ABOUT THE HISTORY OF STATISTICAL CHARTS ON THE TERRITORY OF THE CZECH REPUBLIC

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Abstract

The beginnings of graphical illustration in the statistical literature on our territory are linked with the name of professor of statistics at the University of Prague Georg Norbert Schnabel. These are mainly his publications from years 1826–1833. Modern methods of graphical illustration introduced to its statistical publications Karel Kořistka, organizer of the provincial statistical service in Bohemia, four decades later. It was especially cartograms (year 1868) and since year 1872 line graphs to illustrate the long-time series. Here, for the illustration of the development of several commodities prices in one chart used Kořistka on the vertical axis logarithmic scale, that is more suitable for comparison of faster and slower growth in the relative prices of various commodities. Our paper offers an excursion into the history of these that are using a logarithmic scale and also discusses whether it is possible that those two authors could know about each other's research.

Key words: history of statistics, Georg N. Schnabel, Ernst von Schwarzer, Karel Kořistka

JEL Code: B16, B23, N33

Introduction

Unlike other scientific disciplines, the history of statistics in our country is still inadequately elaborated. The authors of this paper try to gradually contribute to improving this state by partial papers on the development of statistics in the XIXᵗʰ and XXᵗʰ century; see e.g. Závodský (1992), Závodský and Šimpach (2014, 2015), Kodera, Závodský and Šimpach (2015) etc.

In this paper, we are concerned with the development of graphical illustration[1] in statistical publications at the area of the Czech Republic in XIXᵗʰ century as statisticians from the end of XVIIIᵗʰ century did not used graphs in their work. Continuous introduction of statistical graphs has three milestones at our area − work of professor of Prague University Georg Norbert Schnabel in 20s and 30s, economic map of Bohemia by Ernst Schwarzer from

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[1] In general, the history of graphical representation in statistics is discussed, for example by Beniger and Robyn (1978).

year 1842 and finally using of modern statistical graphs by professor Karel Kořistka starting in 1860s.

1   Georg Norbert Schnabel

G. N. Schnabel was born in year 1791 in town Bezdružice in Western Bohemia. He graduated from grammar school in Pilsen and studied philosophy and law at the university in Prague. He gained a doctorate degree in year 1816 at Vienna university, where he worked for a short time as an assistant. He was a professor of statistics at Law Faculty of Prague University since 1817. He took over here a department of law philosophy and criminal law in year 1835. Only in the more liberal atmosphere after 1848 Schnabel could be elected to be dean and in year 1852 also to be a rector. He died in year 1857[2].

Besides the history of Law Faculty of Prague University and law publications, Schnabel published also 11 books from the field of statistics in years 1819–1848, and also many journal articles, reviews, etc. His books illustrate the modernization of Central European university statistics in the three decades. Schnabel's *Statistische Darstellung von Böhmen* (1826) is essentially the first finished description of Bohemia in the spirit of classical university statistics of Achenwall and Schlözer. Last Schnabel's gook *Tafeln zur Statistik von Böhmen* (1848) is already a modern publication that consists of only tables supplemented by brief analysis and comments.

In our contribution, we will have a look especially on the statistical graphs, which were first began to be used by Schnabel in the 1820s. To the brief publication *Ueber Raum-*[3] *und Bevölkerungs-Verhältnisse* (Schnabel 1826) are attached appendixes with graphs. The first graph compares the size of particular lands of Habsburg monarchy using squares of different colours where the square content corresponded to the acreage of the land (square is drawn one to the other and "hang out" on one straight line.

Second graph illustrates combination of the number of inhabitants, their density and national composition in individual countries. The basis of the graph is the size of the area that belongs to 1000 inhabitants (inverse value of population density), illustrated for each country by a circle (of a size proportional to the value of this indicator; the centres of the circles lie on one horizontal line).

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[2] Frequently stated year 1856 is wrong.

[3] In the catalogues of some libraries (including the National Library of the Czech Republic!) and in Google, the title of the publication is incorrectly transcribed from the decorative font in the Latin to the Latin *Ueber Kaum-*
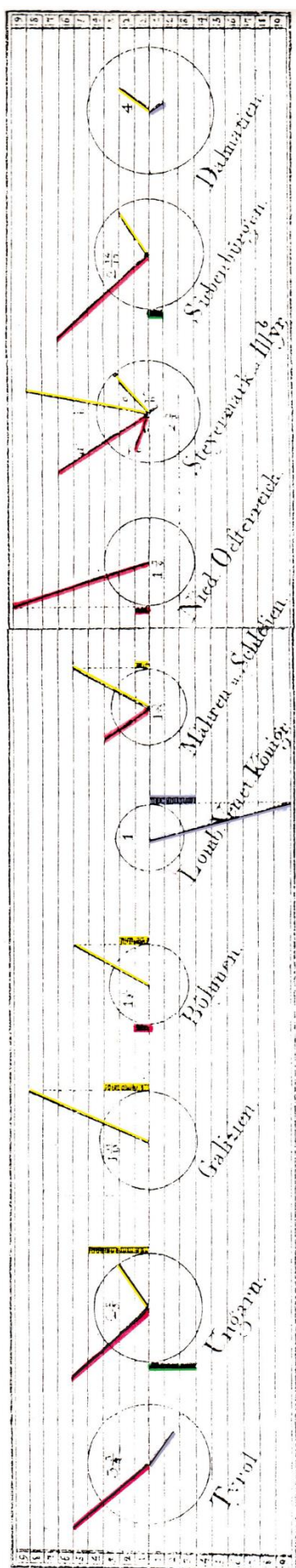
Fig. 1: No. of inhabitants of particular countries of the monarchy on Schnabel's graph

The numerical figure in the circle represents an index comparison with the value of the indicator in the most populous country of the monarchy[4] (e.g. for Bohemia was this index $1^1/_3$). Vertical half-tangents of different colours express the number of inhabitants in round millions (top left Germans, down left Hungarians, top right Slavs, down right Italians). Elongated sloping radials show the remaining hundreds of thousands of inhabitants (nationality is again expressed in colour and direction; auxiliary lines allow reading of values). This graph, especially for the presentation of the number of inhabitants is not particularly illustrative – see Fig. 1.

Two large appendixes[5] to *General statistics*[6] (Schnabel 1829a) – to 1st and 2nd issue – consist of similar statistical graphs in combinative set with geographical schemes and statistical tables. While in the case of tables it is possible to appreciate their clarity and selection of interesting data, statistical graphs here barely make progress against the previous publication. Schnabel depicts the size and population of European states this time by a coordinate graph in which the number of inhabitants is recorded for each state on the vertical axis, the extent of the population on the horizontal axis, and to the line between these two points he writes the population density. Due to the considerable number of European countries compared, the chart is generally unclear. Even more due to the fact, that the author does not respect (on any axis) the scale and, in some cases, the ranking of the states.

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[4] This was the Lombard-Venetian Kingdom, at that time part of the Austrian Empire.

[5] They were published also individually as Schnabel (1829b).

[6] General statistics was in the era of university statistics the description of wide empire or the whole part of the world or its important part. The description of one country or smaller state was called special statistics.

Second of previously described graphs is modified so that the circles are replaced by squares and instead of tangents and radials are supplemented by different ranking numbers. Illustration of the length and size of the catchment area of the eight most important European rivers is simple and clear. In the graphs of the altitudes of the Austrian and other European mountains (two variants of the graph) can be seen the predecessor of the pictograms. Some clarity cannot be denied also to a historical rather than a statistical, somewhat monstrous graph, presenting the territorial development of the Habsburg monarchy and the succession of sovereigns in the individual countries (forming the Austrian Empire at the time of the creation of this book)[7].

Schnabel for his graphs usually used without much changes originals of other authors. A comparison of the size of European states with a set of interlocking squares has already been found in Crome's *Grössen-Karte von Europa* from year 1785[8]. *Verhältniss-Karte* of the same author from year 1820 illustrates the number of inhabitants and their density in particular German states using above described circles (with tangents and radials). For graphic representation of the height of the mountains, Schnabel used probably an article by von Gothe *Höhen Tableau* from year 1813[9] or work of one of his followers[10].

2   Ernst von Schwarzer

Ernst Schwarzer von Heldenstamm (1808-1860) was born in Fulnek in Moravia in a family of an officer. He attended a cadet school, served with artillery, but then worked mostly as a journalist. He was elected to the parliament in Frankfurt am Main in year 1848, and to the Reichstag in Vienna, and for a short time he was the Austrian Minister of Public Works.

Industrial Union (Verein zur Ermunterung des Gewerbsgeistes in Böhmen), that started its activities in Bohemia in year 1833, had from the beginning an interest in industrial statistics. The Industrial Union established its own statistical office, the first statistical office in the territory of today's Czech Republic, in year 1841. This office was in year 1842 managed by approximately for a year by Ernst Schwarzer. During this period he assembled and published a

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[7] Graph has a form of monstrous huge river (he co-ordinates at the shoreline indicate the run of time), which has been spreading over the centuries from several rivers (Bohemia, Moravia, Austria, Hungary, etc.), with minor tributaries showing later territorial gains. Time frame is from Přemysl Oráč to František I.

[8] A. F. W. Crome (1753-1833) was a professor of university in Gießen and a pioneer of graphical illustration in statistics. Here mentioned publication was an attachment of Crome's book *Ueber die Grösse und Bevölkerung der sämtlichen europäischen Staaten*.

[9] In: *Allgemeine geographische Ephemeriden,* vol. 41, pp. 1 and following.

[10] See Závodský (1992), pp. 86-88.

map of industry in Bohemia – Schwarzer (1842). It is the first cartographic work with economical-statistical thematic at our territory.

Relatively detailed map (53 x 60 cm, scale 1 : 547 000) contains besides basic topographic information also former administrative division of the land, transport and post network and especially the distribution of different areas of industrial and handicraft production at the Bohemian territory (using 136 types of marks). Despite its details, the map is quite clear - mainly due to the colour differentiation of the basic production sectors - illustration in Fig. 2.

Fig. 2 – Sample from Schwarzer's *Industrie-Karte*

Source: Schwarzer (1842).

3   Karel Kořistka

Karel Kořistka was born in year 1825 in Moravia in Březová nad Svitavou. After studies of the grammar school in Jihlava and Brno, he attended Philosophical faculty (then propedeutic) of the Vienna University. Then graduated from the Mining and Forestry Academy in Banská

Štiavnica. He was a professor of mathematics and geodetics in years 1851–1893 at polytechnic in Prague. He was elected its first rector after the reorganization on two-language Technical university (since year 1864). He was promoted to a knightly state (with a gold geodetic tower in a coat of arms) for his merits in the development of geodesy, cartography and geography, and the organization of technical higher education in the monarchy in year 1879.

Fig. 3 – Cartogram of potato yields in Bohemia in year 1868

Source: Zpráva o činnosti ústředního výboru pro statistiku polního a lesního hospodářství v království Českém za rok 1868, (Prague 1869) – reduced.

From the multifaceted activities of the Kořistka we are interested mainly in the long-term management of agricultural statistics in Bohemia. In year 1864 Kořistka became a member of Central Committee for Field and Forestry Statistics of the Kingdom of Bohemia and at the beginning of year 1868 he took up exhausting function of the leader of his executive body – the

Statistical Office, which, despite very limited personnel and financial possibilities, showed agile activity[11].

Central Committee and its Statistic Office published annually the Report on their activities in German and Czech (Zpráva o činnosti 1867– ...). They contained an overview of the activities in previous year and table summarization and analysis of surveyed realities. Already in the Report about activities for year 1868, there is published six colour cartograms whose author is professor Kořistka (see Fig. 3). Similar cartograms Kořistka created also for some other volumes of the Reports. They report not only the yields of different crops, but also the distribution of damage due to natural disasters, the intensity of afforestation of individual districts, the proportion of beef cattle per 100 inhabitants etc.

Starting with Reports for year 1872 there are in some years published line graphs illustrating long time series, mostly the development of prices of various agricultural products. It is the first usage of such graphs in statistical literature on our territory. Kořistka explains here in detail the possibilities of usage of different scales on vertical axes. In the case of graph expressing the development of the price of one commodity, it is possible to use usual uniform scale. However, if we want to illustrate the development of prices of several types of commodities in one graph, usual scale does not enable to correctly capture relatively faster growth in the price of a cheaper product (e.g. potatoes) against a relatively slower rise in the price of more expensive commodities (e.g. wheat). Therefore, Kořistka uses in some graphs on vertical axes logarithmic scale, that is justified in a text. Because of the labour and financial demands of making and printing such graphs, it was necessary to abandon them in some years, otherwise the graphs were usually made with bilingual descriptions for publication in the Czech and German versions.

When in 50th years of XIXth century started from the initiative of famous Belgium statistician Adolphe Quételet an international cooperation of statisticians started to continuously develop, also professor Kořistka played an active role there. At 3rd International Statistical Congress in Vienna (1857) he worked in section for graphic illustration in statistics. As a leader of the statistical office Kořistka already regularly took part at the Negotiations of the congresses – in Haag (1869), in Saint Petersburg (1872) and in Budapest (1876). In the last mentioned he successfully presented a statistic of the forests in Bohemian and his own methodology of statistical graphs).

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[11] See Závodský and Šimpach (2016a); Závodský and Šimpach (2016b).

Fig. 4 – Graph of the development of the prices of corn in Bohemia in years 1800–1890 (using normal scale)
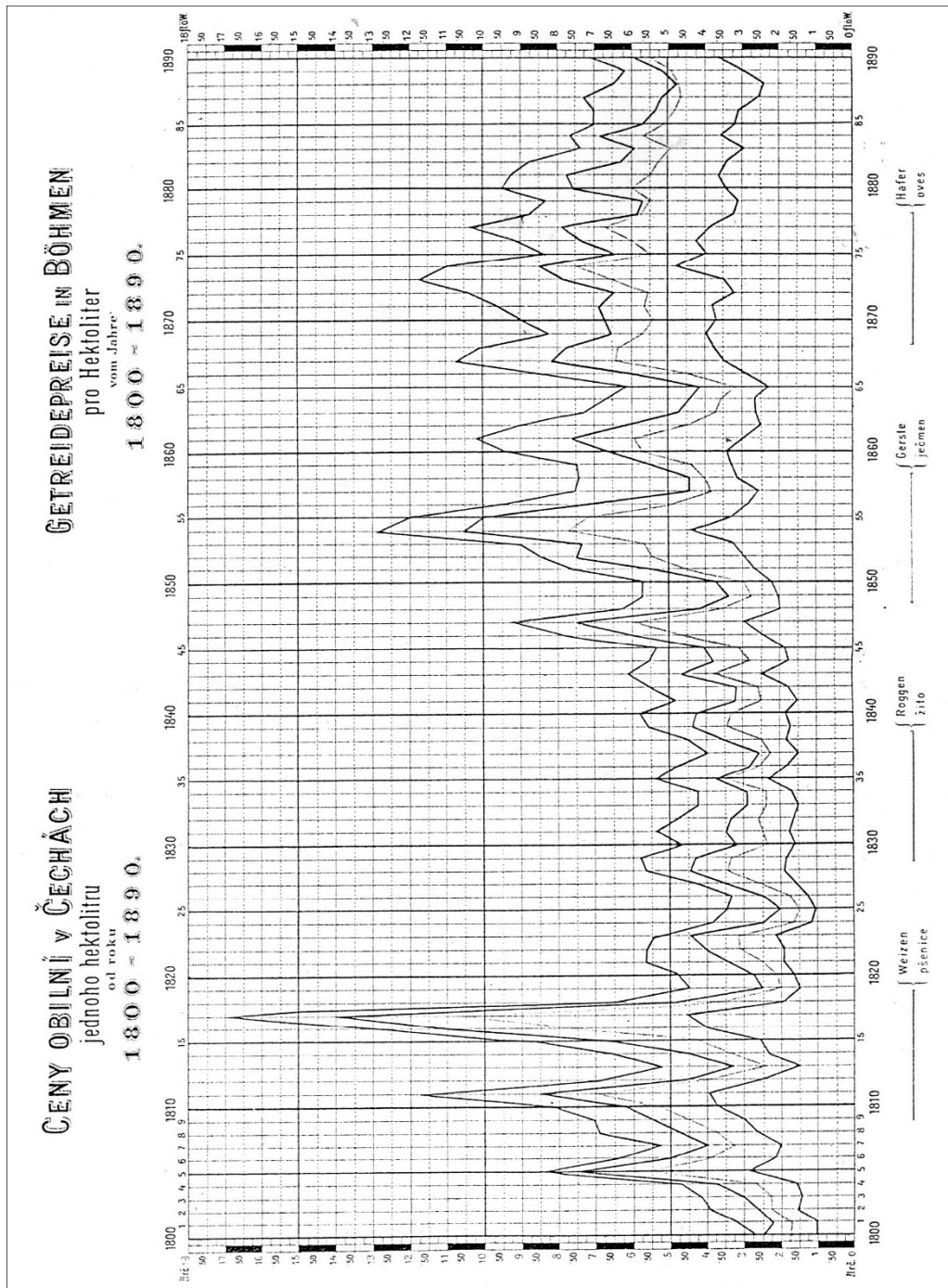
Source: Zprávy statistické kanceláře zemědělské rady pro království České za léta 1891-1892, (Prague 1893) – reduced.

He also presented the successes of the land statistics in Bohemia as a member of the International Statistical Institute (since year 1889), especially at meetings in Kristiania (todays Oslo – 1899) and in Budapest (1901).

Professor Kořistka established the Land Statistical Office in Bohemia (1898) and became the head of his statistical office (1898). He retired only at the age of 80 and died soon after (19ᵗʰ January 1906).

Conclusion

In our article we describe the gradual introduction of graphic representation in statistical literature on our territory during the XIXᵗʰ century. The first stage was the publication of a long-time professor of statistics at the University of Prague, G. N. Schnabel. Has been inspired by the work of classical statisticians Achenwall and Schlözer in his pedagogical work[12] and in rich publishing activities. A remarkable contribution to the development of statistical graphs in the Czech lands was *Statistical-topographical industrial map of Bohemia*, the first work of this type at our territory, from E. Schwarzer, rather occasional statistician.

Beginnings of modern statistical graphs are linked at our territory with the activities of K. Kořistka in land statistical service in Bohemia in the last third of XIXᵗʰ century. Kořistka as experience university professor of mathematics and geodesy introduced the usage of cartograms and line graphs of time series (also with logarithmic scale on axis y) to statistics at our territory and became also an internationally recognized personality in area of statistical graphs.

Acknowledgment

References

BENIGER, J., ROBYN, D. L. (1978). Quantitative Graphics in Statistics: A Brief History. *The American Statistician*, vol. 32, iss. 1, pp. 1–11.

KODERA, J., ZÁVODSKÝ, P., ŠIMPACH, O. (2015). Jan Stocký, Southern Bohemia and Mathematical Methods in Economics. In: *Applications of Mathematics and Statistics in Economics – AMSE 2015*. Prague: University of Economics, Prague, 11 p.

SCHNABEL, G. N. (1826). *Ueber Raum- und Bevölkerungs-Verhältnisse der österreichischen Länder*. Prag 1826.

SCHNABEL, G. N. (1829a). *General-Statistik der europäischen Staaten mit vorzüglicher Berücksichtung des Kaiserthumes Oesterreich I-II*. Prag 1829.

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[12] However, he was here limited by obligatory literature prescribed by Vienna offices.

SCHNABEL, G. N. (1829b). *Zwey geographisch-statistische Übersichtskarten*. Prag 1829.

SCHWARZER, E. v. (1842). *Statistisch-topographische Industrie-Karte des Koenigreiches Boehmen*. Prag 1842.

ZÁVODSKÝ, P. (1992). *Vývoj statistické teorie na území Československa do roku 1848*. Praha: FSÚ a Infostat, pobočka Praha.

ZÁVODSKÝ, P., ŠIMPACH, O. (2014). J. N. Müllner and the Beginnings of Demographic Statistics in the Czech Lands. In: *The 8th International Days of Statistics and Economics*. Slaný: Melandrium, pp. 1687–1695.

ZÁVODSKÝ, P., ŠIMPACH, O. (2015). Statistical and Topographical Description of the Czech Lands in the 18th and 19th Century. In: *The 9th International Days of Statistics and Economics*. Slaný: Melandrium, pp. 1804–1813.

ZÁVODSKÝ, P., ŠIMPACH, O. (2016a). The Development of Provincial Statistical Office in Bohemia in Historical Context. In: *The 10th International Days of Statistics and Economics*. Slaný: Melandrium, pp. 2096–2106.

ZÁVODSKÝ, P., ŠIMPACH, O. (2016b). Karel Kořistka and the Provincial Statistical Service in the Czech Lands. In: *AMSE 2016 (Applications of Mathematics and Statistics in Economics)*. Banská Bystrica: Občianske združenie Financ, pp. 387–398.

Zpráva o činnosti ústředního výboru pro statistiku polního a lesního hospodářství v království Českém. Praha 1867 – ...[13]

Rechenschafts-Bericht über die Thätigkeit des Central-Comité für die land- und forstwirthschaftliche Statistik Böhmens. Prag 1867 – ...

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[13] The report was published in the Czech and German language every year and changed its name many times.