Seasonality and Unemployment in Ireland

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It is widely known that many statistical series exhibit a distinct seasonal pattern. That is, they tend to rise or fall according to the time of the year even when the underlying levels of the series are constant. Such seasonal movements are often a reflection of variations in the climate—ice-cream sales peak in the summer and coal-sales peak in the winter—or of traditional holiday periods. Obviously we would wish to remove the seasonal variation in order to examine the underlying trend of any given economic series. If we do not correct data for seasonality it becomes quite difficult to distinguish between movements which reflect the normal seasonal pattern and other underlying movements.

There are a wide variety of methods for correcting data for seasonality. The crudest, although most widely used in popular discussion, is to compare a period in one year with the same period in a previous year on the grounds that both observations exhibit the same seasonal component so that any differences reflect underlying trends. Thus, for example, the level of industrial production in the first quarter of 1975 might be compared with the first quarter level of 1974 and any change attributed to the underlying trend in output. Unfortunately such a procedure does not allow for changes over time in the seasonal component nor does it permit a successive quarter by quarter (or month by month) analysis of the underlying trend in an economic series.

Thus, far more sophisticated methods are now used to correct raw statistical series for seasonality. Basically these methods attempt to filter the original data into two separate components; one represents the underlying or trend data and the other the seasonal component. For any given observation the sum of the seasonal and trend component equals the observed data. Further, over the whole period during which seasonal variations are assumed to occur (normally a calendar year) the sum of the seasonal components equals zero. Thus the average trend value over the year will equal the average uncorrected value.

A large number of statistical series in Ireland require seasonal correction. This is, in the main, a reflection of the relative importance of agriculture in the economic life of the country—since agricultural output has a very distinct seasonal pattern. One economic series in which

*Thanks are due to Joe Durkan of the Economic and Social Research Institute who provided the X-11 additive seasonal corrections. Any errors in this note are not, of course, his responsibility.

seasonal patterns are pronounced is the monthly series on unemployment. Partly because of the seasonal nature of the agriculture based industries such as food processing there is a tendency for unemployment to fall over the spring and summer and rise in the winter. Broadly speaking, the effect of seasonal factors is to reduce measured unemployment from the period January to July and increase unemployment thereafter. [In fact September is normally the month of peak seasonal employment but the unemployment level is not very different from that of July.]

In recent years the monthly unemployment data for Ireland has been seasonally corrected by using the X-11 programme developed by the U.S. Bureau of the Census. Such a corection programme has been used by the Central Bank and the ESRI and other official bodies. However, the particular X-11 programme used generates proportional seasonal factors which, as we shall see, can lead to misleading conclusions on the underlying trend of unemployment when unemployment has risen very rapidly. In Ireland unemployment was about 55% higher in July 1975 than in July 1974 and this has created considerable problems for those economists and statisticians attempting to seasonally correct the data.

In order to give some idea of the problems created by the use of proportional seasonal factors for unemployment we have set out in Table 1 the changes in measured unemployment for the periods January to July and July to January for the years 1966 to 1975. The movements in seasonally corrected unemployment and seasonal unemployment were produced by the X-11 programme currently used.

It will be noted that for the years 1966 to 1974 the reduction in unemployment due to seasonality from January to July was estimated at around 15,000. The rise from July to January due to seasonal factors was of the same magnitude. However, if one looks at the implied fall in unemployment due to seasonal factors from January to July in 1975 the estimated total is well in excess of 15 thousand. The X-11 programme currently used indicates that some 21.14 thousand individuals were removed from measured unemployment due to the operation of seasonal factors from January to July 1975. The rise in seasonally corrected unemployment in the period was 20.89 thousand and the sum of these two movements gives the actual change in unemployment of -0.25 thousand.

It seems highly unlikely that some 6 thousand *more* individuals found seasonal employment in the first half of 1975 than on average found jobs in the same period from 1966 to 1974. The discrepancy arises because of the nature of the seasonal correction programme which produces proportional seasonal factors. Thus the seasonal factor for July of 0.913 means that the seasonally adjusted unemployment level for July will be Ujuly/0.913. Similarly the January seasonal factor of 1.128 means that the seasonally corrected unemployment level for that month will be Ujan/1.128. (Ujuly and Ujan refer to the observed level of unemployment

in July and January respectively.) Thus the change in unemployment *due to seasonal factors alone* between January and July will be

$$(U_{July} - U_{Jan}) - (U_{July}/0.913 - U_{Jan}/1.128)$$

which is equal to

$$-0.0953\ U_{July} - 0.113475\ U_{Jan}$$

Thus if U_{July} and U_{Jan} are 50% greater than the levels prevailing in the previous year then the seasonal fall in unemployment will also be 50% higher. However, this appears quite implausible since the number of jobs created in the first half of the year and lost in the second due to seasonal factors is unlikely to rise merely because the unemployment level rises.

The use of proportional seasonal factors thus gives rise to an unlikely pattern of seasonal job creation and job losses for 1975. For example, the X-11 proportional programme would indicate that by January 1976 about 124.0 thousand would be unemployed even if there was no disimprovement in the seasonally corrected level of unemployment from July. Since unemployment in July was 101.1 thousand this suggests that some 23.9 thousand jobs would be lost in the six months from July to January due to seasonal factors—an increase of 59% over the average for 1966 to 1974.

A more realistic assumption would be that seasonal unemployment is independent of the level of actual unemployment. Thus seasonal unemployment does not fluctuate when total unemployment fluctuates. This implies that the seasonal facors are *additive* rather than proportional. In fact a variant of the X-11 programme is available which produces additive seasonal factors. In Table 2 we have set out the monthly change in unemployment due to seasonality derived from the X-11 additive programme. We also show in parenthesis the changes implied by the X-11 proportional programme for November 1974 to July 1975. It will be noted that, unlike the proportional programme, the X-11 additive programme does not exhibit a rise in seasonal employment in response to a rise in total unemployment. Thus the implied fall in unemployment between January and July was only 13.2 thousand compared to 13.4 thousand for 1974 and 21.1 thousand implied by the proportional programme for January-July 1975. We also note that there has been a marked downward trend in the seasonal component of unemployment since 1966. This conforms with *a priori* notions that the degree of seasonality in many industries—beef slaughtering for example—has been declining.

In Table 3 we compare the seasonally adjusted unemployment levels produced by the X-11 additive and proportional programmes since 1968. It is clear that the main differences emerge towards the end of 1974 when the actual level of unemployment rose sharply. Thus prior to then no

great error was introduced by using the proportional factors even if additive factors were more appropriate. The additive programme shows a sharper rise between October and January than the proportional programme. However, the movement from March to June is smoother than the proportional programme which shows a very large rise between April and May. Also the additive programme suggests a levelling off in seasonally corrected unemployment in July while the proportional programme shows a further substantial rise. Further differences between the two seasonally corrected data are shown for August and September with the additive corrections indicating a slow upward movement while the proportional series shows a levelling off in August and a further sharp rise in September.

Use of the proportional seasonal factors may give rise to a serious misinterpretation of actual unemployment data over the next four months. In Table 4 we have set out the monthly levels of actual unemployment from October 1975 to January 1976 which are consistent with the September 1975 level of seasonally corrected unemployment based on the two X-11 programmes. We can see that the proportional programme suggests that unemployment will rise to 127.3 thousand by January 1976 even if no disimprovement over the September seasonally corrected level occurs. The additive programme would only imply a rise to 116.3 thousand unemployed by January.

If the additive factors are appropriate but if proportional factors continue to be used for analysis then a constant seasonally corrected level of unemployment over the next four months could be interpreted as a falling seasonally corrected level. For example, suppose the observed unemployment levels are those set out for the additive programme in Table 4 (thus indicating a constant September seasonally corrected level of unemployment). By using **proportional** seasonal factors we obtain the following pattern of seasonally corrected unemployment (in thousands).

Oct.	Nov.	Dec.	Jan.
109.0	109.5	105.6	103.1

This suggests that the underlying level of unemployment is falling quite sharply whereas in reality it is constant. In fact if the additive adjustment for seasonality is applicable then seasonally corrected unemployment could rise in January by 11.0 thousand above the September level before any seasonally corrected rise would be observed by the proportional seasonal factors.

Conclusions

This note suggests that the current widespread use of proportional seasonal factors for unemployment may be quite inappropriate and lead

to implausible estimates of job losses (and gains) due to seasonal factors alone. It suggests that there are strong *a priori* grounds for arguing that seasonal unemployment is independent of rather than proportional to the level of unemployment.[1] By deriving additive seasonal factors which do not depend on the level of unemployment we have suggested that unemployment will rise to 116.3 thousand by the end of January 1976 even if the seasonally corrected level of end-September 1975 is maintained. This contrasts with the proportional corrections which suggest that unemployment will rise to 127.3 thousand by January even if there is no worsening of the position as of September. It is further argued that the use of proportional seasonal factors when additive factors are more appropriate may lead to a misinterpretation of the month-by-month performance of the underlying unemployment level.

Unfortunately, there does not appear to be, at present, any statistical method of choosing between the two forms of seasonal correction. However, if a test of plausibility is applied then it is clear that the use of proportional seasonal factors produces an unacceptable pattern of seasonal job losses and gains for 1975 especially when compared to other years.

TABLE 4: FORECAST ACTUAL UNEMPLOYMENT AT CONSTANT SEPTEMBER 1975 SEASONALLY CORRECTED LEVEL (000's)

	1975 Oct.	Nov.	Dec.	1976 Jan.*
X-11 (proportional)	108.1	111.2	120.7	127.3
X-11 (additive)	104.4	107.9	113.2	116.3

*assumes Jan. 1975 seasonal factor applies in Jan. 1976.

1. Strictly speaking, it could be argued that economic theory suggests that the level of seasonal employment and unemployment is inversely related to the level of unemployment. Thus when the overall level of activity in the economy is low the level of activity in seasonal industries may tend to be low and their recruitment of seasonal labour may be low.

TABLE 1: CHANGES IN NUMBERS UNEMPLOYED, JAN.-JULY AND JULY-JAN. 1966-1975

	JAN.-JULY			JULY-JAN.		
	Actual change in Unemployment	Seasonally Adjusted Change	Change due to Seasonal Factors	Actual change in Unemployment	Seasonally Adjusted Change	Change due to Seasonal Factors
1966	−21.2	− 6.5	−14.8	+26.2	+10.8	+15.4
1967	−16.9	− 0.4	−16.5	+19.4	+ 2.9	+16.5
1968	−15.1	+ 1.6	−16.7	+14.4	− 1.6	+16.0
1969	−15.9	− 0.6	−15.3	+15.7	+ 1.0	+14.7
1970	− 4.1	+11.3	−15.4	+ 8.4	− 6.9	+15.3
1971	−15.9	− 1.9	−14.0	+24.6	+10.1	+14.5
1972	−11.7	+ 3.6	−15.3	+ 8.5	− 6.0	+14.5
1973	−13.7	+ 0.1	−13.9	+10.3	− 2.9	+13.2
1974	− 6.6	+ 7.0	−13.6	+35.6	+18.3	+17.3
1975	0.1	+21.3	−21.2			
Mean*			−15.1			+15.0
Standard deviation			1.1			1.0

*excludes Jan.–July 1975 and July-Jan. 1974.

Source: Central Bank of Ireland, Statistical Folder.

TABLE 2: MONTHLY CHANGES IN UNEMPLOYMENT DUE TO SEASONAL FACTORS (X-11 ADDITIVE), 1966-1975

thousands

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1966		−1.7	−1.8	−3.6	−4.4	−4.5	−2.1	0.7	−1.8	4.6	3.7	5.8
1967	4.9	−1.6	−1.8	−3.5	−4.5	−4.4	−2.0	0.6	−1.7	4.5	3.6	5.8
1968	4.5	−1.3	−1.8	−3.5	−4.4	−4.1	−1.8	0.3	−1.4	4.1	3.4	5.9
1969	4.1	−0.9	−1.9	−3.2	−4.5	−3.8	−1.6	0.1	−1.1	3.6	3.4	5.8
1970	3.6	−0.5	−2.2	−3.0	−4.5	−3.4	−1.4	0.1	−1.0	3.1	3.3	5.7
1971	3.4	−0.3	−2.5	−2.7	−4.3	−3.1	−1.2	0.2	−1.0	2.6	3.4	5.6
1972	3.2	−0.1	−2.9	−2.6	−4.0	−2.9	−1.1	0.4	−1.0	2.2	3.5	5.4
1973	3.2	−0.1	−3.2	−2.6	−3.6	−2.8	−1.1	0.6	−1.1	1.8	3.6	5.4
1974	3.1	−0.1	−3.4	−2.7	−3.3	−2.7	−1.2	0.8	−1.2	1.7	3.6 (2.9)	5.3 (6.3)
1975	3.1 (6.1)	−0.0 (−1.7)	−3.4 (−4.0)	−2.7 (−2.3)	−3.1 (−8.1)	−2.8 (−2.6)	−1.2 (−2.5)	0.8	−1.2	1.6*	3.5*	5.3*

*Forecast values.

Figures in parentheses refer to changes derived from X-11 proportional seasonal factors.

Note: The changes for a given month refer to the differences between the monthly figures for that month and the preceding month.

TABLE 3: COMPARISON OF SEASONALLY CORRECTED UNEMPLOYMENT LEVELS, 1968-1975

thousands

	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A
968	56.7	59.7	57.4	57.5	58.3	58.5	58.8	59.0	58.5	59.6	59.0	58.6	58.4	58.8	58.4	58.7	58.6	59.1	57.9	58.2	58.2	58.2	56.3	55.2
969	56.8	56.8	60.6	60.8	56.0	55.8	55.8	55.7	55.9	55.1	56.5	56.5	56.2	56.9	56.4	57.1	57.3	57.9	58.1	58.5	58.1	58.1	59.2	58.5
970	57.2	57.2	60.4	60.5	64.9	65.5	67.7	68.1	71.0	69.8	74.0	72.7	68.5	68.1	66.5	66.3	65.7	65.3	64.0	64.3	62.6	62.3	63.1	62.5
971	61.6	61.9	61.9	61.9	63.8	64.0	56.7	56.5	58.9	58.3	59.1	59.2	59.7	60.2	60.2	60.7	60.8	61.1	64.2	64.5	68.8	68.6	71.5	71.5
972	69.8	70.9	69.5	70.2	71.7	72.3	72.4	72.7	73.2	72.4	74.1	73.1	73.4	72.8	74.2	73.7	73.3	72.6	71.6	72.0	71.8	70.8	70.0	70.0
973	67.4	67.8	67.5	67.7	66.7	66.7	66.9	70.0	67.3	66.8	67.0	66.6	67.5	67.5	67.5	67.5	66.5	66.6	65.5	66.4	64.8	64.7	64.2	63.7
974	64.6	64.5	64.8	64.5	65.3	65.2	66.5	66.6	69.1	68.6	70.1	69.4	71.6	71.3	73.5	73.1	76.9	76.1	77.3	77.6	82.3	82.0	84.5	85.1
975	89.9	93.6	93.6	95.7	97.4	98.9	98.9	100.8	106.8	103.8	109.1	106.2	110.8	106.5	110.0	107.9	112.8	108.6						

ote: P = adjusted using X-11 proportional seasonal factors.
A= adjusted using X-11 additive seasonal factors.