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A HISTORICAL APPROACH TO STATISTICS TEACHING IN SPAIN

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Résumé

Aborder l'étude de l'histoire des statistiques en Espagne n'est pas une tâche facile. Dans ce travail, nous essaierons d'analyser les aspects les plus importants qui nous permettent de suivre clairement l'évolution historique des statistiques en tant que matière d'enseignement. Nous avons considéré les différents domaines de son enseignement: le primaire, le secondaire et le système universitaire ainsi que l'enseignement professionnel.

Abstract

In approaching the study of the history of Statistical education in Spain, we are not faced with an easy task. In this paper, we attempt to analyze all of the relevant aspects that permit a clear perception of the historical evolution of Statistics in terms of teaching. Different areas of Statistical education, which can be found at primary, secondary and tertiary level, have been considered, along with statistics within the professional sphere.

I. INTRODUCTION

To convey a thorough historical approach to the teaching of Statistics in Spain is not an easy task. Firstly, it implies the difficulties of a historical research whose sources are heterogeneous and incomplete, and secondly, it requires a specific layout in order to provide a clear historical description of the teaching of Statistics in Spain.

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In this paper, all education levels and systems involved have been considered, emphasizing the most relevant elements of each.

The number of issues to be included in this analysis is enormous. However, due to the limited space of this paper, a general and inclusive analysis of many different aspects and their relationship has been privileged over a detailed and deep study of individual issues. The main aim is to focus on the clear exposition of the historical evolution of the teaching of Statistics in Spain.

Consequently, this study will consider a great variety of issues related to the teaching of Statistics in Spain: (a) the legal development of the educational systems in general and of the teaching of Statistics in particular; (b) publications on Probability Calculus and Statistics; (c) authors and other individuals related to Statistics and its teaching; (d) the description and historical evolution of the contents taught; (e) institutions which played an essential role in the teaching of statistics; (f) political, administrative and personal events and finally; (g) all those circumstances that have had anything to do with the teaching of Statistics.

Each of these issues could well be the object of a separate study. In fact, this has been the case with some of them, as a quick look at the bibliographical references at the back of this paper will show. However, the main aim of this paper is to provide a general and systematic historical approach to the teaching of Statistics in Spain from a broad and inclusive perspective.

II. THE TEACHING OF STATISTICS IN SPAIN. THE NINETEENTH CENTURY

The first university chair of General Statistics was established by the Sociedad Económica de Amigos del País³ based in Madrid, and it was assigned to José María

³ Literally, “Economic Society of Friends of the Country.” These associations had their origin in the 18th century and were a consequence of the interest in the consolidation and expansion of knowledge shown by Enlightenment intellectuals. They had the support of the monarch, and their main purpose was to serve and modernize Spain through the advancement of various kinds of knowledge, hence the economic inclination marked by their names.

Ibáñez. This origin is not surprising, for, according to Sánchez-Lafuente, “statistical knowledge in Spain during the second half of the 18th century and the first half of the 19th century was located in the various Economic Societies”⁴. The first course began on 1 December, 1844. In the same year, José María Ibáñez would publish his *Tratado elemental de Estadística, así en la parte filosófica y teórica como en la aplicación de sus principios en la práctica (Treatise on Statistics, including a philosophical and theoretical part as well as its practical application)*. This first course had an attendance of thirty-eight students. Although the course went on for some years, it is doubtful whether it was open to the public.

Legally, the first chair of Political Economics and Statistics in Secondary Education was established in 1821 by the 29 June Reglamento de Instrucción Pública⁵. However, many of the 19th-century governmental plans were never carried out. It was not until the 28 August 1850 Real Decreto⁶ was passed (when Manuel Seijas Lozano was Education Minister) that Statistics was established as a subject in the Secondary Education curriculum, included in the section related to Administration. This same Bill required the teaching of Industrial and Financial Statistics in Finance Colleges, institutions created at the same time under the term “special colleges.”

Thirteen years after the creation of the first university chair by the Sociedad Económica de Madrid, the 1857 Ley de Instrucción Pública (“Public Education Bill”) requires the teaching of Statistics in Law and Finance Colleges. That same year, the Finance College of Madrid offered two degrees in finances, major and minor. Finances minor students had to attend a course on Commercial and Industrial Statistics. In 1912, a course on Mathematical Statistics and Insurance Theory was introduced for the Finances major as well.

⁴ [SANCHEZ-LAFUENTE, 1973a], p. 148.

⁵ In the Spanish legal system, a “Reglamento” is a part of a more general bill or act already passed by the parliament, designed to complete the bill and establish guidelines for its application in more concrete contexts. “Reglamentos” are normally established by the specific ministry.

⁶ As opposed to “normal” bills or acts, the “Real Decreto” has not been voted in the parliament, but passed by the Executive Government (Prime Minister or specific Minister). It also completes what has been established in general bills, and it is normally used for speed and efficiency reasons. In this sense, “Reglamentos” expand the directives established by “Reales Decretos,” which in their turn depend on general bills, called “Ley”.

During the 19th century, J.M. Ibáñez, M. Salva, A. Ramirez, M. Carreras, J.M. Piernas, S. Adame y M. Minguez published numerous books on statistics. In general, these books dealt with a variety of issues from geography to descriptive statistics, and they apply simple calculations of means and percentages to the analysis of demographical and economic problems. Some of the texts were used in the training of state officers in charge of official statistics and working for an institution that would develop into the current INE⁷.

III. THE TEACHING OF STATISTICS IN SPAIN. ITS CONSOLIDATION IN THE 20TH CENTURY

In 1924, José Antonio Artigas taught a course on Statistics applied to engineering at the Industrial Engineering College of Madrid. The first Statistics course at the University of Madrid (Science Faculty) was taught by Esteban Terradas during the academic year 1931-32. For this course, Terradas used fundamental texts like Von Mises's and Darmois's. Other authors studied are Fisher, de Finetti and Kolmogorov, whose work was essential for modern Statistics. According to Arribas Macho⁸, Terradas is not only the first professor to teach mathematical Statistics at the Central University, but also the person responsible for the establishment of the first Statistics chair at the Science Faculty, which was awarded to Fernández Baños in 1934. The references used by Terradas for the Mathematical Statistics course were Darmois, Rietz, Von Mises and Fry. Terradas was also the professor in charge of a Sample Theory course in 1933.

The first Mathematical Statistics Chair was awarded in 1934 to Profesor Olegario Fernández Baños at the Science Faculty of the University of Madrid. Shortly before his death he published his *Tratado de Estadística (Treatise of Statistics)*, where he dealt with a great number of issues on Statistics and its application to economy, such as index numbers, interpolation, adjustment curves, mortality rates, etc. However, it seems that those materials that would later be included in the *Tratado* were already circulating in mimeographed class notes. Fernández Baños was also Director of the Study Service of the Bank of Spain. Apart from that, he was the first to teach statistics at the Faculty of

⁷ Spanish initials for "Instituto Nacional de Estadística," that is, "National Institute for Statistics."

⁸ [ARRIBAS, 2004].

Economic Sciences created in 1944. In those same years, professor J.M. Orts taught Mathematical Statistics at the University of Barcelona.

After Fernández Baños's death in 1945, Sixto Ríos was awarded the Mathematical Statistics Chair in 1948, and created the Institute for Statistical Research, a part of the CSIC⁹. During this period, a series of visiting Statistics scholars taught conferences and seminars on different statistical issues. In 1947, J. Wishart was invited by the Institute of Agronomic Research, where professor Anós, Calvet and Zulueta were working on the applications of Statistics to experiment design. In 1949, Professor H. Wold was invited by the new Institute for Statistical Research and conducted a seminar on Statistics that played an essential part in the creation of the scientific journal *Trabajos de Estadística*. Other visiting scholars invited by the Institute for Statistical Research were H. Cramer, M. Fréchet, P.C. Mahalanobis, R. Fortet, F.J. Anscombe, D.J. Finney, L.J. Savage, J. Neyman, etc.

The most notable Spanish scientists also had the opportunity to visit important international statistical institutions and to contact eminent international experts who were applying the most innovative statistical techniques: for instance, Enrique Cansado, who in 1949 obtained a grant to visit the United States and become acquainted with the work carried out by the U.S. Bureau of the Census. Professor Cansado was in charge of the Methodology Section at the INE and used his visit to the U.S. to teach his course on *Statistical Sampling and its Fundamentals* (1949). Professors Ríos and Anós, among other, were important collaborators in this course.

Between February and May 1950, the Science Faculty of the University of Madrid offered some courses on Statistics and its application, directed by José Álvarez Ude. Enrique Cansado acted as secretary. The courses were organized in two groups: basic and special. They were taught by a group of teachers, the most relevant of which were: José Álvarez Ude, Sixto Ríos, Enrique Cansado, Francisco Azorín, Sixto Cámara, José Castañeda, Antonio de Miguel, José Ros Jimeno, José Royo, Angel Anós, Joaquín Tena, Enrique Blanco, Angel Vegas, Juan Béjar and D.I. Aldanondo.

⁹ CSIC stands for "Consejo Superior de Investigaciones Científicas," that is, "High Institute for Scientific Research".

Due to the success and favourable reception of these courses during the first and following years, the University of Madrid, with the support of the Science Faculty and the Political and Economic Science Faculty, created the Statistics College for the academic year 1952-53. A greater variety of courses on Statistics was offered. A Decreto passed on 11 January 1952 established the Statistical College as an institution dependent on the Central University. Its main purposes were the formation of the Facultative and Technical Statistical State Officers, working for the INE. Making the Statistics College independent from the University of Madrid attempted to avoid a study of Statistics too biased towards certain theoretical or applied aspects of Statistics.

The number of students who enrolled the Statistics College during the first year was 253. Later, for more than ten years, the number of students stabilized around two hundred per year.

Two degrees were established in the Statistics College: major and minor. The first one was divided in two sections: Mathematical and General Statistics. Two years were required for the major in General or Mathematical Statistics, whereas the minor in Statistics could be completed in a year.

Access to the minor could be granted with the following diplomas: Secondary Education, Industrial Master or Expert, or similar. For the major, access was limited to only other Science or Economic majors, like Engineers, Architects, Insurance and Finance Experts, although these students could join the Statistics College after the first course of their majors. Army officers could also apply.

Three diplomas were established: Statistics Certificate was granted to students who had completed the minor, General Statistics or Mathematical Statistics Diplomas were awarded to the students who had finished their respective majors in the Statistics College.

The subjects required for the Mathematical Statistics Diploma were:

- Mathematics: Point Sets, Theory of Measure and Integral Calculus, Matrix algebra, Finite Differences, Function Spaces, etc.

- Mathematical Statistics: Probability Theory, Statistical Inference. Textbooks used were *An Introduction to Probability Theory and Its Applications* (Feller) y *Mathematical Methods of Statistics* (Cramer) [This book was translated by Enrique Cansado and published in 1949 by Aguilar Publishers].
- Methods of Statistics: four more courses on applied Statistics were required. Courses varied from one year to the other and dealt with demographical, economic, industrial, sample statistics, as well as Statistics applied to biology, agriculture, actuarial, econometrics, medicine, psychology, pedagogy, etc.

For the General Statistics major, General Statistics and Statistical Methods were required, apart from two years of Mathematics (Analytic Geometry, Differential and Integral Calculus, Matrices, Quadratics Forms, etc.). However, only one year of Mathematical statistics was required with a level no higher than the textbook *Introduction to the Theory of Statistics* (Mood). Five other free-choice courses on other topics of applied Statistics were also required.

For the minor, the courses required were General Mathematics, Methods of Statistics and General Statistics, plus three free-choice courses on Applied Statistics.

During the academic year 1953-54, some statistical topics are introduced in the Mathematics curriculum in Secondary Education. A special emphasis was laid on graphic representation, and the notions of probability, means, dispersion, correlation, etc.

After that, the Statistics courses extend to other Spanish University Faculties and Colleges. Science Faculties (Mathematical Section), Political Science Faculties, Economics and Finance Faculties offer these courses, as well as Agriculture, Industrial Engineering and Journalism Colleges, some time later. Professors in the following list played an important role in the establishment of Statistics in the curriculum: A. Vegas, G. Arnáiz y A. Alcaide (Economics), J. Béjar y P. Zoroa (Institute for Statistical Research), J. Royo y J. Tena (Pedagogy), E. Blanco (Statistical Quality Control), R. Sales, J. Romaní and J. Gil Peláez.

In Primary Education, it was not until the 1945 Primary Education Bill that it is possible to find a clear description of the contents of Statistics in the primary education curriculum, which emphasized graphic representation of statistical phenomena.

Secondary Education incorporated Statistics to its curriculum in 1953, through the 12 June 1953 Decreto. In this new curriculum for Secondary Education, the statistical contents were included in Mathematics as a subject, and focused on graphic representation, averages, dispersion and correlation, etc.

In 1965, the 8 July Orden Ministerial removes statistics from Primary Education. However, the Ley General de Educación y Financiamiento de la Reforma Educativa, better known as Villar Palasí Education Bill, establishes “Descriptive Statistics” as a part of the Mathematics curriculum. This act also required some concepts of Probability and Statistics to be taught in secondary education.

Since 1970, the Villar-Palasí Education Bill caused a great change in the teaching of Statistics in Secondary Education. According to this act, during the first year of Secondary Education students (15-years-old) had to study statistics in Mathematics and Science. The following contents were included: (1) Combinatorics. Probability; (2) Statistical variables. Central and Dispersion measures. During the third year, the following contents were part of the mathematics and science curriculum: Random Variables. Binomial and Normal Distribution; Bidimensional Distribution, Regression. Correlation. During the last year, designed as a preparatory, pre-college course, students (18-years-old) had to study Probability Calculus. In the mid-eighties, a specific mathematics subject was developed for Human and Social Science students, called Mathematics II. This course consisted of three thematic groups, one of which incorporated Probability and Statistics elements, whose main purpose was to provide Human and Social Science students with an introductory knowledge of applied Statistics.

The Villar-Palasí Bill was replaced in 1990 by a new Education Bill, the L.O.G.S.E¹⁰. This bill divides primary education in three levels: first level, 6 to 8 year-old students,

¹⁰ Spanish initials for “General Bill of the Education System.”

second level 8 to 10, and third level 10 to 12. There is a content group called Information Organization, which extends over the three levels and introduces concepts like data tables, graphic representation, position measures, randomness, etc. Secondary Education is also divided in three levels: Compulsory Secondary Education, first (12-14 years-old) and second (14 to 16) levels, and a non-compulsory third level (16 to 18). In the curriculum of the first level there are two content groups which include Statistics and Probability: “Information Interpretation, Representation and Treatment” and “Randomness Treatment.” In the third level, the Statistics and Probability content is taught in three out of the four existent modes. The main content concerns itself with Descriptive Statistics, Random Variables and their characteristics; as well as concepts such as Regression, Sampling and Basic Statistical Inference, this last topic mainly in the Human and Social Science curriculum.

Although it introduced some changes in the structure of the education system, the 2002 Education Bill (L.O.C.E.¹¹) did not alter the teaching of Statistics significantly.

In 1990, the journal *Estadística Española* promoted some research works on the teaching of Statistics in different Spanish universities. The teaching of Statistics proved to be have a widespread acceptance in the different curricula, even though the depth and approached differed depending on the disciplines and also on the kind of college or faculty. In disciplines such as Sociology, Psychology, Biology and Medicine, Applied Statistics is privileged over mathematical concepts and statistical tools. Contrarily, in the Science disciplines (especially Mathematics) and in Polytechnic Colleges, the approach is more mathematical and theoretical, and less attention is paid to practical applications. In Mathematics Faculties, the number of courses related to theoretical Statistics tends to be higher than the number of courses related to applied Statistics. In the Economic and Business Faculties, however, there seems to be a better balance between the theoretical and conceptual study of Statistics and its practical applications in Social Sciences, mainly in Economics.

It is also remarkable that since the beginning of the 90s, the computer revolution has had a great impact on the study and teaching of Statistics. The use of computers has

¹¹ Spanish initials for “Quality Education Bill.”

facilitated the application of Statistics to diverse social and economic aspects, but it has also brought about the apparent obsolescence of theoretical knowledge, and consequently, the possibility that some fatal mistakes can be made when applying and interpreting the great number of statistical techniques developed.

In the Spanish Economic and Business Science Faculties, the teaching of Statistics tends to be organized in two Statistics courses and one Econometrics course. The Statistics courses are normally divided in courses privileging Descriptive Statistics and those emphasizing Probability Calculus and Statistical Inference. In some universities there are some courses which develop advanced statistical knowledge in Econometrics, Time Series, Sample Theory, etc.

Sociology and Political Science Faculties normally offer courses on Statistics applied to Social Science. In these courses, there is a clear distinction between Descriptive Statistics and Statistical Inference, especially in the treatment of nominal and ordinal relevant variables. In more advanced years, it is possible to find courses on Social Research Techniques, which also include the concepts of certain statistical techniques.

Psychology Faculty curricula often offer courses on Descriptive Statistics, Probability Calculus and Statistical Inference. Other techniques studied in the most advanced years are Multivariate Analysis, Decision Theory, Data Analysis, etc.

In the first years of the Mathematics Degree, faculties require courses on Probability Calculus and Mathematical Statistics. Students specializing in Stochastic Processes may also complete their formation with courses on Statistical Inference, Decision Theory and Applied Statistics.

Medicine and Biology students have access to a variety of both compulsory and optional courses on Statistics. Compulsory courses provide basic knowledge of the fundamental concepts of Statistics, focusing on its application to their disciplines. The optional courses complete these contents with a set of statistical tools and methods.

Polytechnic Colleges present a great heterogeneity depending on the field, but they all tend to offer a course on Statistics at all levels. The basic contents of this course are

Descriptive Statistics, Probability Calculus and Statistical Inference. In addition to this, some disciplines require additional formation on Statistics, and they offer more specialized courses on Statistical Quality Control, Experiment Design and Regression.

From a professional point of view, some institutions provide a specific formation essential for the development of the professional applications of Statistics. The most important institution in this sense is the INE. This national institution promotes the study of Statistics mainly through the College of Public Administrations Statistics, whose main objective is to provide a specific statistical training to INE, Ministry, Local and Regional Administration prospective staff as well as to all users interested in Statistics. The contents of the different courses focus on new statistical concepts, tools and methodologies applied to statistical production. INE statisticians are normally responsible for the teaching in these courses, but other professional experts in Statistics as applied to Business and Institutions also participate. The Selective courses of Statistics State Officers are also an important part of the curriculum of the College for Public Administrations Statistics. The following table displays the most important elements of the training provided by this institution from 2001 to 2004.

	Number of hours			
	2001	2002	2003	2004
Oficial Statistics: General Aspects	28	43	52	18
Oficial Statistics: Economic Statistics	78	126	60'5	118
Oficial Statistics: Social Statistics	52	35	18	50
Data Collection and Methodological Analysis of Surveys	35'5	30	137	92
Selective Courses for Statistics State Officers	300	180	168	105

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