

Ohio 2004 Election: New Registrants, Provisional Ballots, Voting Machines, Turnout and Polls
Open Elapsed Times in Franklin County Precincts
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The survey of those who cast provisional ballots in Cuyahoga County (Feldman and Belcher 2005; Mebane 2005) strongly suggests that provisional ballots are cast in Ohio in large part because election officials fail to process voter registrations and changes in registration occurring shortly before the election. The Franklin County precinct data analyzed in this memo confirm that provisional ballots also occur for that reason in another county.

The analysis reported in the Ohio precincts report (Mebane and Herron 2005) measures the ratio of voting machines per registered voter for precincts in many Ohio counties. A key result from that analysis is that voter turnout increases as that ratio increases. The mechanism conjectured in that report is that more machines per registered voter meant there were shorter lines, and that shorter lines meant that more people could take the time to vote. As discussed in this memo, precinct data from Franklin County verifies that mechanism. The analysis presented here also suggests that inadequate provision of voting machines in Franklin County reduced voter turnout much more than the estimates presented in Mebane and Herron (2005) would imply.

For discussion of the statistical methods used in this memo see Mebane and Herron (2005) and Mebane and Sekhon (2004a; 2004b).

Figure 1 shows the relationship between the proportion of ballots cast as provisional ballots and the change in voter registration between April and November during 2004. The curved line is the ordinary least squares regression line including a quadratic term. *A higher proportion of ballots were cast as provisional ballots where there was a greater increase in voter registration during 2004.* The relationship flattens out for increases in registration above about 500.

Figure 2 shows the relationship between the proportion of ballots cast as provisional ballots and the number of voting machines per voter registered to vote in November 2004. The line is the ordinary least squares regression line. *A lower proportion of ballots were cast as provisional ballots where the number of voting machines per registered vote was higher.*

Table 1 shows that *a higher proportion of ballots were cast as provisional ballots where there was a greater increase in voter registration during 2004 and where there were fewer voting machines per voter registered to voter in November.* The Proportional Change in Voter Registration (April to November) referred to in the table is the difference between the number registered to vote as of 11/4/04 and the number registered to vote as of 4/1/04, divided by the number registered to vote as of 4/1/04. The overdispersed binomial regression results reported in Table 1 shows that the proportion of provisional ballots increased as that change in registration during 2004 was greater. The significant coefficient estimated for the square of the change proportion indicates that the rate of increase in the proportion of provisional ballots was slightly smaller for higher levels of the change. *The negative estimated coefficient for the machines per registered voter ratio shows that crowding in polling places also increased the proportion of provisional ballots.*

Table 2 shows provisional vote outliers. The precinct codes and precinct names are not the codes used by the Secretary of State but rather the codes included in the source data file.

Figure 3 illustrates how providing an inadequate number of voting machines in precincts in Franklin County, Ohio, in 2004 produced long lines and caused voter turnout to decrease. The

figure shows three scatterplots. The first plot shows the relationship between the voting machines per registered voter ratio and voter turnout across precincts. The line in the plot is the ordinary least squares regression line. Turnout is higher where the number of voting machines per registered voter is higher. The second plot shows the relationship between the voting machines per registered voter ratio and the elapsed time each precinct's polls were open. A longer elapsed time implies that there were more voters still waiting to vote at the end of election day. Many voters waited in long lines during the day, so this duration measure is not a perfect indicator for the long lines phenomenon. But it is practically speaking the only such measure available throughout the entire state of Ohio for 2004. The durations are shorter (meaning lines were shorter) where the number of voting machines per registered voter is higher. The third plot shows the relationship between the elapsed time each precinct's polls were open and voter turnout. Turnout is lower where the durations are greater (meaning lines were longer).

Table 3 further clarifies the relationships among voting machine provision, polling place crowding and voter turnout. The first and third plots in Figure 3 have a clear outlier with very low turnout, so there is already a question of how much that point distorts the overall pattern. A little thought also raises a question of what effect having a polling place be open longer should produce on voter turnout. Other things equal, keeping the polls open longer should increase voter turnout (the counterfactual is obvious: imagine closing the polls while people are still standing in line waiting to vote). So if not having enough voting machines is the root cause of reduced voter turnout, we might expect that the relationship between polls open elapsed time and turnout is positive, not negative, when longer elapsed times are considered for the same number of machines per registered voter. The overdispersed binomial regression results reported in Table 3 show exactly the expected pattern. In a regression where voter turnout is the dependent variable and the polls open elapsed time is the only regressor, the estimated coefficient is negative: turnout is lower where the elapsed time is greater. But when the polls open elapsed time and the machines per registered voter ratio are both included as regressors, both estimated coefficients are positive: having more voting machines per registered voter is associated with higher voter turnout, but so is keeping the polls open longer, given the number of voting machines per registered voter. The display at the bottom of Table 3 illustrates the magnitude of the machine effects by computing expected turnout rates for precincts at the first quartile, the median and the third quartile of the machines per registered voter ratio values, taking into account that in many precincts the machine effect was compensated for (and hence reduced) by keeping the polls open longer in response to the long lines of voters still waiting to vote at the end of election day. *With the polls open elapsed time held at the median time observed among Franklin County precincts, moving from the first to the third quartile of the voting machines per registered voter ratio is associated with an increase of about 7.5 percent in voter turnout.*

Table 4 shows the outliers from the regression models reported in Table 3. The precinct codes and precinct names are not the codes used by the Secretary of State but rather the codes included in the source data file.

Data source: spreadsheet file franklinMchWrkProPollClose.xls (downloaded from <https://wiki.dnc.org/bin/view/OhioVRI/WebHome> on Apr 13 19:12).

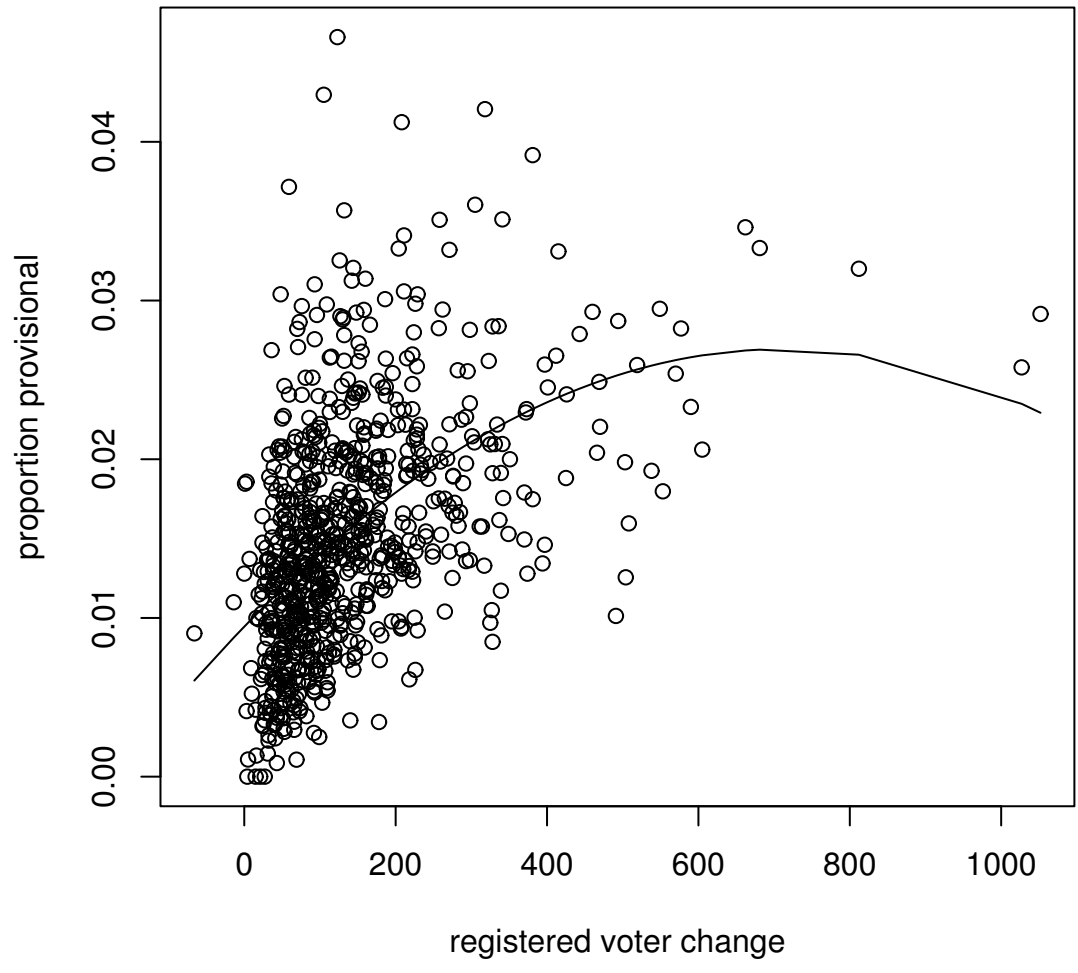


Figure 1: Provisional Ballots and Registration Changes in Franklin County

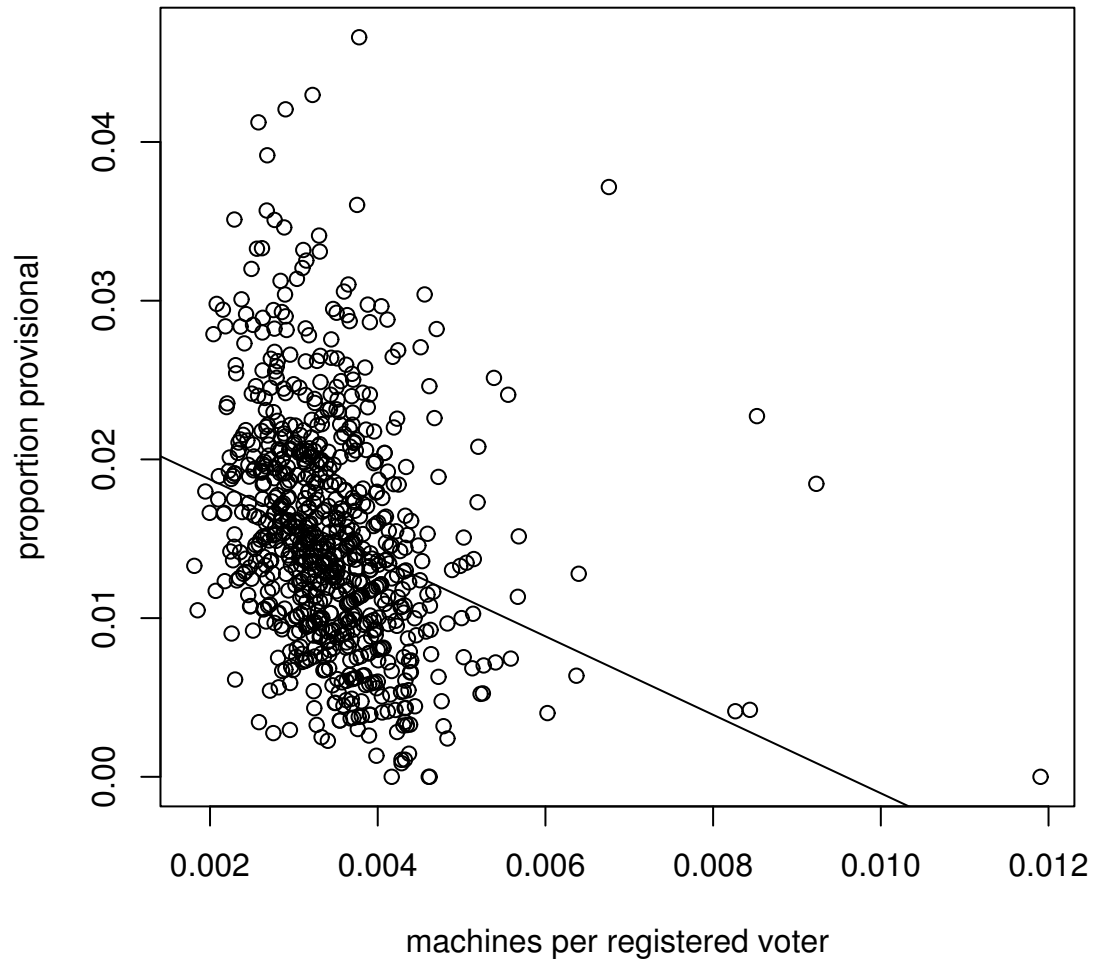


Figure 2: Provisional Ballots and Machines per Registered Voter in Franklin County

Table 1: Provisional Ballots: Registration Changes and Machines per Voter Regressors

Variable	Coef.	SE	<i>t</i> -ratio
(Intercept)	-3.74	0.0899	-41.60
Proportional Change in Voter Registration (April to November)	3.17	0.2200	14.40
Proportional Change in Voter Registration (A to N) Squared	-2.44	0.2330	-10.40
Machines per Registered Voter	-180.00	22.5000	-7.99

Notes: Robust (tanh) overdispersed binomial regression estimates. For each precinct, the dependent variable counts the number of provisional ballots versus the number of nonprovisional ballots. LQD $\sigma = 1.24$; tanh $\sigma = 1.36$; $n = 788$; 13 outliers.

Table 2: Outliers: Provisional Ballots: Registration Changes and Machines per Voter Regressors

Code	Precinct	Precinct Name	SRes
01016D	COLS 16-D	Columbus City Ward 16 - Precinct D	5.31
01040B	COLS 40-B	Columbus City Ward 40 - Precinct B	6.46
01046K	COLS 46-K	Columbus City Ward 46 - Precinct K	3.91
01048A	COLS 48-A	Columbus City Ward 48 - Precinct A	6.81
01062A	COLS 62-A	Columbus City Ward 62 - Precinct A	5.88
01062E	COLS 62-E	Columbus City Ward 62 - Precinct E	4.27
01062I	COLS 62-I	Columbus City Ward 62 - Precinct I	4.93
01065D	COLS 65-D	Columbus City Ward 65 - Precinct D	4.08
01065G	COLS 65-G	Columbus City Ward 65 - Precinct G	4.03
01065H	COLS 65-H	Columbus City Ward 65 - Precinct H	4.00
01066A	COLS 66-A	Columbus City Ward 66 - Precinct A	4.93
01066B	COLS 66-B	Columbus City Ward 66 - Precinct B	4.27
19104A	REYNS 4-A	Reynoldsburg City - Fourth Ward - Precinct A	4.22

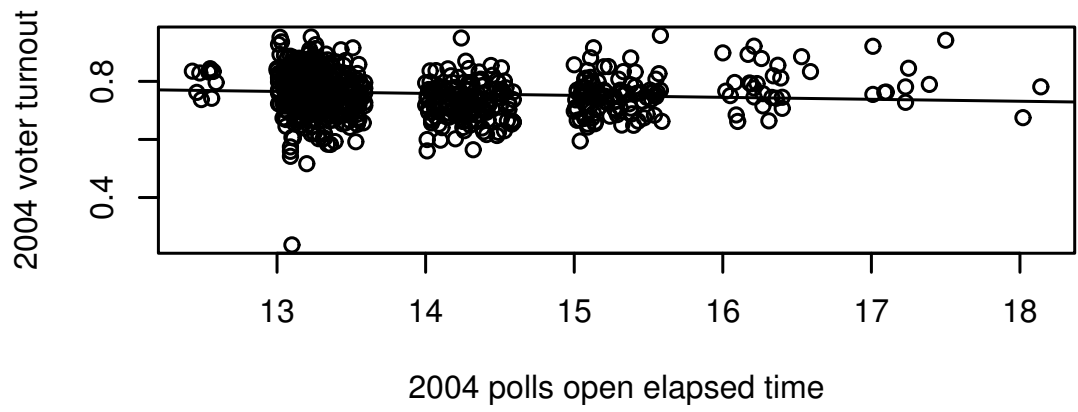
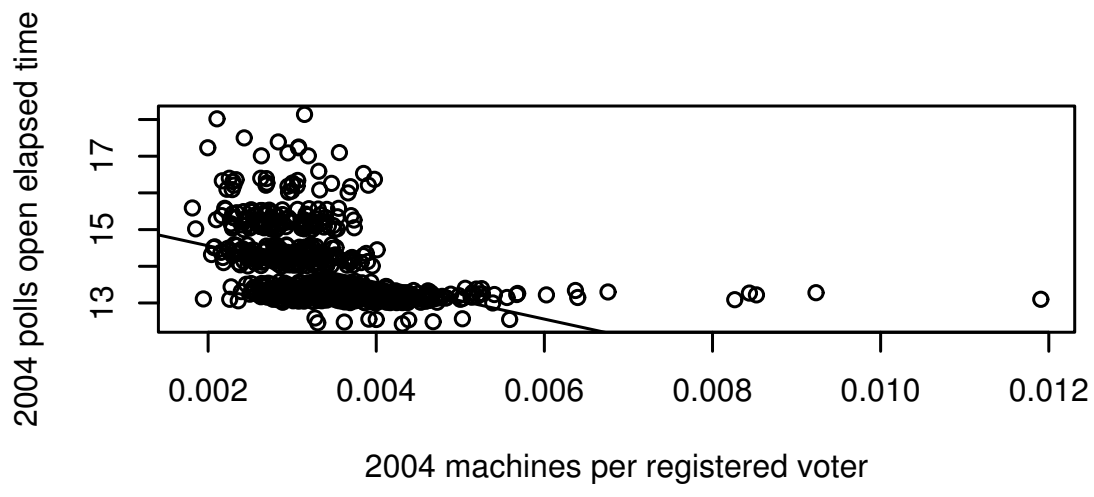
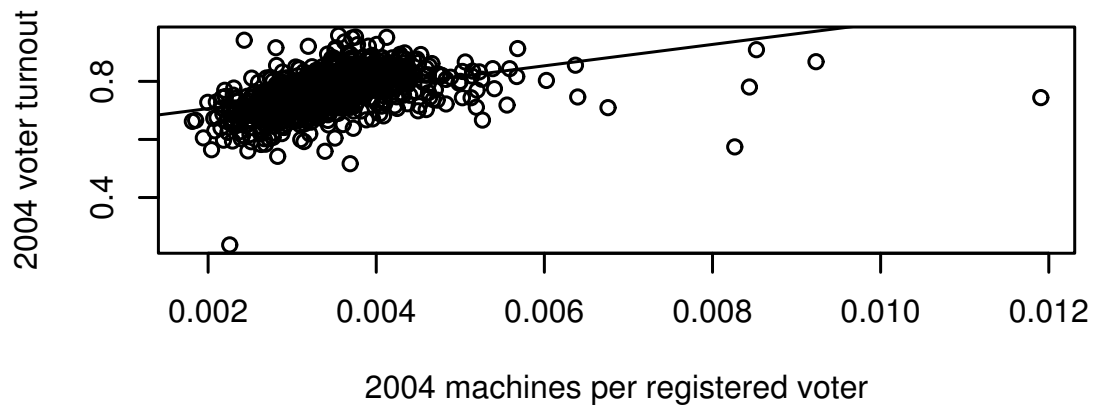


Figure 3: Number of Voting Machines, Turnout and Long Lines in Franklin County

Table 3: Voter Turnout: Polls Open Elapsed Time and Machines per Voter Regressors

Variable	Franklin Precincts			Franklin Precincts		
	Coef.	SE	<i>t</i> -ratio	Coef.	SE	<i>t</i> -ratio
(Intercept)	1.9600	0.167	11.70	-1.7100	0.2050	-8.34
Polls Open Elapsed Time	-0.0584	0.012	-4.88	0.0997	0.0117	8.53
Machines per Registered Voter	—	—	—	445.0000	19.6000	22.70

Notes: Robust (tanh) overdispersed binomial regression estimates. For each precinct, the dependent variable counts the number of registered voters voting versus the number of registered voters not voting. Polls open time only: LQD $\sigma = 4.53$; tanh $\sigma = 4.45$; $n = 788$; 4 outliers. Both regressors: LQD $\sigma = 3.93$; tanh $\sigma = 3.67$; $n = 788$; 7 outliers.

Expected Voter Turnout at
Machine Ratio Quartiles
with Median Polls Open Time

	Quartile		
	25%	50%	75%
Franklin County Precincts	0.715	0.753	0.79

Table 4: Outliers: Voter Turnout: Polls Open Elapsed Time and Machines per Voter Regressors

One Regressor			
Code	Precinct	Precinct Name	SRes
01040B	COLS 40-B	Columbus City Ward 40 - Precinct B	-4.05
01073I	COLS 73-I	Columbus City Ward 73 - Precinct I	4.20
01073J	COLS 73-J	Columbus City Ward 73 - Precinct J	4.95
06000F	FRANKLIN-F	Franklin Township Franklin-F	-8.22
Two Regressors			
Code	Precinct	Precinct Name	SRes
01073J	COLS 73-J	Columbus City Ward 73 - Precinct J	5.02
06000F	FRANKLIN-F	Franklin Township Franklin-F	-6.46
08100A	LOCKBOURNE	Hamilton Township - Lockbourne	-8.08
16200A	HARRISBURG	Pleasant Township - Harrisburg	-4.00
17000J	PRAIRIE-J	Prairie Township - Prairie J	-4.53
19000A	TRURO-A	Truro Township - Truro A	-8.60
21102G	DUB 2-G	Dublin City - Second Ward - Precinct G	4.11

References

- Feldman, Diane, and Cornell Belcher. 2005. "DNC Provisional Ballot Survey." April 28, 2005. Included in the Democratic National Committee report, *Democracy at Risk: The 2004 Election in Ohio*.
- Mebane, Walter R., Jr. 2005. "Inferences from the DNC Provisional Ballot Voter Survey." April 27, 2005. Included in the Democratic National Committee report, *Democracy at Risk: The 2004 Election in Ohio*.
- Mebane, Walter R., Jr., and Michael C. Herron. 2005. "Ohio 2004 Election: Turnout, Residual Votes and Votes in Precincts and Wards." June 9, 2005. Included in the Democratic National Committee report, *Democracy at Risk: The 2004 Election in Ohio*.
- Mebane, Walter R., Jr., and Jasjeet S. Sekhon. 2004a. "Robust Estimation and Outlier Detection for Overdispersed Multinomial Models of Count Data." *American Journal of Political Science* 48 (April): 392–411.
- Mebane, Walter R., Jr., and Jasjeet Sekhon. 2004b. "Multinomial Robust Regression (Multinom-Rob)." Package for **R**. Source code along with LINUX and Windows binaries are available from the Comprehensive R Archive Network (CRAN, <http://cran.r-project.org/>).