Celebrating the Memory of Corrado Gini: a Personality Out of the Ordinary

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Summary

Corrado Gini was one of the most brilliant and internationally recognized scientists of the Italian School of Statistics. This paper, written on the occasion of the 50th anniversary of his death, recalls the key aspects of his life and his extraordinary scientific contributions. In describing his impressive mind, interdisciplinary interests, his long and significant academic life, his immense scientific production, and his commitment to official statistics, we must also take into account the particular historical period that Gini lived in. But the most relevant and honourable of his acknowledgements is the impact he undeniably had and still has on the international scientific community of statisticians and non-statisticians.

1 Introduction

This paper is intended to honour the memory of Corrado Gini, one of the most famous Italian statisticians. Besides being an outstanding scientist, he was also a notable and respected personality in Italy during the XX century. For this reason, it is important to start by briefly describing the historical background of the country, in order to frame the political and social atmosphere in which scientists were involved in that period.

Italy reached unification only in the second half of XIX century; before that everything, including research activity, was fragmented in small separated city-states. A common scientific and cultural platform started to arise in the period between the political unification and the First World War. It is interesting to note that a very important role in this process was played by the International Statistical Institute (ISI) that received a relevant contribution by Italian intellectuals at least until the Second World War (see, e.g. Leti (2004)). In 17 March 1861, the Kingdom of Italy was proclaimed. After Florence became capital of the Kingdom (1865), it hosted a Congress of European Statisticians (1867) for the first time. However, the main difficulty in organising statistical conferences was basically due to the ambiguous relationship between scientific purposes and political interests of the government promoting them.

In 1885, during the celebrations for the jubilee of the Statistical Society of London, Luigi Bodio, together with several other scientists, highlighted the need of creating a new association, independent of government decision-making, thus pouring the foundation of the ISI. The constituent assembly formally established this principle, and Luigi Bodio was elected General

Secretary. He kept this position for 25 years and in 1909 was elected President for two consecutive terms, until his death in 1920. His confirmed designation in the highest offices of the ISI proved the international prestige of the Italian statisticians. Moreover, Rome, selected to host the first Congress in 1887, was the first branch of ISI. Italian statisticians were really active in organising and participating to the congress; in this context, Gini–designated honorary member in 1939–occupied a leading role. ISI Scientific meetings were actually utilized by Gini and his collaborators as an opportunity to make public the remarkable results of the so-called Italian School of Statistics as well as to respond to and criticise other (non-Italian and Italian) scholars' achievements. In this regard, it may be worth recalling Gini's reply (Gini, 1931a) to the presentation of Bortkiewicz (1931a) at the XIX Scientific Meeting in Tokyo, which is significant also for the severe reactions caused among Italian scientists. The point of contention included some conclusions related to the comparison of variability indices together with the authorship of some theoretical and methodological results, obtained several years before by Gini (1912) and Pietra (1915). The motivations advanced in Bortkiewicz (1931b) to justify his paper triggered another strong reaction in Gini (1931b). Pietra (1931a,b) and Savorgnan (1931) also contributed to these criticisms. This particularly hard debate, as well as many other occasions of participation, published by non-Italian journals (Gini, 1921, 1926, 1930, 1934, 1936, 1965) clearly show that Gini *was* Italian Statistics. Actually, most of the innovative results achieved by Italian statisticians in that period were deduced from his works and by the researchers that, directly or not, collaborated with him. This was also true for the main results published in the proceedings of the Italian Statistical Society (*Società Italiana di Statistica*), founded in 1939 and directed by one of his closest collaborators, Gaetano Pietra. However, in practice, a proper and genuine discussion was totally lacking at that time, because he somehow monopolised the debate: although innovative and original, all the works produced by his collaborators were indeed integrated into the framework depicted by the *leader* of the School.

2 An Immortal Scientist, a Man Deeply-Rooted in His Time

To let the reader understand the complex personality of this scholar, we will try to contextualise his scientific career and his life in the specific work environment he happened to be part of, during the particular historical epoch he lived in. Carlo Benedetti, who held a temporary position as Gini's Assistant since January 1952, described him as a man who appeared older than his age (68 at that time) but who was endowed with an outstanding responsiveness and decision-making ability. In that period, Gini (see Figure 1) was the Dean of the Faculty of Statistical, Demographic and Actuarial Sciences (*Facoltà di Scienze Statistiche, Demografiche ed Attuariali*) and the Director of the Statistical Institute (*Istituto di Statistica*), both located in Rome, in *via delle Terme di Diocleziano*, close to *Piazza Esedra*. In the same square, there was (and there is still) the Caffè Piccarozzi, the favourite hangout for the professors of mathematics and actuarial sciences who did not have proper offices in the University building; they used to meet there for scientific discussions and for office hours with students. The Teaching Assistants and some other Professors of Statistics occupied some glass boxes with a one way microphone: Gini was able to call and listen to the assistants, but they could only reply if asked. There was only a relatively small amphitheater classroom.

As regards Gini's human relationships, they were reduced to the minimum required, formalities were almost abolished. In order to describe his authoritarian and detached behaviour, we could borrow a metaphor R.A. Fisher conceived to represent Karl Pearson's attitude towards his assistants, described as 'an army of industrious robots responsive to a magic wand' (Fisher, 1956). The working time was rigidly set from 8.30 am to 1.00 pm and from 4.00 pm to 8.00

Figure 1. *Corrado Gini (1884–1965). Photo source: (i) Giuseppe Leti (1996). 'L'Istat e il Consiglio Superiore di Statistica dal 1926 al 1945', ISTAT, Annali di Statistica, anno 125, serie X, vol. 8. (ii) FotoArte Cappelli.*

pm. Moreover, Gini was essentially unapproachable for students and he taught classes only irregularly because of the several commitments related to his massive research activity, such as for instance his frequent journeys abroad for conferences and anthropological campaigns promoted by the Committee for the analysis of population problems CISP (*Comitato per lo studio dei problemi della popolazione*).

Gini was married and had two daughters, but his numerous appointments and responsibilities, academic and extra-academic, as well as his extremely prolific scientific production (more than 800 publications, as documented by Castellano (1965)) probably did not allow him to dedicate much time and attention to his family.

All these elements contribute to depict the portrait of a man totally devoted to research and work: cold and essential, almost detached with other people, fully aware of his outstanding intellectual abilities. However, as it often happens, appearances are deceptive and do not always coincide with reality. Benedetti (1965), who was very close to him in the last years of his life, realised that his strict discipline in the organisational tasks and his inflexibility in the relationships with other people were actually the most direct way to reach some goals that other researchers were not even able to imagine. When he was 70 years old, after retirement from official positions, he became aware of the results he fulfilled and therefore more available to discuss and interact with other scholars. This view of the last decade of Gini's life is also shared by Italo Scardovi, who was impressed by his humanity and openness towards everybody without any inclination to consider himself custodian of an indisputable truth (Giorgi, 2002).

2.1 Life and Studies

Corrado Gini was born in Motta di Livenza (Treviso) on 23 May 1884. His parents, Lavinia Locatelli and Luciano Gini, were rich landowners. He graduated in Law in 1905 at the University of Bologna and during same period, he also attended some additional courses in Mathematics and Biology. His thesis, focusing on the distribution of sex in human births (entitled '*Intorno alla distribuzione dei sessi nelle nascite umane*'), immediately showed that his interests were not restricted to legal matters; in fact, his dissertation already revealed a distinct passion for other branches of knowledge. Among these, he assigned a privileged role to Probability (see, e.g., Gini, 1907, 1911, 1964, 1968), which he considered the fundamental basis to understand any kind of phenomenon. Gini declares that his first love was probability, by describing his point of view on this subject in his first article entitled '*Contributi alle applicazioni statistiche del calcolo della probabilità*' (Contributions of probability to statistical

applications) published in 1907 on the '*Giornale degli economisti*' (Journal of Economists). He also presented these ideas at the conference of the '*Societàă Filosofica Italiana*' (Italian Philosophical Society), that was held in Parma on September 1907. One year later, he also reported some further and deeper discussions in a volume entitled *'Il sesso dal punto di vista statistico'* (Gender from the statistical point of view, see Gini (1908)). After all, that love became fruitful, and he directly ascribed the brilliant start of his academic career to his view of probability (Gini, 1968), thanks to the extremely positive impression raised by his writings and his talk among the scientists attending the earlier mentioned Conference in Parma. This was a long-lasting love as shown by the fact that, when his students and collaborators were preparing a collection of his main scientific contributions, at the last moment he strongly wanted his '*Teoria logica e psicologica della probabilità*' (Logical and psychological theory of Probability) to be added in. Figure 2 reports the table of contents extracted from the original autograph manuscript. This was somehow burdensome work, one that he put on hold for more than 50 years, as if he was waiting for his own ideas to be confirmed and supported by the cultural and scientific experiences of a whole life.

During his academic career, Gini was mainly committed to the systematic development of the theory of statistics and its applications to real contexts, without forgetting the connections of statistics with probability and its fundamental principles. In particular, in the decade 1939–1949, he explicitly and directly focused again on the relationship between statistics and probability, motivated by a renewed interest in inferential problems. In the occasion of the first Meeting of the Italian Statistical Society (held in Pisa on 9 October 1939), in his plenary opening speech (Gini, 1939) entitled '*I pericoli della Statistica*' (Dangers related to Statistics), he criticised Fisher's fiducial inferential methods, also involving a partially negative judgement on

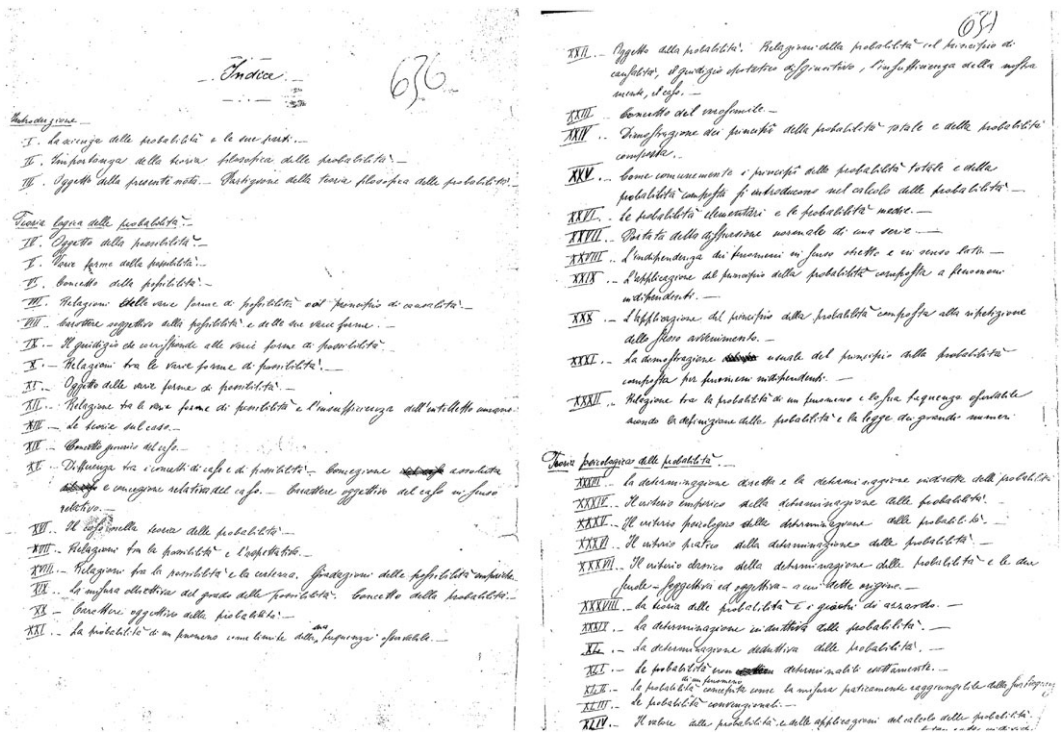
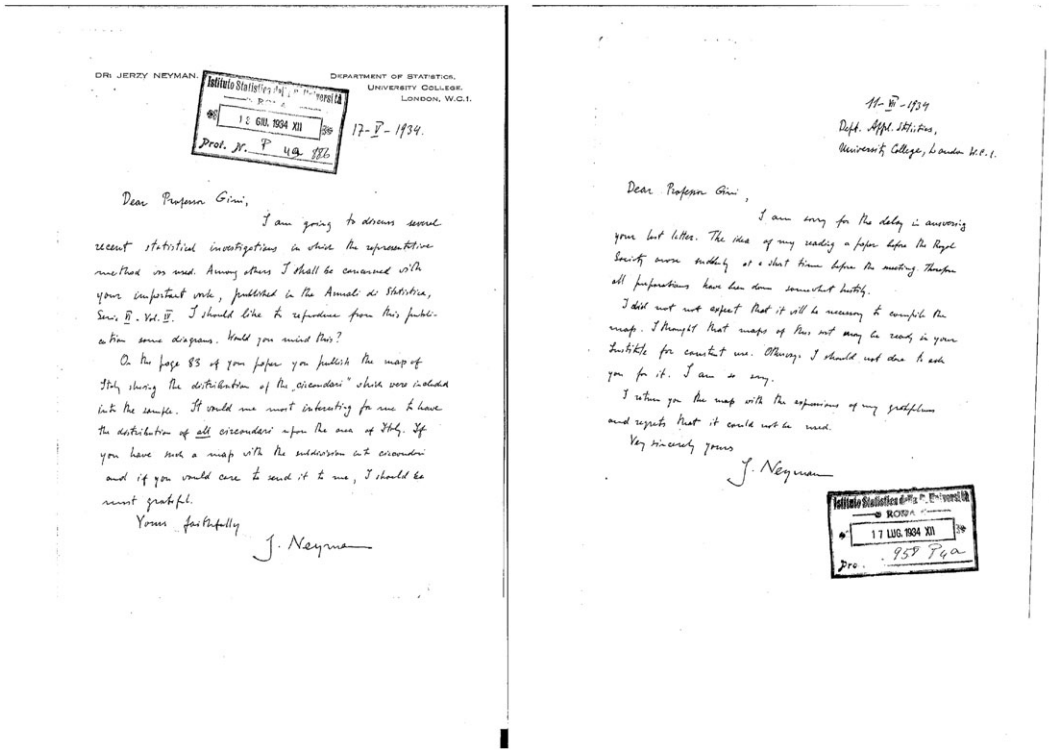


Figure 2. *Table of contents extracted from the original autograph manuscript 'Teoria logica e psicologica della probabilità', dated before 1907, published posthumous in* (Gini, 1968).



DR. JERZY NEYMAN. DEPARTMENT OF STATISTICS, UNIVERSITY COLLEGE, LONDON, W.C.1.

Istituto Statistico della R. Università ROMA 18 GIU. 1934 XII Prot. N. P 49 886

17-V-1934.

Dear Professor Gini,

I am going to discuss several recent statistical investigations in which the representative method was used. Among others I shall be concerned with your important work, published in the Annali di Statistica, Serie II - Vol. IV. I should like to reproduce from this publication some diagrams. Would you mind this?

On the page 83 of your paper you publish the map of Italy showing the distribution of the "circondari" which were included into the sample. It would me most interesting for me to have the distribution of all circondari upon the area of Italy. If you have such a map with the subdivision into circondari and if you would care to send it to me, I should be most grateful.

Yours faithfully

J. Neyman

11-VII-1934

Dept. Appl. Statistics, University College, London W.C.1.

Dear Professor Gini,

I am sorry for the delay in answering your last letter. The idea of my reading a paper before the Royal Society arose suddenly at a short time before the meeting. Therefore all preparations have been done somewhat hastily.

I did not not expect that it will be necessary to compile the map. I thought that maps of this sort may be ready in your Institute for constant use. Otherwise I should not dare to ask you for it. I am so sorry.

I return you the map with the expressions of my grateful and regrets that it could not be used.

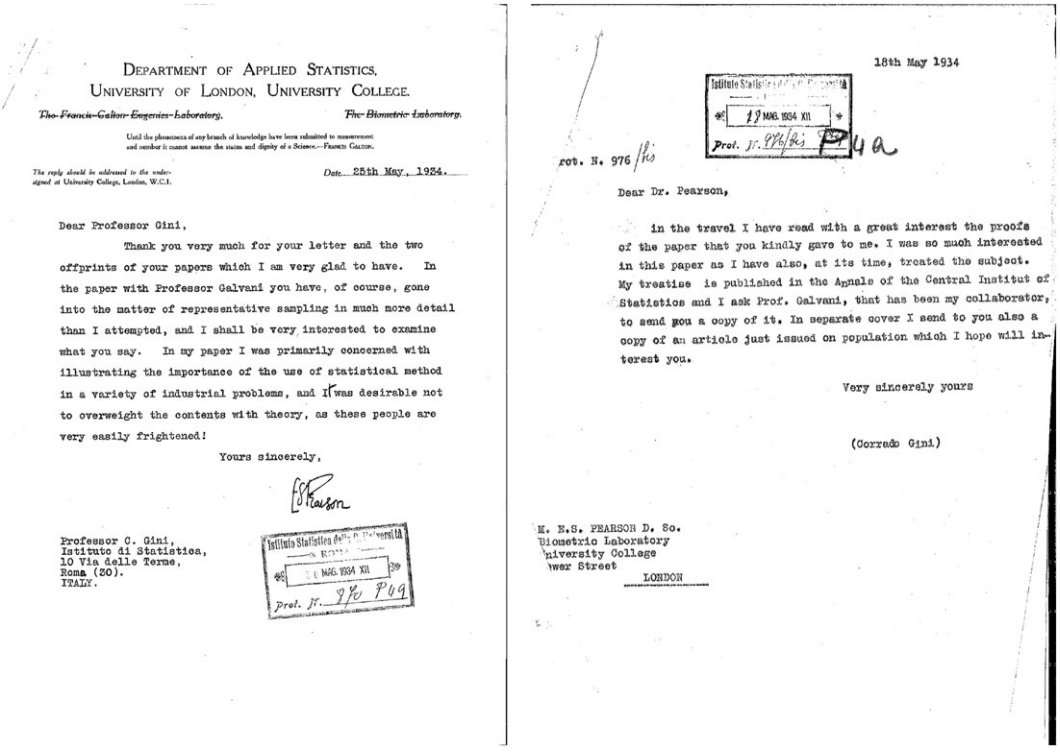
Very sincerely yours

J. Neyman

Istituto Statistico della R. Università ROMA 17 LUG. 1934 XII Pro. 958 P4a

Figure 3. *Some excerpts of Gini's correspondence with Neyman.*

the hypothesis testing procedure proposed by Neyman and Pearson, that he considered theoretically weak (Gini, 1943). Some excerpts of Gini's correspondence with Neyman and Pearson are in Figures 3 and 4 respectively. His disapproval was founded on Bayesian arguments, although, as pointed out by several authors–for example, Forcina (1982), Regazzini (1997), Piccinato (2011)–Gini's view of probability was limited, being more related to the traditional ideas of classical authors, such as Bernoulli, Laplace, Pearson, rather than on the neo-Bayesian approach introduced by de Finetti. Actually, he personally knew de Finetti and they also had a collaboration at the Italian National Institute of Statistics (ISTAT), but Gini did not really pay attention to his innovative idea of probability. On the other hand, the point of view he expressed in the earlier mentioned talk also motivated a correspondence with Fisher himself; as documented in Gini (1965). In a letter dated 22 December 1939, Fisher acknowledged the logic of Gini's thesis, but also asserted that in practice, the drawbacks of the criticised applications were not so important as Gini imagined. More specifically, Fisher added that he had never pretended that a significance test could be applied without taking into consideration the issues highlighted by Gini. Unfortunately, due to the Second World War, a proper discussion was discontinued and could not be restarted, because the course of time had contributed to consolidate the two separate positions. In this occasion, the excessive inflexibility shown by Gini against the inferential theories was not constructive, and ended up hiding the positive elements of his reasoning. After all, Gini was fully convinced of his own capabilities and he did not even call into question the correctness of his way of thinking. Actually, as some authors pointed out, this was also due to his partial knowledge of the original contributions by Fisher and by Neyman and Pearson (Forcina, 1982). However, his discussion helped in clarifying the fundamental elements of the criticised theories, by stressing the potential biases of some interpretations (Herzel & Leti,



DEPARTMENT OF APPLIED STATISTICS,
UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.

~~The Francis Galton Eugenics Laboratory.~~ ~~The Biometric Laboratory.~~

Until the phenomena of any branch of knowledge have been submitted to measurement and number it cannot assume the status and dignity of a Science.—FRANCIS GALTON.

The reply should be addressed to the undersigned at University College, London, W.C.1.

Date 25th May, 1934.

Dear Professor Gini,

Thank you very much for your letter and the two offprints of your papers which I am very glad to have. In the paper with Professor Galvani you have, of course, gone into the matter of representative sampling in much more detail than I attempted, and I shall be very interested to examine what you say. In my paper I was primarily concerned with illustrating the importance of the use of statistical method in a variety of industrial problems, and I was desirable not to overweight the contents with theory, as these people are very easily frightened!

Yours sincerely,

E S Pearson

Professor C. Gini,
Istituto di Statistica,
10 Via delle Terme,
Roma (30).
ITALY.

Istituto Statistico della R. Università
ROMA
MAG. 1934 XII
Prot. N. 976 P49

18th May 1934

Istituto Statistico della R. Università
MAG. 1934 XII
Prot. N. 976/his P4a

rot. N. 976/his

Dear Dr. Pearson,

in the travel I have read with a great interest the proofs of the paper that you kindly gave to me. I was so much interested in this paper as I have also, at its time, treated the subject. My treatise is published in the Annals of the Central Institut of Statistics and I ask Prof. Galvani, that has been my collaborator, to send you a copy of it. In separate cover I send to you also a copy of an article just issued on population which I hope will interest you.

Very sincerely yours

(Corrado Gini)

M. E.S. PEARSON D. Sc.
Biometric Laboratory
niversity College
wer Street
LONDON

Figure 4. *Some excerpts of Gini's correspondence with Pearson.*

1977). Finally, a careful rereading of some documents on this topic (Piccinato, 2011) underlines the attempt of reconciling Gini's position with modern inferential statistics. Even de Finetti (1966) acknowledged that 'on some specific and relevant points a complete harmony comes true between Gini's attitude and the supporters of the subjective interpretation of probability'. Moreover, in Regazzini's opinion (Lijoi & Prünster, 2011), the unquestionable validity of Gini's point of view, unfortunately not accompanied by an alternative proposal, was not enough to let his ideas come out from a substantially isolated position in the international community.

Corrado Gini passed away in the early morning of 13 March 1965.

2.2 Gini and His Time: Academic Life, ISTAT and Controversial Connections with Fascist Regime

Gini's academic career grew extremely rapidly: in 1908 he had a lecturing post in Statistics; in 1909, he was designated Lecturer for the course of Statistics of the Faculty of Law at the University of Cagliari where he also taught Political Economy and in 1910, he became the Chair of Statistics at the same University when he was only 26. In 1913, he moved to Padua, where he was entrusted with many other courses, such as Political Economy, Constitutional Law, Demography, Economic Statistics, and he also founded and supervised the Institute of Statistics. In 1925, he was called to teach Politics and Economic Statistics at the University of Rome, where he had the tenure in Statistics in 1927 and he also taught Sociology and Biometry. In 1928, he founded the School of Statistics that, in 1936, became the Faculty of Statistical, Demographic and Actuarial Sciences. Figure 5 contains the original *Manifesto* of the School of Statistics and the Syllabus of Gini's course in Statistics.

R. UNIVERSITÀ DEGLI STUDI DI ROMA
SCUOLA SPECIALE DI STATISTICA

La Scuola biennale di statistica conferisce il diploma occorrente per l'ammissione all' ESAME DI STATO di abilitazione nelle discipline statistiche.
Con detto esame di Stato si consegue il titolo di STATISTICO, richiesto per l'assunzione in uffici statistici di amministrazioni pubbliche e private.
Il titolo di studi medi richiesto per l'ammissione alla Scuola è il diploma di maturità classica o scientifica, o anche il diploma della soppressa sezione fisico-matematica degli Istituti tecnici.
Per l'a mmissione al secondo anno del Corso, in base a lauree, diplomi o attestati di studi conseguiti presso altre Facoltà, Scuole o Istituti superiori, decide il Consiglio della Scuola caso per caso, semprechè l'aspirante sia fornito d'uno dei suddetti titoli di scuola media.

***

PER L'ISCRIZIONE OCCORRE QUANTO SEGUE: Domanda al Rettore in carta bollata da L. 3.; Titolo di studio; Certificato di nascita; Due fotografie firmate; Contribuzione per tessera e libretto in L. 10; Quietanze delle tasse. (Termine: 30 novembre).

Le tasse e sopratasse della Scuola di statistica sono le seguenti, pagabili al Banco S. Spirito.

Immatricolazione	L. 300
Iscrizione	» 400 (in quattro rate)
Sopratassa di profitto	» 150 (in due rate)
Sopratassa d'esame di diploma	» 75
Diritto per opere sportive ed assistenziali universitarie, L. 25 (all'atto dell' iscrizione)	
Tassa erariale di diploma	» 300 (a mezzo vaglia postale).

Chi ha diritto all'assegno della Cassa Scolastica per merito o alla dispensa dalle tasse per altre ragioni, può presentare la relativa domanda documentata in luogo delle quietanze delle tasse.

***

Per conseguire il diploma in Statistica lo studente deve frequentare, nei due anni del Corso, dieci insegnamenti e sostenerne gli esami. Cinque di essi sono obbligatori e cioè:

1) Statistica
2) Demografia
3) Statistica biometrica e sociale
4) Geografia politica ed economica
5) Antropologia.

Gli altri cinque sono scelti fra i corsi delle varie Facoltà, coordinati in modo che rispondano, a giudizio del Direttore della Scuola, ad uno dei seguenti indirizzi scientifici: *economico, finanziario, matematico, biologico, storico, giuridico.*
All' uopo lo studente deve indicare nella domanda d'iscrizione, o in apposita dichiarazione fatta entro i primi due mesi dell'anno scolastico, il piano dei propri studi.
Chi aspira all' assegno della Cassa Scolastica, deve sostenere non meno di cinque esami, nelle due sessioni di ciascun anno.
Per essere ammesso all'esame di diploma lo studente deve, inoltre, aver frequentato, almeno per un anno scolastico, compiendovi esercitazioni e pagando i relativi contributi di laboratorio, che ammontano a L. 25 per ogni Istituto, i seguenti Istituti universitari:

1) Istituto di statistica
2) Istituto di geografia
3) Istituto di antropologia.

Gli esami di profitto vengono sostenuti per singole materie.
L'esame di diploma consiste nella preparazione e discussione di una dissertazione scritta, su argomento statistico scelto dal candidato tra le materie obbligatorie della Scuola. L'argomento della dissertazione deve essere sottoposto, almeno sei mesi prima della discussione, all' approvazione del Direttore della Scuola, il quale deve accertarsi della preparazione del candidato.

Roma, 1 Novembre 1931 - X

IL DIRETTORE
CORRADO GINI

IL RETTORE
PIETRO DE FRANCISCI

ORARIO DELLE LEZIONI

	INSEGNAMENTI	PROFESSORI	L.	M.	M.	G.	V.	S.	LOCALI
(1)	Statistica	Gini	—	—	19	19	—		Istituto — Via Tevere Diocleziano 16
	Demografia	Savorgnan	—	—	18	18	—		id.
	Statistica biometrica	Gini	10	10	—	—	10		id.
	Statistica sociale	Savorgnan	18	18	—	—	18		id.
	Geografia politica ed economica	Almagià	15	—	15	—	16	—	Scuola di Geografia — (Residenza)

Mod. 36

R. UNIVERSITÀ DEGLI STUDI DI ROMA

Anno accademico 1935 - 1936

Programma del corso che intende impartire il Prof. Corrado Gini
ordinario ~~straordinario incaricato~~ di Statistica

Titolo del corso
Statistica

Ore settimanali di lezione 3

Prot. N. 463 P. 13

Argomenti da svolgere
(il programma dovrà poter essere contenuto in tre righe di stampa)

Concetto e campo di applicazione della statistica - Cenni storici - Introduzione allo studio della statistica: rappresentazioni grafiche; interpolazione; calcolo delle probabilità - La rilevazione dei dati - La elaborazione tecnica dei dati - La integrazione dei dati - La elaborazione logica dei dati -

Orario del corso: mercoledì, giovedì, venerdì, ore 18-19

Luogo nel quale il corso viene svolto: Istituto di Statistica, Via delle Terme 10, Roma

Roma, 1 giugno 1935 anno XIII

FIRMA

Figure 5. *Manifesto of the School of Statistics and Syllabus of the Course in Statistics.*

From 1911 to 1926, he was part of the Superior Council of Statistics, and from 1926 to 1932, acting as President of the Italian National Institute for Statistics (ISTAT), he organised and coordinated the National Statistical Services. He succeeded in reaching a good technical level and in increasing the efficiency of the procedures, despite the considerable amount of difficulties. The most important bureaucrats of the different ministries tried indeed to obstruct the policy of centralisation of statistical information, that also encountered the obstructionism of almost all public authorities. As a consequence, Mussolini had been repeatedly forced to intervene to solve a number of controversies. This apparently contributed to wear out the substantially good relationship between Gini and Mussolini (Figure 6), who was initially interested in statistical questions, at least for the sake of those aspect related to the government, and therefore, to his own business. Actually, the more and more frequent interferences of the fascist regime represented an evident warning: 'times were changing and the impatient and independent spirit of Gini would not have tolerated any intrusion in what concerned his work' (see Castellano (1965)). Gini realised that his privileged relationship with the *Duce*, which was essential to provide him the necessary means for his work, was rapidly weakening, and he decided to abandon his position before the disagreements about the organisation of the National Statistical Service become a proper conflict against the established power, a conflict that could only damage his public image. Hence he resigned and in his last service order (February 10th 1932) he declared that he terminated his work at ISTAT and came back to his studies. His successor was Franco Savorgnan, one of his colleagues at the University of Rome (Figure 7).

Among the possible causes of disagreement, it is worth recalling also the divergent point of views of Mussolini and Gini about the relationship between science and politics. On the one hand, Mussolini thought that technicians had the marginal role of providing an intellectual

Figure 6. *Mussolini is portrayed between Gini and Turati (Secretary of the fascist party) during the ceremony for the first anniversary of the constitution of ISTAT (15 July 1927). Photo source: Giuseppe Leti (1996). 'L'Istat e il Consiglio Superiore di Statistica dal 1926 al 1945', ISTAT, Annali di Statistica, anno 125, serie X, vol. 8.*

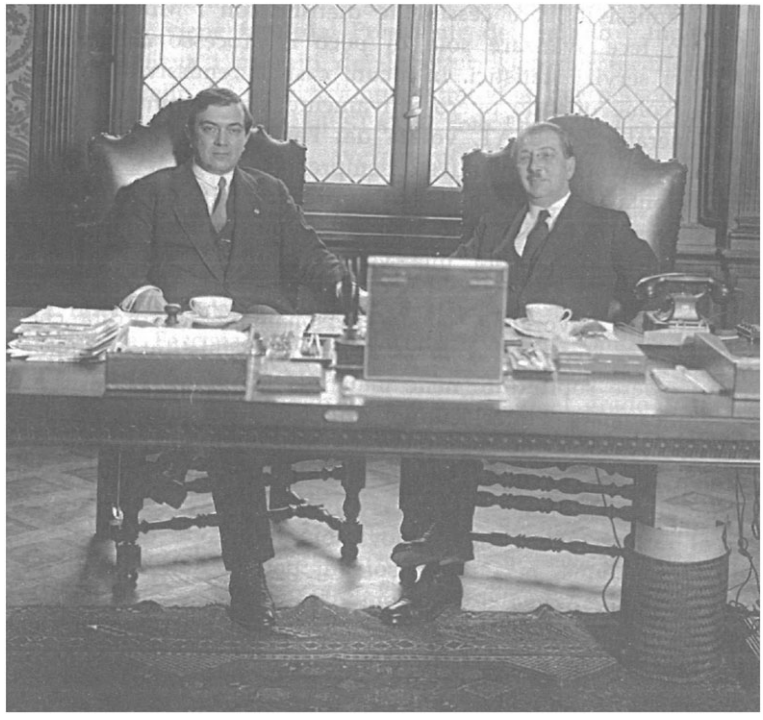


Figure 7. *Gini hands the Presidence of ISTAT over to Savorgnan (Febraury, 1932). Photo source: Giuseppe Leti (1996). 'L'Istat e il Consiglio Superiore di Statistica dal 1926 al 1945', ISTAT, Annali di Statistica, anno 125, serie X, vol. 8.*

warranty to political decisions (Cassata, 2006); on the other hand, Gini believed that scientists should have been involved in the preparation, management and interpretation of statical data. He was actually a strong supporter of the complete autonomy of science, based on the principle that the scientist 'evaluates events and political choices according to his own schemes and theories' (Treves, 2001).

His coherence with this principle was undeniable during the period when he was President of ISTAT: although deferential towards the political power, he was never subdued, always revealing independence and freedom of opinion; conversely, it can be said that he cleverly succeeded in using the political power to his purposes of improving the organization and the reliability of the national statistical service. For instance, according to Leti 'the impression arising from the correspondence is that of a man whose ability to converse and collaborate with the government was not motivated by his spirit of obedience and submission, but animated by a true devotion towards his work' (Leti, 1996). In Leti's opinion, by resigning 'Gini ceased to take advantage of the political power for the sake of public statistics, but actually he never really let the political power prevail over his independent judgement'. Also Trivellato (2004) comments that Gini showed remarkable independence in responding to fascist politics and decisions regarding population and official statistics, always driven by his own ideas and by the awareness of his own calibre from a scientific point of view.

However, even in that period, he did not neglect his research activity. After the working time at ISTAT, usually until 8 p.m., he used to go to the University and to remain there together with the staff in its entirety (assistants, employees and ushers) that was forced to stay there and work until midnight (Giorgi, 1996).

Thanks to the resignation he gained a sort of detachment, but he somehow prefigured that the political fight against him had only been delayed and that he would have encountered many other obstacles to prevent him in reaching other important goals. This fear was well founded and Gini happened to know very well the consequences of tip off, because he had already been reported several times and he also underwent a campaign by the hostile fascist press (Cassata, 2006), about the shipwreck of the transatlantic 'Principessa Mafalda' he was embarked on. From 1927 and 1931, he was reported several times by other people who staked claims upon ISTAT only because they were members of the fascist party; they tried to discredit Gini by charging him with excessive authoritarianism, blaming him of not respecting the law and of having entrusted with relevant tasks some subversive, not belonging to the party, individuals, such as for instance the general director Molinari, who was a socialist. In opposition to the influence of the fascist regime, Gini strongly defended the hiring of non-fascist or socialist employees, motivated by their high expertise in statistics.

Mussolini, who strongly supported the foundation of ISTAT, was perfectly aware of the 'non orthodox' origin of the experts recruited by Gini as managers; indeed, he could have taken a position against these choices, but he did not. To understand the reasons of his acceptance, some precedents should be recalled. In his first government experience (1922–1925), when he was the leader of a coalition including also some liberal representatives, Mussolini guaranteed a substantial continuity between the fascism and the previous liberal establishment by allowing the use of pre-fascist institutions and staff (Cassese, 2010; Perfetti, 2010). By adopting this approach, he encountered the favour of industry and he was sure that the liberal technicians could have been successfully influenced and oriented towards a more conservative fascist attitude, namely towards his totalitarian political project (Misiani, 2007).

Gini's moderate anti-fascist attitude, shown later after Mussolini's downfall, did not spare him the prosecution in the purging trials (Cassata, 2006; Prévost, 2009). Hence, on 6 November 1944, he was forced to abandon his position as Dean of the Faculty of Statistical, Demographic and Actuarial Sciences he founded in 1936, together with the presidency of the Italian Statistical

Society acquired in 1941, waiting for the trial to end. Although he was absolved of the most serious accusations, on 24 January 1945 Gini was suspended for 1 year from his tasks and his wage, with the charge of *apologia of fascism* (see Cassata, 2004).

In order to draw a comprehensive picture that allows a better understanding of reality, men and institutions (Cassese, 2010), it is fundamental to contextualise Gini's life and work into that specific historical period. In 1925, Gini signed the Manifesto of Fascist Intellectuals and he was one of the 18 wise men commissioned to compose the Fascist constitution. He was declared fascist *ad honorem* by the regime, but he always refused to formalise his position through an actual enrolment to the fascist party, because this was probably beyond his way of interpreting his relationship with the political world. However, it should not be forgotten that in 1931, only 12 out of 1200 professors refused to take an oath of allegiance to fascism and as a consequence, they were prevented from teaching again at the University. In this regard, Sergio Romano (2006) notes that some personalities warmly encouraged the academics to sign that oath for several reasons; first of all, 'the Pope [Pio XI] reassured the catholic professors that they would have had the opportunity to sign with mental reservation. Even the Secretary of the Italian Communist party, Palmiro Togliatti, affirmed that the professors would have been more helpful for the party, if they kept their own job. Moreover, the philosopher Benedetto Croce invited them to warrant continuity to their liberal way of teaching'. Among others, Enrico Fermi, Nobel Prize Laureate in Physics in 1938, was substantially supported by the public funding of the fascist regime in his research; he was enrolled in the party since April 1929 and never argued openly against the fascist regime, as far as we know, at least until he was coerced to emigrate from Italy because of the deplorable and inhumane conditions *Racial Law* (1938) that directly involved him and his family (because his wife was Jewish). Actually, in that circumstance 'Fermi, together with many other Italian intellectuals [. . .] discovered the very oppressive nature of fascism, only when he happened to be personally persecuted' (Mieli, 2001). Gini, despite cautious and prudent, did not approve the Racial Law that were indeed 'in complete contrast with his view, provided that he was (generally) in favour of crossbreeding between populations' (Trivellato, 2004). More specifically, as mentioned by Prévost (2009), he expressed his opinion against the racist deviation of fascism and he preferred to reset the Editorial Committee of the journal *Metron* (starting from issues 1 and 2–4 of Volume XIV published in 1940–1941) rather than undergoing the order of deleting the names of Jewish members. Moreover, Gini did not allowed the years of Fascist era to be printed upon the cover of *Metron*.

It is interesting to point out that the attitude towards people involved with the Fascist regime was somehow unbalanced. For example, Gaetano Pietra, full professor at the University of Padua and Gini's pupil, was never tried. However, as a consequence of the Racial Law, Pietra was charged with the course of 'Demography and comparative demography of races' and became Dean of the Faculty of Political Sciences in place of Donato Donati, previously overthrown due to racial discrimination (Ventura, 1996). Moreover, as highlighted by Cocchi & Favero (2009), Pietra approved that lands confiscated from Jewish owners be allocated to needy farmers. Despite this episode, Pietra did not only avoid any trial, but he was even elected Senator of the newborn Republic in 1948.

Nevertheless, when the Fascist period was over, Gini could come back to his activities: in 1946, he was back at the University, in 1949, he became again the President of the Italian Statistical Society, a position that he hold until his death. Undoubtedly, he was totally detached from politics and he exclusively devoted the last 20 years of his life to academic activity and research. In 1955, he was nominated *Professor Emeritus*.

During his long career, he also showed a noteworthy interest for the editorial activity. He founded the international journal of statistics *Metron* in 1920 and *Genus*, as press service of the Italian Committee for the analysis of population problems in 1934. In 1926 he also

founded *La vita economica italiana* (Italian economic life), that was regularly published until 1943. Furthermore, he was member of numerous national and international scientific societies: in particular, he was honorary member of the Royal Statistical Society (1920), vice president (1933) and president (1950) of the International Institute of Sociology, president of the Italian Society of Genetics and Eugenics (1934), president of the International Federation of the Society of Eugenics of the Latin language countries (1935), president of the Italian Society of Sociology (1937), honorary member of the ISI (1939), president of the Italian Statistical Society (1941–1944 and 1949–1965), and national member of the *Accademia dei Lincei* (1962).

As further proof of the variety of his scientific interests and of the originality of his research, he obtained degrees *honoris causa* from several Italian and foreign Universities: in Economics from the Cattolica University of Milan (1932), in Sociology from the University of Geneva (1934), in Sciences from Harvard University (1936) and in Social Sciences from the Argentinian University of Cordoba (1963).

3 Beyond Gini's Most Optimistic Expectations: the Impact of His Research and the Surviving Results Still Up to Date

In his long and intense scientific career, Gini handled a wide variety of topics. However, not all of them managed to withstand the test of time despite the huge commitment and the in-depth theoretical analysis. One example was the so-called 'economic pathology', that was based on an analogy between organism and society, both characterised by the succession of youth, adulthood and old age. Gini started to work on this theory during the course of economic pathology, he taught in 1923–1924 at the Bocconi University in Milan, and he kept his interest alive until the publication of the fifth edition of the monograph '*Economic pathology*' in 1952. However, this theory could never encounter the favour of the Fascist regime, since it collocated the economy of that time in a phase of disease. This view of the society had been already introduced in his book '*I fattori demografici dell'evoluzione delle nazioni*' (Demographic factors in the evolution of nations) (Cassata, 2006).

However, some other results undoubtedly reveal a forward-looking intuition, for instance those regarding probability, one of his first research interests, as already mentioned in Section 2.1. In particular, Scardovi (Gini, 2001) highlights that in 'Considerations on a posterior probability' Gini (1911) provided formal avant-guard solutions regarding the problem of induction, thus anticipating the proposal by Rudolf Carnap who, unaware of the Italian scholar's contribution, came out with the analogous result about 50 years later (Costantini, 1979).

Although Gini claimed on several occasions that the concentration ratio (R) could be used to analyze different kinds of phenomena, he would have been pleasantly surprised by its recent application to insurance issues, that is to evaluate, for example, 'whether an alternative insurance score is useful for detecting differences between loss and premium distributions' (Frees *et al.*, 2011, 2014). Furthermore, R can also be considered 'as an index of unequal distribution of political representation–or voting power–among voters' (Pretolani, 2014), as well as a tool for analyzing specific aspects of a life table (Shkolnikov *et al.*, 2003). But the innovative research proposals that most contributed to Gini's international reputation, were focused on income, wealth and the inequality of their distribution, topics that still stimulate the interest and the attention of contemporary scholars.

Since the dawn of his career, Gini was strongly attracted by quantitative economics. That was a period full of very dynamic and prolific ideas, to be further analysed in the following steps of his scientific itinerary. In 1910, the '*Giornale degli economisti*' published his paper on the relationship between prices and consumption (Gini, 1910), that would have lead him

to deal with the theory of index numbers (Gini, 1924). 'Gini identity', as defined by Ragnar Frisch (Frisch, 1936), actually built a bridge between statistics and economics, and Benedetti (Benedetti, 1984) stressed that Konüs index was a direct consequence of that identity. In 1914 in his paper '*L'ammontare e la composizione della ricchezza delle nazioni*' (Wealth of Nations: amount and composition), among other things, Gini (1914a) highlighted the need of evaluating human capital to calculate collective wealth. In this work, he suggested a new and original interpretation of American prosperity as a consequence of the massive and free contribution of wealth from European emigrants.

The popularity of his studies on income and wealth was so wide that in 1922, he was asked by the League of Nations to assess these two variables for the all the members. In 1931, the ISI, in the session held in Tokyo, designated Gini to be the president of the Commission for the study of wealth and income, with the task of conducting a preliminary report for the London meeting of 1934. Finally in 1959, Gini collected all his contributions on this topic in the volume '*Reddito e Ricchezza*' (Wealth and Income). At the beginning, his studies were integrated in the political-economical discussion oriented to a more fair and equal distribution of income and wealth, discussion that was particularly animated during the decades over the 1800s and the 1900s. Gini (1909) participated to this discussion with his paper '*Il diverso accrescimento delle classi sociali e la concentrazione della ricchezza*' (The different growth of social classes and the concentration of wealth) that, besides analyzing the distribution of wealth among social classes, also proposed the index δ that, according to the author, allowed one to avoid the drawbacks of the index α proposed by Vilfredo Pareto few years before (Pareto, 1895, 1897), that is the uniformity of the distribution of wealth with respect to time and space. Both indices are indeed inequality metrics somehow questionable 'since they both are only meaningful when the parent distribution is Paretian' (Arnold, 1983).

A further and deeper study on this topic successively induced Gini to introduce a synthetic index of income inequality that he baptised *concentration ratio* R (Gini, 1914b). He provided several alternative analytic formulae for R to be used according to the available data and he underlined its relationship with Lorenz curve and with the mean difference. In the last century, the concentration ratio has never stopped to appeal to scholars with diverse cultural background, generating by the way very animated and fruitful discussions that contributed to its evolution and success, despite the intentions of its detractors (for the genesis, evolution and topical interest of the Gini index see, e.g., Giorgi, 1990, 1992, 1993, 2005, 2011b). At the beginning of the 1970s, the interest on the problem of measuring economic inequality was re-initiated by Atkinson who harshly criticised some traditional synthetic indices (including Gini's concentration ratio) because they did not classify income distribution based on strictly concave social utility functions (Atkinson, 1970). The debate showed clearly that the distinction between objective and normative measures was too restrictive (Giorgi, 1984; Giorgi & Pallini, 1985; Muliere, 1987). Moreover, Atkinson's conclusions were framed in utilitarian grounds, an approach in turn characterised by several disadvantages as highlighted by Amartya Sen (Sen, 1972,1973): basically, the difficulty involved in the choice of an index of inequality was replaced by likewise complicated selection of a particular kind of utility function (Arnold, 1983). However, the specific features of Gini's index stimulated Sen's proposal of a new poverty measure based on the index itself (Sen, 1976).

Another factor that contributed to the evolution and the modernity of the concentration ratio has been the decomposition. This tool, indeed, could help the policy-makers in the realisation of an economic policy for reducing the inequality of the distribution of income and wealth. As regards the decomposition among groups or sub-populations, Gini's index is criticised because it does not allow an additive decomposition, in the sense of the analysis of variance (*within* and *between* components), but it also includes a third residual component. This point was contested

by several researchers (for a review see for instance Giorgi (2011a)) who conversely considered the non-additivity as a potential advantage in terms of explicative power (see, Lambert & Decoster (2005);Yitzhaki & Schechtman (2013)). In choosing a measure of inequality, it is not sufficient to consider the formal aspects because the indices (e.g. entropy and variation coefficient) that only satisfy their inner coherence, in this case represented by additive decomposition, generally neglect other relevant points such as for instance the comparison of each income with respect to all the others (Sen, 1999).

Moreover, nowadays, the measure of income inequality is more and more frequently based on sample data, in order to obtain prompt information at low cost. Hence, the analysis of the sample characteristics of the index have recently become necessary, to allow a reliable support to the policy-makers. In particular, these characteristics have been studied both according to a parametric and a non-parametric approach, with an increasing success of the latter mainly because the official agencies utilize large samples and that, consequently, inference can be based on the asymptotic theory (Giorgi, 1999).

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References

Arnold, B.C. (1983). *Pareto Distributions.* Fairland, Maryland: International Co-operative Publishing House.

Atkinson, A.B. (1970). On the measurement of inequality. *J. Economic Theory*, **2**, 244–263.

Benedetti, C. (1965). Ricordando corrado Gini. *Rivista di Politica Economica*, **55**(3), 3–9.

Benedetti, C. (1984). A proposito del centenario della nascita di corrado Gini. *Metron*, **42**(1-2), 3–19.

Bortkiewicz, L. von. (1931a). Die Disparitätsmasse der einkommensstatistik. *Bulletin de l'Institut International de Statistique,* XIX Session (Tokio, 1930), **tome XXV**(3ème livraison, 2ème partie), 189–298.

Bortkiewicz, L. von. (1931b). Erwiderung. *Bulletin de l'Institut International de Statistique,* XIX Session (Tokio,1930), **tome XXV**(3ème livraison, 2ème partie), 311–316.

Cassata, F. (2004). Cronaca di un'epurazione mancata. *Popolazione e Storia*, **2**, 89–119.

Cassata, F. (2006). *Il Fascismo Razionale. Corrado Gini fra Scienza e Politica.* Carocci: Roma.

Cassese, S. (2010). *Lo Stato Fascista.* Bologna, il Mulino.

Castellano, V. (1965). Corrado Gini: a memoir. *Metron*, **24**(1–4), 3–84.

Cocchi, D. & Favero, G. (2009). Gli Statistici Italiani e la Questione della Razza. In *Le leggi antiebraiche del 1938, le società scientifiche e la scuola in Italia*, pp. 207–235. Roma: Accademia Nazionale delle Scienze detta dei XL.

Costantini, D. (1979). Il "metodo dei risultati" e le ipotesi profonde. *Statistica*, **39**, 35–43.

de Finetti, B. (1966). La probabilità secondo Gini nei rapporti con la concezione soggettivistica. *Metron*, **25**(1-4), 85–88.

Fisher, R.A. (1956). *Statistical Methods and Scientific Inference.* London: Oliver & Boyd.

Forcina, A. (1982). Gini's contribution to the theory of inference. *Int. Stat. Rev.*, **50**(1), 65–70.

Frees, E.W., Meyers, G. & Cummings, A.D. (2011). Summarizing insurance scores using a Gini index. *J. Am. Stat. Assoc.*, **106**(495), 1085–1098.

Frees, E.W., Meyers, G. & Cummings, A.D. (2014). Insurance ratemaking and a Gini index. *J. Risk Insur.*, **81**(2), 335–366.

Frisch, R. (1936). Annual survey of general economic theory: the problem of index numbers. *Econometrica*, **4**, 1–38.

Gini, C. (1907). Contributo alle applicazioni statistiche del calcolo delle probabilità. *Giornale degli economisti*, **35**(12), 1199–1237.

Gini, C. (1908). *Il sesso dal punto di vista statistico.* Napoli: Sandron.

Gini, C. (1909). Il diverso accrescimento delle classi sociali e la concentrazione della ricchezza. *Giornale Degli Economisti*, **38**, 27–83.
Gini, C. (1910). Prezzi e consumi. *Giornale Degli Economisti*, **40**(1,2), 99–114, 235–249.
Gini, C. (1911). Considerazioni sulle probabilità a posteriori e applicazioni al rapporto dei sessi alla nascita. *Studi Economico-Giuridici, Facoltà di Giurisprudenza Della Regia Università di Cagliari* anno III; reprinted in *Metron,* 1949, **15**(1–4). English translation in Gini (2001).
Gini, C. (1912). Variabilità e mutabilità: contributo allo studio delle distribuzioni e delle relazioni statistiche. In *Studi Economico-Giuridici della Facoltà di Giurisprudenza della Regia Università di Cagliari*, Vol. 3(2), Bologna, Cuppini.
Gini, C. (1914a). *L'ammontare e la composizione della ricchezza delle nazioni.* Torino, Bocca.
Gini, C. (1914b). Sulla misura della concentrazione e della variabilità dei caratteri. In *Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti, a.a. 1913-14,*73, vol. 63, part II, 1203-1248; English translation in *Metron (2005)*, pp. 3–38.
Gini, C. (1921). Measurement of inequality of incomes. *Econ. J.*, **31**, 124–126.
Gini, C. (1924). Quelques considérations au sujet de la construction des nombres indices des prix et des questions analogues. *Metron*, **4**(1), 3–162.
Gini, C. (1926). The contributions of Italy to modern statistical methods. *J. R..Statist. Soc. A*, **89**, 703–724.
Gini, C. (1930). Present condition and future progress of statistics. *J. Am. Stati. Assoc.*, **25**, 295–304.
Gini, C. (1931a). Observations à la communication du Prof. L. von Bortkiewicz. *Bulletin de l'Institut International de Statistique,*XIX Session (Tokio, 1930), **tome XXV**(3ème livraison, 2ème partie), 299–306.
Gini, C. (1931b). Note. *Bulletin de l'Institut International de Statistique,*XIX Session (Tokio, 1930), **tome XXV**(3ème livraison, 2ème partie), 317–320K.
Gini, C. (1934). Open letters. *J. Am. Stati. Assoc.*, **29**, 200–202.
Gini, C. (1936). On the measure of concentration with special reference to income and wealth. In *Cowles Commission Research Conference on Economics and Statistics*, July 6-August 8, Colorado College Publications, General Series, vol. 208, pp. 73–80.
Gini, C. (1939). I pericoli della statistica. In *Atti della I Riunione scientifica della Società Italiana di Statistica*, (Pisa, 9 ottobre 1939), Roma.
Gini, C. (1943). I Testi Di Significatività. In *Atti Della VII Riunione Scientifica Della Società Italiana Di Statistica*, pp. 1945. Roma, (Roma, 27-30 giugno 1943): published in *Atti della VI e VII Riunione scientifica della Società Italiana di Statistica*.
Gini, C. (1964). Le applicazioni induttive del calcolo delle probabilità. *Rivista di politica economica*, **12**, 1059–1083. reprinted in Gini (1968, 2, p.254-279).
Gini, C. (1965). On the characteristics of Italian statistics. *J. R. Statist. Soc. A*, **128**(1), 89–109.
Gini, C. (1968). *Questioni fondamentali di probabilità e statistica (I, II).* Roma: Tipografia Failli.
Gini, C. (2001). *Induction and Statistics.* Bologna: Clueb.
Giorgi, G.M. (1984). A methodological survey of recent studies for the measurement of inequality of economic welfare carried out by some italian statisticians. *Economic Notes*, **13**, 146–157.
Giorgi, G.M. (1990). Bibliographic portrait of the Gini concentration ratio. *Metron*, **48**(1-4), 183–221.
Giorgi, G.M. (1992). *Il rapporto di concentrazione di Gini: genesi, evoluzione ed una bibliografia commentata.* Siena: Editrice Ticci.
Giorgi, G.M. (1993). A fresh look at the topical interest of the Gini concentration ratio. *Metron*, **51**(1-2), 83–98.
Giorgi, G.M. (1996). Encounters with the Italian statistical school: a conversation with Carlo Benedetti. *Metron*, **54**(3-4), 3–23.
Giorgi, G.M. (1999). Income Inequality Measurement: The Statistical Approach. In *Handbook on Income Inequality Measurement*, Ed. J. Silber, pp. 245–260. Boston: Kluwer Academic Publishers.
Giorgi, G.M. (2002). Intervista a Italo Scardovi. *Statistica & Società*, **1**(1), 15–23.
Giorgi, G.M. (2005). Gini's scientific work: an evergreen. *Metron*, **63**, 299–315.
Giorgi, G.M. (2011a). The Gini Index Decomposition: An Evolutionary Study. In *The Measurement of Individual Well-being and Group Inequalities*, Eds. J. Deutsch & J. Silber, pp. 185–218. Routledge: Oxon.
Giorgi, G.M. (2011b). Corrado Gini: the man and the scientist. *Metron*, **69**, 1–28.
Giorgi, G.M. & Pallini, A. (1985). Di alcune misure di disuguaglianza del benessere e della loro determinazione mediante trasformazione di variabile. *Note Economiche*, **18**, 182–194.
Herzel, A. & Leti, G. (1977). Italian contributions to statistical inference. *Metron*, **35**(1–2), 3–48.
Lambert, P.J. & Decoster, A. (2005). The Gini coefficient reveals more. *Metron*, **63**, 373–400.
Leti, G. (1996). *L'Istat e il Consiglio superiore di statistica dal 1926 al 1945*. Roma: Istat.
Leti G. (2004). The international activities of italian statisticians prior to the second world war. *Statistica*, **64**(1), 317–331.
Lijoi, A. & Prünster, I. (2011). A conversation with Eugenio Regazzini. *Statistical Science*, **26**(4), 647–672.

Mieli, P. (2001). Così Fermi scoprì la natura vessatoria del fascismo. In *Corriere della Sera*, Milano, 41.

Misiani, S. (2007). *I numeri e la politica. Statistica, programmazione e mezzogiorno nell'impegno di Alessandro Molinari* Bologna: il Mulino.

Muliere, P. (1987). Misure della concentrazione: alcune osservazioni sull'impostazione assiomatica. In *La distribuzione personale del reddito: problemi di formazione, di ripartizione e di misurazione*, Ed. M. Zenga, pp. 190–213. Milano: Vita e Pensiero.

Pareto, V. (1895). La legge della domanda. *Giornale Degli Economisti*, **10**, 59–68.

Pareto, V. (1897). Aggiunta allo studio sulla curva delle entrate. *Giornale degli Economisti*, **14**, 15–26.

Perfetti, F. (2010). *Lo stato fascista. Le basi sindacali e corporative.* Firenze: Casa editrice Le Lettere.

Piccinato, L. (2011). Gini's criticisms to the theory of inference: a missed opportunity. *Metron*, **69**(1), 101–117.

Pietra, G. (1915). Delle relazioni tra indici di variabilità (I, II). *Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti*, **74**(2), 775–804.

Pietra, G. (1931a). Observations à la communication du Prof. L. von Bortkiewicz. *Bulletin de l'Institut International de Statistique,* XIX Session (Tokio,1930), **tome XXV**(3ème livraison, 2ème partie), 310.

Pietra, G. (1931b). Note. *Bulletin de l'Institut International de Statistique,* XIX Session (Tokio, 1930), **tome XXV**(3ème livraison, 2ème partie), 320L–320M.

Pretolani, D. (2014). Apportionments with minimum Gini index of disproportionality: a quadratic knapsack approach. *Ann. Oper. Res.*, **215**(1), 257–267.

Prévost, J.G. (2009). *A total science. Statistics in liberal an fascist Italy.* Montreal: McGill-Queen's University Press.

Regazzini, E. (1997). Gini Corrado. In *Leading Personalities in Statistical Sciences*, Eds. N.L. Johnson & S. Kotz, pp. 291–296. New York: John Wiley & Sons.

Romano, S. (2006). 1931: i professori giurano fedeltà al fascismo. In *Corriere della Sera*, Milano, 39.

Savorgnan, F. (1931). Observations à la communication du prof. L. von Bortkiewicz. *Bulletin de l'Institut International de Statistique,* XIX Session (Tokio,1930), **tome XXV**(3ème livraison, 2ème partie), 307–309.

Sen, A. (1972). Utilitarianism and inequality. *Economic and Political Weekly*, **7**(5–7), 343–344.

Sen, A. (1973). *On Economic Inequality.* Oxford: Clarendon Press.

Sen, A. (1976). Poverty: an ordinal approach to measurement. *Econometrica*, **44**, 219–231.

Sen, A. (1999). Foreword. In *Handbook of Income Inequality Measurement*, Ed. J. Silber, pp. xvii–xxvi. Boston: Kluwer Academic Publishers.

Shkolnikov, V.M., Andreev, E.E. & Begun A.Z. (2003). Gini coefficient as a life table function: computation from discrete data, decomposition of differences and empirical examples. *Demographic Research*, **8**, 305–358.

Treves, A. (2001). *Le nascite e la politica nell'Italia del Novecento.* Milano: Edizioni Universitarie di Lettere, Economia e Diritto.

Trivellato, U. (2004). Al crocevia fra scienza, ideologia e regime: uno sguardo allo sfondo e ad alcuni statistici e demografi eminenti. In *Numeri e potere, Statistica e Demografia nella cultura italiana tra le due guerre*, Ed. G. Dalla Zuanna, pp. 69–86. Napoli: L'ancora del Mediterraneo.

Ventura, A. (1996). Le leggi razziali all'Università di Padova. In *L'Università dalle leggi razziali alla resistenza*, Ed. A. Ventura, pp. 131–204. Padova: Cleup.

Yitzhaki, S. & Schechtman, E. (2013). *The Gini Methodology. A Primer on a Statistical Methodology.* New York: Springer.