Improving the quality of European monthly unemployment statistics

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Abstract

Monthly unemployment is one of the most policy relevant and popular statistical domains. At the European level, the international definition of unemployment given by the ILO is used, which makes the figures comparable across countries. For this purpose, unemployment figures are obtained directly or indirectly from the Labour Force Survey, the largest sample survey in Europe, by applying appropriate statistical models.

The production of European Union monthly unemployment statistics is currently carried out partly by Eurostat and partly (more and more) by individual Member States according to national practices. Time has come to review and compare these practices, with a view to single out good and bad ones, and to proceed towards a better harmonisation of the methodologies. The goal is to define guidelines and, for the longer period, to set some legal requirements for the production of monthly ILO unemployment statistics.

After illustrating the current situation concerning the production of European monthly unemployment figures, the paper focusses on the main quality issues and presents the results of ad hoc quality tests assessing the different practices.

JEL classification: C22, C32, C46, E24

1. Introduction

Eurostat has recently started a discussion with the Member States on how to further improve the quality [1] of the [2] monthly ILO unemployment time-series, which are Eurostat's most consulted statistics. The headline indicator is the unemployment rate, seasonally-adjusted (SA). At present different approaches are followed by Eurostat and the Member States to produce these figures, which creates problems of data comparability and which often reflects different attitudes towards what is the acceptable quality level. A first crucial step consists

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therefore in identifying the relevant quality characteristics these series should fulfil. This topic is discussed in Chapter 2, after a quick overview on the different methods. The second step is to actually measure that quality. For this purpose, suitable indicators have to be defined. This issue is addressed in Chapter 3, which reports on the results of ad hoc quality tests we have carried out on the series currently disseminated by Eurostat. Finally, Chapter 4 presents some conclusions and outlines the way forward.

2. Quality issues of monthly ILO unemployment statistics

Eurostat's target is to disseminate monthly ILO unemployment statistics for the EU, the Euro area and the single Member States 30 days after the end of the reference month. The basis for these statistics is the EU Labour Force Survey (LFS) [3], which however is designed as a quarterly survey in most countries. Three main approaches are used to produce the *unadjusted* monthly estimates: 1) calibration of *pure monthly LFS* results (when the survey design and organisation allow); 2) *temporal disaggregation based on mixed sources*, which combines quarterly LFS data with monthly administrative unemployment figures using either the Denton [4] or the Chow-Lin [5] methods; 3) *3-month moving average of LFS data*, adopted when pure monthly LFS figures are not sufficiently reliable and monthly administrative information is not available. Eurostat directly uses the second approach (the only one we can implement ourselves) to estimate the results for about half of the Member States. The first and the third approach, instead, can only be implemented by the national statistical institutes (NSI) of the individual countries. The series thus obtained are subsequently seasonally-adjusted. A few countries only publish trend components as they deem their SA series too volatile[2].

Volatility is definitely a relevant quality aspect, for short-term indicators such as monthly unemployment rates. Where a high volatility is not directly linked to the business cycle but rather stems from the statistical nature of the data, it is confusing and does not allow for a correct identification of the signal. It should therefore be reduced as much as possible. **Large revisions** are a second relevant issue. While new information normally leads to revisions, large revisions undermine the relevance of the statistics, especially if they are used for

[2] A time series can be decomposed in a seasonal (S), a trend (T) and an irregular (I) component. The difference between the SA and the trend is the irregular component, which is included in the former abut not in the latter.

decision making. A third aspect is the *power* to quickly identify **turning points**. Last but not least, **timeliness** is also a crucial element of the overall quality of a time series.

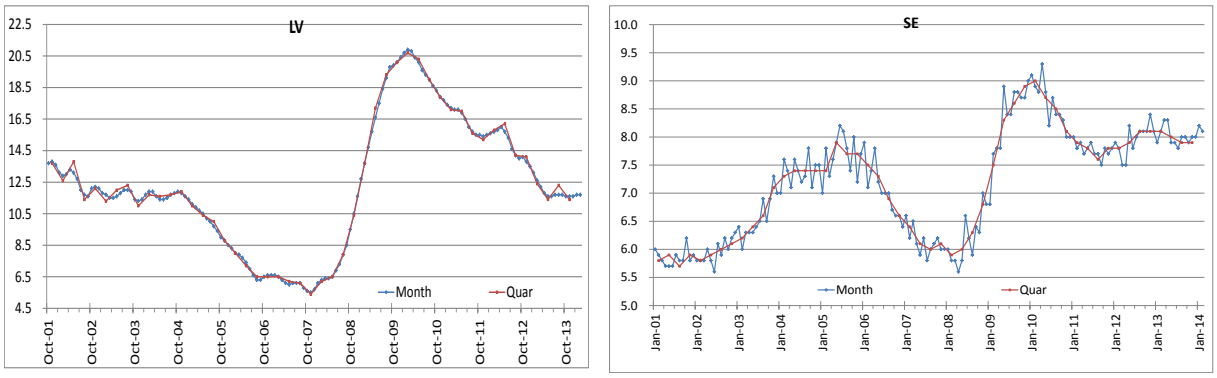
3. Quality tests

In order to assess the methods against the quality issues described in chapter 2, we have run several tests, the results of which are presented below.

3.1. Tests on volatility

A first set of tests aims at comparing the volatility of the time-series. We have run these tests on the SA unemployment rate series of the 28 EU Member States which Eurostat currently publishes. This provides an overview of the present situation and allows comparing the different countries and detecting "problematic" ones. Even if only indirectly, these tests also allow a comparison of the different approaches.

Chart 1. Latvia (left) and Sweden (right), unemployment rates seasonally adjusted, %



The issue here is to define appropriate indicators which allow distinguishing situations like the ones in chart 1, where the series on the left is not volatile while the series on the right definitely is. The chart shows the monthly (blue lines) and the quarterly (red lines) unemployment rates, the latter directly adjusted from the quarterly LFS. The quarterly LFS can be used as reference, as the LFS is primarily designed to provide reliable results on a quarterly basis and in principle should not show excessive volatility. The use of the quarterly LFS as benchmark also gives indications on the source of the volatility, in particular distinguishing if this stems from the production process of the monthly series or rather from the quarterly source to which they are benchmarked.

We looked at several indicators, defined on the basis of desirable properties for monthly unemployment series. As a first property, in normal circumstances the unemployment rate should not show big jumps month-on-month or quarter-on-quarter (*big foot effect*). We have monitored this feature by computing the standard deviation of the month-on-month changes. As shown in table 1, this indicator ranges between 0.08 for Germany to 0.53 for Estonia. It is larger than 0.25 for six countries, three following the mixed-source approach, two producing pure monthly LFS data and one using 3-month moving averages of LFS data.

Table 1 - Summary indicators on volatility of monthly and QLFS unemployment rates (seasonally-adjusted series)

Countries	No. of observations		Standard deviation of M-M and Q-Q changes		% sign inversion		% double large inversions*		No. of thresholds exceeded	
	Monthly	QLFS	Monthly	QLFS	Monthly	QLFS	Monthly	QLFS	Monthly	QLFS
MIXED SOURCES (TEMPORAL DECOMPOSITION)										
BE	182	60	0.19	0.36	12.78	33.90	0.00	8.62	0	2
BG	155	51	0.24	0.55	9.15	12.00	0.00	0.00	0	0
CY	170	56	0.23	0.53	19.64	11.11	1.20	0.00	1	0
ES	218	72	0.23	0.56	7.41	5.63	0.00	0.00	0	0
FR	134	44	0.12	0.20	13.64	20.93	0.00	0.00	0	1
HR	170	56	0.26	0.74	11.31	42.59	0.00	3.77	1	3
IE	182	60	0.21	0.43	11.67	30.51	0.00	1.72	0	2
LT	80	26	0.38	0.68	2.56	8.00	0.00	0.00	1	1
LU	170	56	0.10	0.15	11.31	14.55	0.00	0.00	0	0
LV	149	49	0.37	1.07	9.52	35.42	0.00	14.89	1	3
MT	146	48	0.17	0.38	20.14	59.57	0.00	6.52	1	2
PL	170	56	0.21	0.54	5.95	12.73	0.60	0.00	1	0
PT	194	64	0.17	0.45	7.81	25.81	0.00	0.00	0	1
SI	182	60	0.16	0.36	8.33	27.12	0.00	3.45	0	2
SK	194	64	0.25	0.62	9.38	20.97	0.52	0.00	1	1
PURE MONTHLY LFS										
CZ	254	84	0.16	0.32	18.65	6.10	0.80	0.00	1	0
EL	120	40	0.29	0.61	8.47	7.69	0.00	0.00	1	0
IT	122	40	0.20	0.23	40.83	0.00	4.20	0.00	2	0
RO	122	40	0.18	0.25	37.50	38.46	0.84	0.00	2	1
SE	158	52	0.32	0.19	42.31	19.61	12.26	0.00	3	0
3-MONTH MOVING AVERAGES										
DK	86	28	0.19	0.26	20.24	44.44	0.00	7.69	1	2
EE	68	23	0.53	0.94	15.15	27.27	0.00	0.00	1	2
HU	132	44	0.16	0.25	16.92	20.93	0.00	0.00	0	1
UK	178	59	0.10	0.17	12.50	27.59	0.00	0.00	0	1
TREND										
AT	122	40	0.15	0.30 **	24.17	38.46 **	0.00	7.89 **	1	2
DE	107	35	0.08	0.27 **	0.95	23.53 **	0.00	0.00 **	0	1
FI	313	104	0.17	0.52 **	0.00	27.18 **	0.00	1.98 **	0	2
NL	134	44	0.11	0.16 **	12.12	9.30 **	0.00	0.00 **	0	0
Thresholds			>0.25	>0.63	>20%	>20%	>0	>0	3	2

* Large inversions: for Monthly series: abs. M-M change ≥0.2 pp; for Quarterly series: abs. Q-Q change ≥0.3 pp

These results should however be interpreted with caution. As a matter of facts, countries with steep trends like Estonia, Latvia or Lithuania are penalised as they tend to have large deviations from the average month-on-month changes, even if their series are not particularly volatile. For these countries the indicator is large also for the quarterly LFS, which from a graphical analysis (not shown here but available on request) is not particularly volatile. Indeed, Sweden and Greece are the only countries for which the standard deviation is high for the monthly series but low for the QLFS.

Another possible indicator of excessive volatility is the number of sign inversions, i.e. how often in a time–series an increase is followed by a decrease and vice versa (*pitching effect*). Too frequent inversions in the direction of the change send a confusing message about the real trend of a series and hamper a timely detection of turning points. The results of our tests are also shown in table 1. Some countries publishing trend components like Finland and Germany show no or very limited sign inversions. On the contrary, six countries (but not always the same as for the previous test) show more than 20% of sign inversions in their monthly time-series, with Sweden and Italy, both publishing pure monthly LFS figures, exceeding 40%. These are also the only two countries where the issue does not come from the quarterly LFS, which for them is definitely more stable.

A third aspect we have looked at is the presence of large instability (*roller coaster effect*). The presence in the series of double large inversions, i.e. a big jump up, followed by a large drop and again by a big jump, or vice versa, is a sign of potential issues. We assumed as *large* the changes exceeding ± 0.2 percentage points for the monthly series and ±0.3 p.p. for the quarterly series. Table 1 shows that seven countries present some double large inversion, and Sweden with a high frequency (over 12% of the cases).

Overall, fifteen countries show some sign of volatility in their monthly unemployment series. However, five of these only show the *big foot effect*, which is probably related to the real development of their economic situation over time. On the contrary, the Swedish series is affected by all three effects, while Italy and Romania show the *pitching* and the *roller coaster effects.*

Not surprisingly, a large volatility can be observed mostly among those countries using pure monthly LFS data, while those using other methods are not or only marginally affected. At the same time, it is worth highlighting that not all countries producing pure monthly LFS figures show serious volatility problems. A second conclusion of this analysis is that the quality of quarterly LFS plays an important role and is sometimes at the origin of the volatility of the monthly series.

3.2. Tests on revisions

For all the 28 EU Member States we considered the last 3 years (36 monthly vintages) and we computed the revision in the unemployment rates for the last published month, i.e. the one which was the headline in the previous data release and which is the reference for the month-on-month change in the last release. For countries which have changed method in the last three years, we have carried out the tests separately on the two methods. Periods when only quarterly data were published are excluded.

Table 2 - Summary indicators on revisions of monthly unemployment rates (seasonally-adjusted series). Countries ranked by average absolute revisions

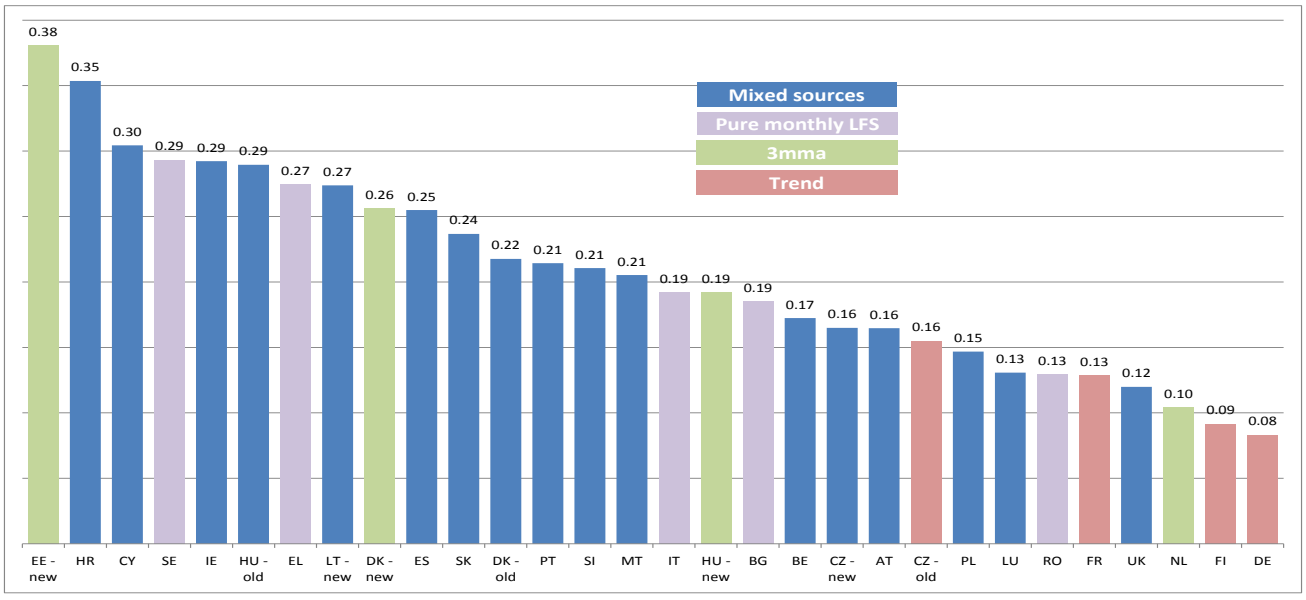
			LEVELS: absolute revisions (pp)			MONTHLY CHANGES: sign inconsistency (%)		
Method	Country	No of vintages	Average, all vintages	Average, new QLFS vintages	Max, all vintages	All vintages	New QLFS vintages	Remarks
Mixed sources	HR	36	0.3	0.8	1.5	12.1	16.7	
Mixed sources	HU - old	15	0.3	0.7	1.3	28.6	60.0	
Mixed sources	CY	36	0.3	0.5	1.0	11.4	8.3	
Pure monthly LFS	EL	30	0.3	N/A	0.7	16.7	N/A	From Sep 2011
Mixed sources	LT - new	23	0.2	0.5	1.0	30.4	50.0	From Apr 2012
Mixed sources	PT	36	0.2	0.5	1.5	5.7	8.3	
Mixed sources	SI	36	0.2	0.5	1.1	14.3	25.0	
3mma	DK - new	6	0.2	N/A	0.3	50.0	N/A	From Sep 2013, with forecast of last month
Mixed sources	BG	36	0.2	0.4	1.3	20.0	25.0	
Mixed sources	IE	36	0.2	0.4	0.9	22.9	41.7	
Mixed sources	BE	36	0.1	0.4	0.8	37.1	50.0	
Mixed sources	ES	36	0.1	0.4	1.0	17.1	27.3	
Mixed sources	DK - old	30	0.1	0.3	0.7	37.9	70.0	
Mixed sources	MT	36	0.1	0.3	1.0	22.9	33.3	
Mixed sources	SK	36	0.1	0.3	0.7	25.7	33.3	
Mixed sources	PL	36	0.1	0.2	0.5	28.6	50.0	
Trend	FI	36	0.1	N/A	0.3	40.0	N/A	
Mixed sources	FR	36	0.1	0.1	0.3	22.9	45.5	
Pure monthly LFS	RO	31	0.1	N/A	0.5	9.7	N/A	From Aug 2011
Pure monthly LFS	IT	36	0.1	N/A	0.5	8.6	N/A	
Mixed sources	CZ - old	22	0.1	0.2	0.4	23.8	57.1	
Mixed sources	LU	36	0.1	0.1	0.3	40.0	41.7	
Pure monthly LFS	CZ - new	14	0.1	N/A	0.2	42.9	N/A	From Jan 2013
Trend	DE	36	0.1	N/A	0.2	37.1	N/A	
3mma	EE - new	19	0.1	N/A	0.4	5.9	N/A	From Aug 2012
Trend	AT	36	0.1	N/A	0.4	34.3	N/A	
Pure monthly LFS	SE	36	0.0	N/A	0.2	14.3	N/A	
3mma	HU - new	21	0.0	N/A	0.2	9.5	N/A	From Jun 2012
3mma	UK	36	0.0	N/A	0.1	17.1	N/A	
Trend	NL	36	N/A	N/A	N/A	N/A	N/A	

Table 2 summarises our results. Four countries have on average large revisions of the headline figures (0.3 p.p. up or down from the previous month), and six have still sizeable average revisions of 0.2 p.p. For eight out of ten of these countries, the temporal disaggregation method based on

mixed sources is or was used to estimate monthly data. Only exceptions are Greece and Denmark. For the latter, however, the results are based on very few vintages and should be interpreted with caution. The average revisions of the mixed-source series are much larger if only the months when new quarterly LFS data are introduced in the production process. Series based on mixed sources also show more extreme revisions. Almost all such series here considered have experienced revisions above 0.5 p.p., and more than half of these series have been revised at least once by one full p.p. or more, with peak revisions of 1.5 p.p. in two cases. For series based on other methods, the maximum revisions are generally smaller.

Revisions do not only concern the levels but also the month-on-month changes. Users are puzzled when an increase is turned into a stability or worse a decrease (or vice versa) one month later. Interesting enough, four countries present more than 40% of sign inconsistencies, each one following a different approach. Nonetheless, all *trend* countries and several *mixed source* countries show relatively high shares of sign inconsistencies. For the latter, these inconsistencies happen more frequently when new monthly LFS data are introduced in the estimation process.

Chart 2. RMSE for unemployment rates, seasonally adjusted



Series based on mixed sources show larger revisions more than those purely based on the LFS, which on the contrary are in general more volatile (except for trends). In order to provide a comparison of the two methods taking into account both aspects, we have computed a synthetic root mean square error (RMSE) including the variance and the mean square revision of the month-on-

month changes. Chart 2 ranks countries according to this RMSE. Most of the mixed-source countries lie in the left part of the chart, showing a larger RMSE. In addition, it should be considered that countries like Estonia and Greece are penalised by steep trends observed in recent years, while results for Denmark should be interpreted with caution, due to the limited number of vintages on which the bias is calculated.

3.3. Tests on turning point identification

Two aspects are concerned here when comparing the different approaches. A first one is if the different methods *tell* the same story, i.e. if the turning points show up at the same moment. A second aspect is instead the delay with which a turning point is identified; otherwise said, how many vintages occur for the curve to take the final shape around a turning point. We have checked these features on the countries for which several methods are applicable, either because they have changed method in recent years (this is the case for CZ, HU and DK), or because they transmit pure monthly LFS data (as for AT, CZ, DE, EL, FI, IT, NL, RO and SE). In the former case we have used the latest vintage obtained with the *new* method and the last vintage estimated with the *old* method. In the latter case, we have computed 3-month moving averages from the latest pure monthly LFS series in order to compare the two methods.

Concerning the question if the different methods tell the same story, the synthetic answer of our finding would be *"in general yes, with some exceptions"*. For our tests we focussed only on the turning point[3] when the economic crisis started, in 2007-2008. We find that the turning points generally show up at the same month or with a difference of one month[4] for all models and for seasonally-adjusted and trend series, with the only exception of Greece which shows a large gap between the pure monthly series and the 3 month moving averages. In addition, there is no approach which systematically anticipates the turning points compared to the others.

This shows that, once a sufficient number of months have elapsed and the turning point is behind us, all the different approaches are quite close in identifying it and it is impossible to establish a

[3] Here a *turning point*, a trough in this case, is defined as the first month-on-month increase (rounded at one decimal) in the unemployment rate after a period of decrease or stability, even if it is followed by some months of stability before a new increase.

[4] It should be considered that a mismatch of just one month may not be statistically significant. Indeed, when the first inversion is ± 0.1 p.p. it may be due to sampling errors or to rounding effects.

hierarchy. But the power of the different approaches to identify turning points is not the same at the moment when a turn happens. Chart 3 shows different vintages of monthly unemployment rates for Finland, estimated from pure monthly LFS data around the turning point of April 2008. Earlier vintages (the dots represent the last point of each of them) should be compared with the latest vintage, represented by the dotted line in the chart, for which the period around the turning point is consolidated and should no longer change with new data points. From the chart it clearly emerges that the trend remains rather flat until January 2009, and it is only with the February 2009 vintage, i.e. 10 months after the turning point, that the curve starts taking the shape of the final one.

Chart 3. Finland: Trend vintages of pure monthly LFS unemployed rates around the April 2008 turning point, *%*

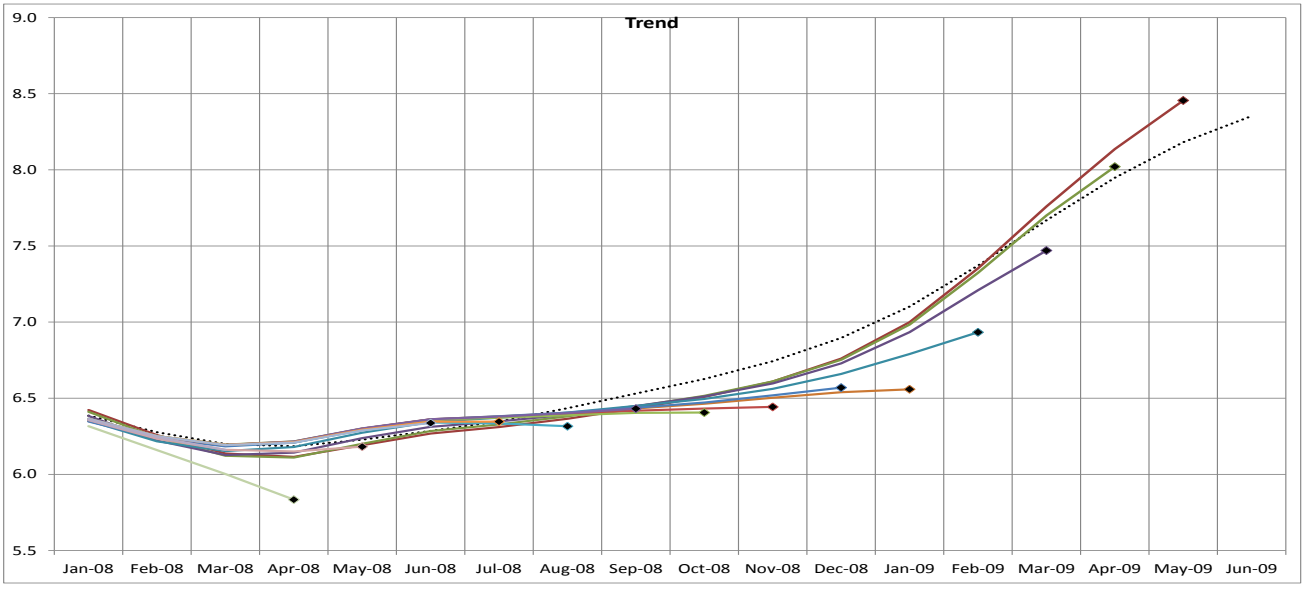


Table 3 provides a summary of the delay in the identification of turning points for the three different approaches, both for the seasonally adjusted series and the trends. In this respect, we have considered a delay equal to 0 (1, 2, etc.) if the turning month is identified as such by the first (second, third, etc.) vintage when it is included in the time series. If we exclude the extremely large delays of Germany and Italy for the 3 month moving averages, in general we can argue that pure monthly LFS and 3 month moving averages allow a fast detection of turning points. The number of cases is probably too small to draw conclusions on the mixed-source approach. Table 3 also allows a comparison between the power of seasonally adjusted series and trends in detecting turning points. It's clear that in several cases trends are definitely slower than seasonally adjusted series, doesn't matter the nature of the

unadjusted data. While trends often take several months before assuming the *real* shape, as chart 3 shows, seasonally adjusted series normally very quickly approach the final curve.

Table 3 - Delay in the identification of turning points (monthly vintages)

	SEASONALLY ADJUSTED			TRENDS		
	Monthly LFS	3MMA	Mixed sources	Monthly LFS	3MMA	Mixed sources
AT	0	0	-	4	1	-
CZ	0	0	5	1	0	5
DE	3	9	-	3	10	-
DK	-	0	5	-	4	9
EL	0	0	-	0	1	-
FI	0	0	-	3	5	-
HU	-	0	0	-	0	0
IT	1	14	-	13	10	-
NL	2	1	-	7	1	-
RO	0	1	-	3	1	-
SE	0	0	-	0	0	-

3.4. Timeliness

A comparison of the different approaches on the basis of their timeliness does not require any test. In general, administrative information on unemployment is available very quickly after the end of the reference month, which allows the mixed-source method to be timely. Eurostat always manages to publish data based on this method according to his target at t+30 days. The timeliness of the pure monthly LFS series is strictly related to the organisation of the LFS. All countries delivering data of this nature except one meet Eurostat's requirement. 3-month moving averages normally do not allow keeping the required timeliness. As a matter of facts, the last monthly data point is normally used in the average for the previous month. This entails a delay of 2 months when the LFS is efficiently organised, as in the case of Estonia and Hungary, and more when it is not. A possible solution, currently implemented by Denmark, would be to forecast the monthly series one month ahead before calculating the moving averages. This solution definitely improves timeliness, but has the potential drawback of revisions in case the forecast is not accurate.

4. Concluding remarks and way forward

Table 4 summarises pros and cons of the different approaches based on the results of the tests shown in chapter 3. The top part compares the three different approaches currently in use to produce unadjusted series (although the tests all concern SA figures), while the bottom part assesses pros and

cons of SA series versus trends, independently of the approach to estimate the unadjusted monthly data.

The table clearly shows that there is no ideal approach for the estimation of the unadjusted series, as each one has potential drawbacks. In addition, these conclusions provide a general assessment, but each approach should be singularly assessed at country level, as what does not work in a country may work well in another one, and vice versa.

Table 4 – Potential risks associated to different approaches

	Volatility	Revisions	Turning points identification	Timeliness
UNADJUSTED SERIES				
Pure monthly LFS	-	+	+	+
3-month moving averages of LFS data	+	+	+	-
Mixed sources	+	-	?	+
ADJUSTMENT				
Seasonally-adjusted series	=	=	+	NA
Trends	+	=	-	NA

It should also be considered that some of the potential issues related to the three approaches can be reduced by taking opportune measures. For instance, it is possible to streamline the organisation of the LFS and/or to use sophisticated estimation methods [6] [7] to reduce the volatility of pure monthly LFS series. The application of these methods may bring the volatility down to an acceptable level. In this case, this approach would definitely be the best one, as in general it has no other drawbacks. The timeliness of 3-month moving averages can be improved by forecasting one month ahead, as Denmark does. This option is to be evaluated against the subsequent risk of revisions. Anyway, at least in terms of levels revisions should remain small, as the forecast only counts for one third of the total data point. The issues related to the mixed-source approach are more difficult to overcome, as they stem from the nature of the data themselves and will always appear whenever the ILO and administrative unemployment diverge. On the other hand, we can clearly conclude that seasonally adjusted series are preferable to trends as in general the latter do not allow a timely identification of turning points. Seasonally-adjusted series are also more informative than trends, e.g. as they incorporate the effects of specific events affecting the results of given months. In the end, the performance of seasonally adjustment is strictly related to the quality of the unadjusted series.

The choice on the method will finally depend on the importance that producers and users attach to each potential issue. In the European Statistical System, where many actors are involved at the same time, a common understanding is definitely needed on criteria to choose one approach or reject another one. In order to discriminate between different approaches, it may therefore be necessary to define a synthetic, quantitative indicator like the RMSE presented in chapter 3, or a scoreboard of indicators, and determine acceptance or rejection thresholds.

A discussion with the Member States about this topic will start soon, on the basis of the findings of this paper and, if relevant, on the feedback from the Conference. In the meantime, Eurostat has organised initiatives to share experiences between users and data producers, including a Workshop on monthly unemployment, held in the Netherlands in November 2013, and trainings on estimation methods for monthly data to be held towards the end of this year. For the longer run, there are plans to streamline the LFS in a way to make it more suitable for the production of monthly results, in addition to the quarterly data which remain the main focus of the survey.

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