Conditions under which index models are useful:

Reply to Bio-index Commentaries

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Abstract

This paper summarizes the key conditions under which the index method is valuable for forecasting and describes the procedures one should use when developing index models. The paper also addresses the specific concern of selecting inferior candidates when using the bio-index as a nomination helper. Political decision-makers should not use the bio-index as a stand-alone method but should combine forecasts from a variety of different methods that draw upon different information.

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The commentators raise important issues that Armstrong and Graefe (2011) do not address. Voss (2011) argues that (1) many of the variables used in the bio-index might have no causal relationship with the election outcome and (2) the bio-index might yield a poor selection of candidates, as it does not consider candidates' personalities, their stands on political issues, or their likely performance. More generally, Cote (2011) has concerns with the suitability of the index method for other problems such as business decision-making.

The commentaries help to explain the conditions under which the bio-index in particular, and the index method in general, is valuable for forecasting. This response provides a more complete summary of the key conditions that favor the index method and expands on the procedures one should use when developing index models.

This response also addresses the concern of selecting inferior candidates when using the bio-index as a nomination helper. Political decision-makers should not use the bio-index as a stand-alone method but should combine forecasts from a variety of different methods. In particular, a new bio-index, based on variables that relate to the question of how a candidate will perform as a leader rather than how he will emerge as a leader, could help voters and political parties to select the best candidate.

Key conditions of the index method

The index method is an alternative to multiple regression models in situations with small samples and many variables. The usefulness of multiple regression models for prediction depends on the availability of valid and reliable quantitative data relative to the number of causal variables. Multiple regression analyzes historical data to determine the variable weights that provide the best fit. Given non-experimental data, the literature

recommends a ratio of 100 observations per predictor variable for using multiple regression models to draw conclusions and make forecasts about human behavior (Armstrong and Graefe, 2011).

In contrast to regression, the index method is suitable for situations in which a large number of causal variables are important and for which one can, at least subjectively, assess the directional effect of each variable on the outcome. Rather than estimating relationships, the index method uses the prior knowledge on the problem to develop the forecasting model.

The index method is based partly on the idea of unit weighting. That is, the method assumes all variables as equally important until proven otherwise. This avoids the problem of spurious effects that occur with non-experimental data. When providing *ex ante* forecasts for the same data, unit weights are often more accurate than regression weights. This is especially likely when one estimates weights from non-experimental data.

Using simulated data, Einhorn and Hogarth (1975) find that unit weighting is more accurate than regression when the sample is small and the number of, and inter-correlation among, predictor variables is high. Empirical studies support this finding. In analyzing published data in psychology, Schmidt (1971) finds that unit weighting is more accurate than regression weights. A review of the literature (Armstrong 1985, pp.230) finds unit weights to be slightly less accurate in three studies (for academic performance, personnel selection, and medicine) but more accurate in five (three on academic performance, and one each on personnel selection and psychology).

Czerlinski et al. (1999) compare unit weighting and multiple regression for 20 selection problems (including psychological, economic, environmental, biological, and health problems), for which the number of predictor variables varies between 3 and 19 (average: 7.7). Most of these examples were taken from statistical textbooks where they were used to demonstrate the application of multiple regression analysis. Not surprisingly, when calculating *in-sample* forecasts, multiple regression model forecasts were more accurate at 77% correct predictions than forecasts from a unit weight model (73% correct). However, when making *out-of-sample* predictions, the unit-weight model forecasts were more accurate (69% correct) than multiple regression model forecasts (68% correct).

The index method differs from the models in the unit weights literature in that index models are not limited to using only the set of variables and data that are available for regression analysis. Rather, the method draws upon the cumulative knowledge of a problem, which might come from experts' domain knowledge or from prior empirical studies. Index models can easily accommodate new knowledge.

Type of problems

The conditions favoring the index method are common in selection problems such as choosing political and job candidates, choosing sites for retail outlets, choosing between potential marriage partners, or choosing between contending advertising proposals. As Armstrong and Graefe (2011) show with the bio-index model, one can also make forecasts about the relative performance of alternatives. If one has sufficient historical data on a quantitative dependent variable and can assess the values of the causal variables, one can use simple linear regression against index scores to estimate a model

that produces quantitative forecasts such as the percentage vote-share of candidates in an election.

Selection of variables

When building an index model, use prior knowledge to prepare a list of predictor variables and to assess each variable's directional influence on the outcome. This prior knowledge can come from empirical evidence or expert domain knowledge. Results from experiments are especially useful. If possible, draw on findings from meta-analyses of experimental studies.

Use judgment to assess the variables if no prior knowledge is available. In such cases, use structured approaches such as the Delphi method to combine judgments from several experts. If prior knowledge is ambiguous or contradictory and thus does not allow for estimating a variable's directional influence on the outcome, do not include the variable in the model.

Index models as decision aids

The primary advantage of index models is that decision-makers can take action upon the forecasts. For example, political parties can use the bio-index to inform their decision about whom to nominate. By comparison, traditional econometric models provide limited or no advice with respect to questions such as what type of candidate a party should nominate or what issues a candidate should stress in the campaign.

Validity of variables

Voss raises concerns regarding the validity of some of the variables included in the bio-index. The composite of variables is indeed easy to criticize, as there was often

little prior evidence to draw upon. Thus, the selection and coding of many variables relies on weak domain knowledge. There is certainly much more that might be learned about the validity of some of the variables in our model.

The index method is especially valuable in environments with many compensatory variables. In such an environment no single variable is more important than any combination of other variables. Thus, candidates can compensate disadvantages on one variable by scoring favorably on another. For example, the fact that a candidate has not written a book will not, on its own, lose the election for a candidate.

In contrast, the index method is less useful for constructing forecasting models that include non-compensatory variables. In situations in which the importance of one variable is greater than the importance of all other variables put together, one can use the take-the-best heuristic (Gigerenzer & Goldstein 1996). This simple decision rule makes predictions based on a single piece of information. For example, Graefe and Armstrong (2010a) use the take-the-best heuristic to develop a forecasting model that predicts election outcomes based on how voters expect the candidates to handle the single most important issue facing the country. The forecasts from the take-the-best model are almost as accurate as an index model based on all the issues.

Combining forecasts

One should not use the bio-index as a stand-alone method for forecasting elections since the approach evaluates only one dimension of a candidate. Other factors clearly matter. For example, Graefe and Armstrong (2010a, 2010b) developed two models that provide accurate forecasts of the winner in U.S. presidential elections based

on information about how voters expect the candidates to handle the issues facing the country.

One should combine forecasts from different models that draw on different information to get a more complete picture of the future. Such a combined forecast also conforms to Simonton's inferential framework for judging presidential candidates. Simonton (1993) argues that voters evaluate candidates along three dimensions when deciding whom to vote for: performance, policy, and personality.

Selecting the best candidate

Bio-indexes aim at solving the question of who *will* win, not who *should* win. Thus, the index contains variables that have an influence on leader emergence. These variables may not necessarily relate to leader performance. For example, while being clean-shaven may improve how voters perceive a candidate, a beard would probably not harm the performance of the candidate once elected.

Voss raises concerns that the candidates themselves might want to take action and improve their biographical score. For example, candidates may want to wear glasses or get plastic surgery. Candidates trying to do well on each variable do not pose a serious problem for the bio-index. First, the bio-index will still differ on many variables. Second, the bio-index model can use relative measures (e.g., who published the most popular book). Third, if the candidates were able to gain equality with one another on certain variables, the impact of these variables decreases – most of which have nothing to do with the competency of a president.

Voss notes that the bio-index could yield the selection of an inferior president because the index does not provide evidence on which candidate would be best for the

country. One can address this problem by developing an index model based solely on variables that have an impact on performance (e.g., intelligence that exceeds a certain cut-off level). Such a model could be a valuable decision tool for voters, as it could aid in deciding about which candidate to vote for.

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