Dissertation Defense

Joint Calibration Estimator for Dual Frame Surveys

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Abstract

Dual frame surveys are becoming more common in survey practice due to rapid changes in the cost of survey data collection, as well as changes in population coverage patterns and sample unit accessibility. Many dual frame estimators have been proposed in literature. Some of these estimators are theoretically optimal but hard to be applied in practice, whereas the rest are applicable but not as optimal as the first group. All the standard dual frame estimators require accurate information about the design domain membership. In this dissertation, a set of desirable properties for the dual frame estimators is specified. These properties are used as criteria to evaluate the standard dual frame estimators. At the same time, the Joint Calibration Estimator (JCE) is proposed as a new dual frame estimator that is simple to apply and meets most the desirable properties for dual frame estimators.

In Chapter 2, the JCE is introduced as an approximately unbiased dual frame estimator, with a degree of unbiasedness depending on the relationship between the study variables and the auxiliary variables. The JCE achieves a better performance when the auxiliary variables can fully interpret the variability in the study variables of interest or at least when the auxiliary variables are strong correlates of the study variables. The JCE can be applied by standard survey software and can easily be extended to multiple frame survey estimation. In Chapter 3, the JCE properties are explored in the presence of the nonresponse error. Theoretically and empirically, the JCE proves to be robust to the nonresponse error as long as a strong set of auxiliary variables is used. This strong set should predict both the response mechanism and the main study variables.

The effect of the domain misclassification on the dual frame estimators is discussed in Chapter 4. Since the JCE does not require domain membership information, it tends to be robust against domain misclassification even if domain totals are included in the calibration auxiliary variables. Finally, in Chapter 5, the dual frame estimation problem is discussed in the context of *the prediction theory*, where the model-based dual frame estimators reduced to the JCE estimators derived in Chapter 2 under *the probability sampling theory*.