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Studies of the Seasonal Pattern of Multiple Maternities

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The seasonality of population data has been of great interest in demographic studies. When seasonality is analyzed, *the population at risk* plays a central role. In a study of the monthly number of births and deaths, the population at risk is the product of the size of the population and the length of the month. Usually, the population can be assumed to be constant, and consequently, the population at risk is proportional to the length of the month. Hence, the number of cases per day has to be analyzed. If one studies the seasonal variation in twin or multiple maternities, the population at risk is the total number of monthly confinements, and the study should be based on the rates of the multiple maternities. Consequently, if one considers monthly twinning rates, the monthly number of birth data is eliminated and one obtains an unaffected seasonality measure of the twin maternities. The strength of the seasonality is measured by a chi-squared test or by the standard deviation. When seasonal models are applied, one must pay special attention to how well the model fits the data. If the goodness of fit is poor, it can erroneously result in a statement that the seasonality is slight, although the observed seasonal fluctuations are marked.

■ **Keywords:** population at risk, chi-squared test, standard deviation, sinusoidal model, adjusted coefficient of determination, Denmark, Switzerland, Naples, the Åland Islands

The seasonality of population data has been of great interest in demographic studies. Seasonality depends mainly on the climatic conditions, and hence, the findings may vary from study to study. Commonly, the studies are based on monthly data. A central role is played by *the population at risk*. In a study of seasonal variation in the number of births or deaths, the population at risk is the product of the size of the population and the length of the month. For short periods, the population can be assumed to be constant, and therefore, the population at risk is proportional to the lengths of the months. Hence, for studies of monthly birth and death data, one must analyze the number of cases per day.

If one studies the seasonal variation in multiple maternities or in the occurrence of an innate disease, the population at risk is the total number of confinements. Hence, the number of multiple maternities in a given month must be compared with the monthly number of all maternities. Therefore, one has to consider the monthly rate of the multiple maternities. If one considers the monthly rates, the monthly number of birth data is eliminated and one has the possibility of obtaining an unaffected seasonality measure of the multiple maternities.

When seasonal models are applied, special attention should be paid to how well the model fits the data. A poor fit can erroneously result in a statement that the seasonality is slight, although the observed seasonal fluctuations are marked.

To our knowledge, Neefe (1877) was the first to analyze detailed statistics concerning the seasonality of multiple births. He presented data from Denmark (1855–1869) and from the towns of Hamburg and Oldenburg. For Denmark, he considered the total dataset and, in addition, detailed statistics for urban and rural data, and legitimate and illegitimate maternities. Later, Weinberg (1901) published multiple maternity data for Denmark (1855–1894) and for Switzerland (1876–1890). While Weinberg's Denmark data were for a longer period than Neefe's data, they were not as detailed. In the 1920s, Cristalli (1924) analyzed seasonal data concerning multiple maternities in the city of Naples (Italy) for the period 1914–1921. All of these demographic data will be scrutinized in this study.

Our research team has shown a continuous interest in seasonality of twin and other demographic data, first

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presented by Eriksson (1973), and later analyzed by Eriksson and Fellman (1999, 2000) and Fellman and Eriksson (1999a).

Materials and Methods

Materials

The data considered in this study are presented in the appendix and comprise the following: Neefe's Danish data in Table A1, Weinberg's data from Denmark in Table A2 and from Switzerland in Table A3, Cristalli's data from Naples (Italy) in Table A4, and Eriksson's twinning data from the Åland Islands (Finland) in Table A5. In all datasets, with the exception of Eriksson (1973), the authors consider multiple maternities instead of twin maternities. Table A3 differs from the others because the data are means for a 15-year period. In our tables, we have included the rates of multiple maternities (MURs).

Chi-Squared Tests

Fellman and Eriksson (2009) tested the seasonality of births and deaths by chi-squared tests. Let N_i be the observed number of births in month number i and let k_i be the length of the month in days. Furthermore, let $N = \sum_{i=1}^{12} N_i$ be the total number of births and let $k = \sum_{i=1}^{12} k_i$ be the length of the year. The expected number of births in month number i is $\hat{N}_i = k_i \frac{N}{k}$. The chi-squared test is

$$\chi^2 = \sum_{i=1}^{12} \frac{(N_i - \hat{N}_i)^2}{\hat{N}_i} \tag{1}$$

with 11 degrees of freedom. Obviously, a similar test holds for deaths.

For twin and other multiple maternities, we have to modify the test. Let n_i be the number of twin maternities in month number i and let n be the total number of twin maternities. The mean twinning rate (TWR) is $r = \frac{n}{N}$ and the expected number of twin maternities in month number i is $\hat{n}_i = rN_i$. Hence, the chi-squared test is

$$\chi^2 = \sum_{i=1}^{12} \frac{(n_i - \hat{n}_i)^2}{\hat{n}_i} \tag{2}$$

with 11 degrees of freedom.

The critical values for chi-squared tests with 11 degrees of freedom are $\chi^2 = 19.68$ for $p < .05$, $\chi^2 = 24.73$ for $p < .01$, and $\chi^2 = 31.26$ for $p < .001$.

Sinusoidal Model Building

St. Leger (1976) assumed that the pattern of the seasonal variation is sine-shaped, and he estimated the sine curve by a maximum likelihood approach. Fellman and Eriksson (1999a) considered a regression approach, and this will be used in this study. Consider the sinusoidal model

$$E(Y_i) = C + A\sin(t_i + \alpha). \tag{3}$$

The equation can be written as

$$\begin{aligned} E(Y_i) &= C + A\sin(t_i + \alpha) \\ &= C + A\cos(t_i)\sin(\alpha) + A\sin(t_i)\cos(\alpha) \\ &= C + B_1\cos(t_i) + B_2\sin(t_i), \end{aligned} \tag{4}$$

where Y_i is the observed rate for month number i, and t_i is an angle created from the time (in months) and $B_1 = A\sin(\alpha)$ and $B_2 = A\cos(\alpha)$.

The parameter estimation is based on the simplified model:

$$Y = A + B_1\cos(t_i) + B_2\sin(t_i) \tag{5}$$

The intercept and the parameters B_1 *and* B_2 are estimated by ordinary least squares (OLS) for the monthly data, and the initial parameters can be calculated by the equations

$$\hat{A} = \sqrt{\hat{B}_1^2 + \hat{B}_2^2} \tag{6}$$

and

$$\tan(\hat{\alpha}) = \frac{\hat{B}_1}{\hat{B}_2}. \tag{7}$$

Fellman and Eriksson (2002) presented without argumentations or proofs that $\mathrm{Var}(\hat{A}) \approx \mathrm{Var}(\hat{B}_1) \approx \mathrm{Var}(\hat{B}_2)$.

This assumption underestimates $\mathrm{Var}(\hat{A})$ and overestimates the significance of the sinusoidal model. In the following, we try to improve the valuation of the $SE_{\hat{A}}$.

$$\begin{aligned} \mathrm{Var}(\hat{A}) &= E(\hat{A}^2) - \left(E(\hat{A})\right)^2 = E\left(\hat{B}_1^2 + \hat{B}_2^2\right) - \left(E(\hat{A})\right)^2 \\ &= \mathrm{Var}(\hat{B}_1) + \left(E(\hat{B}_1)\right)^2 + \mathrm{Var}(\hat{B}_2) \\ &\quad + \left(E(\hat{B}_2)\right)^2 - \left(E(\hat{A})\right)^2 \\ &\approx \mathrm{Var}(\hat{B}_1) + \hat{B}_1^2 + \mathrm{Var}(\hat{B}_2) + \hat{B}_2^2 - \left(E(\hat{A})\right)^2 \\ &\approx \mathrm{Var}(\hat{B}_1) + \mathrm{Var}(\hat{B}_2) + \hat{A}^2 - \left(E(\hat{A})\right)^2 \\ &\approx \mathrm{Var}(\hat{B}_1) + \mathrm{Var}(\hat{B}_2). \end{aligned}$$

Hence,

$$SE_{\hat{A}^2} \approx \sqrt{\mathrm{Var}(\hat{B}_1) + \mathrm{Var}(\hat{B}_2)}. \tag{8}$$

On account of the fact that the angle α and the amplitude A have to be estimated from formulae (6) and (7), statistically non-significant estimates $\hat{B}_1$ and $\hat{B}_2$ cannot be ignored. Therefore, Fellman and Eriksson (2002) recommended full pairs of trigonometric terms. Another argument for this is that $\hat{A}$ may differ significantly from zero, but the angle $\hat{\alpha}$ may be such that $\hat{B}_1$ or $\hat{B}_2$ is close to zero and consequently assumed non-significant. The geometric interpretation is that when one fits the model to the data one focuses on the initial model in (2), and consequently, the amplitude A and the angle α are of interest. From this, it follows that the parameter tests for significance should be applied to $\hat{A}$ and

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TABLE 1

Collection of Chi-Squared, Standard Deviations (*SDs*) Measuring the Strength of Seasonality and the Adjusted Coefficient of Determination $\bar{R}^2$ Measuring the Goodness of Fit for Sinusoidal Models for the MURs for Different Datasets

Population	TWR			Reference
	χ^2	*SD*	$\bar{R}^2$	
Denmark (1855–1869)				Neefe (1877)
Urban dataset	21.26	1.2779	0.343	
Rural dataset	25.16	0.7988	0.472	
Legitimate dataset	28.10	0.7767	0.672	
Illegitimate dataset	26.24	2.1131	−.080	
Total dataset	37.49	0.8430	0.535	
Switzerland (1876–1890)	2.74	0.625	0.824	Weinberg (1901)
Denmark (1855–1894)	77.45	1.0193	0.577	Weinberg (1901)
Naples (1914–1921)	20.14	1.0544	0.321	Cristalli (1924)
Åland (Finland) (1750–1949)	32.44	3.2604	0.630	Eriksson (1973)

Note: Goodness of fit for the Danish legitimate dataset is (0.672), the Åland dataset is (0.630), the dataset for Denmark is (1855–1894) (0.577), and the total Danish dataset is (1855–1869) (0.535). The estimates for the Switzerland data are based on 15 annual means and are not comparable to the other estimates. This is discussed in the text. For the rest of the data, the adjusted coefficients of determination $\bar{R}^2$ are below 0.500, which we consider the limit for an acceptable strength of seasonality.

$\hat{\alpha}$, but not to $\hat{B}_1$ or $\hat{B}_2$. These assumptions indicate that the intercept C is an estimate of the mean annual level of the rate of multiple maternities. The association between the intercept C and the total MUR can be seen later in Table 2. The amplitude A can be used as a measure of the seasonality (the model varies between $C + A$ and $C - A$). Finally, the adjusted coefficient of determination, $\bar{R}^2$, is a measure of the goodness of fit, and one has to pay special attention to how well the model fits the data. If the goodness of fit is poor, the non-significant results obtained can erroneously lead to the statement that the seasonality is slight, although the observed seasonal fluctuations are marked. Fellman and Eriksson (2002) noted this discrepancy and suggested the use of more general trigonometric regression models. In this study, we consider only sinusoidal models and use the adjusted coefficient of determination, $\bar{R}^2$, as a measure of the goodness of fit. In Table 1, the estimates are included for all datasets. The significance of the model can also be checked by comparing $\hat{A}$, which is always positive, and $SE_{\hat{A}}$. Although $\hat{A}$ is by no means normally distributed, it can be considered approximately normal and $t = \frac{\hat{A}-0}{SE_{\hat{A}}}$ should be greater than two in order that a significant deviation from zero can be considered.

Results

In Table A1, we present the Danish data according to Neefe (1877). We follow Neefe and present his data for rural and urban, legitimate and illegitimate, and total data. In the table, we have included all maternities, multiple maternities, and the monthly rates of multiple maternities (MURs). In Figure 1a, we present the MURs of the subsets for urban and rural data and in Figure 1b the subsets for legitimate and illegitimate data. The figures also include the total dataset and the seasonal models. The figures indicate that the seasonality is strongest for the illegitimate data, followed by the urban data. For the other datasets, the seasonality is rather similar. These findings are supported by the standard deviations given in Table 1. Also included in Table 1 are chi-squared tests for the strength of the seasonality. The obtained chi-squared test results indicate that seasonality is significant for all datasets. In Figure 1a and b, we have included the sinusoidal models for the datasets. The inclusion of these models describes the general seasonal pattern of these datasets. The obtained models are discussed below.

Weinberg's Danish data for the total and multiple maternities are presented in Table A2 and his data for Switzerland in Table A3 (Weinberg, 1901). In Table A4, we present the data for Naples according to Cristalli (1924). In fact, we identified a misprint in Cristalli's tables. This misprint is corrected in our analyses. In Figure 2, we include the data from Switzerland (1876–1890) and Naples (1914–1921). According to the chi-squared test results in Table 1, the Naples data show slight significant seasonality. The Switzerland data are means of 15 annual data, and therefore the chi-squared value should be multiplied by 15 in order to yield a value comparable with the Naples test result ($15 \times 2.74 = 41.1$). Later, when we consider sinusoidal models, we return to the means of 15 annual data for Switzerland. The seasonality for Denmark for both the Neefe and Weinberg data is marked. Eriksson's data of twin maternities from the Åland Islands (Finland) are presented in Table A5. According to Table 1, the seasonality for Åland is remarkably strong. The analyses of the sinusoidal models are presented below.

Sinusoidal Model Building

We built sinusoidal models for all datasets. Below, we analyze the results using the goodness of fit measured with the adjusted coefficient of determination. The Switzerland data result in a model that has the best goodness of fit. The model is

$$Y = 12.391 - 0.247 \cos(t_i) + 0.779 \sin(t_i).$$

Hence, $SE(\hat{B}_1) = 0.112$, $SE(\hat{B}_2) = 0.112$, and $\bar{R}^2 = 0.824$. The first parameter is almost significant and the second is significant. The obtained estimates of the initial parameters are $\hat{A} = 0.818$ and $\hat{\alpha} = -17.6°$. When we use $\bar{R}^2$ as a measure of significance, the Switzerland data give the best goodness of fit and the model is acceptable. However, the obtained value $\hat{A} = 0.818$ indicates that the seasonality is weak.

The obtained results for Åland are

$$Y = 23.207545 - 2.457893 \cos(t_i) - 2.737970 \sin(t_i).$$

where

$$\mathrm{Var}(\hat{B}_1) = 0.811, \ \mathrm{Var}(\hat{B}_2) = 0.809 \text{ and } \bar{R}^2 = 0.630$$

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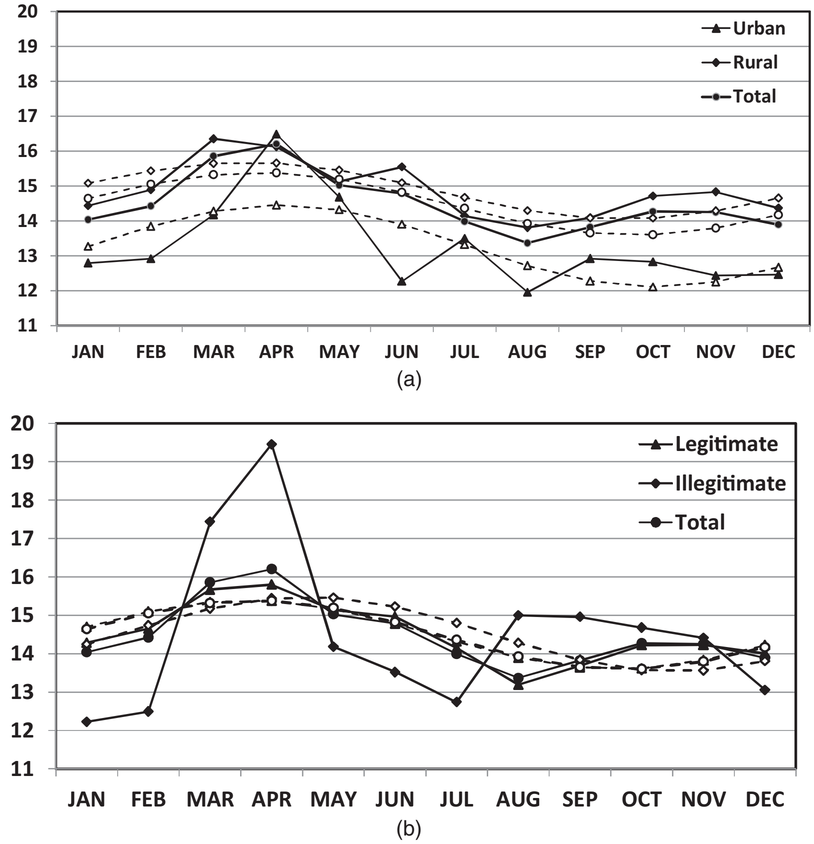

FIGURE 1

Comparison between the MURs for the total dataset, the urban and rural subdata (a) and the legitimate and illegitimate subdata (b) in Denmark in 1855–1869 (Neefe, 1877). The corresponding sinusoidal models are included.

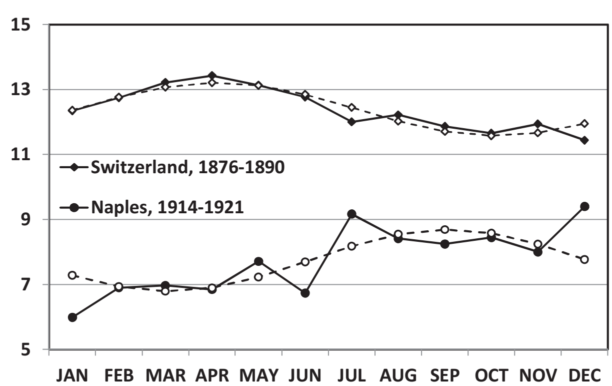

FIGURE 2

Comparison between the MURs for Switzerland, 1876–1890 (Weinberg, 1901) and Naples, 1914–1921 (Cristalli, 1924). The corresponding sinusoidal models are included.

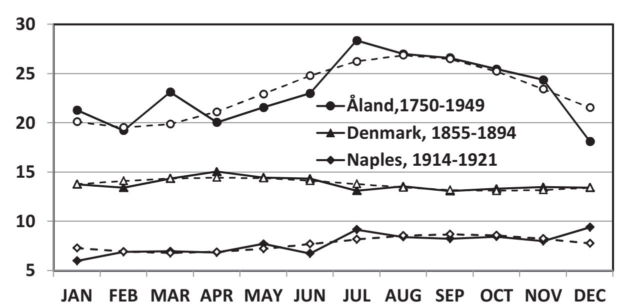

FIGURE 3

Comparison between twinning rates for Åland, 1750–1949 (Eriksson, 1973), and multiple maternity for Denmark, 1855–1894 (Weinberg, 1901) and Naples (Italy), 1914–1920 (Cristalli, 1924). The sinusoidal models are illustrated with dashed lines. For details, see the text.

Both parameter estimates are significant. The obtained estimates of the initial parameters are $\hat{A} = 3.679$ and $\hat{\alpha} = 221.9^{\circ}$. According to the $\hat{A}$ value, the seasonality is strong; in fact, the strongest among all datasets. The seasonality of the Åland data is given in Figure 3.

For Denmark (1855–1894), the obtained results are

$$Y = 13.780202 - 0.182516\ \cos(t_i) + 0.653557\ \sin(t_i),$$

where

$\mathrm{Var}(\hat{B}_1) = 0.164639$, $\mathrm{Var}(\hat{B}_2) = 0.164295$, $\hat{A} = 0.678564$, $\hat{\alpha} = -15.6^{\circ}$ and $\bar{R}^2 = 0.577$. Only the second parameter estimate is significant, but as pointed out above, both

TABLE 2
Test Results of the Sinusoidal Models

Parameter estimate	Weinberg Switzerland, 1876–1890	Eriksson Åland, 1750–1949	Weinberg Denmark, 1855–1894	Neefe Denmark, 1855–1869, legitimate	Neefe Denmark, 1855–1869, illegitimate	Neefe Denmark, 1855–1869, urban	Neefe Denmark, 1855–1869, rural	Neefe Denmark, 1855–1869, total	Cristalli Naples, 1914–1921
MUR	12.401	22.960	13.800	14.524	14.536	13.300	14.901	14.526	7.609
C	12.391	23.208	13.780	14.494	14.509	13.279	14.866	14.489	7.736
SE_C	0.079	0.573	0.116	0.128	0.634	0.299	0.168	0.165	0.251
B1	−0.247	−2.458	−0.183	−0.038	−0.502	−0.321	−0.001	−0.086	−0.222
SE_{B1}	0.112	0.811	0.165	0.182	0.898	0.423	0.237	0.235	0.355
B2	0.779	−2.738	0.654	0.898	0.836	1.132	0.814	0.894	−0.924
SE_{B2}	0.112	0.809	0.164	0.181	0.896	0.422	0.237	0.234	0.354
A	0.818	3.680	0.679	0.899	0.975	1.177	0.814	0.898	0.95
SE_A	0.158	1.146	0.233	0.257	1.269	0.598	0.335	0.332	0.50
α,°	−17.6°	221.9°	−15.6°	−2.4°	−31.0°	−15.8°	−0.1°	−5.5°	193.5°
$\bar{R}^2$	0.824	0.630	0.577	0.672	−0.08[a]	0.343	0.472	0.535	0.321
$(A-0)/SE_A$	5.17	3.21	2.92	3.50	0.77	1.969	2.43	2.71	1.90

Note: The population data resulting in $\bar{R}^2 > 0.500$ are discussed in the text. The rate of MUR is the overall rate of multiple maternities, and the association between MUR and the intercept C can be analyzed in the table (the α is about 30° per month).
[a]The negative value is a consequence of a very bad fit with too many regressors.

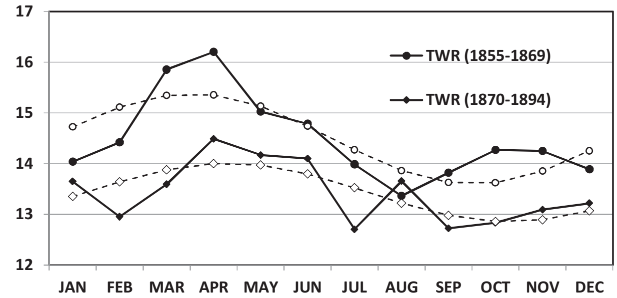

FIGURE 4

Comparison in seasonality in Denmark in 1855–1869 and 1870–1894. The corresponding sinusoidal models are included.

terms should be included in the model. Furthermore, the Neefe data for urban, legitimate, and total data in Denmark (1855–1869) yields acceptable goodness of fit. The obtained model for Denmark is

$$Y = 14.489480 - 0.086058\cos(t) + 0.893885\ \sin(t),$$

where

$\mathrm{Var}(\hat{B}_1) = 0.234818$, $\mathrm{Var}(\hat{B}_2) = 0.234327$, $\hat{A} = 0.898$, $\hat{\alpha} = -5.5°$, and the adjusted coefficient of determination, $\bar{R}^2 = 0.535$.

For the rest of the datasets, the model-building results yield low adjusted coefficients of determination ($\bar{R}^2 < 0.500$), and we assume that the goodness of fit is so slight that the corresponding models should not be discussed. The estimates of the parameters and their standard errors (*SE*s) for all datasets are given in Table 2.

Considering the periods 1855–1869 and 1870–1894, we can compare the temporal changes in the MURs for Denmark. In Figure 4, one can observe similar seasonal models for the MURs, but also a decrease on average of about 1.08 per 1,000. In Figure 3, we present the Åland data, the Weinberg dataset for Denmark (1855–1894), and the Naples data relative to the corresponding sinusoidal models. The variable seasonality strength is apparent.

Discussion

Fellman and Eriksson (1999b) used Walter and Elwood's (1975) sinusoidal model to evaluate the seasonal variation in the twinning rate in Denmark, Switzerland, England, and Wales. Fellman and Eriksson (1999b) studied the secular changes in the seasonal patterns of births in Sweden, Norway, and Iceland. They introduced a modified Walter–Elwood model and investigated the temporal variations in the Walter–Elwood theta and quarters with high and low numbers of births per day. Fellman and Eriksson (2002) studied the temporal changes in births and death using trigonometric regression models. The trigonometric regression models are generalizations of the sinusoidal model. They are used when the general pattern of the graphs is too

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complicated for a sinusoidal model. That study was based on data from Italy, France, Germany, Denmark, Norway, Scotland, Sweden, and Iceland. Special attention was paid to data from Iceland. Eriksson et al. (2008) considered the seasonality in births and deaths on the Åland Islands. Finally, Fellman and Eriksson (2009) considered births for the Åland Islands and its sub-regions and introduced a new measure of the strength of the seasonality.

Conclusions

When seasonality is studied, one must decide whether one seeks the strength of the seasonality or whether one seeks a seasonality model. When seasonal models are applied, one pays special attention to how well the model fits the data. In this study, we used the test of the amplitude $\hat{A}$ and the adjusted coefficient of determination $\bar{R}^2$ as measures of goodness of fit (cf. Table 2). If goodness of fit is poor, the non-significant results obtained can erroneously lead to a statement that the seasonality is slight, although the observed seasonal fluctuations are marked (cf. Switzerland and Naples). Under such circumstances, the use of more general trigonometric regression models could be considered.

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Appendix

TABLE A1

Multiple Maternity Statistics for Denmark, 1855–1869, including the Rate of Multiple Maternities (MUR)

	Urban maternities			Rural maternities			Legitimate maternities			Illegitimate maternities			Total maternities		
Month	Total	Multiple	MUR	Total	Multiple	MUR	Total	Multiple	MUR	Total	Multiple	MUR	Total	Multiple	MUR
Jan	16,803	215	12.80	52,441	757	14.44	61,063	872	14.28	8,181	100	12.22	69,244	972	14.04
Feb	15,567	201	12.91	50,302	749	14.89	58,904	863	14.65	6,966	87	12.49	65,869	950	14.42
Mar	17,001	241	14.18	57,737	944	16.35	66,880	1,048	15.67	7,858	137	17.43	74,738	1,185	15.86
Apr	15,832	261	16.49	55,386	893	16.12	63,301	1,000	15.80	7,917	154	19.45	71,218	1,154	16.20
May	15,808	232	14.68	53,810	814	15.13	61,719	934	15.13	7,899	112	14.18	69,618	1,046	15.02
Jun	15,000	184	12.27	49,857	775	15.54	57,090	854	14.96	7,767	105	13.52	64,857	959	14.79
Jul	15,042	203	13.50	48,299	683	14.14	56,196	795	14.15	7,145	91	12.74	63,341	886	13.99
Aug	15,394	184	11.95	49,031	677	13.81	58,290	769	13.19	6,135	92	15.00	64,425	861	13.36
Sep	15,559	201	12.92	52,302	737	14.09	60,804	832	13.68	7,087	106	14.96	67,861	938	13.82
Oct	15,438	198	12.83	50,297	740	14.71	58,718	835	14.22	7,017	103	14.68	65,735	938	14.27
Nov	14,960	186	12.43	46,728	693	14.83	54,820	780	14.23	6,869	99	14.41	61,688	879	14.25
Dec	15,492	193	12.46	46,569	669	14.37	54,707	766	14.00	7,354	96	13.05	62,061	862	13.89
Total	187,896	2,499	13.30	612,759	9,131	14.90	712,492	10,348	14.52	88,195	1282	14.5	800,655	11,630	14.53

Note: The original data are given in Neefe (1877).

TABLE A2

Twinning Statistics for Denmark (1855–1894) according to Weinberg (1901)

	Maternities		
Month	Total	Multiple	MUR
Jan	210,136	2,895	13.78
Feb	199,292	2,678	13.44
Mar	224,440	3,220	14.35
Apr	213,886	3,221	15.06
May	209,754	3,032	14.46
Jun	195,432	2,800	14.33
Jul	194,295	2,550	13.12
Aug	188,916	2,561	13.56
Sep	204,574	2,678	13.09
Oct	197,035	2,623	13.31
Nov	185,938	2,506	13.48
Dec	204,509	2,745	13.42
	2,428,207	33,509	13.80

TABLE A3

Seasonal Data for Total Maternities, Multiple Maternities, and MURs for Switzerland (1876–1890) According to Weinberg (1901)

	Maternities		
Month	Total	Multiple	MUR
Jan	7,455	92	12.34
Feb	6,906	88	12.74
Mar	7,645	101	13.21
Apr	7,298	98	13.43
May	7,388	97	13.13
Jun	7,208	92	12.76
Jul	7,417	89	12.00
Aug	7,367	90	12.22
Sep	7,166	85	11.86
Oct	7,123	83	11.65
Nov	6,871	82	11.93
Dec	7,082	81	11.44
	86,926	1,078	12.40

TABLE A4

Seasonal Data for Total Maternities, Multiple Maternities, and MURs for the City of Naples (Italy) (1914–1921) According to Cristalli (1924)

	Naples, 1914–1921, maternities		
Month	Total	Multiple	MUR
Jan	18,048	108	5.98
Feb	13,042	90	6.90
Mar	12,778	89	6.97
Apr	12,276	84	6.84
May	11,806	91	7.71
Jun	10,842	73	6.73
Jul	10,914	100	9.16
Aug	10,942	92	8.41
Sep	11,406	94	8.24
Oct	12,197	103	8.44
Nov	12,257	98	8.00
Dec	9,367	88	9.39
Total	145,875	1,110	7.61

TABLE A5

Seasonal Data for Total Maternities, Twin Maternities and TWRs for the Åland Islands (1650–1949) According to Eriksson (1973)

	Åland, 1650–1949, maternities		
Month	Total	Twin	TWR
Jan	7,419	158	21.30
Feb	6,860	132	19.24
Mar	7,479	173	23.13
Apr	7,328	147	20.06
May	6,859	148	21.58
Jun	5,693	131	23.01
Jul	5,536	157	28.36
Aug	6,109	165	27.01
Sep	5,861	156	26.62
Oct	6,165	157	25.47
Nov	6,482	158	24.38
Dec	6,953	126	18.12
Total	78,744	1,808	22.96