ESTIMATION IN FINITE POPULATION SAMPLING: ROBUSTNESS AND OPTIMALITY

Siu Ming Tam

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DECLARATION

The results in Chapters 1 to 5 of this thesis have been published as follows:

Chapter 1	Tam (1988a)
Chapter 2	Brewer, Hanif & Tam (1988)
Chapter 3	Tam (1986a), Tam (1987a) and Tam (1988b)
Chapter 4	Tam (1986b)
Chapter 5	Tam (1987b)

Excepted where otherwise stated in the text, the work presented in this thesis is my own.

Siu Ming Tam

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ABSTRACT

Considerable progress has been made in the past two decades on research into survey sampling methodologies. A significant trend in this development is that the classical survey sampling techniques are formulated using an inference framework, which is made possible by assuming that the given finite population is a realization of a superpopulation model with unknown parameters. One attraction of this method of formulation of survey sampling problems is that not only the classical tools of inference can usefully be brought to bear on the problem, but more importantly, the optimal properties of certain familiar estimators in classical survey sampling are more and more better understood.

A central issue in the use of superpopulation models for designing sampling strategies is robustness of the procedures. Under the design-based approach, it is claimed in the literature that robustness is provided by requiring that the estimators are design-unbiased, a property which is independent of the assumed superpopulation model. Chapter 1 examines the claim in detail and provide sufficient conditions for the sampling strategy to attain

the Godambe-Joshi lower bound to the expected variance (Godambe & Joshi, 1965).

Chapter 2 and Chapter 3 examine the issues of reconciling design-based estimators with model-based predictors. The approach adopted in Chapter 2 is to retain the asymptotic design unbiasedness of the predictors, but modify the form of the estimators for the superpopulation model parameters in constructing the predictors of population totals. On the other hand, the approach adopted in Chapter 3 is to retain the model-based properties of the predictors but modify the selection probabilites for selecting the sample.

The discussion for Chapters 1 to 3 is restricted to the design and analysis of ad hoc surveys, that is, surveys which are conducted once on a given finite population. Chapter 4 and Chapter 5 examine issues related to the analysis of repeated surveys of the finite population over time.

Chapter 6 looks at specification of superpopulation models for survey sampling from the point of view of performing regression analysis on the survey data from ad hoc surveys. It is argued that under certain circumstances, the uniform intra-class correlation assumed in the covariance matrix of the superpopulation model is unnecessary.

CONTENTS