Voting lines and early voting check-in times in Florida

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Abstract

Voting lines can be meaningful, albeit unfortunate, aspects of individuals’ overall voting experiences, and the magnitude of lines and their consequences are the subject of ongoing research in the field of election administration. We use early voter check-in times from Florida in the General Elections of 2012 and 2016 to study the times at which voters cast their ballots and to estimate the effect of waiting in line on future electoral participation. Our check-in times—involving 690,445 early voters from 2012 and 769,063 from 2016—highlight the disproportionately problematic experiences faced by minority voters, although we find many fewer such problems in 2016 compared to 2012. With respect to the consequences of voting lines, we estimate that Florida early voters who waited excessively in 2012 had a very slightly lower probability of voting in 2016, ceteris paribus. Our results draw attention to the continued importance of voting lines and the potential effect they have on future political activity.
Introduction

The majority of voters in the United States who cast ballots in presidential elections do so in-person, either on Election Day itself or during early voting periods whose durations depend on relevant state or local laws. Voting in-person, as opposed to voting absentee or via mail, requires traveling to a voting location, which is often called a precinct, possibly waiting in a line, possibly authenticating oneself with identification, and then going through the physical actions required to register candidate choices and preferences over ballot measures, and finally submitting a ballot for tabulating. A voter’s overall voting experience thus has many facets, and our interest here is the second of the steps noted above, namely, the act of waiting in line to vote.

We draw attention to two important features of voting lines, and by voting lines here we mean lines that form in front of precincts as opposed to lines that affect voters already in the act of casting ballots. First, waiting in line to vote constitutes a time tax in the sense of Mukherjee (2009). This tax can be negligible (for example, a voter waits a scant ten seconds prior to initiating her voting process) or imposing (some of the Florida voters we describe shortly waited over four hours to vote in 2012). Associated with a voting line time tax is the type of distributional question that is associated with all forms of taxation: is the voting time tax fair and in particular is the burden of this tax spread uniformly across voters or concentrated on certain types of individuals?

Second, waiting in line is an experience that in principle can have “downstream” effects, as described by Pettigrew (2017). When an individual is forced to pay a high tax in order to participate in a social or political activity, a natural response might be to avoid said activity, or substitute for it, in the future. To make matters concrete, if a line in front a restaurant is long, some individuals may substitute for said restaurant an alternative eatery, one without a line. While it is far from obvious that voting is substitutable in this way, we should not dismiss the possibility that the effect of waiting in line to vote, which raises the cost to vote, might decrease the likelihood of voting in the future.
These two features of voting lines—time tax and potential future consequences—are distinct. The time tax for voting could be uniformly spread across voters, which might be normatively pleasing, and yet there could be a significant effect of waiting in line on future electoral participation, which might be less so. Or, the time tax could be concentrated on certain types of voters, which most would argue is not fair regardless of whether there are downstream consequences of waiting to vote. With this in mind, our forthcoming analysis of Florida early voting lines is divided into two sections. The first addresses questions associated with the notion of waiting in line as a time tax and the second considers the consequences of this tax.

One of the difficulties in studying voting lines in the United States is the lack of data on who waits to vote. It is of course difficult to study the consequences of waiting in line to vote if one cannot identify which voters waited to vote in the first place. Many researchers deal with this problem by using surveys, which can foster access to wide swaths of voters and integrate responses to waiting time questions with other survey items, namely socioeconomics and partisan queries. A limitation of surveys regarding electoral experiences, though, is that self-reports of voting wait times may not be accurate, and reports of turnout in general may suffer from social desirability bias.

In light of potential issues with survey-based evidence on voting lines, we turn here to a relatively untapped source of data on voting and election administration, namely, voter check-in times. Specifically, we draw on data collected by several Florida counties that recorded check-in times from early voting sites in the 2012 and 2016 General Elections. As will be clear shortly, the thousands of check-in times which form the basis of our research are not subject to issues involving voluntary self-reporting. This is advantageous, as is the association of a voter’s check-in time with her race/ethnicity, party registration, and electoral participation history. However, in the interests of being open about limitations in our data, a voter’s check-in time is not connected directly to her time waiting in line. Our use of early voting check-in times thus complements the literature’s heavy reliance on survey data, and we expect that researchers engaged in election administration
projects will benefit to the extent that multiple sources of data are used in line-based research.

Briefly, our results are as follows. Regarding the time tax associated with waiting to vote, we find disproportionate concentration of this tax on minority voters. The situation was worse in 2012 than in 2016, and in general our data highlight fewer troubling issues in 2016. This is consistent with national, survey-based evidence on voting lines in the 2012 and 2016 General Elections.\footnote{\textsuperscript{1}For a national 2012 versus 2016 comparison, see \url{http://electionupdates.caltech.edu/2016/12/14/this-just-in-lines-at-the-polls-shorter-in-2016-than-in-2012} (last accessed March 30, 2017).} Whether the recent decrease in waiting times reflects progress in Florida election administration, substitution effects and voter sorting, or idiosyncrasies from either the 2012 or 2016 General Election is not clear. Regarding the effect of waiting to vote on future electoral participation, conditional on our strategy for identifying those Florida early voters who suffered long waits in 2012, we find very small yet negative consequences regarding turnout in 2016. The consequences are not completely negligible insofar as long lines do appear to be associated with lower participation levels. The effects, however, are very small.

The next section of the paper situates our study in the literature on voting lines and election administration. We then turn to early voting check-in times in Florida and explain precisely what these times mean and how they can be interpreted. Our results are divided into two sections, first on the distribution of the voting time tax and the second on the effects of the tax. The last section of the paper concludes.

\section*{Voting lines in American elections}

The literature on voting lines is growing, and most of its dates to recent elections. With few exceptions, what we know to date about congestion at the polls and ancillary wait times for voters is derived from survey data. Most notably, Stewart III \textsuperscript{(2013)} and his coauthors have conducted...
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post-election, Internet-based surveys in the United States following the last three general elections. These surveys query voters about their experiences at the polls, including estimated wait times. Stewart III’s Survey of the Performance of American Elections (SPAE), which surveys 200 individuals in each state and Washington, D.C., along with the Cooperative Congressional Election Study (CCES), have been used to gauge relative wait times across states as well as overall wait times for different sub-populations of voters. According to Stewart III, wait times across the states and D.C. tend to vary considerably across states, but a state’s wait times tend to be consistent over time.

Surveys relying on self-reported wait times can serve as valuable barometers for gauging both individual-level and regional distributions of voting delays. For a decade, Floridians have consistently reported having to endure some of the longest wait times in the country. In the 2012 General Election, for example, voters on average reported waiting 39 minutes to cast a ballot, three times the national average (Stewart III 2013).

Surveys are also helpful when trying to tease out the possibility of differential time taxes across sub-populations of voters. Drawing on 2008 CCES data, Mukherjee (2009) finds minority voters were more likely, relative to White voters, to pay such a tax when queuing to vote. Kimball (2013), using the 2012 SPAE, reports that voters in urban areas faced longer lines than rural voters, and Pettigrew (2016) estimates that typically non-white voting locations in the United States were associated with voter wait times approximately twice as long as those in white locations. Herron et al. (Forthcoming) use exit polls in Miami-Dade in 2014 to gauge the polling place experiences of voters leaving polling stations. In his study of the 2012 General Election, which built on the 2008 General Election research design of Alvarez et al. (2009), Stewart III (2013) finds that a voter’s race is an important “individual-level demographic” that explains disparate wait times. “African Americans waited an average of 23 minutes to vote,” Stewart III found, “compared to only 12 minutes for Whites; Hispanics reported waiting 19 minutes, on average.” Stewart III concluded that these differences in wait times could be “due to factors associated with where minority voters live, rather than with minority voters as individuals” (pp. 457-458).
There are several limitations with survey data when used to estimate voter wait times at the polls. As mentioned at the outset, surveys draw on voter self-reports; respondents might not recall accurately how long they waited in line before voting, and social desirability may confound accurate reporting on what has become a controversial, and at times political, issue. Second, surveys often do not distinguish among the various wait times that voters may experience when parking, queuing up to check-in, filling out ballots, or processing completed ballots. Third, and as in the SPAE, not all surveys have access to tens of thousands of respondents; given variability across states in election administration practices, national surveys may not be particularly well-suited for assessing variation in wait times across polling places.

In light of the limitations with survey data, our approach draws on an alternative source of data—the check-in times of early voters in Florida casting their ballots at polling sites during the state’s early voting periods prior to the 2012 and 2016 General Elections. Our use of check-in data complements the study of congestion at the polls in Florida in the 2012 General Election by [Herron and Smith (2015)], in which they draw on precinct-level data detailing when the last voter in a precinct checked in to vote, when the final voter in a precinct cast a ballot, or when the last voting optical scan machine in a precinct was shut down.

Florida’s open records laws make the state an excellent laboratory for the study of election administration. However, one limitation in this results from prohibitions on direct election monitoring. With the exception of those serving as candidate, political party, or ballot issue representatives, Florida state law prohibits precinct observers from tracking voting processes inside a polling place when votes are actively being cast. This effectively precludes scholars who want to understand why lines form inside and in front of Florida precincts from replicating observational studies of voter activities in the vein of [Spencer and Markovits (2010)]’s study of California and [Herron and Smith (2016)]’s research on New Hampshire.
Florida early voting check-in times

Election administration in the Sunshine State—from registering voters, to determining precinct sizes, to staffing and locating polling places, and to setting early voting days and hours—is largely controlled at the county level within a framework established by the Florida legislature. The primary data source in our analysis is thus gleaned from Florida counties, and it consists of early voting check-in times across early voting polling stations during the 2012 and 2016 General Elections. We now explain what these times represent.

In 2012, all 67 of Florida’s counties offered between 6 and 12 daily hours of early voting over an eight-day period (Saturday through Saturday) that ended immediately prior to the General Election, November 6, 2012. In 2016, after long-lines in 2012 had apparently convinced the state legislature to grant counties more flexibility in offering early voting opportunities, counties were permitted to offer up to 12 hours of early voting per day, spread over 14 days, ending the final Sunday before the November 8, 2016, General Election. Counties were permitted to offer a maximum of 168 total hours of early voting.²

Across the United States, early voting is increasingly popular; for analyses of early voting reforms and their consequences, see Neeley and Richardson (2001), Gronke (2008), Gronke and Toffey (2008), Gronke and Galanes-Rosenbaum (2008), and Burden et al. (2014). There are debates in the literature about the extent to which early voting has changed the electorate, if at all, but here we take this mode of voting as given. McDonald, on his Election Project website, estimates that over 23 million voters cast early, in-person ballots in “advance” of the November 8, 2016, General Election, some 17 percent of the 137 million votes cast.³ Thus, even if one were to be

concerned that our focus on early voters in Florida limits our scope, these statistics imply that our results nonetheless apply to millions of Americans.

A Florida voter who wishes to cast his or her ballot early may vote at any early voting polling location in his or her county. This is distinct from in-person, Election Day voting, during which a registered Florida voter must vote at his or her assigned precinct. Rather than relying on traditional, paper-based pollbooks to check-in voters in local precincts, as is the case on Election Day in some Florida counties, the 67 county Supervisors of Elections in Florida use electronic pollbooks to check-in voters during the state’s early voting period. These pollbooks are for the most part known as Electronic Voter iDentification machines, or EViDs for short. Although there is a small amount of variance across Florida counties in electronic pollbook implementation, for simplicity we refer to all electronic pollbooks as EViD machines.\footnote{For example, Sarasota County uses a different electronic voting system for its early voters (phone call with Cathy Fowler, office of the Sarasota Supervisor of Elections, on March 31, 2017).}

EViD machines allow county pollworkers to check-in and verify the registration statuses and identities of voters casting early, in-person ballots. The EViD system is designed to reduce the time it takes to process early voters, and it fosters synchronization across a county’s early voting centers as well as with the Florida statewide voter database. This can thwart potential double-voting. More importantly for our purposes, EViD machines clock the check-in times for all early voters, providing us with effective timestamps that specify when a voter began his or her voting process. EViD timestamps are recorded to the second, and this allows us, for example, to pinpoint early voters who had not checked-in when polls closed at 7:00pm on a given day of early voting but nonetheless cast ballots. Per Florida state law, any voter in line at 7:00pm is allowed to cast a ballot.

EViD timestamps are not subject to potential self-reporting biases and hence are presumably more accurate than surveys of voter times or even within-polling place observations of when voters checked-in. Moreover, EViD timestamps include Florida voter identification numbers, which we
can directly link to the nearly 14 million individual voter registration records in Florida’s statewide voter file. To this end, we merge our EViD with statewide voter files that cover the 2012 and 2016 General Elections.

Despite their advantages, EViD check-in times are not a panacea in the quest to understand voting lines and their consequences. We ultimately care about voter wait times, and in this sense our use of EViD check-in times has limitations. An individual check-in time indicates when a given voter finished waiting in a line, if there were a line to begin with. However, such a time does not specify how long an individual waited to vote, if at all.

Figure 1 displays the distribution of EViD check-in times on the last Saturday (November 3) of the 2012 General Election early voting period for two different polling locations in Florida, one at the Fred B. Karl County Center in Hillsborough County and the other at the West Kendall Regional Library in Miami Dade County. The histograms in this figure describe in ten minute blocks the number of voters who checked into these two polling stations. The counts begin with the first voter who checked-in just as polls opened at 7:00am and end with the last voter who checked-in (regardless of whether this individual checked-in before or after the official 7:00pm deadline for poll closing).

Several features of Figure 1 are notable. First, both panels in the figure contain horizontal red lines at 7:00pm. This is the time beyond which additional voters were not allowed to join a (possibly existing) voting line. In the Hillsborough County location (Figure 1a), no check-ins occurred after 7:00pm, and from this it follows that, at 7:00pm, where was no voting line. In contrast, the Miami-Dade location (Figure 1b) had many post-7:00pm check-ins, the last one of which occurred around 1:00am on Sunday, November 4. This time is noted with a dashed red line. We thus know that the last-voting voter at West Kendall Regional Library waited at least almost six hours to vote.

Figure 1 also includes information on voter self-reported race, and racial details are depicted via bar colors. Early voters at the Fred B. Karl County Center were primarily white, although there
were periods on November 3 when the fraction of non-white votes was disproportionately high, e.g., toward the end of the date. At the West Kendall Regional Library, though, the vast majority of early voters were non-white. The fraction of non-white voters appears roughly consistent across November 3.

Lastly, and very roughly speaking, we observe a flatter or more-uniform distribution of check-in times at Fred B. Karl County Center than in West Kendall Regional Library. We will draw on this fact later, when we try to determine which voters waited in line, and here we provide some intuition. Overall, and as illustrated in Figure 1a, it appears that early voting locations in Florida that shut down very late had flatter distributions of check-in times. We suspect that this is evidence of persistent lines. In contrast, the non-uniformity of check-in times that we observe in Figure 1a is consistent with more of an ebb and flow of early voters. We know that there was not a line to
vote at Fred B. Karl County Center at 7:00pm on Saturday, November 3, this despite the fact that, per check-in times, the Center was regularly processing voters.

Figure [1] highlights the value of EViD check-in times (timestamps, association with race, and so forth) as well as their limitations (check-ins are not linked to arrivals). All data sources have advantages and disadvantages, and we will draw on the former and attempt to work with the latter as we turn to results.

Results

We present results in two sections. First, we describe patterns in check-in times across the 2012 and 2016 General Elections with particular attention to race and partisanship. Second we consider the consequences of extensive early voting wait times based on a identifying assumption that we use to characterize individuals who waited before voting and those who did not.

Who waits?

The election participation history data included in Florida statewide voter files do not contain EViD check-in times. For these times we have to rely on public records requests made to county Supervisors of Elections. Our check-in time coverage of Florida is thus limited.

Early voting in 2012

For the 2012 General Election, we were able to obtain EViD check-in data from four Florida counties in 2012: Alachua, Broward, Hillsborough, and Miami Dade. Altogether these counties had 54 total early voting locations—akin to precincts, except that voters in a given county may cast early ballots in the county—that serviced a total of 690,445 voters in the eight day long, 2012 early voting period.
Figure 2 describes by day of early voting and by hourly window the number of locations across our four counties that actively served voters. All locations served early voters virtually the entire day, and this is evident in the flat line, for the most part pegged at 54 prior to 7:00pm, at the top of the figure; the sole exception occurred at the earliest time of the day, during which a few early voting stations did not have any active voters.

After 7:00pm, however, Figure 2 shows that check-in uniformity across locations quickly changed. On early days within Florida’s eight-day long early voting period, there was a steep drop in active voting locations starting at 7:00pm; note the vertical red line at this time. Even with this drop, however, there were still at least five open locations at 9:00pm on every day of early voting in the early voting period. Then, on the last two days of early voting, November 2 and 3, many early voting locations were open well beyond 7:00pm. On the final Saturday of early voting, over 30 locations were still open at 9:00pm, and several locations were continuing to process voters at midnight.

Figure 3 displays the total number of voters who voted early by the hour of the day at which
they checked-in. Prior to 7:00pm, voters check-ins were distributed fairly uniformly across the day with a small peak before noon. From 7:00am to 7:00pm, our aggregated four counties consistently served approximately 50,000 voters per hour. Then, after 7:00pm, at which point new voters could not join voting lines, the number of voters served per hour dropped drastically but not entirely. A total of 54,329 (7.8%) early voters in 2012 cast ballots after 7:00pm. These are individuals who were in line at the time the polls closed and were allowed to continue to wait to vote. We know that all of these voters had to wait in this way although we do not know precisely how long each waited. Of this group, 24,294 voted after 8:00pm. These voters waited at least one hours to vote, and 9,684 voters, who checked-in after 9:00pm, must have waited at least two hours to vote.

Aggregating across locations, Figure 4 describes the composition of the 2012 early voting pool by race and by hour of check-in. For most of the day, whites were the majority racial group, followed by blacks, Hispanics, and Asians. This ranking is similar to, but does not mirror, Florida’s registered voter pool. In the Florida voter file as of December, 2012, which contains 12,580,602 individuals, approximately 66.4 percent are white, 13.9 percent Hispanic, 13.6 percent black, and
1.63 percent Asian. As in years prior, blacks in Florida in 2012 were disproportionate users of the state’s early voting period (Herron and Smith 2012).

What is striking in Figure 4, however, is the racial composition of the early voting pool immediately before and then after 7:00pm. Simply put, the pool becomes rapidly non-white starting around 7:00pm and by the 8:00pm-9:00pm window is less than 15 percent white.

The partisanship of the early voting pool varies slightly with time although not nearly as starkly as its racial composition. Evolution in partisanship is illustrated in Figure 5, which describes by early voting hour the partisan breakdown of all early voters in our four counties as well as the partisan breakdown of the four aforementioned racial groups. Partisanship here is measured by party registration and is plotted as the percent of early voters in each hour of check-in that are registered Democrat. While Democrats made up 56% of all those who voted early in our set of Florida counties, we can see from the black line in the figure that this percentage varied by hour of the day. Notably, Democrats composed a greater share of the voters in both the early hours of voting and the hours after 7:00pm. Hence, Democrats were disproportionately affected by voting
lines that forced voters to cast their ballots after 7:00pm.

If we consider the breakdown of partisanship by race, as in Figure 5, we can see how this effect might largely be due to the aforementioned racial patterns of voting. For example, black early voters in Florida were almost entirely Democratic, regardless of when they checked-in to vote. Similarly, the partisanship of Hispanic voters—the least Democratic group—remained relatively constant throughout the day. However we do see a slight trend for White and Asian early voters, who became increasingly Democratic as time progressed.

**Early voting in 2016**

We now turn to early voting in 2016. By the General Election in 2016, Florida had increased the number of early voting days from eight to 14, ostensibly in an effort to reduce congestion. Was this change effective? Figure 6 is analogous to the earlier figure that described active early voting locations. Here we have data from Alachua, Hillsborough, and Miami Dade Counties; Broward remains unaccounted for, but hopefully this will change soon. These three counties had 49 early
voting stations in place for the 2016 General Election.

Figure 6: Number of locations where early votes were cast in 2012

Compared to its 2012 version, the most important aspect of Figure 6 is the pictured dropoff in voter check-ins that occurred after 7:00pm. There were indeed check-ins after this time but not nearly as many as in 2012. On the busiest day in 2012, more than half of the polling locations were open past 9:00pm and five were open past midnight. On the busiest day in 2016, though, only two locations were open past 8:00pm and only one early voter cast a ballot past 9:00pm. In the introduction we noted the improvements in voter wait times that others have found in 2016 compared to 2012, and Figure 6 is consistent with national, survey-based findings on voter waiting. Early voting in 2016 appears to represent a major improvement over 2012 in terms of reducing congestion.\footnote{We use the verb “appears” here because of voting-level sorting that may affect with individuals cast their ballots. When the Florida legislature changed the state’s early voting period between 2012 and 2016, voters may have altered their most preferred voting times.}
Late voting in 2012 versus 2016

Figure 7 provides a race-based perspective on the 2012 versus 2016 comparison for Alachua, Hillsborough, and Miami Dade counties (Broward is removed from the 2012 data for comparison). For three key races groups in Florida, black, Hispanic, and white, the figure shows the total number of check-ins by time, aggregated across all days in the 2012 and 2016 early voting periods.

Figure 7: Distribution of voter check-ins, 2012 versus 2016

Figure 7 shows clearly that, not only did more voters check-in for early voting in 2016 compared to 2012, but fewer voters voted past 7:00pm. This is the case for black, Hispanic, and white voters. Moreover, non-white early voters in Florida had disproportionately late check-ins in 2012. We already have seen evidence of this, but Figure 7 shows as well how this problem did not appear in 2016. There were slightly more non-whites with late check-ins in 2016, but the magnitude of the white versus non-white gap shrunk between the two years.

Even though 2016 attracted far more early voters than 2012, the changes made to the early voting period appears to have reduced the congestion. Although the increased number of days may have helped, these three counties still served roughly the same number of early voters per
day in 2016 (approximately 54,933) as they did in 2012 (approximately 55,236). Given reduced prevalence of lines in 2016, it is likely that other reforms made the difference for congestion.

**Effects of waiting to vote**

We now consider the effects on future political participation of waiting in line to vote, in particular waiting in an early voting line in the 2012 General Election. The future participation we have in mind is voting in the 2016 General Election.

We have already noted that the individual-level EViD files we have include Florida voter identification numbers, and this enables us to link these files with statewide Florida vote files. These latter files specify the elections in which voters participated and, if so, how, e.g., voted absentee, voted early, and so forth. Thus, for any early voter in 2012 we can determine whether the individual voted in the 2016 General Election, assuming that this individual still lived in Florida as of November, 2016.\(^6\)

The difficulty in our exercise here is twofold. First, while we know voter check-in times from our EViD data, we do not know associated voter wait times *per se*. To determine wait times precisely we would have to know early voter arrival times, which are not collected by election officials. Hence, distinguishing those early voters in 2012 who waited in line from those who did not is a challenge and requires an alternative method along with some assumptions. Second, early voters who voted at, say, 9:00am on a given day of early voting may be systematically different from those who voted at 6:00pm. Consequently, estimating the effect of voting after closing time—when we know voters have waited in line—is potentially confounded by voter-level selection effects. Hence, we need to ensure that we control for differences across early voters as best as we can so that voter selection into time of early voting does not confound our estimates of the effect of waiting on

\(^6\)When a registered voter moves within Florida, the voter maintains the same voter identification number. Our estimates in this section are thus not confounded by the possibility of 2012 early voters moving across county lines within Florida, for example.
future participation.

Our approach is as follows. We condition on race, partisanship (as before, measured by party registration), gender, age, and previous voting history. And, we make the following assumption: those who voted at early voting locations which stayed open well past the 7:00pm cutoff time are more likely to have waited in line than those who voted in voting locations that closed before 7:00pm or at this time exactly. Moreover, we assume that those who voted just before the 7:00pm cutoff in early voting locations that stayed open late are more likely to have waited in line than those who voted earlier in the day. We cannot know for sure if these assumptions hold, but there is reason to believe that it does.

Take, for example, the two polling locations in Figure 2. The first location—the Fred B. Karl County Center in Hillsborough County—closed on time on November 3, 2012. That is to say, voters in this center voted up to, but not beyond, 7:00pm. Therefore, we assume that the Karl Center was not a congested polling location and that the voters who voted just before 7:00pm did not have to wait in much of a line. If they did have to wait in line to vote, then the line remarkably stopped just in time for the final early voter to check-in right before 7:00pm. While this is technically possible, it would be remarkably coincidental.

On the other hand, the second location in Figure 2—the West Kendall Regional Library in Miami Dade County—remained open until the last early voter checked-in around 1:00am on November 3. We know with certainty that this last voter waited in line to vote. In fact, because all voters had to arrive before 7:00pm in order to check-in, we know with certainty that he or she waited at least six hours to vote. Moreover, we can be fairly confident that the voters who voted just before 7:00pm here also waited in line. Voting that continues past 7:00pm is indicative of a polling place that was operating essentially at capacity at 7:00pm. Hence, those voters who voted just before 7:00pm are similarly likely to have been caught up in a long voting line.

With the above assumptions as background, our strategy for distinguishing voters who waited in line from voters who did not wait in line is first to distinguish those who voted in a polling
place that closed well past 7:00pm from those who voted in a polling place that closed on time. In other words, we attempt to compare voters who cast their ballots in places like the Fred B. Karl County Center to voters who voted in places like the West Kendall Regional Library. More specifically, we want to compare those individuals who voted closest to the 7:00pm cutoff, since those are the individuals who we are most confident were affected by the congestion that caused polling locations to close late.

Therefore, we identify all early voters who voted at a polling location on a day where the last voter checked-in past 7:30pm. These are voters who cast ballots at locations where we know the line at the end of the day was at least a half-hour long. In what follows we call this variable $Over$. Conditioning on race, partisanship, gender, age, and previous voting record (whether the voter voted in the 2008 election) we estimate the effect of voting at a polling location that is congested in 2012—one that goes “over” 7:30pm—on the probability of voting in 2016. We employ a logistic regression as follows:

$$
Pr(Voted_{16_i} = \text{yes}) = \logit^{-1}(\beta + \alpha_{Over} + \gamma_{Hour} + \sigma_{Over\times Hour} + \nu_{Gender} + \\
\rho_{Race} + \tau_{AgeGroup} + \psi_{Party} + \pi_{Voted08})
$$

In the above model, $i$ denotes our collection of 2012 early voters who appear in the history of Florida voting in 2008; $Hour$ indicates the hour of the day at which each voter checked-in, between 7:00am and 7:00pm; $Gender$ indicates whether the voter identifies as male or female; $Race$ indicates if the voter self-identifies as white, black, Hispanic, or Asian; $AgeGroup$ classifies voters according to their 2016 age and bins them into 10-year age groups (20-29, 30-39, 40-49, 50-59, 60-69, and 70+); and, $Voted08$ and $Voted16$ are indicators for participation in the 2008 and 2016 General Elections. All told we estimate our logistic regression based on 562,149 individuals, and coefficient estimates appear in Table 1 in the appendix.

Regression results are displayed graphically in Figure 8. In this figure, we have estimated the probability of voting in 2016 for a male Floridian who is 50 years old, black, registered Democratic,
and who also voted in 2008. The estimates are conditioned on each hour of the early voting day in 2012. The black points in the figure are the estimated probabilities of voting in 2016 conditional on voting at a polling location that closed before 7:30pm. Based on our discussion above, these estimates reflect individuals who likely did not wait in line. The grey points are the estimated probabilities of voting in 2016 conditional on casting an early ballot at a polling location that closed after 7:30pm. These estimates reflect individuals who likely did wait in line to vote. Hence, the difference between these two sets of estimates should reflect the effect of waiting in line. Moreover, the effect should be most isolated as one compares voters casting ballots closer to 7:00pm.

Figure 8: Probability of voting in 2016, given 2012 check-in time

One can see that, beginning at around 2pm, there is a small albeit negative difference between those who voted in congested polling places compared to those in non-congested polling places. This might suggest that the lines started in the early afternoon and this is why a difference is induced so early. Hence, the reason there is no difference between congested and non-congested
polling places earlier in the day might be because lines have yet to form. As congested polling places become congested in the afternoon, we begin to see the small but significant effect on future participation. This result suggests that voting lines have a negative effect on future participation. However, the effect is very small, amounting to no more than a percentage point difference in turnout. Our results are similar to those in Pettigrew (2017).

**Conclusion**

The presence of lengthy voting lines in General Elections in the United States has been of recent concern to scholars of election administration. Burdensome wait times not only impose opportunity costs, but they might also discourage future electoral participation. Hence, researchers have been working to learn more about the prevalence of long lines, who waits in them, and how the burden of waiting might affect future turnout.

Research on voting lines, however, is challenged by the lack of data on lines and wait times. Other than recording the times at which polls officially closed and recording the voters who voted late, there is little additional data recorded by election officials that might distinguish those who waited in line to vote from those who did not. Notwithstanding a small number of exceptions, nor are there official records on how long voters waited. Previous research using election records to study lines have been limited to looking at aggregate precinct results (Herron and Smith 2015; Pettigrew 2017). Data limitations have prevented these projects from identifying individuals who waited in line from those who did not within the same precinct.

To overcome the lack of records, scholars have relied on surveys that ask respondents to recall their experience at the polls and report the length of time that they waited to vote (Stewart III 2013; Pettigrew 2016). While these survey-based analyses have illuminated important variation in wait times across geographies and across racial groups, there is always the caveat that survey responses are subject to biases associated with self-reporting and are limited in sample size.
With these points in mind, we have attempted to add to the existing literature on voting lines by analyzing a new data set on early voter check-in times in Florida’s 2012 and 2016 general elections. Using electronic voting check-in data from Alachua, Broward, Hillsborough, and Miami-Dade Counties, we were able to identify the exact day and time at which each voter checked-in to vote. This data not only provided novel insight into voting patterns across time but also allowed us to identify individual voters who likely waited in line to vote.

We have shown that Florida’s early voting period in 2012 had a significant number of voters that voted past the official 7:00pm closing time and, therefore, had to wait in line to vote. Moreover, the voters were disproportionately black, Hispanic, and Democrat—a finding that coincides with survey results in prior studies. In 2016, we found that congestion observed in 2012 had all but vanished. Voters rarely voted late into the night in 2016, and most early voting locations closed on time. Even though the counties we studied served as many individual per day as they had in 2012, their polling locations appear to have been more prepared to handle the high rates of voting.

As a second result of our analysis, we estimated the effect that waiting in line has on future participation. Using temporal variation in voting across polling locations, we found a very slight negative effect on participation, amounting to no more than a one percentage point decrease in the propensity to vote. The result is similar to that found by Pettigrew (2016).
References


URL: https://dx.doi.org/10.2139/ssrn.2255009


URL: https://www.dropbox.com/s/7eis5yychwgqstw/pettigrew%20-%20lines%20and%20turnout.pdf?dl=0


## Appendix

Table 1: Logit regression predicting voter turnout in 2016

<table>
<thead>
<tr>
<th></th>
<th>Dependent variable: Voted in 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00am</td>
<td>-0.001 (0.040)</td>
</tr>
<tr>
<td>9:00am</td>
<td>-0.041 (0.038)</td>
</tr>
<tr>
<td>10:00am</td>
<td>-0.083** (0.037)</td>
</tr>
<tr>
<td>11:00am</td>
<td>-0.072* (0.037)</td>
</tr>
<tr>
<td>12:00pm</td>
<td>-0.066* (0.037)</td>
</tr>
<tr>
<td>1:00pm</td>
<td>-0.098*** (0.037)</td>
</tr>
<tr>
<td>2:00pm</td>
<td>-0.079** (0.037)</td>
</tr>
<tr>
<td>3:00pm</td>
<td>-0.032 (0.037)</td>
</tr>
<tr>
<td>4:00pm</td>
<td>-0.041 (0.037)</td>
</tr>
<tr>
<td>5:00pm</td>
<td>-0.053 (0.037)</td>
</tr>
<tr>
<td>6:00pm</td>
<td>0.016 (0.038)</td>
</tr>
<tr>
<td>Over</td>
<td>-0.031 (0.035)</td>
</tr>
<tr>
<td>8:00am &amp; Over</td>
<td>-0.017 (0.049)</td>
</tr>
<tr>
<td>9:00am &amp; Over</td>
<td>-0.032 (0.047)</td>
</tr>
<tr>
<td>10:00am &amp; Over</td>
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</tr>
<tr>
<td>11:00am &amp; Over</td>
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<td>12:00pm &amp; Over</td>
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</tr>
<tr>
<td>1:00pm &amp; Over</td>
<td>-0.066 (0.046)</td>
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<tr>
<td>2:00pm &amp; Over</td>
<td>-0.123*** (0.046)</td>
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<td>3:00pm &amp; Over</td>
<td>-0.117** (0.046)</td>
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<tr>
<td>4:00pm &amp; Over</td>
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<tr>
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<td>-0.067 (0.046)</td>
</tr>
<tr>
<td>6:00pm &amp; Over</td>
<td>-0.086* (0.047)</td>
</tr>
<tr>
<td>Gender: Male</td>
<td>-0.151*** (0.009)</td>
</tr>
<tr>
<td>Race: Black</td>
<td>-0.225*** (0.011)</td>
</tr>
<tr>
<td>Race: Hispanic</td>
<td>-0.016 (0.012)</td>
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<tr>
<td>Race: Asian</td>
<td>-0.145*** (0.031)</td>
</tr>
<tr>
<td>Age Group: 30-39</td>
<td>0.301*** (0.014)</td>
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<td>Age Group: 40-49</td>
<td>0.811*** (0.015)</td>
</tr>
<tr>
<td>Age Group: 50-59</td>
<td>1.078*** (0.015)</td>
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<tr>
<td>Age Group: 60-69</td>
<td>1.190*** (0.016)</td>
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<td>Age Group: 70+</td>
<td>0.812*** (0.016)</td>
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<tr>
<td>Party: Independent</td>
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<tr>
<td>Party: Republican</td>
<td>0.060*** (0.012)</td>
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<tr>
<td>Voted08: Yes</td>
<td>0.826*** (0.010)</td>
</tr>
<tr>
<td>Constant</td>
<td>1.024*** (0.032)</td>
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</table>

<table>
<thead>
<tr>
<th></th>
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<th>Akaike Inf. Crit.</th>
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<tbody>
<tr>
<td></td>
<td>562,149</td>
<td>374,615.100</td>
</tr>
</tbody>
</table>

Note: *p<0.1; **p<0.05; ***p<0.01