

Final Report

Daniel Malone and Margo La Clair

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I. Topic

Crime is a complex topic, and there is no academic (or popular) consensus on either the reasons for criminal behavior or the appropriate interventions to curtail such behavior. One theoretical intervention is reducing crime via changing the “built environment”—incorporating a spatial element to crime. This broadly ranges from land policy (zoning) to more targeted planning and landscaping interventions that focus on surveillance, access control, and target hardening (see Carter et al, 2003 and Katyal, 2002). The latter has a long history: in 1285, King Edward I decreed that bushes should be removed along highways to deter robbery (Anderson et al., 2013). Controlling crime via the built environment is an attractive policy, as a zoning change might be more efficient (or more politically palatable) than throwing more resources into enforcement and punishment.

Theoretically, exclusionary zoning practices can help create concentrations of poverty, which could create an environment where crime is more likely. The actual academic literature on the interaction between land policy and crime do find some associations (generally surrounding the debate over the merits of mixed-use residential zoning), but there are few empirical studies (Anderson et al. blame this on a lack of data). One of the more influential non-empirical works is Jane Jacobs’ 1961 book *The Death and Life of Great American Cities*, which advocated for including commercial businesses in residential areas to reduce crime. Empirical investigations produced mixed results. Anderson et al.’s (2013) study of Los Angeles finds that commercial-only zoned areas are associated with higher crime rates, and that zoning changes that including residential parcels in prior commercial-zoned areas is associated with a reduction in crime. Browning et al. (2010) finds a curvilinear association between density – both commercial and residential – and assault and homicide.

The current housing crisis has caused many cities, and even states, to either consider or enact zoning reform. These reforms (such as the 2023 state-wide reforms in Montana) often effectively eliminate single-family residential zoning by allowing multi-family development (ranging from ‘granny suites’ to triplexes) in what was formally single-family residential neighborhoods. This push is also coming from the White House; the Biden infrastructure bill includes incentives for municipal zoning reform. Are these zoning changes associated with any changes in crime, at either the state or individual municipal level?

II. Data Sources and Notes on Data Limitations

Our primary data comes from two sources: the FBI and the University of California, Berkeley. We use the FBI’s crime data to observe crime at a state and city level for the years 2020-2022. This dataset has variables on population, total crime, and a further breakdown of types of crime (generally sorted into personal, social, and property). We then merge the University of California, Berkeley’s data on municipal-level zoning reform for the year 2021 onto this crime dataset. We also used secondary data sources to merge on state-wide zoning changes (Meyershohn). Unemployment data on a state-wide level was provided by the United States Department of Agriculture.

Due to data limitations from the FBI dataset, we are restricted to the years 2020 to 2022. Furthermore, the Covid-19 pandemic deeply impacted the reporting at a state-wide level. For example, California does not have consistent data from 2020-2022. None of the cities in California report crime statistics for 2020. If we had additional years of crime data before the Covid-19 disruptions, we might have more options for dealing with the missing data (i.e. able to impute these missing values) . However, since our dataset is so limited, we had to exclude cities that had incomplete reporting data. After we filtered for having crime statistics in all three years, we are left with 44 states. We note that the distribution of cities within these states is not consistent. Some states, such as Michigan, are very well documented; while others, like Illinois and Pennsylvania have one and two reporting cities, respectively. Future research might look for more data, in order to better capture the prior trends, as well as look at the long-term impact of zoning changes.

Further, the crime statistics used are on a agency wide scale; they are notably not using the more widely used FIPS code system. This makes it difficult to append additional datasets for use as control data, since many datasets use FIPS codes, and are typically not on a city to city basis. Additionally, since housing reform happened so recently, data for certain variables which would have been useful as control variables, such as poverty rates and educational attainment, are simply not available. The econometric analysis will therefore utilize state and year fixed effects to control for geographic variation.

III. Data Cleaning

The data cleaning processes consisted of merging the three years of FBI data and converting it into tidy format. Of particular note is the FBI statistics for the year 2022, which was formatted slightly differently from the 2021 and 2020 data sets. [*MEL note - track down this information to see WHY*]. All the information was in the right place, so to speak, but there were unseen differences between the column names of the datasets, and some of the labels were a row above their location in the other datasets, which created a small challenge when merging. This was resolved by manually entering the offending names to the correct location and then setting the column names of the 2022 dataset equal to the column names of the larger 2021-2020 dataset, and then merging.

We then determined which cities had data for all three years of our event study and filtering for only those cities. We then merged on the zoning data, which we had cleaned.

Due to the comparatively low number of cities who passed zoning reform in 2021, we were able to visually inspect the University of California, Berkeley’s summaries to ensure that these laws involved the loosening of zoning - not increasing zoning restrictions. This merged file comprises our master dataset. Then, we merged on data on state-wide zoning changes to our master dataset. Only Oregon and Maine passed state-wide zoning reforms during our limited time span: Oregon in 2021 and Maine in 2022. We recognize that, without 2023 data, we cannot really form any conclusions about the impact of this reform in Maine.

IV. Data Transformations

We created a log transformed variable for the population per city. This was done to avoid heavy skew in the case, as the range of populations per city in the United States can vary from the hundreds to the millions and, naturally, have varying numbers of criminal citations. To avoid problems in interpreting the data visually, we created an additional variable which log-transformed population. It is easier to interpret crime per capita rather than total numbers of citations in a city, so we created additional variables which calculated the total, property, personal and societal crime per capita, as well as multiplying these values by 1,000 to report the crime rate per 1,000 people. Some of the municipalities in our dataset have very low populations, so there are some extreme outliers for these calculations.

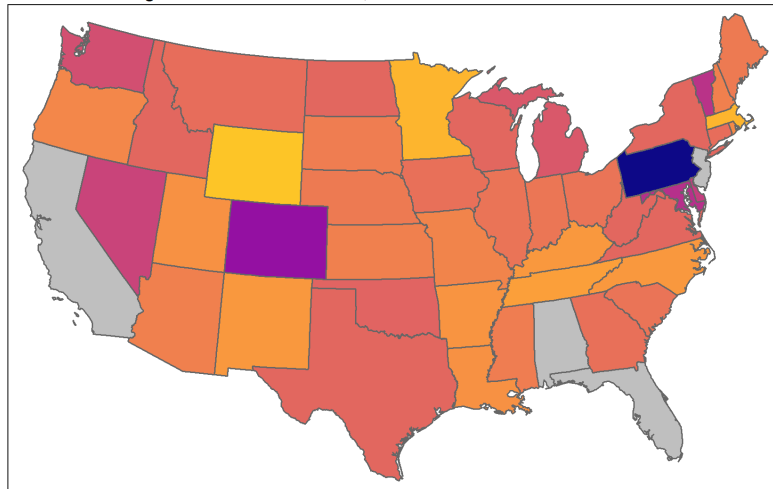
We also created variables which record the average crime rate for each agency, within the time frame of 2020 and 2022. This was done so they may be used during econometric analysis as control variables. This is because the areas which are receiving zoning reforms may be experiencing more crime than areas which are not receiving reforms, and including the average crime rate for each agency would control for differences in preexisting crime rates. Additionally, variables which recorded the average crime rate for each sub-categories defined by the FBI (crime against persons, society and property) were also defined. Variables which defined the change in crime rate for both total crime and each sub-category were also defined.

We created additional dummy variables which reported whether the city in question had zoning reform in 2021, and whether a state in question had zoning reform in that year as well. The average amount of crime across all cities in a state was also calculated and reported in a separate variable called “meanstatecrime”, and the average amount of crime for cities which had a zoning reform versus cities which did not have a zoning reform and reported that as total crime rate. [*MEL note - expand here as well*]

V. Plots and Remarks

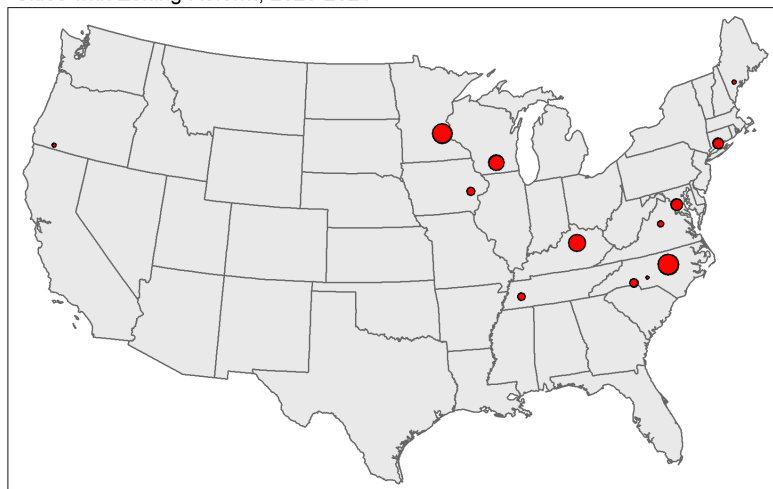
[*MEL note - following end section to be heavily modified*]

Percent Change in Mean Crime Rate, 2020-2022



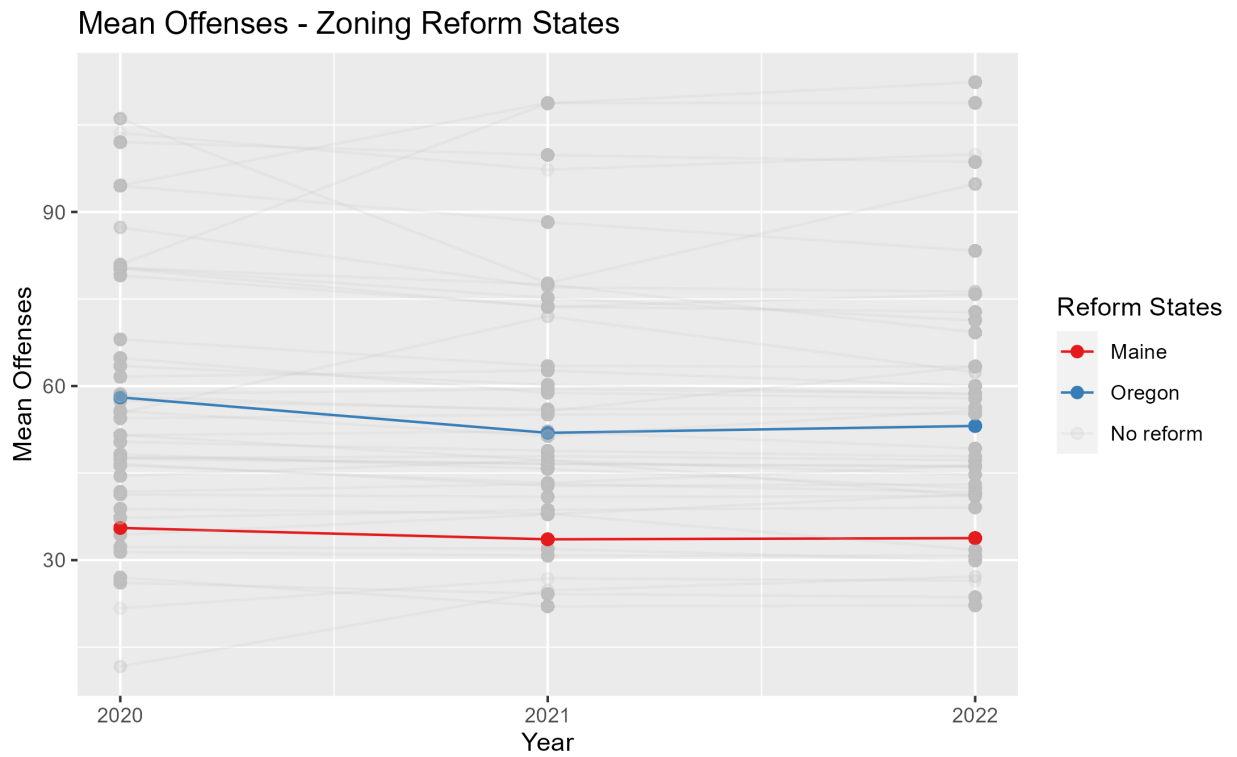
The following plot charts the mean total offenses per all states in our final dataset for 2020-2022.

Cities with Zoning Reform, 2020-2021

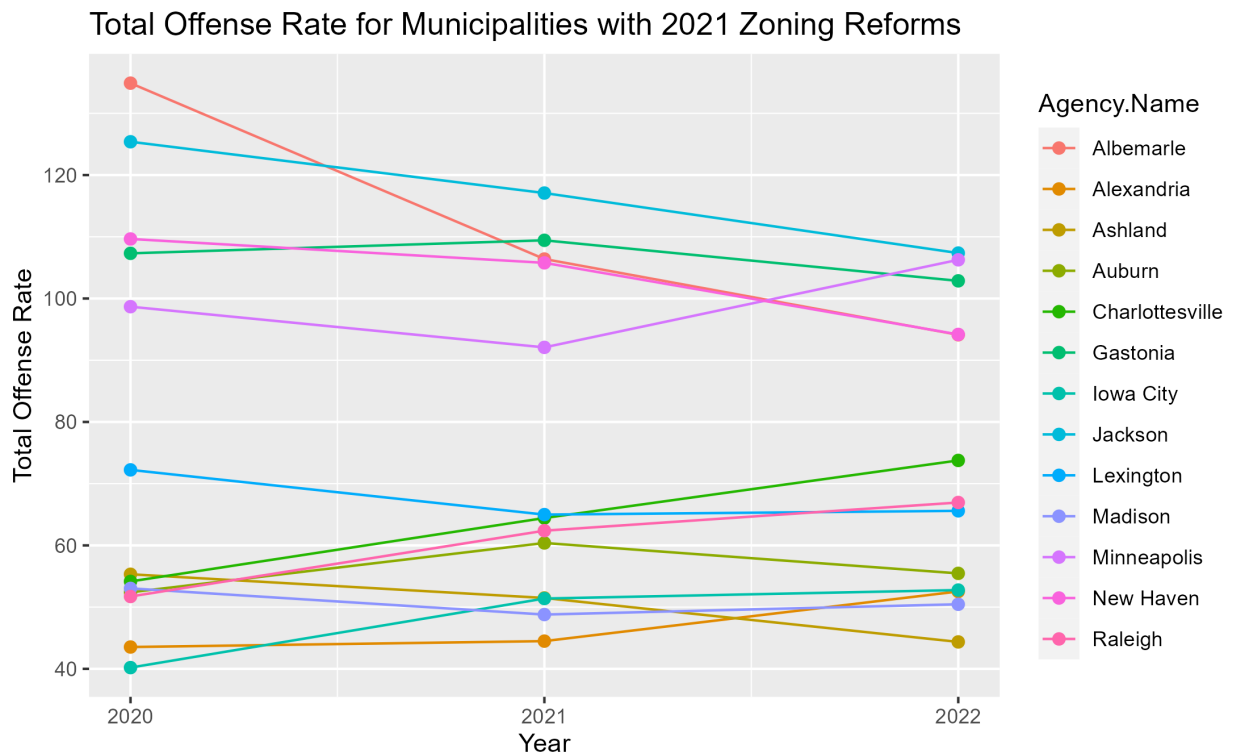


Then, we highlight the two states (noting prior qualification about Maine) that enacted

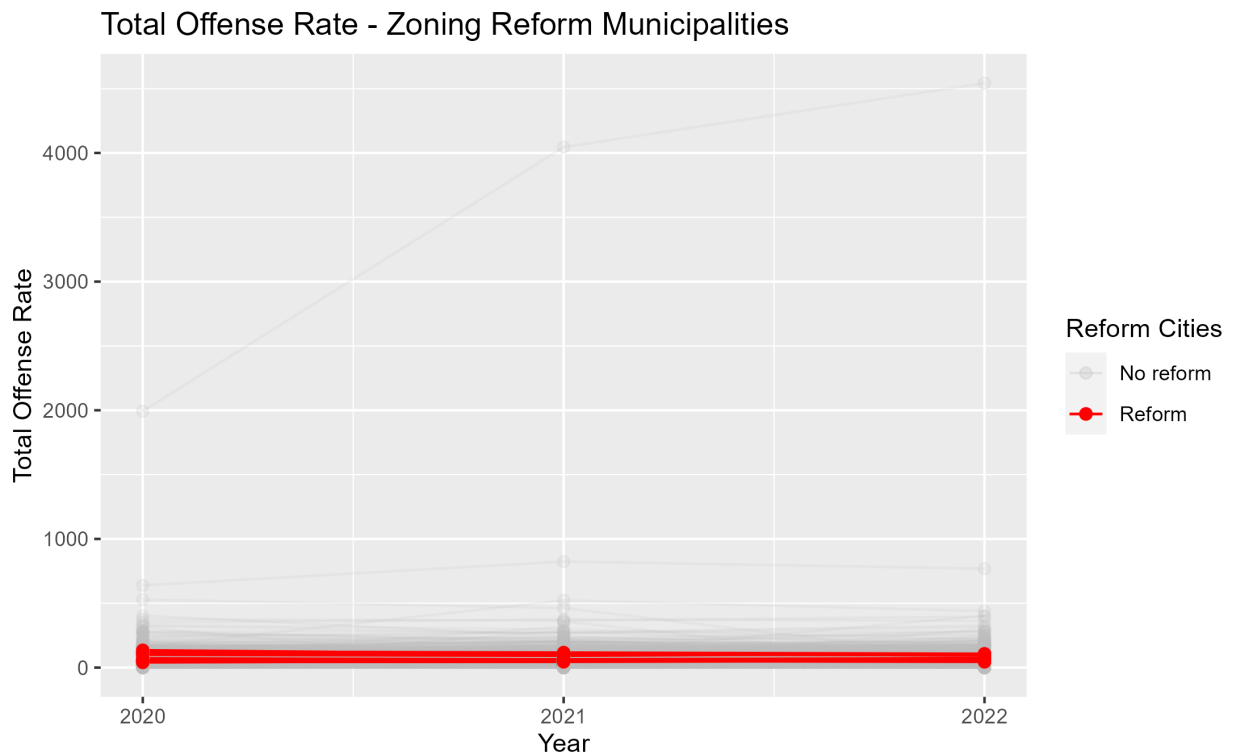
state-wide zoning reform in 2022.



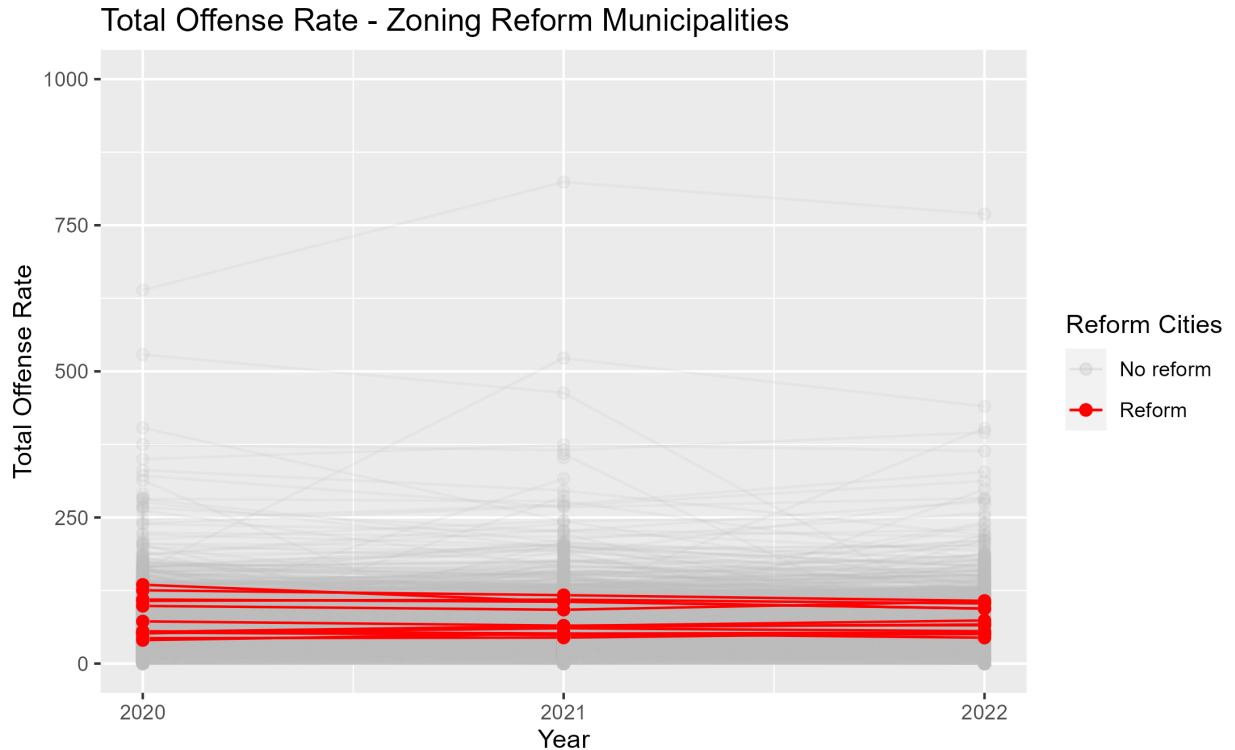
We replicate the same plots for the municipalities that enacted zoning reforms in 2021, looking at their total offense rates.



Interestingly, there seems to be a split within this group: municipalities with high and low rates. Generally, there appears to be a downwards relationship between year and offense rate in the high rate group, and an upwards relationship in the low rate group.



The scale in the prior plot is through off by some extreme rates (coming from small cities, where the population is low). So, the following plot puts in place scale limits - just so we can see the reform cities trends.



The above plots show an interesting split within the municipalities that enacted zoning reform. There are significant issues with the simultaneous lack and abundance of data: we have few years of crime data, and we have magnitudes more data for cities that did not enact zoning reform. We might narrow the focus down to comparing reform/non-reform cities that are geographically close to one another (identified via finding the minimal distance between spatial points), or, more generally, comparing the municipalities to their respective state trends. Within this more narrow focus, we will also want to look at the breakdown between offense types (social, property, persons) to see if there are any relationships or trends there.

. Econometric Analysis

The time frame that zoning reform exists in is far too recent to make any inferences about the effect of zoning reform on crime. However, we can describe the cities which have passed zoning reform and determine if they have a higher crime rate relative to cities which have not passed zoning reform. This would be important to policy makers, because if zoning reform is associated with higher crime rates, it would follow that cities with high crime rates may also have more movements to enact zoning reform. It would also be useful to future researchers studying the effects of changes in zoning laws, as findings of significantly different crime rates and changes in crime rates would impact the efficiency of their analysis models.

The regression formulas use 4 different dependent variables; Total crime rate, crime rate against property, crime rate against persons and crime rate against society. The dependent variables are subdivided in this manner to study the effect of zoning laws on the kinds of crimes which are committed. The primary independent variable in question is reform, which

is a dummy variable which indicates the presence of housing reform in that state or city. The control variables used are the unemployment rate, the mean crime rate for each agency, which controls for a preexisting level of crime in each city, state fixed effects, and year fixed effects. An identical set of regression formulas was run using the change in crime rates as the dependent variables as well.

$$\text{Crime Rate} = \text{Beta0} + \text{Beta1}(\text{Reform}) + \text{Beta2}(\text{Unemployment Rate}) + \text{Beta3}(\text{City Mean Crime Rate}) + \text{Alpha}(\text{State Fixed Effects}) + \text{Gamma}(\text{Year Fixed Effects}) + E$$

	<i>Dependent variable:</i>			
	Change in Total Crime Rate	Change in Crime Against Property Rate	Change in Crime Against Persons Rate	Change in Crime Against Society Rate
	(1)	(2)	(3)	(4)
Reform	9.559 (6.947)	9.465** (4.587)	3.916** (1.679)	-2.809 (2.591)
Unemployment Rate	-1.704 (1.305)	-0.059 (0.862)	-0.021 (0.315)	-1.468*** (0.487)
Mean Total Crime Rate (Agency)	0.242*** (0.007)			
Mean Crime Rate Against Property (Agency)		0.263*** (0.006)		
Mean Crime Rate Against Persons (Agency)			0.014 (0.010)	
Mean Crime Rate Against Society (Agency)				0.123*** (0.009)
Observations	8,714	8,714	8,714	8,714
R ²	0.163	0.198	0.036	0.056
Adjusted R ²	0.158	0.193	0.031	0.051
Residual Std. Error (df = 8665)	38.367	25.335	9.270	14.311
F Statistic (df = 49; 8665)	34.399***	43.583***	6.625***	10.534***

Note:

*p<0.1; **p<0.05; ***p<0.01

As the regressions show, there is no significant relationship between crime rates and zoning reform. However, there is a significant relationship at the 95% confidence level between zoning reform and changes in property crime rates and the crimes against persons rate. What this implies is the impetus for zoning reform may not be an existing level of crime, but cities where the crime rates for property crimes and crimes against persons increase sharply. Movements for housing reform may therefore be associated with shocks in the crime rate.

. Conclusions

Future studies when data of the effects of zoning reform is made available will be able to note that the environment of the different cities are defined by a difference in the change

of crime rates. This may make future studies which are relying on a difference in difference or event time model problematic, since the assumption of parallel preexisting trends may not hold up in these conditions. Researchers following up on this subject would do well to account for the different trends to ensure the accuracy of their findings.

[MEL note - bring up all the interesting things that we could do but cant because we were too early to this policy enactment. Sad, low energy]

. References

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