Joint Center for Housing Studies

Harvard University

Tax Reform and Sprawl

Thomas Davidoff
Sauder School of Business
University of British Columbia

September 2013

HBTL-05

Paper originally presented at *Homeownership Built to Last: Lessons from the Housing Crisis on Sustaining Homeownership for Low-Income and Minority Families* – A National Symposium held on April 1 and 2, 2013 at Harvard Business School in Boston, Massachusetts.

The author wishes to thank Chris Herbert, Jennifer Molinsky, and participants at the Homeownership Built to Last symposium, seminars at the Tinbergen Institute, Maastricht University, and the London School of Economics for helpful discussions.

Introduction

This paper discusses links among three familiar developments in US housing markets over the last quarter century: ongoing "sprawl" of housing units away from dense locations towards suburbs, federal support for homeownership, and low consumer price inflation and interest rates.

Recent discussions about the role of the US government in the homeownership boom and bust of the 2000s have emphasized the 1977 Community Reinvestment Act and implict and explicit support for and pressure on Fannie Mae, Freddie Mac, and the Federal Housing Administration. However, several among the more significant increases in federal support for homeownership occurred within the Tax Reform Act of 1986 (TRA86). TRA86 was wide-ranging and designed to lower tax rates on investors while broadening the base of income and capital gains taxes by reducing exemptions and tax expenditures. Follain and Ling (1988), Poterba (1992a), and Poterba (1992b), among others, discuss key features of the reform that affected the relative financial appeal of owner occupancy versus landlord/tenant relationships. As discussed below, compression of marginal tax rates, slowing of depreciation, and limitations on the use of negative taxable income from investment properties all conspired to make investment in rental housing considerably less attractive after TRA86 than before.[1]

Because rental housing is most commonly multifamily housing, changing ownership incentives should lead to a change in the structural composition of new units. A first contribution of this paper is to show that the predictions of the earlier papers on TRA86 have been borne out empirically. The quarter century during which the depreciation and tax loss provisions of TRA86 prevailed has been remarkable for its low level of multifamily housing production. Figure 1 plots US Census estimates by year of the fraction of US housing units that are owner occupied. Figure 2 plots Census estimates of the monthly fraction of all US housing units for which building permits were issued that were inside buildings with more than one unit (the "multifamily share"). These two figures show a clear trend break around 1986: the multifamily share began a long decline and homeownership started an unprecedented increase.[2] In sections 1 and 2 below, I take some steps to show that there was a causal effect of these provisions, but features of the economic environment around 1986 make causality difficult to establish rigorously.

The second contribution is to establish a high frequency link between the housing tenure of newly built units and urban sprawl. Because rental homes are more commonly multifamily

[1] Low Income Housing Tax Credits were introduced as part of TRA86 in recognition of these adverse effects, but the number of units created each year is small relative to total supply and the program is commonly oversubscribed.

[2] The Census data are drawn from the Current Population Survey. While ownership bottoms out around 1986, growth accelerates for several years thereafter.

than single family (Coulson and Fisher(2011)), rental homes will typically feature more housing units per unit of land than owner occupied homes. In the "monocentric city" model of urban land use (e.g. Wheaton (1977)), land uses with higher ratios of structure to land area will support higher rents per unit of land on locations with relatively short commutes. Glaeser and Kahn (2010) and others have observed the significance of owner-occupancy to sprawl cross-sectionally, but here the link is across time.

Figure 4 plots a measure of the extent of how sprawling new housing units are against time, with the y-axis measuring sprawl as closest to the origin. The sprawl measure is described and rationalized in Section 2 below. We find again that there is a break at 1986, with development occuring in less dense locations that require longer commutes thereafter.

Section 1 briefly describes tax incentives for owner versus rental housing, and how these were affected by TRA86, and then presents regression results consistent with a contributing causal role for TRA86 in the large shift towards single family housing. Section 2 describes data used to measure sprawl and presents some evidence of empirical links among tenure choice, structure type, and sprawl. Section 3 concludes.

1. Housing Tenure and Federal Taxes

The same home is treated differently under federal tax rules depending on whether the home is owner-occupied or rented from a landlord. On the rental unit, the tenant has no federal liability.[3] Landlords pay tax on rental income net of mortgage interest, property taxes, insurance, maintenance, and federally specified depreciation of structures. Investment in the property adds to the depreciable basis. Upon sale, landlords face a capital gains tax on the difference between the property's depreciated basis and the net resale value.

Owner-occupiers owe no tax on the implicit rental income they enjoy from living in the home. They may not deduct depreciation and are commonly able to avoid capital gains taxes. Owner-occupiers may deduct mortgage interest and property taxes, but these deductions only have value to the extent they exceed the standard deduction available to all households.

Ignoring risk and real home price growth, the rental dividend rate net of maintenance expenses and property taxes should be approximately equal to the nominal interest rate i minus expected inflation g. The mortgage interest rate may be written as the nominal interest rate plus a default and other contracting premium k. Assuming landlords defer sale for a sufficiently long period as to render the capital gains tax negligible, and that they take

[3] They may be able to deduct some fraction of space for professional use.

on 100% loan-to-value debt finance, their taxable income per dollar of home value would then be:

$$T_l = \underbrace{[i-g]}_{\text{net rent}} - \underbrace{[i+k]}_{\text{mortgage interest}} - \underbrace{\delta}_{\text{depreciation}}, \tag{1}$$

$$= -\left[\underbrace{g}_{\text{price growth}} + \underbrace{k}_{\text{rate spread}} + \delta\right]. \tag{2}$$

where δ is the depreciation rate.

For fully leveraged owner-occupiers, whose deductions are limited by the standard deduction S, taxable income per dollar of property value p is:

$$T_o = \min\left(0, -\left[i + k + \tau_p - \frac{S}{p}\right]\right). \tag{3}$$

Comparing expressions (1) and (3), landlords are relatively tax advantaged when inflation is a large fraction of the interest rate and when deprecation is large. Homeowners receive larger tax benefits from owning when there is a small standard deduction. As observed by Follain and Ling (1988), for the moderate income consumers who are most typically indifferent between owning and renting, inflation and real price appreciation will provide more tax benefits to a landlord than to an owner occupier. This is because landlords are drawn from the highest end of the income distribution and hence face higher marginal tax rates and because moderate income homeowners commonly do not itemize deductions. For this reason, a flattening of marginal tax rates will make owner-occupancy relatively more attractive than renter-occupancy.

TRA86, which was a major overhaul of the tax code, included several features that directly affected the returns to landlords and owner occupiers. First, marginal tax rates were compressed. While tax rates for lower earners did not fall, the top marginal rate fell from 50% to 28%. Because taxable income was very commonly negative for rental real estate (see, e.g. Samwick (1996)) prior to 1986, this compression in federal income tax rates reduced the tax benefit of being a landlord. Reducing rates on high-income potential homeowners was unlikely to affect tenure choice as dramatically on the household side. Cross tabulations of 1990 Census data drawn from the IPUMS sample reveal the pattern of homeownership rates and average sum of first mortgage payments and property taxes among owners for married, recently moved households shown in Table 1. Potential deductions were significantly smaller for owners whose incomes made them likely to be close to indifferent between owning and renting and whose choices are presumably the most important for determining the ownership rate.

A second salient feature of TRA86 was to limit the use of negative taxable income from real estate investments. Prior to 1986, tax shelter partnerships were an important source of financing for rental real estate. Under TRA86, only corporations could offset other "active" income with losses from real estate, which were deemed "passive" for all individual investors. This provision was softened somewhat to allow professional real estate managers to use losses more widely in the early 1990s, but high-income amateur investors never regained their ability to use depreciation (and their tax rates fell greatly).

A third component of TRA86 was to sharply reduce the present value of depreciation allowances. In the early 1980s, landlords could deduct the fraction of property value attributable to structures over 15, 18, and 19 years, and a declining balance method was used, which served to move forward in time nominal depreciation allowances. At a time of high interest rates, this form of acceleration was significant. TRA86 increased the deprecation lifetime to 27.5 years, and switched the method of depreciation to straight line. Table 2 reproduces calculations in Gravelle (1999) of the present value of different depreciation regimes over time.

In sum, these provisions had small effects on homeowners and generated large increases in tax liability to real estate investors. Appendix A presents a numerical example in which a typical homeowner's tax incentive for ownership was reduced by $140 per year by TRA86 on a home worth $72,500, but a landlord on the same property would have seen an increase of $2,876 in first-year tax liability.

Figure 5 plots the time series of first-year depreciation and inflation tax shields to landlords, with each multiplied by the prevailing top federal marginal tax rate. We find that depreciation and the total tax shield jump downward after 1986. Inflation, which jumps down in the early 1980s and remains low thereafter, is calculated as the prior year's US Consumer Price Index growth. This first year approximation ignores owner-occupier taxes, recognizing that for marginal owner/renters, changes to this value have been very small relative to those for landlords. Low frequency movements over time in this measure of tax preference to investors bear a striking resemblance to long term movements in the multifamily share of new construction.

There is a strong correlation between housing tenure and structure type. Coulson and Fisher (2011), using the 2009 American Housing Survey, find that 87% of single family units are owner-occupied, whereas 86% of units in multiple unit structures are renter-occupied. We thus expect to find that the downward jump in tax preferences to relative landlord tax preferences should be associated with a decline in the multifamily share of new construction, as emphasized by Follain and Ling (1988), Poterba (1992a), and Poterba (1992b). Because single family homes are more land-intensive than multi-family homes, we also expect that rental homes will out-bid single family homes for more convenient locations within metropolitan areas. We thus expect to see a reallocation of permitting activity from densely settled areas to more remote locations within metropolitan areas as the multifamily share of building permits declines. We may also see a shift in permitting from densely settled, largely coastal, metropolitan areas hospitable to multifamily housing towards more sparsely settled metro areas.

1.1. Time Series Evidence on TRA86 and Single- vs. Multifamily Housing

The US Census publishes monthly building permits issued for the US dating back to 1960. The Census has also published annual building permits for over 10,000 permitting jurisdictions since 1980. Both series differentiate between single family units and units located in multifamily buildings, but not directly between owner and renter units. Figure 2 plots the fraction of newly permitted housing units that were in buildings with more than one unit, by month, for the years 1960 through 2010. Figure 3 plots all US housing permits over the same period, and Figure 5, as described above, plots the time series of depreciation and inflation tax shields.

Table 4 presents regression estimates concerning these time series, which are summarized in Table 3. Following Cutler (1988), I deem the reforms in TRA86 to have been unknown to the market prior to November, 1985, and known to the market after May, 1986. I thus explore changes in permitting between the year clearly before the reforms became law and the year clearly after. The dependent variable is the log fraction of US building permits that are multifamily. Comparing the coefficients on the period before reform to the coefficient on the period after reform in column (1), we find that conditioning only on time, there is a significant decline of roughly 20% in multifamily permitting around TRA86. Conditioning on log backward-looking 1-year CPI inflation, first-year depreciation allowance, and marginal tax rate, we find that nearly 80% of time series variation can be explained, and that the effect of being before or after the tax reform almost entirely disappears down to an insignificant 2%.[4] Thus, there was a large and significant downward jump in the multifamily share around

[4]Standard errors are Newey-West with 24 monthly lags. Results are essentially identical if everything is aggregated to an annual level, 2-year differences are taken, and observations are confined to non-overlapping odd years. However, with only 22 observations, statistical inference is not meaningful. Dickey-Fuller / Phillips-Peron unit root tests reject the unit root at 2% for the multifamily series, and 1% for the regression residuals.

TRA86, and consistent with theoretical considerations, the entire drop can be explained by the drop in the top marginal rate, by reduced depreciation, and by declining inflation at that time.

The time series data are thus consistent with a causal role for changes in tax incentives for landlord/tenant relations in the decline in the multifamily share of new construction that persisted through the recent housing boom. However, it is difficult to rule out other explanations. Macro conditions not measured in regression specification (1) of Table 4 might be highly correlated with the tax measures. For example, the decline of the Savings and Loan industry and oil crash had devastating impacts on construction, and in particular on multifamily construction in Texas. Texas, which held a non-trivial share of building permits in the early 1980s boom, had roughly proportional total and multifamily permitting shares of all US residential construction in 1985, at approximately 12%, but the multifamily share dropped considerably farther than the overall share in 1987. Oil prices could also have played an important role in the decline in Texas, but do not explain patterns in the 2000s. Given very high real oil prices in the late 2000s, suburban single family development should not have peaked at the same time if oil were a dominant driver of structure and location choice.

Some comfort in terms of regional effects is provided by Figure 6 which shows the mean ratio of multifamily to all permits by year, across all jurisdictions issuing permits, with equal weighting on all jurisdictions. This mean ratio is not affected by shifts in regional shares, and shows a sharp drop in the multifamily share starting in 1986. Consistent with the decline in multifamily housing came a decline in newly-constructed rental units. In 1990 (per tabulations from IPUMS census data), the fraction of homeowners in units that were fewer than five years old (primarily built after 1986), was 65%. The fraction in units built 5-10 years prior to 1990, before TRA86, was 60%. Similar results hold for the 1980 census, which makes sense in light of the very high multifamily share at the start of the 1970s. For the 2000 census, the numbers are 77% versus 74%. For the 2010 American Community Survey the comparable figures are reversed at 71% ownership for units built after 2005 (after the single family crash) and 76% for units built before 2005.

A slow-moving trend also likely played a role in increasing homeownership: the aging of the baby boom generation. This group came into adulthood and household headship in the 1970s and 1980s, thereby increasing demand for rental housing (and multifamily units). As this group aged, they have increased demand for homeownership. While this phenomenon cannot explain the break in multifamily share around 1986, it surely plays a role in persistently low multifamily construction share through the 2000s.

To rule out alternative explanations for the changes around 1986, it would be attractive to exploit cross-sectional variation in changes in tax incentives. Such variation is not easy to find, however. State taxes are ultimately paid to the state of the investor's residence, not the property address, and syndication of tax loss partnerships commonly crossed state lines. We might expect coastal markets, where land is a larger share of value, to have seen smaller declines in multifamily share, because depreciation is less important in these markets. In fact, this was the case around 1986, but these markets saw relatively very large price increases, confounding identification. The example provided in Appendix A suggests that variation in state taxes and itemization on the owner side are unlikely to have made large differences to the change in tax incentives induced by TRA86.

2. Did Reduced Multifamily Construction Share Lead to Sprawl?

We have seen that changes in tax preferences driven by inflation, depreciation rules, and marginal income tax rates have coincided with a long-term decline in multifamily permitting share. The next question is whether or not sprawl increased after 1986, and whether TRA86 can plausibly claim a causal role. The proper definition of "sprawl" is a matter of controversy and active research. On environmental grounds, sprawl may refer to the increase in travel generated when residences are located far from central places of work, retail, and entertainment. Another definition of sprawl refers to the proliferation of "subcenters" or "Edge Cities." Developing new residences far from most other residences will presumably make multiple subcenters of work and entertainment a likelier outcome than a single large center.

To measure the "smartness" of growth, or the opposite of sprawl, I develop a proxy for convenience of new residences to familiar urban land uses:

1. Starbuck's outlets as of 2012,
2. Employment (measured at the ZIP code level) as of a 1994 Census survey,
3. Housing units (also at the ZIP code (zcta) level) as of the 2000 Census.

The index of convenience G for a community grows with the jurisdictions' proximity (measured as described in equation (4) below) to these three land uses. Starbucks outlets are well-known to occupy valuable and high-traffic real estate, but 2012 locations (the earliest readily available via Internet search) may be poor proxies for average convenience over the last quarter century. I choose earlier measures of employment and housing to capture roughly the middle of the period after 1980 during which disaggregated building permit data is available. Proximity to employment should render a jurisdiction transit- and environmentally-friendly. Proximity to other residences indicates location away from the metropolitan periphery and "greenfield" development.

Proximity to any of these three types of central places individually may be a controversial choice, but it is helpful to know that the correlation of the centrality measures (described below) is .87 between proximity to jobs and proximity to employment and .91 each between proximity to Starbucks and either jobs or employment.[5]

Mathematically, I define the smartness of growth as follows. If each of Starbucks outlets, ZIP code (centroid) residences, and ZIP code (centroid) employment, located at β has N_β of its type (N_β jobs or housing units, N_β is always one for Starbucks outlets, for which I have individual location data), then the locational quality of jurisdiction j is measured as:

$$G_j = \sum_{b=1}^{3} \log \left(\sum_{\beta \in b} \frac{N_\beta}{d(\beta, j)} \right). \tag{4}$$

In (4), b indexes the three land uses, $d(\beta, j)$ is the distance between any location β where land use b is found and the centroid (via US Census) of the jurisdiction j. G_j is thus large when jurisdiction j is located near a large number of jobs, Starbucks, or other residences, and small when distant to these uses.

Two facts provide comfort that G_j is a reasonable measure of the locational quality of jurisdiction j. First, familiar places appear to be suitably ranked. For example, Manhattan's score is 1.62, Los Angeles City's score is .73, and the city of Riverside CA, has a score of -.10. Second, the elasticity of mean miles travelled to work across communities within metropolitan areas with respect to the gravity measure is approximately -.75 and highly significant.

Figure 7 plots by year the median among 18 large metropolitan areas of the correlation by year between G_j for jurisdictions in that metropolitan area and the total number of building permits issued within a jurisdiction.[6] This median correlation measures the extent to which a typical metropolitan area changes in the extent of sprawl over time: a higher correlation between the locational quality G_j and the number of permits in a given year indicates "smarter" growth. Figure 7 shows a clear decline in the smartness of growth within metropolitan areas around 1986, although a larger decline occurred in the recession of the early 1990s. The recovery out of the early 1990s recession leads to an increase in the smartness of growth, but as with the multifamily share, the recovery and boom periods

[5]The latitude and longitude of all Starbucks outlets in select US metropolitan areas are plotted at `http://davidoff.sauder.ubc.ca/metros.pdf`. These plots show clearly very different extents of sprawl in metropolitan areas such as New York, Phoenix, San Francisco, and Dallas.

[6]The 18 metropolitan areas are selected based on always having a non-trivial number of multifamily and single family homes built and having more than two reporting jurisdictions in every year since 1980.

feature considerably less smart growth than occurred in the early 1980s.[7]

Changes in the locational quality of jurisdictions in which development takes place can be decomposed into two sources. First, metropolitan areas that are on average more centralized may see changes in their share of national new construction. Second, within metropolitan areas, development can shift from central to peripheral jurisdictions. The decline of multi-family housing should have generated reductions in locational quality on both dimensions, and there is no simple theoretical argument as to which effect would be more pronounced.

Table 5 presents such a decomposition of changes to the locational quality of jurisdictions in which development takes place over time. Denoted by p_{jt} the number of permits issued in jurisdiction j at time t, the first column presents the quantity $\sum_j \frac{p_j G_j}{\sum_j p_j}$, or the permit-weighted average gravity score among all US jurisdictions. The second column presents $\sum_j \frac{p_j \bar{G}_k}{\sum_j p_j}$, $\bar{G}_j$ is the mean gravity for the metropolitan area in which jurisdiction j is located. Column (2) thus indicates shifts over time in whether more compact (typically coastal) or more sprawling metropolitan areas saw greater relative permitting share. The third column presents the mean across all metropolitan areas m of the within-metro gravity score $\sum_{j \in m} \frac{p_j G_j}{\sum_j p_j}$. Column (3) thus illustrates shifts over time in reallocation between peripheral and more centrally-located jurisdictions within metropolitan areas.

Between 1980 and the cycle peak around 2006, we find that permitting was reallocated both from metropolitan areas with high average convenience to other metropolitan areas (column (2)) and from relatively central jurisdictions to more peripheral jurisdictions (column (3)). The between-metropolitan reallocation is largely driven by changes around 1984-1992, which may relate to the oil crash. Within-metropolitan reallocation exhibits a long, slow trend, but most of the within-metropolitan effect occurs between 1985 and 1990, consistent with an important role for TRA86. As with the national multifamily share, we see a peak before 1986, a trough around 1983, and a highly incomplete recovery through the recent home price and construction boom.

The variation within metropolitan areas is not large, suggesting that the locations where permitting occurs are not highly sensitive to changes in the multifamily share. However, even the roughly 1.5% difference in the gravity score within metropolitan areas between the boom around 1985 and that around 2005 has economic significance. A one-percent reduction in gravity within metropolitan areas is associated with a .75% increase in miles commuted in the small number of states for which commuting distance at the jurisdiction level is available from a special Census tabulation. Reducing miles driven by .75% would have considerable environmental value.[8]

---

[7]The increase in G without an increase in multifamily share during the early 2000s could have resulted from a reallocation of single family homes to denser locations in response to rising land values.

[8]The more widely available commuting time measure is a poor measure of sprawl, since suburban traffic

Considerable reallocation of permitting across metropolitan areas has occurred over time. Column (1) of Table 5 shows that overall gravity jumped sharply around the passage of TRA86, but then fell sharply in the 1989-1993 permitting slump and has not recovered since. Two important sources of this reallocation were the oil bust in generally-sprawling Texas and the accelerating home price boom in more densely settled California and the Northeast. When these coastal markets' booms turned to bust in the recession, overall and metropolitan mean weighted average gravity scores plunged. The coastal share of all building permits is plotted against time in Figure 8. The failure of coastal markets to recover permitting share may well have to do with the decline in overall multifamily share. Figure 9 shows that the fraction of multifamily permits issued to the coastal markets did recover after the recession. This pattern does not seem obviously consistent with coastal markets' making zoning regulations relatively stricter over time, since fiscal zoning would support single family homes over multifamily homes.[9] The correlation between ownership and structure type is of course imperfect, and a rising fraction of new coastal multifamily housing is owner occupied.

3. Conclusions

Rental housing, and therefore multifamily housing, became a much smaller part of overall construction after the Tax Reform Act of 1986. The multifamily share is remarkably highly correlated with tax incentives for high wealth investors. Low marginal rates, low inflation, and diminished depreciation allowances can statistically explain away almost all of the roughly 20 percentage point decline in the multifamily share of new building permits between 1985 and 1987. To the extent that increased homeownership is a goal of federal policy, these changes have been helpful. 1986 represents a turning point in the history of homeownership rates in the US. However, it appears that there have been environmental costs associated with an increase in the single family share. Larson et al. (2012) estimate that single family homes use 20% more residential electricity than multifamily homes, and residential energy represents roughly 7% of all US energy use. If the time series evidence is to be believed, changes in tax preferences induced a 20% increase in the share of housing that is single family. Multiplying this by the roughly 1/3 of all US housing units built since 1986 suggests an energy and emissions cost of $20\% \times 7\% \times \frac{1}{3}$ or roughly 1/2 percent of all US energy consumption.

Glaeser and Kahn (2010) emphasize that coastal metropolitan areas are more energy

moves more quickly than urban traffic.

[9] One could argue that jurisdictions dominated by renters would be less supportive of tight zoning, so that the data are not flagrantly inconsistent with such an explanation of changing regional permitting shares.

efficient than others. Density is sufficiently high on the "Acela Corridor" to support mass transit, and the California Coast offers an energy efficient climate. The data presented in Figure 8 is consistent with a causal role for TRA86 in reducing the construction share of the coastal markets. The fact that the coastal share of multifamily housing recovered much more strongly than the single family and overall share make the decline in overall multifamily construction a more plausible explanation than an increase in regulatory intensity.[10] Unfortunately, the fact that the oil Bust, Wall Street boom, and multifamily-unfriendly tax reform occurred simultaneously make causality difficult to establish.

If the federal government wanted to increase the rental or multifamily share of new units, it is not clear which policy tool would be most suitable. The extremely generous depreciation allowances that prevailed prior to TRA86, which foster over-investment in rental housing, are presumably not the most efficient tool. Indeed, the availability of large tax losses to real estate investors, partly a 1981 response to a recession, was among the motivating factors behind the design and passage of TRA86. A tax on the implicit dividend on owner housing would be preferable, but is likely not implementable. As we have seen, low marginal tax rates among households who are likely close to indifferent between owning and renting make changes to owner mortgage interest deductibility likely a weak policy tool.

[10] See Davidoff (2010).

References

N. Edward Coulson and Lynn M. Fisher. Structure and tenure. Working paper, Pennsylvania State University, 2011.

David M. Cutler. Tax reform and the stock market: An asset price approach. *The American Economic Review*, 78(5):111071117, 1988.

Thomas Davidoff. What explains Manhattans declining share of residential construction? *Journal of Public Economics*, 94(7-8):508514, 2010.

James Follain and David Ling. Another look at tenure choice, inflation, and taxes. *AREUEA Journa*l, 16(3):207229, 1988.

E.L. Glaeser and M.E. Kahn. The greenness of cities: carbon dioxide emissions and urban development. *Journal of Urban Economics*, 67(3):404418, 2010.

Jane Gravelle. Depreciation and the taxation of real estate. Report to congress, Congressional Research Service, 1999.

Charles Himmelberg, Christopher Mayer, and Todd Sinai. Assessing high house prices: Bubbles, fundamentals and misperceptions. *Journal of Economic Perspectives*, 19(4): 6792, Fall 2005.

William Larson, Feng Liu, and Anthony Yezer. Energy footprint of the city: Effects of urban land use and transportation policies. *Journal of Urban Economics*, 72(2):147 159, 2012.

Peter Linneman. What should stabilized multifamily cap rates be? Wharton Real Estate Review, 9(2):6977, 2005.

James Poterba. Taxation and housing: Old questions, new answers. *American Economic Review*, 82:237242, May 1992a.

James Poterba. *Tax Reform and the Housing Market the Late 1980s: Who Knew What, and When Did They Know It?*, pages 230261. 1992b.

Andrew A. Samwick. Tax shelters and passive losses after the tax reform act of 1986. In *Empirical Foundations of Household Taxation*, NBER Chapters, pages 193233. National Bureau of Economic Research, Inc., May 1996. URL http://ideas.repec.org/h/nbr/nberch/6241.html.

William Wheaton. A bid-rent approach to urban housing demand. *Journal of Urban Economics*, 4, 1977.

Table 1: IPUMS 1990 Statistics for married households that moved within the last five years, by income range

Income range	Ownership rate	Mortgage + Property Tax Mean
0-10,000	.33	3,795
10,001-20,000	.40	3,887
20,001-30,000	.51	5,315
30,001-40,000	.61	7,179
40,001-50,000	.70	9,054

Figure 1: US Census estimates of fraction of housing units that are owner occupied

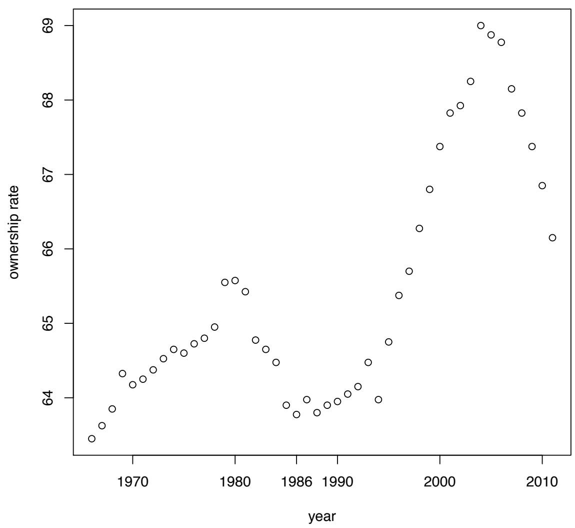

Figure 2: Fraction of all permitted US housing units issued to units in buildings with more than one unit. US Census estimates.

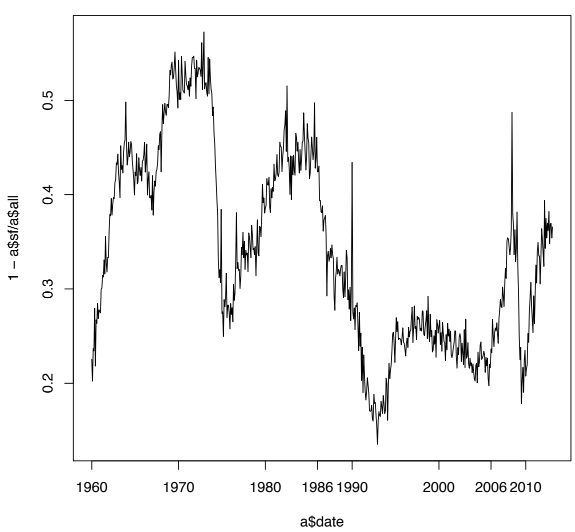

Figure 3: Number of permitted US housing units. US Census estimates.

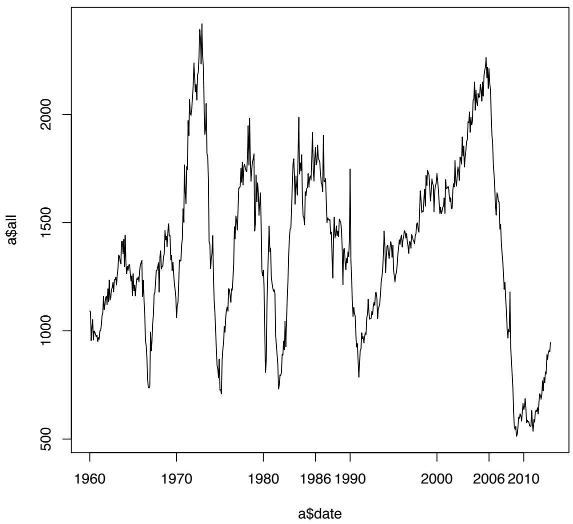

Figure 4: Mean across metropolitan areas of average "gravity" score of building permits. Gravity score is the mean among weighted average distance of jurisdictions to Starbucks outlets in 2012, employment in 1994, and housing units in 2000.

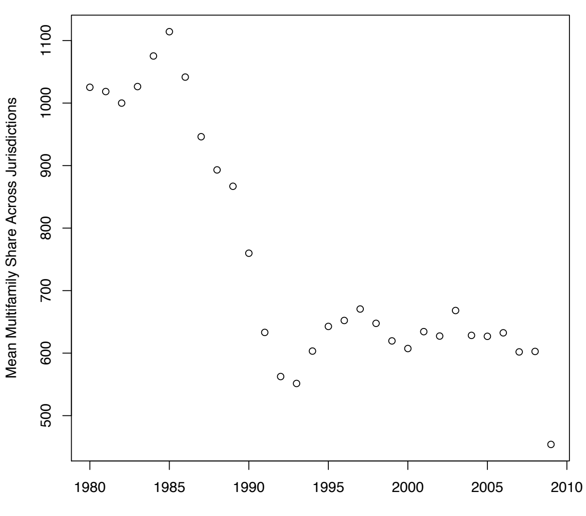

Figure 5: First-year Depreciation and inflation tax shields multiplied by average top federal marginal income tax rate. Sources: Tax Policy Center, “Historical Individual Tax Parameters”, lagged CPI inflation, and Gravelle (1999)

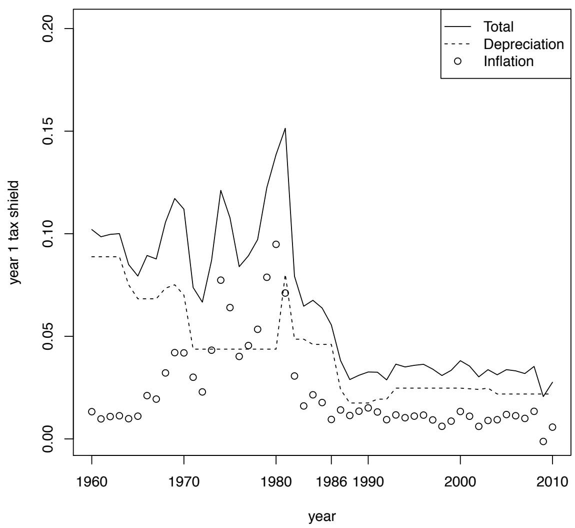

Figure 6: Mean ratio of multifamily to all permits, across all jurisdictions, by year

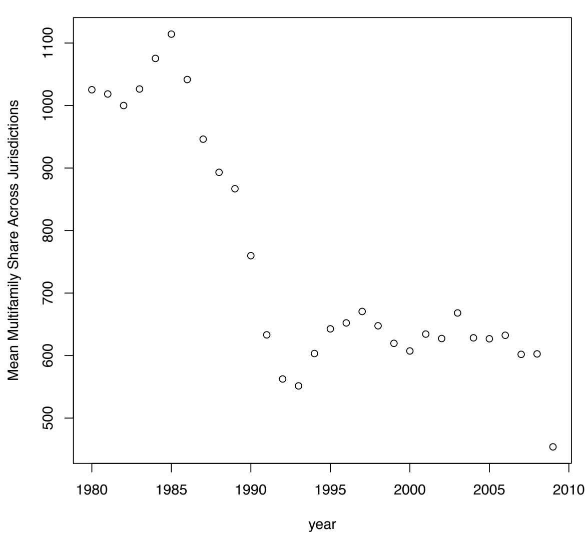

Figure 7: Mean correlation between building permits issued and locational quality within 18 metropolitan areas. Locational quality measured as the mean weighted average inverse distance between census tract medians and (1) Starbuck's outlets as of 2012, (2) Zip code employment as of 1994, (3) Housing units as of 2000

Figure 8: Share of all building permits going to the Boston, New York, Los Angeles, and San Francisco Combined Statistical Areas over time

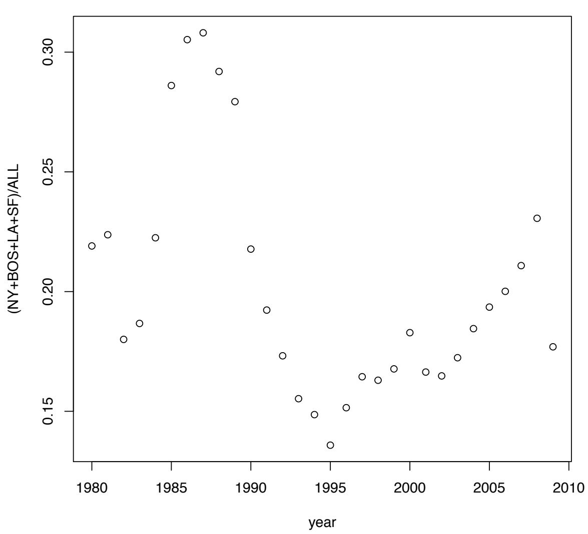

Figure 9: Share of multifamily building permits going to the Boston, New York, Los Angeles, and San Francisco Combined Statistical Areas over time

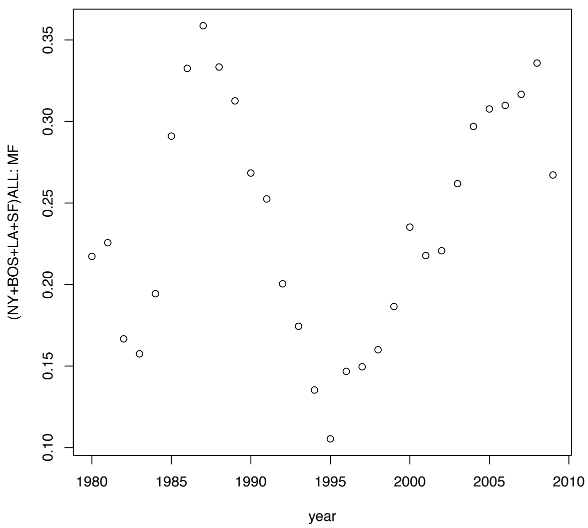

Table 2: From Gravelle (1999): a history of RE depreciation

Years	Depreciation Present Value at 10% discount
1953	0.226
1954-69	0.377
1969-70	0.377
1971-80	0.446
1981	0.572
1982-3	0.522
1984-6	0.507
1987-93	0.378
1994-99+	0.378

Table 3: Summary Statistics: 1960-2006

Variable	Obs	Mean	Std. Dev.
Monthly US Building Permits	552	1,439	352.61
Multifamily Fraction of Permits	552	0.35	0.11
Year-1 Depreciation times top US marginal tax rate	552	0.04	0.02
1-year backward looking CPI growth times top rate	552	0.02	0.02

Table 4: Time series regressions of levels of the fraction of all building permits that are multifamily on Depreciation and Inflation tax shields and indicators for 12-month windows around TRA86 (before November 1985 and after May, 1986, per Cutler (1988). Newey-West standard errors with 24 lags. January, 1960-December, 2006.

	(1)	(2)
constant	35.7886**	31.9101**
	(1.3268)	(2.1636)
Log building permits	0.456**	0.6452**
	(0.038)	(0.0307)
Date	-0.0203**	-0.0178**
	(7e-04)	(0.0011)
Within 12 months before November, 1985	0.2607**	0.0384
	(0.0628)	(0.0479)
Within 12 months after May, 1986	0.0786	0.0219
	(0.0627)	(0.0468)
Log inflation		0.2118**
		(0.0112)
Log Depreciation		0.7125**
		(0.043)
Log top marginal tax rateltop		-1.0743**
		(0.0677)
Adj. R-sq.	0.6	0.79
degrees.freedom	547	544

Table 5: Changes in weighted average density score G_j of building permits 1980 to 2009. Column (1) weights permitting jurisdictions G_j by permits in j divided by all US permits. Column (2) weights metropolitan area mean G_j by metro permits divided by all US permits. Column (3) is the mean across 68 metropolitan areas m of G_j for jurisdictions j in m weighted by permits in j divided by all permits in m.

Year	(1) Overall	(2) Metro level	(3) Within metros
1980	-0.022	0.022	-0.135
1981	-0.020	0.022	-0.132
1982	-0.025	0.010	-0.134
1983	-0.027	0.009	-0.141
1984	-0.023	0.028	-0.140
1985	0.026	0.081	-0.145
1986	0.030	0.096	-0.148
1987	0.041	0.111	-0.147
1988	0.030	0.103	-0.149
1989	0.010	0.092	-0.154
1990	-0.017	0.059	-0.162
1991	-0.041	0.047	-0.158
1992	-0.062	0.039	-0.169
1993	-0.069	0.028	-0.172
1994	-0.074	0.020	-0.169
1995	-0.074	0.008	-0.162
1996	-0.062	0.015	-0.158
1997	-0.052	0.021	-0.160
1998	-0.058	0.022	-0.162
1999	-0.053	0.027	-0.161
2000	-0.035	0.041	-0.159
2001	-0.044	0.031	-0.161
2002	-0.047	0.031	-0.155
2003	-0.057	0.024	-0.160
2004	-0.060	0.026	-0.162
2005	-0.051	0.032	-0.162
2006	-0.019	0.037	-0.155
2007	0.013	0.050	-0.146
2008	0.060	0.067	-0.137
2009	-0.071	-0.003	-0.166

Appendix A: An example of changed tax preferences under TRA86

To see the relative effects of these provisions on a marginal owner or rental home, consider a typical home purchased by a couple earning \$25,000, an income with approximately 50% homeownership among recent movers in 1990, with deductions at the mean for this group of \$5,315 shown in Table 1. For a married resident of Massachusetts with two children under 17, NBER's TAXSIM model generates a federal liability of \$2,567 in 1985 without the mortgage and property tax deductions and \$2,074 with these deductions. For 1987, the figures are \$1,926 and \$1,573. The "difference-indifferences" of taxes without ownership minus taxes with ownership between 1985 and 1987 is \$140. That is, ignoring equilibrium effects on prices, rents, and mortgage rates, TRA86 reduced the tax savings associated with homeownership for this representative itemizing household by \$140 per year. Capitalizing this value at 10% would yield \$1,400 as a present value of the loss in deduction shield to this household between 1985 and 1987.

Turning to the effect of TRA86 on investors, the average home according to IPUMS' 1990 Census tabulations for a household earning \$25,000 that had moved within the last five years was \$72,250, roughly consistent with the mortgage and interest payments for the homeowners considered above given prevailing leverage and rates. Assuming a ratio of depreciable structure cost to value of 80% and a loan-to-value ratio also of 80%, both mortgage debt and the depreciable base of the home would be roughly \$58,000. Assuming the investor paid the top federal rate, their marginal income tax rate fell from 50% to 28% between 1985 and 1987. Assuming the same mortgage and property taxes as paid by the hypothetical owner above, first year depreciation would have been $\$58{,}000\frac{1.75}{19} = \$5{,}342$ in 1985. In 1987, first year depreciation would have been $\frac{\$58{,}000}{27.5} = \$2{,}109$. Assuming rent net of expenses and property taxes divided by price equal to the prevailing real interest rate in 1985, approximately 3%, consistent with cap rate calculations in Linneman (2005), and holding rates constant, taxable income would have been \$2,175 minus \$5,342 depreciation minus approximately \$5,800 in interest (at 10% interest), or roughly -\$9,000 in 1985. Multiplying by a 50% marginal tax rate would have generated a tax loss of roughly \$4,500 in 1985. Adding back (\$5,342-\$2,109) in depreciation would have generated a first year loss of \$5,800 in 1987. Even assuming the passive loss was valued at 100%, at a 28% income tax rate, the tax savings to the landlord would have been just \$1,624. Thus the first year difference in tax savings between 1987 and 1985, even if mortgage rates had been constant and passive losses allowed would have been \$4,500-\$1,624 = \$2,876, roughly double the *present value* of lost deduction shield to an owner occupier.