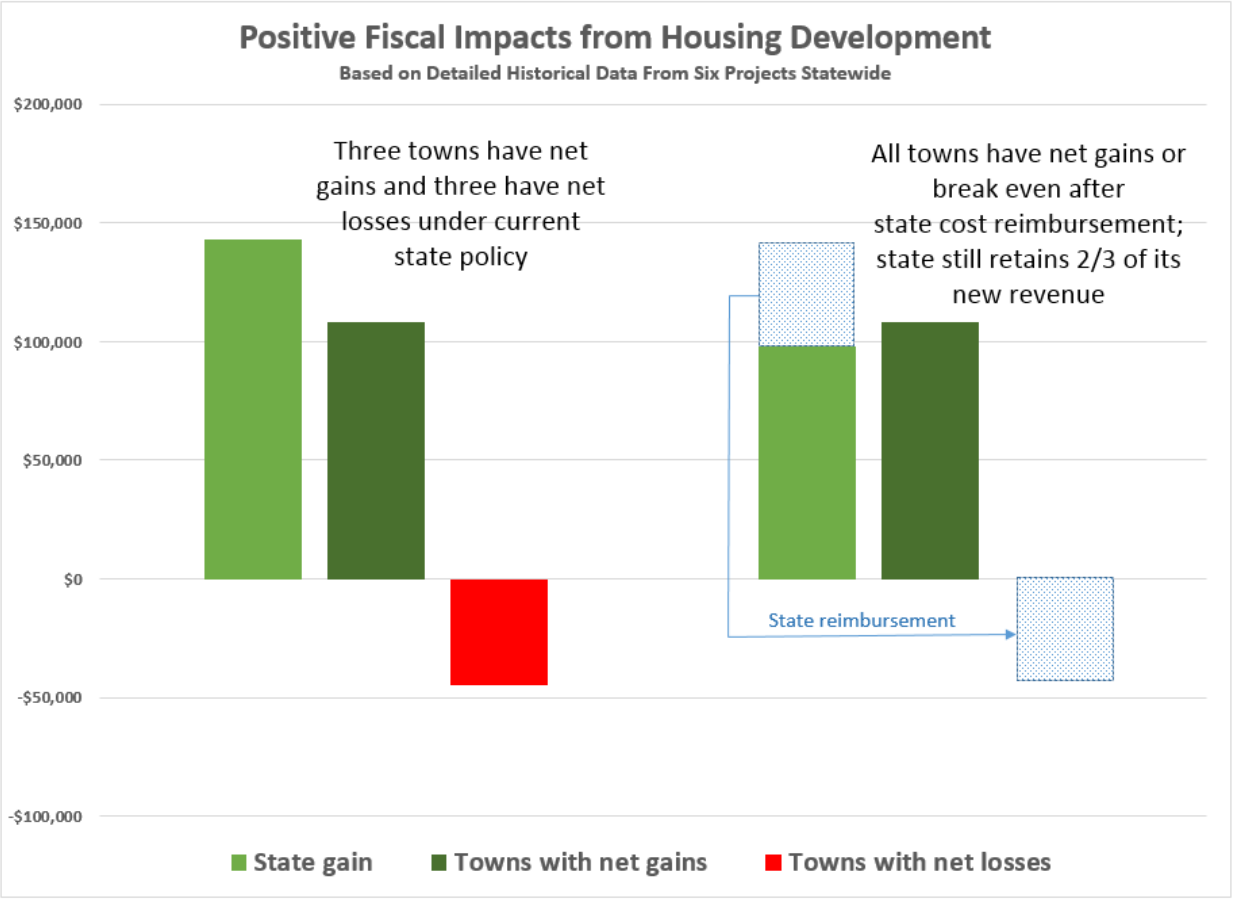
The results of our analysis are consistent with the claim that new housing developments in Massachusetts can have positive fiscal impacts when state tax benefits are considered. Further, our reconsideration of six of the eight communities examined by Nakajima et al. (2007) demonstrates that in the aggregate, these new developments can generate considerably more state tax revenue than any actual local revenue shortfalls associated with those projects. Given the positive state tax impacts, community resistance to housing development can result in a lost opportunity to generate much needed state tax revenue, while preventing the Commonwealth from meeting pressing regional and statewide housing needs.

Our analysis also suggests that development planning should consider the capacity of the local school district to absorb new students. This would limit the chance that a community would approve housing developments that exceed its service capacity, resulting in net negative local fiscal impacts. Appendix A contains a preliminary assessment of the average number of school-age children associated with housing developments of different sizes, number of bedrooms, and price ranges in Massachusetts. These were developed as a helpful planning tool by using a modified analytical approach originally developed by scholars at Rutgers University in 2006.[18]

Additionally, this analysis does not address the potential for the unexpected and substantial costs associated with providing services to school-age children with special educational and other needs, which is often a concern for smaller communities. In some cases, the risks associated with the potential for new high-need students may deter some communities

[18] Listokin, D., Voicu, I., Dolphin, W., & Camp, M. (2006, August). New Jersey Demographic Multipliers: The profile of the occupants of residential and nonresidential development. New Brunswick, NJ: Center for Urban Policy Research, Rutgers, The State University of New Jersey. Retrived from http://www.state.nj.us/state/planning/publications/178-nj-demo-multipliers.pdf

from supporting new residential developments, even when the community has the capacity to serve more *average* new residents.



Overall, our findings suggest that the net new state tax revenue generated by local mixed-income housing offsets any net negative fiscal burdens to communities. A state policy that dedicates a portion of this revenue to such communities could alleviate some of the hesitancy to permit new housing developments, helping to meet regional or state needs. These findings also suggest that incentives and technical assistance encouraging more thoughtful and evidence-based planning could limit the state and local fiscal impacts of new housing developments. It is possible that careful planning could result in enough net new revenue to support the

establishment of a "circuit breaker" program to reduce the local financial risk associated serving new high-need students, but further research is needed to systematically answer this question.

While new state policies along these lines may not eliminate all local resistance to new housing development, they could help to address widespread local concern about these developments. Given the critical importance of new and more affordable housing to the Commonwealth's continued economic competitiveness, state policymakers should consider developing new policies that dedicate a portion of the new tax revenue they receive to an "as of right" fund.[19] Doing so would help to ensure that communities who approve developments that meet state and regional housing needs have access to state financial support when they find themselves with a demonstrable fiscal burden as a result. It would also begin to eliminate a significant and perverse disincentive to the approval of housing development and help close the substantial gap that exists between local interests and state and regional housing needs.

[19] Given that previous attempts to address this problem (e.g., MGL Chapters 40R and 40S) are not always fully funded and do not appear to be inducing new development in a substantial way, any new fund should entitle eligible communities to support without the uncertainty associated with the annual appropriation process. Doing so would substantially increase the level of trust that communities who have previously been reluctant to participate in these types of programs and could be expected to increase participation.

Appendix A: Residential Multipliers

Estimates of the Average Number of School-Age Children per Housing Unit by Type

Housing Value Tertile 1: $0-$260,000

Grades: Nursery School/Preschool - 5

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0306	0.0231	0.0324	0.0233	0.0370	0.0251	0.0333	0.0277
2	0.1032	0.1320	0.1952	0.1814	0.1992	0.2158	0.1778	0.1637
3	0.2653	0.2800	0.3505	0.4233	0.5320	0.5065	0.3844	0.5379
4	0.3309	0.4319	0.3638	0.4962	0.7438	NA	NA	NA
5	0.3715	0.2622	0.2271	0.3254	NA	NA	NA	NA

Grades: 6 - 12

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0246	0.0214	0.0231	0.0203	0.0170	0.0075	0.0165	0.0122
2	0.0884	0.0954	0.1247	0.1428	0.1256	0.1308	0.1199	0.1179
3	0.2558	0.2838	0.3970	0.4308	0.4484	0.3903	0.1707	0.3069
4	0.3934	0.6069	0.3996	0.6279	0.6488	NA	NA	NA
5	0.4730	0.4081	0.5878	0.3237	NA	NA	NA	NA

Housing Value Tertile 2: $260,000 - $402,116

Grades: Nursery School/Preschool - 5

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0117	0.0189	0.0053	0.0212	0.0108	0.0144	0.0099	0.0066
2	0.0926	0.1680	0.1240	0.1804	0.2298	0.1919	0.1925	0.1504
3	0.1998	0.3917	0.3067	0.3964	0.6599	0.6302	0.6402	0.5627
4	0.2748	0.4186	0.3318	0.6385	0.8270	0.8926	0.3250	NA
5	0.3050	0.5833	0.2264	0.2471	NA	NA	NA	NA

Grades: 6 - 12

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0291	0.0083	0.0051	0.0161	0.0194	0.0111	0.0162	0.0059
2	0.0883	0.0959	0.1219	0.1330	0.1461	0.1441	0.1059	0.0884
3	0.2385	0.3430	0.3949	0.4273	0.5713	0.7241	NA	NA
4	0.3688	0.7960	0.3675	0.7655	0.9258	NA	NA	NA
5	0.5122	0.4759	0.3974	0.4471	NA	NA	NA	NA

Housing Value Tertile 3: $402,116 or more

Grades: Nursery School/Preschool - 5

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0231	0.0170	0.0118	0.0192	0.0056	0.0133	0.0171	0.0086
2	0.1177	0.1491	0.1467	0.1237	0.1231	0.1819	0.1311	0.1301
3	0.2974	0.3541	0.3083	0.3393	0.2920	0.3540	0.4539	0.2075
4	0.4410	0.4041	0.3410	0.4078	0.3684	NA	NA	NA
5	0.4902	0.2943	0.3005	0.4130	NA	NA	NA	NA

Grades: 6 - 12

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0166	0.0152	0.0144	0.0184	0.0138	NA	0.0037	0.0070
2	0.0962	0.0935	0.0961	0.0818	0.0995	0.0971	0.0734	0.0710
3	0.2816	0.2569	0.3470	0.3200	0.2644	0.5543	0.2147	0.3257
4	0.4504	0.3279	0.2845	0.5004	0.3741	NA	NA	NA
5	0.5515	0.2755	0.3642	0.4173	NA	NA	NA	NA

Upper Bound of the Estimates of the Average Number of School-Age Children per Housing Unit by Type

Housing Value Tertile 1: $0-$260,000

Grades: Nursery School/Preschool - 5

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0306	0.0231	0.0324	0.0233	0.0370	0.0251	0.0333	0.0277
2	0.1032	0.1320	0.1952	0.1814	0.1992	0.2158	0.1778	0.1637
3	0.2653	0.2800	0.3505	0.4233	0.5320	0.5065	0.3844	0.5379
4	0.3309	0.4319	0.3638	0.4962	0.7438	NA	NA	NA
5	0.3715	0.2622	0.2271	0.3254	NA	NA	NA	NA

Grades: 6 - 12

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0246	0.0214	0.0231	0.0203	0.0170	0.0075	0.0165	0.0122
2	0.0884	0.0954	0.1247	0.1428	0.1256	0.1308	0.1199	0.1179
3	0.2558	0.2838	0.3970	0.4308	0.4484	0.3903	0.1707	0.3069
4	0.3934	0.6069	0.3996	0.6279	0.6488	NA	NA	NA
5	0.4730	0.4081	0.5878	0.3237	NA	NA	NA	NA

Housing Value Tertile 2: $260,000 - $402,116

Grades: Nursery School/Preschool - 5

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0117	0.0189	0.0053	0.0212	0.0108	0.0144	0.0099	0.0066
2	0.0926	0.1680	0.1240	0.1804	0.2298	0.1919	0.1925	0.1504
3	0.1998	0.3917	0.3067	0.3964	0.6599	0.6302	0.6402	0.5627
4	0.2748	0.4186	0.3318	0.6385	0.8270	0.8926	0.3250	NA
5	0.3050	0.5833	0.2264	0.2471	NA	NA	NA	NA

Grades: 6 - 12

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0291	0.0083	0.0051	0.0161	0.0194	0.0111	0.0162	0.0059
2	0.0883	0.0959	0.1219	0.1330	0.1461	0.1441	0.1059	0.0884
3	0.2385	0.3430	0.3949	0.4273	0.5713	0.7241	NA	NA
4	0.3688	0.7960	0.3675	0.7655	0.9258	NA	NA	NA
5	0.5122	0.4759	0.3974	0.4471	NA	NA	NA	NA

Housing Value Tertile 3: $402,116 or more

Grades: Nursery School/Preschool - 5

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0231	0.0170	0.0118	0.0192	0.0056	0.0133	0.0171	0.0086
2	0.1177	0.1491	0.1467	0.1237	0.1231	0.1819	0.1311	0.1301
3	0.2974	0.3541	0.3083	0.3393	0.2920	0.3540	0.4539	0.2075
4	0.4410	0.4041	0.3410	0.4078	0.3684	NA	NA	NA
5	0.4902	0.2943	0.3005	0.4130	NA	NA	NA	NA

Grades: 6 - 12

Number of Bedrooms	Number of Units in Building							
	One-Family Detached	One-Family Attached	2 apts	3-4 apts	5-9 apts	10-19 apts	20-49 apts	50 or more apts
1	0.0166	0.0152	0.0144	0.0184	0.0138	NA	0.0037	0.0070
2	0.0962	0.0935	0.0961	0.0818	0.0995	0.0971	0.0734	0.0710
3	0.2816	0.2569	0.3470	0.3200	0.2644	0.5543	0.2147	0.3257
4	0.4504	0.3279	0.2845	0.5004	0.3741	NA	NA	NA
5	0.5515	0.2755	0.3642	0.4173	NA	NA	NA	NA

Comments on the Use of These Multipliers

To obtain an estimate of the population impact of development, multiply the appropriate multiplier by the number of units of that type. Comparison of the "demographic multipliers" contained in Appendix A illustrates how important unit characteristics can be when attempting to predict the likely local impact of new housing developments.

While the use of state averages to estimate likely population and fiscal impacts can be very useful, these multipliers can mask significant variation at the local level and result in imprecise forecasts. Using the data contained in Appendix A, we compared the actual number of school-age children in three of the six case communities[20] examined by Nakajima et.al (2007) to the number predicted by statewide averages. In two cases (Sherwood Forest in Sandwich and Buckingham Estates in Wilmington) our demographic multipliers predicted 17 and 13 school-age children respectively (within confidence intervals that had upper bounds of 23 and 17). In actuality, these two developments were home to 40 and 23 school-age children, significantly more than predicted. In the third case (Edgemoor Circle in Wellesley) the actual number of school-age children residing in the development was 4, well under the predicted number of 9 (with an upper bound estimate of 10).

[20] The other three communities were not examined because we did not have information on the size of the units (in bedrooms).