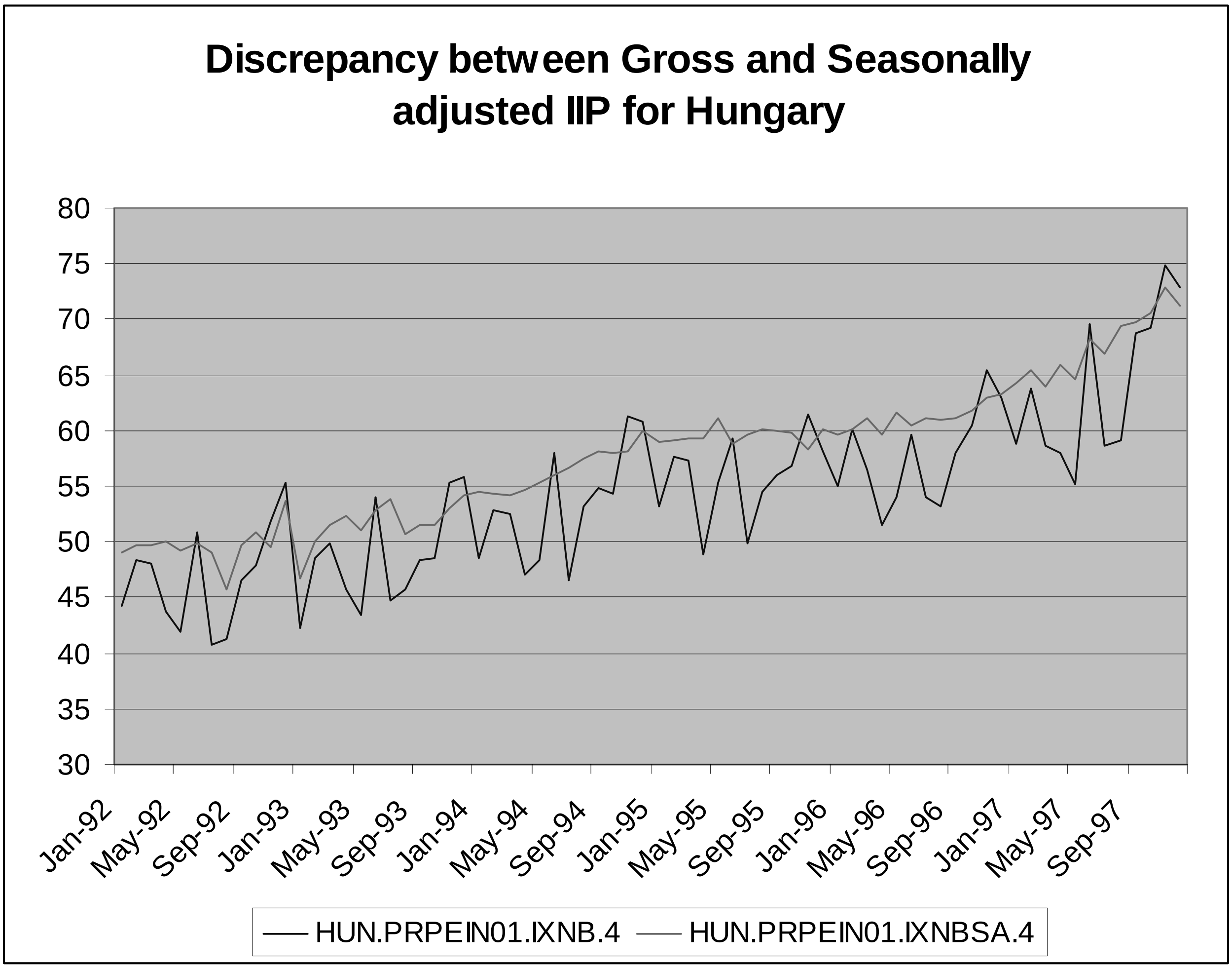
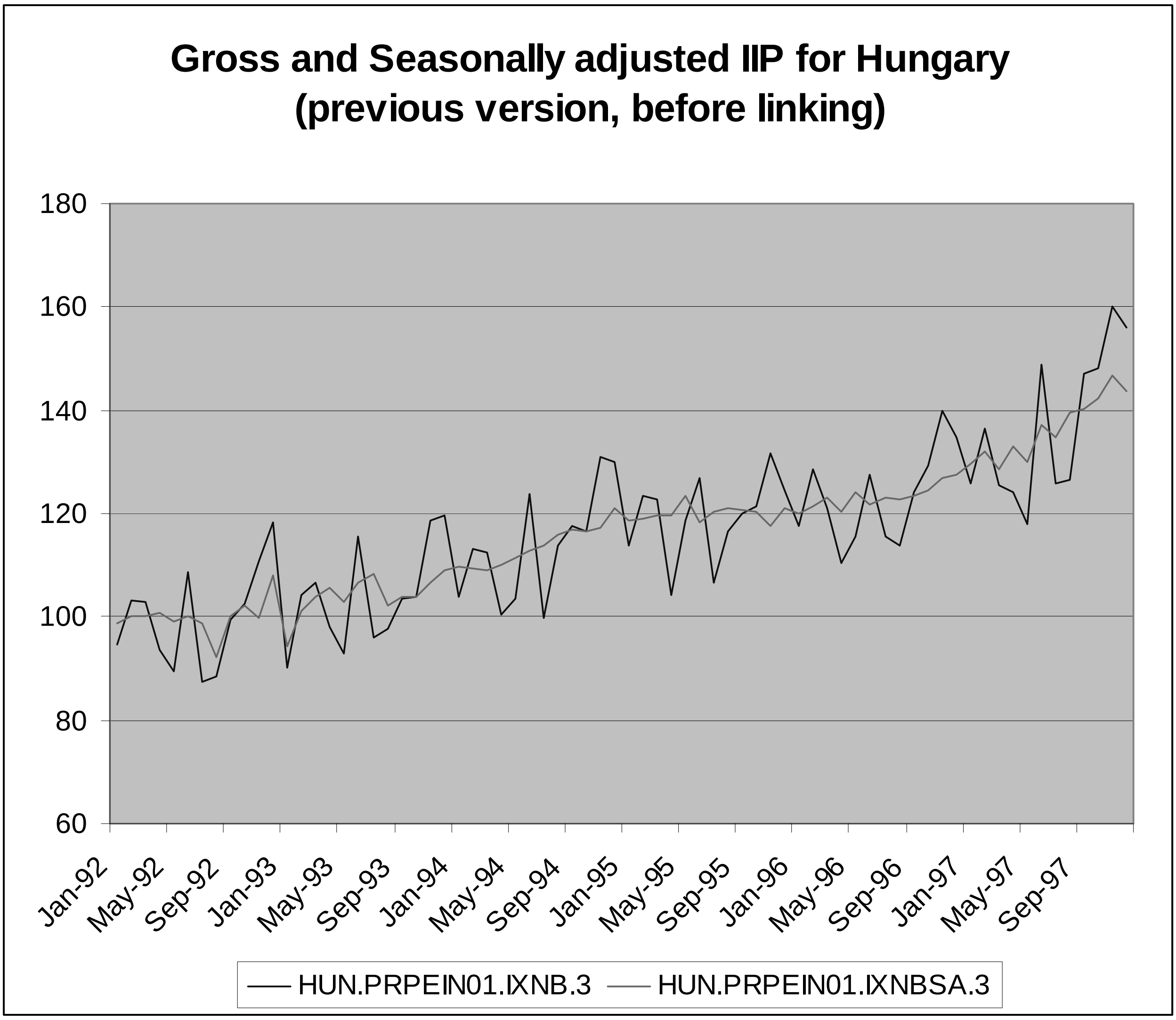
Linking factors for gross and seasonally adjusted series

The purpose of this note is to explain problems with the current linking methodologies used in the MEI and propose changes to solve discrepancies recently identified between gross and seasonally adjusted indices which are provided by countries but for which using links is necessary to have enough historical data. Such discrepancies are found for instance from 1992 to 1997 for a Hungarian series: IIP Total Industry excluding construction after using the "First Common Period" linking method.



As one can notice, the seasonally adjusted IIP is clearly above its "natural" position vis à vis the gross series (see graph below representing version 3 of the gross and seasonally adjusted IIP for Hungary, from 1992 to 1997).



In addition, as a result of the work of Giuseppe Parigi, if one considers the IIP Total industry excluding construction, this type of discrepancy appears significantly not only for Hungary but also for Belgium, Denmark, Germany, Italy, Netherlands, Norway, Sweden, the United Kingdom and to a lesser extent for France.

This note is organised in 5 parts. In Part I, we examine the impact of linking methods on growth rates, whether annual or monthly. In Part II, we analyse the conditions under which linking methods will be able to solve the discrepancies noticed for the Hungarian IIP as well as for the other countries quoted above. In Part III, we give the conditions under which the annual value for the IXOBSA series for the OECD standard base year (i.e. 1995) will be equal to 100. Finally, in Part 4 we give a summary of the main results from the previous parts following by a comment on recommendations and future work in Part 5.

I Impact of linking methods on annual and monthly growth rates

Firstly, we give below the notations used throughout the text:

<u>Notations</u>:

b = "before common period"
c = "common period"
t = time period
n = new series version
o = old series version (o = n-1)
R = Raw series
S = Seasonally adjusted series
Fcp = "First Common Period" linking method
Fcy = "First Common Year" linking method

In the following, we suppose that before applying the linking factor, the new series starts in 01/19N and that it is monthly (the results would be the same if we considered a quarterly series).

We define α as the linking factor between the new series and the old one: $\alpha = f\left(R_{nc}, R_{oc}\right)$

- Before 01/19N, the monthly growth rates are as follows:

$$\frac{R_{nb,t}}{R_{nb,t-1}} = \frac{\alpha R_{ob,t}}{\alpha R_{ob,t-1}} = \frac{R_{ob,t}}{R_{ob,t-1}}$$

Therefore, whatever the value of the linking factor, the monthly growth rates (as well the annual growth rates) will be preserved before 01/19N for the new series.

- The **<u>only</u>** monthly growth rate which will depend on the linking factor α is the one between 12/19N-1 and 01/19N and its formula is given by:

$$\frac{R_{nc,01/19N}}{R_{nb,12/19N-1}} = \frac{R_{nc,01/19N}}{\alpha R_{ob,12/19N-1}}$$

If we use the "First Common Period" method, that is $\alpha_{fcp} = \frac{R_{nc,01/19N}}{R_{oc,01/19N}}$, the above formula becomes:

$$\frac{R_{nc,01/19N}}{R_{nb,12/19N-1}} = \frac{R_{nc,01/19N}}{\alpha_{fcp} R_{ob,12/19N-1}} = \frac{R_{nc,01/19N}}{\frac{R_{nc,01/19N}}{R_{oc,01/19N}} R_{ob,12/19N-1}} = \frac{R_{oc,01/19N}}{R_{ob,12/19N-1}}$$

- Therefore, the "First Common Period" ensures the monthly rate of change between 12/19N-1 and 01/19N for the new series version is equal to that of the old series version.

In addition, it is straightforward to show that the "first common period" and "first common year" links will give the same linking factors if the new series has not been revised compared with the old series, over the first 12 months of the common period (i.e. if monthly growth rates of the new series are strictly equal to those of the old series, over the first 12 months of the common period).

In this case, we would have, for i = 1st to 11th month:

$\frac{R_{nc,i+1/19N}}{R_{nc,i/19N}} = \frac{R_{oc,i+1/19N}}{R_{oc,i/19N}}$ and, as a result, the following formula:

$$\alpha_{fcp} = \frac{R_{nc,01/19N}}{R_{oc,01/19N}} = \frac{R_{nc,02/19N}}{R_{oc,02/19N}} = \ldots = \frac{R_{nc,i/19N}}{R_{oc,i/19N}} = \cdots = \frac{R_{nc,12/19N}}{R_{oc,12/19N}} = \frac{\frac{1}{12}\sum_{i=1}^{12} R_{nc,i/19N}}{\frac{1}{12}\sum_{i=1}^{12} R_{oc,i/19N}} = \alpha_{fcy}$$

Obviously, if the above condition does not hold it means there have been revisions to the old series over the first 12 months of the common period, and thus the use of the first common period linking method (i.e. the current method) becomes questionable. That is, why preserve the historical monthly growth rate at the first common period if we know the new series has been revised? In this case using a first common year linking method is likely to lead to a more robust linking factor.

<u>Annual growth rates</u>

We now compute the annual growth rates for the new series at the months of the common period. If we note i = 1st to 12th month, we have:

$$\frac{R_{nc,i/19N}}{R_{nb,i/19N-1}} = \frac{R_{nc,i/19N}}{\alpha R_{ob,i/19N-1}}$$

- We find that the annual growth rates for the new series at the first 12 months of the common period will depend on the linking factor used α. This is important as annual growth rates are often used to analyse monthly series and these are published in the MEI.

Furthermore, if we denote as α_1 and α_2 the linking factors obtained with two different linking methods and as Δ_1 and Δ_2 the annual growth rates for the new series at the first 12 months of the common period, we obtain the following formula:

$$\frac{\Delta_1}{\Delta_2} = \frac{\alpha_2}{\alpha_1}$$

Therefore, the average annual growth rates over the period before and after the link will differ by a factor equal to $\frac{\alpha_2}{\alpha_1}$, which explains the divergence of levels in series expected to show similar paths on average (e.g. seasonally adjusted and gross series) caused by the use of different linking methods.

II Consistencies of the linking factors for gross and seasonally adjusted indices provided by the countries

The previous formulas hold if we replace R by its seasonally adjusted counterpart S.

As a result, if we note α_1 the linking factor applied to R and α_2 the linking factor applied to S, we have the following formulas before 01/19N:

$$\frac{R_{nb,t}}{R_{nb,t-1}} = \frac{\alpha_1 R_{ob,t}}{\alpha_1 R_{ob,t-1}} = \frac{R_{ob,t}}{R_{ob,t-1}}$$

$$\frac{S_{nb,t}}{S_{nb,t-1}} = \frac{\alpha_2 S_{ob,t}}{\alpha_2 S_{ob,t-1}} = \frac{S_{ob,t}}{S_{ob,t-1}}$$

Therefore, whatever the values of the linking factors α_1 and α_2, the monthly growth rates (as well the annual growth rates) for the raw series as well as for the seasonally adjusted series will be preserved before 01/19N.

BUT the following formulas must hold before 01/19N in order to avoid inconsistencies between the level (which can be visually seen on the graph) of the raw series and that of the seasonally adjusted series:

$$\frac{R_{nb,t}}{S_{nb,t}} = \frac{R_{ob,t}}{S_{ob,t}}$$

But we know that:

$$\frac{R_{nb,t}}{S_{nb,t}} = \frac{\alpha_1 R_{ob,t}}{\alpha_2 S_{ob,t}}$$

Thus we need: $\frac{\alpha_1}{\alpha_2} = 1$

Therefore, in order to avoid inconsistencies between the level of the raw series and that of the seasonally adjusted series before 01/19N (see for example the IIP Total for Hungary), the value of the linking factor must be the same for the raw series and for the seasonally adjusted series:

$\alpha = \alpha_1 = \alpha_2$ with $\alpha_1 = f_1(R_{nc}, R_{oc})$ and $\alpha_2 = f_2(S_{nc}, S_{oc})$

http://www.census.gov/ts/papers/jbes98.pdf

On p.7 of the above article from David F. Findley et alii (1998) “New Capabilities and Methods of the X-12 –ARIMA Seasonal Adjustment Program”, "The only calculations [of the seasonal factors] whose role may not be clear are those of step (iv) in Stages 1 and 2. Their effect is usually to make twelve-month totals of the adjusted series be close to the corresponding totals of the unadjusted series."

Therefore, if data are available for the common year (often the case) for both the gross series and the seasonally adjusted series, we have the approximated formulas:

$$\sum_{i=1}^{12} R_{nc,i} \approx \sum_{i=1}^{12} S_{nc,i}$$

$$\sum_{i=1}^{12} R_{oc,i} \approx \sum_{i=1}^{12} S_{oc,i}$$

The relation below will hold approximately:

$$\frac{\sum_{i=1}^{12} R_{nc,i}}{\sum_{i=1}^{12} R_{oc,i}} \approx \frac{\sum_{i=1}^{12} S_{nc,i}}{\sum_{i=1}^{12} S_{oc,i}}$$

If we denote fcy as the "First Common Year" linking method, we will eventually have:

$$\alpha_{fcy} \approx \alpha_{1,fcy} = \frac{\sum_{i=1}^{12} R_{nc,i}}{\sum_{i=1}^{12} R_{oc,i}} \approx \alpha_{2,fcy} = \frac{\sum_{i=1}^{12} S_{nc,i}}{\sum_{i=1}^{12} S_{oc,i}}$$

<u>NB:</u> if we change the linking factor option from "First Common Period" to "First Common Year" in case of Gross and Seasonally adjusted indices provided by the countries, we will be close to equality between the linking factors but the equality <u>will never be perfect</u>. In addition, we have to note that the seasonally adjusted values are unstable at the beginning and at the end of a time series.

However, we can force the equality as Richard McKenzie and Jens Dossé suggest, <u>by using the linking factor of the raw series and applying it to the seasonally adjusted series</u>. Note that if we use the "First Common Period" linking method, we will always get a discrepancy between α_1 and α_2 if the countries seasonally adjusted series has been revised with the rebase – which is almost always the case (hence the problem we have identified).

III Consistencies of the value of the IXOBSA series at the OECD standard base year (i.e. 1995=100), when the IXNB and IXNBSA series are provided by the countries after 1995 only

The formula below gives the annual value of the IXOBSA series (derived from the IXNBSA series), denoted as A,

- when the IXNB and IXNBSA series are unavailable for the OECD standard base year (i.e. 1995=100);
- when links have thus been applied to both series (currently “First Common Period”) to have data available for the OECD standard base year;
- **when the annual segment of the IXNBSA series is a proxy of the corresponding IXNB series (as is currently the recommendation for MEI series).**

$$A = \frac{\alpha_2}{\alpha_1} * \frac{Average_{1995}\left(S_o\right)}{Average_{1995}\left(R_o\right)} * 100$$

This formula shows that A can be decomposed into a “linking factor” effect: $\frac{\alpha_2}{\alpha_1}$ and a “seasonal factor” effect: $\frac{Average_{1995}\left(S_o\right)}{Average_{1995}\left(R_o\right)}$.

We can see that A will exactly be equal to 100 if and only if:

$$\alpha = \alpha_1 = \alpha_2 \text{ and } \frac{1}{12}\sum_{i=1}^{12} R_{o,i/1995} = \frac{1}{12}\sum_{i=1}^{12} S_{o,i/1995}$$

We already know from Part I that if we can force the first equality $\alpha = \alpha_1 = \alpha_2$, it is not the case for the second equality.

If $\frac{1}{12}\sum_{i=1}^{12} R_{o,i/1995}$ is almost identical to $\frac{1}{12}\sum_{i=1}^{12} S_{o,i/1995}$ then we can use an annual segment for the IXNBSA series which would be a proxy of the corresponding IXNB series.

If not, using an annual proxy segment could create a significant difference if a user wanted to compile the average of the year. He or she would find a different value from what we indicate in the MEI database for the year. For the Hungarian IIP, the current average value for the year 1995 for the IXOBSA series is 106.9 whereas we should find a value close to 100. This discrepancy is mainly explained by the use of the “First Common Period” method for both the Gross and Seasonally adjusted series. As a result, for the Hungarian IIP in particular, the linking effect measured by $\frac{\alpha_2}{\alpha_1}$ is too large (1.0625 > 1).

Changing the annual segment of the IXNBSA series from “proxy” to “frequency” will ensure that the IXOBSA value for the OECD standard base year be equal to 100 according to the evident formula:

$$A^{'} = \frac{\alpha_2}{\alpha_2} * \frac{Average_{1995}(S_o)}{Average_{1995}(S_o)} * 100 = 100$$

<u>NB</u>: in the case of Hungary, the inconsistencies of the Gross and Seasonally adjusted indices will remain if we change the annual segment of the IXNBSA series from “proxy” to “frequency” without changing the linking method (i.e. “First Common Period”) at the same time.

The above text essentially summarises the content of Appendix 2, which describes in more detailed the impact associated with the use of proxy or frequency for defining annual series.

IV Concluding remarks

- <u>Before the “First Common Period”</u> (generally 01/19N), the monthly (and annual) growth rates of the new series are identical to those of the old series, <u>whatever the value of the linking factor</u>;

- <u>From “First Common Period + 1”</u>, the monthly growth rates of change will be based on the new data (no problem!);

- The value of the linking factor has only an impact on the monthly growth rate between “First Common Period – 1” and “First Common Period” because we compare two series coming from 2 different sources. The “First Common Period” linking method ensures this growth rate is the same for the old and new series, which is questionable if the new series has been revised from the start of the first common period;

- Annual growth rates from “First Common Period” to “First Common Period + 12” will also depend on the value of the linking factor which is significant due to the importance of annual growth rates for analysing monthly series. Where the new series has been revised, use of the “First Common Year” linking method is a more robust method for measuring these annual growth rates than the first common period;

- <u>When countries provide MEI with Gross and Seasonally adjusted indices</u>, the “First Common Period” method generally leads to a discrepancy between the levels of the Gross and Seasonally adjusted series: possible solutions explored would be either to change the “First Common Period” method to the “First Common Year” method for all versions of both the gross and seasonal adjusted series or to apply the “First Common Year” linking factor obtained with the gross series, to the seasonally adjusted series;

- Changing linking methods implies a change of the annual growth rates at the months of the year containing the common period, and for the level of the historical series;

- The use of annual proxy segments for our seasonally adjusted series (except for Balance of Payments series) in combination with the current linking method results in value of the IXOBSA series for the OECD base year not being equal to 100.

IV Recommendations and future work

1. Immediately change our linking procedures to the “First Common Year” method. In conjunction with this change, guidelines will be given on what needs to be assessed when links are performed for both gross and seasonally adjusted series at the same time (e.g. need to ensure common periods are the same, need to ensure the resultant linking factors are very close etc.);

2. The operational issues of using a link derived from the “First Common Year” method from the gross series for the seasonally adjusted series should be discussed (e.g. system and governance issues);

3. All recent links put in place associated with countries change to year 2000 base year (or other recent changes to base year) need to be identified and fixed as soon as possible (work program issue);

4. All historical series with this problem (i.e. considering links performed many years in the past) need to be identified and options for revising these series considered, in particular for those with very large discrepancies in long time series (Mr Parigi has developed a program to identify these series);

5. The current policy of using annual proxy segments for seasonally adjusted series should be reviewed, but probably after errors in series caused by the linking problem have been resolved.

Frederick Parrot & Richard McKenzie
Short Term Economic Statistics Division
3 December 2003

Appendix 1

Using a FCY method will result in a revision to the monthly growth rate for the first common period between the old and new series equal to the percentage difference in the linking factors derived from the FCP and FCY methods (easy to show algebraically). If this is large it could cause an extreme value in the monthly growth rate series at this point. However, this is not considered a major problem for a number of reasons:

- If there is a large difference between linking factors derived from the FCP and FCY methods, it generally means the new series has been substantially revised over the first common year. In this case, revisions to monthly growth rates for the first common year (between the old and new series) are likely to be significant. For example, for the Hungarian IIP series shown above, 4 of 11 revisions to the monthly growth rates for the first common year between version 3 and 4 of the series were greater than the revision in the growth rate for the first common month caused by using the FCY method.

- Seasonally adjusted series are likely to be more stable than gross series and therefore you may not expect as large a difference between the linking factors derived from FCP and FCY methods, implying that this could be less of an issue for the seasonally adjusted series.

- If there are large differences between the FCP and FCY linking factors, it is very likely that there would also be a large difference between FCP linking factors for the s.a. and gross series. Thus one must consider which is worse, a large revision to the monthly growth rate for the first common period (from using FCY method) or the introduction of a large discrepancy between the gross and s.a. series (from using FCP method). The latter problem is judged to be more serious.

Despite these issues, careful attention should be paid if the linking factors derived from FCP and FCY method are considerably different (say greater than 5% but this should depend on the volatility of the series as well) by bringing it to the attention of the Administrator and having a broader discussion on the case concerned.

Appendix 2 : Impact of using annual proxy or frequency segments for seasonally adjusted series

The purpose of this appendix is to analyse the impact of defining the annual segment of seasonally adjusted indices as either “Frequency” or “Proxy” (of the corresponding gross series).

In Part 1, we examine the case when STD/STES runs its own seasonal adjustments and in Part 2, the case when countries provide STD/STES with seasonally adjusted indices.

1) <u>Case 1</u>: STD/STES seasonally adjusts indices by itself

- **The value of the IXOBSA series will never perfectly be equal to 100 for the OECD standard base year (currently 1995=100) but it will be close enough to 100;**

- <u>The question is</u>: shall we define the annual segments of these seasonally adjusted indices as “proxy” of the raw indices in order to get an exact 100 for the OECD base year? However, in so doing, the following formula would not perfectly hold whereas we assume that it holds in the subject tables Industrial Production Indices and Retail Trade (we clearly state “sa-1995=100” in the MEI publication):

$$\frac{1}{12}\sum_{i=1}^{12} S_{i/1995} = 100$$

- There is no difference between using “proxy” or “frequency” for the annual segments of the seasonally adjusted indices if:

$$\frac{1}{12}\sum_{i=1}^{12} S_{i/1995} = \frac{1}{12}\sum_{i=1}^{12} R_{i/1995} \qquad \text{(I)}$$

- Again, the difference is generally small at the OECD standard base year (currently 1995=100) between 100 and the monthly (or quarterly) average of an index seasonally adjusted by STD/STES;

- The seasonal adjustment software X12-Arima makes relationship (I) close to equality so that using segments such as “proxy” or “frequency” in case 1 is not a big issue.

2) <u>Case 2</u>: **The countries provide STD/STES with gross and seasonally adjusted indices**

<u>2.1</u>- We use the same assumptions as in above paper on the linking methods (mainly that there are not enough historical data back to the OECD standard base year, i.e. 1995=100) and we examine the consequences on an IXOBSA series of defining the annual segment of an IXNBSA series as "frequency":

In the following, we denote as Ω_{1995} and Φ_{1995} the respective values of the IXNB and IXNBSA series for 1995, which is the OECD standard base year.

If the annual segment of the IXNB and IXNBSA series is "frequency" (evident for the IXNB series), we will have:

$$\Omega_{1995} = \frac{1}{12}\sum_{i=1}^{12} R_{i/1995,nb} \text{ and } \Phi_{1995} = \frac{1}{12}\sum_{i=1}^{12} S_{i/1995,nb} .$$

The transformation used to obtain the IXOBSA series from the IXNBSA series will then be equal to:

$$M_{i/19N,IXOBSA} = \frac{100}{\Phi_{1995}} * M_{i/19N,IXNBSA} .$$

<u>Notations</u>: M denotes a monthly data point, R is the raw series, "n" the new series, "o" the old series and "i" a given month.

- In that case, the average value of the IXOB and IXOBSA series for the OECD standard base year (i.e. 1995=100) will exactly be equal to 100.

- Furthermore, the values of the IXOBSA series over the year 2003 say, will depend on the values of the IXNB, IXOB, IXNBSA series as well as on the linking factors α_1 and α_2 (if countries do not provide historical data for the gross and seasonally adjusted indices back to 1995), as follows:

$$M_{i/2003,IXOBSA,n} = \left(\frac{\alpha_1}{\alpha_2} * \frac{\sum_{i=1}^{12} M_{i/1995,IXNB,o}}{\sum_{i=1}^{12} M_{i/1995,IXNBSA,o}} \right) * \frac{M_{i/2003,IXNBSA,n} * M_{i/2003,IXOB,n}}{M_{i/2003,IXNB,n}} .$$

Therefore, it is important to note that the Industrial Production indices published in the MEI paper publication or CD-Rom (IXOBSA measure as in Part I) <u>will be revised over the entire period</u> if we change our linking procedures for both the IXNB and the IXNBSA series.

<u>2.2</u>- We use the same assumptions as in 2.1 and we examine the consequences on an IXOBSA series of defining the annual segment of an IXNBSA series as "proxy":

- If we define the annual segment of the IXNBSA series as "proxy" of the IXNB series, then we obtain:

$$\Phi_{1995} = \Omega_{1995} = \frac{1}{12}\sum_{i=1}^{12} R_{i/1995,nb} .$$

- The transformation used to obtain the IXOBSA series from the IXNBSA series will then be equal to:

$$M_{i/19N,IXOBSA} = \frac{100}{\Omega_{1995}} * M_{i/19N,IXNBSA}.$$

- The average value of the IXOB series for the OECD standard base year (i.e. 1995=100) will exactly be equal to 100.

- However, as the annual segment of the IXNBSA series is defined as a "proxy" of the IXNB series, we will not get a perfect 100 when compiling the "true" annual average (based on the monthly data) for the OECD standard base year (i.e. 1995=100). The difference between 100 and the compiled annual average is measured by a factor equal to:

$$\frac{\alpha_2}{\alpha_1} * \frac{\frac{1}{12}\sum_{i=1}^{12} S_{i/1995,nb}}{\frac{1}{12}\sum_{i=1}^{12} R_{i/1995,nb}}.$$

- In addition, the values of the IXOBSA series over 2003 say, will depend on the values of the IXNB, IXOB and IXNBSA series and also on the linking factors (as the values of the IXOB series will depend on how the IXNB series is linked), as follows:

$$M_{i/2003,IXOBSA,n} = \frac{M_{i/2003,IXNBSA,n} * M_{i/2003,IXOB,n}}{M_{i/2003,IXNB,n}}.$$

Therefore, the conclusion is the same as in 2.1: the Industrial Production indices published in the MEI paper publication or CD-Rom (IXOBSA measure as in Part I) <u>will be revised over the entire period</u> if we change our linking procedures for both the IXNB and the IXNBSA series.

- We have thus shown that the values of an IXOBSA series over the entire period depend on:

- The choice of the linking procedure for the IXNB and the IXNBSA series and;
- The definition of the annual segment of the IXNBSA series as "proxy" or "frequency" of the IXNB series.

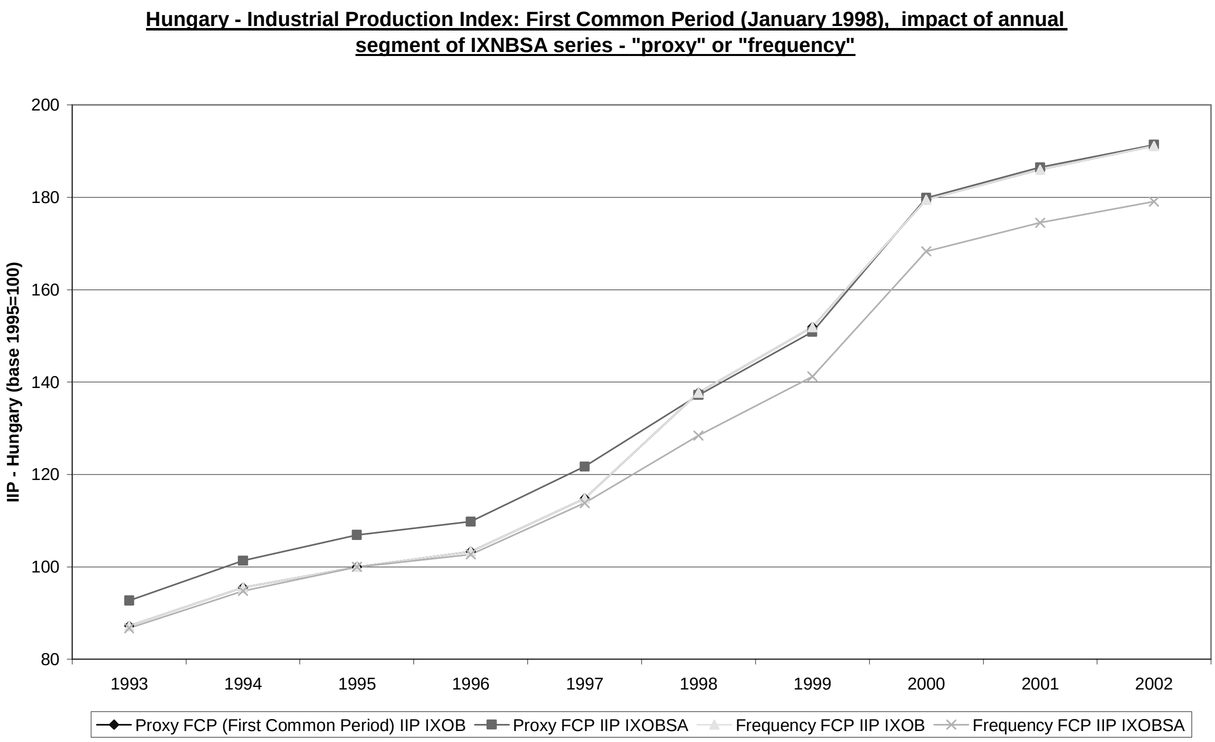
- We note that there is a positive correlation of the effects on the values of the IXOBSA series of the linking method and the definition of the annual segment of the IXNBSA series.

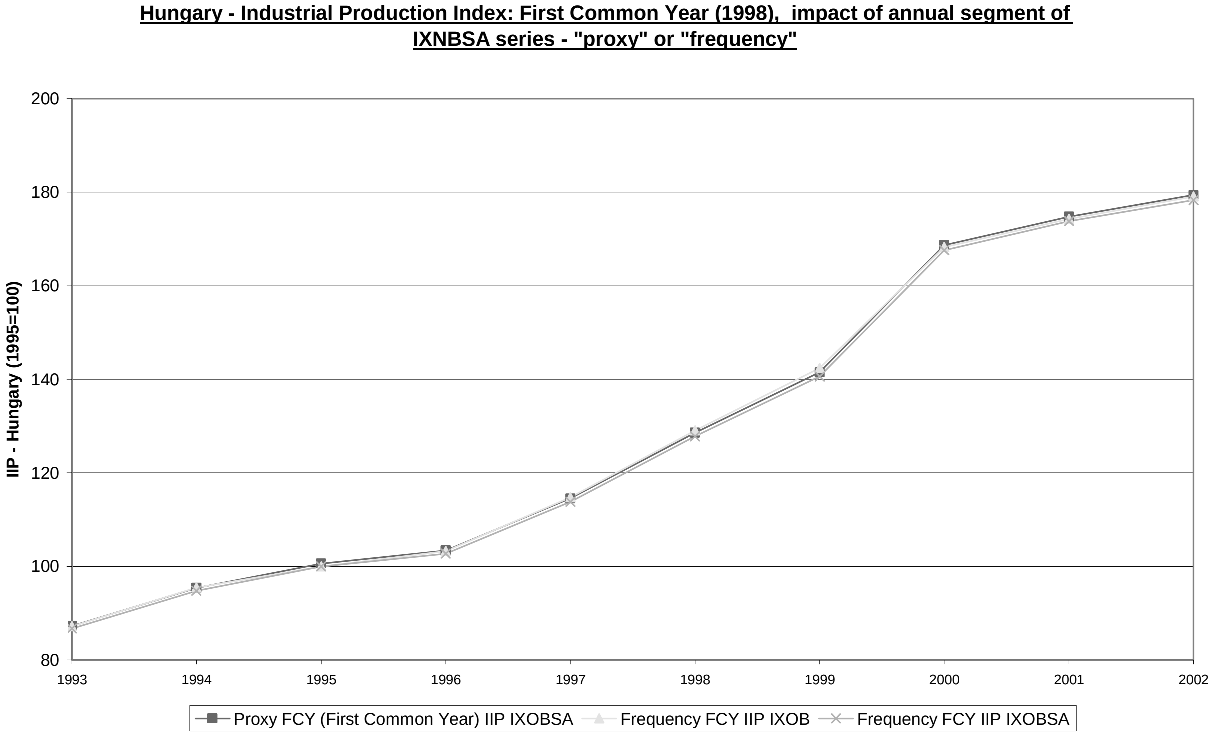
- In other words, choosing the right linking procedure, i.e. the one which ensures that the linking factor for the IXNBSA series is close to the linking factor of the IXNB series, significantly reduces the effect of defining the annual segment of the IXNBSA series as "proxy" or "frequency" (cf. graphs below representing the Industrial Production Index of Hungary in base year 1995=100; first common period: January 1998; first common year: 1998).

- Furthermore, as also shown on the graphs, if the OECD standard base year (currently 1995=100) is before the linking point, the impact on the IXOBSA series of the 2 options "frequency" or "proxy" is as follows:

- "Frequency": IXOBSA series exhibits a discrepancy with the IXNB series after the link point (the discrepancy will be small if a good linking method is chosen);
- "Proxy": IXOBSA series exhibits discrepancy with the IXNB series before the link point, i.e. at the OECD standard base year.

Case of Hungary:





- Once a proper linking method is used, there remains to examine the impact on the values of the IXOBSA series of defining the annual segment of the IXNBSA series as "proxy" of the corresponding IXNB series. The following table summarizes the main findings:

Annual segment of the IXNBSA series = "proxy".	**Annual segment of the IXNBSA series = "frequency"**
The value for the OECD base year (currently 1995=100) for the IXOB series will <u>exactly</u> be equal to 100.	The value for the OECD base year for the IXOB series will <u>exactly</u> be equal to 100.
The compiled annual average for the OECD base year for the IXOBSA series will <u>differ</u> from 100 by a small amount. However, the MEI database will display "100" for 1995 because of the "proxy" segment.	The value for the OECD base year for the IXOBSA series will <u>exactly</u> be equal to 100.
No discrepancy between the pattern of the IXNB/IXNBSA series and that of the IXOB/IXOBSA series.	A small discrepancy between the pattern of the IXNB/IXNBSA series and that of the IXOB/IXOBSA series. However, if this discrepancy is small enough it could be tolerated given that the annual values of the IXNBSA tend to oscillate around the annual values of the IXNB series anyway.

Lastly, defining the annual segment of the IXNBSA series as “proxy” will give the same results as defining it as “frequency” iff:

- The linking factors of the gross and seasonally adjusted indices are identical;
- The average of the IXNB series over the OECD standard base year (i.e. 1995=100) is exactly equal to the average of the IXNBSA series over the OECD standard base year.