PART I

Collecting, Preparing and Checking the Data

This first part of the book synthesizes the founding steps of the statistical analysis, those leading to the construction of a data-set meeting the necessary quality requirements.

Chapter 1 reviews the basic measurement issues and the elemental tools for measuring constructs whose quantification are not straightforward measurement scales. It also introduces the distinction between metric (scale) and non-metric (nominal or ordinal) variables and the concept of error, central to statistical theories. Finally, it presents two sample data-sets which are used for examples throughout the book, together with a short review of the most popular statistical packages for data analysis. The distinction between secondary and primary data is explored in **chapter 2** and **chapter 3** respectively. **Chapter 2** deals with the use of secondary data, that is, information not explicitly collected for the purpose of the research, and explores the main available sources for secondary data relevant to consumer and marketing research, bringing examples of official consumer surveys in the UK, Europe and the US. **Chapter 3** gets into the process of primary data collection and provides a synthesis of the main steps of the data collection process, with an overview of planning and field work issues. This chapter emphasizes the role of non-random errors in collecting data as compared to random errors. **Chapter 4** moves a step forward and begins with the applied work. First, an overview of data quality issues, diagnostics and some solutions is provided, with a special emphasis on missing data and outlier problems. Then, with the aid of the SPSS examples based on the two sample data-sets, it illustrates some graphical and tabular techniques for an initial description of the data-set.

CHAPTER 1

Measurement, Errors and Data for Consumer Research

THIS CHAPTER reviews the key measurement and data collection issues to lay the foundation for the statistical analysis of consumer and marketing data. Measurement is inevitably affected by errors and difficulties, especially when the objects of measurement are persons and their psychological traits, relevant to consumer behavior. The chapter looks at the distinction between systematic and random sources of error, then presents the main measurement scales and discusses the concept of latent dimension for objects – like quality – that cannot be defined or measured in an unequivocal way. Finally, this chapter introduces the two data-sets exploited for applied examples throughout the book and briefly reviews the main statistical packages commonly used in consumer and marketing research.

Section 1.1 introduces the problem of measurement in relation to consumer research
Section 1.2 introduces the fundamental measurement scales and data types
Section 1.3 presents the two data-set used in applied examples throughout the book
Section 1.4 provides a brief overview of commercial software for data analysis

THREE LEARNING OUTCOMES

This chapter enables the reader to:

- Focus on the main problems in measuring objects and collecting data nl1
- Review the key data types and measurement scales
- Be introduced to the data-sets and statistical packages used later in the book

PRELIMINARY KNOWLEDGE: It is advisable to review the basic probabilistic concepts described in the appendix, with particular attention to frequency and probability distributions and the normal curve.

1.1 Measuring the world (of consumers): the problem of measurement

Measuring the World is the title of an enjoyable novel built upon the lives of the most famous of statisticians, Carl Friedrich Gauss, and Alexander von Humboldt, the naturalist and explorer who founded biogeography.[1] The two scientists have something in common besides their German roots: they both devoted their lives to the problem of measuring objects. Interestingly, the novel portraits Gauss as a quite unsociable mathematician who preferred working at home with numbers, while von Humboldt was traveling around Latin America and Europe with his instruments to measure scientifically lands and animal species. Consumer research needs good measurement and a bit of both personalities, that is, some 'unsociable' math and hard field work. These ingredients can create good marketing intelligence. The good news is that both scientific celebrities were successful with money … in the sense that their faces ended up on German banknotes.

This chapter lays the foundations for reading the rest of the textbook. While the math is kept to a minimum, those readers willing to refresh or familiarize with the key mathematical notation and the basic concepts of matrix algebra, probability and statistics are invited to read the appendix, which should help them get a better grasp of the more complex concepts discussed in the rest of the textbook.

However, before getting into quantification and data analysis, it is probably useful to go back to the origin of data and think about the object of measurement and the final purpose of consumer and marketing research. There are several definitions of marketing. A widely used one is that adopted by the Chartered Institute of Marketing (CIM), which states that 'Marketing is the management process which identifies, anticipates, and supplies customer requirements efficiently and profitably.'

Little more is required to show how consumer research is the foundation of any marketing activity. While in the CIM definition the target is the customer, the focus here is rather on consumers in general, as one might argue that customers are only a subset of consumers. Politically correct language is now even suggesting that the term citizen should be preferred, although few publishers would consider a title on citizen research.

As a matter of fact, consumer research should ideally be able to explore even those behaviors and attitudes which consumers are not even consciously considering at the time of the study. The basis of product innovation is to create something which will be welcome by those consumers who are not yet customers.

Let us take one of the controversial topics in current consumer research – genetically-modified foods. This is one of the biggest challenges for those who want to measure and predict behavior relying on a scientific approach. What is the value of asking someone an opinion, an attitude or a statement on purchasing intentions for something which they don't know or – in many circumstances – does not even exist? Are there procedures to ensure that the collected data is not completely useless? What is the point of running complex statistical analysis on huge samples if the single data in itself has little meaning?

A well-known example of consumer research failure is the New Coke case in 1985 (see Gelb and Gelb, 1986), when Coca Cola proposed a new formula based on blind sensory tests on 200,000 consumers, testing preferences versus Old Coke and Pepsi. Since tests were blind, research ignored the role of brand image and failed to predict consumer reaction, which was a wide rejection of the new product in favor of the old one, so that Coca Cola had to go back to a single product after 77 days, with a

cost $35 billion. While some conspiracy theorist argue that the New Coke case was a successful marketing move to strengthen brand loyalty, this is an unlikely justification for the waste of resources in running the consumer research.

This sort of failure is one of the preferred arguments for those researchers who advocate qualitative research methods over quantitative and statistically-based consumer research.

While this whole textbook argues that only probability and rigorous statistics allow generalization of results from a sample to the target population, it is difficult to deny that 'ten thousand times nothing is still nothing' and big representative samples are useless if not misleading when the collected information is not appropriate.

1.1.1 Issues in measurement

Take this book, get a ruler and measure the width of the cover of this book. Repeat the exercise 20 times and write down the measurements. Then get a different instrument, a folding rule, and measure the book width again for 20 times. It would be surprising if you had *exactly* the same measurement 40 times, especially when your instruments are slightly different. More precise instruments and higher target precisions of the measure make it less likely that all observations return the same measure. There may be different reasons for this, for example a slightly different inclination of the ruler, an error in reading the measure or a minor difference between the ruler and the folding rule. Measuring objects is not that straightforward.

Things get much more complicated when the objects of measurement are persons or their tastes, attitudes, beliefs … Needless to say, it might be a waste of time to run complex statistical methods on badly measured information.

The key point here is that empirical measurements and the characteristics being measured are different things, although they are related. *Measurement* is usually defined as the assignment of numerals to objects or events according to rules (Stevens, 1946). Thus, a transparent solution to the problem of measuring requires a clear and explicit definition of the measurement rule including its mathematical and statistical properties. The rule is usually defined as the *scale of measurement*.

Before getting into the discussion of measurement scales, it is worth looking at other aspects of measurement theory, those more directly related with the statistical foundation of this book. For example, before using any statistical methodologies one should carefully check whether it is appropriate (Stevens use the word 'permissible') for a given measurement rule. Another issue which follows from the initial example of this section regards the relationship between *measurement* and *reality*, with an eye at the concepts of precision and accuracy. While at a first glance it might look like a purely philosophical issue, the question is whether 'numbers are real' is quite important to obtain meaningful results from data analysis. For example, take a measurement of attitude toward math taken in three different years on a class of first-year undergraduates. If the measured value increases over time, does it mean that first-year students increasingly like math?

This example draws a line between the contributions of measurement and statistical theory to the knowledge of reality. On the one hand, more accurate measurements lead to better research conclusions. On the other hand, statistics is needed to deal with measurement error (unavoidable, to some extent), to generalize measurements taken on samples and to explore relationship among different measurements.

1.1.2 Errors and randomness

Measuring objects is a big step toward learning about a phenomenon, but statistics can further increase the value of the collected data. Statistics helps through two main routes: dealing with *errors* and *inference.*

It should be clear from the first paragraphs of this chapter that measurements are subject to errors, for many reasons. Consider again the example of the width of this book's cover.

Even if the width is a constant, as it is not supposed to change unless something bad happens to the book, it is likely to get different measures over 40 attempts. In other words, our measures are an approximation of the true measure.

Errors in measurement are potentially made of two main components, a systematic error and a random error. In other words, each measure can be expressed as:

$$empirical\ measure = true\ value + systematic\ error + random\ error$$

A *systematic error* is a bias in measurement which makes each of the measures systematically too high or too low. For example, suppose the ruler used to measure the width of the book is made of a material which is sensitive to humidity. In very humid days it becomes slightly longer, so that it reads 10 centimeters when the actual measure is 10.1 centimeters. Measures taken in humid days are subject to a systematic downward bias. There are several potential sources of systematic errors in consumer research; some of them are discussed in relation to survey and data collection (see chapter 3). For example, if a lecturer asks students how much they enjoyed the lecture on a scale between 1 and 9, using a non-anonymous questionnaire, it is quite likely that responses will show a systematic upward bias. Ignoring systematic errors can have dramatic effects on the quality of research, but it is quite difficult to identify them after the data have been collected. Thus, countermeasures should be taken before running a survey, as discussed in chapter 3.

Instead, *random errors* are fluctuations which do not follow any systematic direction, but are due to factors that act in a random fashion. For example, small changes in the inclination of the ruler can lead to differences in measurements, in either direction. A consumer asked to rate the taste of a cheese, could give different ratings depending on how much time has elapsed since last meal. Luckily, randomness is never a problem for statisticians. The idea (further discussed in chapter 5) is that across a sufficiently large sample positive random errors compensate negative random errors, so that a sum of all random errors would be zero. This is a key point for dealing with errors – while with a single measurement it is not possible to quantify the amount of random error, over multiple measurements the 'average' (or total) random error would be zero. This means that the sample mean is the best possible measure for the true value, provided that there are no systematic errors.

This open the way to the foundation of the statistical theory of errors and its key element: the normal (or Gaussian) curve. The normal curve is the probability distribution representing perfect randomness around a mean value and is bell-shaped. The larger are the random errors (less precise measurements), the flatter is the bell-shaped curve.

All of the methods discussed in this book deal with normal distributions in some way, but they play a major role especially in sampling theory (see chapter 5) and hypothesis testing (see chapter 6). At this point, before familiarizing with the normal curve, those who feel little familiarity with the essential statistical and probability concepts are advised to have a look at the appendix.

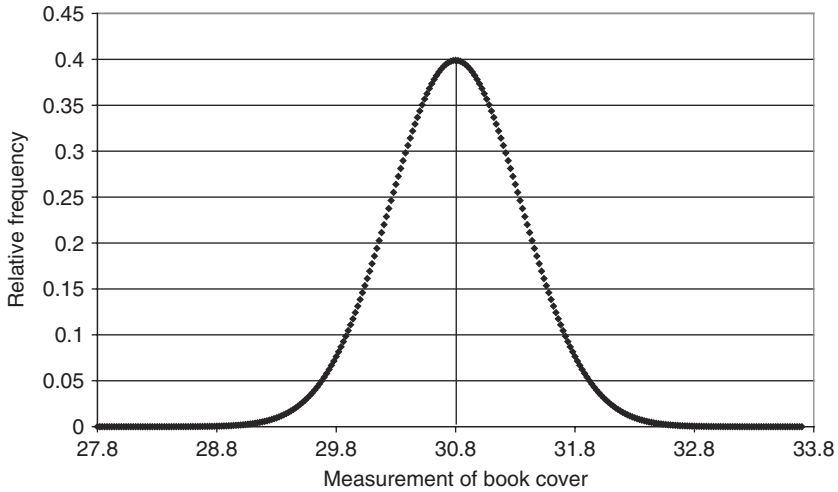


Figure 1.1 *Measurement error and the normal distribution*

Consider error theory again and the example on the width of the book cover. Suppose the 'true' width is 30.8 centimeters and that some 100,000 measurements were made. By plotting the relative frequencies on a graph, with the measurements on the horizontal axis and their relative frequencies on the vertical axis, according to error theory the resulting graph should look as the one in figure 1.1

This is the shape of a normal distribution. The average value (30.8 cm) is also the most likely one and – provided there are no systematic errors – corresponds to the true value.

As one moves away from the mean value, probability decreases symmetrically. Thus the probability of committing a 1 cm error in excess is equal to the probability of a 1 cm error in defect. Besides error, the normal curve may well represent the influence of other random factors (see appendix).

1.2 Measurement scales and latent dimensions

The Oxford English Dictionary defines measurement as 'A dimension ascertained by measuring; a magnitude, quantity, or extent calculated by the application of an instrument or device marked in standard units.' It is an interesting definition, as it relates to a *latent dimension* and some sort of instrument which translates that dimension into some standardized unit. The latent dimension is real and unique, measurement is artificial and not unique. Thus, the researcher may choose the instrument for translating the latent dimension into units. A *latent* dimension or construct is something which can not be defined and measured in an unequivocal and verifiable way. For example, any consumer would recognize in products and services a quality dimension, and some products are of better quality than others. However, the quality dimension of a product is latent, since it is impossible to quantify the quality content of a product with a single and objective measure. While quality is a clear example, one may argue that also the width of this book's cover could be a latent dimension. Without a perfect measurement instrument, if 40 measures are taken and there is some variability, how can one decide which one is the true and real one?

Thus, measurement is first needed to ascertain this dimension. Then – as it is shown later in this book – statistical methods can help in guessing the true latent dimension.

The basic distinction is between *qualitative* or *non-metric* scales (not allowing for mathematical operations) and *quantitative* or *metric* scales, but these two categories can be further split in the four main typologies of measurement scales. These were developed in 1940 by a committee of nineteen scientists who worked for almost eight years to report on measuring human sensations.

Qualitative scales are further divided into:

- *Nominal*, which only requires nominal assignment to a specific class. The basic empirical operation is checking whether two elements are equal (they belong to the same class) or different (they belong to different classes), but no ranking or distance measurement is possible. For example, the job type is usually measured through a nominal scale; and
- *Ordinal*, where classes can be ranked according to some criterion and it becomes possible to determine which class is greater and which is smaller, albeit no distance measurement is possible. This also includes variables which are ordered by nature. For example, consumer perception of quality is usually measured through ordinal scales and consumer may be asked to rate the quality of a product with an integer between 1 (very poor quality) and 9 (top quality). This is the case of Likert scales, discussed below. Otherwise, the respondent can rank-order several products in terms of perceived quality. In terms of basic operations, besides equality, it is possible to perform ranking operations (smaller than, greater than).

Although this distinction is rarely relevant to consumer research, quantitative scales can be split into:

- *Interval scales*, where the distance between two points is meaningful, but there is no absolute reference point which can be set conventionally and the measurement units likewise. Temperature is the typical example. Whatever the measurement unit (Fahrenheit or Celsius), it is possible to say that the temperature change (distance) between today and yesterday is twice the temperature change of the day before. But if one says that today's temperature is twice yesterdays, this is not independent from the measurement unit. Besides equality and ranking,

BOX 1.1 *Types of variables in SPSS*

To avoid some confusion that might arise from the interchangeable use of terms like qualitative, categorical and non-metric variables, it is useful to review the classification employed in SPSS.

The key distinction is on the MEASURE of the variables. Three types exist:

(a) SCALE variables (which correspond to *quantitative* and *metric*);
(b) NOMINAL variables (a sub-group of *qualitative* or *non-metric* variables also called *categorical* which includes those variables whose categories cannot be ordered); and
(c) ORDINAL variables (which completes the set of *qualitative* or *non-metric* variables for those categories that can be ranked).

it is possible to compute relative differences, hence calculating the variability measures discussed later in this chapter; and

- *Ratio scale,* where an absolute and natural reference point (zero) exists. This applies to most quantitative variables (height, weight, monetary, etc.). Different measurement units (for example currencies) are still possible, but if I say that today my wallet contains half of the money I had yesterday, this sentence is meaningful whatever the currency used. It is called ratio scale, because it is possible to perform ratios between two measures and this ratio will be the same independently by the measurement unit. Hence, besides equality and ranking relative differences it is also possible to compute ratios.

This primary classification does not solve the many problems in quantifying latent constructs. These are very common in consumer and marketing research, especially when dealing with psychographics, lifestyle or attitude measurements (see chapter 3). The scaling techniques are usually classified as *comparative* or *non-comparative*, where the former require relative comparison between objects and the latter rely on individual assessment for each of the objects.

1.2.1 Comparative scaling

The basic comparative scaling technique is based on *pairwise comparison*, where the respondent simply chooses between two alternatives according to some ordinal criterion. If transitivity exists, by means of paired comparisons one may obtain the ranking of three or more objects.[2] Another approach to measuring attitudes is given by *Guttman scaling*, where the same concept is expressed at different and ranked level of intensity in several questions. For example one might elicit attitudes toward chocolate with 3 questions – (a) 'I adore chocolate,' (b) 'Chocolate is good,' (c) 'I don't mind eating chocolate,' asking whether they agree or not with the sentence. Those who agree with (a) are expected to agree with (b) and (c), those that disagree with (a) but agree with (b) are expected to agree with (c) too. The design can be more complex with more intensity levels and provides to measure the intensity of an attitude through a set of binary questions.

If the respondent is asked to rank more than two items simultaneously, the measurement scale is called *rank order scale* and returns an ordinal variable. This scale is especially useful when one wants to rank products according to perceptions of their single attributes. *Constant sum scaling* is based on the allocation of a constant sum to each object within the set of alternatives. For example, a respondent may be asked to allocate 100 points into the relevance of each of a set of product attributes when choosing whether to buy it or not. In other words, the question requires giving a relative weight to each of the attributes. It is not advisable to use the resulting variable as a quantitative one, because of the many bias involved in allocating sums, but the outcome can be exploited as an ordinal variable. When there are a large amount of objects to be evaluated (usually around 100 and up to 140), a suitable method is based on *Q-sorting* where the respondent is given a set of cards, each corresponding to an item, and is asked to stack them into different piles,ranked according to same criterion. This might be a suitable method for the Brunsø and Grunert (1998) approach to measuring food lifestyles (see chapter 3), where respondents are asked to express the level of agreement with 69 sentences.

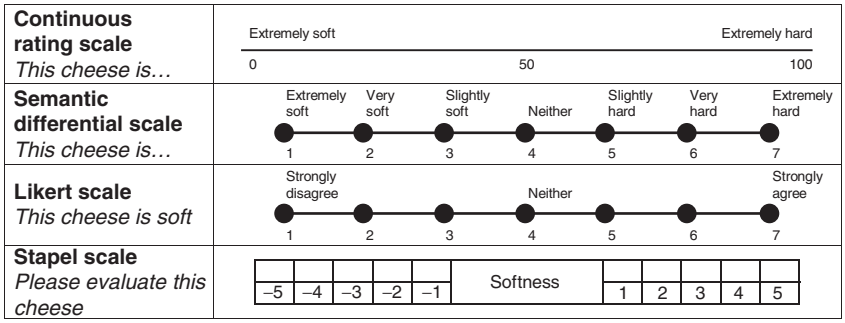


Figure 1.2 *Rating scales*

1.2.2 Non-comparative scaling

With non-comparative scales, the respondent provide a measure for each item without referring to an alternative or any other benchmark. The basic rating scales are shown graphically in figure 1.2.

In *continuous rating* the respondent must tick in a continuous line, running between two extremes of the attribute being investigated. There is no restriction on where the mark should be placed and the line may be accompanied by numbers so that evaluation can be translated into scores at a later stage, although this might be a demanding procedure. The *semantic differential scale* is very similar to the above rating but is itemized in categories, each associated with a number and /or a description, so that the respondent is bound to choose between 5 or 7 points, with a neutral point in the middle. The end points are two bipolar attributes. Typically, the overall attitude is measured through a set of bipolar adjectives, as this scale is exploited for comparisons across products and brand images, in order to detect strengths and weaknesses. An issue is whether the two adjectives are actually bipolar and equidistant from the neutrality point. The *Likert scale* is the most popular measurement scale in marketing, because it is simple and powerful. It measures the intensity of a single attribute, usually by asking the level of agreement with a given statement. As for the Semantic differential scale, it is made by 5 or 7 points (sometimes 9) with a middle point for neutrality. In some situations the middle point is not included, so that the respondent is forced to agree or disagree. There may be problems in Likert scales – respondents that tend to avoid the first of last category as they are perceived as extreme, or the tendency to agree with the sentence, so that if the statement is reversed responses could lose consistency. Likert scales generate ordinal variables.

The *Stapel scale* is used less frequently and is a unipolar scale with 10 points, from −5 to 5 with no neutrality. The respondent ticks the number that best reflect the level of accuracy of a statement, where a value of 5 means maximum accuracy and negative values indicate inaccuracy. Stapel scales work around the bipolarity problem, but some bias is potentially induced by the phrasing of the question, whether it is negative or positive.

1.2.3 Choice and evaluation of measurement scales

Some properties to be considered in relation to any measurement are accuracy, precision, reliability, and validity. Note the distinction between *accuracy* and *precision*.

BOX 1.2 *Cronbach's Alpha*

The Cronbach's Alpha is a widely used measure of internal reliability for measurement scales. Its rationale is that if the set of items supposed to measure a single latent construct, the total variability of these items should approximate the variability of the true score for the latent variable. However, since we do not know the true score, we commit a measurement error. The lower is this measurement error, the higher the reliability. Cronbach (1951) devised a procedure for estimating reliability by looking at the sum of the variabilities within each item and the variability of the summated score. This basically corresponds to looking at the bivariate correlations (see chapter 8) between the items across the sample. In high reliability situations it is possible to sum the scores obtained in the single items to estimate the score in the latent variability. The computation of the Cronbach's Alpha is based on the average of all bivariate correlations between items of the same construct set, with an adjustment for the number of items. The Alpha reliability coefficient has a maximum value of 1, while it can be negative in presence of negative correlations for some of the items. A value below 0.70 indicate scarce reliability of the item, although the coefficient is sensitive to the number of items and can be artificially inflated. A meta-analysis is found in Peterson (1994). The Cronbach's Alpha can be computed in SPSS through the ANALYZE/SCALE/RELIABILITY menu, while in SAS it can be computed as an option (ALPHA) of the CORR procedure in SAS BASE.

The former refers to the degree to which the measurement reflects the true value (how close is the measure of the book's cover to the real cover's width?), the latter to the degree of detail in measurement (for example, whether the ruler is able to catch differences of millimeters) and it is usually related to the variability around the average measurement when carrying out repeated measurements. *Reliability* is the property referring to the consistency of the measurement across several questionnaire items measuring the same latent construct or over time. For example, one might measure the same concept (attitude toward watching television) asking different questions like 'Do you like watching television?,' 'Do you find television programs interesting?,' 'Do you think watching television is good?.' These are attempts of measuring the 'true' attitude toward watching television. If a battery of possible question is used, those more reliable will show a higher degree of consistency of responses across respondents. A typical measure of reliability is the Cronbach's Alpha (see box 1.2) or, if one tries to measure the same thing several times (like the width of the book cover), the more measures are consistent, the more measurement is reliable. Finally, *validity* is the extent to which measurement reflects the 'true' phenomenon under study. For example, suppose that a measure of product quality is obtained by combining proxies like price, packaging and other technical characteristics. If this measure has a high correlation (see chapter 8) with the quality actually perceived by consumers, then it shows a high validity and it can be used to predict product quality in absence of the perceived quality information.

There is a vast literature exploring the empirical performance of alternative non-comparative scales. Evaluations are based on the reliability of scales, their validity and also *generalizability*. As explained above, reliability measures the consistency across various items of the scale which are supposed to be part of the same construct (*internal consistency*), but other forms of reliability look at the stability of results when the survey is repeated in different circumstances (*test-retest*) or when the scale is used in different formats (*alternative forms)*. Validity checks look at the observed differences in scale scores and purge them from the influence of random errors or systematic biases.[3] Finally, with generalizability, the researcher tries to generalize the results obtained to broader situation which goes beyond the sampling process and includes different

administration methods, different timings, etc. (Rentz, 1987). Churchill and Peter (1984) had a close look to the performance of different scales by performing a meta-analysis (see box 2.3) on 89 marketing research studies. They concluded that the choice of the measurement scale did not generally affect the result of the studies, apart from the number of items in the final scale and the number of scale points. If a construct is measured through a large number of items, the reliability measure tends to be higher (and the questionnaire longer). Higher numbers of points in the scales also increase reliability, while other choices including the type of non-comparative scale may actually affect the result, but not in a single direction. One should accurately weigh the pros and cons of each of the measurement scales described in this chapter according to the research question and the environment of the study, especially the administration method and the socio-cultural characteristics of the surveyed population.

1.3 Two sample data-sets

The previous sections have summarized the main issues in measuring objects, with an emphasis on the potential impact of measurement problems and methods on the research output. Over the next three chapters, the focus will move to data collection, organization and preparation prior to more advanced statistical analysis, discussed in the following chapters. To facilitate understanding and replication of examples, all methods discussed in this book with a very few exceptions are based on two sample data-sets:[4]

- The **Expenditure and Food Survey (EFS)** data-set; and
- The **Trust** data-set.

The EFS data-set is a subset from the 2004–05 UK Food and Expenditure Survey (which is described in some detail in chapter 2). The file includes a simple random sample of 500 households and a selection of 420 variables out of the 1952 available in the officially released data-set.[5] The complete list of variables is listed in box 1.3. This sample data-set is a good example of secondary data (see chapter 2) with household expenditure figures. Classification follows the *classification of individual consumption by purpose* scheme.

A second data-set is interesting on a different perspective. In this case, the aim of the original survey was to collect attitudinal and psychographic data to explain chicken purchasing behavior in 5 European countries. Again, the simplified sample data-set is a selection of the original one and contains 500 cases (100 per country selected randomly) out of the original 2,725 household surveyed and 138 variables out of 226 are in the sample data-set.

The Trust survey is a good example of the outcome of primary data collection (see chapter 3), which means that the data were explicitly collected for the purpose of the consumer research. The questionnaire for the Trust survey was developed within a European Research Project[6] and its core section was based on an extension of the Theory of the Planned Behavior (see chapter 15 for further details). Further questions covered socio-demographic characteristics of the respondent, lifestyle questions, questions related to chicken purchasing behavior and a set of question on risk perceptions and trust in information. The list of variables included in the data-set is shown in box 1.4. A nationally representative survey based on probabilistic area sampling was conducted in five countries (UK, Italy, Germany, the Netherlands and France) in May 2004 on a total of 2725 respondents via face-to-face, in-home interviews. The adopted sampling

BOX 1.3 *Variables in the EFS data-set*

Variable	Description	Variable	Description
case	Case Number	c11321	Seafood (fresh, chilled or frozen)
weighta	Annual weight	c11331	Dried, smoked or salted fish and seafood
weightq	Quarterly weight		
a040	Number of children children-age under 2	c11341	Other preserved/processed fish/seafood
a041	Number of children – age 2 and under 5	c11411	Whole milk
		c11421	Low fat milk
a042	Number of children – age 5 and under 18	c11431	Preserved milk
		c11441	Yoghurt
a043	Number of adults-age under 45	c11451	Cheese and curd
a044	Number of adults-age 45 but under 60	c11461	Other milk products
		c11471	Eggs
a045	Number of adults-age 60 but under 65	c11511	Butter
		c11521	Margarine and other vegetable fats
a046	Number of adults-age 65 but under 70	c11522	Peanut butter
a047	Number of adults-age 70 and over	c11531	Olive oil
a049	Household size	c11541	Edible oils
a062	Composition of Household	c11551	Other edible animal fats
a071	Sex of oldest person in household	c11611	Citrus fruits (fresh)
a121	Tenure – type	c11621	Bananas (fresh)
a124	Cars and vans in household	c11631	Apples (fresh)
a1661	Home computer in household	c11641	Pears (fresh)
a172	Internet connection in household	c11651	Stone fruits (fresh)
b010	Rent rates – last net payment	c11661	Berries (fresh)
b1661	Mobile telephone account	c11671	Other fresh, chilled or frozen fruits
b216	Bus tube and/or rail season ticket		
b260	School meals-total amount paid last week	c11681	Dried fruit and nuts
		c11691	Preserved fruit and fruit-based products
g018	Number of adults		
g019	Number of children	c11711	Leaf and stem vegetables (fresh or chilled)
c11111	Rice		
c11121	Bread	c11721	Cabbages (fresh or chilled)
c11122	Buns, crispbread and biscuits	c11731	Vegetables grown for their fruit (fresh, chilled or frozen)
c11131	Pasta products		
c11141	Cakes and puddings	c11741	Root crops, non-starchy bulbs, mushrooms (fresh/chilled/ frozen)
c11142	Pastry (savory)		
c11151	Other breads and cereals		
c11211	Beef (fresh, chilled or frozen)	c11751	Dried vegetables
c11221	Pork (fresh, chilled or frozen)	c11761	Other preserved or processed vegetables
c11231	Lamb (fresh, chilled or frozen)		
c11241	Poultry (fresh, chilled or frozen)	c11771	Potatoes
c11251	Sausages	c11781	Other tubers and products of tuber vegetables
c11252	Bacon and ham		
c11253	Offal, pâté etc.	c11811	Sugar
c11311	Fish (fresh, chilled or frozen)	c11821	Jams, marmalades

(Continued)

BOX 1.3 *Cont'd*

Variable	Description	Variable	Description
c11831	Chocolate	cb111i	Beer and lager (away from home)
c11841	Confectionery products	cb111j	Round of drinks (away from home)
c11851	Edible ices and ice cream		
c11861	Other sugar products	cb1121	Food non-alcoholic drinks eaten drunk on premises
c11911	Sauces, condiments		
c11921	Salt, spices and culinary herbs	cb1122	Confectionery
c11931	Bakers yeast, dessert preparations, soups	cb1123	Ice cream
		cb1124	Soft drinks
c11941	Other food products	cb1125	Hot food
c12111	Coffee	cb1126	Cold food
c12121	Tea	cb1127	Hot take-away meal eaten at home
c12131	Cocoa and powdered chocolate		
c12211	Mineral or spring waters	cb1128	Cold take-away meal eaten at home
c12221	Soft drinks		
c12231	Fruit juices	cb112b	Contract catering (food)
c12241	Vegetable juices	cb1213	Meals bought and eaten at the workplace
c21111	Spirits and liqueurs (brought home)	c31111	Clothing materials
c21211	Wine from grape or other fruit (brought home)	c31211	Mens outer garments
		c31212	Mens under garments
c21212	Fortified wine (brought home)	c31221	Womens outer garments
c21213	Ciders and Perry (brought home)	c31222	Womens under garments
c21214	Alcopops (brought home)	c31231	Boys outer garments (5-15)
c21221	Champagne and sparkling wines (brought home)	c31232	Girls outer garments (5-15)
		c31233	Infants outer garments (under 5)
c21311	Beer and lager (brought home)	c31234	Childrens under garments (under 16)
c22111	Cigarettes		
c22121	Cigars	c31311	Mens accessories
c22131	Other tobacco	c31312	Womens accessories
cb1111	Catered food non-alcoholic drink eaten/drunk on premises	c31313	Childrens accessories
		c31314	Haberdashery
cb1112	Confectionery eaten off premises	c31315	Protective head gear (crash helmets)
cb1113	Ice cream eaten off premises		
cb1114	Soft drinks drunk off premises	c31411	Clothing hire
cb1115	Hot food eaten off premises	c31412	Dry cleaners and dyeing
cb1116	Cold food eaten off premises	c31413	Laundry, launderettes
cb111c	Catered food non-alcoholic drink eaten/drunk on premises	c32111	Footwear for men
		c32121	Footwear for women
cb111d	Wine from grape or other fruit (away from home)	c32131	Footwear for children (5-15) and infants
cb111e	Fortified wines (away from home)	c32211	Repair and hire of footwear
cb111f	Ciders and Perry (away from home)	c41211	Second dwelling – rent
		c43111	Paint, wallpaper, timber
cb111g	Alcopops (away from home)	c43112	Equipment hire, small materials
cb111h	Champagne and sparkling wines (away from home)	c44211	Refuse collection, including skip hire

(Continued)

BOX 1.3 *Cont'd*

Variable	Description	Variable	Description
c45112	Second dwelling: electricity account payment	c54121	Cutlery and silverware
c45114	Electricity slot meter payment	c54131	Kitchen utensils
c45212	Second dwelling: gas account payment	c54132	Storage and other durable household articles
c45214	Gas slot meter payment	c54141	Repair of glassware, tableware and house
c45222	Bottled gas – other	c55111	Electrical tools
c45312	Paraffin	c55112	Lawn mowers and related accessories
c45411	Coal and coke	c55211	Small tools
c45412	Wood and peat	c55212	Door, electrical and other fittings
c45511	Hot water, steam and ice	c55213	Garden tools and equipment
c51113	Fancy decorative goods	c55214	Electrical consumables
c51114	Garden furniture	c56111	Detergents, washing-up liquid, washing powder
c51212	Hard floor coverings	c56112	Disinfectants, polishes, other cleaning materials, etc.
c51311	Repair of furniture, furnishings and floor coverings	c56121	Kitchen disposables
c52111	Bedroom textiles, including duvets and pillows	c56122	Household hardware and appliances, matches
c52112	Other household textiles, including cushions, towels, curtains	c56123	Kitchen gloves, cloths etc.
c53111	Refrigerators, freezers and fridge-freezers	c56124	Pins, needles and tape measures
c53121	Clothes washing machines and clothes drying machines	c56125	Nails, nuts, bolts, washers, tape and glue
c53122	Dish washing machines	c56211	Domestic services, including cleaners, gardeners, au pairs
c53131	Gas cookers	c56221	Cleaning of carpets, curtains & household
c53132	Electric cookers, combined gas electric	c56222	Other household services
c53133	Microwave ovens	c56223	Hire of household furniture and furnishings
c53141	Heaters, air conditioners, shower units	c61111	NHS prescription charges and payments
c53151	Vacuum cleaners and steam cleaners	c61112	Medicines and medical goods (not NHS)
c53161	Sewing and knitting machines	c61211	Other medical products (e.g. plasters, condoms, etc.)
c53171	Fire extinguisher, water softener, safes	c61311	Purchase of spectacles, lenses, prescription sunglasses
c53211	Small electric household appliances, excluding hairdryers	c61312	Accessories repairs to spectacles lenses
c53311	Spare parts: gas and electric appliances	c61313	Non-optical appliances and equipment
c53312	Electrical appliance repairs	c62111	NHS medical services
c53313	Gas appliance repairs	c62112	Private medical services
c53314	Rental hire of major household appliance	c62113	NHS optical services
c54111	Glassware, china, pottery		

(Continued)

BOX 1.3 *Cont'd*

Variable	Description	Variable	Description
c62114	Private optical services	c73311	Air fares (within UK)
c62211	NHS dental services	c73312	Air fares (international)
c62212	Private dental services	c73411	Water travel
c62311	Services of medical analysis laboratories and x-ray centers	c73512	Combined fares other than season tickets
c62321	Services of NHS medical auxiliaries	c73513	School travel
c62322	Services of private medical auxiliaries	c73611	Delivery charges and other transport services
c62331	Non-hospital ambulance services etc.	c81111	Postage and poundage
c63111	Hospital services	c82111	Telephone purchase
c71112	Loan HP purchase of new car van	c82112	Mobile phone purchase
c71122	Loan HP purchase of second-hand car van	c82113	Answering machines, fax machines, modem
c71212	Loan/HP purchase of new or second-hand motorcycle	c83112	Telephone coin and other payments
c71311	Purchase of bicycle	c83114	Mobile phone – other payments
c71411	Animal drawn vehicles	c83115	Second dwelling: telephone account payments
c72111	Car van accessories and fittings	c91111	Audio equipment, CD players
c72112	Car van spare parts	c91112	Audio equipment – in car
c72113	Motor cycle accessories and spare parts	c91113	Accessories for audio equipment – headphones etc.
c72114	Anti-freeze, battery water, cleaning materials	c91121	Television set purchase
c72115	Bicycle accessories, repairs and other costs	c91122	Satellite dish purchase
c72211	Petrol	c91123	Satellite dish installation
c72212	Diesel oil	c91124	Video recorder purchase
c72213	Other motor oils	c91125	Purchase of digital TV decoder
c72313	Motoring organization subscription (e.g. AA and RAC)	c91126	Spare parts for TV, video, audio
c72314	Car washing and breakdown services	c91127	Cable TV connection
c72411	Parking fees, tolls, and permits (excluding motoring fines)	c91128	DVD purchase
c72412	Garage rent, other costs (excluding fines)	c91211	Photographic cinematographic equipment
c72413	Driving lessons	c91221	Optical instruments, binoculars, telescopes, microscopes
c72414	Hire of self-drive cars, vans, bicycles	c91311	Personal computers, printers and calculators
c73112	Railway and tube fares other than season	c91411	Records, CDs, audio cassettes
c73212	Taxis and hired cars with drivers	c91412	Blank and pre-recorded video cassettes
c73213	Taxis and hired cars with drivers	c91413	Camera films
c73214	Other personal travel	c91511	Repair of AV/photographic/ information processing equipment
		c92111	Purchase of boats, trailers and horses

(Continued)

BOX 1.3 *Cont'd*

Variable	Description	Variable	Description
c92112	Purchase of caravans, mobile homes (including decoration)	c94232	TV licence payments (Second dwelling)
c92114	Purchase of motor caravan (new) – loan/HP	c94236	TV slot meter payments
c92116	Purchase of motor caravan (second-hand)	c94238	Video cassette rental
c92117	Accessories for boats, horses, caravans	c94239	Cassette hire (library), CD hire (library)
c92211	Musical instruments (purchase and hire)	c94241	Admissions to clubs, dances, discos, bingo
c92221	Major durables for indoor recreation (e.g. snooker table etc.)	c94242	Social events and gatherings
c92311	Maintenance/repair other major durables for recreation	c94243	Subscriptions for leisure activities
c93111	Games, toys and hobbies (excluding artists materials)	c94244	Other subscriptions
c93112	Computer software and game cartridges	c94245	Internet subscription fees
c93113	Console computer games	c94246	Development of film, photos, etc.
c93114	Games toys etc. (misc fancy, decorative)	c94311	Football pools stakes
c93211	Equipment for sport, camping and open-air recreation	c94312	Bingo stakes excluding admission
c93212	BBQ and swings	c94313	Lottery (not National Irish Lottery) stakes
c93311	Plants, flowers, seeds, fertilizers, insecticides	c94314	Bookmaker, tote, other betting stakes
c93312	Garden decorative	c94315	Irish Lottery Stakes
c93313	Artificial flowers, pot pourri	c94316	National Lottery instants. Scratchcards
c93411	Pet food	c94319	National Lottery stakes
c93412	Pet purchase and accessories	c9431a	Football pools winnings
c93511	Veterinary and other services for pets identified separately	c9431b	Bingo winnings
c94111	Spectator sports: admission charges	c9431c	Lottery (not National Irish Lottery) winnings
c94112	Participant sports (excluding subscriptions)	c9431d	Bookmaker, tote, other betting winnings
c94113	Subscriptions to sports and social clubs	c9431e	Irish Lottery Winnings
c94115	Hire of equipment & accessories for sports	c9431f	National Lottery instants. Scratchcards
c94211	Cinemas	c9431i	National Lottery winnings
c94212	Live entertainment: theater, concerts, shows	c95111	Books
c94221	Museums, zoological gardens, theme parks	c95211	Newspapers
		c95212	Magazines and periodicals
		c95311	Cards, calendars, posters and other prin
		c95411	Stationery, diaries, address books, art
		ca1113	Pre-primary/primary edn: (school trips, ad hoc school expenditure)
		ca2113	Secondary edn: (school trips, other ad hoc school expenditure)

(Continued)

BOX 1.3 *Cont'd*

Variable	Description	Variable	Description
ca3113	Further edn: (school trips, other ad hoc school expenditure)	cc6214	Commission travelers cheques and currency
ca4113	Higher edn: (school trips, other ad hoc school expenditure)	cc7111	Legal fees paid to banks
ca5113	Education not definable: (school trips, other ad hoc school expenditure)	cc7112	Legal fees paid to solicitors
cb2114	Room hire	cc7113	Other payments for services e.g. photocopying
cc1111	Hairdressing salons/personal grooming (exc health and slimming clubs)	cc7114	Funeral expenses
cc1211	Electrical appliances for personal care	cc7115	Other professional fees incl court fines
cc1311	Toilet paper	cc7116	TU and professional organizations
cc1312	Toiletries (disposable inc tampons, lipsyl, toothpaste, deodorant etc.)	ck1211	Outright purchase of, or deposit on, main dwelling
cc1313	Bar of soap, liquid soap, shower gel etc.	ck1313	Central heating installation (DIY)
cc1314	Toilet requisites (durable inc razors, hairbrushes, toothbrushes etc.)	ck1314	Double Glazing, Kitchen Units, Sheds etc.
cc1315	Hair products	ck1315	Purchase of materials for Capital Improvements
cc1316	Cosmetics and related accessories	ck1316	Bathroom fittings
cc1317	Baby toiletries and accessories (disposable)	ck1411	Purchase of second dwelling
cc3111	Jewelry, clocks and watches	ck2111	Food stamps, other food related expenditure
cc3112	Repairs to personal goods	ck3111	Stamp duty, licences and fines (excluding motoring fines)
cc3211	Leather and travel goods (excluding baby items)	ck3112	Motoring Fines
cc3221	Other personal effects n.e.c.	ck4111	Money spent abroad
cc3222	Baby equipment (excluding prams and pushchairs)	ck4112	Duty free goods bought in UK
cc3223	Prams, pram accessories and pushchairs	ck5111	Savings, investments (exc AVCs)
cc3224	Sunglasses (non-prescription)	ck5113	Additional Voluntary Contributions
cc4111	Residential homes	ck5115	Superannuation deductions – subsidiary employee job
cc4112	Home help	ck5116	Widows/Dependants/Orphans fund
cc4121	Nursery, creche, playschools	ck5212	Money given to children for specific purposes: pocket money
cc4122	Child care payments	ck5213	Money given to children for specific purposes: school dinner
cc5213	Insurance for household appliances	ck5214	Money given to children for specific purposes: school travel
cc5412	Boat insurance (not home)	ck5215	Money given to children for specific purposes
cc5413	Non-package holiday, other travel insurance	ck5216	Cash gifts to children
cc6212	Bank and Post Office counter charges	ck5221	Money given to those outside the household
		ck5222	Present – not specified

(Continued)

BOX 1.3 *Cont'd*

Variable	Description	Variable	Description
ck5223	Charitable donations and subscriptions	year	Survey Year
ck5316	Pay off loan to clear other debt	p600	EFS: Total consumption expenditure
a054	Number of workers in household	p601	EFS: Total Food & non-alcoholic beverage
a056	Number of persons economically active	p602	EFS: Total Alcoholic Beverages, Tobacco
a060	Gross normal income of HRP by range	p603	EFS: Total Clothing and Footwear
a091	Socio-economic group – Household Reference Person	p604	EFS: Total Housing, Water, Electricity
a093	Economic position of Household Reference Person	p605	EFS: Total Furnishings, HH Equipment, Carpets
a094	NS-SEC 8 Class of Household Reference Person	p606	EFS: Total Health expenditure
p344	Gross normal weekly household income	p607	EFS: Total Transport costs
p348	Social security benefits – household	p608	EFS: Total Communication
p352	Gross current income of household	p609	EFS: Total Recreation
p396	Age of Household Reference Person	p610	EFS: Total Education
sexhrp	Sex of Household Reference Person	p611	EFS: Total Restaurants and Hotels
a055	Sampling month	p612	EFS: Total Miscellaneous Goods and Services
a190	Internet access via Home Computer	p620p	EFS: Total Non Consumption Expenditure (anonymized)
gor	Government Office Region	p630p	EFS: Total Expenditure (anonymized)
gorx	Govt. Office Region modified	incanon	Anonymized hhold inc + allowances
p389	Normal weekly disposable hhld income	a070p	Age of oldest person in hhold – anonymized
		p396p	Age of HRP – anonymized

Source: Office for National Statistics and DEFRA (through www.esds.ac.uk)

method was Random Location Sampling, a two-stage sampling method which provides a country-representative subdivision into locations; the locations are selected randomly across potential locations to ensure national representativeness. The sampling unit was the household and the respondent the person responsible for the actual purchase of food. The questionnaire took approximately 30 minutes to complete with 'prompts' on certain questions from the interviewer when required by the respondent.

1.4 Statistical software

Another aim of this book is to provide an applied view of the methodologies for consumer and marketing research. To this purpose, the discussion of statistical methods is accompanied by specific consumer research examples and some key rules for applying these methods in SPSS and/or SAS are provided. SPSS and SAS are the

BOX 1.4 *Variables in the TRUST data-set*

Variable	Description	Variable	Description
code	ID		**Please indicate the extent to which you agree or disagree with each of the statements you find below by circling the number that most closely describes your personal view.**
q1	How many people do you regularly buy food for home consumption (including yourself)?		
	How frequently do you buy…		
q2a	Food for your household's home consumption		
q2b	Any type of chicken for your household's home consumption	q9	In my household we like chicken
q2c	Fresh chicken	q10	A good diet should include chicken
q2d	Frozen chicken		*My decision whether or not to buy chicken next week is based on the fact that:*
q2e	Chicken as part of a prepared meal		
q2f	Cooked chicken	q12a	Chicken tastes good
q2g	Processed chicken	q12b	Chicken is good value for money
q2h	Chicken as a meal outside your home	q12c	Chicken is not easy to prepare
		q12d	Chicken is a safe food
		q12e	All the family likes chicken
q4kilos	In a typical week how much fresh or frozen chicken do you buy for your household consumption (Kg.)?	q12f	Chicken works well with lots of other ingredients
		q12g	Chicken is low in fat
		q12h	Chicken is low in cholesterol
q5	In a typical week how much do you spend on fresh or frozen chicken (Euro)?	q12i	Chicken lacks flavor
		q12j	Buying chicken helps the local farmers and economy
q6	In a typical week, what type of fresh or frozen chicken do you buy for your household's home consumption?	q12k	I do not like the idea of chickens being killed for food
		q12l	Chicken is not produced taking into account animal welfare
q7	How likely or unlikely is it that you will buy fresh or frozen chicken for your household's home consumption at least once in the next week?	q14	Others' opinions on chicken are important to me
		q15	I take others' opinions into account when making decisions on whether or not to buy chicken
	In a typical week where do you purchase your fresh or frozen chicken?	q16	Other people suggest chicken in the diet is?
q8a	Discount supermarket	q20a1	I typically store chicken in my freezer
q8b	Supermarket	q20b1	We eat too much chicken
q8c	Local shop	q20a2	Let's say you do have some chicken in your freezer. Is it likely you would buy more next week?
q8d	Butcher		
q8e	Farmer		
q8f	Market		
q8g	Online shopping/home delivery		
q8h	Other		

(Continued)

BOX 1.4 *Cont'd*

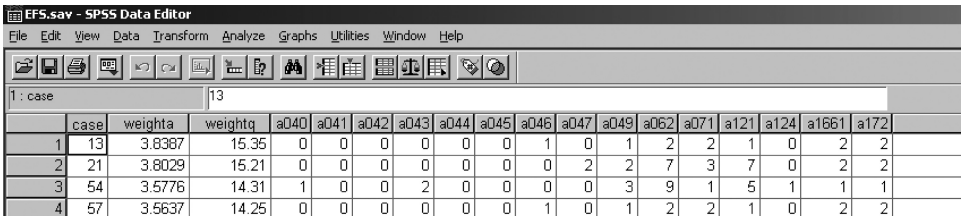
Variable	Description	Variable	Description
q20b2	Let's say last week you ate a lot of chicken. Is it likely you would not buy chicken at all next week?	q25f	I am constantly sampling new and different foods
	Safe chicken is...	q25g	I don't trust new foods
q21a	Packaged	q25h	I will eat almost anything
q21b	Clearly labeled	q25i	If I don't know what is in a food, I won't try it
q21c	Whole chicken	q25j	I am afraid to eat things I have never eaten before
q21d	From the butcher	q26a	I usually aim to eat natural foods
q21e	From the supermarket	q26b	I am willing to pay more for a better quality product
q21f	Produced in your own country	q26c	Quality is decisive for me when purchasing foods
q21g	Produced in the EU	q26d	I always aim for the best quality
q21h	Produced in Asia	q26e	When choosing foods, I try to buy products that do not contain residues of pesticides or antibiotics
q21i	Expensive	q26f	I am willing to pay more for foods containing natural ingredients
q21j	Free range, organic or corn-fed	q26g	For me, wholesome nutrition begins with the purchase of high quality foods
q21k	Recognizable by color, taste or smell		*How would you rate these activities in terms of risk to health?*
	In general, how important are each of the following to your household?	q27a	Smoking cigarettes
q21l	Fresh	q27b	Driving
q24a	Tasty food	q27c	Eating beef
q24b	Value for money	q27d	Eating chicken
q24c	Ease of preparation	q27e	Taking illegal drugs
q24d	Food safety	q27f	Scuba diving
q24e	Food that everyone likes	q27g	Swimming
q24f	Variety in our meals	q28	Risk aversion
q24g	Fat content	q34	Have you actively searched for any information on food safety in the last two weeks?
q24h	Cholesterol content	q35	How many hours per day do you watch TV?
q24i	Ethical food production methods	q36	How many hours per day do you listen to the radio?
q24j	Local community livelihood	q37	How many hours per day do you surf the internet?
q24k	Animal welfare	q38	How many different newspapers do you read in a typical week?
	Please indicate the extent to which you agree or disagree with each of the statements you find below by circling the number that most closely describes your personal view.		
q25a	I like foods from different countries		
q25b	Ethnic food looks too weird to eat		
q25c	I like to try new ethnic restaurants		
q25d	I like to purchase the best quality food I can afford		
q25e	At parties, I will try a new food		

(Continued)

BOX 1.4 *Cont'd*

Variable	Description	Variable	Description
	Suppose that each of the following has provided information about potential risks associated with salmonella in food. Please indicate to what extent you would trust that information	q50	Gender
		q51	Age
		q52	Marital status
		q54	Job Status
		q55	If employed, what is your occupation?
q43a	Shopkeepers	q56	Number of people currently living in your household (including yourself)
q43b	Supermarkets		
q43c	Organic shop		
q43d	Specialty store		*Number and age of children*
q43e	Farmers/breeders	q57a	No children
q43f	Processors	q57b	Less than 3 years
q43g	Doctors/health authority	q57c	3–10 years
q43h	University scientists	q57d	11–16 years
q43i	National authority in charge of food safety	q57e	Greater than 16 years
q43j	Government	q58a	Are there other members of the household who are dependant on you (e.g. elderly or disabled)?
q43k	Political groups		
q43l	Environmental organizations		
q43m	Animal welfare organizations		
q43n	Consumer organizations	q58b	If yes, how many?
q43o	European Union authority in charge of food safety	q59	On average, how much does your household spend on food each week
q43p	Television documentary		
q43q	Television news/current affairs	q60	Please indicate your gross annual household income range
q43r	Television adverts	q61	How would you describe the financial situation of your household?
q43s	Newspapers		
q43t	Internet		
q43u	Radio	q62a	Do you belong to any consumer or environmental organizations?
q43v	Magazines		
q43w	Product label		
q49	How do you rate your ability to assess food quality and safety?	q63	Which size is the town where you live?
		q64	Country

most widely employed statistical packages in consumer and marketing research.[7] However, as it will be shown for specific cases, the performance, flexibility and output of these packages varies with different methodologies. Furthermore, for specific statistical methods and applications, other statistical packages like STATA, Limdep, LISREL or Econometric Views might provide better solutions. Most advanced consumer research could also gain maximum flexibility by exploiting statistical programming languages like Gauss or Matlab. While an exhaustive review of statistical software is not feasible within the aims of this book, not least because of the rapidly evolving characteristics of the aforementioned packages, within each chapter an indication of alternative software choices will be provided when relevant.


EFS.sav - SPSS Data Editor

File Edit View Data Transform Analyze Graphs Utilities Window Help

1 : case 13

	case	weighta	weightq	a040	a041	a042	a043	a044	a045	a046	a047	a049	a062	a071	a121	a124	a1661	a172
1	13	3.8387	15.35	0	0	0	0	0	0	1	0	1	2	2	1	0	2	2
2	21	3.8029	15.21	0	0	0	0	0	0	0	2	2	7	3	7	0	2	2
3	54	3.5776	14.31	1	0	0	2	0	0	0	0	3	9	1	5	1	1	1
4	57	3.5637	14.25	0	0	0	0	0	0	1	0	1	2	2	1	0	2	2

Figure 1.3 *The SPSS menus and data window*

Here it may be worth to explore the fundamental characteristics of the main packages.

SPSS has the advantage of combining a good range of methodologies with a relative ease of use. This is sometimes achieved at the cost of reduced control on options for some methodologies, which may result in a 'black box' problem. Other advantages of SPSS are the data management design, which allows one to deal with large data-sets and is calibrated to fit very well with marketing research, especially for dealing with sampling weights, complex sampling designs, variable definitions, missing data treatment, etc. The user-friendly interface with dialog boxes allows quick implementation of standard methods, while the syntax editor allows one to save sequences of commands for repetitive tasks. The syntax commands can be easily pasted into the editor through the dialog boxes. Output is collected in a separate viewer and objects can be copied and pasted into word processing and spreadsheet software. SPSS is probably the most accessible software for those with a limited background in statistics. The software in its base version provides a quick and effective solution to most marketing research problems. However, more complex issues tasks such as those that require simultaneous estimation of multiple equations systems cannot be accomplished in SPSS.

SAS differs from SPSS in several respects. Essentially it trades off part of the user-friendly features for increased control on statistical methodologies and flexibility. While some dialog-boxes and pre-compiled routines are available in some SAS programs,[8] the software is particularly powerful when its languages are exploited. A strength of SAS is the well-documented on-line user's guide. The relative complexity of SAS derives from the fact that it is an integrated system of different software rather than a single packages. Thus, SAS provides a very flexible programming language and a wide range of procedures as compared to SPSS, which is specifically calibrated to applications in social science and is particularly suitable for those with a marketing research background. SAS is a statistical software with a broader concept and requires a stronger background in statistics.

Other software products cited throughout this book may be useful to users with a specific interests in more advanced methodologies:

- *LISREL* is a software specifically developed for structural equation systems (chapter 15);
- *LIMDEP* is a general econometrics computer program with a specific versatility for discrete choice and limited dependent variable models (chapter 16);
- *Eviews* is also an econometric software, particularly helpful for dealing with advanced time series models and simultaneous equation system.

Summing up

'He who makes no mistakes, makes nothing' or – to translate – it is necessary to deal with error to measure objects. Measurement and error are closely related concepts, as measurements are potentially affected by systematic and random errors. Systematic errors make each of the repeated measures on the same object systematically too high or too low, while random errors are fluctuations without any fixed direction due to factors that act in a random fashion. Care in measurement can avoid systematic errors, while statistics can deal with random errors. For example, random measurement errors are expected to follow a bell-shaped probability distribution, the normal or Gaussian curve.

The measurement scales for recording consumer responses determine the content of the variables for subsequent analysis. These variables can be quantitative or qualitative and the latter can be either nominal or ordinal. There are various scaling rates which serve to the purpose. A first set of scales covers situations where a comparison between alternatives is requested to the respondent (comparative scales), while non-comparative scales are designed when each item is measured separately. For example, the Likert scale is the most frequently employed and is aimed at measuring the intensity of a single attribute, usually by asking the level of agreement with a sentence. The choice of the best structure and measurement scale depends on various aspects, especially how self-consistent is the measure, if it is a valid measure and whether it can be generalized.

The next chapters will explore the range of statistical techniques by referring to application on two sample data-set introduced in this chapter, EFS and TRUST. EFS is a secondary data-set which contains a selection of expenditure and household data from the 2004/05 UK Food and Expenditure Survey. The TRUST dataset is an example of primary data collection and contains behavioral and attitudinal data on chicken purchases in 5 different European countries.

To analyze this data and apply the techniques described in this book, there are several commercial statistical packages; SPSS and SAS are those especially covered in this book.

EXERCISES

1. A survey has been conducted on 30 students to measure how much time they spend in the University canteen, between 9 am and 9 pm. There are 30 observations in the data-set, measured in minutes:

3	29	0	0	25	60	48	16	25	29
25	31	45	90	0	0	30	32	0	65
45	15	28	33	10	38	5	110	30	27

   a. What type of variable is this? And how should it be defined in the SPSS Variable view?

b. While the chronometer could record minutes and second, data were only registered in minutes. Two rounding procedures can be chosen: (a) rounding to the nearest minute (e.g. 10 minutes and 20 seconds = 10 minutes; 10 minutes and 40 seconds = 11 minutes); (b) registering only minutes whatever the number of seconds (e.g. 10 minutes and 1 second = 10 minutes, 10 minutes and 59 seconds = 10 minutes). Are the errors generated by rounding through (a) or (b) systematic or random? If systematic errors are generated, are they downward or upward biases?

2. Classify the following variables according to their type and measure, following the scheme below:

METRIC VARIABLES	
Discrete	(MD)
Continuous	(MC)
NON-METRIC VARIABLES	
Nominal	(NN)
Ordinal	(NO)

And indicate the corresponding classification in SPSS (Scale, Nominal or Ordinal)

Variable	Example of measurements	Classification	SPSS classification
Price of a laptop	$1300.00; $ 1098.22; $2000.00	MC	Scale
Job	Bus driver; Marketing consultant; Singer	NN	Nominal
Education level	Higher education degree, High School Diploma	NO	Ordinal
Monthly income	$7000; $3000; $ 4112		
Monthly income bracket	1 = [0,$2000]; 2 = [$2001,$5000]; 3 = [more than $5000]		
Customer satisfaction	1 to 7 where 1 = completely unsatisfied; 7 = completely satisfied		
Perceived risk of skying	1 to 10 where 1 = not risky at all; 10 = extremely risky		
Ranking of preferred hobbies	1) Reading; 2) Playing baseball; 3) Gardening		
Amount of water drank in a day	2.3 liters; 1 liter; 5 liters		
Days off work over the last month	12 days; 6 days; 8 days		
Number of words in a document	1319 words; 5412 words; 1000 words		
Time spent walking yesterday	38 minutes; 12 minutes and 40 seconds; 15 minutes and 20 sec		
Number of SMS sent last month	18; 12; 15; 31		

(Continued)

Variable	Example of measurements	Classification	SPSS classification
Phone bill	£ 41; £ 32; £ 55		
Weather today	Sunny; Rain; Snow;		
Preferred mean of transport to work	Bike; Walking; Car;		
Telephone number	0044-123-456789;0039-987-654321		

3. Open the TRUST data-set in SPSS:
   - Go to VARIABLE view
   - Consider the TYPE of variable and the MEASURE column and compare them with the LABEL and VALUES column
   - Are the MEASURE types appropriate? Correct them as appropriate

Further readings and web-links

- Measurement scales – Ofir et al. (1987) compare the statistical performance of the Stapel, Semantic Differential and Likert scales and suggest that the three scales are interchangeable. A special issue of the review *Marketing Research* (Fall, 2003) contains a set of interesting papers on the use of measurement scales in consumer perception surveys. This special issue was published to revisit an article previously published on the same journal looking for a good scale to measure quality (Devlin et al., 1993) and a number of reactions sparked by that article. For those interested in measurement scales, a very comprehensive review of the key issues.
- Measurement and Error theory – An excellent review of the problem of measurement, with a specific focus on the identification of error sources and the minimization of errors is provided in the book by Madhu Viswanathan (2005).
- Software reviews – It is not easy to compare the performances of statistical packages like SAS and SPSS in general terms, although for specific techniques the approaches and outcomes can be very different. When this is the case, details are provided in this book. Furthermore, statistical packages evolve quickly. See www.sas.com and www.spss.com to be updated on the latest versions and features of SAS and SPSS, respectively. However, for some specific computational aspect (including the key one of generating random numbers), different packages may perform very differently. McCullough (1998 and 1999) looks into the statistical and numerical accuracy of SPSS versus SAS and S-Plus, identifying some pitfalls.
- The UK Expenditure and Food Survey – The EFS is further discussed in chapter 2. Anything else you may want to know about questionnaires, variables, data-set, etc. can be found by referring to www.data-archive.ac.uk

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and search the catalogue using the key-word EFS plus the year of the survey. For example, with 'EFS 2004-2005' you will be referred to www.data-archive.ac.uk/findingData/snDescription.asp?sn=5375

- The Trust project. The web-site contains all of the working papers (including those on sampling and questionnaire preparation), plus contacts for more information: www.trust.unifi.it

Hints for more advanced studies

- gIs it better to have an even or odd number of points in a Likert scale?
- What are skewness and kurtosis in a normal curve? How are they measured?
- How does the wording of multiple questions influence computation of the Cronbach's alpha?
- What are the methods to measure consumer attitudes?

Notes

1. Daniel Kehlmann (2007), *Measuring the World*. Quercus.
2. There are also procedures to combine pairwise comparisons into interval scales as the Thurstone Scale (see Thurstone, 1927). It is also possible to consider individual personal effects in choosing between the alternatives through the Rasch model (see e.g. Wright, 1977).
3. For a review of techniques for testing validity, see Peter (1981).
4. The data-sets EFS and TRUST can be downloaded from www2.stat.unibo.it/mazzocchi/SCMR
5. The EFS data collection includes several derived and raw files, accessibile from www.data-archive.ac.uk. The data-set used in this book is derived from the household file 'dvhh.'
6. www.trust.unifi.it. Data were produced within the project 'Food Risk Communication and Consumer's Trust in the Food Supply Chain – TRUST,' funded by the European Commission (QLK1-CT-2002-02343).
7. In 2005 revenues for SPSS and SAS were $ 236 millions and $ 1,680 millions, respectively.
8. See the latest addition SAS Enterprise Guide.