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The king has no clothes – the reality behind numbers*

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Charles Wheelan:
Naked Statistics: Stripping the Dread from the Data
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Charles J. Wheelan's two best-known works are characterised by a focus on the applicability of economic theories in real settings. *Naked Economics* is a book teaching the basics of economics that does not get lost in the maze of economics that is full of numbers and models, but places the emphasis on applicability in real life. *Naked Statistics* does the same, focusing on the subject of statistics: instead of dwelling on complex mathematical methods, it tries to provide readers with methods of using statistics in everyday life, and, first of all, it draws attention to the correct interpretation of results and the importance of the human factor.

One of the key messages of the book, as its subtitle (*Stripping the Dread from the Data*) suggests, is that in many cases we think that the methods of statistics are unnecessarily complex and incomprehensible, and this gives rise to fears. However, the large number of statistical indicators used in everyday life are applied in an easy manner by most people – although often unconsciously – even in everyday conversations. A good example for that is the index used in the United States to evaluate baseball players, which compresses complex information into one single numeric indicator, and thus makes the performance of the players comparable (and serves as a useful guide for betting, too). In its methodology, the Gini coefficient used for the measuring of economic inequalities is not much different from the indicator that measures the performance of players, but it may seem an incomprehensible thing for an average baseball fan.

Wheelan tries to convey two key messages in the whole book. On the one hand, he attempts to refute the above misconceptions, in order to bring statistics closer to the reader, as it may offer a useful aid to anyone in the understanding and solution

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of complex problems. On the other hand, he wishes to provide the reader with an interpretive approach, so that the reader can identify the many manipulative uses of statistics, and be able to make informed decisions on the basis of numbers. Because of its nature, it is worth laying more emphasis on the latter, as that is what readers probably meet less frequently in textbooks or other educational materials.

Before becoming acquainted with methodologies, anyone wishing to correctly interpret statistics should be aware that the relevance of these may be reduced by many – intentional or unintentional – errors, which allow companies or even politicians to misinterpret the meaning of figures that are very useful tools for convincing people. This is true even for simple descriptive statistical tools such as the mean, the median or the standard deviation. For instance, if Bill Gates walks into a bar, the average income of those sitting in the bar may be multiplied, but it would be rather misleading to qualify the guests of that bar as rich based on that. The same problem emerges, of course, in the case of using more complicated methods, in a way that is more difficult to detect. One of the most frequent examples is the arbitrary selection of the projection base: a telecommunication company may use geographical coverage as a good advertisement, even if that is not identical with the coverage of the population. The comparison of "apples and oranges" is also well-known. For example, film studios indicate revenues from films at current prices, boasting higher and higher records, while decades earlier, when ticket prices were lower, other classics may have attracted far more spectators. Another thing that may lead to wrong conclusions is that the co-movement of factors is interpreted as a cause and effect relation. For example, in schools that achieve the best test results, the teachers are not necessarily the best teachers, as the harder terms of admittance already predetermine the outstanding results of more talented students.

Apart from these problems that lead to misinterpretations, each statistical tool may contain individual drawbacks that characterise the given method. The author pays considerable attention to probability calculus, which is used every day in a number of areas. The calculation of the probability of the occurrence of certain events may help decision-making through the definition of expected values. Companies make good use of patterns drawn by statistical probabilities in customers' behaviour. A spectacular application of the method is related to the name of the American brewery Schlitz, which set out on a brave enterprise in 1981: in the most expensive commercial spots in the USA, at halftime of the Super Bowl , they aired blind taste tests live, having volunteers drink beer. And not just any volunteers: the people they invited from the street to taste beer all claimed that they usually drank the beer of Shlitz's competitors. This was the ingenuity of this marketing campaign! In fact, Schlitz played safe with the commercials. For an average consumer, in a blind taste test, beers of similar price categories are hard to distinguish, and even if someone usually drinks a certain brand, it is not sure at all that he will recognise it in a blind taste test. So the chance that a consumer would select Schlitz in a blind taste test is roughly 50 per cent. But the fact of only half of the consumers selecting the brand would not look too good in itself. However, half of the consumers of the competitive brand preferring Schlitz beer sounds rather impressive. Therefore, on the basis of preliminarily completed blind taste tests, the manufacturer had a good reason to suppose that half of the consumers of the competitors would prefer its beer in the live show, too.

However, when using probability in decision-making, several aspects need to be considered. It is a common mistake to suppose that the examined events are independent of each other, when they are not. A sad example for this typical error is the case of court trials regarding so-called sudden infant deaths (SID) that happened in Great Britain the 1990s. As the probability of SID within the same family is very low (1/73 million), the judgements said this was a proof of crime in almost all of these cases. However, a decade later, several hundreds of cases were examined again, as it turned out that these SIDs might have been related because of genetic or other reasons, and this significantly increased the probability of deaths within the same family. The opposite of this error can also occur. Statistical examinations showed that football players hitting the target in many cases will hit the target next time with the same chance, so the feeling of “having the goal” is rather fans’ illusion. A similar phenomenon is the correction after an above-average performance, which leads to various disillusions. According to an American urban legend, the performance of athletes published on the cover page of Sports Illustrated drops in matches following the publication. But the reason is not a curse on the magazine: the players were put on the cover page because they had achieved an outstanding performance before, so it could be expected that their subsequent performance would be closer to the average.

No matter how good the methodology is, however, research and the results indicated by them are only as good as the data used in them. Poor quality data will generate poor quality results. According to the author, the data used should meet three key criteria. First, the data should refer to a sample that covers a representative slice of the population. The second criterion is that the data provide enough basis for comparison. Finally, the third criterion is simply that the relevant data should be available. Lots of examples demonstrate the results of not meeting these conditions: mistakes in public opinion polls before presidential elections, misunderstanding the reasons of some medical treatments or the identification of factors explaining the success of some schools.

For decision-makers, on the other hand, it is obviously not the methodology applied or the scope of data used that is the key question, but the proper interpretation of the results. The process of programme evaluation is when the impact of individual decisions or interventions are assessed, and decisions are made on the basis of that.

However, the examination of the separate effects of individual interventions is not always clear because of complex relations. Therefore, the best means of programme evaluation are random examinations, the examination of natural events or the examination of differences between situations that are similar in other aspects ("the difference of differences"). A good example of correct programme evaluation is the American research where the impact of police presence on crime was examined, bearing in mind that sometimes the higher rate of crime triggers higher presence of police, so the relation is not obvious. Therefore, the research examined what happens on days when the presence of police is stronger than other times, but for a reason independent of "everyday" crime: days with danger of terrorist attacks (when more policemen are on the streets) were compared with other days. Based on the final result, one can conclude that the higher level of police presence does result in lower levels of crime. In the USA, this was an important lesson for the policy-makers concerned.

All in all, in today's world, full of information, it is very easy to examine almost any social science issue using different data. In general, this is advantageous, as we can find really (or seemingly) correct answers to millions of questions. What will be the future of American football? What causes the drastic increase in the number of autistic children? How can we identify and award really good teachers? How can we fight global poverty best? What do other people know about us?

It must be borne in mind, however, that the human factor is more important than any well-composed statistical methodology: the correct interpretation of numbers and making the right decisions based on the numbers cannot be substituted with complex calculations.