Three twin sciences, born with the first census

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Abstract:

The hyphotesis of this paper is based on the idea that three sciences have been born during the same event or ancient period: the first census. These three memorable sciences are statistics, demography and accountancy. This paper presents an brief analysis of the common history of these three sciences. The results of this analysis represents the basis for a comparative study in the future about the common moments for the multidisciplinary investigations such as the census.

Keywords: *alphabet, census, statistics*, *demography, accountancy.*

JEL classification: C46, E16, J11, H83, N33.

1. Introduction

The occurrence of *proto-statistics* or *old statistics* and of the first specific data and information are related to the census as a periodic set of state records concerning the population (subsequently defined by Romans as census or by periodic resumption census), land, agriculture, ships built, navigation, and have an attested oldness of approximately five to six thousand years. Ancient civilizations from the Mesopotamian, Egyptian, Chinese, and Greek one to the Roman Empire, as well as the whole Middle Ages do not indicate the systematization of concepts, principles, methods, techniques and instruments, able to prove the scientific nature of statistics. Between the first Roman "*census*", from the time of King Servius Tullius (6th century b.C.) and the English cadastre, performed between 1083 and 1086, in the time of William the Conqueror, no clear idea about the independent nature of statistics as a science appears. For nearly four millennia, statistics a was a mere tool for the practical orientation of managers, providing them with quantitative assessments of the number of inhabitants and their financial power for taxing purposes, as well as forecasts as realistic as possible of the military potential.

They were followed by the *descriptive statistics* or the description of the state, a first manifestation as a science, developed by the European universities, the statistics of the *English political arithmeticians' school* or the stage of the analytical approach through a mathematical tool of an unprecedented simplicity and especially through the identification of the first regulations, by the first statistician as scientist (John Graunt), *statistical classicism* or *the inductive statistics* determined by the emergence and development of the probability theory, *modern statistics*, crystallized around the Anglo-Saxon school of mathematical statistics, and through the birth, in 1924 of the survey theory and the official recognition of the advantages of the selective research in 1934, by the English Royal Satistical Society we actually entre the *modern statistics* age.

"*Statistics and demography are inseparable. They were born in the same day: the day of the first census…*" This is a statement of the late French professor Daniel Villey that has already become famous. In this context, if we analyse more thoroughly, it seems that there was a third twin science, borne in the same day, namely accounting.

The reasons concerning their common origin are given by the nature of the information required at any census, whether ancient or modern. An etymologic approach of demography is strictly related to the significance of the two words of Greek origin composing it, namely "demos" (Greek δήμος) – people and "graphe" (gr.γράφε) or "graphos" (Greek γράφος) - (description) writing. A first meaning would lead to a broader concept of "writing about the human population". A second meaning would be that of science, whose object is the human population, as a clearly delimited system benefiting from relative autonomy, where the emphasis is on state and level variables, the inputs and outputs of the system described and especially structural changes on dependencies, interdependencies, associations and correlations among the characteristic variables of the population.

According to the specificity of its object, the demographic science, *stricto sensu* or in its narrow meaning, studies, via statistical and mathematical methods, the human populations and their derived variables, focusing on the actual multiplication capacity of the human population, on the fertility, on the quantification of both individual disappearances or on the mortality, and on the individual appearances or on the birth rate, as well as on quantifying the results of the territorial movements of human individuals or their migration. According to the historical, anthropological, statistical, mathematical, biological and biometric sociological, medical and genetic, actuarial, ecological interdisciplinarity of its object, the demographic science, *latu sensu* or broadly, also studies a multitude of socio-economic variables such as those

defining social mobility (between the quality of employed and unemployed person, between the position of active and inactive person, among the various occupational statuses, human professions and occupations), the structure of the population according to a wide variety of individual or combined social and economic criteria, actually identifies and measures the influence of the social and economic factors, which influence all these appearances and disappearances generically defined under the established name of demographic phenomena, as well as the multiple correlations between population and economy, population and ethnography, population and medicine or genetics, population and religion, population and resources, population and environment, population and mathematics (including actuarial mathematics in the spectacular life insurance area), population and sociology, population and anthropology or history, etc.

The accountancy emerged correlated with the data concerning the property and welfare also requested at the census. Also, any goods exchange was mentioned as a flow of the performed transactions and of their results. The incipient barter economy did not have techniques able to foster the development of accounting, but with the emergence of the currency is developed somewhat empirically along with the accounting, although limited to recording payments and receipts and at the presentation of the cash balance at a certain historical moment. Great ancient civilizations (the Babylonian, the Chinese, the Egyptian, the Greek and the Roman ones) thus offered through the census the premises of the emergence and of the development from a common tree of the three twin sciences statistics, demography and accountancy, in discontinuous, diverse forms, which were not rigorously regulated until the Romans, but having an exceptional potential. The emergence of the three sciences is preceded by the writing of the numbers and of the alphabet.

2. Historical and cultural landmarks of the three sciences

2.1 Brief history of Statistics
A brief history of the statistical science requires briefly covering several stages starting with the *old statistics* or *pre-statistics* attested as early as 5000 years ago and that lasted nearly 4 millennia as a practical orientation tool for managers. The *descriptive* stage, or the stage of *the description of the state* is the first manifestation of statistics as a science in the modern meaning of the word. The German school founded by Hermann Conring (1606-1681), the author of the first descriptive statistics course, entitled *Notatia rerum publicorum* (1660) uses the word statistics, as a Latin or Italian *status*-type derivative as *statista*, whose meanings of *situation, status or state* and also

of *politician versed in the affairs of state* are metamorphosed in the name of a new science. The descriptive stage is also strongly related to Gottfried Achenwall (1719-1772), the fecund spirit of the Gottingen school, the scientist who, among other things, popularized the concept of statistics by using it with the meaning of *in-depth knowledge of the respective and compared situation (status) of each state*, while his professor Martin Schmeitzel (1679-1747), a native of Braşov had apparently invented it, and A.L. von Schlözer (1735-1809), the most faithful disciple of Achenwall and his successor at the university department, provided it with the academic brilliance through the famous aphorism *statistics is history at rest, the statistic history in movement.* A.L. von Schlözer is the one who discovered that statistics cannot be conceived or defined outside numbers, consolidating the essence of statistics through numerical determinations.

The descriptive statistical knowledge in this long Middle Ages period is a phased process of understanding, coordinating or adapting and anticipating the variation of the external world through the description of the state, but also by understanding its past, by the formal and less profound correlation, by adapting past events to the present time and easy anticipations on short and medium-term. The objective of the descriptive statistical knowledge or of the descriptive scientific approach is to know the variation of a changing world, temporally, spatially and organizationally finite (the economic life, the social life, the actual political life, the prosaic date or the ephemeral indicator) rather that the series of territorial and long-term data or the string of real variants the normal or asymmetric empirical distribution, together with all the amazing internal laws hidden under the veil of numbers. The statistical descriptive approach is essentially total (exhaustive) and its root is almost exclusively the census and the statistical monograph is the main tool for the description of the state and Dimitrie Cantemir remains the first Romanian thinker of descriptive statistics due to his paper "*Descriptio Moldaviae*"...

If the descriptive statistics was preponderantly oriented towards information and description through information, *the school of the political arithmetic* of the *English political arithmeticians* opens the excessively pragmatic stage of the statistical science, providing the premises for emphasizing regularities in the social and economic phenomena and for formulating regularities or even predictions, prefiguring the essence of modern statistics. John Graunt (1620-1674) thus becomes the first modern statistician of the modern scientific world, initiating the quantity scientific, methodological exploration, of a fertile variation field such as the demographic one, previously non-confronted but rather merely recorded, in order to formulate pertinent quality-related conclusions not only descriptive or spatial

ones, but also especially, temporal ones. John Graunt actually marks the year of birth of statistics as a science, by the appearance of his paper *Bills of mortality…,* in 1662 and by the huge impact, in the next decade, through the five successive editions (enviable success to this day). The complete title Graunt's paper is *Natural and political observations upon the bills of mortality chiefly with reference to the government, religion, trade, growth, air, diseases etc. of the City of London.* From the dedication of this memorable paper, dedication to the Chairman of the British Royal Society we can infer the importance and originality of his discoveries: „ I conceive, That it doth not ill become a *Peer of the Parliament* or *Member of his Majesties Council„* to consider That the irreligious *Proposals* of some, to multiply people by *Polygamy*, is withal irrational, and fruitless, That the troublesome seclusions in the *Plague-time* are not a remedy to be purchased at vast inconveniences, That the greatest *Plagues* of the City are equally, and quickly repaired from the Country, that the wasting of *Males* by Wars and Colonies do not prejudice the due proportion between them and *Females,* That *London,* the *Metropolis* of *England,* is perhaps a Head too big for the Body and possibly too strong, That this Head grows three times as fast as the Body unto which it belongs, That the *Trade*, and very *City of London*, removes *Westward...''* The sources of the scientific training of this first statistician and demographer, at the same time, where the method of observation, formulated by the natural history of Francis Bacon, the method of accounts, or more generally, the method of the double recording into the accounts (or of the *"double entry"* as it was called at the time by its author, Luca Paciolo), the balance method and an overall (demo-economic) concept of the society. John Graunt is honored today for the accuracy of his statistical thinking, with which he discovered the first scientific regularities and unifirmities, and also for revealing the possibilities of prdicting the analysed phenomena, and he was recognised for three exceptional merits, in formulating numeric results, then in using statistical and demographic analysis procedures, but, especially in the originality of the thinking and working method. *The English political arithmeticians* were also the first demographers, inevitably providing their statistical science with demographic valences. With Johann Peter Süssmilch (1707-1767), who succeeded in synthesizing political arithmetic by carefully analysing and investigating the explanation of the phenomena of the human life, by formulating hypotheses about regularities and finally regularities of models or theories governing populations, by correlating demographic, social and economic phenomena, by the dynamic examination of the proposed theoretical models, by the critical selection and assessment of data, the process of defining statistics as a science was completed. The quantity or numeric approach is extended by the systemic

vision of Johann Peter Süssmilch. This "brilliant and solitary German meteor" marked the defeat of the descriptions specific to the German school, by the "political arithmetic" or the English pragmatism and intuition. After his death, statistics was completely established as a science and was about to enter its *classical* and profoundly inductive period.

The emergence of the probability theory and the formulation of the theorem of the law of large numbers, by Jakob Bernoulli (1654-1705) in the paper *Ars conjectandi*, the description of the normal distribution function by Friedrich Karl Gauss (1775-1855) and Pierre-Simon Laplace (1740-1827), the development by Thomas Bayes (1702-1761) of the subjective probability theory and of the statistical interference based on it, the description by Simeon Denis Poisson (1781-1840) of the distribution of the rare events by their specific law are a few representative moments of the period of maturation of the classical or inductive statistics. The application of the probability theory to the study of the social phenomena was initiated by Adolphe Quetelet (1796-1874), a Belgian statistician, the creator of the controversial "average man".

The modern statistics stage is crystallized around the Anglo-Saxon school of mathematical statistics, of the International Statistics Congresses, beginning with 1853, but also of the International Statistics Institute in 1885, as a result of the generalization of the operation of the national statistics institutions. The universal coordinates of modern statistics are Oxford, Cambridge and London, the publicity ones *Biometrika* and *Annals of Eugenics*, and the institutional corollary of the *Royal Statistical Society*. The creators of modern statistics, from Karl Pearson (1857-1936), Francis Galton (1822-1911), Ronald Aylmer Fisher (1890-1962), Arthur Lyon Bowley (1869-1957), Francis Ysidro Edgeworth (1845-1926), William Sealy Gosset known under the pseudonym of "Student"(1876-1937), Charles Eduard Spearman (1883-1945), George Udny Yule (1871-1951) to Maurice Kendall (1907-1983) extended the application of the statistical science to the most diverse areas. Numerous methods and tools took over and immortalized their names and contributions or the mark of their statistical thinking in the scientific research.

In 1924, the International Statistical Institute favours the survey method and the representativeness of the samples and thus draws attention on the advantages resulting from the application of the representative method (World Statistics Congress, Rome 1925). However, Jerzy Neyman (1894-1981), American mathematician and statistician of Polish origin and its exposition, held in 1934, before the members of the famous *Royal Statistical Society*, was necessary to officially record the birth of the modern survey theory. The scientific use of statistics and the employment of the professional

statistician become an even more acute necessity after the resounding failure of the magazine *Literary Digest*, in the presidential elections of 1936, in the U.S.A., which failure had been caused by the dilettantism of its opinion polls. From 1938, England and France shift to the oeganization of public opinion survey institutes. The statistical problems are now the ones of assessment, specification and distribution, in addition to the substantiation of the statistical inference sampling methods. Completeness yields to the inference.

The evolution of statistical research and the diversification of the stages composing it in relation to the other types of research continued and continues today. The statistics of the second half of the 20th century lends to the other sciences its own concepts and principles, methods and techniques, tools and tests (which are in a outstanding facelift). Claude Shannon's (1916-2001) and Warren Weaver's (1894-1978) mathematical theory, predicted by the theory of consonantiste psychology of Ştefan Odobleja (1902-1978) and followed by the theory of informational energy of Octav Onicescu (1892-1983) or of the entropic information of Nicolae Geogescu-Roegen (1906-1994), informational symmetry and the balanced use of information are a few aspects of the extended *contemporary stage* of statistics. The predominant meaning of science of the statistics of the last three centuries is also the result of the unanimous recognition of the fact that it has exceeded the stage of incipient science whose body includes laws, which has explanatory capacity and the skill to prepare methods, models and theories (protoscience). The statistical science and its research characteristic to the new millennium use explicit assumptions, repeatable processes under the name of methds, accurate observation and measuring methods under the name of techniques and tools, and mathematical support for the processing and interpretation of its results.

With an institutional tradition of more than a century and a half, with continuous participations of the International Statistical Institute, the first journal of statistics, *Statistical Annals*, founded in 1860, with the creation of a first modern European census in the period 1859 – March 1860, and of the famous census performed in 1930, whose archives were requested in Berlin too, due to the originality of the solution in solving simultaneous ethic problem through the maternal language, the religious membership and the citizenship, with the construction of statistical tools, comparable in terms of utility with the ones existing in the international practice, of the type of *Argus* price indices, with statistical theory papers as valuable as the *Statistical method* of Nicolae Georgescu-Roegen or of the *Actuarial mathematics treatise* of Gheorghe Mihoc (1906-1981), with managers of the national statistical institute such as Sabin Manuilă (1894-1964) and Anton Golopenția (1909-1951), with its many academic personalities who influenced the international

statistical thinking from Dimitrie Gusti (1880-1955), to Octav Onicescu or Ştefan Odobleja, the Romanian statistical school had a contribution correctly assessed as innovative and recognized as substantial in the universal statistical heritage.

2.2. Brief history of the writing, of the numbers and of the alphabet or the demographic beginnings

Starting from the observation that statistics and demographics and accounting are initially separated by writings on various populations (including the human ones) and property or welfare, based on a widely used alphabet, it is natural to identify their emergence in parallel with the moment of the first writing or of the first alphabet, temporarily revitalizing such a difficult historical problem, rather than to try to explain it completely. The European origin of the first alphabet is generally accepted, thus being recognized that the first symbolic and especially accessible literary writing, the Phoenician one dating from 900-800 B.C. The human individual, man in general has continually sought adequate means of exteriorising his brain complexity. If we validate the assumptions of Jacques van Ginneken, then no articulate language was before the writing, but writing rather appeared together with the primitive language of gestures. In other words, the man began to speak, tilting the shoulders, shaking hands and uttering guttural sounds, but simultaneously he drew signs, symbols, more or less randomly, on the ground, plants, snow, sand, or he read the signs left by animals in their passage. To write means, first of all, *to draw*. A first assumption identifies drawing as the first form of writing, although today the "braille" writing substantially expands the concept itself … A second important relationship is that between numbers and letters. The primordiality of the number economically and socially insinuates in the thinking of any unprejudiced man. The number was first. The writing was initially noted by *drawing numbers*. Thus we could conclude that mathematics preceded the writing, as the most veridical source of inspiration of the alphabet. When where the first numbers drawn in time? Nicked bones as representation of the passage of time appear 30,000 years BC. Unearthed mummified dead had clothes on which beads were sewn marking the passage of time or "the age of the deceased". Two legends remain interesting in the analyzed context. The first, an Egyptian legend recounts how the Egyptian god Thoth informed king Thamos that he had discovered writing. Almost afraid of the consequences, the king accused him of being an enemy of civilisation, because young people, who had been forced until then to remember what they were told, with the use of the alphabet, will become slack and will cease to enhance their memory. Writing or joining hieroglyphics was thus going to cause an atavistic fear among the ignorant (illiterate). The second

legend, also from the ancient Greek world, is that of Cadmus. The story goes that the son of a Phoenician king and the grandson of Poseidon, mythological Cadmus left, Phoenicia in search of his sister Europa, abducted by Zeus, who had changed into a bull. Wandering on the sea, Cadmus arrived in Boeotia and founded Thebes, where as soon as he was elected king, he married Harmonia, daughter of Ares and Aphrodite, giving Thebans the alphabet he knew from his country Phoenicia. The conclusion of the two legends becomes particularly simple, namely that the origin of the first writings about the human population and those about the alphabet are lost in the millenary mists of mythology. From the information and the historical documents preserved, the first writings seem to have accompanied the clay boxes used for the commercial samples transported to the Mesopotamian Middle East, about six thousand years ago. These boxes evolved, becoming clay tablets, mediating the unique cuneiform writing system of numbers and especially of words. Sumerians, Akkadians, Assyrians are early carriers of a type of cuneiform writings, through the incredible immensity of ancient spaces. The simplest typological approach identifies four kinds of writing: simple pictographic writings or strings of pictograms or drawings inter-correlated or connected by a common idea of symbolic pictographic writings or strings of pictograms transfiguring a name or an abstract subject having the most eloquent example in the Egyptian hieroglyphic writing (a tenacious and ingenious sequence of drawings whose objects are parts of the human body, geometric figures) demotic writings derived from symbolic pictographic writings in time by stylization and sinusoidal linearization where each sign represents a word and alphabetic writings where each sign represents a letter (the letters being reduced as systematic number down to a threshold after which they re-multiply by the diversity of the accents). The difficult Phoenician alphabet gradually turned into a new one, called Hellenic, and subsequently the Latin one appeared, the latter underlying the first census that was truly rigorous from the methodological point of view. However, seeking the first human writings and implicitly the emergence of the alphabet the first demographic writings can be detailed. The Romans with their practical skills gave the census a unitary methodological character, generating the language and technique of the modern census. The period between two censuses was called by the Latins "lustrum". Introduced in Rome by Servius Tullius (578 – 534 BC) the Roman "censuses were performed every five years. In Augustus' age, in a Rome "of several continents" which had become an extending empire, the frequency increased first to ten and even 15 years, with the decrease of the imperial resources, respectively under Diocletian. "Census populi" or the census operation was initially performed in the field of Mars, its management being entrusted to "censors", while the statements of the citizens on the occasion of the census were stored in the "Tabularium"

or the "public archive". At Roma, for each of the four circumscriptions of the capital city a "curator" was appointed, with population census and tax collection competences. The position of censor, a position with essential population census competences, was created by the Romans in the period of the Republic, around 440 BC and in Dacia, which was under Roman occupation, censuses known as "census provinciae" were performed. Detailed and rigorous imperial-type censuses were preceded by "libri censuales" or records of the population made immediately after the conquering the province by the Romans. The first censuses with a renewed information content were actually performed much later, i.e. in 1749, in Sweden in 1790 in the U.S.A. in 1800 in England, and in 1801 in France. The first census considered truly modern was the one performed in Belgium, in 1846, under the leadership of statistician Adolphe Quetelet, and in our country the one performed after the Union of 1859, led by Dionisie Pop Marțian. These censuses began to be organised based on modern methods, relatively similar to the censuses of the 3$^{\text{rd}}$ millennium, in terms of content and variables.

2.3. Brief history of the emergence of accounting records or of the beginning of accountancy

As shown in the specialised literature[1], which is also proved by the practice, the economic records are the main data source of the informational economic system and also one of its basic components. Based on the nature of the data, the acquiring, processing and representation method, it is deemed that the economic records take three distinct forms: statistical, accounting and technical and operational recording. These three forms of records are closely related, they are interdependent and complement each other. Since the object of research in this section of the work is accountancy, we will present its definition below, and a brief history of the emergence of the accounting records, of accountancy in general.

The first definitions of accountancy were generally focused on the traditional bookkeeping function (documentary records), fulfilled by the accountant. Over time, the accountant was involved, in addition to the documentary records, into a number of complex activities of planning, evaluation, verification and audit which led to the evolution of the definition of accountancy. Currently, in the national legislation[2], accountancy is defined as activity specializing in the measurement, evaluation, knowledge, management and control of assets, liabilities and equity, as well as of the results obtained from the activity of the economic entities. To this end, accountancy must provide the

1. Enache G., (1977), *Bazele contabilității,* Scientific and Encyclopaedic Publishing House, Bucharest, pp.11-16

2. Accounting Law no. 82/1991, republished, art. 2

chronological and systematic recording, processing, publishing and keeping of information related to the financial position, financial performance and other information related to the business, both for their internal requirements, as well as in the relationships with the current an potential investors, the financial and commercial creditors, the customers, the public institutions and other users.

It is believed that the first accounting records emerged with the writing, in Sumer. Thus the scribe wrote on the wet clay plate the undertaken obligations, and the parties involved into negotiations confirmed by signature that the notes were correct. Later, the use of coins by the Greeks, 600 years BC, boosted trade and thus the accounting records. With regard to the history of accounting, mention can be made of the fact that many famous authors analysed over time the aspects of the emergency and development of accountancy. Among them, the French professor Bernard Colasse groups the evolution of accountancy into three main periods[1]. In the early Middle Ages, accountancy was characterized by simplicity. The end of the Middle Ages marks the transition to the second phase in the evolution of accountancy, when due to the fast development of the commercial and banking activity, especially in the area of the Italian republics, double entry bookkeeping will go beyond the administrative area bringing forth the economic rationale. Accountancy is thus widely adopted, in Europe. In the view of professor Colasse, the 19th century and the impact of the industrial revolution on the national economies will determine the passage to a third stage in the evolution of accountancy, characterized by the development and separation of management accounting from the financial one or by the recognition of the role of information in the decision-making process, of the accounting balance or of the profit and loss account.

Luca Paciolo[2] had a special impact on the evolution of accountancy through his treatise "Summa de Aritmetica, Proportioni et Proportionalita" (Everything about arithmetic, geometry and proportions"). Prepared in 1494 at Venice, the paper is viewed as the first general treatise of practical arithmetic and algebra ever published. The chapter entitled *"Particularis de computis e scripturris"* is dedicated to accountancy. In this chapter the author merged the accounting knowledge used until then that he knew[3], comprehensive and understandable description of the new method of accounting. Pacioli does not specify whether the information presented is inspired by previous writings or by

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1. Matei Marius Ștefan "De la primordialitatea aparenței juridice la reflectarea realității economice sau calea de evoluție a contabilității românești", PhD Thesis, ASE, Bucharest, 2004, pp.22-24

2. Luca Pacioli, born in 1445, was a true Renaissance figure, with extended literature, art, mathematics, business and science knowledge.

3. Laurențiu Dobroțeanu "Contabilitatea în Evul Mediu – primele tehnici moderne de conta-bilitate" – Contabilitatea, expertiza și auditul afacerilor, no.7, July, page 15.

the practice of financiers and traders of his time. What can be said with certainty is the influence of the Venetian experience, a genuine trade centre in those times[1].

3. A final remark

In conclusion, with the emergence and generalization of the alphabet, the conditions of scientific investigation and the related methods were also developed, in incipient stages, and the first census works simultaneously generated statistics, demography and accountancy, conferring a unique scientific aura to the first census of the ephemeral empires...

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14. Contabilitatea, expertiza şi auditul afacerilor, no.7, July
15. *Accounting Law no. 82/1991, republished*

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