Nordic Statistical Journal

EDITED BY

THOR ANDERSSON

VOL. 4 **1932** **PARTS 1—2**

ARTICLES IN NORDIC STATISTICAL JOURNAL.

Vol. 1

ARTICLES IN NORDISK STATISTISK TIDSKRIFT.

Vol. 1

Vol. 2

Vol. 3

NEW ORIENTATION OF ECONOMIC THEORY
ECONOMICS AS AN EXPERIMENTAL SCIENCE

Public lecture delivered at the University of Norway, February 8, 1932.

In his "Principles of Economics" John Stuart Mill wrote in the middle of the mineteenth century that, with regard to the general principles, the doctrine of value and price was now fully perfected. Nothing more remained to be discovered, he said, either by himself or any other writer. To us, with our relative view on all matters, not least on the development of science, it is difficult to understand that such a thing can be said, but for the generation which then lived Mill's pronouncement appeared, indeed, to be something in the nature of a truth. In Mill's "Principles" the ideas of Adam Smith, Ricardo, and Malthus were united into one organic whole, and to many people this classical theory presented itself as so complete, and logically perfect, that, in so far as the great principles were concerned, it probably contained the eternal truth.

Developments have given the lie to Mill's statement. Two important new advances have been made in economic theory since his time. I shall first give a brief sketch of the development from the period when Mill wrote his famous sentence that there was nothing more to be done, and subsequently I shall discuss a little more closely the latter of the two advances.

The classical doctrine of values was, in an outstanding degree, a doctrine of costs of production. It was influenced by the reasoning of the private employer, who produces in competition with other employers. The private employer will reason as follows: — "If only I could further reduce the price I could attract customers from my competitors to myself. But my competitors also think as I do. We all try to cut prices. The only thing which stops us is cost of production. In trying to explain the mechanism of formation of prices it is natural, therefore, to assume that there exists a kind of automatic gravity which draws all prices down and that the *permanent substratum* which is present and on to which prices, so to speak, fall and remain, is costs of production. It is, therefore, costs

of production which *causes* prices". This major point of view was, with great acumen, given application by the classics to the various types of profits, to the relation between wages and interest on capital, to the international formation of prices, and so on.

This line of reasoning, of course, contains an uncontrovertible modicum of truth, but it is far too simple to be able to give an even passably complete picture of the forces which are at work. The economic process is an equilibrium phenomenon in which technical production factors and subjective factors play a part. This did not appear in the classical theory. In particular the classics never attained to a full understanding of the subjective side of valuation activity.

On this point economic theory was recast during the period 1870—1890 when a number of Austrian economists, led by Karl Menger, took up a systematic analysis of human wants and of the subjective elements involved therein. Similar ideas were also advanced, approximately at the same time, by Leon Walras, a Swiss, and Stanley Jevons, an Englishman.

It is, no doubt, true that the original formulation by the Austrians of these subjective elements proved, on closer inspection, to be untenable and required modification, but the main point is that, in one form or another, the subjective elements entered into, and were recognised in, economics. It is this which I called the first advance.

The subjective point of view and the costs of production point of view were gradually unified, mainly by English economists, into the doctrine which, we usually call the neo-classical. Its exponent is Alfred Marshall, the Englishman whose "Principles of Economics" has been the leading economic-theoretical system for the past generation. I can quite well remember that, when, as a student, I had to choose such a treatise on economie theory with which to thoroughly familiarise myself, it was quite natural that the choice should fall on Marshall's "Principles".

Neither the classical nor the neo-classical school sought in any particular degree to verify the theoretical results by statistical observations. This was, in part, because such exact and complete observations as would have been necessary for a proper verification were not available, and partly because the theoretical system itself was not yet adapted for such verifica-

tion. The architectural plan was not, as it were, drawn up with this in view.

The consequences of this did not fail to make their appearance. Anti-theoretical schools arose. The theoretical approach as it had been developed by the classics and the subjective value theorists was sharply criticised by the German historical school. Foremost among these was Gustav Schmoller. On the other hand the opposition to the neo-classical theory came in the form of institutionalism, which has developed in America during the past 10—15 years and which has for its leading name that of Wesley C. Mitchell. The fundamental starting point of both these critical schools is the same, namely, an emphasising that the economic laws are strictly bound to time and place. But in their practical work there is a considerable divergence. In contrast with Schmollers industrious disciples, who explored the German archives, the American institutionalists embarked energetically upon an exact *statistical* investigation of economic conditions and events in our own times. This difference has had far-reaching consequences. While the historical school was, and remained, more or less anti-theoretical — in spite of individual opportunistic opinions in a contrary direction — the very material with which the American institutionalists operated gradually forced them into more theoretical lines of thought. The more voluminous and diverse their statistical material has become the more strongly have they felt that the whole will end in chaos unless some rational order is brought about by the introduction of theoretical view points. It is remarkable how, in recent years, the publications of the institutionalists have become more theoretically coloured than was formerly the case.

At the same time the position of the economic theory itself is different from what it was during the time of the historical school. Partly under the influence of the criticism of the historians and the institutionalists the theorists themselves have embarked upon an attempt to work out a more adequate abstract structure and to unite it more closely with the observation material. What has happened can perhaps be expressed by saying that economic theory is about to enter into the phase in which the natural scientific theories have long been, namely, the phase *in which theory draws its fundamental conceptions from the actual observation technique.*

For the first time in the history of economics it appears as if the work on the internal theoretical front and that on the outer descriptive front will converge, and not stand in opposition to each other or directly contend with each other as they previously did to some extent. It seems as if we shall obtain a theory which is sufficiently complicated to be able to serve as a recipient for the concrete observation material and that, at the same time we shall obtain observations which are explicitely planned and carried out with the object of fitting them into the theoretical structure.

It is this which is new in the state of affairs within economic theory. It is this which I described as the second advance since the classics and which gives me the belief that it is right to state that economics are now in progress of development into an *experimental* science, if not in the strictest sense of the word, at least in a certain extended sense.

It is characteristic of the situation that an international society was founded in America last year under the style of "The Econometric Society" which by its statutes is defined as "An international society for the advancement of economic theory in its relation to statistics and mathematics". Among the founders we find on the one hand leading institutionalists such as Mitchell and Carl Snyder, the chief of the Research Department of Federal Reserve Bank of New York, and on the other prominent theorists such as J. M. Keynes, Joseph Shumpeter, Irving Fisher and a dogma historian such as Charles Rist.

One of the most important sides of the development of economics in an experimental direction has been *the quantification* of the economic conceptions, that is to say, the effort to make the conceptions measurable. It is unnecessary to call to mind what the quantitative formulation of conceptions and laws has meant in natural sciences. Is it not Galton who has said that a discipline only acquires rank and worth as a science to the extent to which it can be formulated quantitatively. This opinion is perhaps a little too stiff. But it is certain, in any case, that if the modern natural sciences were robbed of everything that is quantitative, little would remain to them. It is not far from being the case that the quantitative formulation of laws and conceptions is equally important in economics. This

is most plainly brought out in thinking of the final object of economic theory, namely, to elucidate the interactive relation between the various factors, and to do it in such a manner as to provide a basis on which to determine what practical measures are best suited to promote definite economic and social objects.

As long as the analysis remains purely qualitative and it is considered sufficient to prove that a certain measure produces effects in such and such definite *directions*, there is little prospect of truly elucidating matters. Practically all economic phenomena are related to each other. Economics resemble a tangled skein of interactive conditions which spreads in all directions. If we content ourselves with proving qualitatively the existence of relationship between this factor and that, economics will be a sphere in which practically every assertion can be defended as long as it is advanced with sufficient intelligence and adroitness. The question, for instance, may be, what things are suitable to give impetous to production during a period of depression. Some say that a general reduction in wages is necessary since it will reduce working expenses; others, that a general rise in wages is required, since, thereby, the capacity for consumption will increase and evoke a movement in the large stocks of goods. Again, others say there must be a reduction in the discount rate, for that will stimulate the commencement of new enterprises. Some perhaps will assert the necessity for a rise in the discount rate, inasmuch as this will increase deposits from the public and thus give the banks a greater loaning capacity. Taken each by itself these assertions are all, in a manner, correct, but only in such a limited quantitative sense that they give an incorrect impression of the situation. Let me employ a metaphor. Taken each by itself the economic statements I have recently mentioned are about as correct as the following assertion: "When one gets into a boat and rows, the boat will be driven astern owing to the pressure which is induced by the feet on the boat". That the feet create a pressure towards the stern is in itself undoubtedly quite correct. But this factor must not be taken by itself. The point of the whole analysis lies in calculating the relative ratio of strength between the various pressures and counter pressures. This it is which first throws light on to the matter. It applies in the problem of the rowing boat, and it applies in an even higher degree in the complicated

economic problems. But such a weighing of the relative proportion of strength between various pressures and counter pressures in economics is, naturally, not possible until a quantitative formulation can be given of the economic laws. The usefulness of economics in administrative and social respects will, therefore, essentially depend upon the extent to which its laws can successfully be quantified.

As a characteristic example of the struggle of economic theory to win through to a quantitative formulation of ideas I will refer to the conception of utility. In the conflict between the subjective and the classical theories of values the conception of utility was, in various ways, dragged in in quantitative relations. The assertion was set up, for instance, that in the equilibrium point of the market the intensities of utility are proportionate to the prices. Such or similar assertions are unavoidable if the idea of utility is to have a raison d'etre in the price theory at all. But such assertions naturally assume that the intensity of utility is a quantitatively defined conception. A thing which is to be proportionate with certain figures must obviously itself be something quantitative. However, such a quantitative definition was not given by the Austrians. They defined utility simply by refering to a state of mind, namely, the satisfaction which we get when we consume desirable goods.

It is clear that such disagreement between the definition of the ideas and their application was bound to give rise to much and confused discussion. In English, American and Austrian publications especially, animated discussions went on during the period 1880—1890.

The way out was indicated by Irving Fisher in his doctor's thesis in 1892. In order to arrive at an objective definition of the conception of utility Fisher brushes aside all metaphysical manners of speech. He simply supposes that a number of typical individuals are confronted with varions alternative choices and the result noted. In other words, a number of imaginary *choice experiments* with individuals are carried out. From the results of these imaginary experiments Fisher deduces certain quantitative relations with the help of which utility is defined as a quantity.

By consistently following this train of thought to the end one is led to constructing a theory of choice strictly axiomatically,

in the same manner as Hilbert, the German mathematician, built up the foundation of geometry.

On the basis of a set of such choice axioms there can be developed a quantitative theory regarding the phenomena of barter, consumption and even of pecuniary economy. And the interesting point is that, in the deduced theory, there appears not only the imaginary choice experiments with which one started but also a number of actually observable phenomena, such as market prices, quantities sold, composition of consumption budgets and so on. In other words there appears a number of those things in regard to which modern statistics of prices and consumption provide us information. Thereby the connection is joined between theory and observation.

As an example of the connection between the axiomatical pattern and the concrete observations in the theory of value, and especially as an example of the occasionally quite astounding regularities which can be met, I shall refer to certain investigations which are available in regard to the subjective valuation of income. In order to formulate the problem here mentioned, I must quite briefly touch upon some of the elementary conceptions of utility.

Quite intuitively everyone can tell himself that the use which a person ascribes to the monetary unit as a means of satisfying his wants decreases as his means grows larger. If for a moment we assume that the intensity of utility of money is quantitatively defined, the variation of the intensity of utility with income can be exhibited graphically by a curve in which the intensity of utility is measured on the vertical scale and the income along the horizontal scale. The fact that the intensity of utility becomes less as the income increases will then express itself in the manner that the utility curve of money is a declining curve.

To characterise the speed at which the utility curve declines the conception of the *flexibility* of money is introduced. This is the ratio between a small percentage fall in the intensity of utility and the corresponding percentage increase in income. If, for instance, intensity of utility falls by 3 % when income rises by 2 % the flexibility is equal to 3 divided by 2, in other words 1.5. This flexibility enters in as an important conception in the elucidation of a number of problems, e. g. the question of the manner by which the supply of work depends upon the

wage, the question of what would be a just tax progression, and the like. Especially is the question of whether the flexibility is greater or less than 1 of importance. An attempt at numerical investigations in this sphere is therefore of considerable interest. There are two such investigations which I should like to mention.

In a work published in 1926 I showed how from a choice axiomatic basis intensity of utility can be defined quantitatively, and how these axiomatic definitions can be brought into connection with the statistical data. As an example of the application of the method, I carried out a numerical determination of the utility curve of money, and therewith of the flexibility, in respect to a certain group of Paris' middle class. The statistical material which was used was sales and price data for Paris' cooperative businesses. It proved that the flexibility of utility of money was greater than unity over the whole of the income range for which I had material. Further it proved that the flexibility declined as the income rose. I advanced the hypothesis that a corresponding investigation in the case of the United States of America would yield as a result a flexibility of less than unity.

I had an opportunity of carrying out an investigation of this kind in regard to the United States last year. It proved necessary for America to use other, and rather complicated, statistical methods, as the statistical material there available is in another form. I will not enter into the statistical-technical problems which arise in this connection, but only mention some of the results.

In the first place the hypothesis of a flexibility less than unity was verified. Secondly, the American material can be split up in such a manner that comparisons can be made between the various parts of the States. This comparison is, indeed, the most interesting part of the whole investigation. The method applied is such that the utility curve of money can be constructed on the basis of the material for two cities. Now there is material from a whole series of cities. The cities can, therefore, be combined in many ways with a view to discovering whether the utility curves thus constructed are in any way the same. This they are. The agreement is quite surprising. — Except in the case of two cities. The discrepancy between these is not great, but sufficient to be apparent, and

this discrepancy is, in itself, of considerable interest. These two cities, namely, are just the two in the material where, a priori, a divergence from the theory was to be expected. They are two cities in the Southern States with a negro element. It is plausible that a negro population should have a money utility curve different from the white population.

In a number of other spheres of economic theory also, the efforts towards a theoretical quantitative formulation and, further, towards a statistical quantitative verification have asserted themselves. I mention only such spheres as the theory of productivity, the efforts to determine statistically supply and demand curves for the various commodities, and so on. In this sphere important work has been done by H. L. Moore and Henry Schulz, both Americans, and further by the United States Department of Agriculture. Further, there are works by Tinbergen, a Dutchman, Marschak, Schneider and Leontief, Germans, Ricci and Bresciani-Turroni, Italians, and others. This group of explorers has tried systematically to investigate the elasticity of demand for such goods as sugar, wheat, coffee, pig iron, American cotton, Egyptian cotton, etc. The results arrived at in these spheres must, I think, at present be looked at in a critical light. They are extremely rough and certain eradication in the theoretical schedule which lies behind them will be necessary. But these correctives will undoubtedly come in their turn. The most important thing is that a large, continually increasing group of explorers has taken up this work.

This connection between axiomatic theory and actual observation within the modern economic theory is, after all, wholly the same as that which we meet with within a natural science sphere such as, for instance, the theory of relativity. When the physicist is to define the conception of time in relativistic philosophy he is in the first place awake to the fact that he can make no progress by refering to the psychological view of the passage of time. He must build up his definition on experiments. But these experiments do not necessarily require to be concrete experiments, actually capable of accomplishment. It is sufficient if they are possible *in principle*. They are indeed not intended to serve the purpose of acquiring numerical information, but only to give clarity to the thoughts. For this reason the relativity theorist, in the setting up of the definition of the conception of time, can operate with experiments which

are quite valueless in practice, for instance the experiment that one individual sends out a signal flash and another individual sends a signal flash back as soon as he has understood the first signal, and so on. But, subsequently, when a complicated theory has been erected on this basis, the relativity theorist arrives at relations which are verifiable also in a practical sense. The logical process is, in other words, precisely the same as in those economic studies, which are built up on the axiomatic choice theory.

The new orientation which is, at present, in progress in economic theory aims, however, not only at a precise definition and quantification of the inherited conceptions and laws. A generalisation of the whole theoretical structure in several directions is in progress. I will, quite briefly, refer to two of the most important directions in which this work of generalisation is proceeding.

In the first place we have the extension from the static to the dynamic point of view in analysis. The difference between these two points of view can, perhaps, be most simply expressed by saying that, by means of the static theory, there are set up relations or laws which join together quantities existing at one and the same moment of time. By the dynamic theory, on the other hand, these relations are extended in such a manner that they connect quantities which exist at various points of time. Such a dynamic law can often be formulated in such a manner that one and the same relation contains both a certain quantity and this quantity's growth rate with regard to the time. To take a specially simple example we can think of an ordinary law of demand. The static law of demand consists in saying that the quantity demanded is a function of the price. A high price produces a small quantity demanded and vice versa. An example of a dynamic law of demand will be if it is said that quantity demanded is a function, not only of the magnitude of the price, but also of the growth rate of the price in regard to the time. While a high price operates in the direction of depressing the quantity demanded, a rising price will probably have the effect of increasing this quantity. This is a specially simple example of a dynamic economic law. The majority of dynamic-economic laws and the most important ones are, however, considerably more complicated. Of theorists who have been working in this sphere I mention

Evans, Roos and Hotelling, Americans, Amoroso, Italian and Keynes, an Englishman.

Another important direction in which an effort has been made to generalise economic theory is that which may be called the *polypolistic* direction. Here such things as two, three or more-sided duels are studied. For instance there may be a number of comparatively well-organised producers of a raw material. These may be confronted with, let us say, one or two absorbers who again produce a finished product which forms the object of a world demand. The price struggle in such and similar realistic situations must, it is clear, be subjected to closer study if one wishes seriously to endeavour to bring the economic theory into contact with the statistical data. Among theorists who have concerned themselves with these problems I mention Arthur Bowley, an Englishman, Hotelling, an American, Schneider, a German and Zeuthen, a Dane.

With the development of economic theory, which I have here sketched, it is clear that gradually the demand in regard to the skill of economic theorists in dealing with statistical figures has become greater and greater. The position in effect has become such that the theorist must now almost be a full-blooded statistician both as regards critical scent in respect of the reliability of the material, and of the more or less conplicated mathematical-statistical methods. The theorist and the statistician become, so to speak, united in one and the same person. This is necessary, not least because a great part of the work which confronts the economic theorist, when he turns to statistical data to test his theories, calls for a statistical technique of a very special kind.

In this manner the experimental economic work in several spheres has led to a development of new statistical methods, new technical tricks, so to speak. Several of these indeed, are of such a kind that it will probably be possible to give them a more general application than to the special objects for which they were originally developed. Some of these methods, as far as I understand, will also be capable of application in other sciences. I will specially mention one such method which I believe can be used in a somewhat wider field.

Let us a moment consider such a matter as the consumption of electric current in Oslo. This consumption will have a typical daily variation, because we use more light in the evening than in the morning. And there will also be a certain typical annual variation because we use more light in the winter than in the summer. In addition there will be a certain underlying long period tendency, because our century has been a century of electrification. There are also other and more complicated movements present in the consumption of current, e. g. short and long business cycles etc. In the statistical time series of the consumption of current, such as it is actually observed, all these movements will simultaneously assert themselves. It is clear, however, that an effort must be made to isolate the individual movements and study them separately. The daily movement must be divorced from the seasonal movement, and so on, before any hope can be entertained of tracing the guiding forces. In all problems where it is desired to give a theoretical interpretation of an economic statistical time series this problem of decomposition is very important.

The idea itself of dissolving a time series into cycles of various orders, short cycles, long cycles, etc., is old and well-known from other sciences. The classical means of effecting the decomposition has been what is called the harmonic analysis, or a variant of this which is called the periodgram analysis. These methods have been extensively applied to astronomical and meteorological data and the like.

This apparatus, however, is of little value in application to economic or other social data. The harmonic analysis, namely, is only pertinent when, in the observation material, there occur cycles which are comparatively *regular*, which, in other words, change neither the. period nor the phase. In addition the observation material must be so great as to embrace many; say 10—15, indeed, preferably even more complete cycles. If these conditions are not fulfilled the result of the harmonic analysis will not be significant.

In economic and social data, however, there is practically never any question of cycles which are regular. On the contrary there is here a fundamental problem to investigate how an individual wave in the chain can be different from its predecessors, e. g. by a lengthening or shortening of the period or in some other manner. We therefore need here a method

which takes into consideration the possibility of more general types of components.

In recent years I have devoted much work to the statistical decomposition problem on the basis of such more general assumptions. In the numerical work which has been necessary in this connection I have been fortunate enough to have the help of students who have become interested in the problem. Thus, a large part of the work at my statistical seminar at Yale University and now lately at Oslo has been devoted to this problem. During this work we have studied several interesting cyclical phenomena both in new and old economic data. We have, for instance found that the business cycle of an average 40—42 months length which the Americans have studied in pre-war statistical material has, as a matter of fact, continued with unabated strength and with no little regularity right across the war period and post-war period. The reason that this has not previously been seen clearly is quite simply that, during that time, so many other and more powerful factors appeared that the short business cycle became heavily veiled in the observation material. A somewhat searching decomposition analysis is required to bring it to light.

An important point in the method with which I work is that the result does not appear only in the form of a time curve for each component but in the form of a *band* within which the component searched for must lie. The breadth of the band indicates the reliability of the result, the broader the band the more uncertain the result. Such a criterion is of essential importance. There is, namely, in this field a great danger of seeing cycles where no cycles are. Indeed, there is even a certain risk of creating fictive cycles by the very manipulation of the material. It is against such things that the band in question is to protect us.

The examples which I have mentioned are, naturally, by no means sufficient to present a complete survey over the kind and extent of the multifarious problems which engage the economic theory at the present day, but I hope, nevertheless, that the examples have, in any case, carried a little message of the spirit which characterises the position of the problem. It is an endeavour opposed to verbal discussion and aiming at precise formulation supported by numerical data in all the spheres where this, on the whole, is possible.

It is clear that this development of the economic theory has carried with it certain consequences in respect of the relationship between the theorist and the practical business men. On the one hand the element of concrete realism which has entered into the theory alongside with the increased interest in the observation material, has created a real desire on the part of the theorists to come into contact with men engaged in practical work in order to benefit by their special knowledge in the various spheres. It is obvious that an observation material which is formed out of the live forces and processes in a modern economic community has room for many possibilities of incorrect interpretation. In many spheres — in order to guard against incorrect interpretation and to be able to foresee the possible sources of error — one must possess a knowledge which can only be acquired by practical contact with the phenomena. In such spheres no advance can be made without intelligent co-operation between practitioners and theorists.

On the other hand the modern development of economic theory has contributed in a certain sense to increasing the difference between the point of view of the practical business man and the unifying point of view which it is the task of the theorists to represent. Formely it was not uncommon to meet with the opinion that in economics it should always be sought to present methods and reasoning in a popular manner. Indeed, it was almost considered that economics — in contradistinction to other sciences — should only concern itself with such things as the public in general were qualified to keep pace with. This state of affairs has definitely changed with the new development of economic theory. It is true that the efforts towards realism in economic theory now render it necessary that the theorist should understand the main features of the line of thought, and method of reaction, of the business man. But, on the other hand, it is no longer possible to go on with the analysis in such a way that the business man understands all the problems on which the theorist is engaged.

Also the instruction in economic theory has naturally been influenced by the efforts towards precision, quantification and observations. Its technical and realistic character has been further accentuated. It is not political views that are taught to the students. They neither learn to be reactionaries nor to be

stormers of the social orders. But they are trained to *think*. They are trained to cut through all nonsensical discussion or bombastic agitation, irrespective of the quarter from which it emenates. That is, in any event, the ideal goal which theory strives to enable students to attain to.

Finally I wish to speak a few words especially upon work with advanced students. One of the most stimulating things for a University tutor is, in my experience, the work which is done with a small group in a seminar where new theories are discussed, new methods tested. Of special value is it to both students and tutor if this co-operation can proceed so far that the tutor in the consciousness of the students no longer stands as the master whose words must be remembered for one examination or another, but that he stands as a *primus inter pares* whose function is to organise and stimulate the work.

RAGNAR FRISCH

GRUNDBEGRIFFE UND GRUNDPROBLEME DER KORRELATIONSTHEORIE ..... AL. A. TSCHUPROW
ZWECK UND STRUKTUR EINER PREISINDEXZAHL, II, III ... L. v. BORTKIEWICZ
THE FOREST RESOURCES OF SWEDEN ..... TOR JONSON
THE ORE RESOURCES AT THE KIIRUNAVAARA AND GELLIVARE MINES ..... WALFR. PETERSSON
STATISTICS OF INDUSTRIAL PRODUCTION ..... ADOLPH JENSEN
ZIELE UND WEGE DER STOCHASTISCHEN GRUNDLEGUNG DER STATISTISCHEN THEORIE ..... AL. A. TSCHUPROW
FEIL I DET BEFOLKNINGSSTATISTISKE MATERIALE ..... HENRIK PALMSTRØM
UNDERSÖKNING RÖRANDE DEN ANIMALISKA PRODUKTIONENS STORLEK I SVERGE, I ..... ERNST HOIJER
THE PROSPECTS OF THE PAPER INDUSTRY ..... HANS ANSTEIN

Vol. 4

SVENSKA FÖRSÄKRINGSFÖRENINGEN OCH STATISTIKEN ..... UTGIVAREN
WILHELM LEXIS UND SEINE BEDEUTUNG FÜR DIE VERSICHERUNGSWISSENSCHAFT ..... W. LOREY
TIL BELYSNING AF FORHOLDET MELLEM IAGTTAGELSESLÆRE OG FORSIKRINGSTEORI ..... CARL BURRAU
SVENSKARNAS UTBREDNING I NORDAMERIKA ..... HELGE NELSON
ET GLEMT STATISTISK ARBEID OM NORSK SJØFORSIKRING ..... K. LORANGE
CLASSIFICATION BY OCCUPATIONS AND INDUSTRIES AT THE GENERAL CENSUS ..... RAGNVALD JONSBERG
DAS GESCHLECHTSVERHALTNIS DER GEBORENEN ALS GEGENSTAND DER STATISTISCHEN FORSCHUNG ..... AL. A. TSCHUPROW
THE DISTRIBUTION OF FERTILE SOIL IN FINLAND ..... A. K. CAJANDER
RIKSSKOGSTAXERINGEN I SVERGE ..... TOR JONSON
NOTES ON FINANCIAL STATISTICS FOR THE NORTHERN COUNTRIES ..... CHRISTIAN OLSEN
BUSINESS FORECASTING ..... AL. A. TSCHUPROW
THE REPRESENTATIVE METHOD IN STATISTICS ..... ADOLPH JENSEN
THE REPRESENTATIVE METHOD IN PRACTICE ..... ADOLPH JENSEN

Vol. 5

SANNOLIKHETSKALKYLEN I DEN VETENSKAPLIGA LITTERATUREN ..... HARALD CRAMÉR
ECONOMIC AND FINANCIAL CONDITIONS IN NORWAY ..... N. RYGG
THE NORWEGIAN HARVEST STATISTICS AND THEIR RE-ARRANGEMENT ..... S. SKAPPEL
THE WOOD PRODUCTS OF THE SWEDISH EXPORT TRADE ..... HANS ANSTEIN
A. A. TSCHUPROW †
ALEXANDER ALEXANDROVITJ TSCHUPROW ..... L. v. BORTKIEWICZ
A. A. TSCHUPROW. PERSONLIGA ERINRINGAR ..... K. GULKEVITJ
ALEXANDER A. TSCHUPROW ALS GELEHRTER UND LEHRER STANISLAUS KOHN
TEORIEN FOR STATISTISKA KAOKORS STABILITET ..... AL. A. TSCHUPROW
ON THE ANTHROPOLOGY OF THE ISLAND OF BORNHOLM I. MEASUREMENTS ..... L. RIBBING
STATISTISKA PROVNINGSANSTALTER ..... UTGIVAREN
JORDBRUKS- OCH ÖVRIGA LANDSKOMMUNER I SVERGE ..... TOR JERNEMAN
NORDENS FOLKRÄKNINGAR 1920. 1 ..... UTGIVAREN

Vol. 6

FOLKEREGISTER OG BEFOLKNINGSSTATISTIK ..... IØRGEN PEDERSEN
PENSIONSSTYRELSENS STORA AVGIFTSKONTOREGISTER ..... TOR JERNEMAN
VÄRLDSBEFOLKNINGSUNIONEN ..... THOR ANDERSSON
AV INNTEKTSSTATISTIKKENS METODEOMRÅDE. Paretos lov. .... 1. WEDERVANG
GEMENSAM NORDISK OLYCKS- OCH SJUKFÖRSÄKRINGSSTATISTIK ..... BERTIL ALMER
FATTIGVÅRDSSTATISTIKEN OCH SOCIALFÖRSÄKRINGEN ..... TOR JERNEMAN
DANMARKS, NORGES OG SVERGES IND- OG UDVANDRING ..... ADOLPH JENSEN
BESKRIVELSE AV OSLO BY ..... G. AMNÉUS
NORDENS FOLKRÄKNINGAR 1920. 2 ..... UTGIVAREN

Vol. 7

DETERMINATION OF THE DEGREE OF CREDIBILITY OF NORMAL SERIES ..... EILIF GJERMOE
ÜBER DIE SEKSUALPROPORTION BEI DER GEBURT ..... GEORG H. M. WAALER
DØDLIGHETEN AV TUBERKULOS OG KRÆFT I NORGE SIDEN 1890 ..... H. PALMSTRÖM
SKOGSBRUKSTELLINGEN I NORGE ..... GUNNAR JAHN
NORDISKE HANDELSFORBINDELSER MED FRANKRIKE UNDER L'ANCIEN RÉGIME ..... O. A. JOHNSEN

Vol. 8 = Nordic statistical journal Vol. 1

Vol. 9 = Nordic statistical journal Vol. 2

LEXIS AND DORMOY ..... L. v. BORTKIEWICZ
STATISTISKA TJÄNSTEMÄNS UTBILDNING I SVERGE ..... UTGIVAREN
ON THE ADDITION OF TWO NORMAL FREQUENCY CURVES ..... F. J. LINDERS
UDVIKLINGEN INDENFOR DANSK LIVSFORSIKRINGSTEKNIK ..... CARL BURRAU
UTVECKLINGSLINJER I NYARE SVENSK LIVFÖRSÄKRINGSTEKNIK ... H. CRAMÉR

Vol. 10 = Nordic statistical journal Vol. 3

LADISLAUS VON BORTKIEWICZ 1868—1931 ..... UTGIVAREN
THE MATHEMATICAL FOUNDATIONS OF THE METHODS TO BE USED IN STATISTICAL INVESTIGATION OF THE DEPENDENCE BETWEEN TWO CHANCE VARIABLES ..... A. A. TSCHUPROW
DE REPRESENTATIVA UNDERSÖKNINGARNAS METODIK ..... TOR JERNEMAN
FOLKETÆLLINGEN I DANMARK 1930 ..... HANS CL. NYBØLLE

REVIEWS

Sthlm 1933, Klara Civiltryckeri A.-B.