

## TRUKSA

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### Abstract

The paper is devoted to the important mathematicians, statistician and actuar Ladislav Truksa, because on December 17, 2021, 130 years have passed since his birth. From 1920 to 1939, Truksa was a close apol-worker of the most prominent representative of the Czechoslovak School of Actuarial Mathematics, Emil Schoenbaum. After high school, Truksa completed a two-year course in insurance technology at the Czech Technical University and began studying mathematics and physics at the Charles-Ferdinand University, but this study was interrupted by Truksa's combat deployment in WWI. After returning from the war in November 1918, he completed his studies in mathematics and physics and successfully passed the teaching aptitude test at the Charles University. From 1920 to 1945 he worked at the General Institute of Pension, stating that from 1939 to 1945 he was the director of this institution. After WWII, he devoted a lot of mathematical statistics, at the Charles University. In mathematical statistics, he dealt with its application in quant physics, he dealt with stochastic processes and the newly developing information theory. He was constantly interested in everything new in the scientific world, his care for the education of the young generation was a guarantee of his unquestionable success.

**Key words:** Ladislav Truksa, Emil Schoenbaum, actuarial mathematics, insurance, mathematical statistics

**JEL Code:** B26, G22

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### Introduction

According to Hykšová (2006, 2017), Kotůlek (2017), Rys (2019), Zweibel et al. (2011) and Coufal et al. (2021) Emil Schoenbaum (1882–1967) was undoubtedly one of the most important figures in the Czechoslovak school of actuarial mathematics. According to Bílý (1961), Ladislav Truksa occupies an important place by his side and collaborated with him until 1939 at the General Prison Institute, and after World War II until Schoenbaum's forced emigration in 1948, they collaborated at the Faculty of Science of Charles University. According to Durnová et al. (2017) cooperate in actuarial mathematics, mathematical

statistics and econometrics. After 1945, Truksa worked at the Faculty of Science and since 1953 at the Faculty of Mathematics and Physics, Charles University. In the 1950s, he studied statistics in quantum physics, statistical dynamics, but also information theory (especially coding methods).

## **1 Period until the year 1921**

According to Bílý (1961), Ladislav Truksa was born on December 17, 1891 in Pavlíkov in the Rakovník district. His father was a tailor and had a small farm. Already during his studies at the Rakovník school (which was the first. The poor poor prospects of high school teaching candidates at the time and the opportunity to become early as a mathematician in the recently introduced pension insurance (1909), as well as the prospects of employment and old-age workers' insurance, led Truksa to study actuarial mathematics for two years. insurance technology at the Czech Technical University in Prague, while from the academic year 1912/13 he studied mathematics and physics simultaneously at the Faculty of Philosophy of the Czech Charles-Ferdinand University in Prague. After passing the state exam in insurance technology in 1913, Truksa continued to study mathematics and physics at the Faculty of Philosophy, and wanted to obtain approval in these fields for secondary schools.

Truksa's studio intentions, which he enthusiastically set to study, were postponed for a long time by the outbreak of World War I, in which Truksa took part from its inception until demobilization in November 1918 on various fronts. He served in Bosnian troops, to whose members he had a good relationship. He had long felt the effects of malaria during the occupation of Albania.

After demobilization in November 1918, Truksa completed his studies in mathematics and physics at the Faculty of Philosophy of Charles University, then in 1921 he achieved teaching qualifications for these fields at secondary schools at the newly established Faculty of Science, Charles University. However, already during these studies, Truksa's life destiny was significantly affected by his appointment as the head of the mathematics department of the General Pension Institute in Prague, which was newly established as a pension insurance holder in the new state after the establishment of the Czechoslovak Republic.

## **2 The years from 1921 to 1945**

The institute faced the difficult task of preparing an amendment to the pension insurance, which was necessary as a result of the devaluation of the currency. There were not enough

qualified mathematicians for this work; at the same time, the introduction of disability and old-age workers' insurance was being prepared, which required extensive mathematical work. The work in the field of pension insurance, which included the elaboration of balance sheets, participation in the preparation of amending regulations, elaboration of new numerical documents and related numerous and extensive mathematical works, consumed much time and effort of Truksa for a large part (thirty years) of his active activity.

Today, few experts know about the amount of work, mostly anonymous – only Truksa et al. (1944) was issued by default – or in a few sentences in the accompanying reports appreciated, which Truksa performed at the time, because it had to be executed and there was no one who could perform it like him. Truksa did this work, which did not lie in the direction of his main scientific interest, applying the highest scientific aspects, also based on the study of demography and economics. Whereas for most other people, mastering the tasks described would be enough to fulfill life, as was the case with Truksa, who, despite exhausting work in his job, pursued the scientific goals he had set himself. Truksa's scientific interest was first attracted by orthogonal polynomials, especially in terms of their use in numerical methods and in mathematical statistics.

According to Paláček et al. (2017) also includes Truksa's dissertation on Legendre's polynomials (Truksa, 1927), in which he achieved a doctorate in science in February 1927. The same focus is on the Charlier-Jordan polynomials and the Bessel coefficients (Truksa 1928, 1930, 1931). Truksa's habilitation paper Truksa (1931a) is also devoted to orthogonal polynomial systems. It shows how from the system of sum orthogonal polynomials proposed by Chebyshev with the weight function  $\frac{\Gamma(x+\alpha)\cdot\Gamma(m-x+\beta)}{\Gamma(x)\cdot\Gamma(m-x)}$ , which are in the file called Jacobi generalized polynomials, it is possible to derive generalizations of systems of known orthogonal sum and integral polynomials (limit transition) and some new orthogonal systems of polynomials. The paper provides a new and unified view of the introduction of orthogonal polynomial systems. On the basis of this habilitation file, professor Truksa was awarded a docendi for actuarial and mathematical statistics at the Faculty of Science of Charles University in March 1931.

In his teaching career, which he practiced from 1931/32 (interrupted during the occupation) until 1953, he worked as a private associate professor, focusing mainly on mathematical statistics, focusing on emerging trends. Above all, it was the theory of random selection that he lectured on; in them he gave an insight into the current rapid development of this direction, showed its basic position in mathematical statistics, eg in deriving various

distribution functions; this aspect is applied in Truksa (1930a). The significance of his results in random sampling theory shows the publication of his work on the original derivation of the simultaneous distribution of the sample mean and the sample standard deviation and the sample mean and sample variance in Truksa (1940); it is the first work of a Czech mathematician, published until then in this world-class journal.

The second direction to which Truksa paid great attention in his teaching and scientific work was statistical dynamics, which he called a field called today's theory of stochastic processes at the beginning of his teaching career. It was a field in our country at that time, with few exceptions (professor B. Hostinský), uncultivated, if we do not look at those parts of actuarial mathematics that dealt with decremental rules, which were only narrowly focused and did not give a general view.

Professor Truksa correctly perceived the basic importance of the theory of stochastic processes for the description and interpretation of numerous phenomena in the natural sciences, especially in physics, demography, economics, as well as in solving problems of mathematical statistics (random selection theory, etc.) and drew attention to it in his lectures. Truks's lectures on statistical dynamics, given ninety years ago at Charles University, were one of the first systematic explanations of the theory of stochastic processes on university grounds at all, as until then certain parts were interpreted in terms of probabilities and literature was scattered throughout journals.

Truksa immediately recognized the importance of the work of the Soviet school in the theory of stochastic processes, and he was the first to lecture on the results of the work of Bernštejn, Chinčin, Kolmogorov, Romanovský, etc. in our country. He sought to free the study of mathematical statistics from a narrow focus on actuarial and descriptive statistics, and sought to penetrate the methods of mathematical statistics into natural sciences and technical practice, sharply rejecting attempts at standard, formal application of these methods and emphasizing the need for scientific analysis of the phenomenon, which aims to construct an abstract model for the studied real phenomenon.

Truksa put on the officer's uniform again during the mobilization in 1938, when as captain he commanded one battalion on the Šumava border.

In an atmosphere of growing anti-Semitic propaganda, Schoenbaum became the target of one of the attacks by right-wing journalists. The headlines in the extreme Sunday newspaper (*Nedělní list* in Czech) announced the revelation of the regime's sins at the GPI and held it responsible for the alleged billions in losses. Under media pressure, the government issued several decrees, in December 1938 a new board of directors was appointed

to the GPI and in January 1939 a new president František Ježek (1890 – 1969). In March 1939, Schoenbaum had to retire from active service at the university. His student, Associate Professor Truksa, was commissioned to replace his lectures. After the establishment of the Protectorate, Schoenbaum also asked – in anticipation of things to come – to retire at the General Pension Institute. Here his position remained vacant, Truksa, his deputy and the director of the mathematics department of the VPU took over the duties again.

### 3 Since 1945

It was not until the liberation of our country in 1945 that Truksa's ideas on the education of experts in mathematical statistics were realized. The great advances in mathematical statistics, especially the theory of stochastic processes, during World War II, from which we were cut off by the war occupation, forced our experts to become quickly acquainted with the level reached in world literature. At the same time, it was necessary to train young professionals for the needs of the nationalized economy, which showed interest in the application of statistical methods, and for the needs of newly emerging scientific and research institutes.

Truksa set about building mathematical statistics at Charles University (first, until 1948, still associated with the study of actuarial mathematics and econometrics), and he gave lectures on mathematical statistics at the university himself, until teaching forces for this field were educated (1945 to 1951); he also led a seminar on mathematical statistics. His passion for building the study of mathematical statistics at Charles University and his dedication prove best that he did this great work as a private associate professor with the remuneration of an external teacher; he became an employee (associate professor) of the faculty only in 1953 and with effect from March 1, 1960 he was appointed professor, which received a proper award for his work. Surprisingly, Truksa, during his workload as a teacher, found time to give lectures to professionals outside the school, to consult with young practitioners who often came to him for advice. However, he did not find enough time to publish the results of his work in an elaborate form of his own, and so, for example, Truksa's original results from sequence analysis, which particularly interested him, attested by his lecture at the Research Institute of Mathematics in 1947, derived and later published by P. A. Samuelson (1948).

His work *Contribution to the Statistics of Quantum Systems* (Truksa, 1955) testifies to how Truksa still dealt with the applications of the theory of stochastic processes to solve basic physical problems. Truksa took into account the provision of textbooks for his lectures on statistical dynamics, so he published the two-volume textbook *Truksa* (1956, 1958), which

provides a perfect introduction to the theory of stochastic processes, an overview of its results and a rich look at various, mainly physical applications (see Choi et al., 2021, Farewell et al. 2022). The most convincing example of Truksa's scientific perspective and his passion for everything new is how he became acquainted with the theory of information, about which he began lecturing in the acophemic year 1956-57. Several diploma theses in this field, which were prepared under Truksa's leadership, testify to the beautiful results of his work. He was particularly interested in coding problems.

#### 4 Truksa's publishing activity

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## Conclusion

If we overlook Truksa's professional activity, we can say that he richly fulfilled the task he set in his youth, that the fields that immediately attracted his interest grew and developed, and that he played a significant role in educating a generation of experts who look at him with great respect not only for his scientific profile, but also for his rare personal qualities, for his interest in every researcher and his unlimited willingness to help solve scientific problems. His constant interest in everything new in science, his own scientific work and his care for the education of the young generation were the guarantee of his success.

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