Discussion

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I would like to congratulate both Warren and Murray, who with the help of Joe Waksberg and others at the U.S. Census Bureau developed, over the course of the years, one of the most highly visible and successful statistical reporting and forecasting systems in the world. It is, in fact, a testimonial to the credibility and almost perfect success rate of the projection system that when it hiccuped, as it did in the 2000 General Election, the network anchors exhibited shock and embarrassment. For example, Dan Rather of CBS said, ''. . .we're eating so much broken glass. We're in critical condition.'' Over at CNN, anchor Judy Woodruff turned to her colleagues and said, ''Could you pass the crow?'' At NBC, Tom Brokow opined, ''It's not that we have egg on our face, we have omelet all over our suits.'' While all of the top network news hierarchy including the anchors knew that the ''calls'' were in fact ''PROJECTIONS'' and not facts, everyone was surprised when a projection turned out to be incorrect.

It is also a testimonial to the basic estimating, forecasting and projection system created by Mitofsky and Edelman that it has withstood a thorough investigation by RTI and other outside statisticians, journalists, and lawyers. The system was the subject of a rather interesting hearing conducted by representative W.J. ''Billy'' Tauzin of Louisiana, on ''Election Night 2000 Coverage by the Networks.'' If you read the transcript you will find interesting interactions between some of our elected representatives, who where looking for liberal ''bias,'' and some of the witnesses who were discussing statistical bias. We should probably try to find a less politically charged term that describes the difference between the expected value of an estimator and an actual parameter. In our roles as statisticians, our use of bias, paints us as either extreme liberals or conservatives, depending upon the political orientation of the person hearing the term.

As I mention in more detail later, after various examinations by a number of outside statisticians and a statistical committee composed of representatives of all of the VNS members (FOX, NBC, CBS, ABC, CNN, and AP), the revised VNS system will retain many of the basic features of the general system developed by Mitofsky and Edelman.

Before I comment on some of the statistical properties of the system developed by Warren and Murray, it might be worthwhile to mention some of the major societal as well as commercial benefits of an election night forecasting system. An election forecasting and projection system, based on sound and objective principles of scientific sampling, allows news organizations to exercise their first amendment right to report expected election winners and the whys that led to the election results many hours and possibly days before official and certified vote counts are available. State certification of election votes often takes place several days after an election. The Electoral College meets many weeks after Election Day. News in a commercial context is a time-based commodity. The bound-

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ary between responsible reporting and the desire to get the scoop on the competition is often fluid. One of the challenges faced by the Networks in future elections will be the need to add essential certainty to a statistical system that involves various degrees of statistical and nonstatistical error.

Also, it should be recognized and remembered that since the ''exit polls'' (conducted as voters leave election places) do not simply collect information about ''vote'' but demographic information and information about the importance of issues and other facts. The polls make it possible for the networks, on election night, and the general research community, at a later date, to understand the whys of the election. Exit polls allow us the luxury of doing without the need for ecological inference along with its heroic assumptions. We will never know how the religion of voters influenced the election fortunes of the National Socialist Party in prewar Germany. We know how age, gender, race, ethnicity, religion, and political outlook influenced the vote in the 2000 Presidential Election. More recently we know how race ethnicity impacted the recent election of Rudy Guiliani's successor in New York City, because of exit polls.

I should point out that after the election, the VNS exit poll data is deposited at the University of Michigan ICPR as well as the Roper Center at the University of Connecticut.

Now let us talk about statistical sampling for a bit. I believe that one of the major reasons that the Mitofsky-Edelman and the successor VNS election forecasting and reporting system has stood up to very aggressive scrutiny is that it is based on ''strict probability sampling.'' When Warren and Murray entered the scene at CBS in 1967, probability sampling had generally been accepted as a necessary condition for sound survey systems in some quarters, but this acceptance did not generally extend to election night forecasting. It was generally believed that election night forecasting was a system too complex and subjective to be left to mere statisticians, even survey statisticians, who did not understand politics. It is my understanding that there were some exceptions to this, but in general, political experts would select key precincts based on their unique judgments. They would examine how these precincts voted in the current election and their unique knowledge of politics would allow them to project what would happen in the future. The experts might even consult a statistician now and then. But Warren and Murray changed things. The duo used stratified probability sampling to capture much of the wisdom of political experts while preserving randomization and therefore objectivity. They captured the notion of comparing past results with present results by applying ratio estimation. Warren and Murray were able to make sure they took into account the vote in geographic areas (like downstate, or upstate, or in the big city) by using initial and poststratification. They were able to account for the heavily Democratic or Republican or African American districts by using poststratification. They were able to do this all within the model of strict, by the book, probability sampling. As such, they built a system that could stand up to either scientific or political scrutiny. I am sure that the two had a sometimes-uphill battle when ''political experts'' told them that they did not understand politics, and therefore they could not forecast election results. But, in fact, they were able to build a better mousetrap.

Now, I would briefly like to mention some of the lessons learned from the 2000 Election and what can be expected in the future. As Murray and Warren mentioned in their talk, the basic problem associated with the Florida call at 2:30 am or so, was one of data quality.

I remember those wonderful days when I took my graduate courses in mathematical

statistics, and we were told to assume that the *x* values in a random sample appeared on the paper or in the computer without any error. We were told that errors in data were not our problem and that someone else would take care of the problem. Well, as all of us who work in applied statistics know, that is not so. A statistical system that is well based in theory must pay careful attention to data quality. That may be the weakest link in the system. It certainly was in the 2000 Election. We all thought we were looking at the real vote count. We did not pay sufficient attention to the fact that the ''real vote'' might be an estimate and that our estimated total vote to be expected was very much off the mark.

If the system is to work in 2002 and 2004 and beyond, we must either take the full responsibility for insuring data quality, or if we cannot do that, we must build better models that allow us to assess ''TOTAL SYSTEM ERROR.''

The second, and somewhat more traditional set of statistical challenges involves estimation of the standard errors in the case of missing (not at random) data, issues associated with the selection of a ''best estimator'' among competing estimators and the potential for large percentages of absentee ballots. Let me briefly comment on the first two. We know that missing data, which occurs when either exit poll or reported vote is not available for certain sampled precincts, generally results in underestimates of standard error. If we examine the partial data sets that we get as we build to 100% response, the observations seem to ''cluster.'' Therefore, we have adopted a procedure similar to Kish's design effect approach to deal with this empirical reality. We have been exploring the use of multivariate type ratio estimators (originally suggested by Ingram Olkin) to produce more robust ratio estimates when more than one highly correlated ancillary variable is available. Both of these improvements arose out of an extensive investigation conducted by the VNS Statistical Committee with the help of a number of outside statisticians. We have also examined the use of regression estimators, some types of propensity weighted estimators and also adjustments along the lines suggested by Heckman. To date, none of these three approaches has resulted in any measurable improvement. One of the benefits of working with samples in most of the 50 states, and repeating this on a 2- and 4-year cycle, is that examination of past results gives us a testbed for assessing alternative procedures.

After the election of 2000, we know that the American news media and the American public cannot and will not live with uncertainty. As statisticians steeped in the notion of uncertainty, we may not like this situation, but our customers and consumers are not looking to us for estimates and projections with measurable degrees of error. We may tell them that we only make estimates and projections, but they want something called truth and facts.

Last week as I was preparing my comments for this afternoon, I saw Tim Russert on NBC telling the audience that in 2004, the networks will ''get it right.'' He said that they would not make the same mistakes they made in 2000. It is obvious that much of the news media still has faith in the statistical system first created by Warren and Murray and now managed and refined by the VNS consortium. All of us who work in this endeavor have some very interesting and exciting times in store.