Minneapolis Saint Paul

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R Markdown

I find that banning single-family zoning laws costs $33,272 smaller than for Minneapolis than Saint Paul. Zoning laws increase housing values.

When zoning laws are taken away, there's a drop in housing prices because there's an increase in the supply of available units.

I examine the effect of banning single-family zoning laws within Minneapolis.

In December 2018, Minneapolis approved a housing plan, Minneapolis 2040, where 70% of the city's land will be banned from single-family zoning laws.

The town approved building non-single-family homes in January 2020. I compared Minneapolis to a neighboring city, Saint Paul, from 2016-2021.

```
setwd('/Users/andrewscpu/Desktop/here/Minneapolis Saint Paul')
#install packages
#install.packages("dplyr")
#install.packages("readr")
#install.packages("tidyverse")
#install.packages("modelsummary")
#install.packages("fixest")
#install.packages("foreign")
#install.packages("lubridate")
#install.packages("AER")
#install.packages("stargazer")
#install.packages("zoo")
#install.packages("ggplot2")
#install.packages("readr")
#install.packages("data.table")
#install.packages("skimr")
#install.packages("scales")
#install.packages("Ecdat")
#library(Ecdat)
library(skimr)
library(scales)
library(ggplot2)
library(modelsummary)
library(AER)
```

```
## Loading required package: car
```

```
## Loading required package: carData
```

```
## Loading required package: lmtest
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
## Loading required package: sandwich
```

```
## Loading required package: survival
```

```
library(stargazer)
```

```
##
## Please cite as:
```

```
##  Hlavac, Marek (2022). stargazer: Well-Formatted Regression and Summary Statistics Tables.
```

```
##  R package version 5.2.3. https://CRAN.R-project.org/package=stargazer
```

```
library(fixest)
```

```
##
## Attaching package: 'fixest'
```

```
## The following object is masked from 'package:scales':
##
##     pvalue
```

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following object is masked from 'package:car':
##
##     recode
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(readr)
```

```
##
## Attaching package: 'readr'
```

```
## The following object is masked from 'package:scales':
##
##     col_factor
```

```
library(tidyverse)
```

```
## ── Attaching packages
## ───────────────────────────────────────
## tidyverse 1.3.2 ──
```

```
## ✔ tibble  3.1.8     ✔ stringr 1.5.0
## ✔ tidyr   1.2.1     ✔ forcats 0.5.2
## ✔ purrr   0.3.5
## ── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
## ✖ readr::col_factor() masks scales::col_factor()
## ✖ purrr::discard()    masks scales::discard()
## ✖ dplyr::filter()     masks stats::filter()
## ✖ dplyr::lag()        masks stats::lag()
## ✖ dplyr::recode()     masks car::recode()
## ✖ purrr::some()       masks car::some()
```

```
library(foreign)
library(lubridate)
```

```
## Loading required package: timechange
##
## Attaching package: 'lubridate'
##
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
library(zoo)
library(readr)
library(data.table)
```

```
##
## Attaching package: 'data.table'
##
## The following objects are masked from 'package:lubridate':
##
##     hour, isoweek, mday, minute, month, quarter, second, wday, week,
##     yday, year
##
## The following object is masked from 'package:purrr':
##
##     transpose
##
## The following objects are masked from 'package:dplyr':
##
##     between, first, last
```

Filter & Name Cities

```
Minneapolis_Saint_Paul <- fread("/Users/andrewscpu/Desktop/here/Minneapolis Saint Paul/Minneapolis_Saint_Paul.csv
")
str(Minneapolis_Saint_Paul)
```

```
## Classes 'data.table' and 'data.frame':   46534 obs. of  7 variables:
##  $ tot_purch_amt : num  153000 192000 276500 256000 329000 ...
##  $ sale_month    : int  4 10 10 10 10 10 10 10 10 10 ...
##  $ cty_twnshp_nme: chr  "St. Paul" "St. Paul" "Minneapolis" "Minneapolis" ...
##  $ crv_nbr       : int  544001 554748 568613 570199 571677 571683 571693 571697 571704 571706 ...
##  $ df.sale_year  : int  2017 2016 2016 2016 2016 2016 2016 2016 2016 2016 ...
##  $ dates         : IDate, format: "2017-05-16" "2016-10-26" ...
##  $ quarter       : chr  "Q2-2017" "Q4-2016" "Q1-2017" "Q4-2016" ...
##  - attr(*, ".internal.selfref")=<externalptr>
```

```
Saint_Paul = filter (Minneapolis_Saint_Paul, cty_twnshp_nme == "St. Paul")
Minneapolis = filter(Minneapolis_Saint_Paul,cty_twnshp_nme == "Minneapolis")
```

Workable year and quarter format

```
Minneapolis$dates <- as.yearqtr(Minneapolis$dates, format = "%Y-Q%")
Saint_Paul$dates <- as.yearqtr(Saint_Paul$dates, format = "%Y-Q%")
```

Cap Sales Amount at two standard deviations away from the mean, $1,550,045

```
Minneapolis$tot_purch_amt = pmin(Minneapolis$tot_purch_amt, 1550045)
Saint_Paul$tot_purch_amt = pmin(Saint_Paul$tot_purch_amt, 1550045)
```

Create quarterly aggregate means

```
aggregated_data_M=aggregate(Minneapolis$tot_purch_amt,by=list(Minneapolis$dates),FUN= mean)
aggregated_data_SP=aggregate(Saint_Paul$tot_purch_amt,by=list(Saint_Paul$dates), FUN= mean)
aggregated_data_SPM =aggregate(Minneapolis_Saint_Paul$tot_purch_amt,by=list(Minneapolis_Saint_Paul$dates), FUN= m
ean)
```

Graph of Minneapolis

```
head(aggregated_data_M)
```

```
##   Group.1        x
## 1 2016 Q4 293878.4
## 2 2017 Q1 350796.5
## 3 2017 Q2 310442.3
## 4 2017 Q3 306332.2
## 5 2017 Q4 330474.7
## 6 2018 Q1 721633.0
```

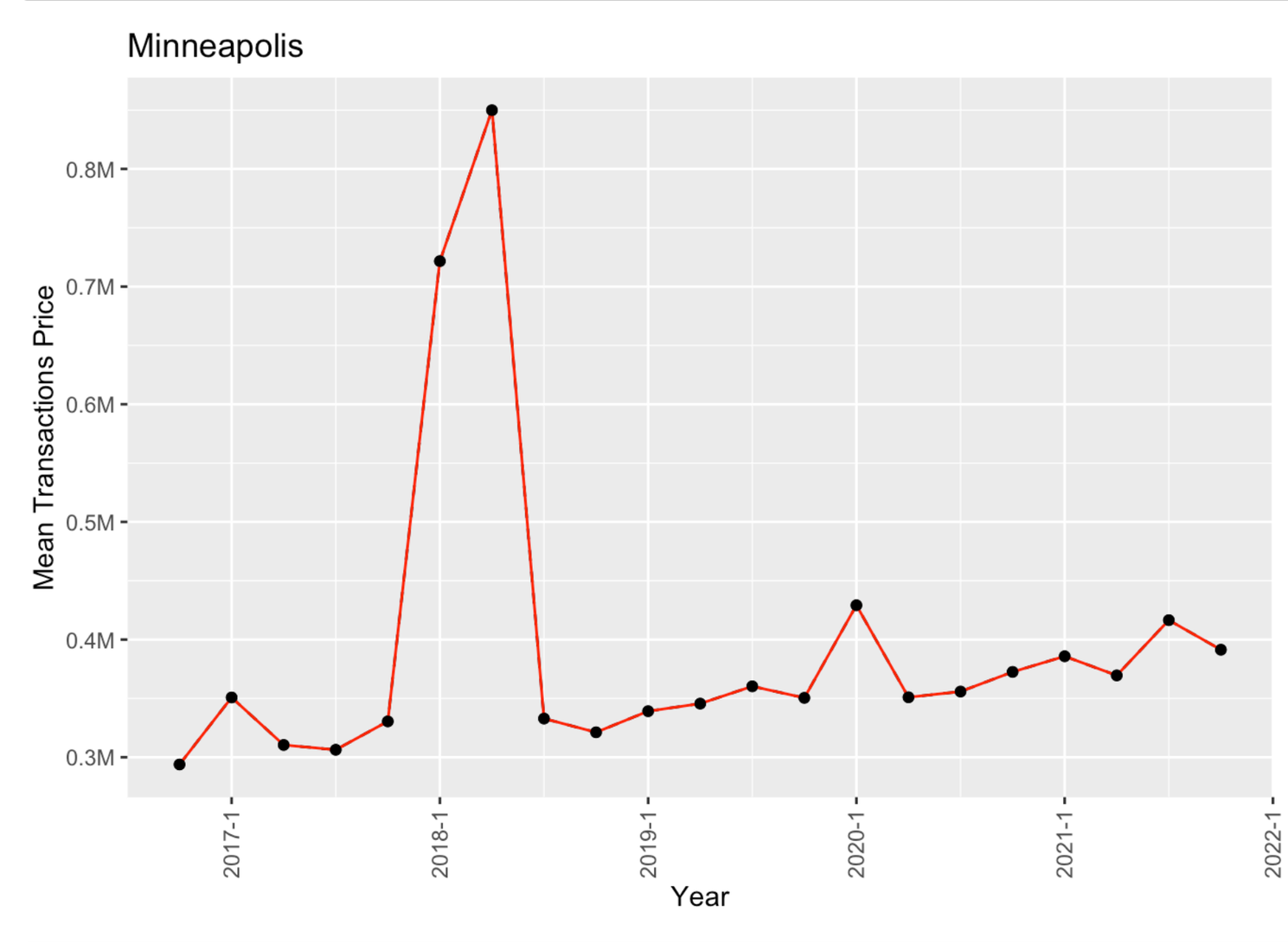
```
head(aggregated_data_SP)
```

```
##   Group.1        x
## 1 2016 Q4 213343.4
## 2 2017 Q1 235127.5
## 3 2017 Q2 217627.9
## 4 2017 Q3 263039.5
## 5 2017 Q4 258295.3
## 6 2018 Q1 247742.9
```

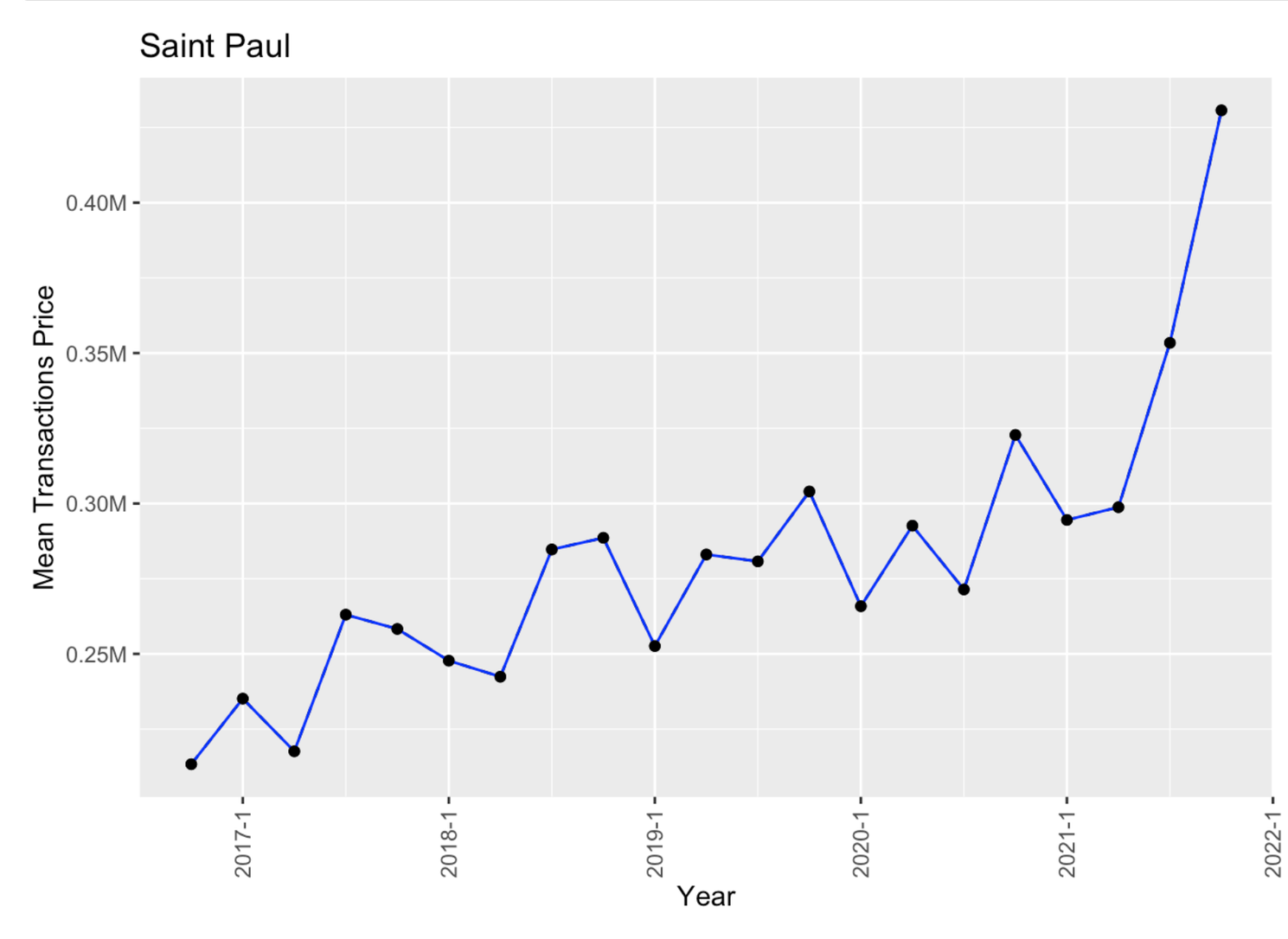
```
colnames(aggregated_data_M)[2] ="M"
colnames(aggregated_data_SP)[2] ="SP"
MSP <- merge(aggregated_data_M,aggregated_data_SP,by="Group.1")
p = ggplot(aggregated_data_M, mapping = aes(x=Group.1, y= M), colour = genus) +
  geom_point()+theme(axis.text.x = element_text(angle = 90, vjust = 0.5))+geom_line(linetype = "dashed")+ geom_li
ne(color="red")+ labs(title = "Minneapolis", x = "Year", y = "Mean Transactions Price")+scale_y_continuous(labels
= label_number(suffix = "M", scale = 1e-6))
```

Graph of Saint Paul

```
p = p + geom_point()
plot(p)
```




```
p = ggplot(aggregated_data_SP, aes(x=Group.1, y= SP), colour = genus) +
  geom_point()+theme(axis.text.x = element_text(angle = 90, vjust = 0.5))+geom_line(linetype = "dashed")+ geom_li
ne(color="blue")+ labs(title = "Saint Paul", x = "Year", y = "Mean Transactions Price")+scale_y_continuous(labels
= label_number(suffix = "M", scale = 1e-6))
p = p + geom_point()
plot(p)
```



Summary Statistics

```
skim(aggregated_data_M)
```

```
## Warning: Couldn't find skimmers for class: yearqtr; No user-defined `sfl`
## provided. Falling back to `character`.
```

Data summary

Name	aggregated_data_M
Number of rows	21
Number of columns	2
_______________________	
Column type frequency:	
character	1
numeric	1
________________________	
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
Group.1	0	1	4	7	0	21	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
M	0	1	394504.9	135901.7	293878.4	332873.6	350954.5	385809.2	849892.1	▇▁▁▁▁

```
skim(aggregated_data_SP)
```

```
## Warning: Couldn't find skimmers for class: yearqtr; No user-defined `sfl`
## provided. Falling back to `character`.
```

Data summary

Name	aggregated_data_SP
Number of rows	21
Number of columns	2
_______________________	
Column type frequency:	
character	1
numeric	1
________________________	
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
Group.1	0	1	4	7	0	21	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
SP	0	1	281018.3	47901.95	213343.4	252611.4	280764.9	294528.6	430698.6	▃▇▂▁▁

New file with converted dates, not shown

```
Book1 <- fread("/Users/andrewscpu/Desktop/here/Minneapolis Saint Paul/Book1.csv")
```

Treatment period from 2019-2021 (Period after announcement)

```
Book1 <- Book1 %>%
    mutate(Treated = cty_twnshp_name == 'M' &
           quarter %in% c('2019 Q1', '2019 Q2', '2019 Q3', '2019 Q4','2020 Q1','2020 Q2','2020 Q2','2020 Q3', '20
20 Q4', '2021 Q1', '2021 Q2', '2021 Q3', '2021 Q4'))
```

Estimate the regression with fixed effcets by state and quarter

The estimate for banning single-family zoning laws was $33,272.15

```
res_1 = clfe <- feols(tot_purch_amt ~ Treated | cty_twnshp_name + quarter, Book1)
msummary(clfe, stars = c('*' = .1, '**' = .05, '***' = .01))
```

	Model 1
TreatedTRUE	−33272.149***
	(3e−11)
Num.Obs.	42
R2	0.799
R2 Adj.	0.566
R2 Within	0.135
R2 Within Adj.	0.089
RMSE	20870.56
Std.Errors	by: cty_twnshp_name
FE: cty_twnshp_name	X
FE: quarter	X

* p < 0.1, ** p < 0.05, *** p < 0.01

Use only Pretreatment data (before announcement) (placebo tests)

Shows the placebo tests that happen in the two quarters leading up to the policy change.

Placebo test with a fake treatment one that represents the interaction between Q2 2018 and Q3 2018, which passes the placebo test and shows that results hold at the five percent level.

Fake treatment two represents the transaction just in Q3 2018. The results of this period were insignificant

```
filter(Book1, quarter >= quarter %in% c("2015 Q2"), quarter %in% c("2017 Q2"))
```

```
## Empty data.table (0 rows and 4 cols): cty_twnshp_name,quarter,tot_purch_amt,Treated
```

```
Book1 <- Book1 %>%
  mutate(FakeTreat1 = cty_twnshp_name == "M" &
           quarter %in% c ('2018 Q2', '2018 Q3'),
         FakeTreat2 = cty_twnshp_name == "M" &
           quarter == '2018 Q3')
# Run the same model we did before but with out fake treatment
clfe1 <- feols(tot_purch_amt ~ FakeTreat1,
               data = Book1)
clfe2 <- feols(tot_purch_amt ~ FakeTreat2,
               data = Book1)
msummary(list(clfe1,clfe2), stars = c('*' = .1, '**' = .05, '***' =.01))
```

	Model 1	Model 2
(Intercept)	281825.880***	285055.175***
	(7117.243)	(7440.852)
FakeTreat1TRUE	71779.216**	
	(32615.303)	
FakeTreat2TRUE		7928.048
		(48222.231)
Num.Obs.	42	42
R2	0.108	0.0007
R2 Adj.	0.086	−0.024
RMSE	43928.57	46496.46
Std.Errors	IID	IID

* p < 0.1, ** p < 0.05, *** p < 0.01