

This thesis is about survey sampling. We take up two areas to study further. One is the problem of post-stratification – the decision to stratify a simple random sample after it is already collected. Another is the application of stratified random sampling for the regression estimation problem. For notation and general concepts, in Chapter 1 we give a short introduction to survey sampling in general and stratified random sampling in particular.

In Chapter 2, we study the problems of poststratification. Why after a simple random sample is collected, we need to stratify the sample for statistical analyses. Some problems arise with poststratification, one is that the sample sizes of different strata are random variables. They have a joint distribution and their moments need to be estimated. We apply the delta method of up to the 4-th order to see if the precision of approximate estimators increase as the order increase. Our conclusion is that it is not necessarily so.

In Chapter 3 we deal with the problem of why and how to apply the stratification method to the regression estimation. In the book *Elementary Survey Sampling, 5-th Edition*, by Scheaffer, Mendengall III and Ott (1996), they have an example (but no theory) of applying stratified random sampling to ratio estimation problem. We use similar technique to figure out how to apply the stratification method to the regression problem. An example is provided at the end as demonstration.