day, 2004. Early exit polls suggesting a Kerry victory were leaked at around 3pm, and prices started to move immediately. Indeed, the figure shows that they moved in lockstep with prices on the much larger equity markets. As the count proceeded, it became clear that these early polling numbers were wrong, and the market reversed course sharply. This is only a single anecdote but is representative of the rapid incorporation of new information by prediction markets observed in many domains.

<Figure 1 here>

Second, in most cases, the time series of prices in these markets appears to follow a random walk, and simple betting strategies based on publicly available information appear to yield no profit opportunities. That is, these markets appear to meet the standard definition of weak-form efficiency.

Third, the law of one price appears to (roughly) hold, and the few arbitrage opportunities that arise in these markets are fleeting, and involve only small potential profits.

Fourth, attempts at manipulating these markets typically fail. Camerer (1998) attempted to manipulate pari-mutuel betting on horse races by canceling $500 bets at the last moment. Rhode and Strumpf (2005) report attempts by specific political campaigns to manipulate the election betting odds on their candidates in the large-scale betting markets operating in the early 20th century. They also analyze an attempt to manipulate the price of a Kerry victory on Tradesports in 2004, as well as their own attempts to manipulate prices on the Iowa Electronic Markets in 2000. None of these attempts at manipulation had a discernible effect on prices, except during a short transition phase.

Finally, prediction markets typically provide quite accurate forecasts and have typically outperformed alternative prediction tools.

Figure 2 shows evidence collected by Gürkaynak and Wolfers (2005) on the relative performance of a prediction market (the "Economic Derivatives" market established by Goldman Sachs and Deutsche Bank), and a survey of economists, in predicting economic outcomes. They show that the market-based forecast encompasses

the information in the survey-based forecasts. Moreover the behavioral anomalies that have been noted in survey-based forecasts are not evident in the market-based forecasts.

<Figure 2 here>

Figure 3 compares the forecasting performance of the Iowa Electronic Markets and the Gallup Poll in predicting the outcomes of Presidential elections in the United States. Over the 13 candidacies from 1988-2004, the average absolute error of the market-based forecasts was 1.6 percentage points, while the corresponding number for the Gallup Poll was 1.9 percentage points. As Berg, Nelson, and Rietz (2003) discuss, the forecasting advantage of markets over the polls is probably even larger over long horizons, as polling numbers tend to be excessively volatile through the electoral cycle. The initial success of these forecasting methods in the United States has led to similar analysis of the forecasting power of prediction markets in Austria, Australia, Canada, Germany, the Netherlands and Taiwan.

<Figure 3 here>

Tests of prediction markets and expert opinions have also been conducted in a range of other domains. The Hollywood Stock Exchange has generated forecasts of box office success and of Oscar winners, that have been more accurate than expert opinions (Pennock, Lawrence, Nielsen and Giles, 2001). Both real and play-money markets have generated more accurate forecasts of the likely winners of NFL football games than all but a handful among 2000 self-professed experts (Servan-Schreiber, Wolfers, Pennock and Galebach, 2004). In the corporate context, the market established by Chen and Plott (2002) within Hewlett-Packard yielded more accurate sales forecasts then the firm's internal experts. Similarly, Ortner (1998) reports that an internal market correctly predicted that the firm would definitely fail to deliver on a software project on time, even when traditional planning tools suggested that the deadline could be met.

Despite this impressive evidence, there still remain a number of documented pathologies in prediction markets. Figure 4 shows evidence from Snowberg and Wolfers

(2005) of the "favorite-longshot bias," which describes a tendency to over-price low probability events. A similar tendency has been documented in a range of other market contexts, suggesting that some caution is in order in interpreting the prices of low probability events.

<Figure 4 here>

Laboratory experiments also point to the possibility that in some contexts prediction markets will fail to aggregate information as efficiently as alternative procedures. Sunder (1995) provides an excellent review of experimental prediction markets, including experiments showing market designs that fail to aggregate information, and that lead to the appearance of bubbles, false equilibria, or excess volatility.

Economic Analysis of Prediction Market Prices

Prediction markets are a useful way to elicit predictions, but how might they be used? The most direct form of inference involves simply using these predictions directly. For instance, forecasts of election outcomes may be of intrinsic interest.

Some analyses have tried to link the time series of expectations elicited in prediction markets with time series of other variables, so as to isolate a causal influence. For instance, Roberts (1990) analyzes changes in the betting odds posted by Ladbrokes on Ronald Reagan's re-election and the returns to holding stocks in defense firms, inferring that Reagan led to more robust defense spending. Likewise, Herron, et. al. (1999) and Knight (2005) analyze the correlation of individual stocks and industry indices with movements in the 1992 and 2000 Iowa Electronic Markets U.S. Presidential election markets. Snowberg, Wolfers and Zitzewitz (2006) conduct a similar analysis for the aggregate equity and bond markets at an intraday frequency, using the data shown in Figure 1, to infer partisan impacts of the 2004 election. Slemrod and Greimel (1999) examine the effect on municipal bond prices of changes in the probability of the