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Zoning and city revenues: Does euclidean zoning impact cities' Tax Revenues?

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Abstract

This paper is primarily concerned with measuring the impact of zoning for single family residential on city tax revenues within the San Francisco Bay Area. Single family residential zoning acts as a form of Euclidean zoning by restricting zoned land to one type or use. In the wake of decisions of cities such as Minneapolis to end zoning for single family housing, there has been a push for more research into the possible impacts going forward. This paper takes cross-sectional data from 2020 for 101 cities within the Bay Area. To estimate the impact of zoning on city tax revenues, this paper utilizes OLS regression models with robust standard error to help account for heteroskedasticity. The final model used found a negative causal impact of single family residential zoning on tax revenues. It was estimated that if a city had more than 80% zoned for single family residential that they would face a decrease of $82,783,312.90 in tax revenue. These findings were shown to be significant at the 10% level. In addition, multiple control variables were found to have statistically significant impacts on city tax revenues.

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Introduction

Euclidean zoning has been deeply tied to the United States and its development over time. The term Euclidean zoning originates from the Village of Euclid, which won at the supreme court in 1926 in the case Euclid v. Ambler helped expand legal precedent for zoning laws in the United States. Generally and throughout this paper, the term Euclidean zoning is used to denote types of zoning and land use regulation that restricts zoning on a by-use or type basis. This generally involves designating a portion of land for the development of a single type. The reasons for cities choosing to use Euclidean zoning are numerous. However, a considerable criticism of Euclidean zoning that has become further scrutinized is its historical use as a tool for segregation (Trounstine, 2018). Along with more scrutiny being put towards the historical and social impacts of Euclidean zoning, there have been more efforts recently to attempt to measure its economic effects.

One of the most common forms of Euclidean Zoning exists in the form of single family or R1 zoning (Manville et al., 2019). The definitions for single family and R1 zoning can differ from each other and usually depend on the legislative bodies that codify them. Single family zoning generally will restrict development on zoned property to only buildings that are designed for only one family to reside in. This usually excludes mixed-use buildings. Mixed-use buildings are generally buildings where more than one type of building or a multi-use building is legally allowed to be developed. A common example might be multifamily apartment units built upon or adjacent to shops.

In order to address these social and economic calls for concern, more and more cities within the United States have been taking steps to evaluate land use regulations. A primary is in 2019 with Minneapolis announcing an end to single family zoning. This has spurred much

academic interest in this policy choice, and suggested alternatives such as upzoning instead of the complete removal of certain types of zoning (Manville et al., 2019; Wegmann, 2019; Chakraborty, 2020; Kuhlmann, 2021).

As shown, research proves to be incredibly important as more zoning and land use regulation arrives across cities in the United States. These policies have large economic impacts and could benefit economic analysis. As has been shown to possibly have impacts on both housing supply and housing prices, with the policies in Minneapolis for example projected to increase housing prices by 3%-5% (Kuhlmann, 2021). However, not much research has been put into measuring the effect of single family zoning on a city's tax revenues. This paper aims to help shed light on this, and hopefully provide useful information for future policy decisions.

This paper attempts to follow standard practice in urban economics when attempting to measure the impact of zoning on economic characteristics. Adjacent papers often use regression based models, generally fixed effect or difference in difference models. However, this paper did not have access to panel data. As such this paper will be using ordinary least squares regression based models with robust standard errors to account for heteroskedasticity. This paper will be looking at 101 cities within the San Francisco Bay Area. Important context must also be given that the cities this paper takes data from are subject to proposition 13. Proposition 13 heavily limits property value tax within the state of California. What is likely to be most important to this study in regards to proposition 13 is that it limits assessing taxable property values to set occasions rather than set intervals of time. These occasions include the handing down of property via inheritance and the sale of property.

Using ordinary least squares regression based models with robust standard errors this paper was able to find with its final model more than 90% confidence that cities with more than

80% zoned for single family residential will have an impact on tax revenues. It was found that if a city was more than 80% zoned for single family residential, it would see an $82,783,312.90 decrease in tax revenues for its respective city. Also of note, it was found to be statistically significant that property values impact tax revenues by increasing them by 3 cents for every dollar in property value. This paper also found a strong positive correlation between property value and population, tax revenues and population, and tax revenues and property value.

This paper will continue with a covering of adjacent literature and other findings related to this paper and its research. From there, discussion on economic theory and its expected outcomes will be discussed. Data and methodology will show my data and briefly outline important information about my data. I will also present my models. Continuing my results will show and explain my findings including a majority of my table and figures I found to be relevant and important to further discussion. This follows with a discussion of the results and possible explanations for the outcomes. Finally, I will wrap up and discuss and summarize conclusions and provide my references.

Literature Review

The literature on the impact of zoning on economic factors has varied in its findings. One of the major issues with measuring the impact of zoning regulations on economic factors is the difficulty in obtaining data on zoning regulation (Menendian et al., 2020). Ideally as will be demonstrated throughout this literature review, panel data is frequently used. However, panel data was not available for this paper. While not much literature exists specifically addressing the impact of zoning on tax revenues, there exists plentiful literature covering adjacent impacts on

economic properties by land use and zoning.

An important economic factor that could have implications for local tax revenues is housing supply. Housing supply has existed as a main topic of focus for discourse surrounding land use regulations impacts. It is also deeply important to this paper as houses exist as streams of tax revenue for local economies and a restriction of them could theoretically impact tax revenues. Using difference-in-difference tests, Freemark (2019) found that upzoning within Chicago districts impacted existing housing prices yet had no measurable impact on housing supply over a five year period. This would seem to imply that measures to address Euclidean zoning might not actually increase the total housing supply. This would show evidence against the possibility that zoning restricts new development and thus housing supply then helps bring down prices. However, while supply may remain unchanged housing prices could then by virtue of increasing result in high taxation rates for that given property.

However to contrast these findings, Chakraborty et al (2009) found that by measuring six major U.S. cities' zoning constraints as total numbers of allowed high-density units, that the zoning practiced by local governments constrained development of multi-family units. Common wisdom would then hold that multifamily units could impact local tax revenues by allowing more individuals to be taxed that otherwise might not have resided within the given city. Using regulations as a measure of zoning's impact can also be seen with Jackson (2016), where from 1970-1995 using fixed effects models they measured this relationship between housing supply and land use regulations. The findings point to regulations being liable for reducing residential permits, with a reduction on average of 4%. Once again posing a risk of tightening housing supply and thus the total supply of taxable revenue streams for local governments.

Another important factor that must be considered in this discussion is redevelopment in these zoned areas leading to price increases rather than supply. The phenomenon of increases in housing prices is also found in Kuhlmann (2021). They attempted to predict the future outcome of Minneapolis' decision to eliminate single family zoning using difference-in-difference models. The study found that relative to unaffected neighborhoods, measured neighborhoods face a 3%-5% increase in housing prices. However, it is noted that there is some evidence to point to price increases being due to new potential development options now free from certain zoning restrictions. Similarly, Greenaway-McGrevy et al. (2020) found in Auckland that upzoning saw an associated significant increase in redevelopment premiums. It also was found that the economic potential of a site was a driving force behind its pricing. This helps illuminate the possibility that changing or removing zoning laws will fundamentally change the potential value of property. This would in turn possibly have a direct impact on the tax assessed value of the home influencing potential local tax revenues.

To review these underlying economic findings are integral to keep in mind as tax revenues are analyzed within the context of this paper. These economic conditions might have a real impact on local city tax revenues. With Proposition 13 being such a fundamental part of the taxation code within California, and thus the Bay Area could experience massive jumps in revenue generated in property taxes if new developments were stirred by changing zoning laws. Even if housing supply is not corrected by changes or removal of certain zoning laws the as previously mentioned finding of increased prices would contribute to more tax revenue for local cities. However, there seems yet to be a fully clear consensus on how zoning impacts multiple economic characteristics of cities and towns. With the findings in this paper hopefully more light

can shine on the negative impact of zoning on local cities' tax revenues, and help bolster future work.

Potential Economic Implications and Theory

The underlying economic theory for why zoning might impact local tax revenues heavily relies upon the supply of taxable streams of revenues. As is highlighted by Erfurt (2022), restricting land use to a single function, or in Erfurt's case a single business, drastically underutilized the total square footage of land that could have contained other forms of taxable streams of revenues.

Thus this paper supposes that as zoning for single family residences increases a decrease in tax revenues will be seen. However, on the other hand, there is a possibility that the artificial restriction of developable land through Euclidean zoning could cause inflation in prices through constricting supply. Potentially driving assessed property values up, increasing tax income for local governments more than increasing streams of tax revenue could have. As well of note, population and total property tax are likely to influence one another. As population increases, so would property value to accommodate incoming population numbers, increasing individual streams of revenue for local governments to tax.

Another factor that requires discussion is the new economic opportunity that arises when zoning laws are changed or removed. When upzoning occurs, or removal of Euclidean zoning occurs, the potential properties to be built on a parcel of land opens up. This could mean new opportunity costs for many developers looking to invest in building new infrastructure in these

areas. This could then theoretically drive up housing prices as more expensive properties enter the housing market; this was seen with Greenaway-McGrevy et al. (2020) in Auckland.

Data & Methodology

Table 1 will provide the descriptions of variables, their means, their standard deviations, and their respective labels. To gain insight into the potential relationship between the percentage zoned for single family residential this paper uses cross-sectional data from 2020 from 101 cities within the Bay Area. This paper uses cross-sectional data, while panel data would be preferred it was not available.

For my variables of total city tax revenue, total property value, average property value per person, and total population are each respectively collected from the California State Controller Office. The data comes from the period of time from 2020-2021. As well the definitions and codes used by the California State Controller Office are the ones I used to categorize data to their respective city.

The data collected for median income, employment rate, and number of established businesses all come from the United States Census Bureau. Median income and unemployment specifically are taken from the American Community Survey 5-Year Data for 2009-2021. The data was only taken from the year 2020. Data collected for the number of established businesses comes from the County Business Patterns for 2020.

For the variable of interest in this paper high_zone the data was taken from the Othering & Belonging Institute study in an article titled Single-family zoning in the San Francisco Bay

Area (Menendian et al., 2020). The data for this variable comes from 2020; 101 cities in the Bay Area had data available. A major caveat once again with this data is the fact that this is cross sectional and will not allow this paper to use panel data. The article also contains the working definition to define single family residential zoning, this being "land designated for detached, single-family residential land use (one or two dwelling units per parcel of land) in both low and high density. This includes single-family homes and two-family detached dwellings" (Menendian et al., 2020; Manville et al., 2019).

This paper will use simple OLS regressions with robust standard errors to measure the relationship between single family residential zoning and city tax revenues. Using forms of regression based modeling is standard for this type of work as evidenced by previous literature (Glaeser & Ward, 2009; Jackson 2016; Freemark 2019; Kuhlmann, 2021). Again while typically fixed effects or difference-in-difference models are used, this paper uses cross-sectional data from a single year which will not allow the use of those regression techniques. Robust standards errors are important to the model as it does demonstrate heteroskedasticity when running a Breusch–Pagan/Cook–Weisberg test on the third model. The significant p-value being chi2(1) = 1174.12 and Prob > chi2 = 0.0000.

Table 1: Means, Standard Deviations and Variable Descriptions

Variable	Mean (Std. Deviations)	Description
tax_rev	1.29e+08 (5.78e+08)	Total City Tax Revenue

high_zone	.6930693 (.4635207)	Binary variable = 1 when single family zoning is higher than 80%
prop_val	1.62e+10 (3.40e+10)	Total Property Value
estab	886.1089 (581.7317)	Number of Established Businesses
unemployment	4.424752 (1.491872)	Percentage of Unemployment
avg_prop	418085.8 (979700.9)	= Property Value / Total Population
income	148294.5 (54061.31)	Median Income Up to $250,000
pop	67986.49 (135428.2)	Total Population

Controls here are important to properly measure the relationship between zoning and tax revenues and prevent omitted variable bias. This is especially important given it is common knowledge that individuals and assessed property values are taxable sources of revenues for cities.

The first model used in the first two regressions measures only the relationship between zoning and tax revenues. The model is as follows: $tax\_rev_i = \beta_0 + \beta_1 high\_zone_i \mu_i$

The following model is used for regression three through four. This model includes controls variables to account for omitted variable bias, the model for these regressions is as follows: $tax\_rev_i = \beta_0 + \beta_1 high\_zone_i + \beta_2 prop\_val_i + \beta_3 estab_i + \beta_4 unemployment + \beta_5 avg\_prop_i + \beta_6 income_i + \beta_7 pop_i + u_i$

Results

Table 2 represents a correlation matrix. This correlation matrix reveals high levels of correlation between multiple variables. Primarily there seems to exist a large positive correlation between; total property value and population, population and total tax revenues, and total property value and total tax revenues.

Table 2: Correlogram of Dataset

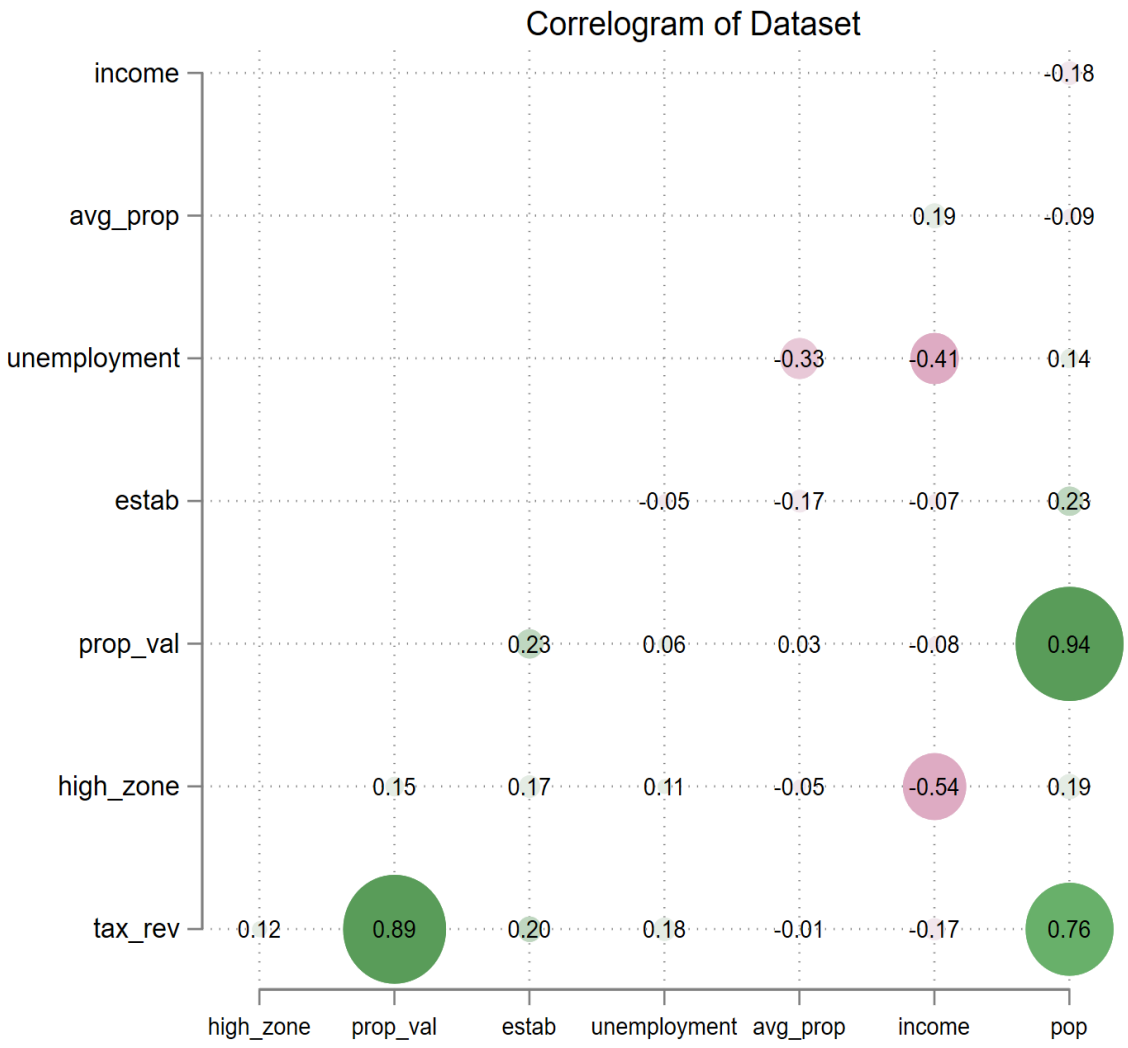

Figure 1: Scatter plot of Property Value and Population of Cities w/Populations < 250,000

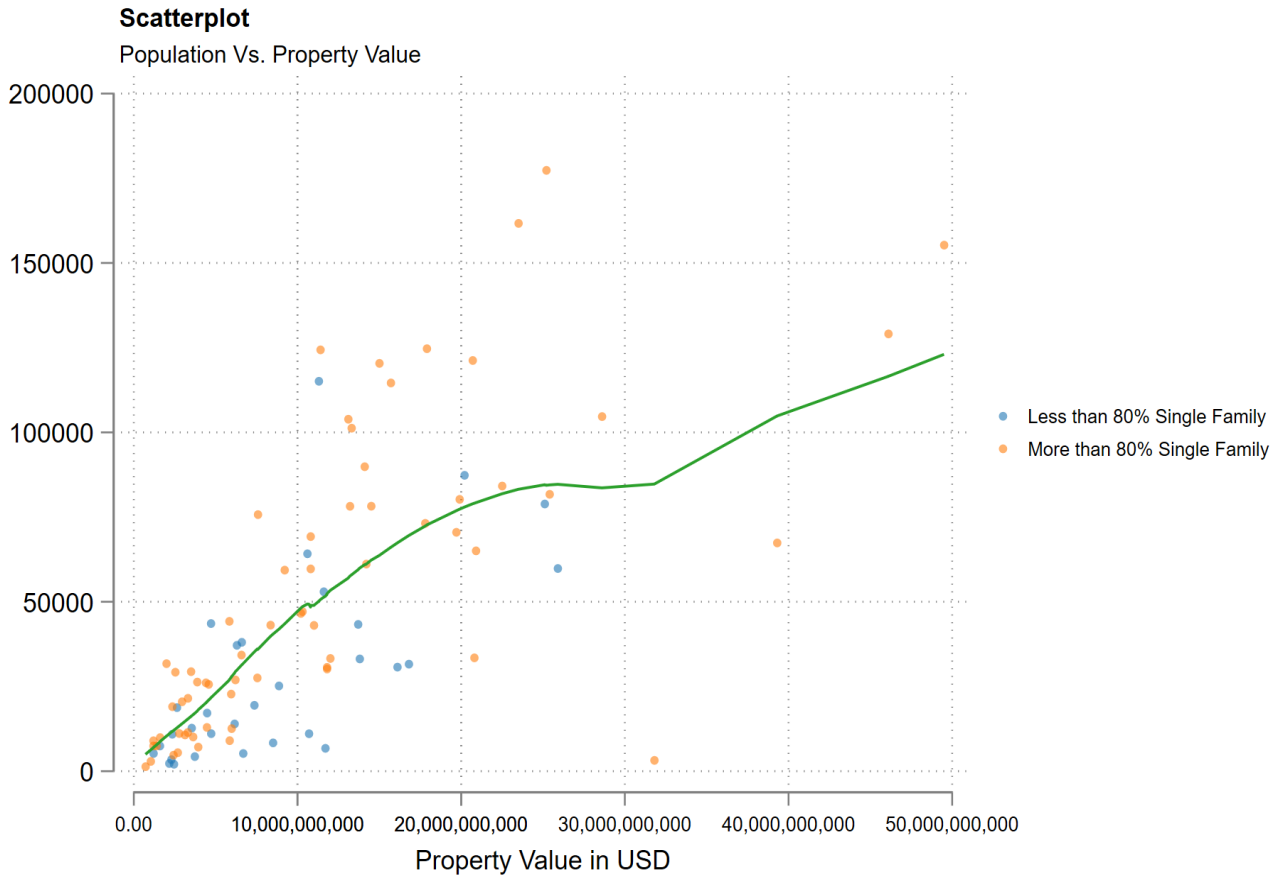

Figure 1 expands upon the indicated correlation within table 2. It shows a scatter plot of 98 cities between Total Population and Total Property Value. As well there is a line of locally weighted regression. The figure also represents whether a city has 80% or more zoning for single family residential by using different colors for plots.

Figure 2: Scatter plot of Tax Revenues and Population of Cities w/Populations < 250,000

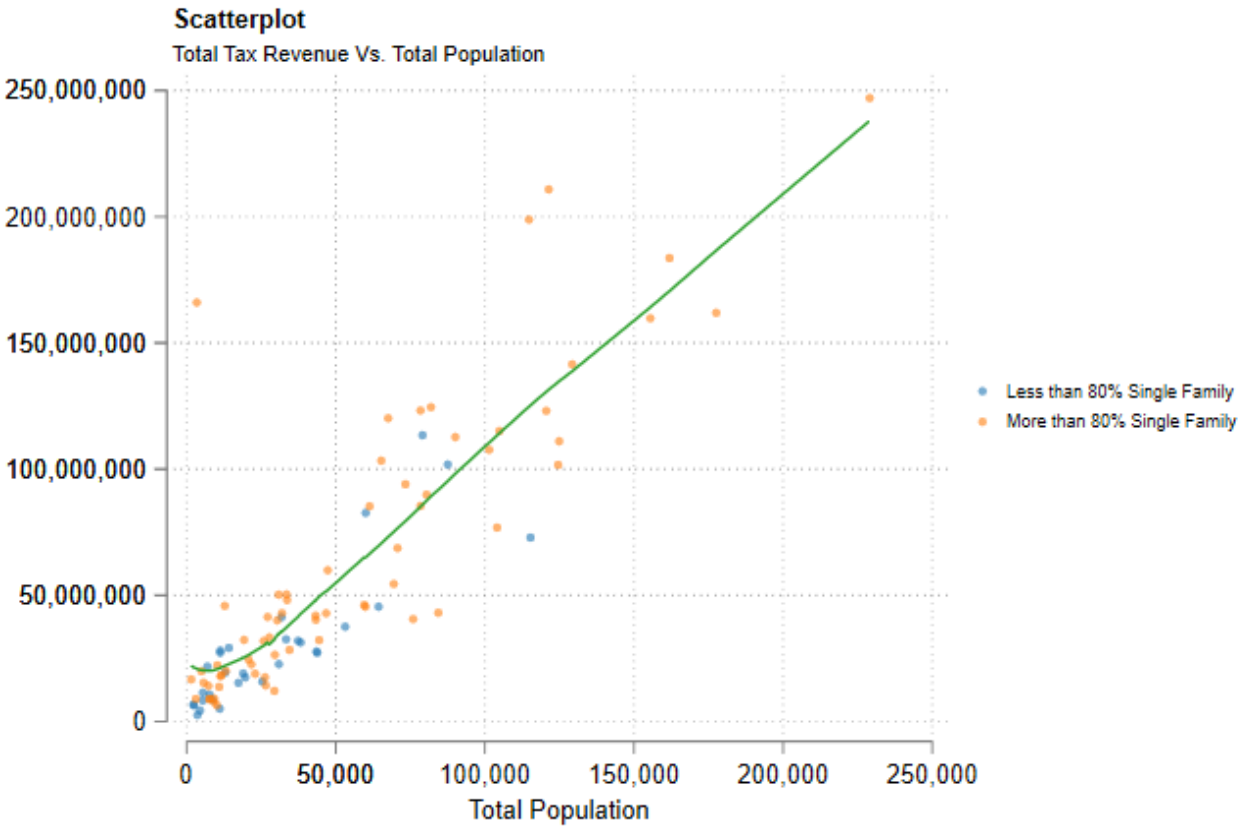

Figure 2 like Figure 1 expands upon the indicated correlation within Table 2. It also demonstrates a scatter plot of 98 cities between Total Tax Revenues and Total Population. Contains a line of locally weighted regression of 98 cities. Plot colors represent whether a city has above or below 80% zoning for single family residential.

Figure 3: Scatter plot of Tax Revenues and Total Property Value w/Populations < 250,000

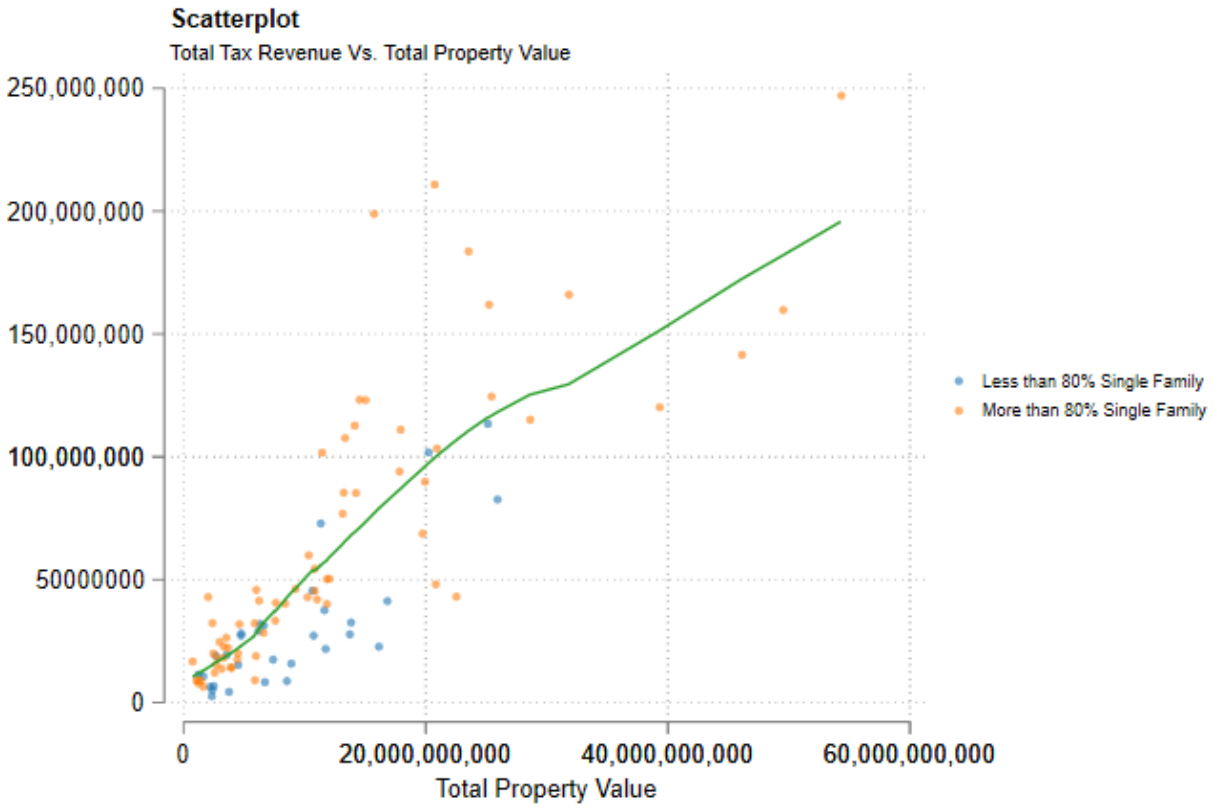

Figure 3 follows the same format as Figures 2 and 1. This includes a scatter of 98 cities between Total Tax Revenues and Total Property Value, including a line of locally weighted, and plotted colors that represent whether a city has above or below 80% zoning for single family residential.

Within table 3 is the output of the previously demonstrated models both with and without robust standard errors (RSE).

Table 3: regression models

	(1)	(2)	(3)	(4)
	OLS	OLS w/ RSE	OLS	OLS w/ RSE

high_zone	143355644.0	143355644.0*	-82783312.9*	-82783312.9*
	(124443498.6)	(82931956.5)	(49334887.1)	(42137074.0)
prop_val			0.0296***	0.0296***
			(0.00173)	(0.00545)
estab			-1880.3	-1880.3
			(34235.7)	(38336.6)
unemployment			47035436.4***	47035436.4***
			(14631678.4)	(15739975.3)
avg_prop			-47.50**	-47.50**
			(21.66)	(18.83)
income			-1709.7***	-1709.7***

			(460.7)	(524.4)
pop			-3887.8***	-3887.8***
			(438.0)	(1273.5)
_cons	30072585.6	30072585.6***	37816157.9	37816157.9
	(103600188.4)	(4930490.7)	(134785075.9)	(107111057.2)
N	101	101	101	101
R^2	0.013	0.013	0.903	0.903
adj. R^2	0.003	0.003	0.896	0.896

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The final regression model #4, shows with a 10% level of significance that if a city has more than 80% zoned for single family residential, that city is estimated to lose $82,783,312.90 in tax revenue. Beyond a 1% level of significance, it is shown that property value will cause tax revenues to increase by 2.96 cents for every dollar of property value. The number of business establishments does not appear to be causally related to city tax revenues as well as the constant.

Somewhat peculiarly, at over a 1% level of significance it is demonstrated that for every percentage increase in unemployment city tax revenues will grow by $47,035,436.40. The average property is found to be statistically significant at the 5% level. For every dollar increase in the average property value, tax revenues will proceed to fall by $47.50. The remaining variables are all statistically significant beyond the level of 1%. Income seems to estimate that as median income increases, tax revenues fall by $1709.70 for every dollar. As for population, as it increases, tax revenues fall by $3,887.80 for each additional person. The adjusted r squared for the final model was rather large and estimates that the model accounts for 89.6% of the variance of tax revenues.

Discussion

Referring to Table 2, the high correlation between property value and population might be explainable based upon the general idea that a high population requires more homes and thus property to sustain its population. As well property value tends to be higher in urban environments, which are more densely populated, which could also contribute to population and property value being so strongly positively correlated.

As for property value and population being fairly strongly positively correlated, this is also supported by Figure 1. The correlation might be due to more streams of taxable revenue as the population increases, as has been discussed previously. It can also be seen in figure 1 that generally, cities with higher population and higher total property values are cities with more than 80% of zoning. While a good portion of cities with less than 80% single family zoning are clustered closer to 0. When it comes to tax revenues, the same pattern is repeated. These results

can be seen repeated across three scatters in all three figures. Since property value is already taxed for its value, it would then make sense that property value would be positively correlated to tax revenue.

Moving on to Table 3, At a 90% confidence level, it can be said that high single family residential zoning brings down tax revenue by $82,783,321.90. This seems to support the economic theory cited previously and the original hypothesis going into this regression. This effect might even be greatest when measured over the course of a longer period of time, when lags in development time can be accounted for. A large concern here again is the fact this was done with cross sectional data thus unable to allow for over time estimation that might have helped highlight these development lags.

As for unemployment generating additional tax revenue, it is harder to explain. One explanation that might account for this anomaly is that unemployment could be found higher in areas of more total property value such as dense urban areas. If this was to be the case it would help explain why property value could be higher generating larger tax revenues, while the unemployment rate remains higher.

When it comes to average property value it is estimated that for every one dollar increase in the average property value of a city tax revenue goes down by $47.50. This estimation result could possibly be due to property values size within communities. Communities with high average property value could be smaller due to cost of entry to reside there. Thus total revenues might be relatively lower. This explanation could also help support why it is estimated that as median income increases by one dollar tax revenues decrease by $1.709.70.

However, this is complicated when looking at the impact of population on tax revenues.

Median income is estimated to have a statistically significant impact on tax revenues causing it to decrease by $3,887.80 for every additional person.

Another notable finding in this regression I wish to draw attention to is the impact of property valuation on tax revenues. For every dollar in property value, $2.96 is added to tax revenues. This is surprising given that as H&R block has found there is not one county in California that has an Effective Real Property Tax Rate above 1% or 1 cent on the dollar (Freeland, 2022). This seems to imply that given the findings in the model that beyond just the additional property taxes earned as the value increases there are additional benefits in tax revenues that accompany this increase.

Conclusion

As highlighted in the literature review, many studies have looked at individual economic impacts of zoning on specific economic characteristics such as housing supply and housing price. However, this study set out to measure specifically the impact of zoning on tax revenues. The paper, while attempting to do so, was able to find statistically significant estimations of the impact of zoning on tax revenues for cities in the Bay Area.

While I am satisfied with the outcome of this paper I believe there is much room for improvement going forward. Immediately what stands out as the most important priority for future research is acquiring panel data. As mentioned, the impacts of zoning on tax revenues could be better measured when taking into account the full effect of the lag from rezoning or removing zoning to new development. Looking back on my data, I would definitely try to find more population-adjusted data.

Returning to the findings, I believe they could help guide future policy decisions. When it comes to zoning, this paper has shown it does have a negative impact on tax revenues. I would encourage less use of Euclidean zoning such as single family residential. However, I believe there is still a large room for debate over what is the best route to achieve this. The primary options are either upzoning or completely un-zoning the land. Beyond the very important estimations found was also the statistically significant estimation of property value on tax revenues. This would certainly push me to recommend legislation that helps increase property value within a given city. Unsurprisingly then I think a good way to do this is to rework Proposition 13 and allow more frequent tax evaluations of property.

This leads me to suggest a major research topic I feel could be worth attempting. I believe it could be worthwhile to pursue more research into how much Proposition 13 could be putting a constraint on tax revenue for cities within California. As well, more research could be done measuring other types of Euclidean zoning's impact on tax revenues. While I believe single family zoning might be a decent estimator for Euclidean zoning in general it would certainly be better served if more data was available that included more types.

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