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THE EFFECT OF WEATHER FACTORS ON FLUCTUATIONS OF GRAIN PRICES IN THE CZECH LANDS IN THE 16TH-18TH CENTURIES

Abstract: Price series of rye, wheat, barley and oats are analysed for Brno, Dačice and Olomouc for the 16th-18th centuries. For 61 selected years with extremely high prices the possible effect of weather and further factors on the price is evaluated. In most cases (67%) the high price of grains is given by the bad harvest of the given or the preceding year, conditioned by adverse weather. The so-called hungry years 1770-1772 as the last case of famine in the Czech Lands are characterised in a detail way.

Key words: grain prices, weather, dearth, hungry years, Czech Lands.

1. Introduction

Meteorological and climatological conditions have always to a certain extent affected man and his activities. The most marked effect was reflected in agriculture for which climatological conditions are even one of the limiting assumptions. The weather variation during the year and meteorological extremes then immediately affect the quality and size of the harvest of farm crops which is important for the nutrition of the population. Grains have always played an important role in it and their production is particularly dependent on the course of weather. The quality and size of their harvest in turn affected the level of prices and thus the accessibility of foodstuffs for different layers of the population. Whereas abroad there are numerous papers putting the price swings in connection with meteorological factors (e.g. Abel 1974; Scott et al. 1998; Bauernfeind, Woitek 1999), papers of this type are rather an exception in the Czech Republic (e.g. Černý 1956; Hosák 1969; Šůla 1969), although the problems of grain prices have so far been paid considerable attention (e.g. Novotný 1963, 1965; Borská-Urbánková 1977; Honc 1977; Petráň 1977; Kostlán 1987).

The object of procession are price series of the four main grains grown in the Czech Lands, i.e. rye (the most important bread crop), wheat (for the production of

beer, the most important market crop), barley (replacement of wheat in the less fertile regions and for the production of beer) and oats (the chief fodder crop). The quality of grain and the size of yields was on the one hand affected by primary natural factors, on the other hand by secondary socio-economic factors. From the natural ones it was above all the quality of soil, the selection of seed, the character of weather and meteorological extremes, distribution of pests and diseases. The group of socio-economic factors is extensive and complicated; it includes above all war events, labour force, tax load, the development of the population number, food habits, epidemics, market or the currency development. The size proper of the prices was thus a result of their complex interaction conditioned by the offer and demand on the one hand, and affected by further subjective factors, such as price regulation, speculation or expectancy of the future harvest on the other hand.

2. Fluctuation of Grain Prices in Moravia in the 16th-18th Centuries

Price series of four chief grain species were compiled from different archives sources (for detail see Durdáková 2000) for the royal towns of Brno and Olomouc and the subject town of Dačice in the 16th-18th centuries. The effort was to work with one type of source which, however was impossible to respect fully for compiling long price series. Different prices were converted to a uniform currency. If for the given year several prices were obtained from one species of grain, they were averaged. Calendar years, not economic ones, were worked with. In some cases it was possible to obtain price series of the given grain species before as well as after the harvest. The development of prices before the harvest was to a considerable extent dictated not only by the grain reserves from preceding years, but also by the expectancy of the size of the new harvest. After favourable harvest the prices usually dropped. The above facts thus to a certain extent affected the quality of the processed series which differ by both their completeness and their overall length (Fig. 1). It appears that the price swing (increase or reduction) in one grain species had, as a rule, also the same character in further grain species (Fig. 2). Also price fluctuation of corresponding grain species between individual places exhibited a satisfactory degree of similarity. Thus, in the years 1755-1802 the correlation coefficient between Dačice and Brno for the prices of barley was 0.95, of rye 0.94, of wheat 0.92 and of oats 0.90 or in the years 1592-1643 between Dačice and Olomouc 0.83 for wheat prices. The rate of correspondence probably drops with the increasing distance of the processed localities and with the shift into more distant past. In all series the rise in prices is evident; it can be well approximated by the linear rising trend. Periods of several years of dearth are quite good to see in the price fluctuation, such as in the years of the Thirty-Years War 1621-1626 and 1629-1631, in the period of a general lack after its end in the years 1648-1650, further in the years 1693-1702, 1719-1721, 1757-1759 (the Seven-year War), 1771-1773 or 1788-1791.

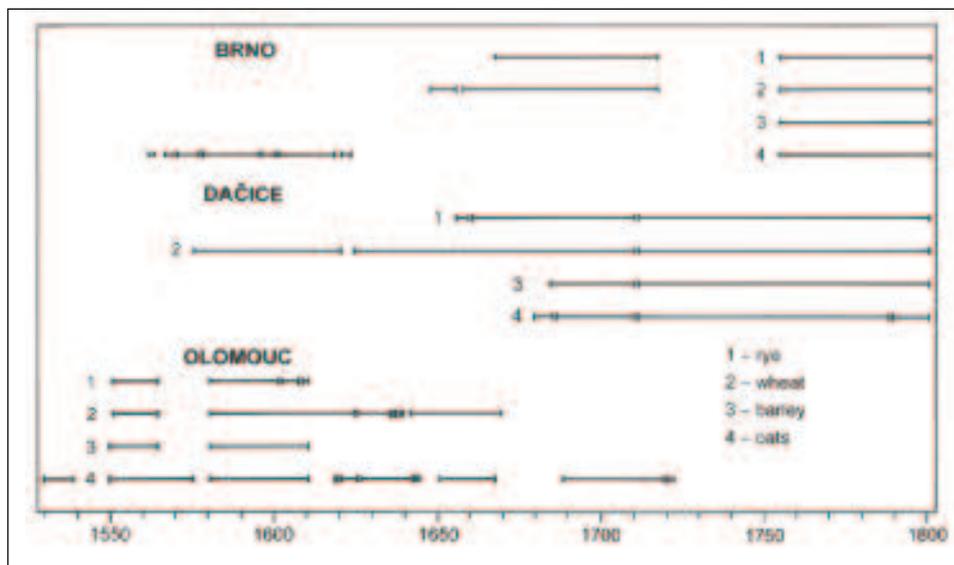


Fig. 1. Length of employed price series for Brno, Dačice and Olomouc.

3. Analysis of Years with Extremely High Grain Prices in Moravia

For each price series the standard deviation was calculated and added to the model values calculated according to the linear regression in the given year. The years in which the prices exceeded this limit for at least two grain species or two towns were taken as years with extremely high prices. Further it was followed whether the extreme dearth of grains could be clarified by the course of weather (for winter grains also the weather in the preceding autumn and subsequent winter was taken into consideration, when winter crops after sowing could come badly or freeze). From 61 years with extremely high grain prices the reason of dearth can be considered in 67% of cases the bad harvest of the given or of the preceding year, conditioned by adverse weather. In 57% of years also socio-economic factors participated markedly in high prices, particularly war years and plague epidemics. As quite dominant the effect of weather on the prices appeared in one-third of all years. In 26% of the years studied the information for judging the character of the weather in Moravia was not sufficient.

4. The Hungry Years 1770-1772

The years 1770-1772 represent a period of extraordinary dearth and the last great famine in the Czech Lands. After a rainy autumn of 1769 and a wet winter of

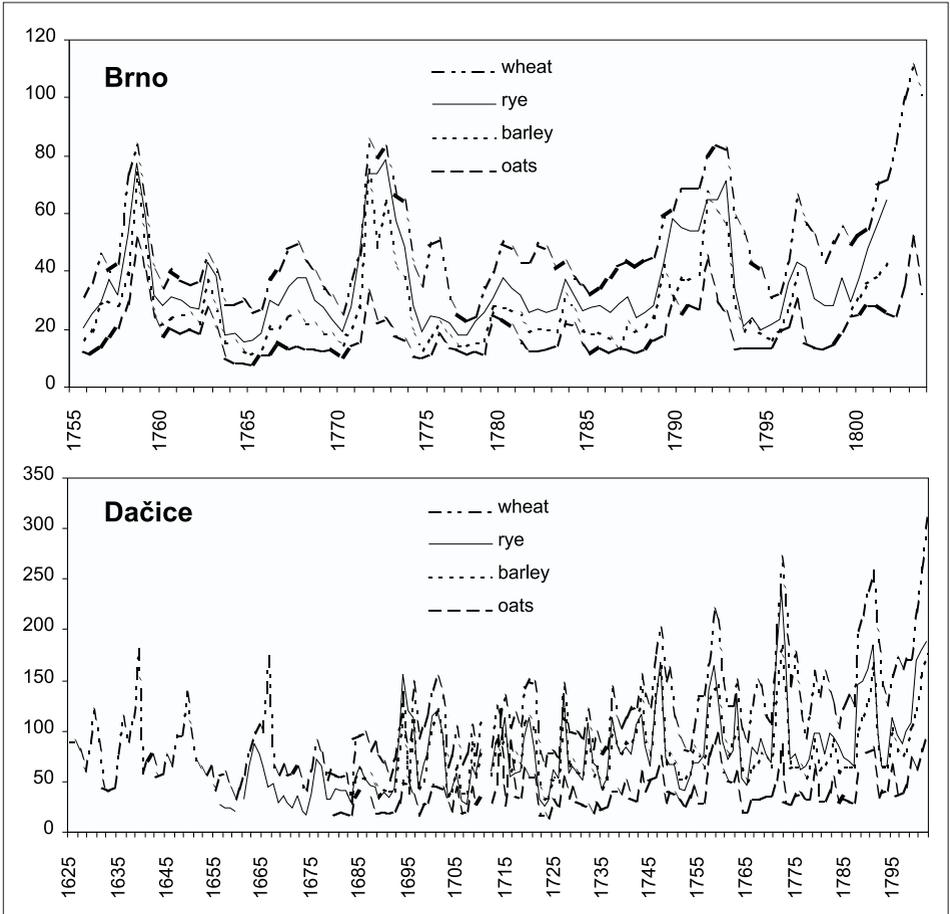


Fig. 2. Fluctuation of prices of selected grains in Brno and at Dačice in the 17th-18th centuries (for Brno price stated always before and after the harvest).

1769/70, there started a snowfall of several days on 19 March and frosts lasting up to mid-April, when winter crops did not germinate and sowing of summer species was delayed to May. After a drought lasting seven weeks there came again rains, so that the harvest and the yield of grains were very bad. A dearth came, also conditioned by speculation with grain, when its selling was delayed waiting for higher prices or grain was secretly exported across the frontier. In autumn the sowing took place in dry weather, but rains set in again in November and December. In the following year 1771, after warm winter there came cold spring with snow and frosts, when in places snow remained until May. Great wetness was the cause of frequent landslides, new spring burst out, cellars broke down as well as walls of buildings. Besides, rains at the time of harvest caused in that year the second disastrous bad harvest. That resulted

in great dearth, hunger, substitute food of poor quality (bark, nettles, beetroot, etc.) and subsequently also spread of diseases (typhoid fever) and a great mortality rate of the population (Fig. 3). In Bohemia about 250 thousand people died from June 1771 to June 1772, this demographic crisis being compensated as late as in 1783. The critical situation was also reflected in the rise in criminality and a conspicuous growth of the number of beggars. Emperor Joseph II made sure of the situation in Bohemia during his inspection trip from 1 October to 17 November 1771, on the basis of which Maria Theresa issued an order of supplying Bohemia with grains from Hungary. Rich landlords were forced to buy grains and sell them to the poor at a certain charge, and/or grains were distributed to the population for sowing. Only the good harvest of 1772 resulted in the drop of prices and only the particularly productive year 1773 made the dearth pass over. The direct result of the famine was among others the establishment of community funds of grains for the support at the time of bad harvest and natural disasters and the extension of growing potatoes. A conspicuous deterioration of the living conditions of the subjects resulted later in 1775 to numerous anti-serf uprisings in Bohemia (for detail to the topic of hungry years see Brázdil et al. 2000).

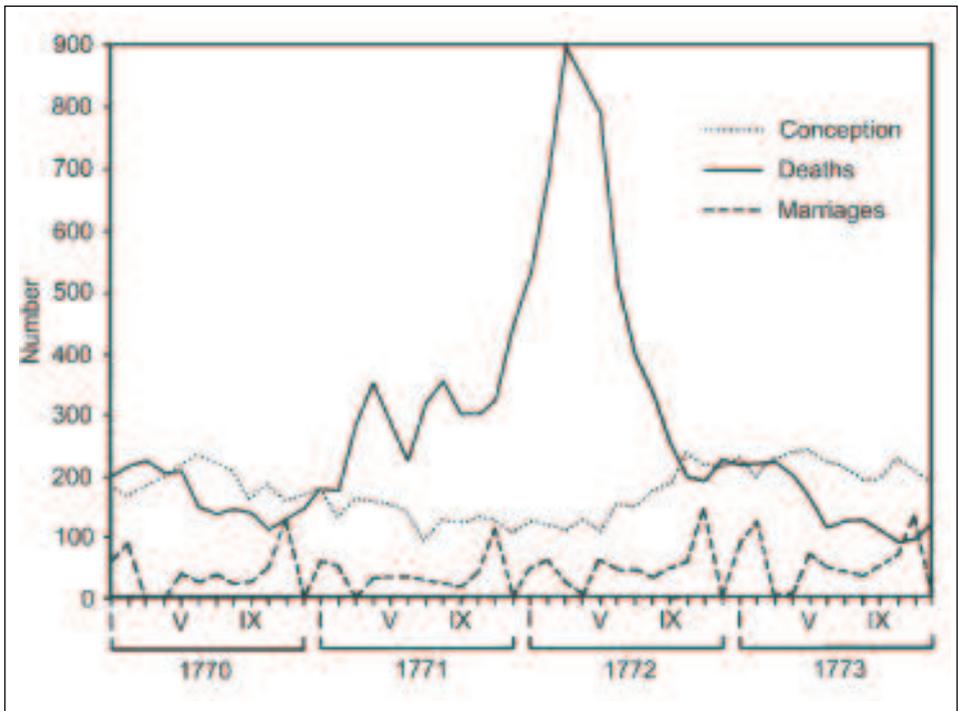


Fig. 3. Fluctuation of the number of conceptions, deceased and marriages in the set of probes from Bohemia in the years 1770-1773 (according to Fialová et al. 1996).

5. Conclusion

The present historical climatology can offer historical research credible climatological data with a great temporal resolution. Thus it permits to bridge the drawbacks of two extreme approaches, i.e. climatological determinism on the one hand and absolute negligence of meteorological factors on the other hand in the study of historical events and phenomena. Some studies of recent years (e.g. Bauernfeind, Woitek 1999; Behringer 1999; Landsteiner 1999) are indicative of the fact that papers taking into consideration this fact will increase in importance. The topic of the effect of meteorological factors on the prices of grains in the Czech Lands will require further extensive investigation which will have to be oriented on both improving the price series and on obtaining further meteorological data in the years when their density is not sufficient.

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