

Replication of Enos (2016)

Niel Schrage

5/8/2020

1 Abstract

Enos (2016) measures the shift in voter turnout for white voters living in Chicago near demolished public housing, occupied predominantly by African Americans, as compared to white voters living farther away; observing that white voters living in close proximity to demolished public housing had a 10 percentage point drop in voter turnout between 2000 and 2004, Enos concludes that this change in behavior was the result of the decline in race threat from the change in size and proximity of the outgroup population. The results of my replication effort were largely successful, although there were some challenges. For my extension, I expanded the parallel trends robustness check that Enos presents in his appendix; my results were consistent with his findings. These results are significant in two important ways: first, they illustrate the strength of the robustness checks that Enos conducted and, second, they suggest that his conclusions about the effect of racial threat on voting are even more robust than his paper suggests.

2 Introduction

Building on past research, Enos seeks to empirically test how much the context in which a person lives affects their political behavior. In 1949, V. O. Key published research suggesting increased political motivation by Southern whites threatened by the presence of African Americans; a relationship that is now known as “racial threat.” Enos studies this phenomenon by looking at public housing demolition in Chicago that caused mass displacement of approximately 25,000 African Americans. Enos examines the effect on white voting turnout in Chicago of removing African American neighbors. He tests this effect using a difference-in-differences model (which I will elaborate on more later). The effect of the treatment is the difference in average voter turnout at times $t-1$ (pre demolition turnout) and t (post demolition turnout) for white voters in close

proximity to the demolished projects compared to the average voter turnout over the same period for white voters living farther away. The results suggest that racial threat is highly context specific and that the strength of the effect is inversely correlated with distance from the project and directly correlated with the size of the outgroup.

I was largely successful in my attempt to replicate this paper. I'd like to thank Professor Enos for providing easily accessible replication data through the Harvard Dataverse. I ran the replication using R (R Core Team 2020). All of my code for this replication as well as my extension are in my repository located at¹

My extension expanded on the initial parallel trends test run by Enos as a robustness check to validate the assumptions of the difference-in-differences model. For the difference-in-differences model he performed, Enos examined the change in voting turnout between 2000 and 2004 by African American and white treatment groups living near public housing projects that were demolished as compared against African American and white control groups that lived farther away. In order to illustrate the robustness of his results, he performed a parallel trends assumption test that included voting information for several different election cycles, and allows the trends for difference to be seen over time – thus highlighting the effect of public housing demolition. If prior changes in voting turnout between 1996 - 2000 were similar for African American and white voters in both treatment and control, then the change in voting turnout behavior between 2000 - 2004 was unlikely to have been caused by an unmeasured change occurring prior to the demolition of the projects. I was inspired to do this extension for two reasons. First, this was an essential part of confirming the difference-in-differences model. Second, this was actually a potential replication that Enos himself suggested in the comments of his code as a worthwhile future project.

To conduct this extension, I ran the parallel trends test code. Then I wrote new code to create graphics (displayed later) using Tidyverse (Wickham et al. 2019). Enos originally ran his test with distance set to 200 meters from demolished projects. To extend this, I ran a series of tests at 100, 200 (as a replication), and 300 meters. There are two important takeaways: First, by and large my figures confirmed Enos' conclusions that the prior changes in voting were similar for white and black voters in both treatment and control. Second, it is essential to point out how the small sample size amongst the group of interest (white treatment) could be potentially skewing the results found here (and could potentially cast doubt on the difference-in-differences model.)

¹https://github.com/nschrage/schrage_replication

3 Literature Review

In the paper “What the Demolition of Public Housing Teaches Us about the Impact of Racial Threat on Political Behavior,” Ryan Enos studies the impact that an exogenous demographic shift has on voting turnout and results. This paper seeks to answer the overarching question: how much does the context in which a certain person lives affect their political behavior?

The paper seeks to extend the research performed by Key (Key and Heard 1984) who examined county voting patterns in the American South and found a positive correlation between the number of African Americans in the county and white voter turnout in general and votes for conservative politicians in particular. Key argued that presence of African Americans – the outgroup – inspired fears among the white population, which motivated them to vote and vote for conservative politicians. He labeled this phenomenon “racial threat.”

Key’s analysis launched a new field of research on racial context and its influence on behavior. The impact of context in general, and racial threat in particular, has blossomed into a cottage industry among the academic community. As Enos notes, studies have investigated, among other issues, the effects of racial threat on voter turnout (Leighley and Vedlitz 1999), candidate support (Enos 2010), racial attitudes (Gay 2006), and social capital (Putnam 2007). More recent studies have examined the effect of racial threat arising in the context of workplace populations (Hamel and Wilcox-Archuleta, n.d.), influencing the election behavior of Latinos threatened by the candidacy of Donald Trump (Gutierrez et al. 2019), triggering support for ballot initiatives (Reny and Newman 2018) and being shaped more by adolescent rather than contemporaneous context (Goldman and Hopkins 2020).

However, while easy to hypothesize situations where context may be a powerful influence on attitudes and behavior, the challenge of empirically testing for racial threat has proven to be great. Enos highlights shortcomings in data, challenges of identification, and disputes over theory as historical limitations to contextual racial threat examinations. The variety of potential endogenous confounding factors that have historically made academic consensus on research and conclusions from context based racial threat studies hard to find.

For example, two studies highlighted by Enos, Giles and Buckner (Giles and Buckner 1993) and Voss (Voss 1996) illustrate the difficulties of identifying appropriate data to define context and assess whether racial threat is demonstrated. Using aggregate data on election results in the 1992 Louisiana gubernatorial election, Giles and Buckner concluded that the proximity of white voters to African American residents at the county level made whites more likely to vote for self avowed racist David Duke. They explained their result by suggesting that Duke’s candidacy triggered “old-fashioned” racial stereotypes. In contrast, Voss examined

the same election but relied on a different geographic aggregation; they could find no relationship between white voters' proximity to African Americans and votes for Duke's election. Voss rejected the explanation of "old fashioned stereotypes" in current day Louisiana and argued that the use of aggregate data by Giles and Buckner was misplaced.

Other scholars have highlighted alternate causal explanations, citing election bias as a challenge to establishing causation (Cho, Gimpel, and Hui 2013) or speculating that "economic threat" is a better explanation than "racial threat" (Gay 2006). Finally, the theory of context around "racial threat" has faced serious attack from scholars that, as Enos identifies, argue that "racial attitudes and related behaviors should not be sensitive to context." He also identifies confusion over the mechanisms by which racial threat is manifest, identifying instrumental and psychological mechanisms as alternative explanations that may prove too much or too little. While this has long been a question political scientists have been interested in exploring, there are usually a number of obstacles to conducting a thorough investigation.

Enos seeks to address these concerns by an innovative exploration of racial threat in the context of voting turnout. In the early 2000s, public housing reconstruction in Chicago caused mass displacement — forcing approximately 25,000 African Americans to move to new homes and new neighborhoods. Enos takes advantage of this unique situation to study racial threat and context. By relying on the "exogenous" nature of these demolitions — the deciding factors about which projects would be demolished were based on algorithms outside of individual residents' control — Enos explores the effect of removing African American neighbors on white voting turnout in Chicago.

Critically, Enos recognizes that the key assumption in this study is that the choice of units designated for demolition is uncorrelated with the difference in changes in turnout for white and African American voters. Enos describes how the demolitions can be thought of as a quasi -experiment, "The treatment is the demolition, and the outcome is the change in white political participation and support for conservative candidates."

For his study, Enos utilized four different data sources: voting information (consisting of an augmented 2004 Illinois voter file updated with 2000 and 2010 census data); location data between voters and their distance from each demolished housing project; edge data covering the exact distance between each voter and the edge of a housing project; and, lastly, property records for all Chicago voters.

These data sources provide many advantages previously unavailable to studies of racial threat. In particular, the use of individual voter data avoids the ecological assumptions that usually plague aggregate/sampling data, and location data is helpful because it allows for testing of a variety of definitions. The result is that

any assessment of racial threat should be removed from the usual risks associated with data or causation that handicapped previous research. Similarly, because the change in the African American population is observable and triggered by exogenous activity – the removal of the African American population as a result of the demolition of public housing – the racial threat is more clearly identified by the changes in voter turnout and more clearly linked to the context in which it was observed.

Enos examined three hypotheses: - H1 (Racial Threat and Turnout): After the demolition of the projects, turnout should decline for white voters close to the projects relative to the rest of the city. - H2 (Proximity and Size): The salience of a group is a strong predictor of intergroup attitudes (BREWER 1984). Psychologists have empirically demonstrated the intuitive finding that salience can be a function of the size and “immediacy” of an object (Latané et al. 1995). This leads me to expect a “dose effect,” whereby the treatment should vary with the size and proximity of the treatment. Operationally, the treatment effect should decline as the white voters are farther away from a project and as the population of a project represents a smaller portion of the local outgroup population. - H3 (Racial Threat and Vote Choice): After the demolition of the projects, white voters close to the former projects should experience a decline in racially conservative voting relative to the rest of the city.

Enos tested these hypotheses using the difference-in-differences approach to examine changes in voter turnout between sets of voters (before and after the demolition) by race and proximity to the demolished projects.

The effect of the treatment (the demolition) is seen in difference in average voter turnout at times t-1 (pre demolition turnout) and t (post demolition turnout) for white voters in close proximity to the demolished projects compared to the average voter turnout over the same period for white voters living farther away.

The equation that Enos uses:

$$ATE = [P(Vote2004|d* \leq d) - P(Vote2000|d* \leq d)] - [P(Vote2004|d* > d) - P(Vote2000|d* > d)]$$

d^* is how Enos defines the treatment and control groups (who lives close v. far). He starts this value at 100 meters away and creates 10 different groups (so all the way up to 1000 meters or 1 kilometer which in his mind is sufficient for potential interactions.) For this study, the analysis suggests the following calculation: voting turnout among white treatment voters (those who live within a specified distance) in 2004 - 2000 minus the voting turnout of white control (those who live further than the specified distance) in the same years.

Figure 1 displays this result for all four groups (African American Treatment, African American Control, White Treatment, White Control).

In order to feel confident in the results found through the difference-in-differences test, Enos conducted a series of robustness checks. He identified that none were more important than the parallel trends test. By incorporating data from previous elections, Enos was able to illustrate that the previous trends in voting behavior between treatment and control groups were largely parallel – meaning that the difference between the ‘treatment’ and ‘control’ groups stayed consistent over time (“Difference-in-Difference Estimation,” n.d.), meaning that change observed is attributable to the treatment.

The results suggest that racial threat is highly context specific and that the strength of the effect is inversely correlated with distance from the project and directly correlated with the size of the outgroup. These findings strongly suggest that racial threat occurs because of attitude change rather than selection.

4 Replication

I was successfully able to replicate the major elements of this paper. Professor Enos provided two different options for replication. The first being a complete replication, and the second using his processed data to recreate the tables and figures. In the course of this project, I utilized both of these approaches. For the replication section I primarily used the tables and figures option, and for my replication I used the more complete data processing version. There was one thing I was unable to replicate: the regression table displayed in figure Four. The .rda file that is referenced in the code did not exist within the dataverse files provided. However this was a relatively minor thing that did not impact the rest of my progress.

There were two big hurdles to overcome that made a complete replication of this paper more challenging (at least in the context of Gov 1006). The first was that much (if not all) of the code was written in base R. I learned R through Tidyverse (Wickham et al. 2019), so there was a bit of an adjustment period, and I had to rewrite some of the code just to understand the functionality. The second hurdle was that the time it took to actually run the difference-in-differences test made it challenging to adjust the parameters and quickly see the results.

Results from Enos (Enos, Ryan D. 2016) were successfully replicated. As an example, here is Figure 1 from page 9. In the Rmd (available in my GitHub repo), the code to replicate everything is present, but the results are not printed.²

²https://github.com/nschrage/schrage_replication

FIGURE 1 Treatment Effects

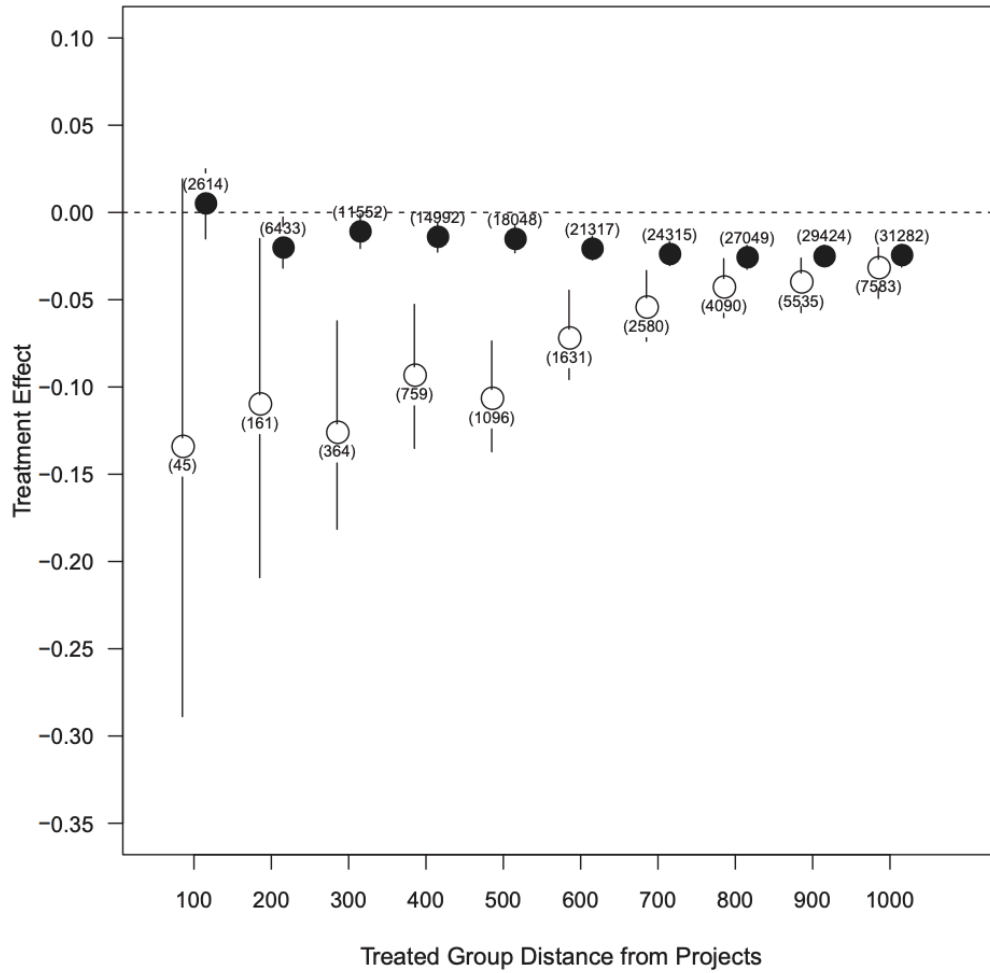


Figure 1: Original. Results for difference-in-differences testing for Enos (2016). The figure shows the effect of housing demolition by calculating mean turnout in 2004 minus the mean turnout in 2000 for the treatment group minus the same difference for the control group. White and black circles represent the effect on white and black voters, respectively. The number of individuals in each treatment group is indicated in parentheses and vertical lines indicate the 95% confidence intervals generated by the bootstrapped standard errors of the difference between treatment and control groups.

Figure A.2: Parallel Trends Test

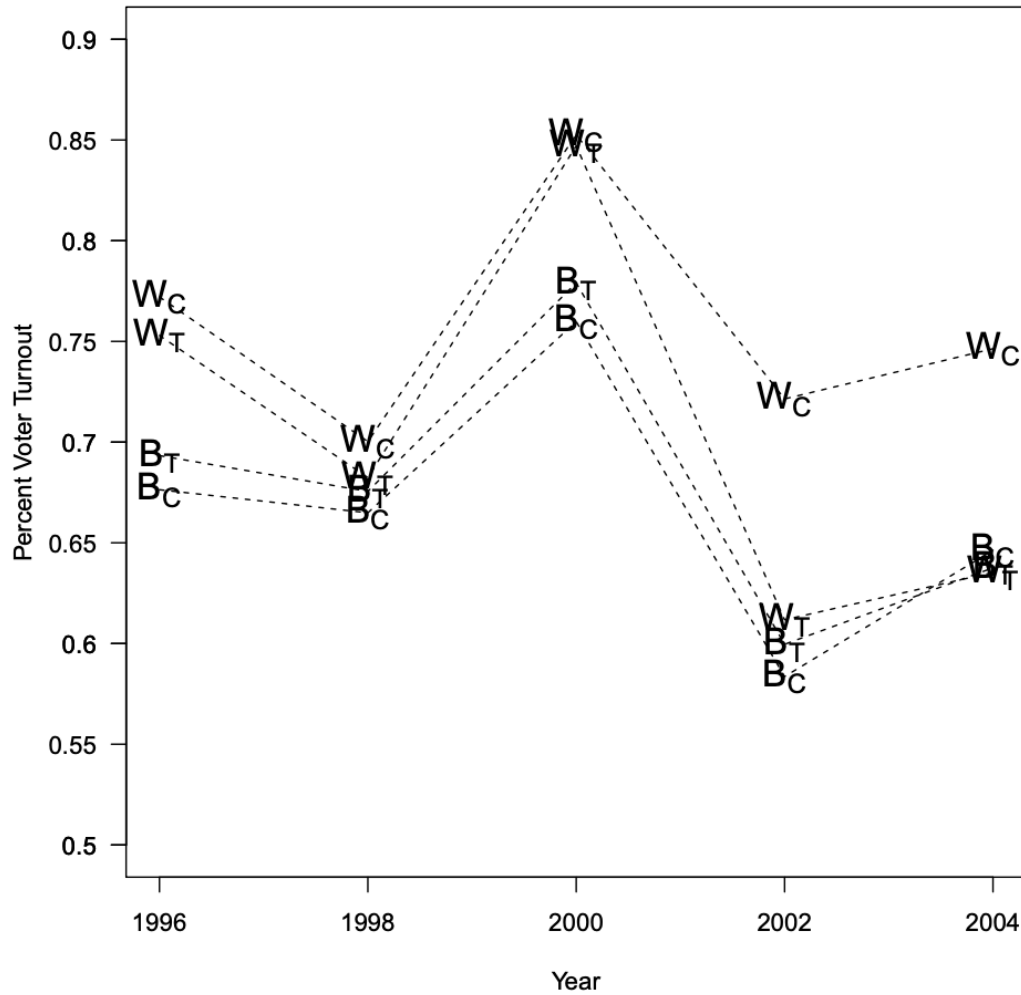


Figure 2: Original. Results for the parallel trends test. Before the treatment in 2000 occurred, all groups (treatment/control) were parallel, while after the exogenous intervention between 2000 and 2004 all groups continue to follow the same trend with the exception of the white treatment group which has a notable downturn. As Enos concludes, “the prior changes in voting were similar for white and black voters in both treatment and control.”

5 Extension

My extension expanded on the initial parallel trends test that Enos ran as a robustness check to validate the assumptions of the difference-in-differences model. For the difference-in-differences model described in his paper, Enos examined the change in voting turnout between 2000 and 2004 by African American and white treatment groups living near public housing projects that were demolished and compared them with African American and white control groups that lived farther away. In order to illustrate the robustness of his results, he performed a parallel trends assumption test that included voting information for several different election cycles, and allows the trends for difference to be seen over time – thus highlighting the effect of public housing demolition. If prior changes in voting turnout between 1996 - 2000 were similar for African American and white voters in both treatment and control, then the change in voting turnout behavior between 2000 - 2004 was unlikely to have been caused by an unmeasured change occurring prior to the demolition of the projects. I was inspired to perform this extension for two reasons. First, this was an essential part of confirming the difference-in-differences model. Second, Enos himself suggested this potential replication as a worthwhile future project in the comments of his code.

To conduct this extension, I ran the parallel trends test code. Then I wrote new code to create graphics (displayed later) using Tidyverse and ggplot (Wickham et al. 2019). Enos originally ran his test with distance set to 200 meters from demolished projects. To extend this, I ran a series of tests at 100, 200 (as a replication), and 300 meters. There are two important takeaways: First, by and large my figures confirmed Enos’ conclusions that the prior changes in voting were similar for white and black voters in both treatment and control. Second, it is essential to point out how the small sample size amongst the group of interest (white treatment) could be potentially skewing the results found here (and could potentially cast doubt on the difference-in-differences model.)

6 Conclusion

Building on past research, Enos designed an empirical test to examine how much the context in which someone lives affects their political behavior. In particular, his work is grounded in V. O. Key’s landmark 1949 examination of the American south and the phenomenon of “racial threat” – essentially the increased political motivation of whites threatened by the presence of African Americans. Enos examined a natural experiment created by the demolition of public housing in Chicago that led to the mass displacement of approximately 25,000 African Americans. Specifically, Enos compared the effect on white voting turnout in

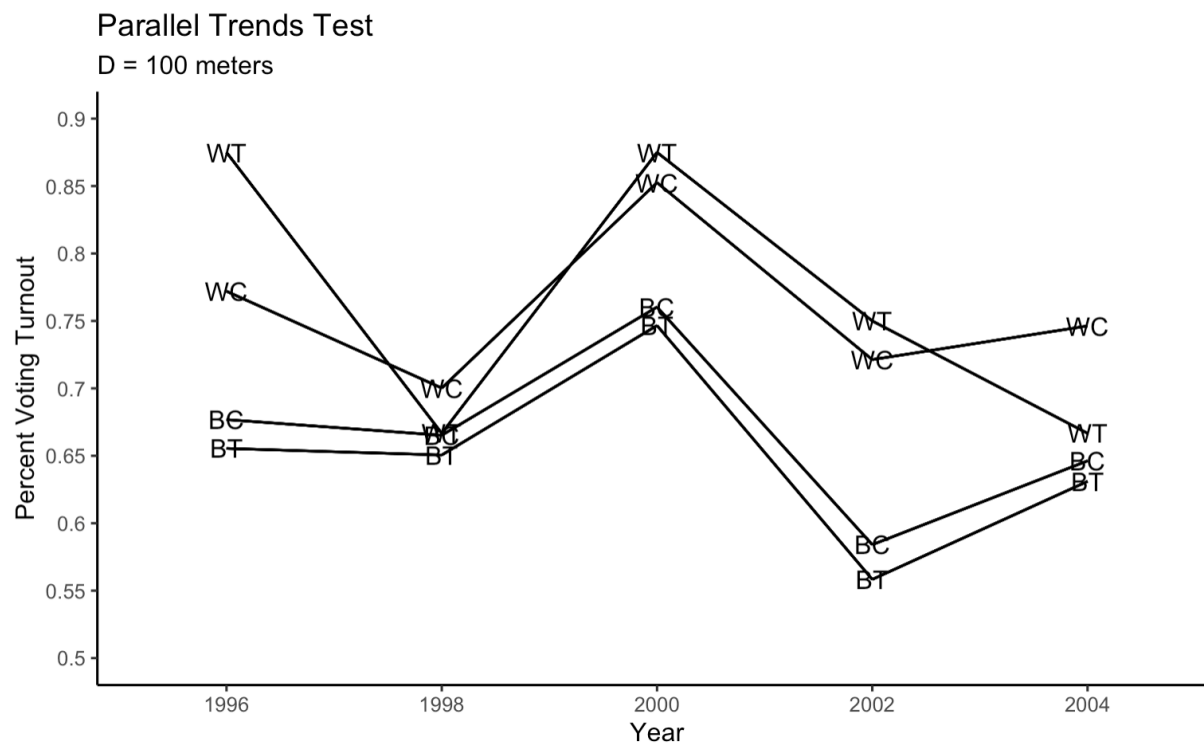


Figure 3: Extension. Results for the parallel trends test, with proximity/treatment distance set to 100 meters from demolished projects. Unlike the other examples, the white treatment group was out of alignment both before and after the treatment occurred. At first this was somewhat puzzling, but a possible explanation is revealed by looking at the raw numbers and realizing that the sample size of white treatment is so much smaller than the other categories (Wt: 24 v. Wc 81921, Bt: 1843 v. Bc: 237599). This make it hard to reach a definitive conclusion about the validity of this model.

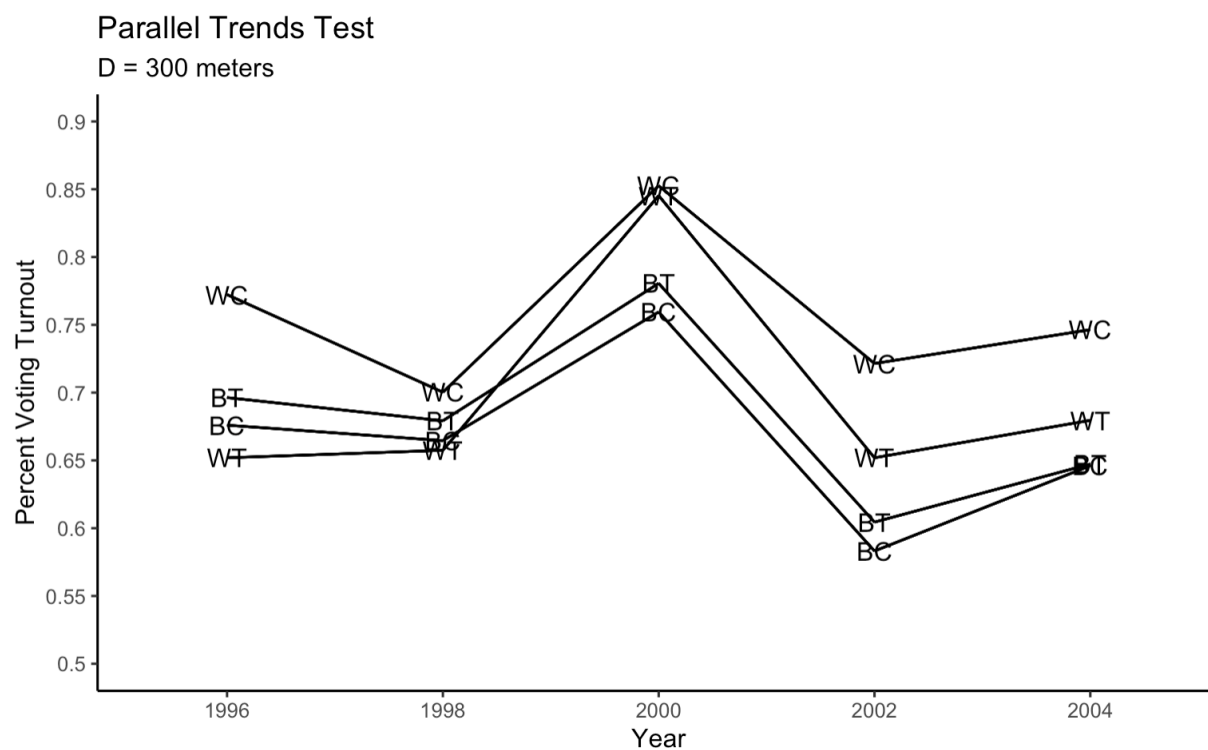


Figure 4: Extension. Results for the parallel trends test, with proximity/treatment distance set to 300 meters from demolished projects. Before the treatment in 2000 occurred, all groups (treatment/control) were parallel, while after the exogenous intervention between 2000 and 2004 all groups continue to follow the same trend with the exception of the white treatment group which has a notable downturn. As Enos concludes, “the prior changes in voting were similar for white and black voters in both treatment and control (Enos 16).”

Chicago of removing African American neighbors on white voting turnout in Chicago. Using a difference-in-differences model, Enos compared the difference in average voter turn out at times t-1 (pre demolition turnout) and t (post demolition turnout) for white voters in close proximity to the demolished projects to the average voter turnout over the same period for white voters living farther away. The results confirmed that racial threat is highly context specific, in this case demonstrating that the strength of the effect is inversely correlated with distance from the project and directly correlated with the size of the outgroup.

With the exceptions and limitations noted earlier, I was largely successful in my attempt to replicate this paper. I'm particularly grateful to Professor Enos for providing such (relatively) accessible replication data through the Harvard Dataverse. I ran the replication using R (R Core Team 2020). All of my code for this replication as well as my extension are in my repository.³

As described earlier, my extension of the Enos research sought to expand on the initial parallel trends test that Enos ran as a robustness check to validate the assumptions of the difference-in-differences model. In his paper, Enos relied on the difference-in-differences model to compare the change in voting turnout between 2000 and 2004 by African American and white treatment groups living near public housing projects that were demolished with similar information on African American and white control groups that lived farther away. He tested the robustness of his results by performing a parallel trends assumption test that included voting information for several different election cycles, which allowed trends for difference to be reviewed over time – thus highlighting the effect of public housing demolition. If prior changes in voting turnout between 1996 - 2000 were similar for African American and white voters in both treatment and control, then the change in voting turnout behavior between 2000 - 2004 was unlikely to have been caused by an unmeasured change occurring prior to the demolition of the projects. I was inspired to do this extension for two reasons. First, this was an essential part of confirming the difference-in-differences model. Second, this was actually a potential replication that Enos himself suggested in the comments of his code as a worthwhile future project.

To conduct this extension, I ran a modified version of the parallel trends test code. Then I wrote new code to create graphics (displayed later) using Tidyverse (Wickham et al. 2019). Enos originally ran his test with distance set to 200 meters from demolished projects. To extend this, I ran a series of tests setting distances at 100, 200 (as a replication), and 300 meters. This extension revealed two important conclusions: First, my results by and large confirmed Enos' results that the prior changes in voting were similar for white and black voters in both the treatment and control groups. Second, the analysis revealed how the small size of the sample of interest (white treatment) could be potentially skewing the results (and thus potentially cast

³https://github.com/nschrage/schrage_replication

doubt on the difference-in-differences model.)

The results of this research reaffirm the legitimacy of the exploration of context and racial threat. This Chicago experience from 2000-2004 addresses many of the fundamental challenges of data, identification and theory that have been leveled against racial threat as a effect of intergroup behavior. Certainly both the original paper and the replication suggest that the interaction of the two groups had a meaningful impact on the voting behavior of the white population living near the Chicago public housing projects. At the same time, an essential point is that while the neighbors were living nearby, they were not living together as part of an integrated community. The relative segregation of these populations challenges some of the fundamental assumptions about proximity and community. Future research might examine the consequences of similar exogenous interventions when populations truly are already integrated instead of separate, when populations arrive at the same time or when communities come together following a crisis.

7 Appendix

Bibliography

Amaral, David J. 2018. “*The Space Between Us: Social Geography and Politics* , by Ryan D. Enos: Cambridge, Cambridge University Press, 2017.” *Journal of Urban Affairs* 40 (8): 1194–6. <https://doi.org/10.1080/07352166.2018.1446603>.

BREWER, M. B. 1984. “Beyond the Contact Hypothesis : Theoretical Perspectives on Desegregation.” *Groups in Contact : The Psychology of Desegregation*, 281–302. <https://ci.nii.ac.jp/naid/10010171823/>.

Cho, Wendy K. Tam, James G. Gimpel, and Iris S. Hui. 2013. “Voter Migration and the Geographic Sorting of the American Electorate.” *Annals of the Association of American Geographers* 103 (4): 856–70. <https://doi.org/10.1080/00045608.2012.720229>.

Craig, Maureen A and Rucker, Julian M and Richeson, Jennifer A. 2018. “Racial and Political Dynamics of an Approaching ‘Majority-Minority’ United States.” *The Annals of the American Academy of Political and Social Science*.

“Difference-in-Difference Estimation.” n.d. *Columbia University Mailman School of Public Health*. Columbia University. <https://www.mailman.columbia.edu/research/population-health-methods/difference-difference-estimation>.

Dinesen, Peter Thisted, and Kim Mannemar Sønderskov. 2015. “Ethnic Diversity and Social Trust: Evidence

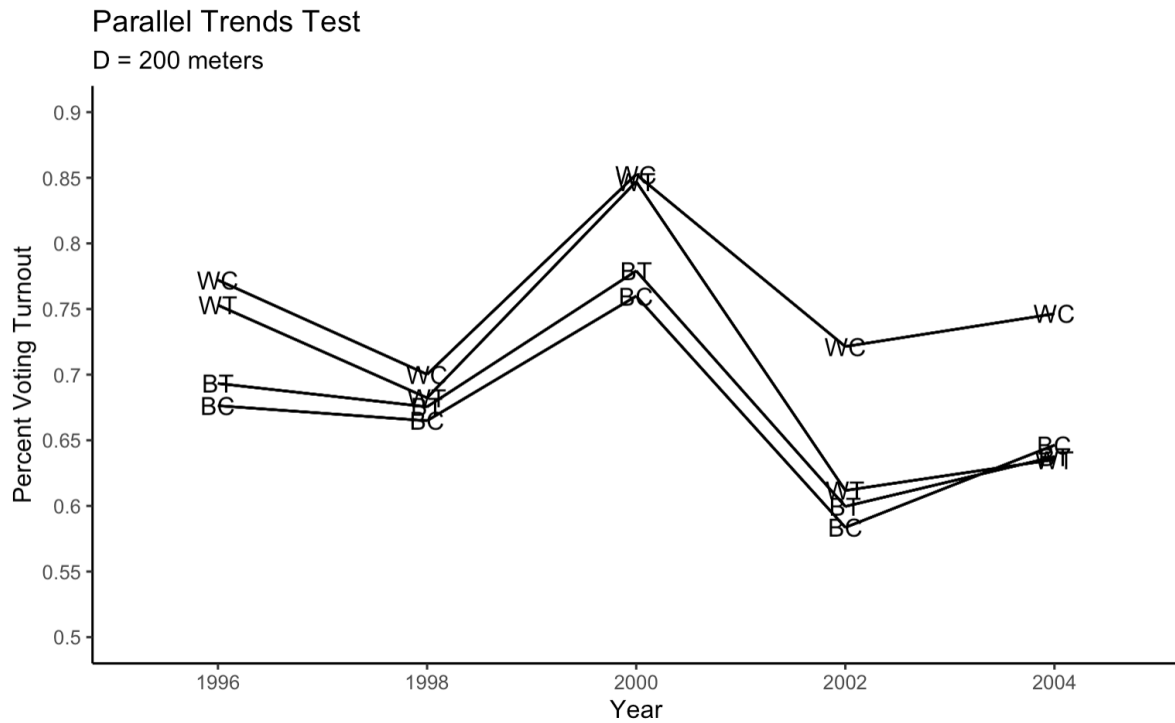


Figure 5: Replication. Results for the parallel trends test, with proximity/treatment distance set to 200 meters from demolished projects. Before the treatment in 2000 occurred, all groups (treatment/control) were parallel, while after the exogenous intervention between 2000 and 2004 all groups continue to follow the same trend with the exception of the white treatment group which has a notable downturn. As Enos concludes, “the prior changes in voting were similar for white and black voters in both treatment and control (Enos 16).”

from the Micro-Context.” *American Sociological Review* 80 (3). Los Angeles, CA: SAGE Publications: 550–73.

Enos, Ryan D. 2010. “The Persistence of Racial Threat: Evidence from the 2008 Election.” In *American Political Science Association Annual Meeting*.

Enos, Ryan D. 2014. “Causal Effect of Intergroup Contact on Exclusionary Attitudes.” *Proceedings of the National Academy of Sciences*. <http://www.pnas.org/content/111/10/3699.abstract>.

———. 2016. “What the Demolition of Public Housing Teaches Us About the Impact of Racial Threat on Political Behavior.” *American Journal of Political Science*. <https://onlinelibrary.wiley.com/doi/abs/10.1111/ajps.12156>.

Fossett, Mark and Kiecolt, K. 1989. “The Relative Size of Minority Populations and White Racial Attitudes.” *Social Science Quarterly*. <http://search.proquest.com/docview/204349224/>.

Gay, Claudine. 2006. “Seeing Difference: The Effect of Economic Disparity on Black Attitudes Toward Latinos.” *American Journal of Political Science* 50 (4): 982–97. <https://doi.org/10.1111/j.1540-5907.2006.00228.x>.

Giles, Michael W., and Melanie A. Buckner. 1993. “David Duke and Black Threat: An Old Hypothesis Revisited.” *The Journal of Politics* 55 (3): 702–13. <https://doi.org/10.2307/2131995>.

Goldman, Seth K., and Daniel J. Hopkins. 2020. “Past Place, Present Prejudice: The Impact of Adolescent Racial Context on White Racial Attitudes.” *The Journal of Politics* 82 (2): 529–42. <https://doi.org/10.1086/706461>.

Gutierrez, Angela, Angela X. Ocampo, Matt A. Barreto, and Gary Segura. 2019. “Somos Más: How Racial Threat and Anger Mobilized Latino Voters in the Trump Era.” *Political Research Quarterly* 72 (4): 960–75. <https://doi.org/10.1177/1065912919844327>.

Hamel, Brian T, and Bryan Wilcox-Archuleta. n.d. “Black Workers in White Places: Daytime Racial Diversity and White Public Opinion,” 37.

Key, V. O., and Alexander Heard. 1984. *Southern Politics in State and Nation*. New ed. Knoxville: University of Tennessee Press.

Kinder, Donald and Sanders, Lynn. 1996. *Divided by Color: Racial Politics and Democratic Ideals*. <http://search.proquest.com/docview/59728764/>.

King, Gary. 2006. “Publication, Publication.” American Political Science Association.

- King, Gary. 1995. "Replication, Replication." *Ps-Political Science & Politics*. AMER POLITICAL SCI ASSN.
- King, Gary and Tomz, Michael and Wittenberg, Jason. 2000. "Making the Most of Statistical Analyses: Improving Interpretation and Presentation." *American Journal of Political Science*. <http://search.proquest.com/docview/196894807/>.
- Latané, Bibb, James H. Liu, Andrzej Nowak, Michael Bonevento, and Long Zheng. 1995. "Distance Matters: Physical Space and Social Impact." *Personality and Social Psychology Bulletin* 21 (8): 795–805. <https://doi.org/10.1177/0146167295218002>.
- Leighley, Jan E., and Arnold Vedlitz. 1999. "Race, Ethnicity, and Political Participation: Competing Models and Contrasting Explanations." *The Journal of Politics* 61 (4): 1092–1114. <https://doi.org/10.2307/2647555>.
- Putnam, Robert D. 2007. "E Pluribus Unum: Diversity and Community in the Twenty-First Century the 2006 Johan Skytte Prize Lecture." *Scandinavian Political Studies* 30 (2): 137–74. <https://doi.org/10.1111/j.1467-9477.2007.00176.x>.
- R Core Team. 2020. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. <https://www.R-project.org/>.
- Reyn, Tyler T., and Benjamin J. Newman. 2018. "Protecting the Right to Discriminate: The Second Great Migration and Racial Threat in the American West." *American Political Science Review* 112 (4): 1104–10. <https://doi.org/10.1017/S0003055418000448>.
- Voss, D. Stephen. 1996. "Beyond Racial Threat: Failure of an Old Hypothesis in the New South." *The Journal of Politics* 58 (4): 1156–70. <https://doi.org/10.2307/2960153>.
- Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Golemund, et al. 2019. "Welcome to the tidyverse." *Journal of Open Source Software* 4 (43): 1686. <https://doi.org/10.21105/joss.01686>.