QUETELET, THE FATHER OF STATISTICS

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Abstract: *By the 17th and 18th centuries, two trends in statistics had developed: descriptive statistics and political arithmetic. The main representatives of descriptive statistics were the newly established statistical offices or organisations in the countries. The main task of this movement was to describe the status of the state. Political arithmetic concentrated on the observation of socio-economic phenomena that could be quantified and on the relationships between social phenomena. Adolphe Quetelet, who played a major role in many disciplines, was most active in the field of statistics. He was the man who united the two branches of statistics and one of the people who made statistics a science. He is associated with the founding of many statistical journals and societies, and worked tirelessly to establish international cooperation between statisticians, resulting in the regular International Statistical Congresses. The aim of this article is to summarise Quetelet's work and the history of the International Statistical Congresses, which contributed to the harmonisation of national statistics. Finally, we have examined Quetelet's work in the field of crime statistics because Quetelet focused his attention not only on crime, but also on all the phenomena he believed determined the moral face of society. He also studied the evolution of suicide, divorce, out-of-wedlock births and prostitution. Quetelet recognised that it was possible to improve the state of human societies through appropriate state intervention, but that this required an understanding of the interplay of social processes. It can therefore be said that Quetelet made an outstanding contribution to many important areas of statistics and can rightly be called the father of statistics.*

Keywords: Adolphe Quetelet; the evolution of statistics; theory of statistics; Political arithmetic; Statistical congresses

JEL classification: C00

1. Introduction

Károly Keleti, in his speech at the Hungarian Academy of Sciences on 30 November 1874, said that Adolphe Quetelet "a hero of the whole head outstanding among those who have struggled in the field of statistics". The scientific work of Adolphe Quetelet (1796-1874) was extremely varied. A Belgian polyhistor, he achieved great success

in meteorology, astronomy, mathematics, demography, sociology, criminology and the history of science. He created the body mass index, which is still used today. In 1828, he founded the Royal Observatory in Brussels, which he directed for several years, pioneering the study of meteorites. At the age of twenty-four, he was elected a member of the Belgian Academy of Sciences and was its President from 1832 to 1834, and then its Honorary Secretary from 1834 to 1874. Throughout his life, Adolphe Quetelet was associated with many eminent personalities, including contemporaries such as Pierre Simon de Laplace, Simeon Denis Poisson, and André-Marie Ampiér. At the request of King Leo I of Belgium, he taught mathematics to the Dukes Ernest and Albert of Saxe-Coburg and Gothia, discussed population trends with Malthus, philosophical issues with Goethe, and census issues with James Garfield, the twentieth President of the United States. He was a close friend of Queen Victoria's husband, Prince Albert, and corresponded extensively with the German mathematician Carl Friedrich Gauss, the English physicist Michael Faraday, and the German naturalist Alexander von Humboldt. In recognition of his scientific work, Quetelet was elected a fellow of several prestigious foreign institutions.
Although Adolphe Quetelet played a major role in many disciplines, his greatest contribution was in the field of statistics. He is one of those who made statistics a science. Károly Keleti clearly attributed to him the creation and dissemination of the idea of modern statistics. At the start of the 2006-2007 academic year, the new lobby of the Faculty of Economics and Business at the University of Ghent was named after Adolphe Quetelet, and a large meeting room at Eurostat in Luxembourg is named after him.

2. The scientific work of Quetelet

2.1. State Descriptive Statistics versus Political Arithmetic

By the 17th and 18th centuries, two trends in statistics had emerged: state descriptive statistics and political arithmetic. Contemporary professional literature used the term 'political' to mean information on the general development and state of society, the state or the economy, rather than the narrowed sense in which it is used today. Descriptive statistics was typically German, while political arithmetic was an Anglo-Saxon trend. The German school emerged from the work of Hermann Conring (1606-1681) and Gottfried Achenwall (1719-1772) as an indispensable body of knowledge for the practice of government. This trend made the description of the condition of the state its main task. Its representatives were concerned with the consistent systematisation of facts, in contrast to the English trend, political arithmetic, which traditionally emphasised the measurement of phenomena. Whereas the descriptive statisticians made little use of data or figures in their analyses, the political arithmeticians concentrated on the observation of socio-economic phenomena that could be quantified. Political arithmetic was an extension to the social sciences of a new approach which had already taken root in the natural sciences. (Bekker, 2011) The theory and methodology of political arithmetic was most influenced by the development of the calculation of probability and the formulation of the law of large numbers. For the representatives of this science, descriptions of the state and the population were not sufficient, but they began to

investigate the causes that affect the material, spiritual, moral and religious relations of the members of society. They were looking for regularities similar to those of natural science, those that influence human actions. Social phenomena were not only described in quantitative terms, but also explained in terms of data and causal links were sought. Statistical activity has moved from a
qualitative to a quantitative approach and measurement has become a central element of scientific research. The creators of political arithmetic, John Graunt (1620-1674) and Sir William Petty (1623-1687), were primarily concerned with questions of population movements.
In the 19th century, Adolphe Quetelet, who was primarily interested in political arithmetic, united the two schools of statistics. Until the 19th century, statistical activity was characterised by a predominance of enumerative methods. The most popular method was censuses, including not only censuses of the population, but also censuses of agricultural, commercial and other business enterprises. In the United States and German territories, sampling-based procedures were
essentially banished from official statistics during this period. (Desrosicres, 1997)

2.2. The creation of modern statistics

The change in approach to official statistics from the 1930s onwards is undoubtedly due to the scientific work of Adolphe Quetelet, who was the first to successfully reconcile the tasks of statistical officials and scientific researchers. Thus, the era of the creation of official statistical bodies was also an era of unity between practical statistical activity and its theory and methodology. The Belgian polymath was also influenced by German academic descriptive statistics, the theory describing the current status of the state apparatus, but he also recognised the potential of statistics, the mass of data that is essential for the development of society. Quetelet believed that without the availability of reliable, large-scale data covering the relevant areas of society, modern statistical activity cannot be successfully carried out.
During his studies in Paris, Quetelet became familiar with the theoretical foundations of probability theory, and with this knowledge, he successfully introduced into official statistics methods originally used only in the natural sciences, such as averages and distributions based on systematic observations. These procedures enabled him to project into the future the laws observed in the past. In his 1835 work 'Sur l'homme et le développement de ses facultés, ou Essai de physique sociale', Quetelet outlined the programme of social physics and described his theory of the 'average man', which he characterised by the average of measured variables following a normal distribution. With Quetelet's work of 1835, a new era of statistics began. On the methodological side, he formulated two key principles. The first is that "Causes are proportional to the effects they produce". The second principle Quetelet developed was that large numbers are needed to draw any reliable conclusion. Quetelet's scientific work had an impact in various fields of social sciences. The roots of demography, sociology, criminology, biostatistics and many economic insights can be traced back to Quetelet's ideas (Desrosicres, 1997).

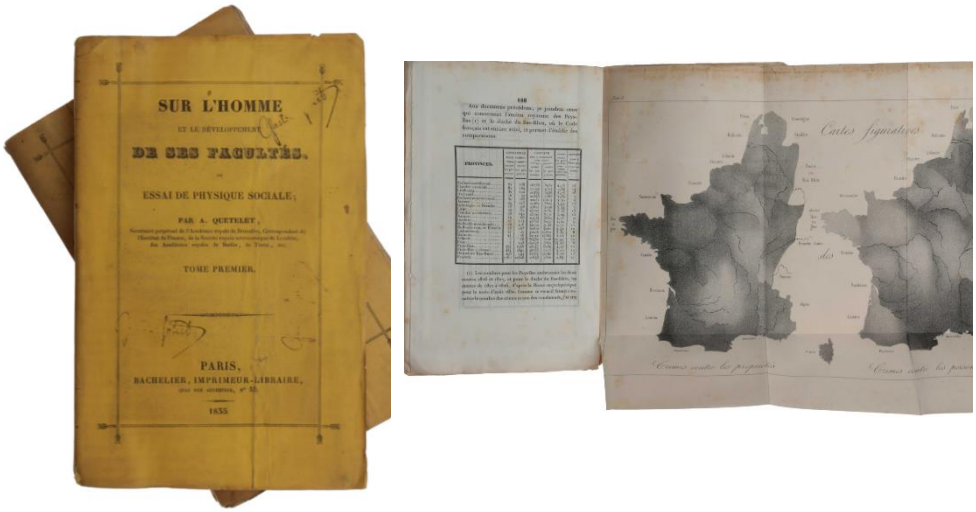

Figure 1: First edition of Quetelet's major work
Source: https://www.iberlibro.com/primera-edicion/lHomme-D%C3%A9veloppement-Facult%C3%A9s-Essai-Physique-sociale/30473596128/bd

Quetelet thus not only assigned to statistics the task of aggregating and communicating data, but also recognised a much more important role. He saw statistics as a tool for the development of the state and society. He believed that by using long time-series data, statistics could provide a picture of the economic, social and cultural characteristics of a country, and that it could be used to draw appropriate conclusions and take appropriate action on the basis of the information available (Horváth, 2021)
Quetelet used statistical correlations as a model for meteorological forecasts, the results of which he used to "explain phenomena and warn individuals and governments what will happen as a result of the observations presented, and what they must do to change events, which have the appearance of strict regularity, for the benefit of society by means of reasonable measures" (Keleti, 1875, p.11).

3. International Statistical Congresses - Harmonisation of national statistics

In the first half of the 19th century, most European countries set up their own national statistical offices. The institutional form of the statistical services varied from state to state, but they had in common that the primary purpose of using the data collected was to measure the economic and social potential of the nation.
Statistics, after its institutionalization in the 19th century, became a widely accepted science, the main representatives of which were the newly established statistical offices and organizations of the countries, which collected, systematized, analyzed and published data on the functioning of the state and society. (Horváth, 2021)

In statistics, Quetelet, as was already common in the natural sciences, placed great emphasis on the issue of standardising methods of data collection and tabulation, and the presentation of results. The growing amount of data raised the need for international cooperation, standardisation of research methods and international comparability of data. Quetelet recognised the need to promote the development of an international movement of statistical activity, the creation of comparable statistics and the standardisation of data collection, data processing and the system of indicators.

At the Great Exhibition of London in 1851, Adolphe Quetelet, in consultation with a small group of experts from various countries, developed the idea of international statistical congresses. In recognising the merits of the inventors of these congresses, it is important to bear in mind that in the early 1850s the phenomenon of international congresses was still relatively new in the world. The few international congresses held during this period were mainly concerned with problems that threatened the whole world, such as the first sanitary congress held in Paris in 1851, which was convened to control and treat cholera epidemics.

The first International Statistical Congress took place in Brussels in 1853, with 26 countries in attendance. At the first session of the Congress, Quetelet was elected president and dedicated his opening speech to the importance of uniform procedures and terminology for official statistical publications.

Between 1853 and 1876, nine International Statistical Congresses were held in different European capitals. Quetelet saw the International Statistical Congresses as events that allowed the synthesis of the experiences of the various national statistical services. In all, more than 4000 participants attended the nine congresses. In addition to European countries, statisticians from the United States of America, North Africa (e.g. Ottoman Egypt) and Turkey attended the conferences. The congresses contributed to the development of the official statistical services of each nation, to the development of dialogues between statisticians and effectively improved the international comparability of statistical data.

The debates at the conferences also helped to promote Quetelet's view that within the field of statistics, the schools of public administration and mathematics cannot be separated, as the two fields are interdependent and can only be developed together (Raderaad N., 2011)

Table 1: Highlights of the International Statistical Congresses

SN	Place	Time	Number of participants (people)		
			Domestic	Foreign	Total
I.	Brussels	19-22 September 1853	88	65	153
II.	Paris	10-15 September 1855	203	108	311
III.	Vienna	31 August - 5 September 1857	464	78	542
IV.	London	16-21 July 1860	505	81	586
V.	Berlin	4-12 September 1863	350	127	477
VI.	Florence	29 Speptember - October 1867	666	85	751
VII.	The Hague	6-11 September 1869	372	116	488
VIII.	Saint Petersburg	22-29 August 1872	511	125	636
IX.	Budapest	29 August – 11 September 1876	267	175	442

Source: Rózsa,2017 3. o.

At each conference, there was the opportunity to listen to presentations and engage in scientific discussions in sections covering different topics.
Public health issues have been among the key themes of the congresses. Several resolutions were adopted on health issues such as traffic and industrial accidents, epidemics and hospital statistics. Already at the first International Statistical Congress, William Farr of England and Marc d'Espine of Genoa were asked to draw up a standard classification of deaths that could be used internationally. At the next congress in Paris in 1855, Farr and d'Espine presented two separate compilations based on very different principles. Farr's classification included five groups and distinguished between general diseases and diseases localised to a particular organ or anatomical area. D'Espine classified diseases according to their nature. Congress adopted a compromise list of 139 headings, which has been revised regularly throughout history. Despite repeated revisions, the current structure of the International Classification of Diseases (BNO) is based on William Farr's proposal (Endrei D., 2016).
At the Congress of The Hague in 1869, a groundbreaking decision was taken on the need for comparative international statistics. Twenty-four major topics were entrusted to the various agencies.
By the end of the 1870s, the system of International Statistical Congresses was in crisis, partly because of the growing nationalism in Europe and partly because of Franco-German political antagonism. However, during the 25 years of the International Statistical Congresses, the profession had fully embraced Quetelet's original idea of the need for an international organisation to coordinate the work and cooperation of the national statistical offices. In 1885, a decade and a half after the last International Statistical Congress, the International Statistical Institute (later abbreviated to ISI), the largest and most prestigious institution in statistics, was founded to continue the work of the Congresses and continues to play an active role

in the development of international statistical guidelines, the professional development of statisticians and the dissemination of good practice.

4. The creator of crime statistics

Justice statistics, and crime statistics in particular, developed relatively late, only in the 19th century. The reason for this is to be found in the feudal system and the lack of a criminal justice system, since crime statistics can only be compiled if there are criminal codes that define the offences and if there is a modern judicial organisation and procedures.

We first encountered criminal statistics in France. In the late 18th and early 19th centuries, the Intendant, appointed by the monarch, reported annually on the number of deaths and other serious crimes by type of crime. In the early 19th century, conviction and prison data began to be collected in many other European countries, such as Bavaria, Prussia, England and the Austro-Hungarian Monarchy. The emperors wanted to quantify and record criminal justice as a state activity. Over the years, these conviction and enforcement data were gradually expanded to include personal data on offenders. Over time, more and more aspects of both the offender and the offence side were analysed, which allowed the study of crime as a mass phenomenon in society. From 1826 onwards, annual crime statistics reports were produced by the French Minister of Justice (Balázs J., 1968).

The database of more than a million convict records enabled Adolphe Quetelet to create a morality statistic. Quetelet's major work, based on French crime statistics for the years 1826-1830, used the methodology of probability to identify trends that gave a completely new dimension to the way society had been understood up to that time. Observing the recurrent regularity of the crime figures from year to year, he established the social necessity of crime, which he expressed in his famous and much-debated saying: 'There is a tax which the people pay with frightful regularity, and that is the tax of prisons, galley raids and blood banks, which we should strive to reduce.' "We can predict how many people will soil their hands with the blood of their fellow human beings, how many will be counterfeiters, how many will be poisoners". In his search for the laws that govern the moral world of mankind, he came to the conclusion that man is under the coercive influence of laws in society. Human action is determined by human capacity, degree of education, wealth, existing institutions and a myriad of other random factors that are hardly detectable. Quetelet divided the explanatory variables into two broad groups. One group consisted of permanent causes, or natural factors, and the other of random causes, by which he meant individual moral, intellectual and volitional influences. He found that some citizens were more likely to commit crimes than others, especially those who were underage, male, poor, unemployed and undereducated (Hoóz 1996).

Quetelet focused his attention not only on crime, but also on all the phenomena he believed determined the moral face of society. He also studied the evolution of suicide, divorce, out-of-wedlock births and prostitution.

Quetelet recognised that it was possible to improve the state of human societies through appropriate state intervention, but that this required an understanding of the interplay of social processes.

The International Statistical Congresses have promoted the development of national crime statistics through the dissemination of improved statistical methods and have

achieved considerable standardisation in the field of crime statistics. The Paris Congress of 1855 and the Budapest Congress of 1876 dealt with the issues of criminal statistics (Hoóz 1996).

5. Summary

Adolphe Quetelet opened a new era in the development of statistics. He gave statistics new goals and new tools to achieve them. His conviction that the scientific study of social life should be based on quantitative methods and mathematical techniques foreshadowed, as early as the mid-nineteenth century, the concept that has become the guiding principle of modern social research. The statistical methods that he pioneered and which he promoted in international scientific circles are as important and inescapable today as they were in his day.

References

1. Balázs József 1968: A bűnügyi statisztika elméletének első felmerülése és kialakulása a statisztikai tudományban Acta Universitatis Szegediensis de Attila József Nominatae Acta Juridica Et Politica Tomus XV. Fasciculus 2.
https://acta.bibl.u-szeged.hu/6353/1/juridpol_015_fasc_002_001-022.pdf
2. Bekker Zsuzsa, (2011): „Mérni és mérni" A politikai aritmetikától a voluntarizmusig Tanulmányok Nagy Aladár tiszteletére, 19-29 ISBN 978-963-661-948-023
https://gtk.uni-miskolc.hu/files/437/jubileumi_tanulmanykotet_web.pdf
3. Desrosicres, A. (1997): The administrator and the scientist: how the statistical profession has changed Statistical Journal of United Nations ECE, 23(4) 31-50. p in Statisztikai Szemle KSH 1998. 04-05
https://www.ksh.hu/statszemle_archive/1998/1998_04-05/1998_04-05_001.pdf
4. Endrei Dóra (2016): A betegség osztályozási (BNO,FNO) kódrendszerek Egészségügyben használatos adatbázisok és kódrendszerek Pécs, Pécsi Tudományegyetem 43-51. oldal
https://www.etk.pte.hu/protected/OktatasiAnyagok/%21Palyazati/eukodrendszerek/EubenHasznalatosKodrendszerek_20160118jo.pdf
5. Ferenczi Zoltán, (2006): Statisztikaoktatás tudományos műhelyei Győrben 1800-2005 Történeti statisztikai tanulmányok 9. KSH Könyvtár és Levéltár Budapest
6. Horváth Balázs, (2021). Tudományos transzferminták a magyar hivatalos statisztika történetében: nemzetközi hatások Keleti Károly munkásságára Statisztikai Szemle, 99. évfolyam 5. szám 446–468. oldal
7. Horváth Balázs, (2022). Népszámlálások Magyarországon – A kezdetektől napjainkig Újkor.hu A velünk élő történelem
https://ujkor.hu/content/nepszamlalasok-magyarorszagon
8. Horváth Róbert, (1976) Quetelet és a magyar statisztika Statisztikai Szemle, 1976 március Történeti dolgozatok 290–308. oldal
https://www.ksh.hu/statszemle_archive/all/1976/1976_03/1976_03_0290_0309.pdf
9. Hoóz István, (1967): A polgári statisztika egyetemi oktatásának kezdetei A Magyar Statisztikai Társaság kiadványsorozata: 5. Statisztikatörténeti Vándorülés. Gödöllő, 1967. május 12-25 341-342.

10. Hoóz István, (1996) Bevezetés az általános és az igazságügyi statisztikába 111-112. o. Pécs
11. Keleti Károly, (1875) Quetelet emlékezete in. Értekezések a társadalmi tudományok köréből. III. köt. II. sz. Magyar Tudományos Akadémia
12. KSH, (1993): Az 1850. és 1857. évi népszámlálás Budapest
https://library.hungaricana.hu/hu/view/NEDA_1850-1857/?pg=2&layout=s
13. KSH, (2011): A magyarországi népszámlálások története
https://www.ksh.hu/nepszamlalas/magyarorszagi_nepszamlalasok_tortenete
14. Randeraad, N. (2011). The international statistical congress (1853-1876): Knowledge transfers and their limits. European History Quarterly, 41(1), 50-65.
https://doi.org/10.1177/0265691410385759
15. Rózsa Dávid, (2017): Hágától Washingtonig – A magyar hivatalos statisztika kapcsolatai a nemzetközi szervezetekkel a kezdetektől 1947-ig Statisztikai Szemle, 95. évfolyam, 11–12. szám 1068-1075.
https://www.ksh.hu/statszemle_archive/all/2017/2017_11-12/2017_11-12_1067.pdf