Markets vs. Polls as Predictors:
An Historical Assessment of US Presidential Elections

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In recent years, prediction markets have drawn considerable attention as a tool for forecasting future events (e.g., Arrow et al., 2008). Markets on election outcomes are a centerpiece of this discussion. A common claim is that prices in election markets, such as the Iowa Electronic Market , predict elections better than the polls (Berg and Rietz, 2006; Berg, Forsythe, Nelson, and Rietz, N.d.;). This idea that markets beat polls has entered the academic mainstream (e.g., Caldiera, 2004; Sunstein, 2005) and the popular press as well (e.g., Surowiecki, 2004). At the same time, the efficiency of election markets is the subject of debate (Kou and Sobel, 2004; Rohde and Strumpf, 2004; Wolfers and Zitzewitz, 2004, 2008). Erikson and Wlezien (2008) challenge the idea that markets dominate the polls, showing that historically one could profit in the Iowa market by exploiting information available in the polls (Erikson and Wlezien, 2008). Election markets appear to be subject to an underdog bias similar to that in horseracing (Wolfers and Zitzewitz, 2004, 2008). For instance, throughout most of Clinton's two victorious presidential campaigns, the Iowa winner-take-all market underestimated Clinton's chances compared to what a reasonable interpretation of the polls would suggest (Erikson and Wlezien, 2008).

To really settle the controversy, it would help to have both market prices and poll results for a series of elections and then see which predictor works as an election forecaster. Unfortunately, modern electronic markets have been around for only a handful of elections. If, for instance, we want to compare winner-take-all market prices from the Iowa Electronic Market (IEM) with poll results as predictors of presidential elections in the US, we have only the five presidential elections between 1992 and 2008.

As it turns out, this is not quite right, and we have much more data set to draw on. As Rohde and Strumpf (2004) point out, vigorous election markets thrived on the Wall Street curb – that is, not on the New York Stock Exchange -- going back from at least as far as 1880 up to 1960. By pulling together these Wall Street Curb markets, contemporary electronic markets, and, for the intervening years, London bookmaker odds, it is possible to compare election-eve market prices and election-eve trial-heat polls as predictors of presidential elections for 16 data points—all presidential elections from 1936 through 2008 except for 1964, 1968, and 1972 for which no market data is available. . This is more than the usual number of cases that presidential election forecasters use for their augury (see Campbell and Garand, 2000). Curb market prices from earlier years yields 14 control cases for 1880-1932—presidential elections with prediction markets but no scientific polls.

Our data set consists of election-eve market prices drawn directly from the appendix to Snowberg, Wolfers and Zitzewitz (2004). Snowberg, Wolfers and Zitzewitz report election-eve market prices from Rhode and Strumpf's Wall Street Curb markets (through 1960) with electronic markets (1992 onward), supplemented by information from London betting markets for 1976-1988. For 1932-2008, we can compare the final pre-election prices with late trial-heat poll preferences as electoral predictors. We also can compare the performance of market prices during the poll era with market prices during the pre-poll era to see whether market prices improve when the feedback of scientific polls is available.

With more than a century and a quarter's worth of the prices of election outcomes on the day before each election, we possess the evidence regarding popular expectations of presidential election outcomes at the moment of the election. This paper compares the accuracy of presidential

betting markets in years before and after public opinion polls were introduced. And, for the modern polling era, we compare the predictive power of polls versus markets.

What should be our expectations about the evolution of election markets? It is commonly understood that before scientific polling was invented, public opinion was difficult to gauge (Geer, 1996; Kernell, 2000). Almost certainly, it would seem, elections of the pre-poll era were conducted under greater uncertainty about the outcome than elections today, but with observers monitoring various indicators for cues (Kernell, 2000; Karol 2007; see also Robinson and Chaddock, 1932). In the absence of scientific polls, election market prices were eagerly studied for evidence of election trends (Rohde and Strumpf, 2004). One obvious hypothesis then is that before polls, market prices provided a less reliable election indicator of presidential election outcomes than polls do today. A second obvious hypothesis is that the accuracy of market prices would improve once scientific polls were established. To summarize, based on the conventional wisdom we expect polls to dominate election markets as the election predictor when we only have one but not the other, but election markets should improve once polls are available to provide reliable information to investors.

What should be our expectations of market prices versus polls when both are available? We might expect that market prices add information about the forthcoming election beyond what evident from the polls. Enthusiasts for contemporary election markets claim that market prices are superior to the polls for forecasting presidential elections. Tell us the betting line, say market believers, and we tell you the outcome with greater accuracy than the latest polls (Berg and Rietz 2006; Berg, Forsythe, Nelson, and Rietz, N.d.; Wolfers and Zitzewitz, 2004; Page, 2008). The evidence is not uniformly in support of markets, however, with at least one study showing that one can profit at election markets by the strategy of betting on poll projections where they differ from market prices (Erikson and Wlezien, 2008).

Although these may all be reasonable, if not obvious, expectations, it turns out that *none* holds up when put to the test of data analysis. We find that market prices are far better predictors without polls (1880-1932) than with polls available (1936-2008). We also find that market prices of the pre-poll era predicted presidential elections at least as well as polls have done following the introduction of scientific survey research. Finally, we find that last-minute market prices add nothing to election prediction once we control for trial heat polls during the final week of the campaign.

At first glance, this is quite topsy turvy. The first of these upsets would have us believe that markets perform better when polls are not available as a guide. The second would have us believe that we can just as easily predict elections with only election markets as with polls. The third would have us believe that election market prices are not informative when polls are available. Put succinctly, our preliminary results shown below that (1) markets without polls beat markets with polls; (2) markets without polls are as good as polls; and (3) polls beat markets when both are present. This ordering is not transitive.

In the sections below we first present the data analysis supporting our odd set of results. Then we attempt a reconciliation of theory and evidence, and consider implications of the findings and the future of forecasting using markets and polls. In the end we find no reason to challenge the value

of contemporary polling. At the same time, early election markets before polls were surprisingly good at extracting campaign information without "scientific" polling to guide them.

Election Markets—Then and Now

Comparing Prediction Markets 1880-1932 vs. 1936-2008

Recall that we have three different kinds of market data. First, for the period between 1880 and 1960, we have the prices from the real Wall Street Curb markets (Rohde and Strumpf, 2004). Second, for the period from 1992 to the present, we have the prices from online markets, specifically the Iowa Electronic Markets through 2000, Tradesports in 2004, and Intrade (formerly Tradesports) in 2008. Thirdly, for some of the intervening years, where we have neither the old or new markets, we have the London betting odds—specifically, via Snowberg et al. we have these betting odds for 1976-1988. Each is slightly different, and the differences might help explain differences in performance of market prices in our analysis, which we discuss in the concluding sections. Each does provide a winner-take-all price, however. These can be interpreted as the market's judgment of the probability of victory, i.e., a price of 34 cents registers a 34% probability of victory, the rate of return on a $1 investment.[1] For this analysis we rely mainly on the election-eve prices available the day before the election. We convert the prices into two-party probabilities of a Democratic win.[2]

Figures 1 and 2 show election-eve probabilities from the betting markets as a function of the actual vote. Figure 1 plots these data for the 15 elections between 1880 and 1932, before the advent of polling. Figure 2 plots the data for the 16 subsequent elections for which we have market data—excluding 1964, 1968, and 1972—through 2008. In each figure we overlay an ogive curve to fit the data. (For details about how this is done, see below.) Our interest is in whether markets do better in the more recent period where poll results are available.

-- Figures 1 and 2 about here --

The figures show that prices respond most crisply to the signal of the actual vote during the early, pre-poll era. Remarkably, early prices correlate at 0.93 with the vote. For the later period, the vote-price correlation is a much more modest 0.70. See Table 1 for relevant correlations. From these results it is pretty clear that markets have done fairly well forecasting elections on election eve, though especially *before the advent of polling*. This implies that polls have had a distorting effect. Consider that in 1948, Dewey's late pre-election market price was 89 cents, pretty much as the polls (and Chicago Tribune) had it.

-- Table 1 about here --

Actually, as Figures 1 and 2 show, the statistical relationship between winner-take-all market prices and vote margins is decidedly non-linear. With prices on the vertical axis and the vote

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[1] This seemingly straightforward interpretation of prices is the subject of some dispute—see Manski (2006) and Wolfers and Zitzewitz (2007).

[2] For measurement details, see Snowberg, Wolfers, and Zitzewitz (2007) and Rohde and Strumpf (2004).

margin on the horizontal axis, the relationship approximates the cumulative normal distribution. We can assume that the price represents a probability based on the following equation:

$$ExpectedVote_t = \beta Vote_t + e_t,$$

where the error variance e_t is, normally distributed.   The observed *p*-value is the cumulative normal distribution at $\beta Vote_t$. We can impute the implied value of the quantity $\beta Vote_t$ from the z-value or standardized score corresponding to the particular *p*-value. For instance, if the *p*-value equals .975, the z-value is +1.96 standard deviation units. (This is the familiar upper cutoff for the .05 level of statistical significance.) In effect, the variable is a linearized version of the probabilities. We call this variable the imputed vote from market prices. With an unknown metric (since β is unknown), the imputed vote is a scalar function of the price-setters' expected vote. Note that the imputed vote is used to produce the ogive curves in the Figures.[3]

For the pre-poll era (1880-1932), our imputed vote correlates at a striking 0.95 with the actual vote outcome. The slight increase from the 0.93 correlation between raw market prices and the vote reflects the correction for the nonlinear relationship shown in Figure 1. For the post-poll era (1932-2008), using the imputed vote instead of the raw prices actually causes a drop in the correlation, to 0.67. Regardless, election markets clearly did much better at predicting election outcomes during the era in which they did not have polls for guidance than later, when polls could be a guidepost for setting market prices.

Markets Then and Polls Now

Prediction Markets 1880-1932 vs. Polls 1936-2008

For a hard test of early markets, we can compare their predictive power to that of polls during the modern poll era. How do early prices compare to modern polling as an augur? To find out, we measure the polls by means of the average of all polls during the final week of the campaign (or the final polls if none are available during the period). For the 19 post-1932 presidential elections, the correlation between the polls and the vote is an impressive 0.91. Also see Figure 3. Still, this correlation is slightly less than the pre-poll correlation of 0.93 between market prices and the vote and even farther behind the impressive 0.95 correlation between 1880—1932 vote margins and the imputed vote. Clearly, pre-poll era election markets were the equal if not better at predicting presidential vote margins than polls have been for the current era of public opinion polling.

-- Figure 3 about here --

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[3] The curves shown in Figures 1 and 2 are based on the prediction of the "imputed vote" from the actual vote. The first step is transforming the price into the imputed vote, as the z-score corresponding to the *p*-value with a normal curve. Second, the imputed vote is regressed on the actual vote to obtain an equation predicting the imputed vote in terms of the actual vote. Third, the predicted imputed vote is de-linearized back in terms of the *p*-value that corresponds to the predicted imputed vote. For instance, if the *predicted* imputed vote is +1.96, then the corresponding value for the curve is .025.

Polls Now and Markets Now

Polls 1936-2008 vs. Election Markets 1936-2008

We have seen that early election markets dominate both 1936-2008 markets and 1936-2008 polls as election predictors. But which indicator avoids the booby prize of worst predictor from the set—contemporary polls or contemporary markets? From our discussion above, we already know that polls win this contest. As indicated above and shown in Table 2, final-week election polls have performed well at predicting the vote (correlation = 0.91). And, as we saw above, market prices (measured either as raw prices or imputed vote) correlate at no more than 0.70 with the vote. Polls clearly are the better predictor.

A second question though is whether market prices use information about the election that is not apparent from the polls. Ideally we would answer this question by comparing polls and prices months before the election, when there still are events to affect the outcome. But for the poll era, except for the five most recent elections we only have prices for election eve. The analysis must be limited therefore to comparing prices on the eve of the election with polls during the final week. Do these late market prices contain information not found in the late polls?

-- Table 2 about here --

The answer appears to be no. Table 2 provides the evidence. When polls and prices are raced in a multivariate equation predicting the vote, the poll coefficient is positive and significant while the price coefficient is actually slightly negative but not statistically significant. Switching to the imputed vote as the market measure in the second column of Table 2 produces very similar results. From this exercise we see that election eve market prices do not provide information beyond election eve polls. This admittedly is a hard test because if there is information about the election, it is likely to be reflected in final polls. Market prices clearly reflect the polls: raw prices correlate with poll margins at 0.87 and the imputed vote correlates at 0.86, both considerably higher than their correlations (0.70 and 0.67) with the vote. Thus it would seem that market prices follow the polls when they are available. Perhaps from what we have seen, markets would work better without the polls providing very visible clues about the vote.

Prediction Markets and the Polls, 1952-2008

Our analysis so far suggests that as tools for election forecasting, early (pre-poll) election markets dominate modern-day polling which dominates modern-day election markets. How can this be? While some of these distinctions are trivial in magnitude, there is little doubt that the quality of election markets declined when "scientific" polls became available as a cuing device for inferring election outcomes. With poll information available, markets declined in volume and became dependent on polls. Polls provided the leading information for election-eve markets. Under these circumstances, election markets could hardly be expected to perform better than the polls. As we have seen, later markets reflected the polls plus error.

To understand the relative predictive power of "modern" polls and markets relative to the early pre-poll markets, it is crucial to take into account the election years we include for the analysis of "modern" polls and markets. We begin with 1936, a year when even the heralded Gallup poll

considerably underestimated Roosevelt's vote strength and when there was considerable market uncertainty reflecting the huge difference between the Gallup and the Literary Digest poll predictions. The period also includes the polling disaster of 1948 of "Dewey beats Truman" fame. We know that polling performance changed dramatically, particularly in the wake of the 1948 debacle. Perhaps the markets improved as the polls themselves improved.

The evidence supports this explanation. The correlation between the polls and the vote for the post-1948 period is a near-perfect 0.97, significantly larger than the correlation (0.91) for the full 1932-2008 period. Likewise, the correlation between market prices and the vote markets is a healthy 0.89, strikingly larger than what we get (0.70) including 1936-1948. The relationship still is slightly lower than the pre-poll correlation, but this is not surprising given the likely uncertainty surrounding polls in the wake of the 1948 election. As the accuracy of polls became clearer, so presumably did the accuracy of markets. Election-eve market prices after 1948 still did not offer any information about the vote beyond what was available in late polls—see Appendix A.

-- Figures 4-5 about here --

The relationship between post-1948 market prices and the vote is clear in Figure 4. (Recall that we do not have market data in 1964, 1968, and 1972.) Prices not only correspond with the election outcome; they demonstrate a much higher level of certainty than we see over the full post-1932 period—compare Figures 2 and 4. Indeed, there is more certainty in the post-1948 period than in the pre-poll period. This can be seen in Figure 5, which plots the the ogives for the two periods (from Figures 1 and 4). Although markets prices and the vote were more closely correlated in the pre-poll period, prices then were comparatively cautious. That is, the slope relating the victory margin and prices is relatively flat by comparison with the post-poll era. Put differently, before polls there was more of an underdog bias representing uncertainty (also see Erikson and Wlezien, 2008). With an underdog, or "long shot," bias, the likely winner is undervalued and the likely loser is overvalued (Wolfers and Zitzewitz, 2004; 2008).[4]

-- Figure 6 about here --

Markets with polls also showed a long shot bias. This is clear in Figure 6, which plots both market prices and the poll-based probability of victory against the vote for the 1952-2008 period. The poll-based probability is from the mean forecast error (1.31) of the equation predicting the vote from the polls and takes into account the historic accuracy of polls (see Erikson and Wlezien, 2008). In the figure it is clear that the polls provided a much higher level of certainty about the election outcome—the resulting curve is much steeper than what we get from market prices. While market prices obviously reflected the polls, these prices were almost uniformly more cautious about the probable success of the likely winner than the poll-based forecast would be.

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[4] Figure 5 suggests a hint of a differential partisan bias to the pre-poll and post-poll markets, with the latter favoring Democrats. Consider the neutral point, where the Democratic and Republican candidates each receive 50% of the two-party vote. In such an election, the expected price in the pre-poll market would be about 45 cents and in the post-poll market about 60 cents. The "bias" for the latter years' markets disappears when we include election markets going back to 1936. (See Figure 2.) This Democratic tilt to the ogive curve is due simply to markets being more certain of the Democratic landslides than the comparable Republican landslides. Recent close elections are predicted as close, without evident bias. (See Figure 4.)

Pre-Poll Markets in Advance of the Election

So far, we have examined market prices solely in terms of prices on the eve of the election. These inform regarding Election Day expectations before poll readings. We have not yet examined the accuracy of market prices from earlier in these campaigns. Prices from earlier in these campaigns can inform about the crystallization of expectations during campaigns when there is no feedback from the polls.

In the long version of their paper on election markets, Rohde and Strumpf (2003) display a valuable graph of market prices over the course of the campaigns for the years 1884-1940. (No data on within-campaign election odds exist for later years, until the electronic winner-take-all market was born in 1992.) Rohde and Strumpf show that the earlier in the campaign, the less certain are prices, conditional on the final outcome. Here we extend this analysis to compare the certainty embedded in early market prices with the certainty from election polls for the modern poll era, 1952-2008. From the early market data we extract prices at 1, 30, 60, 90, and 120 days before each election, for the pre-poll years 1884-1932. We then linearize these prices in the usual way to z-scores representing the imputed scale-free expected vote at 1, 30, 60, 90, and 120 days prior to each election. We then observe the correlations of these "readings" of the expected vote with the actual vote. To facilitate comparison with modern polling, we perform a similar task for the 1952-2008 period. For each modern election, we observe the correlation between the actual vote and poll preferences (7 day averages) for days 1, 30, 60, 90, and 120 days prior to the election. Table 3 presents the results.

--Table 3 about here--

One sees immediately that the farther back one goes in campaign-time in terms of days before the election, the imputed vote from the markets fades as an election predictor. Also as one goes further back in campaign time of modern elections, so too do polls fade as electoral predictors. Each tendency of course is expected. The earlier in the campaign, the harder it must be to predict what will happen. In terms of size of correlation, however, the contemporary polls beat the markets during the early stages of the campaign. In other words, at the early stages of the campaign, there was greater uncertainty about the outcome in the era before scientific polling was available.

None of this should detract from the early market prices, however, as an election predictor. We must emphasize again that early election markets were almost as good as post-1952 polls as election eve augers (and arguably better when the comparison years are 1936-2008). Even at the benchmark date of thirty days before the election, this "contest" between early markets and contemporary polls is roughly even. These findings suggest that knowledgeable political insiders (who set the betting odds) knew about as much regarding the eventual outcome as do contemporary observers with polls in hand.

But early in the campaign, the polls win the contest. In the modern era, polls provide evidence of who is winning and losing months before the votes are cast. Without polls, it takes more time for the consensus to emerge regarding who will win. But this consensus did develop and by Election Day was extremely accurate. Knowledgeable observers were able to gauge from the election campaign and its reception by the voters how the vote would turn out even without the polls.

Discussion and Conclusion

The impetus for this study is the lively debate regarding how well election markets perform when compared to the vote. It turns out that the availability of public opinion polls affects the accuracy of election markets, but not necessarily in the way one might think. Once polls entered the picture, betting odds on presidential election outcomes were heavily dependent on what the polls were showing. At least that is the case regarding election eve market prices. With little information to go on that was not already captured by polls, the market prices reflected the polls plus some error. It did not help that when early polls were inaccurate (e.g., 1948) the market followed the polls. If there was information beyond the polls in 1948 to suggest that Truman might win, those who set the prices on election bets did not see it coming.

The big story is that before polling, election markets worked remarkably well. This is a story told before by Rohde and Strumpf (2004). As we show here, they worked so well that we are led to believe that the political cognoscenti of the times could read the political tea leaves about as well as modern day observers can from reading the polls. At the same time, during this early era, it took time for campaign perceptions to crystallize. Early on, say midsummer, outcomes were less easy to anticipate than they are from the same vantage point in the campaign timeline today with observers armed with trial heat polls.

The early curb markets were thick markets. Smart money investors were able to read clues from intuitive indicators and seemingly unreliable straw polls. In an atmosphere with many gamblers willing to bet based on their hearts on their political favorites, others could use their heads to exploit the market for personal gain. The latter group's actions set the prices in a way that reflected the fundamentals of the election in a way that mimicked the understanding of election outcomes in the current era where the campaign news is dominated by stories about who is ahead in the polling horserace. (Of course horserace news was of interest before polls as well, with news of the market prices helping to put in focus the pace of the race.)

We can speculate about the lessons learned regarding current election markets. In the current era, the dominance of polls has inhibited election markets from thriving as they might. By all accounts betting markets withered with the dawn of polls (Rohde and Strumpf, 2004). Interest in them is renewed with the advent in recent years of electronic election markets such as the pioneering Iowa Electronic Stock Market and, more recently Intrade (formerly Tradesports) and other online election betting sites. Although the performance of these new infant markets may not always live up to their promise (Erikson and Wlezien, 2008), the future may be brighter. With growing interest and higher volume of trading, the performance of current trading markets may surpass that of its ancestral forebearers from the pre-poll era. By theory, the promise is that election markets, informed by polls plus other information, should perform better than polls alone. While empirical support for that claim may be in dispute, the future may hold a clearer verdict.

Appendix A: Predicting the Vote from Market Prices and the Polls, 1952-2008

Table A1. Predicting the Vote from Market Prices and the Polls, 1952-2008		
	coefficient (std. error)	coefficient (std. error)
Polls	0.79*** (0.19)	0.81*** (0.19)
Market Price	0.01 (0.03)	----
Market Price Implied Vote	----	0.21[a] (1.09)
Intercept	-0.41 (0.48)	-0.40 (0.51)
Adjusted R squared	.91	.91
RMSE	1.37	1.37
N=12, ***=significant at .001.		

[a] Units of Market Price Implied Vote scale are arbitrary.

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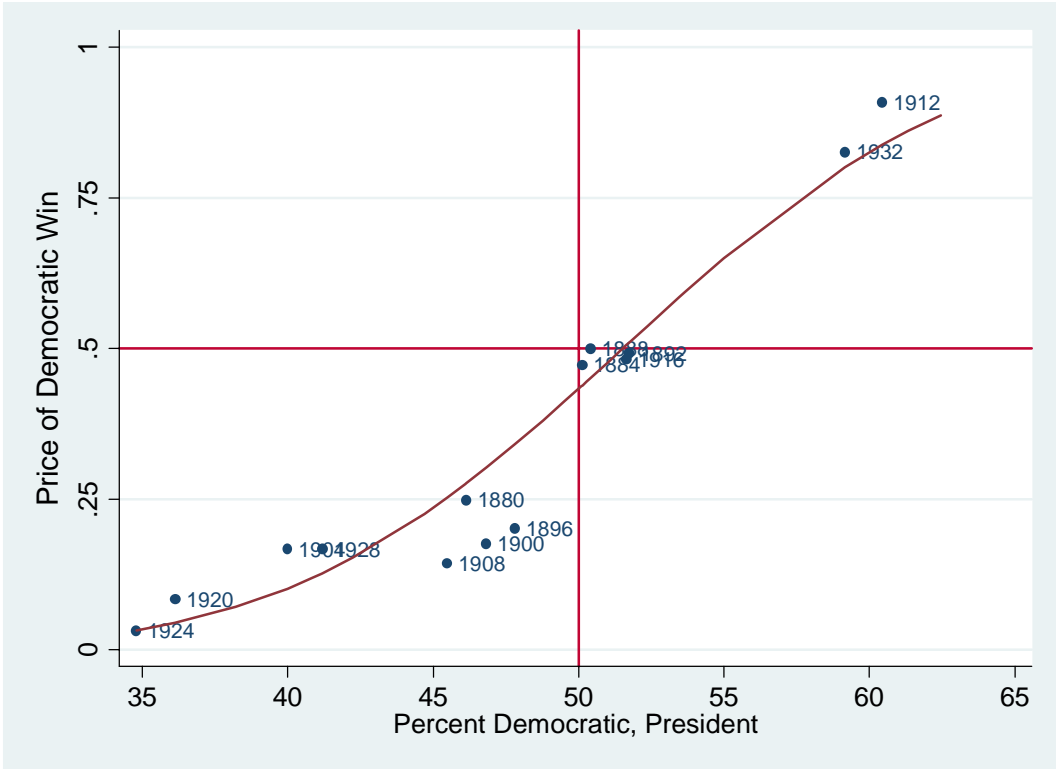
Figure 1. Market Prices by Vote for President, 1880-1932. Curved line represents the best-fit of a normal ogive.
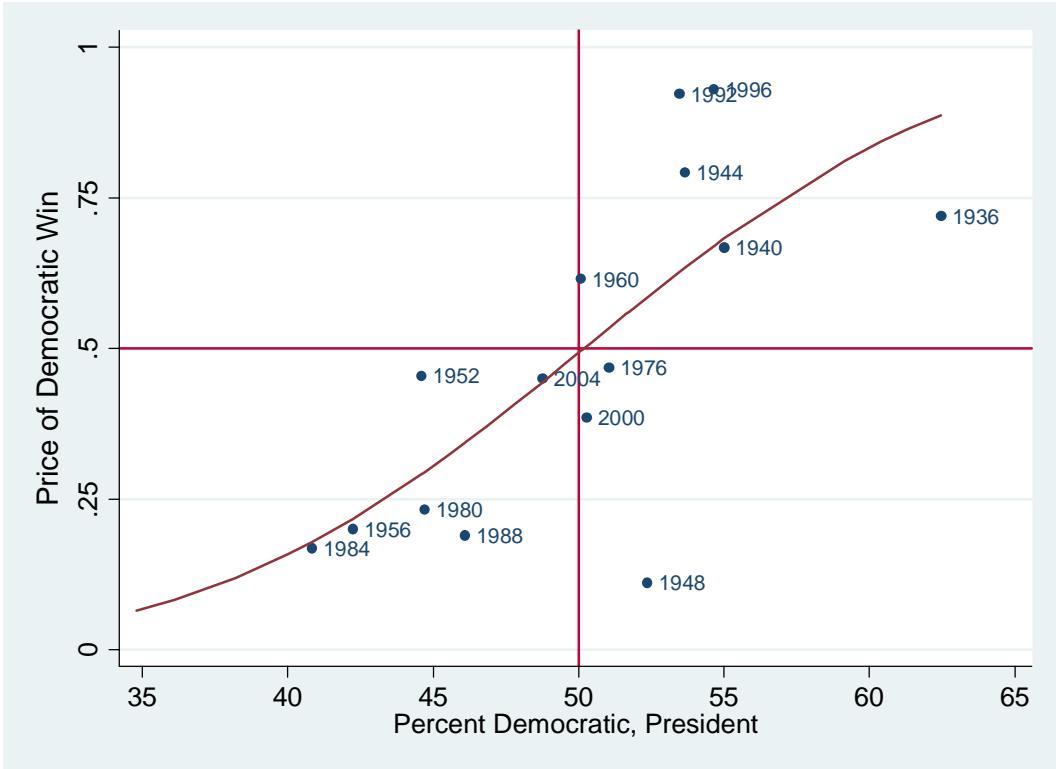
Figure 2. Market Prices by Vote for President, 1936-2008. Curved line represents the best-fit of a normal ogive.
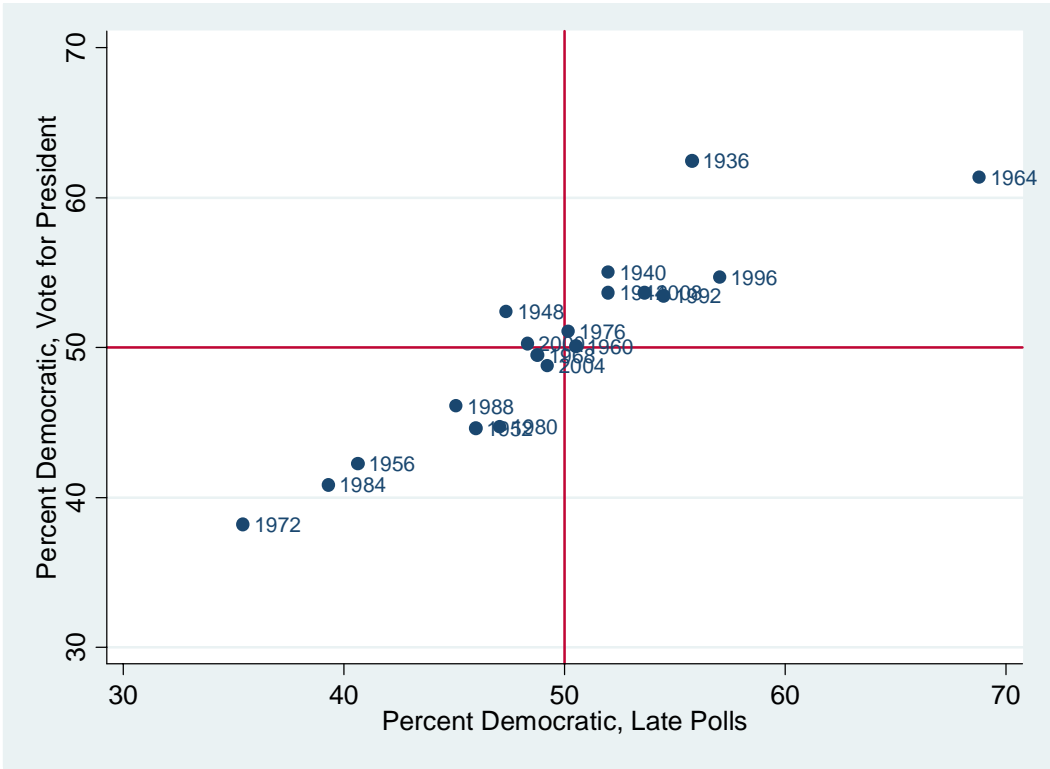
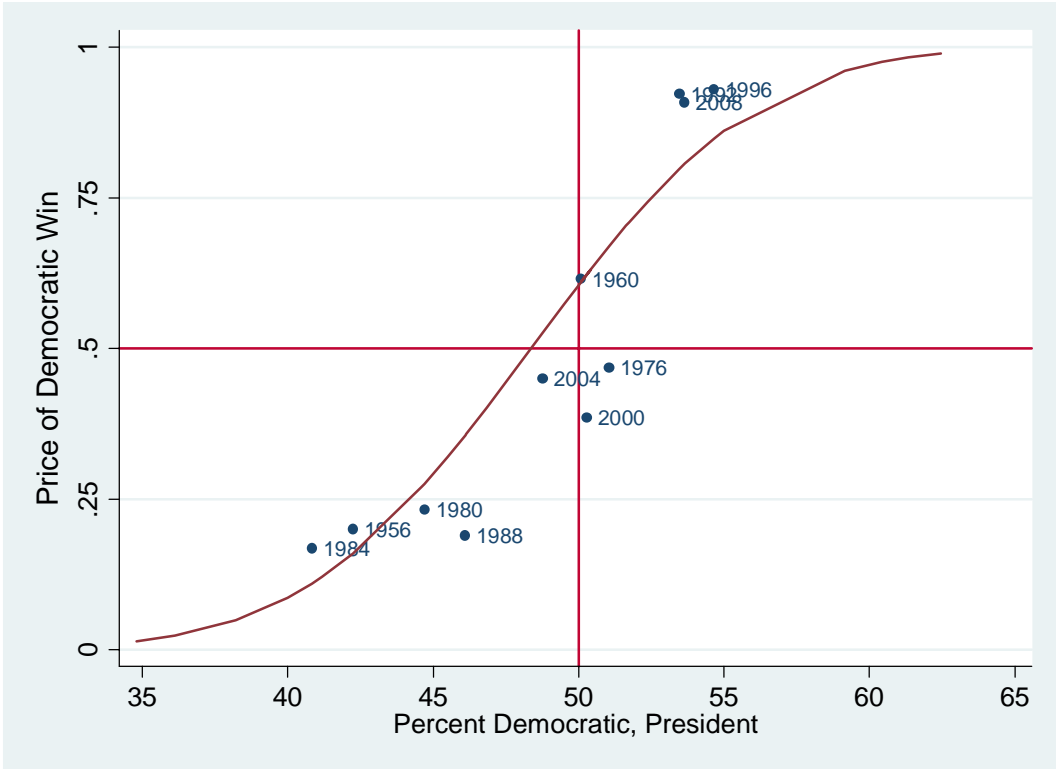Figure 3. Predicting the Vote from the Polls, 1936-2008.

Figure 4. Market Prices by Vote for President, 1952-2008. Curved line represents the best-fit of a normal ogive.
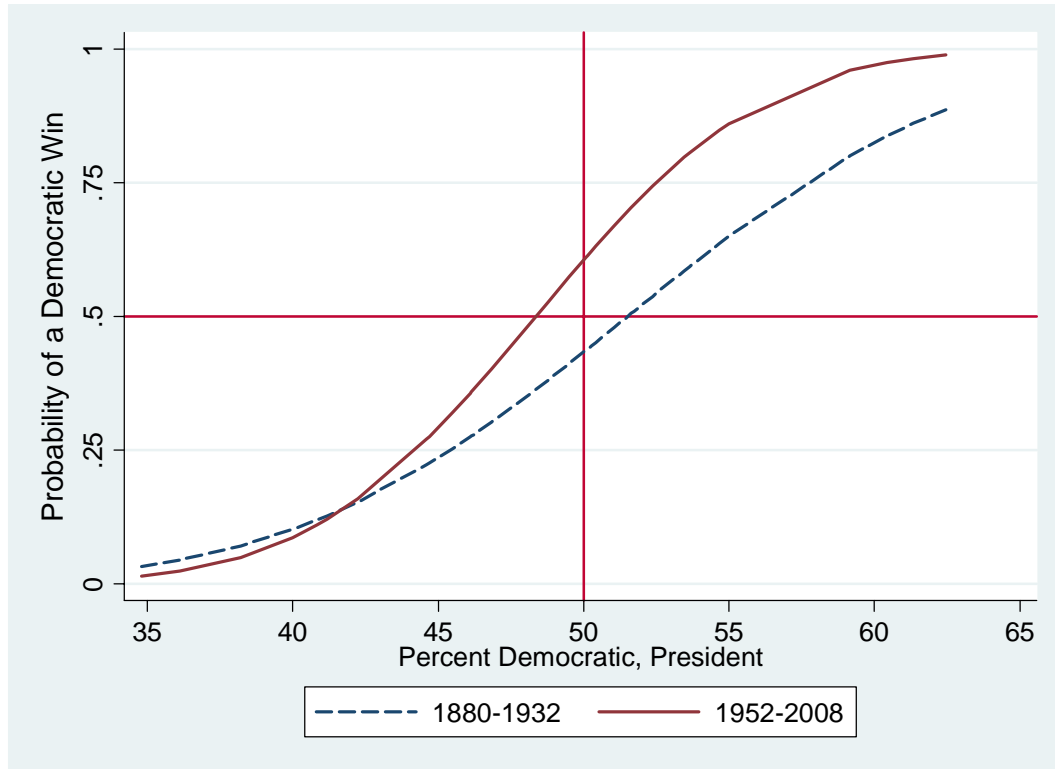
Figure 5. Market Prices by Vote for President, 1880-1932 and 1952-2008. Curved lines represent the best-fits of a normal ogive.
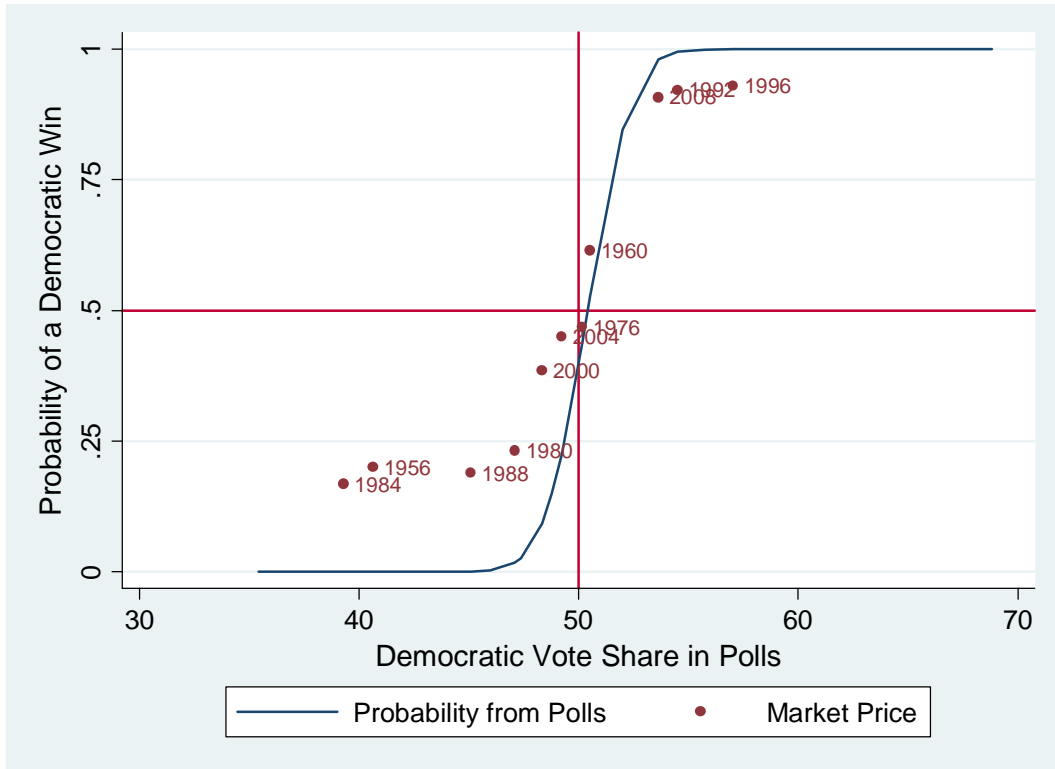
Figure 6. Market Prices as a function of the Polls, 1952-2008. The poll-based probability is from the mean forecast error (1.31) of the equation predicting the vote from the polls.

Table 1. Predicting the Presidential Vote from Election-Eve Market Prices and Trial-Heat Polls, 1880-2008		
	Correlation with the vote	RMSE predicting vote
Market Prices, 1880-1932 (N=14)	.93	2.88
As Imputed Vote Expectation	.95	2.38
Market Prices, 1936-2008 (N=15)	.70	4.10
As Imputed Vote Expectation	.67	4.30
Polls, 1936-2008 (N=18)[a]	.91	2.57
Market prices are measured in terms of the probability of a Democratic president as seen on election eve. Polls represent the Democratic share of the two-party vote in trial heat polls over the final week of the campaign.		

[a] The correlation is unchanged when excluding years where market prices are not available—1964, 1968 and 1972.

Table 2. Predicting the Vote from Market Prices and the Polls, 1936-2008		
	Coefficient (std. error)	Coefficient (std. error)
Polls	1.31*** (0.26)	1.38*** (0.24)
Market Price	-0.06 (0.05)	----
Market Price Implied Vote	----	-2.53[a] (1.35)
Intercept	1.26 (0.66)	1.40 (0.64)
Adjusted R squared	.80	.82
RMSE	2.48	2.36
N=15, ***=significant at .001. .		

[a] Units of Market Price Implied Vote scale are arbitrary.

Table 3. Market Prices and Polls as Predictors of the Vote during the Campaign		
Correlations with %Dem., Pres. 2-Party vote	Democratic Vote Share in the Polls 1952-2008	Imputed Vote from Market Price 1884-1932
1 day	.98	.94
30 days	.91	.91
60 days	.91	.68
90 days	.78	.59
120 days	.79	.63
Number of cases	15	13
Market prices are measured in terms of the probability of a Democratic president as seen at the designated time of the campaign. Polls represent the Democratic share of the two-party vote in trial heat polls over the week ending at the designated time.		