

TRENDS IN SEASONAL MORTALITY BY CAUSES OF DEATH IN THE CZECH REPUBLIC, NORWAY AND SPAIN

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This poster briefly introduces some methods of analysis of seasonality in demography. For analysis of seasonal mortality by causes of deaths were used time-series decomposition and method called X-12. The usage of both methods is illustrated by main results obtained for three European countries. Three states have been chosen with respect to different geographic location and demographic development, namely the Czech Republic, Norway and Spain.

Figure 1: Seasonal-adjusted time series, diseases of the respiratory system, Czech Republic, Norway and Spain, 1999–2007

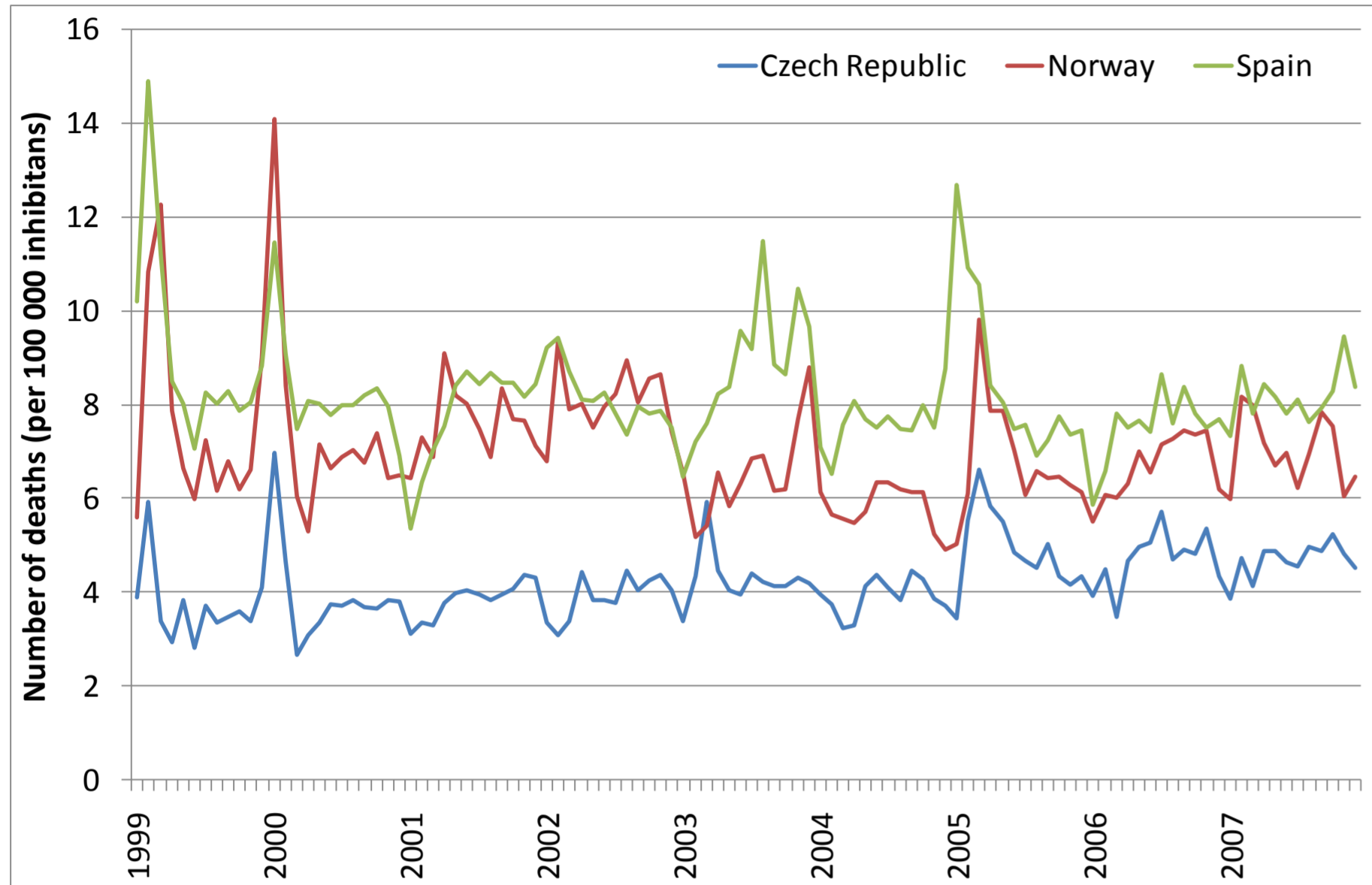
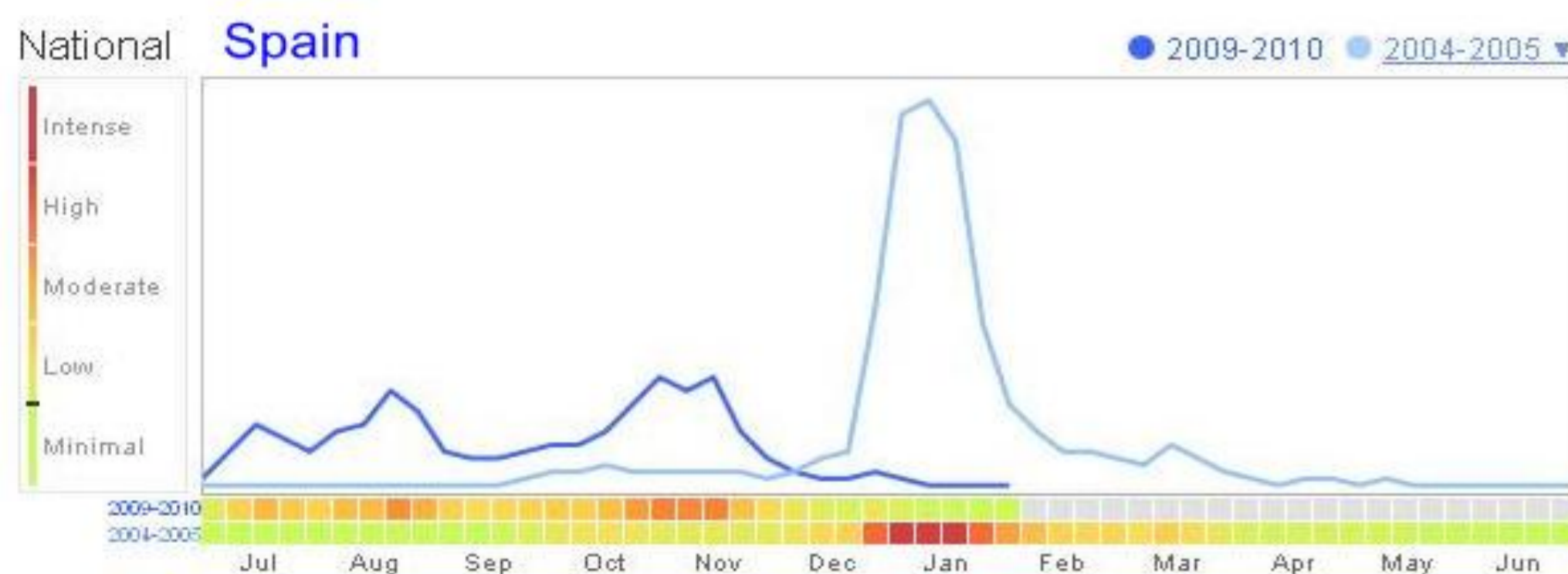


Figure 1 shows time-series of number of deaths by diseases of the respiratory system adjusted for seasonality (the seasonal component was removed) and there are obviously some fluctuations, similar for all three states (These fluctuations are for example in February 1999, January 2000, March 2005 for the Czech Republic and Norway and from January to March 2005 for Spain. See Figure 2)
Many fluctuations could be explained by objective facts - for example, in March 2005 was increase of deaths evocated by flu epidemic started in February 2005. In Spain was in January 2005 very high incidence of flu. Similar epidemics occur mostly during the end of winter (Figure 3)

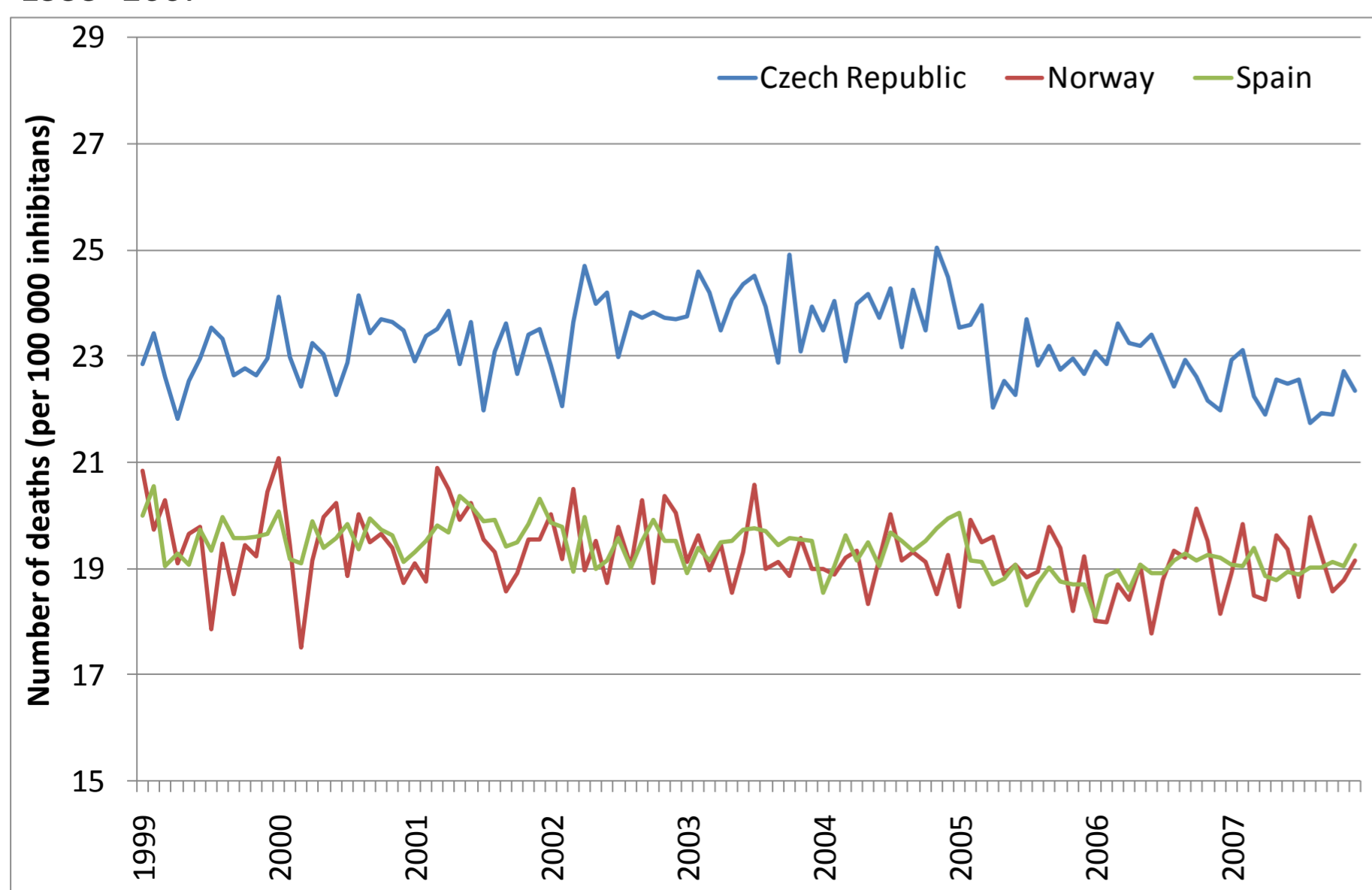
Figure 2: Flu trends for Spain, 2004–2005 and 2009–2010



Source: <http://www.google.org/flutrends/es/#ES>

Different pattern of mortality could be seen for the neoplasms – almost no irregular influences occur in the seasonal-adjusted time-series (Figure 4)
After removing the seasonal component only the trend and random irregularities could be studied. The number of deaths seems to be higher in the Czech Republic in comparison with Norway and Spain
The seasonal-adjusted time-series are not standardized for the different age-structures, it represents only the crude death rates

Figure 4: Seasonal-adjusted time series, neoplasms, Czech Republic, Norway and Spain, 1999–2007



The Czech Republic, Norway and Spain have been chosen with respect to different geographic location and demographic development

First step of analysis of seasonality is standardization for the number of day per month. Conversion coefficient matches 365/12, or 366/12 in case of leap year

Seasonality was revealed by traditional time-series decomposition, using multiplication model supposing components product ($\text{Number of Deaths} = Tr \times C_c \times S_c \times I$). By this method is possible identify 4 components of time-serie, that are:

- the Trend Component (Tr) - reflects the long term progression of the series
- the Cyclical Component (C_c) - describes repeated but non-periodic fluctuations
- the Seasonal Component (S_c) – reflects seasonality, periodic fluctuations
- the Irregular Component (I) - describes random, irregular influences, compared to the other components it represents the residuals of the time series

Seasonal indexes are suitable for comparison. These indexes show concentration of deaths to certain months

Figure 3: Seasonal indexes, diseases of the respiratory system, Czech Republic, Norway and Spain, 1999–2007

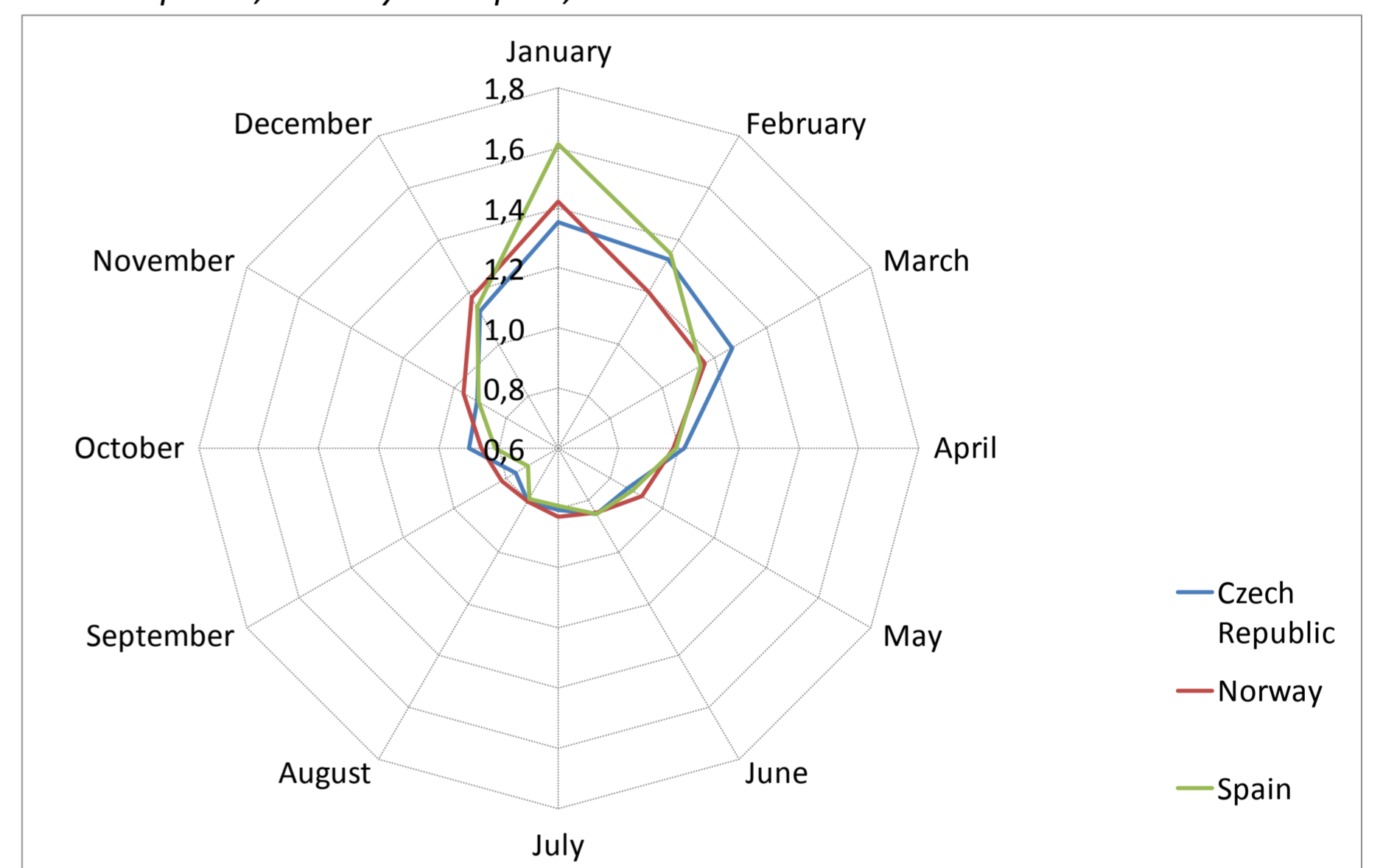
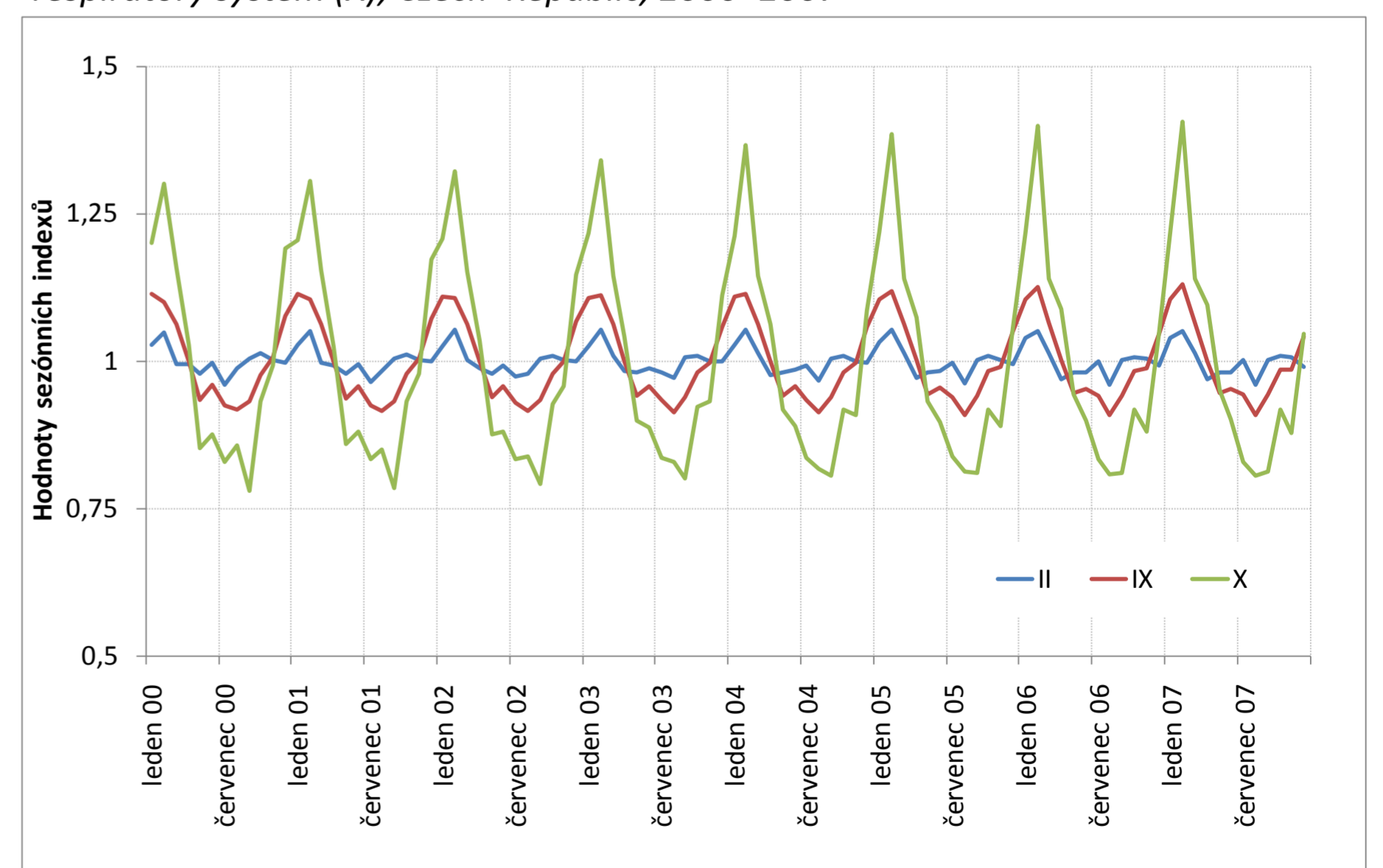


Figure 5: Seasonal indexes, neoplasms (II), cardiovascular diseases (IX), respiratory system (X), Czech Republic, 2000–2007



- The X-12 is modern method for analyzing the seasonality in time-series
- It was developed in US Census Bureau and is used also in the Czech Statistical Office
- X-12 method is based on the traditional time-series decomposition which is several times repeated during the calculation
- The most important feature of the X-12 method is the possibility of extraction so called „moving seasonality“ based on the assumption that seasonality could change in time
- The easiest way of calculation is the usage of proper statistical software – for example SAS
- Changes in seasonality could be simply compared for several causes of death (Figure 5)