

DOKUZ EYLÜL UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

**COMPARISON OF ESTABLISHED SAMPLING
METHODS FOR ANNUAL INDUSTRY AND
SERVICE STATISTICS SURVEY BY TURKSTAT**



by
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May, 2018
İZMİR

COMPARISON OF ESTABLISHED SAMPLING METHODS FOR ANNUAL INDUSTRY AND SERVICE STATISTICS SURVEY BY TURKSTAT

**A Thesis Submitted to the
Graduate School of Natural and Applied Sciences of Dokuz Eylül University
In Partial Fulfilment of the Requirements for the Degree of Master of
Science in Statistics**

**by
Sibel ŞAHİN YAŞA**

**May, 2018
İZMİR**

M.Sc THESIS EXAMINATION RESULT FORM

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ABSTRACT

Annual Industry and Service Statistics is one of the largest surveys that aimed to determine changes in economic structure in Turkey conducted by Turkish Statistical Institute. Full enumeration and sampling methods are used together for this survey.

Recently there are some studies about using administrative sources for this survey but may not satisfy the information needed. So, it is believed that sampling may decrease the size of the survey.

In this thesis, we suggest a sampling scheme for the full enumeration part of Annual Industry and Service Statistics, and comparing the suggested methods. Stratified sampling uses the first step. Poisson sampling, systematic and simple random sampling are used in strata. The estimations obtained from using with sampling methods are very close to real values. The closest estimations and smallest variances are calculated by poisson and simple random sampling methods using together. Also, estimations are given more detailed based on geographical regions.

Keywords: Annual industry and service statistics, poisson sampling, stratified sampling, simple random sampling, systematic sampling

TÜİK YILLIK İŞ İSTATİSTİKLERİ SANAYİ VE HİZMET ARAŞTIRMASI VERİLERİ İÇİN OLUŞTURULAN ÖRNEKLEME YÖNTEMLERİNİN KARŞILAŞTIRILMASI

ÖZ

Yıllık Sanayi ve Hizmet İstatistikleri, ülkemizdeki ekonomik yapıdaki değişiklikleri ortaya koymak için Türkiye İstatistik Kurumu tarafından yapılan en büyük araştırmalardan biridir. Bu araştırmada tamsayım ve örnekleme yöntemleri bir arada kullanılmaktadır.

Son yıllarda bu araştırma için idari kayıtların kullanılması yönünde çalışmalar yapılsa da, idari kayıtlardan derlenen bilginin, bu çalışmadan elde edilecek bilgiyi sağlayamayabileceği düşünülmektedir. Dolayısıyla Yıllık Sanayi ve Hizmet İstatistikleri araştırmasının hacminin küçültülmesine ihtiyaç olduğu düşünülmektedir.

Bu çalışma Yıllık Sanayi ve Hizmet İstatistikleri araştırmasının tamsayım ile yapılan kısmı için örnekleme metodu önermek ve önerilen metotları karşılaştırmak için yapılmıştır. İlk aşamada tabakalı örnekleme kullanılmıştır. Tabakalar içinde ise poisson, sistematik ve basit rastgele örnekleme birlikte kullanılmıştır. Elde edilen tahminler gerçek değerlere oldukça yakın bulunmuştur. En yakın tahminler ve en küçük varyanslar poisson ve basit rastgele örnekleme metotlarının birlikte kullanılmasından elde edilmiştir. Ayrıca coğrafi bölgeler bazında daha ayrıntılı tahmin üretilebilmiştir.

Anahtar kelimeler: Yıllık sanayi ve hizmet istatistikleri, poisson örnekleme, tabakalı örnekleme, basit rasgele örnekleme, sistematik örnekleme

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CHAPTER ONE

INTRODUCTION

The Annual Industry and Service Statistics is one of the surveys that having large sample size conducted by Turkish Statistical Institute (TURKSTAT). These statistics are produced with regard to European Council decisions from 2002. The main purpose is determining changes of social and economic structure in the country. This survey is conducted different ways in each European Union country. Some of them use only sampling methods, some of them like Turkey, use full enumeration and sampling methods together. Timetable, data collection methods, media for collection data are changing from country to country within the European Council regulations. At the end of the study, every member and candidate country send their own results to the Statistical Office of the European Union (EUROSTAT). Every country publishes own results, and also EUROSTAT shares into web site all these countries results. For being comparable, the questionnaire is common, but if there is a necessity for some additional information, the local survey could contain additional questions.

The frame of this study based on the Business Registers of Turkish Statistical Institute. The Business Registers is used by some administrative sources, in Turkey primarily for Revenue Administration, and also Radio and Television Supreme Council, Undersecretariat of Treasury, Banking Regulation and Supervision Agency, Capital Markets Board of Turkey, The Union of Chambers and Commodity Exchanges of Turkey, The Central Union of Credit Surety Cooperatives of Turkish Craftsmen and Artisans.

In recent years there are some studies about using administrative sources for the Annual Industry and Service Statistics. But, information taken by the administrative source is not satisfying to information needed this survey wholly. Not all of survey, but a mini survey is needed to get information which is not obtained from

administrative sources. And also the quality of data obtained from administrative sources is argumentative.

Full enumeration and sampling are used for the Annual Industry and Service Statistics together. It changes year by year but generally, %60-65 of the frame consists of full enumeration. Some activity codes must be used full enumeration because of small size, but the others might be estimated using statistical methods. This is one of the objectives of this study.

As an example, in 2015 survey, when conducted in 2016, data are collected in 188,994 sampling units. This takes much more time. In recent years, first results are reported in 5 or 6 months after the end of field work, but detailed results are reported in about 12 months.

One of the purposes of this study is suggesting that some sampling methods for the part of full enumeration and compare the results with real data. This is provided that the results reported in a short time with lower cost.

Another purpose of this study is comparing the suggested sampling methods. Mainly, stratified sampling is used. Due to small population size full enumeration are suggested for some strata. Except for these strata, random sampling, systematic sampling, and poisson sampling methods are used and then compared.

Currently, the result of this survey is given in NACE Rev 2.2 (Nomenclature of Economic Activities) four digits level for Turkey and two digits level for NUTS2 (Nomenclature of territorial units for statistics) regions. Giving NUTS2 estimations in four digits level requires much more sample size in the current structure. It may cause additional requirements like time, cost, and labor. Another purpose of this study is to give the results tables in four digits level NACE codes for NUTS2 regions. This is important for regional politics and decisions. This information is needed for regional developments and creating regional policies. In the future, it may be discussed the estimations given for NUTS3 (province) level.

In Chapter 2, there are general information about the Annual Industry and Service Statistics, definition, purpose, coverage, current method and short information about suggested method. In Chapter 3, there are descriptions of some sampling methods. In Chapter 4, a sampling scheme for the Annual Industry and Service Statistics is given. In Chapter 5, applications of sampling scheme are provided. Poisson, systematic and simple random sampling results are given separately. And also, estimations of all activities are given separately and totally. Conclusions are given in Chapter 6.

The data are used in this study is micro data and belongs to TURKSTAT. Usage of micro data depends on a protocol between Graduate School of Natural and Applied Sciences of Dokuz Eylül University and TURKSTAT. It is restricted to use direct results obtained from data and some calculated statistics by this protocol. So, some calculated statistics and all confidence intervals could be given in this study but unfortunately, the value of parameters could not be given due to these restrictions.

CHAPTER TWO

ANNUAL INDUSTRY AND SERVICE STATISTICS

2.1 Definition, Purpose, Coverage

The purposes of the Annual Industry and Service Statistics are;

To determine changes in the country's social and economic structure and to follow structure of enterprises in the industry and service sector which constitutes important part of national economy, to compile enterprise based data to determine structure of the sectors, to obtain guiding knowledge about economic and social measures that will be taken by decision maker and to produce data for various researchers, to make available international statistical comparison, to compile sector based data compatible with European Union Structural Business Statistics regulations. The aim of Annual Industry and Service Statistics is to produce information based on enterprise and the local unit. For all sector, in terms of enterprise NACE Rev. 2 (4-digit) class level estimations for Turkey and in terms of local units NACE Rev. 2 (2-digit) division level 26 regional estimations are planned to be reached (Turkish Statistical Institute [TURKSTAT], 2013).

The coverage of survey is Turkey. The statistical unit of the survey is enterprise. An enterprise is an organizational unit that produces goods and services using decision autonomy concerning allocation of resources (TURKSTAT, 2013)

Enterprises are classified according to their activities by Statistical Classification of Economic Activities in the European Community (NACE Rev.2). This is a detailed list of activities. All European Community countries use this list to classify the activities. NACE codes list is given in the Appendix 1.

TURKSTAT uses NUTS2 classifications in tables. The sampling size and results are regulated according to Statistical Regions according to NUTS classification.

The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU for the purpose of the collection, development, and harmonization of European regional statistics, socioeconomic analyses of the regions.

NUTS 1: major socio-economic regions

NUTS 2: basic regions for the application of regional policies

NUTS 3: small regions for specific diagnoses. (EUROSTAT)

There are 12 NUTS1 regions, 26 NUTS2 regions and 81 NUTS3 regions in Turkey. Annual Industry and Service Statistics survey conducts 26 NUTS2 regions. The results are reported NACE 2 digits level for 26 NUTS2 regions and NACE 4 digits level for Turkey. The micro data is given in NUTS2 level. It is the reason that the results are given in NUTS2 level in this study. NUTS2 codes list is given the Appendix 2.

2.2 Method

2.2.1 Current Method

Sampling and full enumeration are used for the Annual Industry and Service Statistics. The stratified random sampling method is used. The sampling unit is an enterprise. The enterprises having more than 20 employees and some activity codes are in the coverage of full enumeration.

The aim of the Annual Industry and Service Statistics study is to produce estimations in terms of enterprise on the basis of NACE Rev. 2 (4 digits) class level for Turkey and in terms of local units on the basis of NACE Rev. 2 (2 digits) class level division level for regions (...). The sample size is determined by taking account these criteria and using iterative processes. At the first step, sample size is determined by using compromise allocation where $n_{min} = 55$ for NACE Rev. 2 at 4-digit level. The aim of this allocation is to reach optimum distribution providing desirable level of estimations. This

allocation method assures the sample size which is specified by n_{min} value even if the number of the units in a strata is very small. Therefore, stratum in which very few number of units i.e. enterprises that identified are taken by full enumeration structurally in the system. Selection probabilities of the units are evaluated at stratum level with respect to sample sizes for NACE Rev. 2 at 4 digits level. These probabilities are modified by 15 iterative processes to ensure the total sample size and suitable n_{min} value for each estimation level. New selection probabilities are determined at the end of the iterative process. Units are selected by Poisson Sampling Method according to final selection probabilities. (TUKSTAT, 2013)

Every year the list of previous year enterprises is taken from the Business Registers. This list contains some basic information about enterprises like turnover, the number of employees, activity code, etc which is taken from Revenue Administration. According to these information, it is decided whether enterprises are in full enumeration data or in sampling data. The frame of Annual Industry and Service Statistics is consisting of the list of drawn sample and the list of full enumeration enterprises. The data taken from Revenue Administration contain the information which is gathered by this survey, but these data have not necessary details. For example, Revenue Administration gives the turnover of an enterprise, but it is a total turnover of the enterprise. In the case of multi activities, there is no information about turnover according to each activity.

The result tables are given by according to economic activity (NACE Rev.2 section level and division level), size class (employed person number) and statistical region (NUTS2 level). The variables in that tables are, the number of enterprises, the number of persons employed, personnel cost, gender, wages and salaries, contributions to social security, total purchases of goods and services, turnover, production value, value-added at factor cost, gross investment in tangible goods. These are given at total in NACE Rev.2 division level (two digits code). The same variables are also given by according to size class (person) in NACE Rev.2 section

level (alphabetical code). Also, these variables are given by the activity of local unit according to NACE Rev.2 section level.

All NACE codes and their explanations are given in Appendix 1.

All NUTS2 region codes given in Appendix 2.

2.2.2 Suggested Method

The twentieth century saw a dramatic change in the way information was generated as probability sampling replaced full enumeration (Brick, 2011). Development requires speed, reliability, and accuracy in estimations. So there is no time to enumerate things, this is the time of sampling.

Usage of administrative records for the Annual Industry and Service Statistics was planned for a while. Administrative records may help to get some information but failed in some aspects, as Brick (2011) says the purpose of the administrative records may not require the same level of quality as is needed for sampling purposes. Using sampling method is very important in the Annual Industry and Service Statistics because even if administrative records are used, there could be a lack of information. A survey might be needed for the information not in the contents of administrative records.

Sampling is a procedure of selecting some part of a population to observe so that one may estimate something about the whole population (Thompson, 2012). The population may be finite or infinite, but finite means not always possible to get information about the whole population. Time, money and people might not be suitable at the same time. Thus using sampling is necessary often.

History of sampling based on ancient ages. Thompson (2012) says, Herodotus describes a sampling method used by a Persian king to estimate the number of his troops during an invasion of Greece.

A sample group of a fixed number of soldiers was instructed to stand as close together as possible and the area in which they had stood was enclosed by a short fence. Then the entire army was marched through, filling the enclosure group by group, and the number of groups required was tabulated. Multiplying the number of groups by the number in the sample group gave the estimated size of the whole force. No attempt was made to assess the accuracy of the estimate, and no description is given of how the initial sample group was selected. (Thompson, 2012)

It is important to know more details as possible as about regional economic structure for regional politics and decisions. The Annual Industry and Service Statistics is the most detailed survey about economic structure in Turkey. This survey provides detailed information about Turkey but in regional size, not provide desired details. The regional estimates are required a sample size much more than current sample size with the current design. It means more times, more cost, more study. This study is designed to give more detailed information according to economic activities in regional size using a different design of sampling methods.

Firstly, reducing the full enumeration limits is aimed. In the current situation the enterprises having more than 20 employees are in the coverage of full enumeration. But, it is enough that full enumerate the enterprises have more than 250 employees, as shown in Chapter 4.

Secondly, using stratified sampling is aimed. Because, stratified sampling can give information in population level and also stratum level. The method that used in strata is determined in Chapter 4.

Each NUTS2 region has different characteristics according to economic activities. Geographical and demographic structures are affected by the economic activities and similar regions have a similar structure. In a region, economic activities based on fishenes may develop, in order to another region agricultural activities may

developed, and so on. As a result, NUTS2 regions could be a strata in each different activity codes.

Despite the similarity in each NUTS2 region, some activity codes have large variation. Generally, in each strata, simple random sampling is using for choosing units, but for the strata having large variation different sampling methods are using. One of these is poisson sampling. The selection of units is done according to the inclusion probabilities of units in this method. The probability of selection of a unit has higher inclusion probability is more than the others. So, in unequal probability situation poisson sampling may better than simple random sampling. Another sampling method used is systematic sampling, the selection of sampling units is easier than others. Simple random sampling is used, it is a basic method. The details of sampling methods are given Chapter 3.

The sizes of some activity codes are very small. The activity codes have a size smaller than 200 in total is recommended out of sampling procedure. For these activity codes, it is recommended to use full enumeration. In this thesis, any procedure about full enumeration activity codes will not be studied.

There are 514 four digits NACE activity codes in data. 393 of them have a size smaller than 200 or calculated sample sizes are approximately equal to population size, so they are not of interest of this study. Stratified random sampling is used for 105 activity codes. Stratified sampling and in strata poisson, systematic and simple random sampling are used for 16 activity codes, and then compared. The detailed information about these are given in Chapter 4 and 5.

CHAPTER THREE

SAMPLING METHODS

3.1 Simple Random Sampling

Simple random sampling is a fundamental sampling method. It is selecting a sample of size n which drawn from a population of size N in such a way that every possible sample of size n has a equal chance of being selected (Scheaffer, R.L., Mendenhall, W. & Ott, L., 1990). In this method, every possible combination of n units is equally likely to be the sample selected (Thompson, 2012).

Each unit in a population has the same chance of selection. The probability that the i^{th} unit of the population is included in the sample is $\pi_i = \frac{n}{N}$ so that the inclusion probability is the same for each unit (Thompson, 2012).

Simple random sampling is basic and simple way drawing a sample. It provides the theoretical basis for the more complicated forms (Lohr, 2010). It is an easy and reliable way of estimating population parameters compared to the other sampling methods. According to characteristics of the population, sometimes it may not be a good choice.

The estimator of population mean is,

$$\hat{\mu} = \bar{y} = \frac{\sum_{i=1}^n y_i}{n} \quad (3.1)$$

The estimated of variance of $\bar{y}$ is,

$$\hat{V}(\bar{y}) = \frac{s^2}{n} \left(\frac{N-n}{N} \right) \quad (3.2)$$

where

$$s^2 = \frac{\sum_{i=1}^n (y_i - \bar{y})^2}{n-1} \quad (3.3)$$

The factor $(N - n)/N$ is called as the finite population correction (fpc) factor. This correction is done because with small populations the greater our sampling fraction n/N , the more information we have about the population and thus the smaller variance (Lohr, 2010). For large populations fpc is close to 1 and in this case it is ignorable. In Eurostat's (2008) guidelines, sampling designs for persons or households, practical importance of the fpc is minor, because fpc is close to 1, but this is not necessarily so in sampling designs for business surveys where sampling fractions can be much larger.

Estimator of the population total is;

$$\hat{\tau} = N\bar{y} = \frac{N \sum_{i=1}^n y_i}{n} \quad (3.4)$$

Estimated variance of $\hat{\tau}$ is,

$$\hat{V}(\hat{\tau}) = \hat{V}(N\bar{y}) = N^2 \left(\frac{s^2}{n} \right) \left(\frac{N - n}{N} \right) \quad (3.5)$$

N =population size

n =sample size

$y_i = i^{th}$ observation

$\bar{y}$ =sample mean

$\hat{\mu}$ =estimator of population mean

s^2 =sample variance

$\hat{V}(\bar{y})$ =estimator of variance of $\bar{y}$

$\hat{\tau}$ =estimator of the population total

$\hat{V}(\hat{\tau})$ = estimator of variance of $\hat{\tau}$

3.2 Stratified Sampling

If the population elements can be separated for some similar groups, stratified sampling is more useful than other methods. The word stratify comes from Latin

words meaning "to make layers"; we divide the population into ... subpopulations, called strata (Lohr, 2010). The important thing here, one element is contained by only one group called stratum.

Instead of increasing sample size, to estimate the population total (or mean) with greater precision the population is divided into several groups each of which is more homogeneous than entire population (Sampath, 2001).

This sample survey design has three major advantages over simple random sampling. First, the variance of the estimator of the population mean is usually reduced because the variance of observations within each stratum is usually smaller than the overall population variance. Second, the cost of collecting and analyzing the data is often reduced by the separation of a large population into smaller strata. Third, separate estimates can be obtained for individual strata without selecting another sample and, hence, without additional cost. (Scheaffer, et al., 1990)

It is important that the time of estimating statistics for each stratum individually and the time of estimating all strata should match. As far as strata are homogeneous, the variance is smaller than the simple random sample. If there is no natural separation of strata in population, the most important thing in stratified sampling is designing strata. In a stratum, elements must be similar to each other and each element placed into only one stratum. The first step in the selection of a stratified sample is to clearly specify the strata; then each sampling unit of the population is placed into its appropriate stratum. It must be certain that the samples selected from the strata are independent (Scheaffer, et al., 1990).

The selection in each stratum is independent of each other. The variances of estimators for individual strata can be summed to obtain variances of estimators for the whole population. (Thomson, 2012).

There is no restriction on the sampling method which is used to take sample inside the strata. It is not necessary to use the same sampling design in all strata. Depending on the nature of the strata, different sampling designs can be used in different strata (Sampath, 2001). Same method can be used for each stratum or differs from stratum to stratum according to the structure of the population. If the simple random sample is used in each stratum, its called stratified random sample and as Lohr (2010) says, the simplest form of stratified sampling.

Estimator of the population mean is,

$$\hat{\mu} = \bar{y}_{st} = \frac{1}{N} \sum_{i=1}^n N_i \bar{y}_i \quad (3.6)$$

Estimated of variance of $\bar{y}_{st}$ is,

$$\hat{V}(\bar{y}_{st}) = \frac{1}{N^2} \sum_{i=1}^L N_i^2 \left(\frac{N_i - n_i}{N_i} \right) \left(\frac{s_i^2}{n_i} \right) \quad (3.7)$$

Estimator of the population total is;

$$\hat{\tau} = N \bar{y}_{st} = \sum_{i=1}^L N_i \bar{y}_i \quad (3.8)$$

Estimated variance of $\hat{\tau}$ is,

$$\hat{V}(\hat{\tau}) = \hat{V}(N \bar{y}_{st}) = \sum_{i=1}^L N_i^2 \left(\frac{N_i - n_i}{N_i} \right) \left(\frac{s_i^2}{n_i} \right) \quad (3.9)$$

L=number of strata

N_i =number of sampling units in stratum i

N= number of sampling units in the population ($N_1 + N_2 + \dots + N_L$)

n_i =sample size for stratum i

n =sample size

$\bar{y}_i$ =sample mean for the sample selected from stratum i

μ_i =population mean for stratum i

τ_i =population total for stratum i

$\bar{y}_{st}$ =estimator of the population mean

$\hat{V}(\bar{y}_{st})$ =estimator of variance of $\bar{y}_{st}$

$\hat{\tau}$ =estimator of the population total

$\hat{V}(\hat{\tau})$ =estimator of variance of $\hat{\tau}$

Different from simple random sampling, it is not enough deciding sample size, also strata sizes should be decided. Strata sizes are determined according to the total number of units in each stratum, the variance of each stratum and cost of gathering information from each stratum. If the costs are not important or not known, accepted as equal. There are some allocation methods. In this study, the costs are not important and strata size and variance are important, so the best choice for allocation is allocated proportionally with $N_i S_i$. This allocation method has been suggested by J. Neyman at 1934, usually named Neyman Allocation. (Yamane, 2010)

Approximate sample size is

$$n = \frac{\sum_{i=1}^L N_i^2 \sigma_i^2 / w_i}{N^2 D + \sum_{i=1}^L N_i \sigma_i^2} \quad (3.10)$$

where w_i is the fraction of observations allocated to stratum i , σ_i^2 is the population variance for stratum i , and

$$w_i = \frac{N_i \sigma_i / \sqrt{c_i}}{\sum_{k=1}^L N_k \sigma_k / \sqrt{c_k}} \quad (3.11)$$

where c_i denotes the cost of obtaining a single observation from the i^{th} stratum. If the costs per observation are equal or negligible, this formula becomes,

$$w_i = \frac{N_i \sigma_i}{\sum_{i=1}^L N_i \sigma_i} \quad (3.12)$$

$$D = \frac{B^2}{4} \quad (3.13)$$

when estimating μ

$$D = \frac{B^2}{4N^2} \quad (3.14)$$

when estimating τ

where B is the bound on the error of estimation.

The stratum size is,

$$n_i = n w_i, i = 1, 2, \dots, L \quad (3.15)$$

3.3 Systematic Sampling

Systematic sampling is a procedure that selects only the first element randomly then selects other elements by adding a constant number k to the first element and continues adding k to the previous element for finding next element and so on. In these schemes, instead of selecting n units at random, the sample units are decided by a single number chosen at random (Sampath, 2001). This is the main advantage of systematic sampling. The simplicity of only one random draw is a great advantage (Särndal, 1992). Another definition is a sample obtained by randomly selecting one element from the first k elements in the frame and every k^{th} element thereafter is called a 1-in- k systematic sampling, with a random start (Scheaffer, et al., 1990). The most important thing in systematic sampling is randomly ordered frame. If the frame does not randomly ordered or ordered by a rule, systematic sampling cause systematic fault.

Drawing n elements from a population with size N using 1-in- k systematic sampling. k must be less than or equal to N/n (Scheaffer, et al., 1990). Once it has been decided k value and selected first element randomly, and then drawing a sample is only an adding procedure. This is easier than drawing a sample with other methods. It was mentioned that systematic procedures have an obvious advantage over all procedures in simplicity of selection (Brewer, et al., 1980).

The estimator of the population mean μ :

$$\hat{\mu} = \bar{y}_{sy} = \frac{\sum_{i=1}^n y_i}{n} \quad (3.16)$$

where sy represents systematic sampling.

Estimated variance of $\bar{y}_{sy}$:

$$\hat{V}(\bar{y}_{sy}) = \frac{s^2}{n} \left(\frac{N-n}{N} \right) \quad (3.17)$$

Estimator of the population total is;

$$\hat{\tau} = N\bar{y}_{sy} \quad (3.18)$$

Estimated variance of $\hat{\tau}$ is,

$$\hat{V}(\hat{\tau}) = \hat{V}(N\bar{y}_{sy}) = N^2 \left(\frac{s^2}{n} \right) \left(\frac{N-n}{N} \right) \quad (3.19)$$

assuming a randomly ordered population. (Scheaffer, et al.,1990)

$\hat{\mu}$ =estimator of population mean

$\bar{y}$ =sample mean

$\hat{V}(\bar{y}_{sy})$ =estimator of variance of $\bar{y}_{sy}$

$\hat{\tau}$ =estimator of population total

$\hat{V}(\hat{\tau})$ =estimator of variance of τ

3.4 Cluster Sampling

Cluster sampling involves the random selection of clusters of elements from a sampling frame of clusters rather than selection of individual elements (Hibberts, Johnson & Hudson, 2012)

If a population consists of similar groups of elements, cluster sampling is a good choice. The groups are similar to other groups but inside the groups, elements are not similar to other element, these groups are called clusters. Clusters are observation units in the population are aggregated into larger sampling units (Lohr, 2010). Different from stratified sampling, each clusters are heterogeneous within, but clusters are similar to other clusters. In this method, clusters are created and then a sample is taken from these clusters. Cluster sampling may provide maximum information at minimum cost when a frame listing population elements is not available or when the cost of obtaining observations increases with increasing distance between elements (Scheaffer, et al., 1990).

The notations and formulas for cluster sampling given by Scheaffer, et al. (1990) as follows:

Estimator of population mean is,

$$\hat{\mu} = \bar{y} = \frac{\sum_{i=1}^n y_i}{\sum_{i=1}^n m_i} \quad (3.20)$$

Estimated variance of $\bar{y}$ is,

$$\hat{V}(\bar{y}) = \left(\frac{N-n}{Nn\bar{M}^2} \right) s_r^2 \quad (3.21)$$

where

$$s_r^2 = \frac{\sum_{i=1}^n (y_i - \bar{y}m_i)^2}{n-1} \quad (3.22)$$

N =the number of clusters in the population

n =the number of clusters selected in a simple random sample

m_i =the number of elements in cluster i , $i=1, \dots, N$

$\bar{m} = \frac{1}{n} \sum_{i=1}^n m_i$ =the average cluster size for the sample

$M = \sum_{i=1}^N m_i$ =the number of elements in the population

$\bar{M} = M/N$ =the average cluster size for the population

y_i =the total of all observations in the i th cluster

Here $\bar{M}$ can be estimated by $\bar{m}$ if M is unknown.

Estimator of the population total, if M is known, is,

$$\hat{\tau} = M\bar{y} = M \frac{\sum_{i=1}^n y_i}{\sum_{i=1}^n m_i} \quad (3.23)$$

Estimated variance of $\hat{\tau} = M\bar{y}$ is,

$$\hat{V}(\hat{\tau}) = \hat{V}(M\bar{y}) = M^2 \hat{V}(\bar{y}) = N^2 \left(\frac{N-n}{Nn} \right) s_r^2 \quad (3.24)$$

Estimator of the population total, if M is unknown, is,

$$\hat{\tau} = N\bar{y}_t = \frac{N}{n} \sum_{i=1}^n y_i \quad (3.25)$$

Estimated variance of $\hat{\tau} = N\bar{y}_t$,

$$\hat{V}(\hat{\tau}) = \hat{V}(N\bar{y}_t) = N^2 \hat{V}(\bar{y}_t) = N^2 \left(\frac{N-n}{Nn} \right) s_t^2 \quad (3.26)$$

where

$$s_t^2 = \frac{\sum_{i=1}^n (y_i - \bar{y}_t)^2}{n-1} \quad (3.27)$$

The cluster sizes are not highly correlated with the cluster total, the cluster sizes are providing little information on cluster totals; hence, the unbiased estimator $N\bar{y}_t$ appears to be better than the estimator $M\bar{y}$ (Scheaffer, et al., 1990).

3.5 Poisson Sampling

Poisson sampling was introduced into literature by Hájek (1958, 1964). Poisson sampling is a sampling design in which the sample units have unequal probabilities of selection, π_i (Williams, et al., 1998). In addition the units in the population are independent and the sample size, n , is a random variable.

Poisson Sampling is a method for choosing a sample s , of random size s , from a finite population U consisting of N individuals. Each individual i in the population has a predetermined probability π_i of being included in the sample s . A poisson sample may be realised by using N independent Bernoulli trials to determine whether the individual under consideration is to be included in the sample s or not. (Aires, N., 1999)

Similar to Aires (1999), Lohr (2010) defines poisson sampling as a sampling process in which independent Bernoulli trials determine whether each unit in the population is to be included in the sample.

Poisson sampling is different from the other sampling methods described above. The chance of being selected for elements are not equal in this sampling design. Each element in the population has an inclusion probability and selection procedure is done according to these inclusion probabilities. In poisson sampling, the i^{th} population unit is independently selected with probability π_i (Brewer, 2000). An inclusion probability is the probability that an individual unit will be in the final sample (Ghosh&Vogt, 1999).

Another difference is that the sample size is a random variable. It is the disadvantages of poisson sampling. Because always there is a chance to get an empty

sample or sample size equal to population size. In some cases, the resulting sample will be unacceptable: too small for reasonable inferences or too large for available resources (Ghosh & Vogt, 1998). In that case, the sample size has a variance. To avoid these, a modification of poisson sampling named conditional poisson sampling is used in this study. Grafström (2005) defines conditional poisson sampling as a modification of poisson sampling. Each unit i in the population is included with a given probability π_i but only samples of size n are accepted. Conditional poisson sampling often called rejective sampling (Ghosh & Vogt, 2002). In this study poisson sampling referred conditional poisson sampling.

After defining n , it is necessary to define the probabilities of each unit i is sampled, that is inclusion probabilities. A characteristic which is easily observed or previously known and existing in each unit of population (x_i) selected. It is covariate or auxiliary variable in the sampling literature (Williams, et al., 2009). Kott & Bailey (2000) called this x value as a control variable for the target variable y . One of the important things in poisson sampling is to decide what are the x_i values. When selecting auxiliary variables there are two basic requirements, they should be related to y , and they should be easy to obtain information on (Lundquist, 2009). This value and previously decided n value are used to calculate inclusion probabilities. If a unit have to be in sample, its inclusion probability is defined as 1 without making any calculation. The implementation of poisson sampling, as described in most sampling texts ..., assumes that X is known (Williams et al., 2009).

The inclusion probabilities calculated as,

$$\pi_i = \frac{nx_i}{X}, i = 1, \dots, N \quad (3.28)$$

where X is the total of x_i values. Then, generating random numbers r_i which come from uniform distribution. ($r_i \sim Uniform(0,1)$). r_i are variables that takes random value between 0 and 1.

In poisson sampling, a list of population units is generated and successive units are independently included in the sample, the i^{th} unit being chosen with probability p_i . This sampling scheme ensures that the list of selection probabilities and inclusion probabilities are identical. (Ghosh, D., & Vogt, A., 1999)

Every element in the population has one inclusion probability and one random number. Inclusion probability and random number are compared. If random number is smaller than the inclusion probability of case i ($r_i < \pi_i$), case i (i^{th} element) is selected in sample. Number of selected units may smaller or larger than previously decided n value. After the second step inclusion probabilities are calculated using n which is the number of selected cases in first the iteration. This procedure is repeated until achieving a constant n value. That means whatever the iteration number, n is not change. If this n value is equal to previously decided n value, the selected units consist of the sample, and it can be calculated statistics from this sample. But, if this n value does not equal to previously decided n value, this sample is rejected. In that case new random numbers are generated, and all procedure is done again.

Särndal, et al. (1992) give the formulas of estimators of poisson sampling as follows;

The estimator of population total $\tau = \sum_U y_i$ is

$$\hat{\tau} = \sum_s \tilde{y}_i = \sum_s \frac{y_i}{\pi_i} \quad (3.29)$$

Hajek (1962-1964) say, Horwitz and Thompson showed that $\sum_{i \in s} (y_i / \pi_i)$ is an unbiased estimator of population total, if $\pi_i > 0$, $i=1, \dots, N$, for any sampling design.

$$V(\hat{\tau}) = \sum_U \left(\frac{1}{\pi_i} - 1 \right) y_i^2 \quad (3.30)$$

An unbiased variance estimator is

$$\hat{V}(\hat{\tau}) = \sum_s (1 - \pi_i) \check{y}_i^2 \quad (3.31)$$

Ardilly & Tille (2006) given proof of formulas and some examples of poisson sampling.



CHAPTER FOUR

SAMPLING SCHEME

4.1 Model Description

The aim is to propose a new sampling scheme for the full enumeration part of the Annual Industry and Service Statistics survey. Years by years the proportion of full enumeration increases and this is the waste of time and sources. The frequency of sampling and full enumeration data of the Annual Industry and Service Statistics Survey according to years is given in Table 4.1. These values in Table 4.1 are obtained by database through website of TURKSTAT.

Table 4.1 Frequency of sampling and full enumeration data

YEAR	SAMPLING	FULL ENUMERATION	TOTAL
	Percent	Percent	Percent
2009	53.4%	46.6%	100.0%
2010	38.4%	61.6%	100.0%
2011	39.2%	60.8%	100.0%
2012	35.4%	64.6%	100.0%
2013	32.2%	67.8%	100.0%

It is considered that all of the units have more than 20 employees within full enumeration data, and also units have less than 20 employees within sampling data. It might not be realistic for some case. This situation needs to be fixed. So, at the beginning, if a unit seems to have more than 20 employees, this unit is accepted as a full enumeration unit.

The data used in this study covers 2009, 2010, 2011, 2012 and 2013 years of Annual Industry and Service Statistic Survey conducted by Turkish Statistical Institute. Calculations were made using the 2009, 2010, 2011 and 2012 data, and applications were made by using 2013 data which is the latest micro data of that survey available. So, the statistics and parameters of 2013 data can be compared and checked at the end.

The data consists of two parts; full enumeration and sampling data. Table 4.2 shows the method is used in which activity codes. "F" refers full enumeration, "R" refers random sampling and "P/R/S" refers all three methods (poisson, simple random and systematic).



Table 4.2 Full enumeration or sampling method according to activity codes

NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD
0510	F	1073	F	1419	R	2014	F	2343	F	2521	F	2732	F	2931	F	3317	F
0520	R	1081	F	1420	F	2015	F	2349	F	2529	F	2733	F	2932	R	3319	F
0610	F	1082	F	1431	F	2016	F	2351	F	2530	F	2740	R	3011	F	3320	F
0620	F	1083	F	1439	R	2020	F	2352	F	2540	F	2751	F	3012	F	3511	F
0710	F	1084	F	1511	F	2030	F	2361	R	2550	F	2752	F	3020	F	3513	F
0729	F	1085	F	1512	F	2041	F	2362	F	2561	R	2790	F	3030	F	3514	F
0811	R	1086	F	1520	R	2042	F	2363	R	2562	R	2811	F	3040	F	3521	F
0812	R	1089	F	1610	F	2051	F	2364	F	2571	F	2812	F	3091	F	3522	F
0891	F	1091	F	1621	F	2052	F	2365	F	2572	F	2813	F	3092	F	3523	F
0892	F	1092	F	1622	F	2053	F	2369	F	2573	R	2814	F	3099	F	3530	F
0893	F	1101	F	1623	F	2059	F	2370	P/R/S	2591	F	2815	F	3101	R	3600	F
0899	F	1102	F	1624	F	2060	F	2391	F	2592	F	2821	F	3102	F	3700	F
0910	F	1105	F	1629	F	2120	F	2399	F	2593	F	2822	R	3103	F	3811	F
0990	F	1107	F	1712	F	2211	F	2410	F	2594	F	2823	F	3109	R	3812	F
1011	F	1200	F	1721	R	2219	R	2420	F	2599	R	2824	F	3211	F	3821	F
1012	F	1310	R	1722	F	2221	R	2431	F	2611	F	2825	F	3212	F	3822	F
1013	F	1320	R	1723	F	2222	R	2432	F	2612	F	2829	R	3213	F	3831	F
1020	F	1330	R	1724	F	2223	R	2433	F	2620	F	2830	F	3220	F	3832	F
1031	F	1391	F	1729	F	2229	R	2434	F	2630	F	2841	F	3230	F	3900	F
1032	F	1392	R	1811	F	2311	F	2442	F	2640	F	2849	F	3240	F	4120	P/R/S
1039	R	1393	F	1812	R	2312	F	2443	F	2651	F	2891	F	3250	R	4211	P/R/S
1041	F	1394	F	1813	F	2313	F	2444	F	2652	F	2892	F	3291	F	4212	F
1042	F	1395	F	1814	F	2314	F	2445	F	2660	F	2893	F	3299	F	4213	F
1051	R	1396	F	1820	F	2319	F	2451	F	2670	F	2894	F	3311	F	4221	P/R/S
1052	F	1399	F	1910	F	2320	F	2452	F	2680	F	2895	F	3312	R	4222	R
1061	R	1411	F	1920	F	2331	F	2453	F	2711	F	2896	F	3313	F	4291	R
1062	F	1412	F	2011	F	2332	R	2454	F	2712	R	2899	F	3314	F	4299	F
1071	R	1413	P/R/S	2012	F	2341	F	2511	R	2720	F	2910	F	3315	R	4311	F
1072	F	1414	P/R/S	2013	F	2342	F	2512	R	2731	F	2920	R	3316	F	4312	P/R/S

Table 4.2 continues

NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD	NACE	METHOD
4313	F	4624	F	4672	P/R/S	4765	F	5223	F	6202	F	7721	F	8520	R	9104	F
4321	R	4631	R	4673	R	4771	R	5224	R	6203	F	7722	F	8531	R	9200	F
4322	R	4632	R	4674	R	4772	F	5229	R	6209	F	7729	F	8532	F	9311	F
4329	R	4633	F	4675	R	4773	F	5320	F	6311	F	7731	F	8541	F	9312	F
4331	R	4634	R	4676	F	4774	F	5510	R	6312	F	7732	F	8542	F	9313	F
4332	F	4635	F	4677	F	4775	F	5520	F	6391	F	7733	F	8551	F	9319	F
4333	R	4636	R	4690	F	4776	F	5530	F	6399	F	7734	F	8552	F	9321	F
4334	F	4637	F	4711	P/R/S	4777	R	5590	F	6831	F	7735	F	8553	R	9329	F
4339	R	4638	P/R/S	4719	F	4778	P/R/S	5610	R	6832	R	7739	F	8559	R	9511	F
4391	F	4639	R	4721	F	4779	F	5621	F	6910	R	7740	F	8560	F	9512	F
4399	R	4641	R	4722	F	4781	F	5629	R	6920	F	7810	R	8610	R	9521	F
4519	F	4643	R	4724	F	4789	F	5811	F	7021	F	7912	F	8622	R	9523	F
4520	R	4644	F	4725	F	4791	F	5812	F	7022	R	7990	F	8623	F	9524	F
4531	R	4645	F	4726	F	4799	F	5813	F	7111	R	8010	R	8690	R	9525	F
4532	R	4646	R	4729	F	4920	F	5814	F	7112	P/R/S	8020	F	8710	F	9529	F
4540	F	4647	R	4730	P/R/S	4931	F	5819	F	7120	F	8030	F	8720	F	9601	F
4611	F	4648	F	4741	F	4932	F	5821	F	7211	F	8110	F	8730	F	9602	F
4612	F	4649	F	4742	R	4939	R	5829	F	7219	F	8121	R	8790	F	9603	F
4613	F	4651	F	4743	F	4941	P/R/S	5911	F	7311	R	8122	F	8810	F	9604	F
4614	F	4652	R	4751	F	4942	R	5912	F	7312	F	8129	R	8891	R	9609	F
4615	F	4661	F	4752	R	5010	F	5913	F	7320	F	8130	F	8899	F		
4616	F	4662	F	4753	F	5020	R	5914	F	7410	F	8219	F	9001	F		
4617	F	4663	F	4754	R	5030	F	5920	F	7420	F	8220	F	9002	F		
4618	F	4664	F	4759	R	5110	F	6110	F	7430	F	8230	F	9003	F		
4619	F	4665	F	4761	F	5121	F	6120	F	7490	F	8291	F	9004	F		
4621	R	4666	F	4762	F	5210	F	6130	F	7500	F	8292	F	9101	F		
4622	F	4669	R	4763	F	5221	F	6190	F	7711	F	8299	F	9102	F		
4623	F	4671	P/R/S	4764	F	5222	F	6201	R	7712	F	8510	F	9103	F		

4.1.1 Description of Full Enumeration Data

The enterprises with more than 250 employees will be included in full enumeration data. Because, the number of enterprises having more than 250 employees is small, and value of variables like the number of employees, turnover, production value, total purchases of goods and services are much more than the others. This separation is also suitable for the European Union. Enterprises with fewer than 250 employees are small and medium-sized enterprises (Giovanninni, 2008). The number of enterprises according to years given Table 4.3.

Table 4.3 Number of enterprises according to number of person employed year by year

Size Class (Number of people employed)	2009	2010	2011	2012	2013
1-19	2,445,339	2,262,755	2,522,011	2,567,919	2,613,047
20-49	35,139	55,937	65,308	74,042	77,499
50-99					
100-249					
250-499	2,822	3,287	3,763	4,156	4,585
500-999					
1,000-4,999					
5,000+					
Total	2,483,300	2,321,979	2,591,082	2,646,117	2,695,131

Note that this is the published values and it is the total of full enumeration and estimations. For example, in 2013 the number of units in survey is 168,676 and estimated number of units is 2,695,131. These values are taken from the databases through web site of TURKSTAT. The calculations in this study were made by using original data not estimated part of data. It means the table get from databases not to use calculations, calculations made by micro data (raw data).

The percentages of enterprises in full enumeration data (the enterprises have more than 20 employees in Annual Industry and Service Statistic Survey) are given in Table 4.4. These percentages in Table 4.4 and 4.5 were calculated from the data obtained from the database through website of TURKSTAT. The percentages of turnover in full enumeration data (the enterprises have more than 20 employees in Annual Industry and Service Statistic Survey) are given in Table 4.5.

Table 4.4 Percent of enterprises according to number of person employed year by year

Size Class (Number of people employed)	2009	2010	2011	2012	2013
20-49	92.57%	94.45%	94.55%	94.69%	94.41%
50-99					
100-249					
250-499	7.43%	5.55%	5.45%	5.31%	5.59%
500-999					
1,000-4,999					
5,000+					
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Approximately 5-7% of enterprises have approximately half of total turnover. This is the reason that the enterprises having more than 250 employees will be planned in full enumeration.

Table 4.5 Percentage of turnover according to number of person employed year by year

Size Class (Number of people employed)	2009	2010	2011	2012	2013
20-49	44.80%	49.70%	49.45%	49.80%	50.59%
50-99					
100-249					
250-499	55.20%	50.30%	50.55%	50.20%	49.41%
500-999					
1,000-4,999					
5,000+					
Total	100.00%	100.00%	100.00%	100.00%	100.00%

The activity codes that are not observed last years, but observed in the frame taken from Business Registers, accepted as full enumeration data.

There are 514 NACE Rev.2 classes (4 digits level) in data. 387 of them has frequency smaller than 200 in total. It is hard to divide 26 strata. The activity codes that have frequency smaller than 200 were accepted as full enumeration data. For remaining 127 codes, sample sizes were calculated but sample sizes for 6 of them

were almost equal to population size, so they were decided to accept in the full enumeration.

Before selecting samples, outlier values are determined and removed from the data. At this point it is useful to know that there are many analyzes and checks made before the data are published and necessary corrections are made by TÜİK. There are many different definitions for the outlier. But, in this study, the meaning of an outlier is the value which is far from the mean $\pm 3\sigma$. This because of, the interval $\pm 3\sigma$ covers %99.7 of all data and desired minimum data is loss as much as possible. When defining outliers, firstly data for each year (2009, 2010, 2011 and 2012 years data) are obtained separately. The values which falls far from mean $\pm 3\sigma$ are specified for every variable, then these are removed from the current year sampling data and added to the full enumeration data. Because the number of outliers is small, some value of these causes very large variance. The number of outliers which added to the full enumeration data is 1,520 over 110,420 units in this thesis. Finally, calculations were made by 108,900 units.

Note that, after calculating sample sizes in some activity codes, some of the strata needed full enumeration. Because calculated sample size is nearly equal to this activity code size.

4.1.2 Description of Sampling Data

After decided sampling and full enumeration data, a specific sampling method is used. Each of activity codes is controlled and then sampling method are specified. For the first step stratified sampling is used. Because the data have large variability and all NUTS2 region parameters need to be estimated. Each of NACE Rev. 2 (4 digits level) class were accepted as a discrete population. Each population has 26 strata which are 26 regions. Generally, it is not chosen more than 5 or 6 strata when using this method (Scheaffer, et al., 1990), but in the Annual Industry and Service Statistic Survey, there needs to be estimations for all regions and all NACE Rev. 2 (2 digits level) divisions. In this study, one of the aims is providing the estimations for

all regions and also all NACE Rev.2 (4 digits level) classes. It is the reason that there are 26 strata, and cluster sampling is not used. Separate estimates can be obtained for individual strata without selecting another sample (Scheaffer, et al., 1990) using with stratified sampling.

There is no exact way to the determine a sampling method. In this point, the coefficient of variation seems to be a good choice. Poisson, simple random and systematic sampling are used for the activity codes which have higher coefficient of variation, then simple random sampling was used for the others. In the activities, that included the strata having a coefficient of variation more than 2.5, are used each of 3 sampling methods and for the others are used simple random sampling. The strata which have a higher coefficient of variation and their values are given in table 4.6. The variable D12110, turnover is used for this calculation. The variables codes like D12110 are defined by EUROSTAT and are taken from web site of EUROSTAT. They are standard codes for all countries in the European Union, for example 12110 is turnover in Turkey and also in France its mean turnover etc.

According to Table 4.6, it is decided to using poisson sampling in activity codes 1413, 1414, 2370, 4120, 4211, 4221, 4312, 4638, 4671, 4672, 4711, 4730, 4778, 4941, 7010 and 7112. The definition of these codes;

1413: Manufacture of other outerwear

1414: Manufacture of underwear

2370: Cutting, shaping, and finishing of stone

4120: Construction of residential and non-residential buildings

4211: Construction of roads and motorways

4221: Construction of utility projects for fluids

4312: Site preparation

4638: Wholesale of other food, including fish, crustaceans, and molluscs

4671: Wholesale of solid, liquid and gaseous fuels and related products

4672: Wholesale of metals and metal ores

4711: Retail sale in non-specialised stores with food, beverages or tobacco predominating

4730: Retail sale of automotive fuel in specialized stores

4941: Freight transport by road

7010: Activities of head offices

7112: Engineering activities and related technical consultancy

Table 4.6 Strata having high coefficient of variation

NUTS2K	NACE	CV
TR32	7112	3.62
TR10	4711	3.42
TRC2	4941	3.40
TR83	4211	3.29
TR32	4221	3.10
TR10	4120	3.05
TR81	4730	2.97
TRC3	4120	2.87
TR42	1414	2.86
TR90	7112	2.75
TRC3	4211	2.74
TR41	4711	2.72
TR31	2370	2.69
TR41	4778	2.67
TR10	4672	2.64
TR33	4312	2.64
TR21	1414	2.58
TR62	4638	2.58
TR51	4120	2.57
TR31	7010	2.53
TR51	4671	2.52
TR33	1413	2.51

In this study, the sample size is calculated for estimating NACE Rev. 2 (4 digits level) classes for 26 regions. There are not specific calculations for local units. There are many variables in the Annual Industry and Service Statistics. Approximately 200 cells filled. 5 most important and published variables are chosen for estimations:

D12110: Turnover

D12120: Production Value

D12150: Value-added at factor cost

D13110: Total purchases of goods and services

D16110: Number of people employed

4.2 Sample Size

In practice, surveys are concerned with many population variables. However, most of the theory for sample surveys were developed for a small number of variables, typically one or two (Chambers, 2003). For this reason, in this study chosen only one variable to determine sample size.

Firstly, sample sizes are calculated for all five variables. The best result is calculated from D12110 variable. The sample sizes are calculated for D12120, D12150, D13110, and D16110 given in table 4.7.

Table 4.7 Sample sizes calculated from D12120, D12150, D13110 and D16110 variables

	For D12120 with B=100,000	For D12150 with B=50,000	For D13110 with B=200,000	For D16110 with B=2
NUTS2K	ni	ni	ni	ni
TR10	15,622	5,717	20,190	910
TR21	752	230	401	40
TR22	374	123	301	27
TR31	1,750	710	1,592	140
TR32	831	303	674	80
TR33	878	205	466	58
TR41	1,775	667	1,296	162
TR42	1,535	679	1,373	107
TR51	2,995	1,307	2,491	268
TR52	722	184	494	47
TR61	1,704	414	1,026	116
TR62	1,275	413	1,106	90
TR63	637	178	618	55
TR71	240	84	242	27
TR72	679	227	466	55
TR81	196	63	362	22
TR82	60	27	59	11
TR83	602	140	483	55
TR90	906	141	496	51
TRA1	94	40	101	18
TRA2	61	34	50	11
TRB1	275	104	205	48
TRB2	321	104	321	27
TRC1	781	386	732	60
TRC2	504	192	315	72
TRC3	503	92	360	37
Total	36,071	12,763	36,220	2,595

After many trials the largest sample size are calculated from using D12110 variable. Calculations are made by formulas of stratified sampling and Neyman allocation. NUTS2 regions have different variances from each other for every activity codes. Some activities are concentrated to a region and this causes a difference in variances. Suppose that cost is not important and variances are important. So using Neyman allocation is the most appropriate allocation. In different data sets, different allocations may work well. There are some studies about how to choose allocation methods. Mathew, et al. (2013) and Barnabas & Sunday (2014) have studied about the efficiency of allocation methods, they are all concluded that in their paper, Neyman allocation is the most efficient allocation. Neyman allocation is known to be theoretically optimal in comparison with proportional allocation (Winkler, 2009)

Formulas in Chapter Three are used to determine sample sizes and allocations. Formula 3.10 is used for calculating sample size and formula 3.15 is used for allocation in strata.

The sample sizes are calculated by formulas of Neyman allocation have used in the strata that using different sampling method. This is because of randomness of sample size in poisson sampling and necessity of a fixed sample size. This kind of poisson sampling is named conditional poisson sampling. If a fixed sample size n is desired, it is possible to generate poisson samples and accept the sample only if the sample size n . The resulting design is called conditional poisson sampling (Grafström, 2010).

The specification of the degree of precision wanted in the results is an important step (Cochran, 1977). In general, when deciding bound on the error of estimation, the variance is used. But, the variances are sometimes very large, and this caused large bounds. To maintain the sensitivity decided to another calculation instead of variance after many trials. Bound on the error of estimations are changed in every activity codes. But it is needed a standard for this, for every activity codes using the previous year data (in this study year 2012 data). Calculated 5% of the turnover mean. If this

value is greater than or equal 150,000 TL, bound on the error of estimation accepted as 200,000. If this value is smaller than 150,000 TL, calculated value rounded down. For example, if the calculating value is 125,000, the bound on the error of estimation accepted 120,000.

Table 4.8 NUTS2 sample percentage

NUTS2K	n_i	%
TR10	21,644	82%
TR21	684	48%
TR22	556	45%
TR31	3,070	59%
TR32	1,426	48%
TR33	1,010	46%
TR41	2,911	61%
TR42	2,218	58%
TR51	5,812	72%
TR52	960	52%
TR61	1,858	54%
TR62	1,662	50%
TR63	884	43%
TR71	445	40%
TR72	1,013	50%
TR81	350	46%
TR82	229	45%
TR83	773	39%
TR90	898	40%
TRA1	307	46%
TRA2	184	39%
TRB1	574	39%
TRB2	463	47%
TRC1	1,022	57%
TRC2	1,030	45%
TRC3	680	47%
Total	52,663	62%

Some strata (regions) in some activity codes are full enumeration. When calculating the variance of an activity code, if there exists full enumeration strata, n

accepted as $N-1$ in formulas for not to lose the variation comes from full enumeration strata and to see the effects of variances of full enumeration strata.

The sample percentages according to NUTS2 are given in Table 4.8.

The percentage of sampled units according to NACE are given in Table 4.9.

The applications in all data are summarized in Figure 4.1.



Table 4.9 Activity codes (NACE) sampling percentage

NACE	Sampling Percentage	NACE	Sampling Percentage	NACE	Sampling Percentage	NACE	Sampling Percentage	NACE	Sampling Percentage
0520	50.19%	2363	68.39%	4321	77.66%	4671	53.71%	6832	48.18%
0811	79.68%	2370	62.02%	4322	72.37%	4672	69.04%	6910	83.41%
0812	63.26%	2511	82.61%	4329	71.47%	4673	86.76%	7010	74.94%
1039	72.86%	2512	77.43%	4331	70.48%	4674	88.72%	7022	90.95%
1051	76.90%	2561	76.80%	4333	81.50%	4675	76.41%	7111	63.11%
1061	68.28%	2562	87.77%	4339	85.78%	4711	57.09%	7112	59.66%
1071	59.08%	2573	63.56%	4399	70.01%	4730	66.62%	7311	88.39%
1310	77.70%	2599	80.12%	4511	57.16%	4742	79.20%	7810	74.58%
1320	94.67%	2712	87.45%	4520	72.92%	4752	70.92%	7911	80.65%
1330	90.65%	2740	89.79%	4531	70.32%	4754	23.77%	8010	68.72%
1392	76.30%	2822	81.40%	4532	89.45%	4759	78.15%	8121	64.81%
1413	64.59%	2829	77.04%	4621	49.70%	4771	69.94%	8129	72.12%
1414	76.87%	2920	69.23%	4631	69.14%	4777	86.96%	8520	74.50%
1419	74.10%	2932	75.33%	4632	81.90%	4778	68.17%	8531	77.74%
1439	89.00%	3101	71.14%	4634	69.64%	4939	54.69%	8553	73.31%
1520	75.30%	3109	70.00%	4636	66.09%	4941	70.48%	8559	54.98%
1721	67.77%	3250	75.48%	4638	55.35%	4942	78.47%	8610	67.78%
1812	64.43%	3312	80.83%	4639	75.88%	5020	73.33%	8622	68.24%
2219	87.45%	3315	83.43%	4641	87.52%	5224	57.76%	8690	77.42%
2221	75.32%	4120	29.41%	4642	90.58%	5229	82.77%	8891	39.58%
2222	81.23%	4211	66.67%	4643	76.49%	5510	65.59%	9522	57.05%
2223	75.50%	4221	78.64%	4646	81.85%	5610	49.57%		
2229	95.04%	4222	74.45%	4647	69.80%	5629	61.42%		
2332	42.50%	4291	76.21%	4652	84.78%	5630	72.93%		
2361	61.78%	4312	67.34%	4669	91.53%	6201	87.75%	TOTAL	62.28%

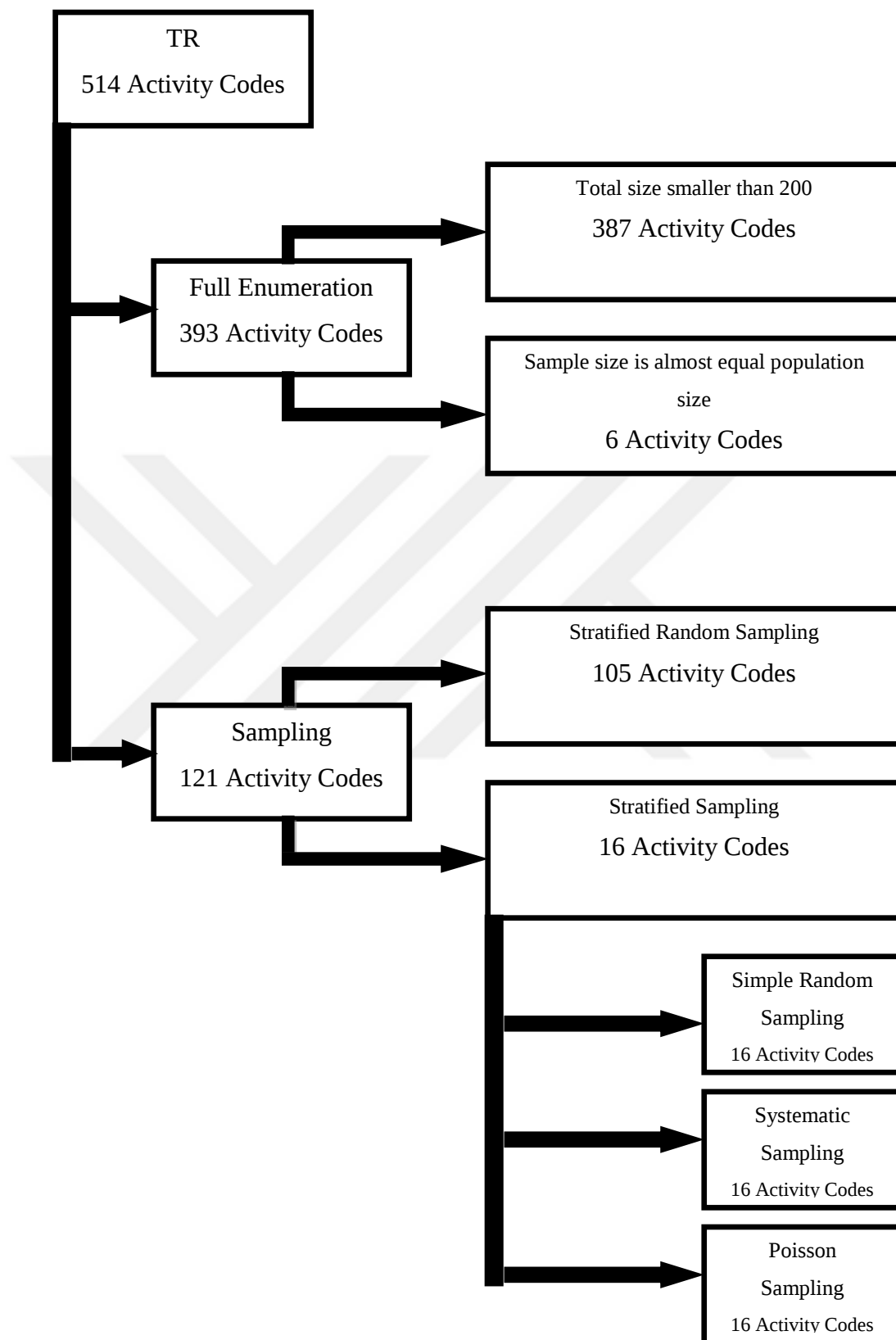


Figure 4.1 Sampling scheme

CHAPTER FIVE

APPLICATIONS

5.1 Poisson Sampling Applications

Even stratification, some activity codes variability are extremely large. So, simple random sampling in strata fails sometimes. In that point, poisson sampling has some advantages, as far as deciding good inclusion probabilities

When using poisson sampling, deciding to sample size is having some difficulties due to the randomness of sample size. n may take values between 0 and N , according to inclusion probabilities and random numbers which used for calculations. For that reason decided to use conditional poisson sampling, since it is used fixed n . In conditional poisson sampling, n fixed and tried to achieve this fixed n . In that case number of trials are uncertain. For example, achieving 100 sample with size 2 and population size 14, it must be drawn 342 sample. 100 of 342 has sample size 2, and the others size changed between 0 and 14. Similarly, for $N=37$ and $n=10$, it must be drawn 609 sample.

The most important point before drawing a sample is deciding what are the x_i values for calculating inclusion probabilities. In the development of poisson sampling, it was mentioned that the characteristic x_i is chosen so that it is positively correlated with y_i (Williams, et al., 2009). If the y_i are roughly proportional to the π_i , it is more efficient for samples of any size (Brewer, et al., 1984). Auxiliary variables are defined as the variables which are not our primary interest, but it is reasonable to assume they are connected to our study variable in some way (Lundquist, 2009).

A characteristic which is easily observed or previously known and existing each unit of population (x_i) is selected. This value and previously decided n value are used to calculate inclusion probabilities. If a unit have to be in sample, determining its inclusion probability as 1 without making any calculation. There is no known

analytic formula that permits us to calculate probabilities of selection (Saavedra, 2000). In this thesis, x_i values are some kind of transformation previous years mean and variance of turnover data. x_i values calculated as using mean and variances previous year data. First, the mean of stratum is subtracted from each turnover value and divided by variance of stratum. The absolute value of this is multiplied by 10,000,000. Then it is rounded 3 decimals and summed all values. A coefficient is obtained by dividing this summation using for calculation of decided sample size. Finally, all rounded values are divided by this coefficient. If this smaller than 1, this is the x_i value, if greater than 1, x_i value is accepted as 1. Then, inclusion probabilities π_i 's are calculated using the formula $\pi_i = \frac{nx_i}{X} \quad i = 1, \dots, N$.

Then, random numbers are generated which come from uniform distribution. The "RANDBETWEEN" function in excel is used to generate random numbers. The randomly selected 100 random number sets consists of 3,479 (which is the largest stratum size using poisson sampling) random numbers were tested with Kolmogorov-Smirnov Test at the 0.05 significance level, and except for 6 of 100 are uniformly distributed.

If the random number is smaller than the inclusion probability of case i , case i is selected in the sample. The number of selected units may be equal to the previously decided n value. If it is smaller or larger than n , second order inclusion probabilities are calculated using with new n value which is the number of selected cases in the first iteration. This procedure are repeated that until achieving a constant n value. That means at this point, whatever the iteration number is, n is not changed. In this study, maximum iteration number is about 50. It is not necessarily larger iteration number in this study, but n and N values are getting larger, may be iteration numbers are getting larger. If this n value equals to previously decided n value, the selected units are the sample, and it can be calculated statistics from this sample. But, if this n value does not equal to previously decided n value this sample is rejected. In that case new random numbers are generated, and all procedure is done again.

4120 activity codes have the largest population size. So, an example of the application of poisson sampling was done in this activity code. The sample size that calculated using formulas of Neyman allocation is used. Sample size in poisson sampling is random and it can change between 0 and population size N . Avoid of very large or small sample size and variance of sample size n , it is needed to fix sample size. To get 100 samples with size n are needed sometimes 500, sometimes 4,000 trials. The number of trials changes according to data, sample size, population size, inclusion probabilities and random numbers. For example, the largest stratum TR10, $N=3,479$ and $n=1,990$, after 3,548 trials achieved.

Table 5.1 Number of 95% confidence intervals that contain μ by sampling methods for 4120

NUTS2	Simple Random					Poisson					Systematic				
	D 12110	D 12120	D 12150	D 13110	D 16110	D 12110	D 12120	D 12150	D 13110	D 16110	D 12110	D 12120	D 12150	D 13110	D 16110
TR10	92	83	90	81	93	92	82	89	87	96	91	82	89	85	95
TR21	86	88	87	88	92	97	94	93	95	97	93	90	90	94	94
TR22	94	92	91	91	96	98	96	96	98	96	95	93	94	93	95
TR31	91	91	79	95	89	93	94	94	95	93	90	92	91	94	91
TR32	95	96	90	94	91	94	95	97	93	89	93	95	93	93	90
TR33	87	87	89	82	87	97	97	96	99	96	93	91	90	90	91
TR41	91	89	91	89	96	97	95	94	93	93	94	90	90	91	92
TR42	90	91	78	80	89	96	94	97	87	93	93	92	91	85	92
TR51	91	91	99	91	94	90	87	84	89	84	90	91	91	90	90
TR52	86	81	88	82	95	92	92	89	90	96	90	89	88	88	93
TR61	89	86	90	85	92	93	98	92	96	93	90	91	90	90	91
TR62	95	91	85	89	92	95	95	95	94	93	94	92	90	91	91
TR63	89	85	90	83	95	92	94	92	90	88	90	90	90	89	90
TR71	84	83	90	86	86	98	97	90	99	93	91	90	90	91	89
TR72	92	90	85	89	91	91	93	88	88	92	90	91	87	88	89
TR81	93	98	91	95	77	97	92	87	93	95	95	95	91	94	92
TR82	88	80	87	85	80	92	89	92	93	82	89	85	89	89	83
TR83	90	87	77	83	85	93	94	89	97	83	91	90	89	90	85
TR90	88	84	90	89	94	91	93	93	97	95	89	88	89	90	91
TRA1	90	91	88	88	84	94	95	94	92	87	90	92	91	90	86
TRA2	90	90	87	88	89	94	93	94	90	88	92	91	90	89	90
TRB1	85	89	81	87	91	97	88	92	94	93	89	89	88	90	90
TRB2	94	94	83	92	93	95	94	91	89	86	94	94	90	90	89
TRC1	85	89	58	91	91	92	94	61	90	90	90	90	63	90	90
TRC2	89	91	91	91	95	92	90	96	94	88	90	90	92	92	92
TRC3	81	81	91	79	95	92	91	93	93	89	88	88	90	88	90

For determining the inclusion probabilities, a dummy variable (x_i) is used. This is obtained from the mean and variance of D12110 (turnover) variable. Here, y_i is the turnover value and x_i is the dummy variable that produced with the previous year turnover value's mean and variance.

The 95% confidence intervals that contain μ in simple random, systematic and poisson sampling are given Table 5.1. Except for a few points, every number of 95% confidence intervals calculated from poisson sampling are larger than simple random and systematic sampling 95% confidence intervals.

Note that, the sample size is calculated for bound on the error of estimation for D12110 (turnover) is approximately 200,000 TL.

It is decided to use poisson sampling some activity codes. In these activity codes, NUTS2 regions are accepted as strata, and poisson sampling is used within strata. After getting estimated values of each stratum, the stratified sampling formulas are used for calculating estimated values of that activity codes.

The results are given in the following table. In Table 5.2 95% confidence intervals of the mean for the activity codes that used poisson sampling is given. In Table 5.3 sample variances, in Table 5.4 given 95% confidence intervals for total and in Table 5.5 variances of the total for activity codes using poisson sampling are given. For all activity codes, 95% confidence interval for means and totals contain population means and totals.

Table 5.2 95% confidence intervals of mean for activity codes using poisson sampling

NACE	D12110			D12120			D12150			D13110			D16110		
	Lower limit	Upper limit	Contain μ	Lower limit	Upper limit	Contain μ	Lower limit	Upper limit	Contain μ	Lower limit	Upper limit	Contain μ	Lower limit	Upper limit	Contain μ
1413	3,943,381	4,190,143	√	3,860,422	4,102,445	√	875,844	952,366	√	3,225,278	3,429,548	√	41.5	45.8	√
1414	5,532,834	5,762,590	√	5,450,045	5,676,779	√	1,118,868	1,181,122	√	4,563,236	4,753,083	√	50.0	53.4	√
2370	5,015,638	5,581,392	√	4,936,245	5,490,717	√	1,559,169	1,737,360	√	3,625,538	4,062,613	√	45.8	51.8	√
4120	3,664,928	3,888,237	√	4,049,659	4,291,224	√	571,571	635,552	√	3,578,996	3,793,003	√	25.9	28.4	√
4211	9,984,848	10,914,766	√	9,895,078	10,806,206	√	1,207,836	1,437,587	√	8,793,772	9,611,603	√	46.3	51.3	√
4221	5,811,505	6,183,766	√	5,745,037	6,113,190	√	702,102	798,245	√	5,105,315	5,450,518	√	32.1	34.9	√
4312	4,964,613	5,428,602	√	4,952,350	5,422,193	√	823,924	933,563	√	4,222,302	4,621,559	√	27.5	30.9	√
4638	24,793,408	31,370,693	√	3,886,158	5,590,399	√	1,446,735	1,945,329	√	24,327,383	30,986,214	√	35.3	44.8	√
4671	89,804,370	100,312,349	√	8,656,456	10,142,825	√	3,009,302	3,836,320	√	87,466,773	97,824,924	√	26.4	45.6	√
4672	44,457,456	48,618,008	√	4,447,955	5,083,974	√	1,987,684	2,364,169	√	42,402,623	46,302,676	√	28.6	33.6	√
4711	13,072,210	14,419,592	√	1,833,908	2,076,057	√	923,280	1,021,153	√	12,704,694	14,030,706	√	47.0	51.9	√
4730	22,343,777	23,757,506	√	2,806,266	3,087,203	√	1,182,246	1,293,218	√	21,480,396	22,827,608	√	31.9	35.7	√
4778	4,749,801	5,399,090	√	1,537,204	1,791,033	√	619,707	763,657	√	4,497,437	5,145,086	√	23.8	27.8	√
4941	7,794,565	8,178,889	√	7,593,796	7,970,595	√	1,193,657	1,276,634	√	6,619,760	6,945,429	√	36.4	39.2	√
7010	4,667,503	5,835,798	√	4,820,395	5,992,903	√	2,653,838	3,170,079	√	1,995,064	2,882,369	√	17.4	20.1	√
7112	2,353,175	2,559,286	√	2,350,941	2,560,331	√	1,038,247	1,145,321	√	1,343,009	1,477,341	√	24.3	27.7	√

Table 5.3 Sample variances of activity codes using poisson sampling

NACE	D12110	D12120	D12150	D13110	D16110
1413	3,962,613,622	3,811,874,774	381,067,120	2,715,423,826	1.2
1414	3,435,254,730	3,345,490,901	252,206,220	2,345,517,726	0.7
2370	20,829,674,319	20,007,241,814	2,066,344,803	12,431,992,871	2.4
4120	3,245,164,874	3,797,499,847	266,397,078	2,980,459,358	0.4
4211	56,275,179,718	54,024,034,314	3,435,122,187	43,526,622,941	1.7
4221	9,018,252,036	8,820,338,471	601,541,618	7,754,911,051	0.5
4312	14,010,201,322	14,365,948,256	782,278,033	10,373,708,213	0.8
4638	2,815,277,945,401	189,012,316,832	16,177,871,017	2,885,518,872,553	5.8
4671	7,185,653,165,000	143,774,196,422	44,510,113,758	6,982,200,962,847	24.0
4672	1,126,496,017,460	26,324,979,735	9,224,124,799	989,848,857,521	1.6
4711	118,143,477,393	3,815,869,311	623,375,828	114,425,515,881	1.6
4730	130,064,987,231	5,136,228,404	801,413,334	118,113,582,201	0.9
4778	27,434,941,999	4,192,848,367	1,348,505,013	27,296,494,719	1.0
4941	9,612,200,486	9,239,499,728	448,076,141	6,902,097,646	0.5
7010	88,824,566,084	89,466,291,760	17,343,289,252	51,235,893,749	0.5
7112	2,764,602,575	2,853,232,350	746,109,498	1,174,337,508	0.7

Table 5.4 95% confidence intervals of total for activity codes using poisson sampling

NACE	D12110			D12120		
	Lower limit	Upper limit	Contain τ	Lower limit	Upper limit	Contain τ
1413	10,769,374,554	11,443,279,481	√	10,542,813,383	11,203,776,278	√
1414	8,946,593,007	9,318,107,328	√	8,812,723,044	9,179,351,368	√
2370	3,129,758,328	3,482,788,558	√	3,080,216,620	3,426,207,194	√
4120	58,100,111,151	61,640,214,247	√	64,199,241,092	68,028,779,320	√
4211	11,532,499,250	12,606,554,189	√	11,428,815,175	12,481,168,452	√
4221	3,510,149,009	3,734,994,503	√	3,470,002,242	3,692,366,833	√
4312	2,705,713,971	2,958,588,308	√	2,699,030,598	2,955,095,301	√
4638	6,719,013,491	8,501,457,913	√	1,053,148,756	1,514,998,185	√
4671	36,280,965,587	40,526,189,067	√	3,497,208,317	4,097,701,258	√
4672	21,828,611,107	23,871,441,871	√	2,183,945,743	2,496,231,072	√
4711	15,111,474,571	16,669,048,882	√	2,119,998,084	2,399,922,413	√
4730	45,447,242,485	48,322,767,943	√	5,707,945,847	6,279,370,772	√
4778	1,686,179,310	1,916,676,928	√	545,707,452	635,816,624	√
4941	16,711,547,166	17,535,537,768	√	16,281,098,096	17,088,956,182	√
7010	1,806,323,622	2,258,453,888	√	1,865,492,935	2,319,253,501	√
7112	3,470,932,781	3,774,947,381	√	3,467,638,383	3,776,487,708	√

Table 5.4 continues

	D12150			D13110			D16110		
NACE	Lower limit	Upper limit	Contain τ	Lower limit	Upper limit	Contain τ	Lower limit	Upper limit	Contain τ
1413	2,391,929,288	2,600,911,108	✓	8,808,233,315	9,366,095,058	✓	113,296	125,199	✓
1414	1,809,209,907	1,909,873,861	✓	7,378,752,103	7,685,735,896	✓	80,928	86,286	✓
2370	972,921,286	1,084,112,904	✓	2,262,335,704	2,535,070,803	✓	28,559	32,342	✓
4120	9,061,118,226	10,075,408,487	✓	56,737,830,626	60,130,481,176	✓	410,912	450,821	✓
4211	1,395,050,832	1,660,413,085	✓	10,156,806,745	11,101,401,518	✓	53,426	59,259	✓
4221	424,069,526	482,140,063	✓	3,083,610,143	3,292,112,715	✓	19,384	21,060	✓
4312	449,038,366	508,791,836	✓	2,301,154,536	2,518,749,873	✓	14,964	16,826	✓
4638	371,383,696	527,184,039	✓	6,592,720,778	8,397,264,120	✓	9,578	12,138	✓
4671	1,215,757,812	1,549,873,436	✓	35,336,576,471	39,521,269,489	✓	10,660	18,419	✓
4672	975,952,672	1,160,807,222	✓	20,819,688,050	22,734,614,078	✓	14,055	16,521	✓
4711	1,067,311,714	1,180,452,418	✓	14,686,625,763	16,219,495,819	✓	54,294	60,016	✓
4730	2,404,687,614	2,630,405,148	✓	43,691,124,980	46,431,354,472	✓	64,916	72,579	✓
4778	219,995,905	271,098,235	✓	1,596,590,276	1,826,505,570	✓	8,462	9,874	✓
4941	2,559,199,806	2,737,104,234	✓	14,192,764,880	14,890,999,531	✓	78,046	84,142	✓
7010	1,027,035,448	1,226,820,397	✓	772,089,722	1,115,476,992	✓	6,715	7,792	✓
7112	1,531,413,601	1,689,348,960	✓	1,980,937,588	2,179,078,681	✓	35,828	40,833	✓

Table 5.5 Variances of total for activity codes using poisson sampling

NACE	D12110	D12120	D12150	D13110	D16110
1413	29,554,602,899,457,800	28,430,338,151,529,200	2,842,136,147,295,470	20,252,611,163,093,400	9,221,004
1414	8,982,122,755,496,030	8,747,418,258,425,570	659,440,829,015,532	6,132,799,398,206,760	1,868,440
2370	8,110,575,267,821,700	7,790,339,788,569,250	804,585,073,915,806	4,840,719,656,273,330	931,206
4120	815,567,076,912,629,000	954,378,581,688,055,000	66,950,276,801,161,300	749,041,919,534,953,000	103,650,604
4211	75,072,496,623,913,100	72,069,412,375,628,200	4,582,538,876,019,840	58,065,603,168,520,000	2,214,573
4221	3,290,002,634,855,600	3,217,800,599,523,400	219,452,006,872,069	2,829,115,630,159,240	182,822
4312	4,161,380,047,740,370	4,267,045,780,778,790	232,356,132,622,400	3,081,250,682,043,860	225,513
4638	206,756,827,588,210,000	13,881,253,560,444,300	1,188,119,025,346,860	211,915,391,519,192,000	426,386
4671	1,172,813,566,978,630,000	23,466,249,243,144,300	7,264,762,727,155,310	1,139,606,912,351,980,000	3,918,223
4672	271,576,786,385,177,000	6,346,452,439,531,430	2,223,761,230,609,220	238,633,752,420,021,000	395,565
4711	157,879,382,006,009,000	5,099,283,531,791,520	833,039,560,293,005	152,910,936,190,699,000	2,130,411
4730	538,099,142,312,716,000	21,249,378,158,906,100	3,315,571,983,795,550	488,654,315,285,644,000	3,821,472
4778	3,457,488,565,383,670	528,403,715,470,050	169,945,344,209,912	3,440,040,746,938,050	129,738
4941	44,184,748,013,566,900	42,471,541,023,059,200	2,059,687,726,424,480	31,727,120,723,175,000	2,418,571
7010	13,303,166,437,837,500	13,399,277,050,600,300	2,597,487,087,911,120	7,673,548,570,819,990	75,461
7112	6,014,738,476,643,360	6,207,563,630,400,470	1,623,254,476,211,660	2,554,918,041,408,700	1,630,130

The formulas are used for calculating activity codes estimations as follows. The activity code 1413 is chosen as an example because, in this activity code, there are full enumeration strata, sampled strata, strata of size equal to 1 and strata of size equal to 0. These are all possible situations in any activity code, so it is possible to derive all other activity codes formulas from 1413 activity code formulas.

For activity code 1413,

1413 activity code estimated total,

$$\hat{t}_{1413} = \hat{t}_{TR10} + \hat{t}_{TR21} + \hat{t}_{TR22} + \hat{t}_{TR31} + \hat{t}_{TR32} + \hat{t}_{TR33} + \hat{t}_{TR41} + \hat{t}_{TR42} + \hat{t}_{TR51} + \hat{t}_{TR52} + \hat{t}_{TR61} + \hat{t}_{TR62} + \hat{t}_{TR63} + \hat{t}_{TR71} + \hat{t}_{TR72} + \hat{t}_{TR81} + \hat{t}_{TR82} + \hat{t}_{TR83} + \hat{t}_{TR90} + \tau_{TRA1} + \hat{t}_{TRB1} + \hat{t}_{TRB2} + \hat{t}_{TRC1} + \hat{t}_{TRC2} + \hat{t}_{TRC3} \quad (5.1)$$

1413 activity code size,

$$N_{1413} = N_{TR10} + N_{TR21} + N_{TR22} + N_{TR31} + N_{TR32} + N_{TR33} + N_{TR41} + N_{TR42} + N_{TR51} + N_{TR52} + N_{TR61} + N_{TR62} + N_{TR63} + N_{TR71} + N_{TR72} + N_{TR81} + N_{TR82} + N_{TR83} + N_{TR90} + N_{TRA1} + N_{TRB1} + N_{TRB2} + N_{TRC1} + N_{TRC2} + N_{TRC3} \quad (5.2)$$

1413 activity code estimated mean,

$$\bar{y}_{1413} = \frac{\hat{t}_{1413}}{N_{1413}} \quad (5.3)$$

$$N_{1413}^* = N_{TR10} + N_{TR21} + N_{TR22} + N_{TR31} + N_{TR32} + N_{TR33} + N_{TR41} + N_{TR42} + N_{TR51} + N_{TR52} + N_{TR61} + N_{TR62} + N_{TR63} + N_{TR71} + N_{TR72} + N_{TR81} + N_{TR82} + N_{TR83} + N_{TR90} + N_{TRB1} + N_{TRB2} + N_{TRC1} + N_{TRC2} + N_{TRC3} \quad (5.4)$$

Note that, the difference between N and N^* is, N^* does not include N_{TRA1} because size of this is 1. Also N_{TRA2} in neither N nor N^* formulas due to its size zero.

1413 activity code estimated variance of τ ,

$$\hat{V}(\hat{t}_{1413}) = \hat{V}(\hat{t}_{TR10} + \hat{t}_{TR21} + \hat{t}_{TR22} + \hat{t}_{TR31} + \hat{t}_{TR32} + \hat{t}_{TR33} + \hat{t}_{TR41} + \hat{t}_{TR42} + \hat{t}_{TR51} + \hat{t}_{TR52} + \hat{t}_{TR61} + \hat{t}_{TR62} + \hat{t}_{TR63} + \hat{t}_{TR71} + \hat{t}_{TR72} + \hat{t}_{TR81} + \hat{t}_{TR82} + \hat{t}_{TR83} + \hat{t}_{TR90} + \hat{t}_{TRB1} + \hat{t}_{TRB2} + \hat{t}_{TRC1} + \hat{t}_{TRC2} + \hat{t}_{TRC3}) \quad (5.5)$$

$$\begin{aligned}
\hat{V}(\hat{\tau}_{1413}) = & \hat{V}(N_{TR10}\bar{y}_{TR10}) + \hat{V}(N_{TR21}\bar{y}_{TR21}) + \hat{V}(N_{TR22}\bar{y}_{TR22}) + \hat{V}(N_{TR31}\bar{y}_{TR31}) + \\
& \hat{V}(N_{TR32}\bar{y}_{TR32}) + \hat{V}(N_{TR33}\bar{y}_{TR33}) + \hat{V}(N_{TR41}\bar{y}_{TR41}) + \hat{V}(N_{TR42}\bar{y}_{TR42}) + \\
& \hat{V}(N_{TR51}\bar{y}_{TR51}) + \hat{V}(N_{TR52}\bar{y}_{TR52}) + \hat{V}(N_{TR61}\bar{y}_{TR61}) + \hat{V}(N_{TR62}\bar{y}_{TR62}) + \\
& \hat{V}(N_{TR63}\bar{y}_{TR63}) + \hat{V}(N_{TR71}\bar{y}_{TR71}) + \hat{V}(N_{TR72}\bar{y}_{TR72}) + \hat{V}(N_{TR81}\bar{y}_{TR81}) + \\
& \hat{V}(N_{TR82}\bar{y}_{TR82}) + \hat{V}(N_{TR83}\bar{y}_{TR83}) + \hat{V}(N_{TR90}\bar{y}_{TR90}) + \hat{V}(N_{TRB1}\bar{y}_{TRB1}) + \\
& \hat{V}(N_{TRB2}\bar{y}_{TRB2}) + \hat{V}(N_{TRC1}\bar{y}_{TRC1}) + \hat{V}(N_{TRC2}\bar{y}_{TRC2}) + \hat{V}(N_{TRC3}\bar{y}_{TRC3})
\end{aligned} \tag{5.6}$$

1413 activity code estimated variance of mean,

$$\begin{aligned}
\hat{V}(\bar{y}_{1413}) = & \frac{1}{(N_{1413}^*)^2} \left[\left(N_{TR10}^2 \left(\frac{N_{TR10} - n_{TR10}}{N_{TR10}} \right) \left(\frac{S_{TR10}^2}{n_{TR10}} \right) \right) + \left(N_{TR21}^2 \left(\frac{N_{TR21} - n_{TR21}}{N_{TR21}} \right) \left(\frac{S_{TR21}^2}{n_{TR21}} \right) \right) + \right. \\
& \left(N_{TR22}^2 \left(\frac{N_{TR22} - n_{TR22}}{N_{TR22}} \right) \left(\frac{S_{TR22}^2}{n_{TR22}} \right) \right) + \left(N_{TR31}^2 \left(\frac{N_{TR31} - n_{TR31}}{N_{TR31}} \right) \left(\frac{S_{TR31}^2}{n_{TR31}} \right) \right) + \\
& \left(N_{TR32}^2 \left(\frac{N_{TR32} - n_{TR32}}{N_{TR32}} \right) \left(\frac{S_{TR32}^2}{n_{TR32}} \right) \right) + \left(N_{TR33}^2 \left(\frac{N_{TR33} - n_{TR33}}{N_{TR33}} \right) \left(\frac{S_{TR33}^2}{n_{TR33}} \right) \right) + \\
& \left(N_{TR41}^2 \left(\frac{N_{TR41} - n_{TR41}}{N_{TR41}} \right) \left(\frac{S_{TR41}^2}{n_{TR41}} \right) \right) + \left(N_{TR42}^2 \left(\frac{N_{TR42} - n_{TR42}}{N_{TR42}} \right) \left(\frac{S_{TR42}^2}{n_{TR42}} \right) \right) + \\
& \left(N_{TR51}^2 \left(\frac{N_{TR51} - n_{TR51}}{N_{TR51}} \right) \left(\frac{S_{TR51}^2}{n_{TR51}} \right) \right) + \left(N_{TR52}^2 \left(\frac{N_{TR52} - n_{TR52}}{N_{TR52}} \right) \left(\frac{S_{TR52}^2}{n_{TR52}} \right) \right) + \\
& \left(N_{TR61}^2 \left(\frac{N_{TR61} - n_{TR61}}{N_{TR61}} \right) \left(\frac{S_{TR61}^2}{n_{TR61}} \right) \right) + \left(N_{TR62}^2 \left(\frac{N_{TR62} - n_{TR62}}{N_{TR62}} \right) \left(\frac{S_{TR62}^2}{n_{TR62}} \right) \right) + \\
& \left(N_{TR63}^2 \left(\frac{N_{TR63} - n_{TR63}}{N_{TR63}} \right) \left(\frac{S_{TR63}^2}{n_{TR63}} \right) \right) + \left(N_{TR71}^2 \left(\frac{N_{TR71} - n_{TR71}}{N_{TR71}} \right) \left(\frac{S_{TR71}^2}{n_{TR71}} \right) \right) + \\
& \left(N_{TR72}^2 \left(\frac{N_{TR72} - n_{TR72}}{N_{TR72}} \right) \left(\frac{S_{TR72}^2}{n_{TR72}} \right) \right) + \left(N_{TR81}^2 \left(\frac{N_{TR81} - n_{TR81}}{N_{TR81}} \right) \left(\frac{S_{TR81}^2}{n_{TR81}} \right) \right) + \\
& \left(N_{TR82}^2 \left(\frac{N_{TR82} - n_{TR82}}{N_{TR82}} \right) \left(\frac{S_{TR82}^2}{n_{TR82}} \right) \right) + \left(N_{TR83}^2 \left(\frac{N_{TR83} - n_{TR83}}{N_{TR83}} \right) \left(\frac{S_{TR83}^2}{n_{TR83}} \right) \right) + \\
& \left(N_{TR90}^2 \left(\frac{N_{TR90} - n_{TR90}}{N_{TR90}} \right) \left(\frac{S_{TR90}^2}{n_{TR90}} \right) \right) + \left(N_{TRB1}^2 \left(\frac{N_{TRB1} - n_{TRB1}}{N_{TRB1}} \right) \left(\frac{S_{TRB1}^2}{n_{TRB1}} \right) \right) + \\
& \left(N_{TRB2}^2 \left(\frac{N_{TRB2} - n_{TRB2}}{N_{TRB2}} \right) \left(\frac{S_{TRB2}^2}{n_{TRB2}} \right) \right) + \left(N_{TRC1}^2 \left(\frac{N_{TRC1} - n_{TRC1}}{N_{TRC1}} \right) \left(\frac{S_{TRC1}^2}{n_{TRC1}} \right) \right) + \\
& \left. \left(N_{TRC2}^2 \left(\frac{N_{TRC2} - n_{TRC2}}{N_{TRC2}} \right) \left(\frac{S_{TRC2}^2}{n_{TRC2}} \right) \right) + \left(N_{TRC3}^2 \left(\frac{N_{TRC3} - n_{TRC3}}{N_{TRC3}} \right) \left(\frac{S_{TRC3}^2}{n_{TRC3}} \right) \right) \right]
\end{aligned} \tag{5.7}$$

For strata, the formulas are,

The activity code estimated total,

$$\hat{\tau} = \sum_{i=1}^{26} \hat{\tau}_i \tag{5.8}$$

The activity code estimated mean,

$$\bar{y} = \frac{\hat{t}}{N} \quad (5.9)$$

The activity code estimated variance of $\bar{y}$,

$$\hat{v}(\bar{y}) = \frac{1}{N^2} \sum_{i=1}^{26} N_i^2 \left(\frac{N_i - n_i}{N_i} \right) \left(\frac{s_i^2}{n_i} \right) \quad (5.10)$$

where $N = \sum_{i=1}^{26} N_i$, $i = \text{TR10, TR21, ..., TRC3}$ (26 NUTS2 regions)

5.2 Stratified Random Sampling Applications

It must be estimated that all parameters according to NUTS2 regions. In this study, also aimed that all parameters are estimated according to NUTS2 regions and NACE codes in four digits level. Each region is accepted as homogeneous according to turnover, production value, value-added at factor cost, total purchases of goods and services and the number of people employed. Each activity code is accepted as a population and each NUTS2 region is accepted as a stratum of this population. According to characteristics, in NUTS2 regions it is decided to use simple random sampling or full enumeration.

Using an excel macro, simple random samples are drawn each stratum for each population. For each stratum and for each decided variables the 95% confidence intervals that contain parameters are calculated. Because of the number of populations and strata are very large, the results of 2 largest population that using simple random sampling are given below. The results of 5610 activity code with $n=1,492$ and 8121 activity code with $n=1,420$ are given. In Table 5.6, the number of confidence intervals contained μ for code 5610 are given. Generally, for all NUTS2 regions, they are larger than 90 for D12110 variable. All calculations are made for D12110 variable. The results of other variables are given as extra information. Because, it is needed to choose one of them for calculation but in the real situation, it

is needed to give estimations for all variable, even the variables not mentioned about here but in the survey. Similarly, Table 5.7 shows the number of 95% confidence intervals contained μ for 8121 activity codes. Most of the NUTS2 region's number of 95% confidence intervals are contained μ larger than 90.

Table 5.6 Number of 95% confidence interval contains μ for activity code 5610

NUTS2	D12110	D12120	D12150	D13110	D16110
TR10	97	97	97	96	99
TR21	96	97	91	95	94
TR22	83	88	81	84	83
TR31	89	89	95	86	90
TR32	93	95	96	90	93
TR33	92	95	89	82	87
TR41	86	85	90	86	85
TR42	95	96	93	96	90
TR51	87	88	93	85	94
TR52	98	97	96	99	97
TR61	92	92	90	95	87
TR62	95	96	95	93	90
TR63	86	87	93	84	73
TR71	91	91	98	93	94
TR72	88	87	81	91	90
TR81	97	98	94	97	91
TR82	100	97	98	97	95
TR83	92	89	81	92	86
TR90	93	93	88	96	86
TRA1	92	91	91	94	82
TRA2	65	83	88	52	80
TRB1	94	95	93	96	96
TRB2	99	99	84	97	82
TRC1	96	96	89	89	60
TRC2	95	94	91	87	91
TRC3	70	75	75	76	84

Table 5.7 Number of 95% confidence interval contains μ for activity code 8121

NUTS2	D12110	D12120	D12150	D13110	D16110
TR10	96	95	95	96	98
TR21	96	96	96	95	95
TR22	90	92	78	91	80
TR31	98	95	95	96	98
TR32	98	97	98	97	95
TR33	94	94	95	94	95
TR41	95	94	98	95	96
TR42	94	95	94	98	96
TR51	98	98	97	94	98
TR52	92	95	96	92	96
TR61	100	100	100	100	100
TR62	95	96	95	89	96
TR63	97	97	93	98	96
TR71	92	93	92	90	92
TR72	95	95	94	98	94
TR81	99	99	99	91	98
TR82	86	86	87	92	90
TR83	90	91	89	90	90
TR90	94	92	95	92	89
TRA1	94	95	94	94	92
TRA2	95	97	96	90	96
TRB1	94	93	95	87	94
TRB2	94	93	95	95	95
TRC1	94	94	96	89	97
TRC2	97	97	94	97	93
TRC3	92	91	96	85	95

In Table 5.8 95% confidence intervals are given for activity codes that used stratified random sampling for variable D12110. All 95% confidence intervals contain population means. For D12120, 95% confidence intervals given in Table 5.9, and all confidence intervals contain population means. Table 5.10 shows 95% confidence intervals for D12150. For activity codes 4634, 4777 and 7911, 95% confidence intervals do not contain the population means. Population means are different from upper or lower limits approximately between 0.003% and 5%. For D13110, 95% confidence intervals given in Table 5.11, and all confidence intervals

contain population means. In Table 5.12, 95% confidence intervals given for variable D16110. For activity codes 0812, 2332, 4632 and 7911, 95% confidence intervals do not contain the population means. Population means are different from upper or lower limits approximately between 0.06% and 4%. Except for these activity codes, all confidence intervals contain the population means for variable D16110.

Sample variances for all variables and all activity codes are given in Table 5.13. Due to the restriction of usage the micro data, population variances are not to given in tables. 95% confidence intervals for population totals are given in Tables 5.14,15,16,17 and 18. The 95% confidence intervals are not contained population totals similar to the 95% confidence intervals for means.

Table 5.8 95% confidence intervals of mean for activity codes using simple random sampling,
D12110

NACE	Lower limit	Upper limit	Contain μ	NACE	Lower limit	Upper limit	Contain μ
0520	3,206,729	4,255,945	√	4532	6,000,220	6,540,568	√
0811	5,479,477	6,181,757	√	4621	40,603,736	47,756,767	√
0812	7,415,956	8,261,797	√	4631	17,732,853	19,832,924	√
1039	23,274,205	25,843,621	√	4632	16,629,433	18,176,928	√
1051	15,126,649	16,818,871	√	4634	31,354,073	34,374,276	√
1061	28,383,794	31,723,589	√	4636	26,506,684	30,130,404	√
1071	2,682,318	2,867,915	√	4639	24,336,308	25,970,477	√
1310	16,086,911	17,398,362	√	4641	17,816,654	19,178,608	√
1320	12,503,414	13,051,160	√	4642	15,684,355	16,585,446	√
1330	6,791,492	7,375,019	√	4643	34,178,549	38,447,631	√
1392	6,857,799	7,768,646	√	4646	24,604,172	26,417,725	√
1419	3,541,432	4,150,122	√	4647	19,288,823	23,576,883	√
1439	4,880,861	5,379,846	√	4652	42,003,485	45,238,742	√
1520	4,741,610	5,134,522	√	4669	16,214,256	16,846,216	√
1721	12,644,257	14,671,486	√	4673	15,032,842	15,538,197	√
1812	6,314,569	7,320,383	√	4674	17,346,338	18,099,817	√
2219	8,128,803	9,267,489	√	4675	32,249,010	37,578,717	√
2221	14,403,310	16,348,977	√	4742	14,484,487	15,690,732	√
2222	12,169,133	13,314,819	√	4752	5,494,240	5,835,631	√
2223	5,148,497	5,555,106	√	4754	7,824,518	10,291,530	√
2229	9,043,559	9,493,905	√	4759	5,438,524	5,804,552	√
2332	2,951,410	3,640,121	√	4771	9,137,589	9,840,197	√
2361	7,606,958	8,688,123	√	4777	10,597,507	12,247,462	√
2363	16,147,383	17,405,982	√	4939	3,651,309	3,972,396	√
2511	8,013,536	8,466,620	√	4942	4,185,381	4,657,925	√
2512	4,483,078	4,952,185	√	5020	11,832,684	14,767,404	√
2561	4,530,779	5,263,161	√	5224	2,831,505	3,479,170	√
2562	4,706,163	5,180,013	√	5229	7,918,728	8,701,826	√
2573	4,343,498	5,202,046	√	5510	5,203,478	5,518,200	√
2599	6,354,170	7,127,646	√	5610	2,519,760	2,723,504	√
2712	7,700,464	8,458,238	√	5629	3,768,986	4,082,352	√
2740	6,617,585	7,170,536	√	5630	1,493,714	1,591,022	√
2822	7,175,938	7,970,011	√	6201	6,841,420	7,279,529	√
2829	4,620,366	5,248,588	√	6832	23,113,604	34,962,609	√
2920	6,753,830	7,864,488	√	6910	3,252,711	3,543,832	√
2932	11,809,056	12,789,012	√	7022	3,853,375	4,094,387	√
3101	6,103,388	6,952,317	√	7111	2,654,425	2,915,596	√
3109	4,462,571	4,814,931	√	7311	7,982,847	8,336,318	√
3250	4,045,937	4,680,190	√	7810	1,692,812	1,840,901	√
3312	2,066,983	2,309,472	√	7911	25,513,634	26,817,310	√
3315	1,546,347	1,671,675	√	8010	1,841,353	1,969,407	√
4222	4,996,202	5,563,640	√	8121	1,892,645	2,002,456	√
4291	7,168,376	8,667,289	√	8129	2,228,571	2,446,046	√
4321	4,667,858	5,033,032	√	8520	3,830,614	4,127,120	√
4322	4,332,018	4,719,967	√	8531	4,073,830	4,443,836	√
4329	2,984,677	3,347,083	√	8553	502,702	531,414	√
4331	2,244,186	2,574,078	√	8559	1,170,749	1,255,349	√
4333	4,184,492	4,613,815	√	8610	9,114,719	9,968,028	√
4339	2,272,962	2,522,187	√	8622	2,780,082	2,929,702	√
4399	3,616,762	3,956,816	√	8690	3,592,020	3,867,927	√
4511	44,900,864	48,954,862	√	8891	1,036,103	1,117,606	√
4520	2,497,402	2,797,427	√	9522	1,185,009	1,263,804	√
4531	19,456,934	22,459,971	√				

Table 5.9 95% confidence intervals of mean for activity codes using simple random sampling, D12120

NACE	Lower limit	Upper limit	Contain μ	NACE	Lower limit	Upper limit	Contain μ
0520	2,986,807	3,976,186	√	4532	1,318,755	1,426,111	√
0811	5,565,144	6,310,381	√	4621	8,042,567	10,514,415	√
0812	7,376,540	8,229,249	√	4631	3,321,787	4,108,959	√
1039	21,898,260	24,243,822	√	4632	2,256,535	2,620,156	√
1051	14,309,236	15,920,064	√	4634	3,964,532	4,618,954	√
1061	26,032,639	29,208,367	√	4636	4,179,452	4,989,099	√
1071	2,574,216	2,752,628	√	4639	2,716,493	2,974,418	√
1310	15,193,977	16,430,176	√	4641	4,000,337	4,355,095	√
1320	11,890,118	12,409,766	√	4642	3,565,841	3,866,001	√
1330	6,636,586	7,193,217	√	4643	5,997,629	6,912,860	√
1392	6,688,734	7,531,022	√	4646	6,433,025	6,897,322	√
1419	3,569,943	4,185,370	√	4647	4,059,289	5,027,151	√
1439	4,832,977	5,329,191	√	4652	5,597,958	6,295,386	√
1520	4,570,387	4,952,278	√	4669	4,413,249	4,690,374	√
1721	12,253,632	14,202,733	√	4673	3,157,911	3,284,411	√
1812	6,216,456	7,209,378	√	4674	3,805,100	4,009,800	√
2219	7,889,014	8,976,948	√	4675	6,460,614	7,661,003	√
2221	13,901,943	15,804,287	√	4742	2,170,557	2,381,165	√
2222	11,620,618	12,732,100	√	4752	1,180,122	1,264,158	√
2223	4,985,317	5,398,351	√	4754	1,380,798	1,866,025	√
2229	8,677,450	9,116,269	√	4759	1,511,501	1,612,431	√
2332	3,047,046	3,698,073	√	4771	3,144,181	3,463,107	√
2361	7,367,445	8,442,516	√	4777	2,808,822	3,404,933	√
2363	15,462,451	16,636,631	√	4939	3,600,066	3,915,988	√
2511	7,863,715	8,306,498	√	4942	4,056,019	4,514,286	√
2512	4,353,118	4,816,617	√	5020	11,859,796	14,798,092	√
2561	4,459,001	5,146,552	√	5224	2,839,780	3,488,729	√
2562	4,528,994	4,984,910	√	5229	7,814,457	8,586,506	√
2573	4,252,648	5,104,331	√	5510	5,196,511	5,516,735	√
2599	6,094,710	6,831,558	√	5610	2,485,255	2,687,014	√
2712	7,418,461	8,099,855	√	5629	3,717,458	4,018,317	√
2740	6,320,168	6,855,902	√	5630	1,471,468	1,568,988	√
2822	6,744,118	7,493,013	√	6201	6,758,746	7,193,697	√
2829	4,509,741	5,122,256	√	6832	22,630,457	34,417,307	√
2920	6,479,111	7,525,834	√	6910	3,260,208	3,554,268	√
2932	11,468,011	12,417,331	√	7022	3,850,017	4,091,369	√
3101	5,810,041	6,608,418	√	7111	2,696,760	2,955,780	√
3109	4,323,111	4,654,940	√	7311	7,945,818	8,295,645	√
3250	3,968,551	4,589,245	√	7810	1,674,536	1,820,493	√
3312	2,426,451	2,750,392	√	7911	25,466,532	26,770,676	√
3315	1,540,957	1,666,071	√	8010	1,850,418	1,978,874	√
4222	5,058,962	5,630,817	√	8121	1,889,126	1,999,368	√
4291	7,237,888	8,766,651	√	8129	2,206,190	2,422,959	√
4321	4,493,184	4,846,708	√	8520	3,838,103	4,132,166	√
4322	4,261,559	4,647,479	√	8531	4,118,534	4,486,503	√
4329	2,936,829	3,299,715	√	8553	499,175	527,831	√
4331	2,183,101	2,508,992	√	8559	1,156,852	1,240,851	√
4333	4,123,024	4,561,084	√	8610	9,147,441	10,003,419	√
4339	2,211,150	2,454,596	√	8622	2,778,481	2,928,484	√
4399	3,607,725	3,944,872	√	8690	3,608,604	3,905,198	√
4511	5,780,063	6,391,742	√	8891	1,033,333	1,115,270	√
4520	2,360,856	2,648,376	√	9522	1,136,530	1,221,940	√
4531	4,021,442	4,653,816	√				

Table 5.10 95% confidence intervals of mean for activity codes using simple random sampling,
D12150

NACE	Lower limit	Upper limit	Contain μ	NACE	Lower limit	Upper limit	Contain μ
0520	504,742	903,035	√	4532	692,985	747,919	√
0811	1,560,217	1,830,221	√	4621	2,358,762	2,977,642	√
0812	1,240,447	1,426,267	√	4631	1,092,475	1,301,477	√
1039	2,124,620	2,471,570	√	4632	937,983	1,060,312	√
1051	1,488,330	1,852,489	√	4634	1,629,732	1,866,954	
1061	2,251,945	2,631,734	√	4636	1,448,441	1,836,969	√
1071	695,796	746,320	√	4639	1,308,811	1,391,440	√
1310	2,458,841	2,775,197	√	4641	1,616,825	1,775,441	√
1320	2,451,740	2,550,311	√	4642	1,448,560	1,537,056	√
1330	1,644,414	1,769,127	√	4643	2,870,325	3,234,131	√
1392	1,407,954	1,596,005	√	4646	3,488,589	3,791,225	√
1419	892,526	1,049,355	√	4647	1,802,468	2,299,158	√
1439	1,212,217	1,334,418	√	4652	2,823,522	3,136,210	√
1520	929,326	1,014,233	√	4669	2,176,208	2,415,128	√
1721	2,301,633	2,738,588	√	4673	1,275,432	1,332,972	√
1812	1,467,065	1,711,015	√	4674	1,896,974	1,973,275	√
2219	2,123,408	2,465,369	√	4675	2,074,727	3,380,854	√
2221	2,513,714	2,870,022	√	4742	844,653	949,235	√
2222	2,165,910	2,400,902	√	4752	516,288	552,431	√
2223	901,983	976,580	√	4754	691,937	1,032,585	√
2229	2,045,955	2,148,668	√	4759	706,652	762,222	√
2332	939,622	1,197,081	√	4771	1,272,289	1,403,634	√
2361	1,319,855	1,567,001	√	4777	456,695	749,079	
2363	1,931,288	2,134,969	√	4939	739,140	815,658	√
2511	1,633,838	1,739,823	√	4942	747,664	883,688	√
2512	881,037	995,145	√	5020	3,147,707	3,825,926	√
2561	1,234,849	1,464,971	√	5224	1,306,062	1,621,601	√
2562	1,114,575	1,245,585	√	5229	1,786,877	1,936,828	√
2573	1,423,423	1,844,262	√	5510	2,103,477	2,256,940	√
2599	1,510,506	1,726,986	√	5610	665,204	723,799	√
2712	1,623,059	1,811,080	√	5629	992,700	1,104,089	√
2740	1,483,767	1,647,858	√	5630	375,511	414,695	√
2822	1,577,419	1,804,164	√	6201	3,570,451	3,862,698	√
2829	1,325,075	1,526,741	√	6832	3,283,686	6,678,916	√
2920	1,095,429	1,293,607	√	6910	2,186,063	2,448,333	√
2932	3,025,553	3,342,575	√	7022	1,951,453	2,066,917	√
3101	1,243,047	1,443,494	√	7111	744,707	884,517	√
3109	1,014,737	1,106,329	√	7311	1,939,250	2,032,183	√
3250	1,387,797	1,621,480	√	7810	1,240,737	1,372,651	√
3312	781,570	926,287	√	7911	1,727,231	1,864,551	
3315	629,643	691,360	√	8010	1,408,383	1,518,106	√
4222	1,002,516	1,182,685	√	8121	1,258,214	1,344,209	√
4291	1,045,609	1,473,467	√	8129	1,144,893	1,371,977	√
4321	873,809	993,538	√	8520	2,457,030	2,685,513	√
4322	726,726	840,090	√	8531	2,567,689	2,821,449	√
4329	390,787	622,764	√	8553	256,842	277,487	√
4331	461,027	577,540	√	8559	603,973	659,194	√
4333	622,076	830,990	√	8610	4,581,992	5,147,031	√
4339	411,406	496,909	√	8622	1,310,917	1,411,373	√
4399	815,748	946,775	√	8690	1,591,417	1,799,144	√
4511	2,613,113	3,016,611	√	8891	530,351	583,977	√
4520	557,538	634,178	√	9522	472,083	508,131	√
4531	2,281,789	2,619,670	√				

Table 5.11 95% confidence intervals of mean for activity codes using simple random sampling,
D13110

NACE	lower limit	Jpper limit	Contain μ	NACE	lower limit	Jpper limit	Contain μ
0520	2,594,161	3,362,857	√	4532	5,575,629	6,111,265	√
0811	4,037,368	4,706,535	√	4621	39,194,758	46,303,536	√
0812	6,203,407	7,001,779	√	4631	17,062,393	19,138,483	√
1039	22,050,944	24,485,780	√	4632	15,594,112	17,098,116	√
1051	14,183,423	15,821,667	√	4634	30,617,620	33,691,589	√
1061	26,613,165	29,806,073	√	4636	25,036,291	28,458,051	√
1071	2,042,821	2,196,409	√	4639	23,527,256	25,135,635	√
1310	14,013,921	15,095,477	√	4641	16,838,717	18,162,395	√
1320	10,423,090	10,928,958	√	4642	14,755,897	15,624,213	√
1330	5,449,155	5,957,037	√	4643	32,160,192	36,288,820	√
1392	5,761,373	6,546,316	√	4646	21,565,263	23,203,205	√
1419	3,025,616	3,550,466	√	4647	18,085,732	22,178,844	√
1439	3,825,648	4,257,527	√	4652	39,874,337	42,885,582	√
1520	3,972,118	4,314,346	√	4669	14,394,869	15,244,476	√
1721	10,498,075	12,278,001	√	4673	14,160,286	14,645,588	√
1812	5,000,166	5,963,408	√	4674	16,072,600	16,796,567	√
2219	6,225,045	7,136,273	√	4675	30,690,014	35,859,780	√
2221	12,369,629	14,120,286	√	4742	14,110,885	15,299,299	√
2222	10,336,129	11,335,111	√	4752	5,241,463	5,573,731	√
2223	4,579,571	4,948,231	√	4754	7,506,579	9,940,193	√
2229	7,429,060	7,822,501	√	4759	5,298,210	5,667,036	√
2332	2,156,231	2,685,312	√	4771	8,256,774	8,892,253	√
2361	6,355,696	7,302,141	√	4777	11,257,600	13,622,523	√
2363	14,510,671	15,688,818	√	4939	2,907,895	3,192,384	√
2511	6,652,573	7,070,056	√	4942	3,451,424	3,861,815	√
2512	3,828,196	4,230,729	√	5020	8,599,746	11,095,609	√
2561	3,309,426	3,928,921	√	5224	1,556,589	2,032,726	√
2562	3,764,399	4,180,864	√	5229	6,083,850	6,794,049	√
2573	3,010,596	3,559,230	√	5510	3,150,643	3,369,074	√
2599	5,046,819	5,671,076	√	5610	1,921,359	2,087,626	√
2712	6,360,816	7,018,895	√	5629	2,866,922	3,107,255	√
2740	5,501,640	5,929,518	√	5630	1,149,282	1,233,065	√
2822	5,720,759	6,370,376	√	6201	3,262,324	3,593,075	√
2829	3,427,857	3,934,420	√	6832	18,595,083	29,625,282	√
2920	5,949,812	6,966,292	√	6910	1,038,256	1,143,560	√
2932	9,127,818	9,890,346	√	7022	1,891,811	2,064,324	√
3101	5,011,606	5,697,507	√	7111	1,993,410	2,213,209	√
3109	3,739,443	4,031,135	√	7311	6,022,106	6,355,096	√
3250	2,718,890	3,183,217	√	7810	446,507	504,171	√
3312	1,747,437	2,006,839	√	7911	23,711,629	25,007,656	√
3315	916,267	1,003,038	√	8010	430,114	497,153	√
4222	4,174,720	4,685,756	√	8121	678,807	740,958	√
4291	6,143,225	7,644,851	√	8129	1,042,593	1,262,711	√
4321	3,904,320	4,233,151	√	8520	1,373,261	1,511,913	√
4322	3,706,998	4,059,335	√	8531	1,562,752	1,721,880	√
4329	2,637,162	3,022,614	√	8553	245,595	264,551	√
4331	1,929,299	2,213,147	√	8559	573,169	620,584	√
4333	3,627,876	4,005,273	√	8610	4,507,185	4,981,237	√
4339	1,916,854	2,134,981	√	8622	1,468,262	1,561,929	√
4399	2,894,758	3,186,979	√	8690	1,996,259	2,172,390	√
4511	42,793,263	46,693,769	√	8891	495,501	557,683	√
4520	2,005,491	2,275,818	√	9522	763,731	831,270	√
4531	17,905,877	20,760,788	√				

Table 5.12 95% confidence intervals of mean for activity codes using simple random sampling,
D16110

NACE	Lower limit	Upper limit	Contain μ	NACE	Lower limit	Upper limit	Contain μ
0520	35.9	53.7	√	4532	23.8	25.5	√
0811	37.4	41.8	√	4621	28.3	34.2	√
0812	34.2	38.3		4631	29.3	33.2	√
1039	63.8	71.8	√	4632	28.9	32.4	
1051	45.9	50.1	√	4634	38.3	41.2	√
1061	35.0	38.1	√	4636	40.8	46.2	√
1071	36.0	38.5	√	4639	36.7	38.7	√
1310	65.4	71.3	√	4641	31.5	33.6	√
1320	60.2	62.3	√	4642	30.0	32.4	√
1330	59.5	62.5	√	4643	36.5	42.0	√
1392	50.6	55.7	√	4646	37.6	40.3	√
1419	40.7	46.3	√	4647	37.2	46.8	√
1439	42.6	45.7	√	4652	31.9	34.6	√
1520	40.9	44.1	√	4669	29.5	30.6	√
1721	50.6	57.1	√	4673	28.3	29.1	√
1812	37.1	42.0	√	4674	31.2	32.5	√
2219	47.2	52.2	√	4675	26.4	31.0	√
2221	51.9	57.1	√	4742	32.5	36.7	√
2222	44.8	48.3	√	4752	20.0	21.0	√
2223	33.2	35.5	√	4754	29.3	37.3	√
2229	52.3	54.6	√	4759	30.2	31.9	√
2332	53.4	62.3		4771	45.1	48.7	√
2361	39.9	45.2	√	4777	31.6	35.3	√
2363	52.8	57.4	√	4939	33.7	37.5	√
2511	51.5	55.5	√	4942	25.9	29.1	√
2512	35.5	38.7	√	5020	33.2	36.9	√
2561	33.7	36.6	√	5224	55.5	68.0	√
2562	31.4	34.7	√	5229	34.1	36.0	√
2573	33.1	37.7	√	5510	60.9	64.4	√
2599	48.2	53.5	√	5610	34.2	37.0	√
2712	40.5	44.0	√	5629	56.0	61.7	√
2740	45.9	48.9	√	5630	32.8	36.2	√
2822	41.2	44.5	√	6201	40.4	44.3	√
2829	30.4	33.7	√	6832	34.9	58.8	√
2920	34.1	39.2	√	6910	26.2	30.0	√
2932	62.4	67.4	√	7022	44.2	46.9	√
3101	44.1	49.5	√	7111	21.4	24.6	√
3109	44.2	47.0	√	7311	46.0	51.5	√
3250	36.9	42.0	√	7810	64.0	70.9	√
3312	25.9	31.0	√	7911	38.3	40.2	
3315	35.7	38.4	√	8010	87.3	94.0	√
4222	40.9	46.7	√	8121	78.9	84.3	√
4291	44.8	52.6	√	8129	74.3	83.7	√
4321	41.9	46.1	√	8520	69.7	75.2	√
4322	38.2	41.7	√	8531	71.4	77.9	√
4329	30.1	33.2	√	8553	25.9	27.4	√
4331	35.1	41.3	√	8559	37.4	39.7	√
4333	42.5	45.8	√	8610	124.6	134.5	√
4339	22.6	25.7	√	8622	37.4	39.6	√
4399	30.1	37.0	√	8690	36.2	39.2	√
4511	51.9	57.0	√	8891	27.6	29.5	√
4520	22.8	25.0	√	9522	27.5	29.1	√
4531	31.6	35.0	√				

Table 5.13 Sample variances of activity codes using simple random sampling

NACE	D12110	D12120	D12150	D13110	D16110
0520	71,640,405,036	63,702,043,031	10,323,633,371	38,453,664,708	20.7
0811	32,095,757,434	36,142,396,179	4,744,233,094	29,140,519,225	1.2
0812	46,559,141,317	47,318,408,332	2,247,044,801	41,479,978,528	1.1
1039	429,631,961,321	358,031,684,885	7,833,614,649	385,804,451,539	4.2
1051	186,355,550,603	168,859,661,025	8,629,989,514	174,656,452,469	1.2
1061	725,884,380,151	656,317,895,132	9,386,691,225	663,438,395,436	0.6
1071	2,241,643,895	2,071,449,321	166,117,984	1,535,111,941	0.4
1310	111,926,276,999	99,449,970,212	6,512,999,625	76,124,752,519	2.2
1320	19,524,789,283	17,573,014,474	632,305,310	16,653,377,565	0.3
1330	22,158,954,672	20,163,391,209	1,012,152,522	16,786,202,575	0.6
1392	53,990,760,120	46,168,873,187	2,301,314,431	40,096,297,615	1.7
1419	24,111,277,754	24,647,932,792	1,600,592,242	17,926,584,722	2.0
1439	16,203,278,535	16,023,802,570	971,806,431	12,138,153,334	0.6
1520	10,046,580,461	9,490,889,237	469,153,779	7,621,786,322	0.7
1721	267,444,203,940	247,227,503,071	12,425,139,223	206,172,984,606	2.8
1812	65,836,051,847	64,159,099,691	3,872,834,736	60,380,774,812	1.6
2219	84,379,339,057	77,025,230,691	7,609,899,267	54,035,901,683	1.6
2221	246,356,952,599	235,508,083,471	8,261,904,883	199,448,059,318	1.8
2222	85,419,938,452	80,395,648,755	3,593,640,232	64,944,603,726	0.8
2223	10,759,237,223	11,101,955,911	362,135,277	8,844,605,137	0.3
2229	13,198,423,258	12,531,365,598	686,551,094	10,073,665,794	0.3
2332	30,867,556,009	27,582,063,525	4,313,633,164	18,216,775,159	5.2
2361	76,069,801,739	75,214,501,219	3,974,989,961	58,293,331,689	1.9
2363	103,086,768,712	89,721,704,719	2,699,786,418	90,328,914,163	1.3
2511	13,359,346,957	12,758,774,022	731,000,717	11,342,383,915	1.0
2512	14,320,987,003	13,980,599,874	847,334,910	10,544,660,437	0.7
2561	34,906,234,289	30,763,642,162	3,446,232,767	24,974,866,553	0.5
2562	14,612,021,972	13,526,914,503	1,116,951,821	11,287,131,462	0.7
2573	47,968,591,961	47,204,475,518	11,525,473,689	19,588,138,011	1.4
2599	38,933,249,493	35,333,209,562	3,049,724,481	25,360,323,174	1.8
2712	37,368,648,698	30,215,093,155	2,300,587,023	28,182,726,533	0.8
2740	19,897,566,974	18,677,822,004	1,752,252,468	11,914,272,683	0.6
2822	41,034,479,175	36,498,080,865	3,345,814,651	27,462,661,138	0.7
2829	25,683,505,727	24,415,294,365	2,646,630,535	16,699,204,464	0.7
2920	80,276,481,080	71,300,258,425	2,555,876,487	67,239,666,691	1.7

Table 5.13 continues

NACE	D12110	D12120	D12150	D13110	D16110
2932	62,494,309,229	58,648,027,162	6,540,445,565	37,838,994,139	1.6
3101	46,899,829,708	41,480,481,080	2,614,716,592	30,616,157,464	1.9
3109	8,079,847,426	7,165,669,671	545,932,635	5,537,020,832	0.5
3250	26,179,027,111	25,071,724,691	3,553,720,980	14,030,600,022	1.6
3312	3,826,576,609	6,829,056,136	1,362,916,186	4,378,973,436	1.7
3315	1,022,173,936	1,018,680,894	247,874,758	489,969,016	0.5
4222	20,953,912,922	21,281,366,085	2,112,457,674	16,995,413,533	2.2
4291	146,211,161,300	152,092,714,383	11,913,162,859	146,741,072,518	4.0
4321	8,678,179,690	8,133,268,598	932,886,332	7,036,779,801	1.2
4322	9,794,389,448	9,692,244,698	836,329,544	8,078,772,885	0.8
4329	8,547,087,032	8,569,763,502	3,502,035,658	9,668,704,433	0.6
4331	7,082,251,469	6,911,499,023	883,430,540	5,243,230,202	2.5
4333	11,994,834,577	12,488,064,646	2,840,308,523	9,268,804,072	0.7
4339	4,042,116,209	3,856,843,600	475,754,267	3,096,337,509	0.6
4399	7,525,293,018	7,397,158,403	1,117,247,568	5,557,152,485	3.1
4511	1,069,535,165,806	24,348,705,890	10,595,231,753	990,078,862,985	1.7
4520	5,857,899,711	5,379,781,857	382,236,386	4,755,611,261	0.3
4531	586,879,677,669	26,024,150,541	7,429,441,217	530,411,596,517	0.7
4532	19,000,942,507	750,027,765	196,382,760	18,671,014,031	0.2
4621	3,329,722,538,132	397,623,097,290	24,925,342,570	3,288,650,055,839	2.3
4631	287,009,159,005	40,324,273,821	2,842,691,428	280,491,892,213	1.0
4632	155,842,659,384	8,604,482,846	973,831,700	147,206,157,055	0.8
4634	593,608,469,456	27,870,364,927	3,662,168,384	614,931,815,620	0.5
4636	854,548,973,549	42,659,898,192	9,823,670,256	761,950,906,199	1.9
4639	173,788,867,633	4,329,267,139	444,316,862	168,346,741,923	0.3
4641	120,712,531,202	8,190,139,510	1,637,264,970	114,023,101,646	0.3
4642	52,840,213,545	5,863,201,579	509,657,014	49,066,296,251	0.3
4643	1,186,032,890,198	54,511,638,291	8,613,253,751	1,109,275,464,243	2.0
4646	214,036,842,456	14,028,795,542	5,960,324,136	174,592,401,805	0.5
4647	1,196,601,321,271	60,961,392,644	16,054,560,863	1,090,272,651,985	5.9
4652	681,154,336,075	31,653,836,986	6,362,833,247	590,092,409,054	0.5
4669	25,990,049,867	4,997,809,619	3,714,776,355	46,974,712,181	0.1
4673	16,619,574,974	1,041,385,503	215,463,648	15,326,834,143	0.0
4674	36,946,161,059	2,726,866,057	378,861,258	34,108,798,688	0.1
4675	1,848,564,022,770	93,771,792,300	111,019,251,045	1,739,280,307,479	1.3

Table 5.13 continues

NACE	D12110	D12120	D12150	D13110	D16110
4742	94,688,861,743	2,886,531,283	711,774,993	91,910,124,914	1.2
4752	7,584,578,526	459,579,529	85,013,041	7,184,656,963	0.1
4754	396,068,436,839	15,322,129,555	7,551,610,540	385,417,162,668	4.2
4759	8,718,774,112	662,927,044	200,956,911	8,852,633,867	0.2
4771	32,125,763,194	6,619,227,795	1,122,672,415	26,280,303,109	0.9
4777	177,162,548,336	23,125,034,230	5,563,340,920	363,966,896,821	0.9
4939	6,709,230,510	6,495,103,429	381,029,240	5,266,934,146	0.9
4942	14,531,553,176	13,666,760,508	1,204,092,153	10,960,351,046	0.7
5020	560,481,410,513	561,848,118,081	29,934,163,370	405,386,302,092	0.9
5224	27,297,806,551	27,406,189,191	6,479,386,312	14,753,367,874	10.1
5229	39,907,957,792	38,789,742,455	1,463,268,805	32,823,674,250	0.2
5510	6,445,852,322	6,673,205,714	1,532,603,695	3,104,964,043	0.8
5610	2,701,463,058	2,649,054,296	223,438,521	1,799,043,364	0.5
5629	6,390,443,008	5,890,551,713	807,451,592	3,758,857,292	2.1
5630	616,203,343	618,902,579	99,921,201	456,819,768	0.8
6201	12,490,888,828	12,311,429,697	5,558,108,185	7,119,163,013	1.0
6832	9,136,747,083,490	9,041,145,062,193	750,181,161,677	7,917,617,620,368	37.2
6910	5,515,391,289	5,627,283,099	4,476,378,241	721,636,785	0.9
7022	3,780,107,714	3,790,789,702	867,604,017	1,936,723,233	0.5
7111	4,438,917,016	4,366,111,942	1,272,047,465	3,143,971,330	0.7
7311	8,130,850,638	7,964,073,633	562,048,557	7,215,899,181	1.9
7810	1,427,154,270	1,386,348,305	1,132,416,963	216,389,189	3.1
7911	110,603,147,903	110,682,604,375	1,227,149,144	109,309,062,925	0.2
8010	1,067,118,321	1,073,825,460	783,458,896	292,471,411	2.9
8121	784,718,678	790,901,543	481,254,208	251,378,303	1.9
8129	3,077,837,068	3,057,885,998	3,355,834,912	3,153,089,077	5.8
8520	5,721,284,103	5,627,426,440	3,397,297,010	1,251,074,126	2.0
8531	8,909,312,636	8,811,492,857	4,190,585,483	1,647,855,862	2.8
8553	53,648,322	53,439,000	27,736,217	23,386,129	0.1
8559	465,759,330	459,173,877	198,441,402	146,308,279	0.3
8610	47,384,976,504	47,681,798,962	20,777,105,210	14,624,498,268	6.4
8622	1,456,819,649	1,464,287,007	656,722,445	570,955,253	0.3
8690	4,953,978,479	5,724,687,745	2,808,085,973	2,018,837,757	0.6
8891	432,287,989	436,910,003	187,146,019	251,622,680	0.2
9522	404,034,939	474,727,223	84,565,040	296,854,639	0.2

Table 5.14 95% confidence intervals of total for activity codes using simple random sampling,
D12110

NACE	Lower limit	Upper limit	Contain τ	NACE	Lower limit	Upper limit	Contain τ
0520	824,129,364	1,093,777,987	√	4532	1,650,060,530	1,798,656,261	√
0811	1,726,035,322	1,947,253,309	√	4621	13,318,025,515	15,664,219,589	√
0812	2,684,576,150	2,990,770,462	√	4631	7,181,805,450	8,032,334,141	√
1039	9,519,149,962	10,570,040,946	√	4632	3,675,104,617	4,017,101,002	√
1051	4,780,021,234	5,314,763,259	√	4634	10,534,968,451	11,549,756,605	√
1061	9,395,035,817	10,500,507,918	√	4636	6,096,537,379	6,929,992,811	√
1071	2,851,304,548	3,048,593,444	√	4639	18,568,602,833	19,815,473,998	√
1310	6,997,806,167	7,568,287,388	√	4641	9,139,943,614	9,838,625,704	√
1320	6,801,856,979	7,099,830,823	√	4642	7,826,493,324	8,276,137,419	√
1330	3,776,069,817	4,100,510,640	√	4643	10,321,921,881	11,611,184,457	√
1392	4,224,403,885	4,785,486,096	√	4646	14,368,836,295	15,427,951,448	√
1419	1,175,755,298	1,377,840,384	√	4647	4,725,761,698	5,776,336,283	√
1439	1,420,330,518	1,565,535,161	√	4652	11,592,961,895	12,485,892,918	√
1520	2,745,392,123	2,972,888,123	√	4669	8,042,270,983	8,355,723,167	√
1721	3,451,882,269	4,005,315,598	√	4673	23,962,350,560	24,767,885,422	√
1812	2,450,052,676	2,840,308,759	√	4674	7,996,661,957	8,344,015,435	√
2219	2,137,875,086	2,437,349,605	√	4675	9,158,718,932	10,672,355,653	√
2221	4,551,446,008	5,166,276,732	√	4742	5,431,682,696	5,884,024,559	√
2222	4,928,498,959	5,392,501,883	√	4752	5,252,493,734	5,578,863,324	√
2223	2,816,227,969	3,038,643,001	√	4754	4,444,326,415	5,845,588,980	√
2229	3,644,554,147	3,826,043,913	√	4759	3,235,921,780	3,453,708,175	√
2332	826,394,757	1,019,233,913	√	4771	6,414,587,665	6,907,818,144	√
2361	2,905,857,846	3,318,863,096	√	4777	2,193,683,966	2,535,224,593	√
2363	7,508,532,961	8,093,781,695	√	4939	4,513,018,056	4,909,881,315	√
2511	5,345,028,489	5,647,235,486	√	4942	1,146,794,523	1,276,271,529	√
2512	1,708,052,596	1,886,782,622	√	5020	3,372,315,046	4,208,710,249	√
2561	1,132,694,731	1,315,790,190	√	5224	656,909,222	807,167,334	√
2562	1,538,915,248	1,693,864,320	√	5229	4,458,243,931	4,899,127,805	√
2573	1,025,065,591	1,227,682,906	√	5510	9,496,347,696	10,070,714,209	√
2599	2,077,813,709	2,330,740,100	√	5610	7,584,477,110	8,197,747,616	√
2712	1,778,807,105	1,953,852,924	√	5629	3,233,790,020	3,502,657,847	√
2740	1,555,132,562	1,685,075,870	√	5630	595,991,800	634,817,652	√
2822	1,851,392,048	2,056,262,929	√	6201	2,791,299,316	2,970,048,020	√
2829	1,187,434,112	1,348,887,195	√	6832	5,084,992,920	7,691,773,935	√
2920	1,492,596,418	1,738,051,769	√	6910	705,838,211	769,011,570	√
2932	7,179,906,303	7,775,719,176	√	7022	851,595,935	904,859,524	√
3101	2,136,185,666	2,433,311,042	√	7111	1,144,057,164	1,256,621,769	√
3109	4,551,822,022	4,911,230,088	√	7311	3,712,023,813	3,876,387,931	√
3250	1,055,989,465	1,221,529,608	√	7810	406,274,918	441,816,174	√
3312	496,075,904	554,273,161	√	7911	9,491,071,719	9,976,039,347	√
3315	550,499,604	595,116,409	√	8010	1,701,410,566	1,819,732,245	√
4222	2,483,112,393	2,765,129,221	√	8121	4,146,786,159	4,387,380,518	√
4291	1,777,757,315	2,149,487,657	√	8129	831,257,035	912,375,124	√
4321	3,071,450,237	3,311,735,026	√	8520	1,336,884,397	1,440,364,833	√
4322	3,339,985,516	3,639,094,274	√	8531	1,226,222,935	1,337,594,587	√
4329	1,098,361,211	1,231,726,542	√	8553	178,961,736	189,183,225	√
4331	509,430,308	584,315,784	√	8559	1,739,733,450	1,865,448,032	√
4333	1,447,834,393	1,596,379,824	√	8610	4,384,179,777	4,794,621,478	√
4339	463,684,336	514,526,103	√	8622	1,654,148,839	1,743,172,597	√
4399	2,412,380,412	2,639,196,371	√	8690	1,224,878,722	1,318,963,097	√
4511	36,055,393,527	39,310,754,455	√	8891	696,261,306	751,031,203	√
4520	1,078,877,696	1,208,488,373	√	9522	369,722,933	394,306,796	√
4531	5,506,312,432	6,356,171,745	√				

Table 5.15 95% confidence intervals of total for activity codes using simple random sampling,
D12120

NACE	Lower limit	Upper limit	Contain τ	NACE	Lower limit	Upper limit	Contain τ
0520	767,609,417	1,021,879,855	√	4532	362,657,714	392,180,506	√
0811	1,753,020,211	1,987,769,935	√	4621	2,637,961,922	3,448,728,267	√
0812	2,670,307,435	2,978,988,295	√	4631	1,345,323,773	1,664,128,218	√
1039	8,956,388,458	9,915,723,053	√	4632	498,694,261	579,054,409	√
1051	4,521,718,630	5,030,740,106	√	4634	1,332,082,874	1,551,968,415	√
1061	8,616,803,617	9,667,969,323	√	4636	961,273,879	1,147,492,802	√
1071	2,736,391,970	2,926,043,560	√	4639	2,072,684,512	2,269,481,206	√
1310	6,609,380,186	7,147,126,760	√	4641	2,052,173,099	2,234,163,752	√
1320	6,468,224,447	6,750,912,920	√	4642	1,779,354,590	1,929,134,658	√
1330	3,689,941,755	3,999,428,923	√	4643	1,811,284,065	2,087,683,803	√
1392	4,120,260,220	4,639,109,737	√	4646	3,756,886,624	4,028,036,310	√
1419	1,185,221,068	1,389,542,724	√	4647	994,525,753	1,231,651,980	√
1439	1,406,396,229	1,550,794,452	√	4652	1,545,036,337	1,737,526,407	√
1520	2,646,254,109	2,867,369,047	√	4669	2,188,971,351	2,326,425,419	√
1721	3,345,241,402	3,877,346,115	√	4673	5,033,709,390	5,235,350,996	√
1812	2,411,985,030	2,797,238,823	√	4674	1,754,151,248	1,848,517,976	√
2219	2,074,810,596	2,360,937,252	√	4675	1,834,814,319	2,175,724,927	√
2221	4,393,014,127	4,994,154,725	√	4742	813,958,859	892,936,738	√
2222	4,706,350,332	5,156,500,444	√	4752	1,128,196,267	1,208,534,874	√
2223	2,726,968,597	2,952,898,201	√	4754	784,293,036	1,059,902,400	√
2229	3,497,012,466	3,673,856,460	√	4759	899,343,153	959,396,318	√
2332	853,172,807	1,035,460,554	√	4771	2,207,215,256	2,431,101,208	√
2361	2,814,364,147	3,225,040,995	√	4777	581,426,081	704,821,093	√
2363	7,190,039,649	7,736,033,533	√	4939	4,449,681,794	4,840,160,696	√
2511	5,245,097,921	5,540,433,911	√	4942	1,111,349,237	1,236,914,474	√
2512	1,658,537,881	1,835,131,069	√	5020	3,380,041,936	4,217,456,274	√
2561	1,114,750,189	1,286,637,949	√	5224	658,828,908	809,385,016	√
2562	1,480,980,978	1,630,065,718	√	5229	4,399,539,457	4,834,202,694	√
2573	1,003,625,039	1,204,622,078	√	5510	9,483,632,928	10,068,040,982	√
2599	1,992,970,218	2,233,919,349	√	5610	7,480,618,286	8,087,910,891	√
2712	1,713,664,500	1,871,066,416	√	5629	3,189,578,543	3,447,716,187	√
2740	1,485,239,591	1,611,137,074	√	5630	587,115,535	626,026,331	√
2822	1,739,982,499	1,933,197,476	√	6201	2,757,568,564	2,935,028,563	√
2829	1,159,003,341	1,316,419,812	√	6832	4,978,700,458	7,571,807,632	√
2920	1,431,883,625	1,663,209,329	√	6910	707,465,233	771,276,179	√
2932	6,972,550,408	7,549,737,155	√	7022	850,853,723	904,192,516	√
3101	2,033,514,441	2,312,946,354	√	7111	1,162,303,409	1,273,941,081	√
3109	4,409,573,261	4,748,038,935	√	7311	3,694,805,415	3,857,475,111	√
3250	1,035,791,687	1,197,793,055	√	7810	401,888,748	436,918,211	√
3312	582,348,239	660,094,167	√	7911	9,473,549,787	9,958,691,583	√
3315	548,580,624	593,121,130	√	8010	1,709,786,342	1,828,479,282	√
4222	2,514,304,130	2,798,515,996	√	8121	4,139,073,972	4,380,614,303	√
4291	1,794,996,247	2,174,129,566	√	8129	822,908,917	903,763,668	√
4321	2,956,515,397	3,189,134,040	√	8520	1,339,497,798	1,442,125,926	√
4322	3,285,661,666	3,583,206,648	√	8531	1,239,678,757	1,350,437,319	√
4329	1,080,753,071	1,214,295,203	√	8553	177,706,349	187,907,877	√
4331	495,564,034	569,541,261	√	8559	1,719,082,572	1,843,905,240	√
4333	1,426,566,323	1,578,135,096	√	8610	4,399,919,330	4,811,644,540	√
4339	451,074,600	500,737,520	√	8622	1,653,196,181	1,742,447,807	√
4399	2,406,352,763	2,631,229,412	√	8690	1,230,533,922	1,331,672,384	√
4511	4,641,390,206	5,132,568,939	√	8891	694,399,738	749,461,656	√
4520	1,019,889,694	1,144,098,432	√	9522	354,597,461	381,245,345	√
4531	1,138,068,054	1,317,030,037	√				

Table 5.16 95% confidence intervals of total for activity codes using simple random sampling,
D12150

NACE	Lower limit	Upper limit	Contain τ	NACE	Lower limit	Upper limit	Contain τ
0520	129,718,674	232,079,899	√	4532	190,571,007	205,677,736	√
0811	491,468,453	576,519,493	√	4621	773,673,816	976,666,543	√
0812	449,041,878	516,308,637	√	4631	442,452,441	527,098,345	√
1039	868,969,597	1,010,872,238	√	4632	207,294,336	234,328,957	√
1051	470,312,341	585,386,625	√	4634	547,589,853	627,296,492	
1061	745,393,693	871,103,838	√	4636	333,141,359	422,502,929	√
1071	739,631,667	793,338,267	√	4639	998,622,674	1,061,668,597	√
1310	1,069,595,824	1,207,210,848	√	4641	829,431,296	910,801,034	√
1320	1,333,746,731	1,387,369,395	√	4642	722,831,283	766,990,932	√
1330	914,294,388	983,634,388	√	4643	866,838,125	976,707,494	√
1392	867,299,946	983,138,935	√	4646	2,037,336,093	2,214,075,687	√
1419	296,318,657	348,385,890	√	4647	441,604,613	563,293,626	√
1439	352,755,065	388,315,653	√	4652	779,291,953	865,593,866	√
1520	538,079,622	587,240,795	√	4669	1,079,399,333	1,197,903,625	√
1721	628,345,840	747,634,551	√	4673	2,033,038,532	2,124,757,970	√
1812	569,221,207	663,873,747	√	4674	874,505,162	909,679,594	√
2219	558,456,402	648,391,926	√	4675	589,222,581	960,162,483	√
2221	794,333,589	906,927,070	√	4742	316,744,963	355,963,257	√
2222	877,193,473	972,365,296	√	4752	493,571,230	528,124,308	√
2223	493,384,567	534,189,138	√	4754	393,019,991	586,508,062	√
2229	824,520,054	865,913,115	√	4759	420,458,175	453,522,107	√
2332	263,094,144	335,182,596	√	4771	893,146,964	985,350,952	√
2361	504,184,643	598,594,523	√	4777	94,535,848	155,059,378	
2363	898,048,916	992,760,636	√	4939	913,576,606	1,008,153,204	√
2511	1,089,769,635	1,160,461,722	√	4942	204,860,030	242,130,640	√
2512	335,675,165	379,150,065	√	5020	897,096,527	1,090,388,798	√
2561	308,712,246	366,242,776	√	5224	303,006,279	376,211,320	√
2562	364,466,029	407,306,184	√	5229	1,006,011,944	1,090,434,116	√
2573	335,927,917	435,245,802	√	5510	3,838,846,396	4,118,914,641	√
2599	493,935,556	564,724,286	√	5610	2,002,262,619	2,178,635,410	√
2712	374,926,720	418,359,475	√	5629	851,736,579	947,308,784	√
2740	348,685,287	387,246,641	√	5630	149,828,859	165,463,495	√
2822	406,974,190	465,474,304	√	6201	1,456,744,042	1,575,980,681	√
2829	340,544,359	392,372,526	√	6832	722,410,973	1,469,361,477	√
2920	242,089,819	285,887,213	√	6910	474,375,623	531,288,323	√
2932	1,839,536,293	2,032,285,817	√	7022	431,271,180	456,788,738	√
3101	435,066,598	505,222,857	√	7111	320,968,647	381,226,686	√
3109	1,035,031,764	1,128,455,185	√	7311	901,751,023	944,965,169	√
3250	362,215,013	423,206,362	√	7810	297,776,943	329,436,184	√
3312	187,576,689	222,308,856	√	7911	642,529,782	693,612,933	
3315	224,152,967	246,124,088	√	8010	1,301,346,322	1,402,729,557	√
4222	498,250,651	587,794,645	√	8121	2,756,746,803	2,945,161,907	√
4291	259,311,031	365,419,803	√	8129	427,045,070	511,747,368	√
4321	574,966,142	653,748,019	√	8520	857,503,587	937,243,958	√
4322	560,305,855	647,709,423	√	8531	772,874,484	849,256,288	√
4329	143,809,514	229,177,329	√	8553	91,435,902	98,785,434	√
4331	104,653,218	131,101,540	√	8559	897,504,063	979,562,081	√
4333	215,238,240	287,522,698	√	8610	2,203,938,100	2,475,721,960	√
4339	83,926,924	101,369,378	√	8622	779,995,720	839,767,193	√
4399	544,103,886	631,498,890	√	8690	542,673,334	613,507,967	√
4511	2,098,329,787	2,422,338,615	√	8891	356,395,756	392,432,507	√
4520	240,856,522	273,964,742	√	9522	147,289,988	158,536,972	√
4531	645,746,260	741,366,664	√				

Table 5.17 95% confidence intervals of total for activity codes using simple random sampling,
D13110

NACE	Lower limit	Upper limit	Contain τ	NACE	Lower limit	Upper limit	Contain τ
0520	666,699,312	864,254,327	√	4532	1,533,297,912	1,680,597,901	√
0811	1,271,770,929	1,482,558,628	√	4621	12,855,880,768	15,187,559,666	√
0812	2,245,633,362	2,534,644,046	√	4631	6,910,269,171	7,751,085,711	√
1039	9,018,836,257	10,014,684,111	√	4632	3,446,298,703	3,778,683,636	√
1051	4,481,961,765	4,999,646,629	√	4634	10,287,520,252	11,320,373,991	√
1061	8,808,957,744	9,865,810,202	√	4636	5,758,346,864	6,545,351,694	√
1071	2,171,518,966	2,334,782,562	√	4639	17,951,296,313	19,178,489,577	√
1310	6,096,055,712	6,566,532,575	√	4641	8,638,261,806	9,317,308,841	√
1320	5,670,161,175	5,945,353,382	√	4642	7,363,192,455	7,796,482,041	√
1330	3,029,730,353	3,312,112,404	√	4643	9,712,377,937	10,959,223,641	√
1392	3,549,005,677	4,032,530,657	√	4646	12,594,113,360	13,550,671,967	√
1419	1,004,504,674	1,178,754,732	√	4647	4,431,004,341	5,433,816,776	√
1439	1,113,263,489	1,238,940,362	√	4652	11,005,316,937	11,836,420,537	√
1520	2,299,856,609	2,498,006,125	√	4669	7,139,854,987	7,561,260,107	√
1721	2,865,974,467	3,351,894,264	√	4673	22,571,495,343	23,345,067,113	√
1812	1,940,064,315	2,313,802,208	√	4674	7,409,468,421	7,743,217,599	√
2219	1,637,186,829	1,876,839,910	√	4675	8,715,964,008	10,184,177,453	√
2221	3,908,802,853	4,462,010,350	√	4742	5,291,582,058	5,737,237,293	√
2222	4,186,132,326	4,590,719,979	√	4752	5,010,838,655	5,328,487,279	√
2223	2,505,025,425	2,706,682,107	√	4754	4,263,737,081	5,646,029,505	√
2229	2,993,911,195	3,152,467,998	√	4759	3,152,434,674	3,371,886,544	√
2332	603,744,775	751,887,336	√	4771	5,796,255,224	6,242,361,531	√
2361	2,427,875,923	2,789,418,017	√	4777	2,330,323,180	2,819,862,246	√
2363	6,747,462,131	7,295,300,461	√	4939	3,594,158,041	3,945,786,066	√
2511	4,437,266,448	4,715,727,252	√	4942	945,690,077	1,058,137,333	√
2512	1,458,542,534	1,611,907,917	√	5020	2,450,927,715	3,162,248,440	√
2561	827,356,456	982,230,152	√	5224	361,128,624	471,592,337	√
2562	1,230,958,558	1,367,142,409	√	5229	3,425,207,693	3,825,049,369	√
2573	710,500,756	839,978,358	√	5510	5,749,923,248	6,148,559,897	√
2599	1,650,309,755	1,854,441,812	√	5610	5,783,290,740	6,283,755,357	√
2712	1,469,348,584	1,621,364,671	√	5629	2,459,818,964	2,666,024,952	√
2740	1,292,885,390	1,393,436,692	√	5630	458,563,383	491,993,001	√
2822	1,475,955,787	1,643,556,970	√	6201	1,331,028,214	1,465,974,426	√
2829	880,959,131	1,011,145,970	√	6832	4,090,918,362	6,517,562,037	√
2920	1,314,908,529	1,539,550,611	√	6910	225,301,465	248,152,460	√
2932	5,549,713,545	6,013,330,637	√	7022	418,090,302	456,215,501	√
3101	1,754,062,264	1,994,127,599	√	7111	859,159,665	953,892,957	√
3109	3,814,232,145	4,111,757,730	√	7311	2,800,279,337	2,955,119,724	√
3250	709,630,179	830,819,596	√	7810	107,161,632	121,000,963	√
3312	419,384,978	481,641,301	√	7911	8,820,726,049	9,302,848,208	√
3315	326,191,184	357,081,360	√	8010	397,425,694	459,369,765	√
4222	2,074,835,762	2,328,820,912	√	8121	1,487,266,487	1,623,439,906	√
4291	1,523,519,727	1,895,923,088	√	8129	388,887,285	470,991,040	√
4321	2,569,042,639	2,785,413,583	√	8520	479,268,020	527,657,729	√
4322	2,858,095,260	3,129,747,409	√	8531	470,388,350	518,285,776	√
4329	970,475,754	1,112,322,060	√	8553	87,431,656	94,180,280	√
4331	437,950,955	502,384,405	√	8559	851,728,681	922,188,143	√
4333	1,255,245,087	1,385,824,291	√	8610	2,167,955,805	2,395,975,117	√
4339	391,038,236	435,536,225	√	8622	873,616,093	929,348,021	√
4399	1,930,803,310	2,125,715,077	√	8690	680,724,288	740,785,094	√
4511	34,362,990,296	37,495,096,694	√	8891	332,976,817	374,762,762	√
4520	866,372,307	983,153,521	√	9522	238,283,966	259,356,297	√
4531	5,067,363,192	5,875,303,001	√				

Table 5.18 95% confidence intervals of total for activity codes using simple random sampling,
D16110

NACE	Lower limit	Upper limit	Contain τ	NACE	Lower limit	Upper limit	Contain τ
0520	9,219	13,803	√	4532	6,533	7,024	√
0811	11,796	13,156	√	4621	9,281	11,214	√
0812	12,390	13,866		4631	11,868	13,451	√
1039	26,098	29,384	√	4632	6,396	7,156	
1051	14,496	15,825	√	4634	12,869	13,833	√
1061	11,574	12,606	√	4636	9,394	10,625	√
1071	38,244	40,923	√	4639	27,978	29,502	√
1310	28,459	31,011	√	4641	16,157	17,243	√
1320	32,744	33,916	√	4642	14,986	16,143	√
1330	33,082	34,748	√	4643	11,034	12,693	√
1392	31,195	34,316	√	4646	21,960	23,559	√
1419	13,511	15,362	√	4647	9,126	11,465	√
1439	12,405	13,289	√	4652	8,817	9,549	√
1520	23,671	25,505	√	4669	14,626	15,199	√
1721	13,806	15,581	√	4673	45,066	46,355	√
1812	14,388	16,312	√	4674	14,400	14,973	√
2219	12,425	13,739	√	4675	7,507	8,790	√
2221	16,396	18,039	√	4742	12,188	13,766	√
2222	18,143	19,568	√	4752	19,077	20,050	√
2223	18,185	19,421	√	4754	16,657	21,207	√
2229	21,058	21,993	√	4759	17,969	19,009	√
2332	14,950	17,443		4771	31,646	34,193	√
2361	15,239	17,278	√	4777	6,539	7,305	√
2363	24,566	26,670	√	4939	41,675	46,380	√
2511	34,356	36,999	√	4942	7,101	7,972	√
2512	13,513	14,763	√	5020	9,468	10,504	√
2561	8,431	9,153	√	5224	12,881	15,775	√
2562	10,265	11,356	√	5229	19,188	20,241	√
2573	7,800	8,902	√	5510	111,169	117,446	√
2599	15,775	17,495	√	5610	102,849	111,316	√
2712	9,360	10,159	√	5629	48,084	52,932	√
2740	10,784	11,500	√	5630	13,082	14,463	√
2822	10,636	11,472	√	6201	16,466	18,056	√
2829	7,804	8,673	√	6832	7,668	12,928	√
2920	7,536	8,657	√	6910	5,686	6,500	√
2932	37,943	40,995	√	7022	9,761	10,361	√
3101	15,420	17,314	√	7111	9,219	10,618	√
3109	45,055	47,890	√	7311	21,393	23,935	√
3250	9,643	10,955	√	7810	15,356	17,013	√
3312	6,225	7,445	√	7911	14,252	14,970	
3315	12,699	13,688	√	8010	80,648	86,845	√
4222	20,328	23,211	√	8121	172,929	184,717	√
4291	11,103	13,047	√	8129	27,713	31,230	√
4321	27,557	30,359	√	8520	24,328	26,248	√
4322	29,469	32,179	√	8531	21,477	23,453	√
4329	11,080	12,221	√	8553	9,235	9,763	√
4331	7,970	9,365	√	8559	55,548	58,980	√
4333	14,702	15,852	√	8610	59,932	64,684	√
4339	4,618	5,252	√	8622	22,224	23,561	√
4399	20,080	24,668	√	8690	12,338	13,382	√
4511	41,652	45,767	√	8891	18,580	19,852	√
4520	9,856	10,791	√	9522	8,592	9,090	√
4531	8,949	9,896	√				

Table 5.19 Variances of total for activity codes using simple random sampling

NACE	D12110	D12120	D12150	D13110	D16110
0520	4,731,777,112,246,130	4,207,456,240,157,860	681,865,660,543,975	2,539,826,100,325,510	1,367,364
0811	3,184,701,531,406,610	3,586,229,260,838,420	470,746,528,788,294	2,891,468,020,117,990	120,343
0812	6,101,296,114,761,950	6,200,793,501,520,400	294,461,738,966,427	5,435,702,306,170,440	141,885
1039	71,869,264,121,703,200	59,891,898,279,254,600	1,310,414,892,162,660	64,537,754,457,901,700	702,783
1051	18,608,719,861,020,600	16,861,650,311,273,700	861,756,232,956,328	17,440,494,717,769,600	114,951
1061	79,528,618,573,687,100	71,906,844,908,589,200	1,028,415,277,335,090	72,686,974,042,375,500	69,364
1071	2,532,988,110,937,320	2,340,673,517,599,530	187,708,172,820,590	1,734,628,904,297,190	467,143
1310	21,179,249,765,068,100	18,818,420,613,411,000	1,232,422,354,023,900	14,404,706,295,385,700	423,873
1320	5,778,088,041,135,800	5,200,487,611,346,880	187,121,904,249,550	4,928,333,942,970,340	89,382
1330	6,850,130,611,574,410	6,233,230,104,840,590	312,892,781,942,165	5,189,219,519,149,560	180,642
1392	20,487,117,872,000,200	17,519,055,943,893,700	873,247,568,617,932	15,214,780,707,667,800	633,923
1419	2,657,641,479,157,720	2,716,793,744,025,250	176,423,679,252,374	1,975,939,874,438,350	222,976
1439	1,372,109,829,613,740	1,356,911,625,390,160	82,293,540,355,365	1,027,870,962,474,380	50,807
1520	3,368,025,680,176,250	3,181,735,198,803,050	157,279,582,004,277	2,555,135,268,270,300	218,820
1721	19,932,349,075,441,900	18,425,618,576,373,200	926,033,201,133,044	15,365,866,369,715,400	205,095
1812	9,911,222,589,270,190	9,658,767,503,836,830	583,032,032,437,464	9,089,963,363,264,370	240,874
2219	5,836,434,503,233,170	5,327,758,181,654,770	526,369,122,414,371	3,737,609,283,514,110	112,353
2221	24,600,219,858,702,600	23,516,895,183,051,800	825,000,773,996,691	19,916,085,411,218,000	175,692
2222	14,011,005,404,617,900	13,186,896,287,064,700	589,446,839,046,297	10,652,538,626,216,500	132,196
2223	3,219,260,610,340,380	3,321,805,126,189,820	108,354,134,170,052	2,646,385,458,432,290	99,390
2229	2,143,542,722,834,640	2,035,206,555,337,810	111,502,076,595,612	1,636,053,987,885,080	56,820
2332	2,420,016,391,131,040	2,162,433,780,332,140	338,188,840,075,446	1,428,195,172,454,170	404,540
2361	11,100,409,748,909,500	10,975,600,875,907,900	580,046,435,105,094	8,506,396,133,408,640	270,802
2363	22,289,936,564,792,900	19,400,075,602,788,500	583,761,318,208,399	19,531,369,464,891,900	287,975
2511	5,943,426,508,151,630	5,676,238,215,988,740	325,214,177,783,155	5,046,101,837,361,400	454,562
2512	2,078,848,794,276,690	2,029,437,858,334,550	122,999,982,821,453	1,530,673,453,669,570	101,732
2561	2,181,639,643,061,490	1,922,727,635,155,210	215,389,547,957,822	1,560,929,159,587,380	33,924
2562	1,562,448,897,483,930	1,446,419,440,913,470	119,434,541,318,060	1,206,921,680,054,300	77,498
2573	2,671,658,697,833,290	2,629,100,468,473,420	641,922,782,586,781	1,090,980,934,659,360	78,946
2599	4,163,093,435,047,960	3,778,144,765,223,280	326,103,989,078,485	2,711,753,996,709,650	192,673
2712	1,994,028,463,160,420	1,612,307,585,826,800	122,761,624,142,679	1,503,858,470,507,780	41,538
2740	1,098,843,136,114,190	1,031,482,720,171,450	96,768,142,540,294	657,965,708,908,163	33,299
2822	2,731,419,071,821,360	2,429,458,254,703,490	222,710,806,428,093	1,828,024,575,962,500	45,467
2829	1,696,369,869,792,250	1,612,605,777,545,500	174,807,300,216,927	1,102,965,755,669,080	49,231
2920	3,920,783,612,448,720	3,482,375,921,756,500	124,831,563,516,374	3,284,052,560,863,790	81,789

Table 5.19 continues

NACE	D12110	D12120	D12150	D13110	D16110
2932	23,101,896,326,885,500	21,680,064,312,660,000	2,417,767,269,494,410	13,987,713,929,363,200	606,276
3101	5,745,229,139,257,780	5,081,358,932,335,540	320,302,782,475,643	3,750,479,289,380,980	233,379
3109	8,406,273,261,586,070	7,455,162,725,574,420	567,988,313,285,524	5,760,716,474,081,910	523,261
3250	1,783,341,505,806,160	1,707,910,957,709,320	242,083,026,909,603	955,778,504,072,419	111,886
3312	220,410,812,703,677	393,353,633,422,146	78,503,972,285,116	252,228,869,889,896	96,856
3315	129,546,235,966,697	129,103,541,750,524	31,414,655,269,664	62,096,713,217,174	63,635
4222	5,175,805,076,842,880	5,256,688,955,217,090	521,796,057,626,878	4,198,020,101,353,390	540,751
4291	8,992,571,264,594,240	9,354,310,305,424,670	732,707,168,459,944	9,025,162,924,157,200	245,976
4321	3,757,339,391,502,140	3,521,412,505,423,610	403,906,197,766,312	3,046,672,329,858,600	511,205
4322	5,822,186,658,123,690	5,761,467,630,704,650	497,148,570,430,581	4,802,353,832,254,650	477,922
4329	1,157,480,714,183,520	1,160,551,652,557,710	474,259,676,955,371	1,309,374,629,072,700	84,729
4331	364,941,335,961,914	356,142,633,131,218	45,522,292,290,750	270,178,409,081,227	126,780
4333	1,435,973,616,180,020	1,495,021,147,134,160	340,030,375,107,158	1,109,624,148,308,550	86,061
4339	168,216,708,148,294	160,506,403,238,932	19,798,989,555,163	128,857,181,762,764	26,171
4399	3,347,920,085,312,390	3,290,914,404,766,510	497,051,153,452,757	2,472,316,012,066,310	1,369,402
4511	689,645,900,728,418,000	15,700,264,696,454,200	6,831,900,791,098,990	638,411,761,562,468,000	1,102,014
4520	1,093,224,675,737,900	1,003,996,409,360,610	71,334,483,350,451	887,511,196,044,482	56,889
4531	47,002,606,504,813,700	2,084,248,192,644,980	595,016,517,627,987	42,480,134,353,432,400	58,373
4532	1,436,946,277,129,270	56,720,849,742,905	14,851,446,224,646	1,411,995,436,122,160	15,707
4621	358,224,869,542,342,000	42,777,883,298,878,700	2,681,568,055,014,040	353,806,127,607,383,000	243,175
4631	47,076,677,305,780,700	6,614,189,013,505,620	466,272,461,471,024	46,007,682,620,169,500	163,044
4632	7,611,511,326,981,060	420,251,546,688,162	47,562,914,079,721	7,189,695,916,723,340	37,582
4634	67,016,021,767,707,300	3,146,452,718,823,790	413,444,161,907,997	69,423,342,256,212,500	60,421
4636	45,205,640,700,756,200	2,256,708,614,334,770	519,672,156,517,966	40,307,202,937,924,100	98,594
4639	101,174,491,280,881,000	2,520,365,121,154,160	258,667,503,134,546	98,006,254,398,709,600	151,047
4641	31,767,796,123,975,400	2,155,390,824,614,180	430,877,384,859,420	30,007,345,636,970,500	76,734
4642	13,157,266,012,985,100	1,459,943,056,330,650	126,905,106,084,873	12,217,556,832,848,000	87,023
4643	108,170,943,717,578,000	4,971,679,458,658,640	785,563,195,111,877	101,170,359,440,823,000	179,039
4646	72,998,549,340,679,300	4,784,604,892,421,260	2,032,804,308,434,290	59,545,786,189,932,300	166,288
4647	71,825,994,309,274,900	3,659,207,593,472,810	963,675,015,799,286	65,443,615,935,388,800	356,174
4652	51,887,612,704,851,400	2,411,262,686,282,620	484,695,185,390,188	44,950,879,352,126,600	34,870
4669	6,393,968,108,100,780	1,229,541,131,255,890	913,894,419,832,889	11,556,530,791,896,000	21,390
4673	42,227,614,399,884,200	2,645,989,775,122,400	547,457,794,355,803	38,942,971,956,862,100	108,160
4674	7,851,835,094,475,800	579,516,301,331,128	80,515,973,315,804	7,248,836,005,965,130	21,349
4675	149,097,779,820,500,000	7,563,257,679,776,940	8,954,368,712,261,350	140,283,392,480,028,000	107,081

Table 5.19 continues

NACE	D12110	D12120	D12150	D13110	D16110
4742	13,315,621,182,575,000	405,918,461,668,652	100,093,358,447,584	12,924,861,316,026,100	162,135
4752	6,931,819,359,779,440	420,026,276,424,983	77,696,478,455,906	6,566,316,646,551,010	61,620
4754	127,781,183,366,722,000	4,943,286,725,474,120	2,436,330,798,946,210	124,344,826,688,740,000	1,347,187
4759	3,086,664,005,114,270	234,692,746,921,812	71,143,770,447,624	3,134,053,704,939,920	70,463
4771	15,831,704,604,982,600	3,261,981,934,336,230	553,257,456,837,068	12,951,038,493,519,400	422,289
4777	7,591,238,033,639,340	990,884,591,724,873	238,383,595,076,092	15,595,617,561,889,100	38,240
4939	10,249,664,613,907,700	9,922,543,527,522,420	582,096,846,503,807	8,046,274,227,792,600	1,440,538
4942	1,090,970,886,247,650	1,026,045,711,889,650	90,398,422,479,028	822,859,315,120,179	49,394
5020	45,525,102,568,936,900	45,636,113,391,132,600	2,431,402,419,691,260	32,927,502,387,439,300	69,889
5224	1,469,277,139,826,060	1,475,110,727,028,370	348,746,488,883,249	794,085,272,430,619	545,123
5229	12,649,585,473,497,600	12,295,145,876,366,000	463,810,849,872,449	10,404,087,203,226,100	72,221
5510	21,468,716,889,367,200	22,225,945,780,075,200	5,104,528,183,163,660	10,341,470,865,187,200	2,564,305
5610	24,475,525,453,958,400	24,000,696,825,147,300	2,024,375,346,200,490	16,299,512,785,397,000	4,665,426
5629	4,704,414,086,621,430	4,336,412,110,928,940	594,416,793,474,995	2,767,135,419,848,030	1,529,616
5630	98,100,188,470,847	98,529,909,409,994	15,907,555,109,235	72,726,163,922,334	124,139
6201	2,079,283,317,911,630	2,049,409,833,109,090	925,224,920,982,300	1,185,084,351,834,430	164,430
6832	442,218,558,840,930,000	437,591,421,010,132,000	36,308,768,225,184,600	383,212,692,825,825,000	1,800,684
6910	259,714,260,392,249	264,983,133,851,744	210,788,174,986,245	33,981,154,557,240	43,133
7022	184,624,240,848,297	185,145,959,843,777	42,374,647,789,240	94,591,499,442,858	23,419
7111	824,577,663,814,536	811,053,320,512,619	236,296,809,227,281	584,027,258,247,616	127,348
7311	1,758,093,179,103,990	1,722,031,821,312,670	121,528,949,282,631	1,560,257,800,502,830	420,504
7810	82,204,085,956,063	79,853,662,371,182	65,227,217,062,942	12,464,017,281,295	178,743
7911	15,305,706,019,444,300	15,316,701,523,780,900	169,817,807,099,230	15,126,625,363,789,800	33,595
8010	911,080,011,801,550	916,806,405,560,414	668,898,402,810,074	249,705,071,218,969	2,498,977
8121	3,767,027,104,450,660	3,796,707,828,746,590	2,310,251,682,489,700	1,206,736,768,610,580	9,041,693
8129	428,216,393,379,633	425,440,621,028,374	466,893,955,469,659	438,686,130,255,244	804,888
8520	696,858,125,056,743	685,426,167,779,927	413,794,173,117,758	152,382,079,641,640	239,913
8531	807,192,634,090,579	798,330,064,327,095	379,671,235,302,332	149,297,388,964,832	254,142
8553	6,799,173,680,474	6,772,645,072,949	3,515,177,192,672	2,963,864,453,216	18,188
8559	1,028,487,888,451,300	1,013,945,919,587,210	438,197,510,765,562	323,077,357,505,634	766,414
8610	10,963,035,548,841,600	11,031,708,689,757,900	4,807,011,838,498,900	3,383,538,543,685,630	1,469,192
8622	515,750,576,110,391	518,394,207,610,985	232,496,163,633,606	202,132,433,453,249	116,233
8690	576,053,571,562,699	665,672,415,702,653	326,527,044,989,804	234,752,473,221,329	70,935
8891	195,214,339,438,927	197,301,566,842,446	84,512,147,720,424	113,628,776,390,648	105,318
9522	39,330,377,142,246	46,211,846,761,742	8,231,899,290,886	28,897,018,017,242	16,177

5.3 Systematic Sampling Applications

In this study, k values are accepted as N/n . In each activity code that used systematic sampling, k values are calculated separately. After that, for each activity codes for each NUTS2 regions are decided random starting points using random numbers generated by MATLAB program.

Firstly, the 95% confidence intervals of the mean for activity codes using systematic sampling for variables are given in Table 5.20. For all variables and all activity codes, 95% confidence intervals contain μ .

Sample variances are given in Table 5.21.

95% confidence intervals of the total for activity codes using systematic sampling are given in Table 5.22. Similar to means, for all variables and all activity codes confidence intervals contain τ .

Variances of the total are given in Table 5.23.

Table 5.20 95% confidence intervals of mean for activity codes using systematic sampling

NACE	Lower limit	Upper limit	Contain μ	Lower limit	Upper limit	Contain μ
1413	3,892,167	4,286,905	√	3,806,539	4,193,748	√
1414	5,355,850	5,740,678	√	5,295,027	5,675,209	√
2370	4,687,523	5,362,502	√	4,637,810	5,307,233	√
4120	3,635,181	4,035,907	√	3,920,871	4,358,054	√
4211	9,905,754	10,854,011	√	9,761,501	10,676,806	√
4221	5,751,248	6,246,946	√	5,719,909	6,218,644	√
4312	4,967,158	5,578,094	√	4,889,043	5,543,718	√
4638	24,607,444	31,971,826	√	3,712,710	5,496,125	√
4671	82,542,564	98,086,735	√	8,432,279	9,933,652	√
4672	43,152,711	48,517,556	√	4,466,456	5,016,499	√
4711	12,111,817	13,744,493	√	1,696,507	1,953,366	√
4730	22,670,947	23,782,667	√	2,908,098	3,178,487	√
4778	4,546,712	5,351,497	√	1,544,909	1,851,252	√
4941	7,862,805	8,281,567	√	7,676,522	8,079,873	√
7010	5,106,641	6,634,272	√	5,272,285	6,842,740	√
7112	2,323,129	2,551,845	√	2,308,615	2,542,685	√

Table 5.20 continues

NACE	D12150			D13110			D16110		
	Lower limit	Upper limit	Contain μ	Lower limit	Upper limit	Contain μ	Lower limit	Upper limit	Contain μ
1413	867,812	940,712	√	3,177,506	3,535,922	√	41.6	44.3	√
1414	1,097,785	1,172,005	√	4,382,641	4,720,114	√	50.2	53.1	√
2370	1,240,825	1,637,563	√	3,492,090	4,011,374	√	43.4	48.6	√
4120	548,676	669,037	√	3,485,821	3,882,623	√	27.1	29.5	√
4211	1,041,091	1,288,938	√	8,851,203	9,718,033	√	45.6	49.8	√
4221	662,549	832,545	√	5,040,417	5,526,108	√	32.5	36.0	√
4312	824,631	994,603	√	4,159,346	4,720,969	√	27.5	31.0	√
4638	550,861	1,875,571	√	24,449,634	31,761,367	√	34.7	43.7	√
4671	2,985,826	4,012,315	√	79,740,450	94,989,482	√	24.5	29.5	√
4672	1,941,472	2,272,221	√	41,401,512	46,633,803	√	29.4	34.3	√
4711	863,985	1,001,747	√	11,803,757	13,342,654	√	45.4	51.2	√
4730	1,197,415	1,306,327	√	21,765,497	22,886,810	√	32.1	34.1	√
4778	664,907	793,340	√	4,255,992	5,052,031	√	23.9	28.5	√
4941	1,191,361	1,284,046	√	6,681,881	7,064,845	√	36.9	38.6	√
7010	2,795,105	3,737,581	√	2,204,110	3,252,374	√	19.1	23.4	√
7112	1,002,027	1,137,111	√	1,317,299	1,483,380	√	24.8	27.1	√

Table 5.21 Sample variances of activity codes using systematic sampling

NACE	D12110	D12120	D12150	D13110	D16110
1413	10,140,174,226	9,757,032,003	345,838,096	8,359,936,826	0.5
1414	9,637,434,557	9,406,150,590	358,483,545	7,411,484,471	0.5
2370	29,648,879,025	29,162,801,937	4,810,799,087	17,548,388,326	1.6
4120	10,450,181,266	12,438,083,477	942,767,751	10,246,516,019	0.4
4211	58,516,659,208	54,520,559,662	3,997,561,192	48,898,537,483	1.1
4221	15,990,535,170	16,187,052,540	1,880,636,398	15,351,380,110	0.8
4312	24,289,513,589	27,891,981,113	1,880,120,035	20,526,638,697	0.8
4638	3,529,396,311,428	206,981,983,344	114,200,976,563	3,479,113,281,796	5.2
4671	15,723,999,161,790	146,691,559,706	68,570,423,237	15,132,559,940,867	1.5
4672	1,873,019,401,032	19,688,901,277	7,119,079,748	1,781,606,316,457	1.5
4711	131,636,108,201	3,258,111,765	1,235,043,401	132,982,473,115	2.2
4730	80,430,084,218	4,757,830,150	771,927,622	81,824,167,070	0.3
4778	42,149,011,714	6,107,246,183	1,073,461,113	41,237,888,792	1.4
4941	11,412,002,825	10,587,550,830	559,043,300	9,544,328,572	0.2
7010	151,867,445,015	160,501,355,897	57,805,397,069	71,510,431,368	1.2
7112	3,404,242,751	3,565,488,328	1,187,514,053	1,795,017,830	0.3

Table 5.22 95% confidence intervals of total for activity codes using systematic sampling

NACE	D12110			D12120		
	Lower limit	Upper limit	Contain	Lower limit	Upper limit	Contain
1413	10,629,508,048	11,707,537,127	√	10,395,658,646	11,453,125,180	√
1414	8,660,408,804	9,282,675,858	√	8,562,058,247	9,176,813,220	√
2370	2,925,014,389	3,346,201,231	√	2,893,993,254	3,311,713,265	√
4120	57,628,524,506	63,981,240,477	√	62,157,574,556	69,088,229,230	√
4211	11,441,146,008	12,536,382,267	√	11,274,533,091	12,331,711,303	√
4221	3,473,753,579	3,773,155,447	√	3,454,825,140	3,756,061,155	√
4312	2,707,101,338	3,040,061,273	√	2,664,528,271	3,021,326,139	√
4638	6,668,617,314	8,664,364,711	√	1,006,144,478	1,489,449,859	√
4671	33,347,195,731	39,627,040,927	√	3,406,640,730	4,013,195,463	√
4672	21,187,980,895	23,822,119,948	√	2,193,029,966	2,463,101,182	√
4711	14,001,260,313	15,888,633,865	√	1,961,161,974	2,258,091,467	√
4730	46,112,706,930	48,373,944,942	√	5,915,070,363	6,465,043,507	√
4778	1,614,082,729	1,899,781,333	√	548,442,632	657,194,603	√
4941	16,857,853,506	17,755,678,690	√	16,458,462,766	17,323,248,671	√
7010	1,976,269,990	2,567,463,115	√	2,040,374,382	2,648,140,359	√
7112	3,426,615,090	3,763,971,020	√	3,405,207,220	3,750,460,328	√

Table 5.22 continues

	D12150			D13110			D16110		
NACE	Lower limit	Upper limit	Contain	Lower limit	Upper limit	Contain	Lower limit	Upper limit	Contain
1413	2,369,995,844	2,569,083,431	√	8,677,768,888	9,656,603,381	√	113,544	120,857	√
1414	1,775,119,080	1,895,132,745	√	7,086,730,484	7,632,423,868	√	81,151	85,796	√
2370	774,274,618	1,021,839,609	√	2,179,064,395	2,503,097,420	√	27,112	30,298	√
4120	8,698,156,437	10,606,250,965	√	55,260,712,546	61,551,219,378	√	429,599	467,642	√
4211	1,202,460,124	1,488,723,383	√	10,223,139,738	11,224,328,546	√	52,710	57,470	√
4221	400,179,357	502,856,889	√	3,044,411,984	3,337,769,162	√	19,610	21,732	√
4312	449,423,842	542,058,896	√	2,266,843,382	2,572,927,988	√	15,000	16,918	√
4638	149,283,294	508,279,838	√	6,625,850,766	8,607,330,536	√	9,409	11,837	√
4671	1,206,273,523	1,620,975,253	√	32,215,141,949	38,375,750,772	√	9,909	11,903	√
4672	953,262,727	1,115,660,282	√	20,328,142,326	22,897,197,498	√	14,443	16,836	√
4711	998,766,933	1,158,018,975	√	13,645,143,169	15,424,108,513	√	52,522	59,239	√
4730	2,435,542,463	2,657,068,769	√	44,271,020,045	46,551,770,720	√	65,278	69,418	√
4778	236,041,880	281,635,868	√	1,510,877,187	1,793,470,988	√	8,493	10,135	√
4941	2,554,277,478	2,752,993,814	√	14,325,951,796	15,147,028,138	√	79,196	82,776	√
7010	1,081,705,531	1,446,443,711	√	852,990,391	1,258,668,647	√	7,410	9,071	√
7112	1,477,989,292	1,677,238,896	√	1,943,016,398	2,187,986,155	√	36,575	39,945	√

Table 5.23 Variances of total for activity codes using systematic sampling

NACE	D12110	D12120	D12150	D13110	D16110
1413	75,629,079,978,622,500	72,771,466,965,971,600	2,579,385,366,739,410	62,351,426,783,926,500	3,480,134
1414	25,198,894,124,604,900	24,594,158,479,369,800	937,322,983,046,929	19,378,726,919,887,700	1,404,384
2370	11,544,561,919,118,700	11,355,295,166,840,200	1,873,209,705,267,520	6,832,921,252,738,740	634,546
4120	2,626,314,569,305,870,000	3,125,909,399,987,470,000	236,934,137,112,626,000	2,575,129,906,488,640,000	94,182,283
4211	78,062,686,299,985,300	72,731,789,603,009,200	5,332,846,569,583,370	65,231,871,465,219,300	1,474,608
4221	5,833,603,078,576,660	5,905,295,759,288,310	686,086,248,112,077	5,600,429,086,130,450	293,107
4312	7,214,592,773,640,120	8,284,615,690,037,840	558,442,653,490,324	6,096,924,859,022,070	239,461
4638	259,202,394,507,587,000	15,200,963,838,780,200	8,387,033,919,776,220	255,509,558,528,365,000	383,609
4671	2,566,408,247,190,650,000	23,942,409,608,991,500	11,191,790,198,987,600	2,469,875,903,308,580,000	248,469
4672	451,549,390,220,184,000	4,746,620,008,789,890	1,716,274,864,824,950	429,511,432,377,677,000	372,754
4711	175,910,070,288,738,000	4,353,932,043,869,280	1,650,432,958,491,250	177,709,266,193,137,000	2,936,313
4730	332,751,805,503,537,000	19,683,885,550,868,500	3,193,584,994,626,130	338,519,343,737,342,000	1,115,417
4778	5,311,829,201,233,630	769,665,700,203,016	135,282,936,785,983	5,197,004,935,031,460	175,408
4941	52,457,964,215,850,700	48,668,176,051,632,800	2,569,774,463,084,670	43,872,758,742,697,200	834,291
7010	22,745,035,372,424,600	24,038,127,571,288,300	8,657,456,513,652,620	10,710,045,795,551,600	179,430
7112	7,406,355,635,122,520	7,757,165,543,653,690	2,583,585,262,606,480	3,905,285,666,775,460	739,039

5.4 Estimations of Turkey Total

The estimated values of the mean for Turkey total for all variables are given in Table 5.24. Estimated values are calculated from all sampling methods close to each other. For variables D12110, D12120 and D13110 the estimates getting poisson and simple random sampling used together are closer than others to population results. The total turnover (D12110) are estimated with 0.02% difference the real total. Total production value (D12120) are estimated 0.13% difference and total purchases of good and services (D13110) are estimated 0.14% difference. For value-added at factor cost (D12150), simple random sampling estimate is the nearest value. This estimation has 0.00002% difference from population value. For the number of person employed (D16110), the nearest estimate is calculated from systematic and simple random sampling used together. This estimation has 0.4% percent difference from real population value.

Table 5.24 Estimated mean of all variables for Turkey

	$\hat{\mu}$ (poisson and simple random sampling used together)	$\hat{\mu}$ (systematic and simple random sampling used together)	$\hat{\mu}$ (only simple random sampling used)
D12110	8,816,223	8,794,762	8,761,422
D12120	5,042,945	5,037,115	5,064,304
D12150	1,274,414	1,270,958	1,268,228
D13110	7,841,134	7,810,591	7,831,534
D16110	40.62	40.71	40.65

Sample variances for Turkey total are given in Table 5.25. Except for variable D16110, all other variables the smallest sample variances are calculated from the samples that getting from poisson and simple random sampling used together. The largest sample variances are calculated from the samples using only simple random sampling. On the contrary for variable D16110, the smallest sample variance is calculated from simple random sampling and the largest calculated from poisson and simple random sampling.

Table 5.25 Sample variances of all variables for Turkey

	$\hat{V}(\bar{y})$ (poisson and simple random sampling used together))	$\hat{V}(\bar{y})$ (systematic and simple random sampling used together)	$\hat{V}(\bar{y})$ (only simple random sampling used)
D12110	912,221,940	1,380,044,096	1,920,211,472
D12120	328,898,549	644,885,325	1,450,807,641
D12150	29,491,667	56,265,420	67,903,670
D13110	835,671,976	1,304,802,590	2,428,341,002
D16110	0.025	0.022	0.021

Estimated population totals and variances of totals have a situation similar to the means. Estimated totals for Turkey are given in Table 5.26 and variances of the total for Turkey given table 5.27.

Table 5.26 Estimated total of all variables for Turkey

	$\hat{t}$ (poisson and simple random sampling used together)	$\hat{t}$ (systematic and simple random sampling used together)	$\hat{t}$ (only simple random sampling used)
D12110	745,455,721,619	743,641,098,497	740,822,016,427
D12120	426,406,194,396	425,913,245,604	428,212,238,425
D12150	107,758,066,110	107,465,821,686	107,235,044,723
D13110	663,007,049,935	660,424,519,776	662,195,321,458
D16110	3,434,500	3,442,350	3,437,053

Table 5.27 Variances of total for all variables for Turkey

	$\hat{V}(\hat{t})$ (poisson and simple random sampling used together)	$\hat{V}(\hat{t})$ (systematic and simple random sampling used together)	$\hat{V}(\hat{t})$ (only simple random sampling used)
D12110	6,521,974,569,488,670,000	9,866,691,540,969,710,000	13,728,644,137,219,900,000
D12120	2,351,475,971,428,320,000	4,610,638,601,705,230,000	10,372,618,904,366,500,000
D12150	210,852,089,553,808,000	402,272,322,436,796,000	485,480,549,738,752,000
D13110	5,974,676,925,558,650,000	9,328,748,780,349,380,000	17,361,540,614,875,600,000
D16110	178,738,701	157,290,057	150,140,509

Note that, this Turkey total is the total of activity codes taking a sample, not all activity codes.

Turkey total estimations formulas are,

Turkey estimated total,

$$\hat{t}_{turkey} = \sum_{i=1}^{121} \hat{t}_i \quad (5.11)$$

Turkey estimated mean,

$$\bar{y}_{turkey} = \frac{\hat{t}_{turkey}}{N} \quad (5.12)$$

Turkey estimated variance of $\bar{y}$,

$$\hat{V}_{turkey}(\bar{y}_{turkey}) = \frac{1}{N^2} \sum_{i=1}^{121} N_i^2 \left(\frac{N_i - n_i}{N_i} \right) \left(\frac{s_i^2}{n_i} \right) \quad (5.13)$$

where $N = \sum_{i=1}^{121} N_i$, $i = 0520, 0811, \dots, 9522$ (121 sampled activity codes)

5.5 Comparison of Poisson, Simple Random, and Systematic Sampling Applications

The values are obtained the strata using poisson sampling are compared to the values that obtained from the same strata using simple random sampling and systematic sampling. The calculating means from samples are given Table 5.28.

The estimated values from poisson sampling are more close to population values except for a few point. In variable D12110, activity codes 1414 and 2370, the difference between the simple random sampling estimations and population are fewer than the difference between poisson sampling and systematic sampling results from population values. For 1414, the poisson estimation is 0.18% different from

population value whereas the random estimation is 0.15% different from population value. For 2370, the poisson estimation 0.2% different from population value but the random estimation 0.075% different.

In variable D12120 for activity code 4672 systematic sampling result is the closest to population value. The poisson estimation is 1.38% and the simple random estimation is 2.38% different from population value when the systematic estimation is 0.30% different from population value.

In variable D12150 for activity codes 4711 and 4730 systematic sampling result is the closest value to population value. For activity code 4711, the poisson estimation is 4.03% and the simple random estimation is 4.05% different from population value whereas the systematic estimation has 0.26% difference. For activity code 4730, the poisson estimation is 0.43% and the simple random estimation is 3.52% different from population value whereas the systematic estimation is 0.12% different.

In D13110, for activity codes 1414 and 4211 the simple random sampling estimates and activity codes 1413, 4638 and 4778 the systematic estimations are more close to population values. For 1413, the systematic estimation is 0.31% different from population value but the poisson estimation is 0.32% and the simple random estimation is 1.18% different. For 1414, the poisson estimation is 0.31% and the systematic estimation is 2.41% different from population value but the simple random estimation is 0.19% different. For 4211, the poisson estimation is 0.29% and the systematic estimation is 0.35% different from population value whereas the simple random estimation has 0.19% difference. For 4638, the poisson estimation has 0.76% difference, the simple random estimation has 6.92% difference and the systematic estimation has only 0.45% difference. For 4778, the poisson estimation is 3.03%, the simple random estimation is 19.02% and the systematic estimation is 1.60% different from population value.

Variable D16110, estimates of all sampling methods are very close to each other. For example activity code 1413, the poisson and the simple random estimations are

nearly same as the population value and the systematic estimation has a small difference 1.9%.

All of other activity codes the poisson sampling estimations are closer than other sampling estimations.

The mean estimations that calculated from poisson, simple random and systematic sampling are given in Table 5.28. The sample variances calculated from these 3 methods are given in Table 5.29. For variable D12110, activity code 4730 systematic sampling has the smallest sample variance, all other activity codes poisson sampling has the smallest variances.

For D12120, activity codes 4672, 4711 and 4730 systematic sampling has the smallest variance, all other activity codes poisson sampling has the smallest variances.

For variable D12150, activity codes 1413, 4672 and 4778 systematic sampling and activity code 4730 simple random sampling has the smallest variance, all other activity codes poisson sampling has the smallest variances.

For D13110, activity code 4730 systematic sampling has the smallest variance, all other activity codes poisson sampling has the smallest variances.

For variable D16110 there is a different situation. Activity codes 4221, 4312, 4711, 4778 and 7010 poisson sampling and activity code 4120 simple random sampling have the smallest variance, all other activity codes systematic sampling has the smallest variances. If all the calculations were made according to D16110, the use of a systematic and simple random sample was recommended, since yielded the minimum variances.

For being comparable, the population total for all Turkey is given in Table 5.30 and variances of totals for all Turkey are given in Table 5.31.

Table 5.28 Comparison of sample means calculated from poisson, simple random and systematic sampling

NACE	Method	D12110	D12120	D12150	D13110	D16110
1413	Poisson	4,079,265	3,983,700	914,098	3,356,905	44.0
	Simple Random	4,100,862	4,013,113	921,889	3,385,781	44.0
	Systematic	4,089,536	4,000,144	904,262	3,356,714	42.9
1414	Poisson	5,656,781	5,573,848	1,144,340	4,678,176	52.0
	Simple Random	5,655,073	5,583,750	1,153,098	4,672,644	53.0
	Systematic	5,548,264	5,485,118	1,134,895	4,551,377	51.6
2370	Poisson	5,316,854	5,228,373	1,643,637	3,846,636	49.0
	Simple Random	5,302,169	5,199,998	1,658,239	3,820,464	48.0
	Systematic	5,025,013	4,972,521	1,439,194	3,751,732	46.0
4120	Poisson	3,782,545	4,211,850	581,056	3,759,826	28.0
	Simple Random	3,797,525	4,349,736	596,596	3,928,230	28.0
	Systematic	3,835,544	4,139,463	608,857	3,684,222	28.3
4211	Poisson	10,422,920	10,298,780	1,277,213	9,225,830	47.0
	Simple Random	10,502,563	10,369,718	1,355,537	9,270,455	49.0
	Systematic	10,379,882	10,219,153	1,165,015	9,284,618	47.7
4221	Poisson	6,012,468	5,955,747	723,321	5,320,459	34.0
	Simple Random	6,021,919	5,950,130	662,681	5,400,693	34.0
	Systematic	5,999,097	5,969,277	747,547	5,283,263	34.2
4312	Poisson	5,201,711	5,154,384	898,995	4,396,960	30.0
	Simple Random	5,214,854	5,164,159	890,322	4,415,013	30.0
	Systematic	5,272,626	5,216,380	909,617	4,440,157	29.3
4638	Poisson	28,252,464	4,718,881	1,351,873	28,190,711	38.0
	Simple Random	29,531,747	4,963,330	1,173,681	29,914,677	39.0
	Systematic	28,289,635	4,604,418	1,213,216	28,105,501	39.2
4671	Poisson	95,137,114	9,572,420	3,348,214	92,702,040	32.0
	Simple Random	97,969,001	10,334,216	3,850,490	94,414,339	33.0
	Systematic	90,314,649	9,182,966	3,499,070	87,364,966	27.0
4672	Poisson	46,547,802	4,689,875	2,108,828	44,509,497	31.0
	Simple Random	44,817,684	4,621,033	1,989,518	43,065,743	30.0
	Systematic	45,835,133	4,741,478	2,106,846	44,017,658	31.9
4711	Poisson	13,719,056	1,933,736	98,758	13,308,228	50.0
	Simple Random	13,227,018	1,864,101	95,746	12,853,775	48.0
	Systematic	12,928,155	1,824,937	932,866	12,573,206	48.3
4730	Poisson	23,073,926	2,983,500	1,258,706	22,124,246	34.0
	Simple Random	21,198,524	2,855,133	1,209,245	20,263,198	32.0
	Systematic	23,226,807	3,043,292	1,251,871	22,326,153	33.1
4778	Poisson	4,960,611	1,655,600	733,062	4,586,541	26.0
	Simple Random	4,092,012	1,491,096	647,971	3,830,257	22.0
	Systematic	4,949,104	1,698,081	729,124	4,654,012	26.2
4941	Poisson	7,968,129	7,751,246	1,230,820	6,774,760	38.0
	Simple Random	7,676,806	7,471,596	1,216,946	6,501,642	37.0
	Systematic	8,072,186	7,878,198	1,237,703	6,873,363	37.8
7010	Poisson	5,240,561	5,405,900	2,898,874	2,446,608	20.0
	Simple Random	4,910,563	5,032,160	2,655,881	2,320,981	18.0
	Systematic	5,870,456	6,057,513	3,266,343	2,728,242	21.3
7112	Poisson	2,448,107	2,440,178	1,082,849	1,407,092	26.0
	Simple Random	2,205,036	2,202,639	991,759	1,258,775	25.0
	Systematic	2,437,487	2,425,650	1,069,569	1,400,340	25.9

Table 5.29 Comparison of sample variances calculated from poisson, simple random and systematic sampling

NACE	Method	D12110	D12120	D12150	D13110	D16110
1413	Poisson	3,962,613,622	3,811,874,774	381,067,120	2,715,423,826	1.2
	S. Random	9,294,293,598	8,692,007,977	383,996,458	7,743,821,277	0.9
	Systematic	10,140,174,226	9,757,032,003	345,838,096	8,359,936,826	0.5
1414	Poisson	3,435,254,730	3,345,490,901	252,206,220	2,345,517,726	0.7
	S. Random	9,945,149,478	9,816,704,109	392,693,720	8,137,143,074	0.8
	Systematic	9,637,434,557	9,406,150,590	358,483,545	7,411,484,471	0.5
2370	Poisson	20,829,674,319	20,007,241,814	2,066,344,803	12,431,992,871	2.4
	S. Random	29,827,315,994	27,912,094,542	5,672,289,224	14,007,935,045	1.7
	Systematic	29,648,879,025	29,162,801,937	4,810,799,087	17,548,388,326	1.6
4120	Poisson	3,245,164,874	3,797,499,847	266,397,078	2,980,459,358	0.4
	S. Random	14,135,457,468	34,729,067,395	1,030,788,262	29,756,033,422	0.3
	Systematic	10,450,181,266	12,438,083,477	942,767,751	10,246,516,019	0.4
4211	Poisson	56,275,179,718	54,024,034,314	3,435,122,187	43,526,622,941	1.7
	S. Random	66,957,561,349	66,942,019,504	4,842,094,859	53,045,840,471	1.2
	Systematic	58,516,659,208	54,520,559,662	3,997,561,192	48,898,537,483	1.1
4221	Poisson	9,018,252,036	8,820,338,471	601,541,618	7,754,911,051	0.5
	S. Random	19,189,467,191	19,552,489,086	1,178,479,880	23,699,358,705	1.2
	Systematic	15,990,535,170	16,187,052,540	1,880,636,398	15,351,380,110	0.8
4312	Poisson	14,010,201,322	14,365,948,256	782,278,033	10,373,708,213	0.8
	S. Random	26,090,440,990	29,330,757,980	1,907,498,369	22,312,246,003	1.0
	Systematic	24,289,513,589	27,891,981,113	1,880,120,035	20,526,638,697	0.8
4638	Poisson	2,815,277,945,401	189,012,316,832	16,177,871,017	2,885,518,872,553	5.8
	S. Random	5,066,309,669,958	342,442,165,510	115,795,854,447	5,095,396,040,487	7.9
	Systematic	3,529,396,311,428	206,981,983,344	114,200,976,563	3,479,113,281,796	5.2
4671	Poisson	7,185,653,165,000	143,774,196,422	44,510,113,758	6,982,200,962,847	24.0
	S. Random	28,534,781,413,945	722,879,049,423	408,938,422,649	30,027,364,190,514	25.5
	Systematic	15,723,999,161,790	146,691,559,706	68,570,423,237	15,132,559,940,867	1.5
4672	Poisson	1,126,496,017,460	26,324,979,735	9,224,124,799	989,848,857,521	1.6
	S. Random	3,515,931,100,207	45,678,823,405	11,265,726,061	2,909,574,805,806	2.7
	Systematic	1,873,019,401,032	19,688,901,277	7,119,079,748	1,781,606,316,457	1.5
4711	Poisson	118,143,477,393	3,815,869,311	623,375,828	114,425,515,881	1.6
	S. Random	221,225,633,224	5,276,496,216	1,655,635,749	213,344,374,889	3.5
	Systematic	131,636,108,201	3,258,111,765	1,235,043,401	132,982,473,115	2.2
4730	Poisson	130,064,987,231	5,136,228,404	801,413,334	118,113,582,201	0.9
	S. Random	121,887,975,522	5,597,991,237	673,483,345	122,423,831,140	0.4
	Systematic	80,430,084,218	4,757,830,150	771,927,622	81,824,167,070	0.3
4778	Poisson	27,434,941,999	4,192,848,367	1,348,505,013	27,296,494,719	1.0
	S. Random	68,771,701,761	9,262,071,848	1,988,452,356	63,258,449,629	2.4
	Systematic	42,149,011,714	6,107,246,183	1,073,461,113	41,237,888,792	1.4
4941	Poisson	9,612,200,486	9,239,499,728	448,076,141	6,902,097,646	0.5
	S. Random	16,592,657,584	15,100,865,233	620,584,470	13,605,981,424	0.2
	Systematic	11,412,002,825	10,587,550,830	559,043,300	9,544,328,572	0.2
7010	Poisson	88,824,566,084	89,466,291,760	17,343,289,252	51,235,893,749	0.5
	S. Random	161,328,326,457	170,366,208,819	60,184,674,114	73,249,779,539	1.5
	Systematic	151,867,445,015	160,501,355,897	57,805,397,069	71,510,431,368	1.2
7112	Poisson	2,764,602,575	2,853,232,350	746,109,498	1,174,337,508	0.7
	S. Random	7,335,421,014	8,135,683,020	2,069,744,573	4,510,249,608	1.2
	Systematic	3,404,242,751	3,565,488,328	1,187,514,053	1,795,017,830	0.3

Table 5.30 Comparison of totals calculated from poisson, simple random and systematic sampling

NACE	Method	D12110	D12120	D12150	D13110	D16110
1413	Poisson	11,140,472,715	10,879,484,700	2,496,401,638	9,167,707,555	120,164
	S. Random	11,199,454,122	10,959,811,603	2,517,678,859	9,246,567,911	120,164
	Systematic	11,168,522,587	10,924,391,913	2,469,539,637	9,167,186,134	117,200
1414	Poisson	9,147,014,877	9,012,912,216	1,850,397,780	7,564,610,592	84,084
	S. Random	9,144,253,041	9,028,923,750	1,864,559,466	7,555,665,348	85,701
	Systematic	8,971,542,331	8,869,435,733	1,835,125,912	7,359,577,176	83,473
2370	Poisson	3,317,716,896	3,262,504,752	1,025,629,488	2,400,300,864	30,576
	S. Random	3,308,553,456	3,244,798,752	1,034,741,136	2,383,969,536	29,952
	Systematic	3,135,607,810	3,102,853,259	898,057,113	2,341,080,908	28,705
4120	Poisson	59,964,685,885	66,770,458,050	9,211,480,768	59,604,521,578	443,884
	S. Random	60,202,163,825	68,956,364,808	9,457,836,388	62,274,230,190	443,884
	Systematic	60,804,882,492	65,622,901,893	9,652,203,701	58,405,965,962	448,621
4211	Poisson	12,038,472,600	11,895,090,900	1,475,181,015	10,655,833,650	54,285
	S. Random	12,130,460,265	11,977,024,290	1,565,645,235	10,707,375,525	56,595
	Systematic	11,988,764,137	11,803,122,197	1,345,591,754	10,723,734,142	55,090
4221	Poisson	3,631,530,672	3,597,271,188	436,885,884	3,213,557,236	20,536
	S. Random	3,637,239,076	3,593,878,520	400,259,324	3,262,018,572	20,536
	Systematic	3,623,454,513	3,605,443,147	451,518,123	3,191,090,573	20,671
4312	Poisson	2,834,932,495	2,809,139,280	489,952,275	2,396,343,200	16,350
	S. Random	2,842,095,430	2,814,466,655	485,225,490	2,406,182,085	16,350
	Systematic	2,873,581,305	2,842,927,205	495,741,369	2,419,885,685	15,959
4638	Poisson	7,656,417,744	1,278,816,751	366,357,583	7,639,682,681	10,298
	S. Random	8,003,103,437	1,345,062,430	318,067,551	8,106,877,467	10,569
	Systematic	7,666,491,012	1,247,797,168	328,781,566	7,616,590,651	10,623
4671	Poisson	38,435,394,056	3,867,257,680	1,352,678,456	37,451,624,160	12,928
	S. Random	39,579,476,404	4,175,023,264	1,555,597,960	38,143,392,956	13,332
	Systematic	36,487,118,329	3,709,918,097	1,413,624,388	35,295,446,360	10,906
4672	Poisson	22,854,970,782	2,302,728,625	1,035,434,548	21,854,163,027	15,221
	S. Random	22,005,482,844	2,268,927,203	976,853,338	21,145,279,813	14,730
	Systematic	22,505,050,422	2,328,065,574	1,034,461,504	21,612,669,912	15,640
4711	Poisson	15,859,228,736	2,235,398,816	114,164,248	15,384,311,568	57,800
	S. Random	15,290,432,808	2,154,900,756	110,682,376	14,858,963,900	55,488
	Systematic	14,944,947,089	2,109,626,720	1,078,392,954	14,534,625,841	55,881
4730	Poisson	46,932,365,484	6,068,439,000	2,560,208,004	45,000,716,364	69,156
	S. Random	43,117,797,816	5,807,340,522	2,459,604,330	41,215,344,732	65,088
	Systematic	47,243,325,936	6,190,056,935	2,546,305,616	45,411,395,382	67,348
4778	Poisson	1,761,016,905	587,738,000	260,237,010	1,628,222,055	9,230
	S. Random	1,452,664,260	529,339,080	230,029,705	1,359,741,235	7,810
	Systematic	1,756,932,031	602,818,618	258,838,874	1,652,174,088	9,314
4941	Poisson	17,083,668,576	16,618,671,424	2,638,878,080	14,525,085,440	81,472
	S. Random	16,459,072,064	16,019,101,824	2,609,132,224	13,939,520,448	79,328
	Systematic	17,306,766,098	16,890,855,719	2,653,635,646	14,736,489,967	80,986
7010	Poisson	2,028,097,107	2,092,083,300	1,121,864,238	946,837,296	7,740
	S. Random	1,900,387,881	1,947,445,920	1,027,825,947	898,219,647	6,966
	Systematic	2,271,866,552	2,344,257,370	1,264,074,621	1,055,829,519	8,241
7112	Poisson	3,610,957,825	3,599,262,550	1,597,202,275	2,075,460,700	38,350
	S. Random	3,252,428,100	3,248,892,525	1,462,844,525	1,856,693,125	36,875
	Systematic	3,595,293,055	3,577,833,774	1,577,614,094	2,065,501,276	38,260

Table 5.31 Comparison of variance of totals calculated from poisson, simple random and systematic sampling

NACE	Method	D12110	D12120	D12150	D13110	D16110
1413	Poisson	29,554,602,899,457,800	28,430,338,151,529,200	2,842,136,147,295,470	20,252,611,163,093,400	9,221,004
	Simple Random	69,320,196,897,346,800	64,828,133,305,799,900	2,863,984,208,928,800	57,756,214,603,434,900	6,639,039
	Systematic	75,629,079,978,622,500	72,771,466,965,971,600	2,579,385,366,739,410	62,351,426,783,926,500	3,480,134
1414	Poisson	8,982,122,755,496,030	8,747,418,258,425,570	659,440,829,015,532	6,132,799,398,206,760	1,868,440
	Simple Random	26,003,472,944,726,400	25,667,628,249,204,500	1,026,771,949,844,540	21,276,098,488,013,400	1,961,693
	Systematic	25,198,894,124,604,900	24,594,158,479,369,800	937,322,983,046,929	19,378,726,919,887,700	1,404,384
2370	Poisson	8,110,575,267,821,700	7,790,339,788,569,250	804,585,073,915,806	4,840,719,656,273,330	931,206
	Simple Random	11,614,040,992,410,300	10,868,299,724,229,200	2,208,653,288,712,030	5,454,353,716,252,200	666,718
	Systematic	11,544,561,919,118,700	11,355,295,166,840,200	1,873,209,705,267,520	6,832,921,252,738,740	634,546
4120	Poisson	815,567,076,912,629,000	954,378,581,688,055,000	66,950,276,801,161,300	749,041,919,534,953,000	103,650,604
	Simple Random	3,552,489,373,057,040,000	8,728,026,180,393,880,000	259,055,241,266,827,000	7,478,215,172,891,990,000	77,230,956
	Systematic	2,626,314,569,305,870,000	3,125,909,399,987,470,000	236,934,137,112,626,000	2,575,129,906,488,640,000	94,182,283
4211	Poisson	75,072,496,623,913,100	72,069,412,375,628,200	4,582,538,876,019,840	58,065,603,168,520,000	2,214,573
	Simple Random	89,323,060,778,955,000	89,302,327,569,061,200	6,459,475,593,984,090	70,764,477,334,956,500	1,659,423
	Systematic	78,062,686,299,985,300	72,731,789,603,009,200	5,332,846,569,583,370	65,231,871,465,219,300	1,474,608
4221	Poisson	3,290,002,634,855,600	3,217,800,599,523,400	219,452,006,872,069	2,829,115,630,159,240	182,822
	Simple Random	7,000,624,662,841,940	7,133,060,858,429,670	429,928,316,008,897	8,645,905,245,201,900	436,330
	Systematic	5,833,603,078,576,660	5,905,295,759,288,310	686,086,248,112,077	5,600,429,086,130,450	293,107
4312	Poisson	4,161,380,047,740,370	4,267,045,780,778,790	232,356,132,622,400	3,081,250,682,043,860	225,513
	Simple Random	7,749,513,234,936,660	8,711,968,389,013,710	566,574,702,935,109	6,627,294,869,046,180	306,126
	Systematic	7,214,592,773,640,120	8,284,615,690,037,840	558,442,653,490,324	6,096,924,859,022,070	239,461
4638	Poisson	206,756,827,588,210,000	13,881,253,560,444,300	1,188,119,025,346,860	211,915,391,519,192,000	426,386
	Simple Random	372,074,848,471,407,000	25,149,295,077,222,200	8,504,163,346,408,320	374,210,980,609,437,000	577,289
	Systematic	259,202,394,507,587,000	15,200,963,838,780,200	8,387,033,919,776,220	255,509,558,528,365,000	383,609

Table 5.31 continues

NACE	Method	D12110	D12120	D12150	D13110	D16110
4671	Poisson	1,172,813,566,978,630,000	23,466,249,243,144,300	7,264,762,727,155,310	1,139,606,912,351,980,000	3,918,223
	Simple Random	4,657,332,883,258,380,000	117,985,426,930,580,000	66,745,293,591,095,800	4,900,946,273,718,970,000	4,157,489
	Systematic	2,566,408,247,190,650,000	23,942,409,608,991,500	11,191,790,198,987,600	2,469,875,903,308,580,000	248,469
4672	Poisson	271,576,786,385,177,000	6,346,452,439,531,430	2,223,761,230,609,220	238,633,752,420,021,000	395,565
	Simple Random	847,624,185,568,936,000	11,012,296,425,371,200	2,715,952,504,630,810	701,443,203,758,551,000	649,461
	Systematic	451,549,390,220,184,000	4,746,620,008,789,890	1,716,274,864,824,950	429,511,432,377,677,000	372,754
4711	Poisson	157,879,382,006,009,000	5,099,283,531,791,520	833,039,560,293,005	152,910,936,190,699,000	2,130,411
	Simple Random	295,631,777,799,613,000	7,051,171,846,805,960	2,212,485,653,822,470	285,099,768,561,796,000	4,735,952
	Systematic	175,910,070,288,738,000	4,353,932,043,869,280	1,650,432,958,491,250	177,709,266,193,137,000	2,936,313
4730	Poisson	538,099,142,312,716,000	21,249,378,158,906,100	3,315,571,983,795,550	488,654,315,285,644,000	3,821,472
	Simple Random	504,269,569,259,345,000	23,159,763,036,102,400	2,786,305,662,700,020	506,486,487,544,217,000	1,537,027
	Systematic	332,751,805,503,537,000	19,683,885,550,868,500	3,193,584,994,626,130	338,519,343,737,342,000	1,115,417
4778	Poisson	3,457,488,565,383,670	528,403,715,470,050	169,945,344,209,912	3,440,040,746,938,050	129,738
	Simple Random	8,666,953,714,461,180	1,167,252,604,615,550	250,594,708,128,923	7,972,146,114,468,360	302,407
	Systematic	5,311,829,201,233,630	769,665,700,203,016	135,282,936,785,983	5,197,004,935,031,460	175,408
4941	Poisson	44,184,748,013,566,900	42,471,541,023,059,200	2,059,687,726,424,480	31,727,120,723,175,000	2,418,571
	Simple Random	76,272,066,452,528,300	69,414,690,849,051,100	2,852,662,975,602,920	62,543,104,629,245,600	1,106,908
	Systematic	52,457,964,215,850,700	48,668,176,051,632,800	2,569,774,463,084,670	43,872,758,742,697,200	834,291
7010	Poisson	13,303,166,437,837,500	13,399,277,050,600,300	2,597,487,087,911,120	7,673,548,570,819,990	75,461
	Simple Random	24,161,982,125,176,800	25,515,576,728,647,800	9,013,798,457,423,220	10,970,546,231,754,300	224,582
	Systematic	22,745,035,372,424,600	24,038,127,571,288,300	8,657,456,513,652,620	10,710,045,795,551,600	179,430
7112	Poisson	6,014,738,476,643,360	6,207,563,630,400,470	1,623,254,476,211,660	2,554,918,041,408,700	1,630,130
	Simple Random	15,959,125,344,166,600	17,700,195,369,481,400	4,502,988,037,434,540	9,812,611,803,327,750	2,686,665
	Systematic	7,406,355,635,122,520	7,757,165,543,653,690	2,583,585,262,606,480	3,905,285,666,775,460	739,039

Table 5.32 Estimated total of Turkey and 95% confidence intervals for all variables using simple random sampling and poisson sampling together

	$\hat{\tau}$ (poisson and simple random sampling used together)	Lower limit	Upper limit	Contain τ
D12110	745,455,721,619	740,450,242,871	750,461,200,367	✓
D12120	426,406,194,396	423,400,627,877	429,411,760,915	✓
D12150	107,758,066,110	106,858,060,897	108,658,071,323	✓
D13110	663,007,049,935	658,216,192,090	667,797,907,780	✓
D16110	3,434,500	3,408,144	3,460,856	✓

In Table 5.32 estimated totals for Turkey using poisson and simple random sampling, in Table 5.33 estimated totals for Turkey using only simple random sampling and in Table 5.34 estimated totals for Turkey using systematic and simple random sampling are given. All these confidence intervals contain population values. Except for variable D16110, for all other variables, 95% confidence intervals for Turkey total that calculated using poisson and simple random sampling together are smaller than each other.

Table 5.33 Estimated total of Turkey and 95% confidence intervals for all variables using only simple random sampling

	$\hat{\tau}$ (only simple random sampling used)	Lower limit	Upper limit	Contain τ
D12110	740,822,016,427	733,559,788,165	748,084,244,688	✓
D12120	428,212,238,425	421,899,754,543	434,524,722,308	✓
D12150	107,235,044,723	105,869,386,614	108,600,702,833	✓
D13110	662,195,321,458	654,028,553,773	670,362,089,143	✓
D16110	3,437,053	3,412,851	3,461,254	✓

Table 5.34 Estimated total of Turkey and 95% confidence intervals for all variables using simple random sampling and systematic sampling together

	$\hat{\tau}$ (systematic and simple random sampling used together)	Lower limit	Upper limit	Contain τ
D12110	743,641,098,497	737,484,485,611	749,797,711,384	√
D12120	425,913,245,604	421,704,655,668	430,121,835,540	√
D12150	107,465,821,686	106,222,692,833	108,708,950,539	√
D13110	660,424,519,776	654,438,091,683	666,410,947,869	√
D16110	3,442,350	3,417,848	3,466,853	√

CHAPTER SIX

CONCLUSIONS

In the time of knowledge and technology, everything changes very quickly. Knowledge is needed very quickly as well. Statistics is a key getting knowledge as quickly as possible. The Annual Industry and Service Statistics is the survey that having the largest sample size conducted by Turkish Statistical Institute. The large size of survey causes sometimes waste of time and difficulties in fieldwork. More using statistics, less waste of time. And also more information are obtained.

In this study, estimations of the full enumeration part of the Annual Industry and Service Statistics in different sampling methods and their comparison are presented. It seems the estimated results are very close to real results. Due to micro data usage restriction rule of TURKSTAT, real population values can not be given inside of text. Only calculated values of micro data and comments on these could be given.

The series of eleven years (2003-2013 years) data analysis at the beginning of the study. Before 2009, NACE Rev.1 codes are used for activity classification. There are correspondence tables from NACE Rev.1 code to NACE Rev.2 code. But, some activity codes there are no one to one transformation. A NACE Rev.1 code may match 2-3 NACE Rev.2 codes or vice versa. For example, in NACE Rev 1, the activity code 3210 corresponds 2790, 3313, 2611 and 2612 codes in NACE Rev.2. For this reason, it is decided to use last five years data.

From 2009 to 2013 the Annual Industry and Service Statistics data are examined. Found some enterprises having extraordinary values, but the number of this enterprises are not so large in all data. It is decided to remove these enterprise sampling data. It should be suggested that every year remove these kinds of enterprises, which are decided using previous years data, in sampling data and accepted as full enumeration. It is decreased the variance and guaranteed to get information. From 2009 to 2012 data, decided the enterprises that have these kinds of outlier values using the turnover variable. Which means the value far from mean

$\mp 3\sigma$. Then these enterprises are removed 2013 enterprises list, from which drawn a sample. they are accepted as full enumeration.

Sample sizes are calculated separately for each activity code, then allocated each region. Stratified sampling and Neyman allocation formulas are used calculation. Besides the strata sizes, the variance of strata is an important factor, and Neyman allocation is used for these two factors. Of course, the largest strata have the largest sample size. But the representation of the most varied strata is as important as the largest strata. The Annual Industry and Service Statistics is the survey that having the largest size survey in Turkey, every unit in the frame should be checked carefully.

The main reason for using stratified sampling is to give total results and also to give separate results for strata. Inside strata, simple random, systematic and poisson sampling are used according to the structure of data. Simply, if the coefficient of variation is largely simple random, systematic and poisson sampling are used and compared results, all other strata simple random sampling is used.

Some activity codes are used 3 different sampling method, poisson, systematic and simple random sampling. In poisson sampling sample size is random and this could be a very important problem sometimes. Sample size may be equal to 0, may be equal to population size, so on. To avoid this uncertainty, the sample size is fixed and then drawn the sample. This fixed sample size is the sample size that calculated stratified sampling formulas. And also the application of simple random and systematic sampling these values are used. To avoid the problem using different sample size and to compare the results are the reasons of this.

Calculated strata sizes are not always integers, in this case, always the decimal points are rounded up. So, calculated sample size and sample size used have a slight difference.

The sample size in this study is %62 of full enumeration data. So, the size of the survey is decreasing %38, but the results remain nearly same. The size of the survey

is decreased but the level of estimates for activity codes increased that is another very important result of this study. The results are reported NACE Rev 2.2 four digits level for Turkey and two digits level for NUTS2 regions. But, here it is showed that the results can be reported NACE Rev 2.2 four digits level for Turkey and also four digits level NUTS2 regions. It is important and desirable for regional decisions. The structure of data is very complex. The data is not properly fit any model, so the method used is decided after analyzing the each activity code and each NUTS2 regions. There are many alternative sampling methods. The simple random sample is the basic, simple and known way of drawing a sample. In some strata, the simple random sample is used drawing sample inside the strata. Sometimes the variance inside the strata is relatively large, the advantages of stratified random sampling no doubt, but again doing stratification caused to lose sensitivity and very small stratum size. Poisson sampling seems a good choice like these situations as far as inclusion probabilities are good decided. Because population elements that have greater inclusion probabilities have a greater chance being in the sample. And also if there is an element thought must be in the sample, it could take the value 1 and guaranteed to be in the sample. Another alternative is systematic sampling. Estimations of the strata using poisson sampling are compared using simple random and systematic sampling. Except for a few points, poisson sampling estimations have smaller differences from population values and also smaller variances.

The Annual Industry and Service Statistics has approximately 200 variables, but it is too hard calculating sample sizes and giving estimations for all variables in this study. Sample size calculations are made for selected 5 important variables, the largest sample size is calculated for the turnover variable. So the turnover variable is selected for calculating sample size and estimations are given for selected 5 variables. The total turnover is estimated with 0.02% difference from real situation using with poisson and simple random sampling together. Production value, value-added at factor cost, total purchases of goods and services and the number of people employed variables also estimated very close to real. The real total turnover is estimated 0.016% difference. Total production value is estimated 0.13%, value-added at factor cost estimated 0.40%, total purchases of goods and services estimated

0.14% and the total number of person employed estimated 0.63% difference with real value.

For all of five variables, almost all 95% confidence intervals for μ contain real value of μ for all different sampling methods.

In the last section, there is a comparison of using only simple random sampling, using simple random and systematic sampling and using simple random and poisson sampling together. The results of using only simple random sampling and simple random and systematic sampling are not bad, but it is obvious that using simple random and poisson sampling methods together resulted better. The estimations are much closer to population values in that case.

It is tried to suggest a sampling model to the Annual Industry and Service Statistics in this study. Of course there are many different possible sampling schemes and there are many different ways to calculate estimations of these parameters. This study only one of these ways, only a trial for arguing the use of sampling methods instead of full enumeration.

REFERENCES

- Aires, N. (1999) Algorithms to find exact inclusion probabilities for conditional poisson sampling and pareto π ps sampling designs. *Methodology and computing in applied probability* 1 (4), 457-469
- Annual Industry and Service Statistics (n.d.) In *TURKSTAT Central Dissemination System - MEDAS*. Retrieved December 17, 2016, from <https://biruni.tuik.gov.tr/medas/?kn=129&locale=en>
- Ardilly, P. & Tillé, Y. (2006). *Sampling Methods: Exercises and Solutions*. New York: Springer
- Barnabas, A.F. & Sunday, A.O. (2014) Comparison of allocation procedures in a stratified random sampling of skewed populations under different distributions and sample sizes. *International Journal of Innovative Science, Engineering & Technology*. 1(8), 218-225.
- Brewer, K.R.W., Early, L.J. & Hanif, M. (1980) Sampling with Unequal Probabilities without Replacement: A Review. *International Statistical Review*. 48, 317-335.
- Brewer, K.R.W., Early, L.J. & Hanif, M. (1984) Poisson, modified poisson, and collocated sampling. *Journal of Statistical Planning and Inference* (10), 15-30.
- Brewer, K.R.W. & Gregoire, T. G. (2000) Estimators for use with poisson sampling and related selection procedures. *Proceedings of the American Statistical Association International Conference of Establishment Surveys, Session 4*, 279-288.
- Brick, J.M. (2011) The future of survey sampling. *Public Opinion Quarterly* 75(5), 872-888.

- Chambers, R. (2003) *An Introduction To Model-Based Survey Sampling*. Southampton: EUROSTAT
- Cochran, W.G. (1977) *Sampling Techniques*. New York: John Wiley&Sons
- European Commission. *Survey Sampling Reference Guidelines-Introduction to Sample Design and Estimation Techniques* (2008) Luxembourg: Office for Official Publications of the European Communities
- Ghosh, D. & Vogt, A. (1998) Rectification of sample size in Bernoulli and poisson sampling. *Proceedings of the American Statistical Association, Survey Research Methods Section*, 448-450
- Ghosh, D. & Vogt, A. (1999) A modification of Poisson sampling. *Proceedings of the American Statistical Association, Survey Research Methods Section*, 198-199.
- Ghosh, D. & Vogt, A. (2002) Sampling method related to Bernoulli and poisson sampling. *Proceedings of the American Statistical Association, Survey Research Methods Section*, 3569-3570.
- Giovannini, E. (2008) *Understanding Economic Statistics An OECD Perspective*. Bologna: Societa Editrice il Mulino
- Grafström, A. (2005). *Comparison of methods for generating conditional poisson samples and sampford samples*. Master's Thesis, Umeå Universitet, Umeå.
- Grafström, A. (2010). *On unequal probability sampling designs*. Doctoral Dissertation, Umeå Universitet, Umeå.
- Hájek, J. (1958). Some contributions to the theory of probability sampling. *Bulletin of the Institute of International Statistics*, 36(3):127-134

- Hájek, J. (1964). Asymptotic theory of rejective sampling with varying probabilities from a finite population. *Annals of Mathematical Statistics*, (35), 1491-1523.
- Hibberts, M., Johnson, R.B. & Hudson, K. (2012). Common survey sampling techniques. In L. Gideon (Ed.). *Handbook of survey methodology for the social sciences* (53-74). New York: Springer
- Kott, P.S. & Bailey, J.T. (2000) The theory and practice of maximal brewer selection with poisson prn sampling. *Proceedings of the American Statistical Association International Conference of Establishment Surveys*, Session 4, 269-278.
- Lohr, S. (2010). *Sampling: Design and Analysis* (2nd ed.). Boston: Brooks/ Cole
- Lundquist, A. (2009) *Contributions to the Theory of Unequal Probability Sampling*, Doctoral Dissertation, Umeå Universitet, Umeå.
- Mathew, O.O., Sola, A.F., Oladiran, B.H. & Amos, A.A. (2013) Efficiency of Neyman allocation procedure over other allocation procedures in stratified random sampling. *American Journal of Theoretical and Applied Statistics*, 2 (5), 122-127
- NUTS 2013 Classification (n.d) In *EUROSTAT NUTS Classification*. Retrieved December 17, 2016, from <http://ec.europa.eu/eurostat/web/nuts/overview>
- Regulation (EC) No 295/2008 of The European Parliament and of the Council Concerning Structural Business Statistics (March 11, 2008). In *EUR-Lex Access to European Union Law Websites*. Retrieved December 17, 2016, from <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02008R0295-20090420>
- Saavedra, P.J. (2000) Estimation strategies using variants of poisson sampling discussion. *Proceedings of the American Statistical Association International Conference of Establishment Surveys*, Session 4, 301-300.

Sampath, S. (2001). *Sampling Theory and Methods*. Boca Raton: CRC Press

Särndal, C.E., Swenson, B. & Wretman, J. (1992). *Model Assisted Survey Sampling*. New York: Springer-Verlag

Scheaffer, R.L., Mendenhall, W. & Ott, L. (1990). *Elementary Survey Sampling*. (5th ed.). Belmont: Duxbury Press

Statistical Classification of Economic Activities in the European Community (n.d.)
In *TURKSTAT Classification Server* (Revision 2). Retrieved December 17, 2016,
from <http://biruni.tuik.gov.tr/DIESS/>

Thompson, S.K. (2012). *Sampling* (3rd ed.). New Jersey: Wiley

TURKSTAT *Annual Business Statistics 2010*. (2013) Ankara: Turkish Statistical Institute

Williams, M.S., Schreuder, H.T. & Terrazas, G.H. (1998) Poisson sampling-the adjusted and unadjusted estimator revisited. *Research Note of United States Department of Agriculture* (RMRS-RN-4)

Williams, M.S., Ebel, E.D. & Wells, S.J. (2009). Poisson sampling: A sampling strategy for concurrently establishing freedom from disease and estimating population characteristics. , *Preventive Veterinary Medicine*, (89), 34-42

Winkler, W.E. (2009) Sample allocation and stratification. *Research Report Series of U.S. Census Bureau* (Statistics #2009-8)

Yamane, T. (2010). *Temel Örnekleme Yöntemleri*. (A. Esin, C.Aydın, M.A.Bakır, E.Gürbüzel, Trans.). İstanbul: Literatür Yayıncılık

APPENDICES

Appendix 1

List of NACE codes

NACE REV.2 CODE	NACE REV.2 DESCRIPTION
A	AGRICULTURE, FORESTRY, AND FISHING
01	Crop and animal production, hunting and related service activities
01.1	Growing of non-perennial crops
01.11	Growing of cereals (except rice), leguminous crops and oil seeds
01.12	Growing of rice
01.13	Growing of vegetables and melons, roots and tubers
01.14	Growing of sugar cane
01.15	Growing of tobacco
01.16	Growing of fibre crops
01.19	Growing of other non-perennial crops
01.2	Growing of perennial crops
01.21	Growing of grapes
01.22	Growing of tropical and subtropical fruits
01.23	Growing of citrus fruits
01.24	Growing of pome fruits and stone fruits
01.25	Growing of other tree and bush fruits and nuts
01.26	Growing of oleaginous fruits
01.27	Growing of beverage crops
01.28	Growing of spices, aromatic, drug and pharmaceutical crops
01.29	Growing of other perennial crops
	Post-harvest crop activities
01.64	Seed processing for propagation
01.7	Hunting, trapping and related service activities
01.70	Hunting, trapping and related service activities
02	Forestry and logging
02.1	Silviculture and other forestry activities
02.10	Silviculture and other forestry activities
02.2	Logging
02.20	Logging
02.3	Gathering of wild growing non-wood products
02.30	Gathering of wild growing non-wood products
02.4	Support services to forestry
02.40	Support services to forestry
03	Fishing and aquaculture
03.1	Fishing
03.11	Marine fishing
03.12	Freshwater fishing
03.2	Aquaculture
03.21	Marine aquaculture
03.22	Freshwater aquaculture
B	MINING AND QUARRYING
05	Mining of coal and lignite

05.1	Mining of hard coal
05.10	Mining of hard coal
05.2	Mining of lignite
05.20	Mining of lignite
06	Extraction of crude petroleum and natural gas
06.1	Extraction of crude petroleum
06.10	Extraction of crude petroleum
06.2	Extraction of natural gas
06.20	Extraction of natural gas
07	Mining of metal ores
07.1	Mining of iron ores
07.10	Mining of iron ores
07.2	Mining of non-ferrous metal ores
07.21	Mining of uranium and thorium ores
07.29	Mining of other non-ferrous metal ores
08	Other mining and quarrying
08.1	Quarrying of stone, sand, and clay
08.11	Quarrying of ornamental and building stone, limestone, gypsum, chalk, and slate
08.12	Operation of gravel and sand pits; mining of clays and kaolin
08.9	Mining and quarrying n.e.c.
08.91	Mining of chemical and fertilizer minerals
08.92	Extraction of peat
08.93	Extraction of salt
08.99	Other mining and quarrying n.e.c.
09	Mining support service activities
09.1	Support activities for petroleum and natural gas extraction
09.10	Support activities for petroleum and natural gas extraction
09.9	Support activities for other mining and quarrying
09.90	Support activities for other mining and quarrying
C	MANUFACTURING
10	Manufacture of food products
10.1	Processing and preserving of meat and production of meat products
10.11	Processing and preserving of meat
10.12	Processing and preserving of poultry meat
10.13	Production of meat and poultry meat products
10.2	Processing and preserving of fish, crustaceans, and molluscs
10.20	Processing and preserving of fish, crustaceans, and molluscs
10.3	Processing and preserving of fruit and vegetables
10.31	Processing and preserving of potatoes
10.32	Manufacture of fruit and vegetable juice
10.39	Other processing and preserving of fruit and vegetables
10.4	Manufacture of vegetable and animal oils and fats
10.41	Manufacture of oils and fats
10.42	Manufacture of margarine and similar edible fats
10.5	Manufacture of dairy products
10.51	Operation of dairies and cheese making
10.52	Manufacture of ice cream
10.6	Manufacture of grain mill products, starches, and starch products
10.61	Manufacture of grain mill products
10.62	Manufacture of starches and starch products
10.7	Manufacture of bakery and farinaceous products
10.71	Manufacture of bread; manufacture of fresh pastry goods and cakes
10.72	Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes
10.73	Manufacture of macaroni, noodles, couscous and similar farinaceous products
10.8	Manufacture of other food products

10.81	Manufacture of sugar
10.82	Manufacture of cocoa, chocolate, and sugar confectionery
10.83	Processing of tea and coffee
10.84	Manufacture of condiments and seasonings
10.85	Manufacture of prepared meals and dishes
10.86	Manufacture of homogenized food preparations and dietetic food
10.89	Manufacture of other food products n.e.c.
10.9	Manufacture of prepared animal feeds
10.91	Manufacture of prepared feeds for farm animals
10.92	Manufacture of prepared pet foods
11	Manufacture of beverages
11.0	Manufacture of beverages
11.01	Distilling, rectifying and blending of spirits
11.02	Manufacture of wine from grape
11.03	Manufacture of cider and other fruit wines
11.04	Manufacture of other non-distilled fermented beverages
11.05	Manufacture of beer
11.06	Manufacture of malt
11.07	Manufacture of soft drinks; production of mineral waters and other bottled waters
12	Manufacture of tobacco products
12.0	Manufacture of tobacco products
12.00	Manufacture of tobacco products
13	Manufacture of textiles
13.1	Preparation and spinning of textile fibres
13.10	Preparation and spinning of textile fibres
13.2	Weaving of textiles
13.20	Weaving of textiles
13.3	Finishing of textiles
13.30	Finishing of textiles
13.9	Manufacture of other textiles
13.91	Manufacture of knitted and crocheted fabrics
13.92	Manufacture of made-up textile articles, except apparel
13.93	Manufacture of carpets and rugs
13.94	Manufacture of cordage, rope, twine, and netting
13.95	Manufacture of non-wovens and articles made from non-wovens, except apparel
13.96	Manufacture of other technical and industrial textiles
13.99	Manufacture of other textiles n.e.c.
14	Manufacture of wearing apparel
14.1	Manufacture of wearing apparel, except fur apparel
14.11	Manufacture of leather clothes
14.12	Manufacture of workwear
14.13	Manufacture of other outerwear
14.14	Manufacture of underwear
14.19	Manufacture of other wearing apparel and accessories
14.2	Manufacture of articles of fur
14.20	Manufacture of articles of fur
14.3	Manufacture of knitted and crocheted apparel
14.31	Manufacture of knitted and crocheted hosiery
14.39	Manufacture of other knitted and crocheted apparel
15	Manufacture of leather and related products
15.1	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, and harness; dressing and dyeing of fur
15.11	Tanning and dressing of leather; dressing and dyeing of fur
15.12	Manufacture of luggage, handbags and the like, saddlery and harness
15.2	Manufacture of footwear

15.20	Manufacture of footwear
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
16.1	Sawmilling and planing of wood
16.10	Sawmilling and planing of wood
16.2	Manufacture of products of wood, cork, straw and plaiting materials
16.21	Manufacture of veneer sheets and wood-based panels
16.22	Manufacture of assembled parquet floors
16.23	Manufacture of other builders' carpentry and joinery
16.24	Manufacture of wooden containers
16.29	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
17	Manufacture of paper and paper products
17.1	Manufacture of pulp, paper, and paperboard
17.11	Manufacture of pulp
17.12	Manufacture of paper and paperboard
17.2	Manufacture of articles of paper and paperboard
17.21	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
17.22	Manufacture of household and sanitary goods and of toilet requisites
17.23	Manufacture of paper stationery
17.24	Manufacture of wallpaper
17.29	Manufacture of other articles of paper and paperboard
18	Printing and reproduction of recorded media
18.1	Printing and service activities related to printing
18.11	Printing of newspapers
18.12	Other printing
18.13	Pre-press and pre-media services
18.14	Binding and related services
18.2	Reproduction of recorded media
18.20	Reproduction of recorded media
19	Manufacture of coke and refined petroleum products
19.1	Manufacture of coke oven products
19.10	Manufacture of coke oven products
19.2	Manufacture of refined petroleum products
19.20	Manufacture of refined petroleum products
20	Manufacture of chemicals and chemical products
20.1	Manufacture of basic chemicals, fertilizers and nitrogen compounds, plastics and synthetic rubber in primary forms
20.11	Manufacture of industrial gases
20.12	Manufacture of dyes and pigments
20.13	Manufacture of other inorganic basic chemicals
20.14	Manufacture of other organic basic chemicals
20.15	Manufacture of fertilizers and nitrogen compounds
20.16	Manufacture of plastics in primary forms
20.17	Manufacture of synthetic rubber in primary forms
20.2	Manufacture of pesticides and other agrochemical products
20.20	Manufacture of pesticides and other agrochemical products
20.3	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
20.30	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
20.4	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
20.41	Manufacture of soap and detergents, cleaning and polishing preparations
20.42	Manufacture of perfumes and toilet preparations
20.5	Manufacture of other chemical products
20.51	Manufacture of explosives

20.52	Manufacture of glues
20.53	Manufacture of essential oils
20.59	Manufacture of other chemical products n.e.c.
20.6	Manufacture of man-made fibres
20.60	Manufacture of man-made fibres
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
21.1	Manufacture of basic pharmaceutical products
21.10	Manufacture of basic pharmaceutical products
21.2	Manufacture of pharmaceutical preparations
21.20	Manufacture of pharmaceutical preparations
22	Manufacture of rubber and plastic products
22.1	Manufacture of rubber products
22.11	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres
22.19	Manufacture of other rubber products
22.2	Manufacture of plastic products
22.21	Manufacture of plastic plates, sheets, tubes, and profiles
22.22	Manufacture of plastic packing goods
22.23	Manufacture of builders' ware of plastic
22.29	Manufacture of other plastic products
23	Manufacture of other non-metallic mineral products
23.1	Manufacture of glass and glass products
23.11	Manufacture of flat glass
23.12	Shaping and processing of flat glass
23.13	Manufacture of hollow glass
23.14	Manufacture of glass fibres
23.19	Manufacture and processing of other glass, including technical glassware
23.2	Manufacture of refractory products
23.20	Manufacture of refractory products
23.3	Manufacture of clay building materials
23.31	Manufacture of ceramic tiles and flags
23.32	Manufacture of bricks, tiles and construction products, in baked clay
23.4	Manufacture of other porcelain and ceramic products
23.41	Manufacture of ceramic household and ornamental articles
23.42	Manufacture of ceramic sanitary fixtures
23.43	Manufacture of ceramic insulators and insulating fittings
23.44	Manufacture of other technical ceramic products
23.49	Manufacture of other ceramic products
23.5	Manufacture of cement, lime, and plaster
23.51	Manufacture of cement
23.52	Manufacture of lime and plaster
23.6	Manufacture of articles of concrete, cement, and plaster
23.61	Manufacture of concrete products for construction purposes
23.62	Manufacture of plaster products for construction purposes
23.63	Manufacture of ready-mixed concrete
23.64	Manufacture of mortars
23.65	Manufacture of fibre cement
23.69	Manufacture of other articles of concrete, plaster, and cement
23.7	Cutting, shaping, and finishing of stone
23.70	Cutting, shaping, and finishing of stone
23.9	Manufacture of abrasive products and non-metallic mineral products n.e.c.
23.91	Production of abrasive products
23.99	Manufacture of other non-metallic mineral products n.e.c.
24	Manufacture of basic metals
24.1	Manufacture of basic iron and steel and of ferro-alloys
24.10	Manufacture of basic iron and steel and of ferro-alloys

24.2	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel
24.20	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel
24.3	Manufacture of other products of first processing of steel
24.31	Cold drawing of bars
24.32	Cold rolling of narrow strip
24.33	Cold forming or folding
24.34	Cold drawing of wire
24.4	Manufacture of basic precious and other non-ferrous metals
24.41	Precious metals production
24.42	Aluminium production
24.43	Lead, zinc and tin production
24.44	Copper production
24.45	Other non-ferrous metal production
24.46	Processing of nuclear fuel
24.5	Casting of metals
24.51	Casting of iron
24.52	Casting of steel
24.53	Casting of light metals
24.54	Casting of other non-ferrous metals
25	Manufacture of fabricated metal products, except machinery and equipment
25.1	Manufacture of structural metal products
25.11	Manufacture of metal structures and parts of structures
25.12	Manufacture of doors and windows of metal
25.2	Manufacture of tanks, reservoirs, and containers of metal
25.21	Manufacture of central heating radiators and boilers
25.29	Manufacture of other tanks, reservoirs, and containers of metal
25.3	Manufacture of steam generators, except central heating hot water boilers
25.30	Manufacture of steam generators, except central heating hot water boilers
25.4	Manufacture of weapons and ammunition
25.40	Manufacture of weapons and ammunition
25.5	Forging, pressing, stamping and roll-forming of metal; powder metallurgy
25.50	Forging, pressing, stamping and roll-forming of metal; powder metallurgy
25.6	Treatment and coating of metals; machining
25.61	Treatment and coating of metals
25.62	Machining
25.7	Manufacture of cutlery, tools and general hardware
25.71	Manufacture of cutlery
25.72	Manufacture of locks and hinges
25.73	Manufacture of tools
25.9	Manufacture of other fabricated metal products
25.91	Manufacture of steel drums and similar containers
25.92	Manufacture of light metal packaging
25.93	Manufacture of wire products, chain and springs
25.94	Manufacture of fasteners and screw machine products
25.99	Manufacture of other fabricated metal products n.e.c.
26	Manufacture of computer, electronic and optical products
26.1	Manufacture of electronic components and boards
26.11	Manufacture of electronic components
26.12	Manufacture of loaded electronic boards
26.2	Manufacture of computers and peripheral equipment
26.20	Manufacture of computers and peripheral equipment
26.3	Manufacture of communication equipment
26.30	Manufacture of communication equipment
26.4	Manufacture of consumer electronics
26.40	Manufacture of consumer electronics

26.5	Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks
26.51	Manufacture of instruments and appliances for measuring, testing and navigation
26.52	Manufacture of watches and clocks
26.6	Manufacture of irradiation, electromedical and electrotherapeutic equipment
26.60	Manufacture of irradiation, electromedical and electrotherapeutic equipment
26.7	Manufacture of optical instruments and photographic equipment
26.70	Manufacture of optical instruments and photographic equipment
26.8	Manufacture of magnetic and optical media
26.80	Manufacture of magnetic and optical media
27	Manufacture of electrical equipment
27.1	Manufacture of electric motors, generators, transformers and electricity distribution, and control apparatus
27.11	Manufacture of electric motors, generators, and transformers
27.12	Manufacture of electricity distribution and control apparatus
27.2	Manufacture of batteries and accumulators
27.20	Manufacture of batteries and accumulators
27.3	Manufacture of wiring and wiring devices
27.31	Manufacture of fibre optic cables
27.32	Manufacture of other electronic and electric wires and cables
27.33	Manufacture of wiring devices
27.4	Manufacture of electric lighting equipment
27.40	Manufacture of electric lighting equipment
27.5	Manufacture of domestic appliances
27.51	Manufacture of electric domestic appliances
27.52	Manufacture of non-electric domestic appliances
27.9	Manufacture of other electrical equipment
27.90	Manufacture of other electrical equipment
28	Manufacture of machinery and equipment n.e.c.
28.1	Manufacture of general-purpose machinery
28.11	Manufacture of engines and turbines, except aircraft, vehicle, and cycle engines
28.12	Manufacture of fluid power equipment
28.13	Manufacture of other pumps and compressors
28.14	Manufacture of other taps and valves
28.15	Manufacture of bearings, gears, gearing and driving elements
28.2	Manufacture of other general-purpose machinery
28.21	Manufacture of ovens, furnaces and furnace burners
28.22	Manufacture of lifting and handling equipment
28.23	Manufacture of office machinery and equipment (except computers and peripheral equipment)
28.24	Manufacture of power-driven hand tools
28.25	Manufacture of non-domestic cooling and ventilation equipment
28.29	Manufacture of other general-purpose machinery n.e.c.
28.3	Manufacture of agricultural and forestry machinery
28.30	Manufacture of agricultural and forestry machinery
28.4	Manufacture of metal forming machinery and machine tools
28.41	Manufacture of metal forming machinery
28.49	Manufacture of other machine tools
28.9	Manufacture of other special-purpose machinery
28.91	Manufacture of machinery for metallurgy
28.92	Manufacture of machinery for mining, quarrying, and construction
28.93	Manufacture of machinery for food, beverage and tobacco processing
28.94	Manufacture of machinery for textile, apparel and leather production
28.95	Manufacture of machinery for paper and paperboard production
28.96	Manufacture of plastics and rubber machinery
28.99	Manufacture of other special-purpose machinery n.e.c.

29	Manufacture of motor vehicles, trailers, and semi-trailers
29.1	Manufacture of motor vehicles
29.10	Manufacture of motor vehicles
29.2	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
29.20	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
29.3	Manufacture of parts and accessories for motor vehicles
29.31	Manufacture of electrical and electronic equipment for motor vehicles
29.32	Manufacture of other parts and accessories for motor vehicles
30	Manufacture of other transport equipment
30.1	Building of ships and boats
30.11	Building of ships and floating structures
30.12	Building of pleasure and sporting boats
30.2	Manufacture of railway locomotives and rolling stock
30.20	Manufacture of railway locomotives and rolling stock
30.3	Manufacture of air and spacecraft and related machinery
30.30	Manufacture of air and spacecraft and related machinery
30.4	Manufacture of military fighting vehicles
30.40	Manufacture of military fighting vehicles
30.9	Manufacture of transport equipment n.e.c.
30.91	Manufacture of motorcycles
30.92	Manufacture of bicycles and invalid carriages
30.99	Manufacture of other transport equipment n.e.c.
31	Manufacture of furniture
31.0	Manufacture of furniture
31.01	Manufacture of office and shop furniture
31.02	Manufacture of kitchen furniture
31.03	Manufacture of mattresses
31.09	Manufacture of other furniture
32	Other manufacturing
32.1	Manufacture of jewellery, bijouterie and related articles
32.11	Striking of coins
32.12	Manufacture of jewellery and related articles
32.13	Manufacture of imitation jewellery and related articles
32.2	Manufacture of musical instruments
32.20	Manufacture of musical instruments
32.3	Manufacture of sports goods
32.30	Manufacture of sports goods
32.4	Manufacture of games and toys
32.40	Manufacture of games and toys
32.5	Manufacture of medical and dental instruments and supplies
32.50	Manufacture of medical and dental instruments and supplies
32.9	Manufacturing n.e.c.
32.91	Manufacture of brooms and brushes
32.99	Other manufacturing n.e.c.
33	Repair and installation of machinery and equipment
33.1	Repair of fabricated metal products, machinery and equipment
33.11	Repair of fabricated metal products
33.12	Repair of machinery
33.13	Repair of electronic and optical equipment
33.14	Repair of electrical equipment
33.15	Repair and maintenance of ships and boats
33.16	Repair and maintenance of aircraft and spacecraft
33.17	Repair and maintenance of other transport equipment
33.19	Repair of other equipment

33.2	Installation of industrial machinery and equipment
33.20	Installation of industrial machinery and equipment
D	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY
35	Electricity, gas, steam and air conditioning supply
35.1	Electric power generation, transmission and distribution
35.11	Production of electricity
35.12	Transmission of electricity
35.13	Distribution of electricity
35.14	Trade of electricity
35.2	Manufacture of gas; distribution of gaseous fuels through mains
35.21	Manufacture of gas
35.22	Distribution of gaseous fuels through mains
35.23	Trade of gas through mains
35.3	Steam and air conditioning supply
35.30	Steam and air conditioning supply
E	WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES
36	Water collection, treatment and supply
36.0	Water collection, treatment and supply
36.00	Water collection, treatment and supply
37	Sewerage
37.0	Sewerage
37.00	Sewerage
38	Waste collection, treatment and disposal activities; materials recovery
38.1	Waste collection
38.11	Collection of non-hazardous waste
38.12	Collection of hazardous waste
38.2	Waste treatment and disposal
38.21	Treatment and disposal of non-hazardous waste
38.22	Treatment and disposal of hazardous waste
38.3	Materials recovery
38.31	Dismantling of wrecks
38.32	Recovery of sorted materials
39	Remediation activities and other waste management services
39.0	Remediation activities and other waste management services
39.00	Remediation activities and other waste management services
F	CONSTRUCTION
41	Construction of buildings
41.1	Development of building projects
41.10	Development of building projects
41.2	Construction of residential and non-residential buildings
41.20	Construction of residential and non-residential buildings
42	Civil engineering
42.1	Construction of roads and railways
42.11	Construction of roads and motorways
42.12	Construction of railways and underground railways
42.13	Construction of bridges and tunnels
42.2	Construction of utility projects
42.21	Construction of utility projects for fluids
42.22	Construction of utility projects for electricity and telecommunications
42.9	Construction of other civil engineering projects
42.91	Construction of water projects
42.99	Construction of other civil engineering projects n.e.c.
43	Specialised construction activities
43.1	Demolition and site preparation

43.11	Demolition
43.12	Site preparation
43.13	Test drilling and boring
43.2	Electrical, plumbing and other construction installation activities
43.21	Electrical installation
43.22	Plumbing, heat and air-conditioning installation
43.29	Other construction installation
43.3	Building completion and finishing
43.31	Plastering
43.32	Joinery installation
43.33	Floor and wall covering
43.34	Painting and glazing
43.39	Other building completion and finishing
43.9	Other specialised construction activities
43.91	Roofing activities
43.99	Other specialised construction activities n.e.c.
G	WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES AND MOTORCYCLES
45	Wholesale and retail trade and repair of motor vehicles and motorcycles
45.1	Sale of motor vehicles
45.11	Sale of cars and light motor vehicles
45.19	Sale of other motor vehicles
45.2	Maintenance and repair of motor vehicles
45.20	Maintenance and repair of motor vehicles
45.3	Sale of motor vehicle parts and accessories
45.31	Wholesale trade of motor vehicle parts and accessories
45.32	Retail trade of motor vehicle parts and accessories
45.4	Sale, maintenance and repair of motorcycles and related parts and accessories
45.40	Sale, maintenance and repair of motorcycles and related parts and accessories
46	Wholesale trade, except motor vehicles and motorcycles
46.1	Wholesale on a fee or contract basis
46.11	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods
46.12	Agents involved in the sale of fuels, ores, metals and industrial chemicals
46.13	Agents involved in the sale of timber and building materials
46.14	Agents involved in the sale of machinery, industrial equipment, ships and aircraft
46.15	Agents involved in the sale of furniture, household goods, hardware and ironmongery
46.16	Agents involved in the sale of textiles, clothing, fur, footwear and leather goods
46.17	Agents involved in the sale of food, beverages and tobacco
46.18	Agents specialised in the sale of other particular products
46.19	Agents involved in the sale of a variety of goods
46.2	Wholesale of agricultural raw materials and live animals
46.21	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds
46.22	Wholesale of flowers and plants
46.23	Wholesale of live animals
46.24	Wholesale of hides, skins and leather
46.3	Wholesale of food, beverages and tobacco
46.31	Wholesale of fruit and vegetables
46.32	Wholesale of meat and meat products
46.33	Wholesale of dairy products, eggs and edible oils and fats
46.34	Wholesale of beverages
46.35	Wholesale of tobacco products
46.36	Wholesale of sugar and chocolate and sugar confectionery
46.37	Wholesale of coffee, tea, cocoa and spices
46.38	Wholesale of other food, including fish, crustaceans and molluscs
46.39	Non-specialised wholesale of food, beverages and tobacco

46.4	Wholesale of household goods
46.41	Wholesale of textiles
46.42	Wholesale of clothing and footwear
46.43	Wholesale of electrical household appliances
46.44	Wholesale of china and glassware and cleaning materials
46.45	Wholesale of perfume and cosmetics
46.46	Wholesale of pharmaceutical goods
46.47	Wholesale of furniture, carpets and lighting equipment
46.48	Wholesale of watches and jewellery
46.49	Wholesale of other household goods
46.5	Wholesale of information and communication equipment
46.51	Wholesale of computers, computer peripheral equipment and software
46.52	Wholesale of electronic and telecommunications equipment and parts
46.6	Wholesale of other machinery, equipment and supplies
46.61	Wholesale of agricultural machinery, equipment and supplies
46.62	Wholesale of machine tools
46.63	Wholesale of mining, construction and civil engineering machinery
46.64	Wholesale of machinery for the textile industry and of sewing and knitting machines
46.65	Wholesale of office furniture
46.66	Wholesale of other office machinery and equipment
46.69	Wholesale of other machinery and equipment
46.7	Other specialised wholesale
46.71	Wholesale of solid, liquid and gaseous fuels and related products
46.72	Wholesale of metals and metal ores
46.73	Wholesale of wood, construction materials and sanitary equipment
46.74	Wholesale of hardware, plumbing and heating equipment and supplies
46.75	Wholesale of chemical products
46.76	Wholesale of other intermediate products
46.77	Wholesale of waste and scrap
46.9	Non-specialised wholesale trade
46.90	Non-specialised wholesale trade
47	Retail trade, except motor vehicles and motorcycles
47.1	Retail sale in non-specialised stores
47.11	Retail sale in non-specialised stores with food, beverages or tobacco predominating
47.19	Other retail sale in non-specialised stores
47.2	Retail sale of food, beverages and tobacco in specialised stores
47.21	Retail sale of fruit and vegetables in specialised stores
47.22	Retail sale of meat and meat products in specialised stores
47.23	Retail sale of fish, crustaceans and molluscs in specialised stores
47.24	Retail sale of bread, cakes, flour confectionery and sugar confectionery in specialised stores
47.25	Retail sale of beverages in specialised stores
47.26	Retail sale of tobacco products in specialised stores
47.29	Other retail sale of food in specialised stores
47.3	Retail sale of automotive fuel in specialised stores
47.30	Retail sale of automotive fuel in specialised stores
47.4	Retail sale of information and communication equipment in specialised stores
47.41	Retail sale of computers, peripheral units and software in specialised stores
47.42	Retail sale of telecommunications equipment in specialised stores
47.43	Retail sale of audio and video equipment in specialised stores
47.5	Retail sale of other household equipment in specialised stores
47.51	Retail sale of textiles in specialised stores
47.52	Retail sale of hardware, paints and glass in specialised stores
47.53	Retail sale of carpets, rugs, wall and floor coverings in specialised stores
47.54	Retail sale of electrical household appliances in specialised stores

47.59	Retail sale of furniture, lighting equipment and other household articles in specialised stores
47.6	Retail sale of cultural and recreation goods in specialised stores
47.61	Retail sale of books in specialised stores
47.62	Retail sale of newspapers and stationery in specialised stores
47.63	Retail sale of music and video recordings in specialised stores
47.64	Retail sale of sporting equipment in specialised stores
47.65	Retail sale of games and toys in specialised stores
47.7	Retail sale of other goods in specialised stores
47.71	Retail sale of clothing in specialised stores
47.72	Retail sale of footwear and leather goods in specialised stores
47.73	Dispensing chemist in specialised stores
47.74	Retail sale of medical and orthopaedic goods in specialised stores
47.75	Retail sale of cosmetic and toilet articles in specialised stores
47.76	Retail sale of flowers, plants, seeds, fertilisers, pet animals and pet food in specialised stores
47.77	Retail sale of watches and jewellery in specialised stores
47.78	Other retail sale of new goods in specialised stores
47.79	Retail sale of second-hand goods in stores
47.8	Retail sale via stalls and markets
47.81	Retail sale via stalls and markets of food, beverages and tobacco products
47.82	Retail sale via stalls and markets of textiles, clothing and footwear
47.89	Retail sale via stalls and markets of other goods
47.9	Retail trade not in stores, stalls or markets
47.91	Retail sale via mail order houses or via Internet
47.99	Other retail sale not in stores, stalls or markets
H	TRANSPORTATION AND STORAGE
49	Land transport and transport via pipelines
49.1	Passenger rail transport, interurban
49.10	Passenger rail transport, interurban
49.2	Freight rail transport
49.20	Freight rail transport
49.3	Other passenger land transport
49.31	Urban and suburban passenger land transport
49.32	Taxi operation
49.39	Other passenger land transport n.e.c.
49.4	Freight transport by road and removal services
49.41	Freight transport by road
49.42	Removal services
49.5	Transport via pipeline
49.50	Transport via pipeline
50	Water transport
50.1	Sea and coastal passenger water transport
50.10	Sea and coastal passenger water transport
50.2	Sea and coastal freight water transport
50.20	Sea and coastal freight water transport
50.3	Inland passenger water transport
50.30	Inland passenger water transport
50.4	Inland freight water transport
50.40	Inland freight water transport
51	Air transport
51.1	Passenger air transport
51.10	Passenger air transport
51.2	Freight air transport and space transport
51.21	Freight air transport
51.22	Space transport

52	Warehousing and support activities for transportation
52.1	Warehousing and storage
52.10	Warehousing and storage
52.2	Support activities for transportation
52.21	Service activities incidental to land transportation
52.22	Service activities incidental to water transportation
52.23	Service activities incidental to air transportation
52.24	Cargo handling
52.29	Other transportation support activities
53	Postal and courier activities
53.1	Postal activities under universal service obligation
53.10	Postal activities under universal service obligation
53.2	Other postal and courier activities
53.20	Other postal and courier activities
I	ACCOMMODATION AND FOOD SERVICE ACTIVITIES
55	Accommodation
55.1	Hotels and similar accommodation
55.10	Hotels and similar accommodation
55.2	Holiday and other short-stay accommodation
55.20	Holiday and other short-stay accommodation
55.3	Camping grounds, recreational vehicle parks and trailer parks
55.30	Camping grounds, recreational vehicle parks and trailer parks
55.9	Other accommodation
55.90	Other accommodation
56	Food and beverage service activities
56.1	Restaurants and mobile food service activities
56.10	Restaurants and mobile food service activities
56.2	Event catering and other food service activities
56.21	Event catering activities
56.29	Other food service activities
56.3	Beverage serving activities
56.30	Beverage serving activities
J	INFORMATION AND COMMUNICATION
58	Publishing activities
58.1	Publishing of books, periodicals and other publishing activities
58.11	Book publishing
58.12	Publishing of directories and mailing lists
58.13	Publishing of newspapers
58.14	Publishing of journals and periodicals
58.19	Other publishing activities
58.2	Software publishing
58.21	Publishing of computer games
58.29	Other software publishing
59	Motion picture, video and television programme production, sound recording and music publishing activities
59.1	Motion picture, video and television programme activities
59.11	Motion picture, video and television programme production activities
59.12	Motion picture, video and television programme post-production activities
59.13	Motion picture, video and television programme distribution activities
59.14	Motion picture projection activities
59.2	Sound recording and music publishing activities
59.20	Sound recording and music publishing activities
60	Programming and broadcasting activities
60.1	Radio broadcasting
60.10	Radio broadcasting

60.2	Television programming and broadcasting activities
60.20	Television programming and broadcasting activities
61	Telecommunications
61.1	Wired telecommunications activities
61.10	Wired telecommunications activities
61.2	Wireless telecommunications activities
61.20	Wireless telecommunications activities
61.3	Satellite telecommunications activities
61.30	Satellite telecommunications activities
61.9	Other telecommunications activities
61.90	Other telecommunications activities
62	Computer programming, consultancy and related activities
62.0	Computer programming, consultancy and related activities
62.01	Computer programming activities
62.02	Computer consultancy activities
62.03	Computer facilities management activities
62.09	Other information technology and computer service activities
63	Information service activities
63.1	Data processing, hosting and related activities; web portals
63.11	Data processing, hosting and related activities
63.12	Web portals
63.9	Other information service activities
63.91	News agency activities
63.99	Other information service activities n.e.c.
K	FINANCIAL AND INSURANCE ACTIVITIES
64	Financial service activities, except insurance and pension funding
64.1	Monetary intermediation
64.11	Central banking
64.19	Other monetary intermediation
64.2	Activities of holding companies
64.20	Activities of holding companies
64.3	Trusts, funds and similar financial entities
64.30	Trusts, funds and similar financial entities
64.9	Other financial service activities, except insurance and pension funding
64.91	Financial leasing
64.92	Other credit granting
64.99	Other financial service activities, except insurance and pension funding n.e.c.
65	Insurance, reinsurance and pension funding, except compulsory social security
65.1	Insurance
65.11	Life insurance
65.12	Non-life insurance
65.2	Reinsurance
65.20	Reinsurance
65.3	Pension funding
65.30	Pension funding
66	Activities auxiliary to financial services and insurance activities
66.1	Activities auxiliary to financial services, except insurance and pension funding
66.11	Administration of financial markets
66.12	Security and commodity contracts brokerage
66.19	Other activities auxiliary to financial services, except insurance and pension funding
66.2	Activities auxiliary to insurance and pension funding
66.21	Risk and damage evaluation
66.22	Activities of insurance agents and brokers
66.29	Other activities auxiliary to insurance and pension funding
66.3	Fund management activities

66.30	Fund management activities
L	REAL ESTATE ACTIVITIES
68	Real estate activities
68.1	Buying and selling of own real estate
68.10	Buying and selling of own real estate
68.2	Renting and operating of own or leased real estate
68.20	Renting and operating of own or leased real estate
68.3	Real estate activities on a fee or contract basis
68.31	Real estate agencies
68.32	Management of real estate on a fee or contract basis
M	PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES
69	Legal and accounting activities
69.1	Legal activities
69.10	Legal activities
69.2	Accounting, bookkeeping and auditing activities; tax consultancy
69.20	Accounting, bookkeeping and auditing activities; tax consultancy
70	Activities of head offices; management consultancy activities
70.1	Activities of head offices
70.10	Activities of head offices
70.2	Management consultancy activities
70.21	Public relations and communication activities
70.22	Business and other management consultancy activities
71	Architectural and engineering activities; technical testing and analysis
71.1	Architectural and engineering activities and related technical consultancy
71.11	Architectural activities
71.12	Engineering activities and related technical consultancy
71.2	Technical testing and analysis
71.20	Technical testing and analysis
72	Scientific research and development
72.1	Research and experimental development on natural sciences and engineering
72.11	Research and experimental development on biotechnology
72.19	Other research and experimental development on natural sciences and engineering
72.2	Research and experimental development on social sciences and humanities
72.20	Research and experimental development on social sciences and humanities
73	Advertising and market research
73.1	Advertising
73.11	Advertising agencies
73.12	Media representation
73.2	Market research and public opinion polling
73.20	Market research and public opinion polling
74	Other professional, scientific and technical activities
74.1	Specialised design activities
74.10	Specialised design activities
74.2	Photographic activities
74.20	Photographic activities
74.3	Translation and interpretation activities
74.30	Translation and interpretation activities
74.9	Other professional, scientific and technical activities n.e.c.
74.90	Other professional, scientific and technical activities n.e.c.
75	Veterinary activities
75.0	Veterinary activities
75.00	Veterinary activities
N	ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES
77	Rental and leasing activities
77.1	Renting and leasing of motor vehicles

77.11	Renting and leasing of cars and light motor vehicles
77.12	Renting and leasing of trucks
77.2	Renting and leasing of personal and household goods
77.21	Renting and leasing of recreational and sports goods
77.22	Renting of video tapes and disks
77.29	Renting and leasing of other personal and household goods
77.3	Renting and leasing of other machinery, equipment and tangible goods
77.31	Renting and leasing of agricultural machinery and equipment
77.32	Renting and leasing of construction and civil engineering machinery and equipment
77.33	Renting and leasing of office machinery and equipment (including computers)
77.34	Renting and leasing of water transport equipment
77.35	Renting and leasing of air transport equipment
77.39	Renting and leasing of other machinery, equipment and tangible goods n.e.c.
77.4	Leasing of intellectual property and similar products, except copyrighted works
77.40	Leasing of intellectual property and similar products, except copyrighted works
78	Employment activities
78.1	Activities of employment placement agencies
78.10	Activities of employment placement agencies
78.2	Temporary employment agency activities
78.20	Temporary employment agency activities
78.3	Other human resources provision
78.30	Other human resources provision
79	Travel agency, tour operator and other reservation service and related activities
79.1	Travel agency and tour operator activities
79.11	Travel agency activities
79.12	Tour operator activities
79.9	Other reservation service and related activities
79.90	Other reservation service and related activities
80	Security and investigation activities
80.1	Private security activities
80.10	Private security activities
80.2	Security systems service activities
80.20	Security systems service activities
80.3	Investigation activities
80.30	Investigation activities
81	Services to buildings and landscape activities
81.1	Combined facilities support activities
81.10	Combined facilities support activities
81.2	Cleaning activities
81.21	General cleaning of buildings
81.22	Other building and industrial cleaning activities
81.29	Other cleaning activities
81.3	Landscape service activities
81.30	Landscape service activities
82	Office administrative, office support and other business support activities
82.1	Office administrative and support activities
82.11	Combined office administrative service activities
82.19	Photocopying, document preparation and other specialised office support activities
82.2	Activities of call centres
82.20	Activities of call centres
82.3	Organisation of conventions and trade shows
82.30	Organisation of conventions and trade shows
82.9	Business support service activities n.e.c.
82.91	Activities of collection agencies and credit bureaus
82.92	Packaging activities

82.99	Other business support service activities n.e.c.
O	PUBLIC ADMINISTRATION AND DEFENCE; COMPULSORY SOCIAL SECURITY
84	Public administration and defence; compulsory social security
84.1	Administration of the State and the economic and social policy of the community
84.11	General public administration activities
84.12	Regulation of the activities of providing health care, education, cultural services and other social services, excluding social security
84.13	Regulation of and contribution to more efficient operation of businesses
84.2	Provision of services to the community as a whole
84.21	Foreign affairs
84.22	Defence activities
84.23	Justice and judicial activities
84.24	Public order and safety activities
84.25	Fire service activities
84.3	Compulsory social security activities
84.30	Compulsory social security activities
P	EDUCATION
85	Education
85.1	Pre-primary education
85.10	Pre-primary education
85.2	Primary education
85.20	Primary education
85.3	Secondary education
85.31	General secondary education
85.32	Technical and vocational secondary education
85.4	Higher education
85.41	Post-secondary non-tertiary education
85.42	Tertiary education
85.5	Other education
85.51	Sports and recreation education
85.52	Cultural education
85.53	Driving school activities
85.59	Other education n.e.c.
85.6	Educational support activities
85.60	Educational support activities
Q	HUMAN HEALTH AND SOCIAL WORK ACTIVITIES
86	Human health activities
86.1	Hospital activities
86.10	Hospital activities
86.2	Medical and dental practice activities
86.21	General medical practice activities
86.22	Specialist medical practice activities
86.23	Dental practice activities
86.9	Other human health activities
86.90	Other human health activities
87	Residential care activities
87.1	Residential nursing care activities
87.10	Residential nursing care activities
87.2	Residential care activities for mental retardation, mental health and substance abuse
87.20	Residential care activities for mental retardation, mental health and substance abuse
87.3	Residential care activities for the elderly and disabled
87.30	Residential care activities for the elderly and disabled
87.9	Other residential care activities
87.90	Other residential care activities
88	Social work activities without accommodation

88.1	Social work activities without accommodation for the elderly and disabled
88.10	Social work activities without accommodation for the elderly and disabled
88.9	Other social work activities without accommodation
88.91	Child day-care activities
88.99	Other social work activities without accommodation n.e.c.
R	ARTS, ENTERTAINMENT AND RECREATION
90	Creative, arts and entertainment activities
90.0	Creative, arts and entertainment activities
90.01	Performing arts
90.02	Support activities to performing arts
90.03	Artistic creation
90.04	Operation of arts facilities
91	Libraries, archives, museums and other cultural activities
91.0	Libraries, archives, museums and other cultural activities
91.01	Library and archives activities
91.02	Museums activities
91.03	Operation of historical sites and buildings and similar visitor attractions
91.04	Botanical and zoological gardens and nature reserves activities
92	Gambling and betting activities
92.0	Gambling and betting activities
92.00	Gambling and betting activities
93	Sports activities and amusement and recreation activities
93.1	Sports activities
93.11	Operation of sports facilities
93.12	Activities of sports clubs
93.13	Fitness facilities
93.19	Other sports activities
93.2	Amusement and recreation activities
93.21	Activities of amusement parks and theme parks
93.29	Other amusement and recreation activities
S	OTHER SERVICE ACTIVITIES
94	Activities of membership organisations
94.1	Activities of business, employers and professional membership organisations
94.11	Activities of business and employers membership organisations
94.12	Activities of professional membership organisations
94.2	Activities of trade unions
94.20	Activities of trade unions
94.9	Activities of other membership organisations
94.91	Activities of religious organisations
94.92	Activities of political organisations
94.99	Activities of other membership organisations n.e.c.
95	Repair of computers and personal and household goods
95.1	Repair of computers and communication equipment
95.11	Repair of computers and peripheral equipment
95.12	Repair of communication equipment
95.2	Repair of personal and household goods
95.21	Repair of consumer electronics
95.22	Repair of household appliances and home and garden equipment
95.23	Repair of footwear and leather goods
95.24	Repair of furniture and home furnishings
95.25	Repair of watches, clocks and jewellery
95.29	Repair of other personal and household goods
96	Other personal service activities
96.0	Other personal service activities
96.01	Washing and (dry-)cleaning of textile and fur products

96.02	Hairdressing and other beauty treatment
96.03	Funeral and related activities
96.04	Physical well-being activities
96.09	Other personal service activities n.e.c.
T	ACTIVITIES OF HOUSEHOLDS AS EMPLOYERS; UNDIFFERENTIATED GOODS- AND SERVICES-PRODUCING ACTIVITIES OF HOUSEHOLDS FOR OWN USE
97	Activities of households as employers of domestic personnel
97.0	Activities of households as employers of domestic personnel
97.00	Activities of households as employers of domestic personnel
98	Undifferentiated goods- and services-producing activities of private households for own use
98.1	Undifferentiated goods-producing activities of private households for own use
98.10	Undifferentiated goods-producing activities of private households for own use
98.2	Undifferentiated service-producing activities of private households for own use
98.20	Undifferentiated service-producing activities of private households for own use
U	ACTIVITIES OF EXTRATERRITORIAL ORGANISATIONS AND BODIES
99	Activities of extraterritorial organisations and bodies
99.0	Activities of extraterritorial organisations and bodies
99.00	Activities of extraterritorial organisations and bodies

Appendix 2

NUTS 2 Region Codes

Region Code	NUTS1 Region Name	Region Code	NUTS2 Region Name
TR1	İstanbul	TR10	İstanbul
TR2	Batı Marmara	TR21	Tekirdağ, Edirne, Kırklareli
		TR22	Balıkesir, Çanakkale
TR3	Ege	TR31	İzmir
		TR32	Aydın, Denizli, Muğla
		TR33	Manisa, Afyon, Kütahya, Uşak
TR4	Doğu Marmara	TR41	Bursa, Eskişehir, Bilecik
		TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova
TR5	Batı Anadolu	TR51	Ankara
		TR52	Konya, Karaman
TR6	Akdeniz	TR61	Antalya, Isparta, Burdur
		TR62	Adana, Mersin
		TR63	Hatay, Kahramanmaraş, Osmaniye
TR7	Orta Anadolu	TR71	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir
		TR72	Kayseri, Sivas, Yozgat
TR8	Batı Karadeniz	TR81	Zonguldak, Karabük, Bartın
		TR82	Kastamonu, Çankırı, Sinop
		TR83	Samsun, Tokat, Çorum, Amasya
TR9	Doğu Karadeniz	TR90	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane
TRA	Kuzeydoğu Anadolu	TRA1	Erzurum, Erzincan, Bayburt
		TRA2	Ağrı, Kars, Iğdır, Ardahan
TRB	Ortadoğu Anadolu	TRB1	Malatya, Elazığ, Bingöl, Tunceli
		TRB2	Van, Muş, Bitlis, Hakkari
TRC	Güneydoğu Anadolu	TRC1	Gaziantep, Adıyaman, Kilis
		TRC2	Şanlıurfa, Diyarbakır
		TRC3	Mardin, Batman, Şırnak, Siirt