
Forecasting Hurricanes and Other Things:

The DeSart and Holbrook Forecast Model and the 2012 Presidential Election

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This paper presents an assessment of the performance of the DeSart and Holbrook presidential election forecast model in generating a forecast of the 2012 Presidential election. The model generates a prediction of state-level outcomes which can then be aggregated to both national popular vote and electoral vote outcomes a month in advance of the election. In 2012, it correctly predicted the outcome in every state and projected that President Obama had a 98.8% probability of winning reelection. A rolling forecast through the month of October also allows us to examine the impact of the debates and Hurricane Sandy on the outcome.

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Hurricane forecasting has become increasingly sophisticated and precise in the past couple of decades, and an informal competition has started to develop between the so-called European and American forecast models as to which one is more accurate in predicting the path of the storm. Similarly, in the past couple of elections we've seen a significant expansion in the development of election forecast models to predict the outcome of American presidential elections. Not only has the number of models grown, but they've also become increasingly complex and sophisticated in their nature.

In 2004, the first APSA Symposium on presidential election forecasts reported predictions from 7 different academic models (Campbell, 2004). In 2008, it reported on 9 models (Campbell, 2008). In 2012, that number had grown to 13 (Campbell, 2012a), and the picture presented from this last set of forecasts suggested that the race between Barack Obama and Mitt Romney would likely be a nail-biter. A number of models predicted an Obama victory by margins ranging from about a half of a percentage point to a rather comfortable margin of over 7½ percentage points. But making the picture a bit fuzzier was the fact that a number of models also generated predictions that Romney would win, some by a margin as big as 6 percentage points.

By the end of September, in the wake of the party conventions and Romney's infamous "47%" gaffe, Obama was enjoying a fairly comfortable lead of about five points in the polls and the story line was that the race was effectively Obama's to lose and that those who were predicting a Romney victory had missed the mark.

And then came the first debate on October 3rd.

Mitt Romney's aggressive offense and Barack Obama's lackluster defense during the debate, effectively changed the narrative of the campaign and truly seemed to turn it into a wide-open, tossup race. You can imagine, then, the skepticism expressed by many when we announced earlier that day the results of our own forecast model which projected that President Obama had a 98.8% probability of winning reelection with 53.1% of the national two-party popular vote and 332 Electoral Votes. In this paper we will discuss this forecast, the model we used to generate it, assess its overall performance, discuss what it can tell us about the 2012 campaign, and update it for the 2016 election.

The Forecast Model

The forecast model that we initially developed after the 1996 election (Holbrook and DeSart, 1999) was a simple and quite parsimonious model comprised of just two variables: the average Democratic share of support among the major party candidates in all trial-heat polls taken in each state during the month of September (POLLS), and the average Democratic share of the two party popular vote across the two previous elections (PRIOR VOTE). These two variables are meant to capture both the short-term and long-term influences that determine the election outcomes in each of the states. The model, therefore, is represented by the following equation:

$$\text{VOTE}_i = \alpha + \beta_1(\text{POLLS})_i + \beta_2(\text{PRIOR VOTE})_i$$

This model generates predictions of the Democratic share of the two-party popular vote (VOTE) in each of the states, i .

The poll variable is derived from data obtained from various internet sources like NationalJournal.com's PollTrack, PollingReport.com, and Pollster.com. In our previous work,

we have shown that these September polls generally are a fairly good indicator of how the election will turn out in each of the states (Holbrook and DeSart, 1999; DeSart and Holbrook, 2003). Indeed, it is the case that candidates win the states in which they hold a significant lead in the polls in the month of September.

This pattern held true for 2012 as well, and was one of the reasons the election proved to be as predictable as it was, despite the apparent closeness of the race. As Table 1 demonstrates, there were 34 states in which either Romney or Obama held leads outside the average margin of error over the course of September. The leading candidate held on to win each of those states. A Kendall's Tau-c of .96 confirms the strong correlation of September polls with the eventual outcome. Disregarding the margin of error and simply awarding states on the basis of the point estimates from the average September polls also show the significant predictive power of these polls. In 2012, every state where a candidate led within the polls' average margin of error ended up being won by that candidate.

The PRIOR VOTE variable is intended simply as a measure indicating the overall partisan tendency of a state. It serves as a stabilizing influence in the model. While the polls might respond to the short term stimuli of the specific campaign, the prior vote variable reflects the tendency for states to regress back to their typical behavior on Election Day. Using just these two variables we had been able to generate amazingly accurate predictions of state election outcomes.

In addition, we have shown that the state-level results can be extrapolated to the national-level, both in terms of the popular vote and Electoral College vote (DeSart and Holbrook, 2003). The process for performing these extrapolations is relatively straightforward. For the Electoral

College forecast it is a simple matter of awarding a state's Electoral College votes based on the model's point estimate for the outcome in that state.

The national popular vote extrapolation is a little more complex. Since each state's contribution to the total number of votes cast in the election varies considerably according to its population and level of turnout, simply averaging the state-level predictions across the 50 states would produce a biased estimate favoring the less populated/lower turnout states. To account for this, each state needs to be weighted according to its overall contribution to the total number of votes cast nationwide. To calculate this weight for the purposes of a prediction, a state's total number of votes in each of the two previous elections is taken as a proportion of the total number of votes cast in those elections. Each state's weight is then derived by taking the average of its proportions across those elections. The national popular vote forecast is thus a simple matter of taking the weighted mean of the state-level forecasts.

Even though the model performed reasonably well in generating forecasts of the 2004 election we did modify it in advance of the 2008 election somewhat to improve its predictive power. (DeSart and Holbrook, 2008) We made two changes. First, we increased the time frame of the prior vote variable from the average of the two previous elections to the average of the previous four. This would help us mitigate the effects of any home-state advantage that might have been enjoyed by a candidate in a previous election and "normalizing" the average somewhat.

The second change involved the inclusion of a third variable: a national poll variable. In our original presentation of the model (Holbrook and DeSart, 1999) we had noted that there was a significant year-specific effect in the forecasts from year to year that wasn't being picked up by the state polls. The trick, of course, was in knowing what that effect would be in advance of the

election. The use of national polls made perfect sense since it should capture the effects of the particular electoral context of a given year. Our specific measure is the average Democratic share of the of all national head-to-head trial heat polls conducted in the last two weeks of September.

The inclusion of these two changes thus resulted in the following equation:

$$\text{VOTE}_i = \alpha + \beta_1(\text{POLL})_i + \beta_2(\text{PRIOR VOTE})_i + \beta_3(\text{NATIONAL POLLS})_i$$

which we used to generate the forecast that we announced on October 3, 2012.¹ From our generation of the point-estimates of the state outcomes, not only can we come up with a estimates of the national popular vote and Electoral College outcomes, but we can also calculate win probabilities for each of the states using the point-estimates along with the $SE_{y|x}$ from the model, which, following our 2010 update of the model was 2.99 (DeSart and Holbrook, 2010).

From these state-level win probabilities we are then able to run a 100,000 iteration Monte Carlo simulation to determine the probability that the Democratic candidate will win at least the minimum 270 electoral votes required to win. In addition, we can also run a Monte Carlo simulation using randomly-generated state popular vote outcomes normally distributed around each of the state point estimates using the model $SE_{y|x}$ to determine the distribution of possible national popular vote outcomes, which will yield a probability that the Democratic candidate will win a majority of the national two-party popular vote.

Using this method and applying it to the data we collected for the 2012 election we projected that Barack Obama would win 332 Electoral Votes and 53.1% of the national two-party popular vote. In addition, the model revealed that Obama had a 98.8% probability getting at least 270 Electoral Votes, and had a better than 99.999% probability of winning in the popular vote as well.

¹ The specific equation used to generate the forecasts was $\hat{y} = .575 \times \text{POLLS} + .570 \times \text{PRIOR VOTE} + .440 \times \text{NATIONAL POLLS} - 29.454$.

A Problem of Missing Data

There was one issue that complicated matters for us which had never come up in previous elections. In each of the elections for which we had data (1992 – 2008) we'd never encountered a situation where we didn't have at least one poll conducted in each of the states during the month of September. 2012 was the first year where we did not have a complete set of September polling data. There were ten states where no September poll results were ever reported: Alaska, Delaware, District of Columbia, Georgia, Hawaii, Idaho, Kansas, Louisiana, Mississippi, South Carolina, and Wyoming. Fortunately, and this was probably the reason why no data were available, these were all states that were widely considered to be non-competitive so the eventual winner in those states would have been fairly easy to predict with or without data. So there was little likelihood that this would affect our Electoral College projection.

But it *did* present a problem for us in that without a complete set of data, it would render our attempt at estimating the national popular vote impossible. Without data to generate a point estimate for every state, we would not be able to aggregate up a weighted popular vote percentage. In an effort to deal with this shortcoming in the data, we made an effort to impute poll data for those states.

How we did this was fairly straightforward. We started from the assumption that states that voted similarly to each other in 2008 would most likely vote similarly to each other again in 2012. Therefore, in order to estimate what the poll results would be in the states for which we had no data, if in fact a poll had been conducted, we simply averaged the poll results from the four states (for which we had data) that voted most similarly to it in 2008.²

² This method was impractical for imputing data for the District of Columbia, since it is so overwhelmingly Democratic that it is an outlier with no states even remotely similar to it. So, to impute data for DC, we simply used the value of the PRIOR VOTE variable for the POLL variable as well.

The extent to which this method affected the accuracy of our predictions appears to be fairly modest. Overall, the mean absolute error of our state forecasts was 2.19. When we compare the mean absolute errors of our predictions for states for which we had data to those of states for which we used imputed data, we found that our forecasts were only slightly better for states for which we had complete data. The mean absolute error in our predictions for states for which we had complete data was 1.99. The same measure for the states with imputed data was a bit higher at 3.00. A simple t-test of the two distributions indicated that the differences would not be considered statistically significant ($p < 0.18$).

Furthermore, a cursory examination of the data indicated that the use of complete data as opposed to imputed data was not necessarily a guarantee that the forecasts would be more accurate. Of the bottom quartile of states in terms of forecast accuracy, about a third of them were states with imputed data, and the state with the *least* accurate prediction, West Virginia, was a state for which complete information was available.

Ultimately, we conclude that our method of imputation was reasonable, but we will examine the efficacy of other strategies before deciding on a method to use in generating our 2016 forecast, if it becomes necessary.

Overall Performance of the Model in 2012

Generally speaking, the model did reasonably well in generating both state-level forecasts and extrapolated estimates of the national-level outcomes. The projection that President Obama would win 53.1% of the national two-party popular over-estimated the actual result (52%) by just over 1 percentage point. By the benchmarks proposed by Campbell (2008), this would fall into his category of a “quite accurate” forecast.

To put this more into perspective, Table 2 presents a comparison of the forecast errors of our model with that of each of the models that were put forth in the APSA Symposium published in the October 2012 of *PS: Political Science and Politics*. (Abramowitz, 2012; Berry and Bickers, 2012; Campbell, 2012b; Cuzán, 2012; Erikson and Wlezien, 2012; Hibbs, 2012; Holbrook, 2012; Jérôme and Jérôme-Speziari, 2012; Klarner, 2012; Lewis-Beck and Tien, 2012; Lockerbie, 2012; Montgomery et al., 2012; Norpoth and Bednarczuk, 2012) Because our model relies upon September data, it comes out at least a month later than those presented in the APSA symposium and too late for it to be presented at the APSA annual meeting (usually held around the first weekend of September) and to be included in the printed Symposium in *PS*.

An examination of Table 2 reveals that while ours was not the most accurate model in generating a popular vote prediction, it was definitely above average. Now, it would be a fair criticism to state that because our forecast comes at least a month closer to the election than the others, it *should* be more accurate, but since complete polling data in the states prior to September is largely unavailable there is not much that we can do to remedy the problem, and the trade-off we get in terms of simplicity and accuracy v. election lead-time make its performance reasonably respectable.

One thing that *is* clear from Table 2 is that our model is one of only a few academic models that generate an Electoral College projection in addition to the popular vote projection. Indeed, when our model was first published in 1999, it was the first that was developed for the

purpose of generating predictions of state-level outcomes.³ In addition, in 2012 it generated a perfect forecast, accurately projecting the winner in all 50 states (and the District of Columbia).⁴

Ultimately, what this shows is that, despite the narrative that the race was essentially a toss-up and too close to call, it proved to be highly predictable, as is once again evidenced by the data presented in Table 1. President Obama held significant leads in 19 states, worth a total of 237 electoral votes. That meant that all he needed was to put together a combination of victories in the remaining 11 “toss-up” states (worth a total of 116 electoral votes) that would get him an additional 33 electoral votes in order for him to secure a victory.

Romney, on the other hand, had a much more daunting task. Even though he held significant leads in more states than did Obama at the end of September, they were only worth a total of 185 electoral votes. That meant that Romney had a much more difficult task ahead of him, particularly since Obama held leads in the polls (albeit within the margin of error) in 8 of the eleven toss-up states. For Romney to have a chance, he’d have to practically sweep all of those toss-up states.

The Rolling October Forecast

In addition to the forecast we produce at the end of September, we also have an October forecast model which allows us to generate a daily updating forecast through the month of October right up until Election Day. The structure of the model is the same as that for September. The only difference is that the October model, as the name would suggest, relies upon data from the month of October. Its coefficients are somewhat different than those of the

³ Holbrook (1991) did suggest that his pooled cross-sectional analysis of state presidential election outcomes could possibly be used to generate state-level forecasts, that was not its primary purpose.

⁴ Because of its outlier status as an overwhelmingly Democratic “state” we do not include data from the District of Columbia in generating the coefficients for the model as it would likely bias the estimates. We do, however, use data from DC to generate a forecast.

September model, with the October model giving greater weight to the POLL variable and less weight to the PRIOR VOTE and NATIONAL POLLS variable.⁵

The first projection we reported from the October model in 2012 came on October 10th, a week after the first presidential debate. It suggested that Romney's performance (and Obama's apparent lack thereof) in that debate had significantly changed the direction of the campaign. According to that first projection from the October Model, Romney had seized some momentum and had eaten into Obama's seemingly insurmountable lead.

The model indicated that three "tossup" states that the September model had projected were going to be won by Obama had flipped and were now forecast to be in Romney's column: Colorado, Florida, and Virginia. These were important gains for Romney, and the probability that Obama would win an Electoral College majority had dropped from 98.8% to 80.4%. Even so, those gains were still not enough for Romney because the model still had Obama winning 281 electoral votes.

The key seemed to be whether the momentum would stay on Romney's side or whether it would stabilize and/or move back towards Obama. The answer appeared to come the very next night with the Vice-Presidential debate. The model indicated at that point that the Romney momentum had apparently stalled and Obama's win probability had started to slowly creep back up. It never again got down as low as 80.4% and spent much of the month of October hovering between 84% and 87%.

The key was Ohio. As long as that stayed in Obama's column, he didn't need Florida, Virginia, or Colorado, and it never really showed signs of flipping. The lowest Obama's probability of winning Ohio ever got was 66.4% on October 24th. In the meantime, all three of

⁵ The corresponding regression equation for the October forecasts was: $\hat{y} = .795 \times \text{POLLS} + .315 \times \text{PRIOR VOTE} + .109 \times \text{NATIONAL POLLS} - 10.981$.

the states that had flipped to Romney in the forecast were edging back towards Obama. Colorado wavered at the end of October and finally flipped back to Obama for good the day before the election, and Virginia moved back to Obama's column in our final forecast posted on the morning of the election. Florida stayed on the razor's edge according to the forecast and it remained in Romney's column in the final Election Day forecast, but only barely so, with Obama projected to receive 49.95% of the two-party popular vote there.

In the end, the missed Florida call in the final Election Day forecast is the only misstep by the model in 2012. Figure 1 graphically depicts the model's performance in both its September and Final forecasts. As you can see, the predictions remained stayed fairly close to the actual result through the fall campaign. The only real glaring misses appear to be in the upper right quadrant. In particular is the Final forecast projection for one state that severely under predicts Obama's support by approximately 20 percentage points. This state is Alaska, which was one of the states for whom we did not have polling data, and therefore relied upon imputed data for the estimate. Most likely this is a function of the fact that former Alaska Governor Sarah Palin had apparently enjoyed somewhat of a home state advantage in 2008, so Alaska ended up skewing much more Republican that year than it otherwise would have. As a consequence, when we were finding the "most similar states" in order to derive our imputed estimates Alaska was being compared to states that were far more Republican than it was, resulting in an imputed figure that understated President Obama's actual level of support in that state. This reveals a potential shortcoming in our imputation method and will be the focus of future research.

A Note about Hurricane Sandy

Much was made during the closing days of the campaign about the potential effects of Hurricane Sandy on the outcome of the election. Some, like Karl Rove in a Wall Street Journal op-ed piece a couple days after the election, suggested that if not for Hurricane Sandy the election might have turned out different. Indeed, Rove himself stated that President Obama was “lucky” that the hurricane had hit because it had halted the momentum that Romney had built up following the first debate and turned it around back into Obama’s favor.

While there is some evidence in our forecast data to suggest that there is some truth in this claim, there is much more to suggest that its impact was minimal and did not fundamentally affect the outcome. It is true that in the final week of the campaign after Hurricane Sandy made landfall, the model’s projected win probability for President Obama did creep up, but only slightly. On October 22nd, the day that Hurricane Sandy developed in the Atlantic, our model had set Obama’s probability of winning a majority in the Electoral College at 86.16%. By Election Day, that probability had climbed up to 88.62% and our projected Electoral College total for Obama had gone from 281 to 303.

So there may have been some marginal effect benefitting Obama from the storm, but other evidence suggests that Romney’s momentum had dissipated well before that point. As was pointed out earlier, the initial impact of the first presidential debate was clear in our projection of October 10th, dropping Obama’s win probability by roughly 18 percentage points, but that’s where it bottomed out. It had been rather steadily climbing again from that point on and by the day of the third and final presidential debate (October 22nd), it had rebounded significantly.

So, while Hurricane Sandy may have had some effect in benefitting President Obama during the campaign’s final days, it is difficult to separate out its effect from that of the other

campaign events, and it is certainly not clear that it was a decisive factor in any way. Our data reveals that any momentum that Romney had gained from the first debate had certainly stalled by the time of the second debate occurred on October 16th.

Updating the model for 2016

With another election behind us, we now have an additional set of data from which to derive estimates of the coefficients necessary to generate a forecast for the 2016 election. Table 3 presents the results from the analysis utilizing data from all six elections from 1992 to 2012. The model continues to perform well each election, and with each new set of data points it becomes a bit more accurate in projecting outcomes at both the state and national level, by most diagnostics. Based on this analysis, the equation we will use for generating a forecast of the 2016 election will be:

$$\text{VOTE}_i = -27.636 + .607(\text{POLL})_i + .529(\text{PRIOR VOTE})_i + .410(\text{NATIONAL POLLS})_i$$

Of course, what this model cannot predict is whether or not a hurricane will make landfall a week before the election. Nor will it be able to tell how many more forecast models will be developed between now and 2016, or how many variables those models will contain. But what the results of this analysis would seem to suggest is that more is not necessarily better.

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Table 1 - September Polls and November Outcomes - 2012

		September Polls		
		Obama leading	Toss-Up	Romney
A c t u a l	Obama	California (55) Minnesota (10) Connecticut (7) New Jersey (14) DC (3) New Mexico (5) Delaware (3) New York (29) Hawaii (4) Oregon (7) Illinois (20) Pennsylvania (20) Maine (4) Rhode Island (4) Maryland (10) Vermont (3) Massachusetts (11) Washington (12) Michigan (16) N = 19 Electoral Votes = 237	Colorado (9) Florida (29) Iowa (6) Nevada (6) New Hampshire (4) Ohio (18) Virginia (13) Wisconsin (10) N = 8 Electoral Votes = 95	—
	W i n n e r	Romney	—	Montana (3) North Carolina (15) South Dakota (3) N = 3 Electoral Votes = 21

September Poll variable indicates which candidate held a significant lead in the aggregated average of polls conducted in each state in September. Toss-Up states are those where the leading candidate's average poll share did not exceed 50% plus the average margin of error of the polls conducted in that state. Italicized states are states with imputed data due to missing observations.

Tau_c = .96

Table 2 - Comparison of 2012 Forecast Models

<u>Model</u>	Popular Vote		Electoral Vote	
	<u>Forecast</u>	<u>Error</u>	<u>Forecast</u>	<u>Error</u>
DeSart and Holbrook	53.1%	+1.1	332	0
Lockerbie	53.8%	+1.8	—	—
Norpoth and Bednarczuk	53.2%	+1.2	—	—
Erikson and Wlezien	52.6%	+0.6	—	—
Jerôme and Jérôme-Speziari	51.6%	-0.4	324	-8
Campbell	51.3%	-0.7	—	—
Klarner	51.3%	-0.7	301	-31
Abramowitz	50.6%	-1.4	—	—
Montgomery et al.	50.3%	-1.7	—	—
Lewis-Beck and Tien	48.2%	-3.8	—	—
Holbrook	47.9%	-4.1	—	—
Hibbs	47.5%	-4.5	—	—
Berry and Bickers	47.1%	-4.9	213	-119
Cuzán	46.9%	-5.1	—	—
Mean Absolute Error		2.3		

Forecasts are each model's projections of Obama's share of the national two-party popular vote and, when available, number of votes won in the Electoral College. Source: (Campbell, 2012)

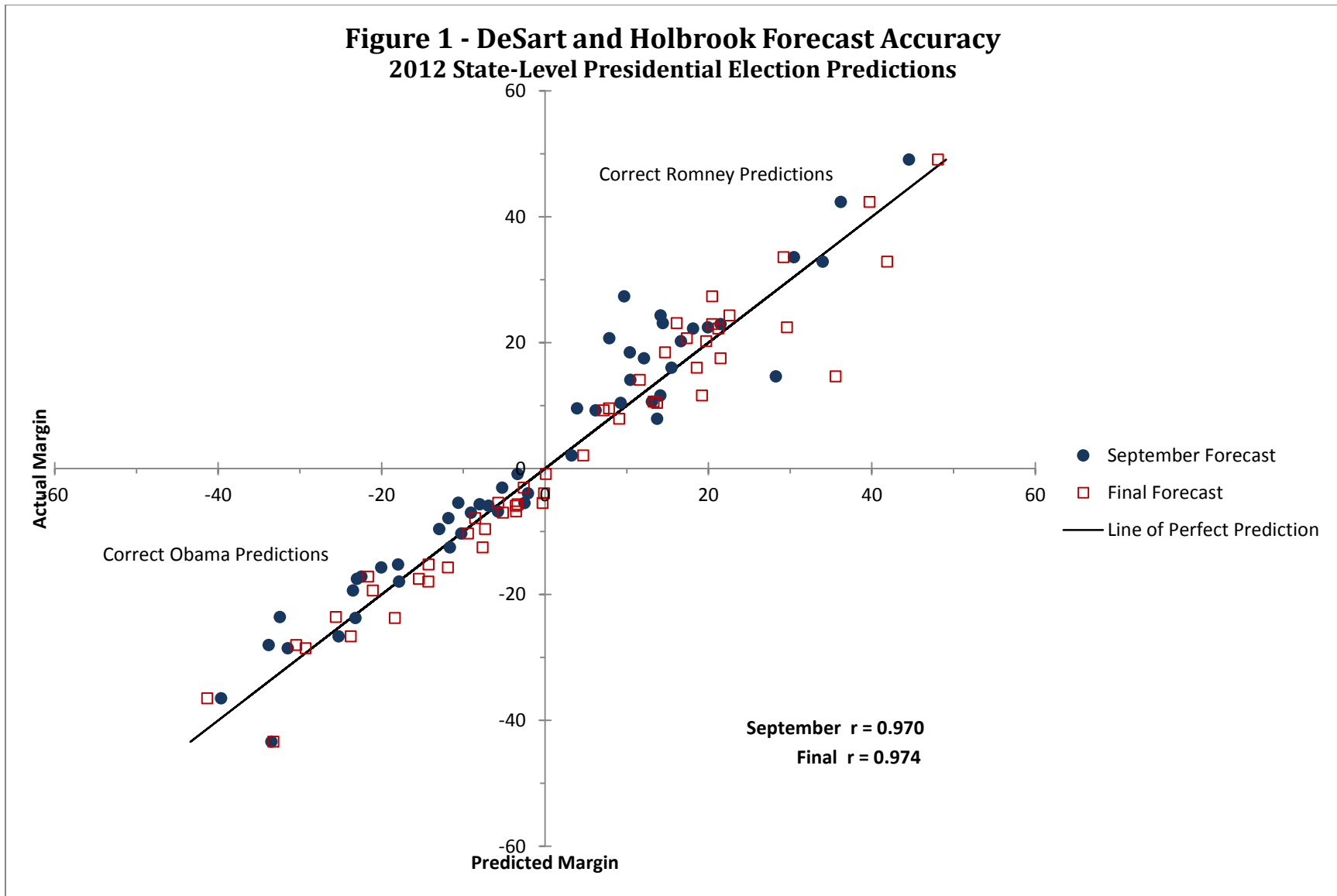
Table 3 - General Forecasting Models for State- and National-Level Presidential Election Outcomes

	<u>Unstandardized Regression Coefficient</u>						
September Polls	0.607*						
Prior 4 Elections	0.529*						
National Polls	0.410*						
Constant	-27.636*						
R ²	0.894						
S.E. y x	2.947						
N = 300							
* = p < .001							
 In-Sample Model Performance							
	<u>1992</u>	<u>1996</u>	<u>2000</u>	<u>2004</u>	<u>2008</u>	<u>2012</u>	<u>OVERALL</u>
States correctly predicted	86%	92%	92%	96%	92%	100%	93%
Mean absolute Error	2.47	2.23	2.24	1.69	3.15	1.99	2.30
 <i>National-level predictions</i> [†]							
Two-party popular vote	53.70%	55.03%	50.25%	48.42%	51.93%	52.69%	
Error	+0.34	+0.37	+0.06	-0.26	-1.67	+0.80	0.58**
Electoral College vote	394	396	286	235	333	329	
Error	+27	+20	+22	-13	-29	0	18.5**

[†] Excluding the District of Columbia

** Mean Absolute Error

**Figure 1 - DeSart and Holbrook Forecast Accuracy
2012 State-Level Presidential Election Predictions**



Data represents a scatterplot of the models' projected margin of victory [$2 \times (\text{FORECAST} - 50)$] on the horizontal axis by the actual margin of victory by each candidate [$2 \times (\text{RESULT} - 50)$] on the vertical axis.