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# Seasonal Adjustment of European Aggregates: Direct versus Indirect Approach

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# Seasonal Adjustment of European Aggregates: Direct versus Indirect Approach

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## 1. Introduction

Most of the European and Euro-zone economic short term indicators are computed either through "horizontal" aggregation, e.g. by country, or through "vertical" aggregation, e.g. by sector, branch or product. To obtain seasonally adjusted figures, three main strategies can be used:

- The **direct approach**: the European indicator is first computed by aggregation of the raw data and then seasonally adjusted,
- The **indirect approach**: the raw data (for example the data by country) are first seasonally adjusted, all of them **with the same method and software**, and the European seasonally adjusted series is derived by aggregation of these series.
- The **spurious indirect approach**: each Member State seasonally adjusts its series**, with its own method and strategy**, and the European seasonally adjusted series is then derived as the aggregation of the adjusted national series.

These strategies produce often quite different results. The choice between the first two approaches has been the subject of articles and discussions for decades and there is still no consensus on the best method to use. On the contrary, some agreement appears in the literature on the fact that the decision has to be made case by case following some empirical rules and criteria (Dagum [2], European Central Bank [3], Lothian and Morry [8], Pfefferman and al [9], Planas and Capomlongo [10], Scott and Zadrozny [11] etc.).

The “spurious” approach is often used and, as it cannot be derived from a simple adjustment, is rarely compared to the others.

The choice between the methods cannot be based on accuracy and statistical considerations only. To publish timely estimates, Eurostat must often work with an incomplete set of national data. The indirect approaches imply estimation of missing raw and seasonally adjusted data and therefore different models have to be estimated, checked and updated. The direct approach is obviously easier to implement and would be preferred except if there is a strong evidence an indirect approach is better.

The second part of the paper is devoted to a detailed presentation of the direct versus indirect problem, its implications and some non statistical guidelines for the choice of a strategy. Section 3 presents the various quality measures that can be used to make the right choice and the methodology used in the application which concern the Gross Domestic Product (Section 4).. TRAMO-SEATS and X-12-ARIMA were used for these applications; the same quality measures have been computed for both softwares and, when possible the spurious indirect approach have been compared to the other approaches.

## 2. The Direct versus Indirect Problem

Nowadays it is common to decompose an observed time series $X_t$ into several components, themselves unobserved, according to for example an additive model: $X_t = TC_t + S_t + D_t + E_t + I_t$, where $TC_t$, $S_t$, $D_t$, $E_t$ and $I_t$ designate, respectively, the *trend-cycle*, the *seasonality*, the *trading-day effect*, the *Easter effect* and the *irregular* components. The seasonality $S_t$ and the calendar component ($D_t + E_t$) are removed from the observed time series to obtain the seasonally adjusted series $A_t = TC_t + I_t$. We will suppose from now on that $X_t$ is an European indicator computed by linear aggregation of *N* national; in this aggregation, each Member State *n* has a weight $\omega_n$. Therefore we have: $X_{n,t} = TC_{n,t} + S_{n,t} + D_{n,t} + E_{n,t} + I_{n,t}$ and $X_t = \sum_{n=1}^{N} \omega_n X_{n,t}$. Note that the weights can be positive and sum up to 1, as in the IPI case, or can be all equal to 1, as in the GDP case.

### 2.1 Direct, Indirect and Spurious Indirect Seasonal Adjustments

The seasonally adjusted series $A_t$ of the European aggregate $X_t$ can be derived from at least three different strategies:

- The **direct approach** consists in adjusting directly the aggregate. The direct seasonally adjusted series is noted $A_t^D$;
- In the indirect approach, all the national indicators $X_{n,t}$ are seasonally adjusted**, with the same method and software**, and the European seasonally adjusted series is then derived by aggregation. Thus we have: $A_t^I = \sum_{n=1}^{N} \omega_n A_{n,t}$
- In the **spurious indirect approach**: each Member State seasonally adjusts its series, **with its own method and strategy**, and the European seasonally adjusted series is

then derived as the aggregation of the adjusted national series. The spurious indirect seasonally adjusted series is noted $A_t^S$ .

The multivariate approach, which permits to derive simultaneously the seasonally adjusted series for the aggregate and the components, must be mentioned at this stage as an alternative. This method has been proposed for many years (Geweke [5]) but given its computational complexity, the limitations of existing softwares and its lack of optimality with respect to revision errors, it is rarely used in practice and the univariate approaches are generally preferred.

The spurious indirect approach is a quite popular strategy but, as it does not result from a simple seasonal adjustment process, it is scarcely studied by itself. The national seasonal adjustment policies can substantially differ:

- The methods are often different; some countries use a model based approach (TRAMO-SEATS, STAMP) or a non parametric approach (X-11 family);
- the software, or the release, that implements the method can itself differ: X-11, X-11-ARIMA and X-12-ARIMA are currently in use in European countries; the same occurs for various versions of TRAMO-SEATS.
- The revision policies can vary (current or concurrent seasonal adjustments);
- Member States can perform themselves direct or indirect seasonal adjustments;
- The strategy for the correction of calendar effects is usually not the same, the seasonal adjustments are not performed on the same span of time, etc.

All these differences show how it is difficult to compare, from the theoretical point of view, the spurious indirect seasonal adjustment to the direct and indirect ones. Furthermore, these three strategies are not the only possible ones and we can imagine for example a mixed approach: a subset of the basic series can be first aggregated in one new component, this component and the remaining sub-series can then be adjusted and the adjusted aggregate derived by implication. In fact this procedure is frequently used since many of what are considered the basic components are themselves aggregates of other components, although the latter are not always observed separately (Pfefferman [9]).

### 2.2 Could Direct and Indirect Approaches Coincide ?

As far as the aggregate is a linear combination of the components and the seasonal adjustment is a non-linear process, the answer is generally no, except under some very restrictive conditions (see for example Pfefferman [9]). Thus, if the aggregate is an algebraic sum (GDP for example), if the decomposition model is purely additive, if there is no outlier in the series and if the global filter used in the seasonal adjustment process is the same for all series, the two approaches are equivalent. Clearly the reality is much more complex:

- For the majority of economic series the additive model is not the most appropriate and the series are adjusted using the multiplicative option; and a logarithmic transformation will not ensure the equivalence.
- Outliers are frequently present in economic time series as the result of structural changes, anomalous conditions, external shocks etc.
- For model-based approaches, such as TRAMO-SEATS, the filter used for the seasonal adjustment is optimally derived from the characteristics of the series. As a different filter is associated to each series, direct and indirect adjustments would never coincide.

On the other hand, it may occur that sub-series are not very noisy, show a very similar trend-cycle or seasonal pattern and are affected more or less by the same external shocks. In these conditions, the direct and indirect approaches could not be too different.

### 2.3 A Priori Advantages and Drawbacks

The choice between direct, indirect and spurious adjustment can be guided by some statistical or non statistical considerations or by some *a priori* desirable properties.

*1. The additivity constraint and the indirect approaches*

The additivity constraint plays an important role in some domains (quarterly national accounts, balance of payments) or has to be assured as the consequence of a legal act (external trade). Then the indirect or the spurious indirect approaches appear to be the relevant ones. Furthermore, the spurious indirect approach seems to imply there is no discrepancy between national figures and European data. Some points must be precised:

- Even with a direct approach it is always possible to assure ex-post the additivity constraint by distributing the discrepancies with adequate statistical methods.
- The additivity constraint is verified on the levels of the series. But users are more generally concerned with growth rates. The indirect growth rate is a weighted average of the sub-series growth rates, with weights that sum up to 1. Therefore, the indirect growth rate is always between the smaller and the larger sub-series growth rate and in that sense, the indirect approach is consistent. But you can have a majority of sub-series increasing while the global growth rate decreases (see Sections 3 and 4).
- The additivity constraint has nothing to do with either the time consistency problem, requiring for example that quarterly and annual figures have to be coherent, or the consistency between raw and adjusted data annual totals.

*2. Some "statistical" considerations*

Most of the statisticians agree on one point: if the sub-components do not have similar characteristics or if the relative importance of the sub-series (in terms of weight) is changing very fast, indirect adjustment should be preferred. From the opposite point of view (Dagum [2]), if the sub-series have a similar seasonal and more or less the same timing in their peaks and troughs, the direct approach have to be used. The aggregation will produce a smoother series with no loss of information on the seasonal pattern.

On one hand, as some studies show a synchronization of the cycles in the European Union (see for example Blake and al [1]), the direct approach should be preferred. On the other hand, some countries have strong specificities and this point is of great importance with respect to the forthcoming enlargement of the Union.

A "mixed" two-step approach could be studied: a first direct approach for groups of similar series and then an indirect approach for the estimation of the final seasonally adjusted aggregate. Finally, one must note that following this idea of similarity of the sub-series, the direct approach should be more adapted to "horizontal" aggregation, e.g. by country, and the indirect approach to "vertical" aggregation, e.g. by sector, branch or product.

The spurious indirect approach poses serious methodological problems for further statistical analysis of the aggregate. As Member States use in general different methods, they also implicitly use different definitions of the trend-cycle and the seasonality. As seasonal adjusted series are unfortunately often used in econometric modelling, this could generate artefacts and spurious relationships which could spoil the quality of the estimations and mislead the interpretation of the results. Of course, these undesirable effects are more evident for the end points of the series and can have negative implications for the construction of flash estimates, nowcasting and coincident or leading indicators.

*3. Production consequences*
Eurostat calculates European and Euro-zone aggregates from national data. As national indicators are not produced at the same time by all Member States, Eurostat has to impute missing information using some modelling of the concerned series, in order to publish timely figures. As an example, Eurostat must publish the European IPI roughly 45 days after the end of the month but at that date the results for only six countries are available. A truly spurious indirect approach is impossible regarding the delays; an indirect approach implies to estimate and seasonally adjust missing national IPI (6 for the Euro-zone); a direct approach requires much less work as it implies only to estimate and seasonally adjust the aggregate. Once more the usual trade-off between accuracy and timeliness has to be taken into account in the choice of the “optimal” method.

## 3. Methodology

To assess empirically the quality of the different approaches, some problems have to be solved. The first one is that the effect of the aggregation strategy must be isolated from the other numerous sources of variation. The second problem resides in the definition of quality indicators that should be computed for the different approaches. And the last one is a computational problem as the two main softwares currently used, TRAMO-SEATS and X-12-ARIMA, do not provide the user with a common set of quality statistics.

### 3.1 Various Causes of Revisions

Seasonally adjusted figures are usually subject to revisions that can be the consequences of numerous causes. For example, at the European level, we can underline: imputation of national data not yet available, adjustment policy (current or concurrent adjustment), modification of the adjustment parameters, treatment of outliers, estimation of calendar effects, impact of new data etc. and the same causes at the national level.
In order to study the direct versus indirect problem, it would be preferable to isolate the variations only due to this problem and therefore to work with quite stable time series and under stable assumptions. For instance, the series could be first cleaned from any calendar effect or outlier, the decomposition model could be fixed etc. Unfortunately, it is quite difficult to measure the relative importance of each source of revisions.

### 3.2 Quality Measures

There is no real consensus on the measures to assess the quality of a seasonal adjustment, and that explains the large number of criteria one can find in the literature. Several aspects of the seasonal adjustment can be addressed and, for each of them, some criteria are defined.

*1. How different the various approaches really are ?*

The results of the three approaches are compared to see how important the direct vs indirect problem is. The mean and the maximum of the absolute percentage deviation series $\left|1-\left(A_t^D / A_t^I\right)\right|$ can be calculated: for each couple of possible approaches; for the seasonally adjusted series, the trend-cycle estimates and the seasonal components; for the two softwares TRAMO-SEATS and X-12-ARIMA; on the complete series and on the last three years. Users pay a lot of attention to the growth rate of the seasonally adjusted series. The mean and the range of the series of the growth rate differences can therefore be computed and checked.

*2. Inconsistencies*

Moreover, the various seasonally adjusted series should deliver more or less the same message and their growth rates should have the same sign. To measure the degree of consistency in growth rates, two statistics are computed: C1 measures the global percentage of concordance between the direct and indirect series; C2 measures the percentage of concordance between the seasonally adjusted series and the national adjusted series.
An inconsistency in the growth rates is detected when the aggregate does not evolve as the majority, in terms of weight, of adjusted sub-series.

*3. Quality of the seasonal adjustment*

X-12-ARIMA proposes a set of M and Q-statistics to assess the quality of the seasonal Adjustment[1]. These statistics have been adapted when possible to the TRAMO-SEATS estimates.

*4. Roughness of the components*

Dagum ([2]) proposed two measures of roughness of the seasonally adjusted aggregates. The first one is the $L_2$-norm of the differenced series: $R_1 = \sum_{t=2}^{T}\left(A_t - A_{t-1}\right)^2 = \sum_{t=2}^{T}\left(\nabla A_t\right)^2$.
The second one is based on the 13-term Henderson filter: the adjusted series is smoothed with the Henderson filter and $R_2$ is defined as the $L_2$-norm of the residuals: $R_2 = \sum_{t=1}^{T}\left(A_t - H_{13}A_t\right)^2 = \sum_{t=1}^{T}\left[\left(I - H_{13}\right)A_t\right]^2$. The rationale of these measures of roughness is that the involved filters (the first difference operator and $I$ - $H_{13}$) are high-pass filters that remove most of the low frequencies components that correspond to the trend-cycle variations. In other words, these statistics measure the size of the deviations to a smooth trend, e.g. the size of an "irregular component". This is why Pfefferman ([9]) suggested a "natural" third measure, a measure of similarity between seasonally adjusted data and trend: $R_3 = \sum_{t=1}^{T}\left(A_t - TC_t\right)^2$.
Indeed, there is no fundamental reason why a seasonally adjusted series should be smooth as the irregular component, a characteristic of the series, is a part of the seasonally adjusted series. Gomez and Maravall ([6]) prefer to focus the quality measures on the other components, the trend-cycle and the seasonality. For the seasonality, they use the criteria $Mar(S) = \sum_{t=1}^{T}\left[\left(1 + B + \ldots + B^{11}\right)S_t\right]^2$. The smoothness of the trend-cycle is measured by

[1] For a precise definition and the interpretation of these statistics, one can refer to Ladiray, Quenneville [7]

the $L_2$-norm of the first and the second differences: $Mar1(TC) = \sum_{t=2}^{T} (\nabla TC_t)^2$ and $Mar2(TC) = \sum_{t=3}^{T} (\nabla^2 TC_t)^2$. All these measures can be computed on the direct, indirect and spurious indirect adjustments, on the estimates obtained from TRAMO-SEATS and X-12-ARIMA and on the complete series or only on the last three years.

*5. Idempotency*

A seasonal (and trading-day and holiday) adjustment that leaves detectable residual seasonal and calendar effects in the adjusted series is usually regarded as unsatisfactory. X-12-ARIMA and TRAMO-SEATS are used on the three seasonally adjusted series and the usual tests proposed by these softwares are used to check for idempotency.

*6. Stability of the seasonally adjusted series*

Even if no residual effects are detected, the adjustment will be unsatisfactory if the adjusted values undergo large revisions when they are recalculated as future time series values become available. Frequent and substantial revisions cause data users to lose confidence in the usefulness of adjusted data. Such instabilities can be the unavoidable result of the presence of highly variable seasonal or trend movements in the series being adjusted. But, in any case, they have to be measured and checked. X-12-ARIMA includes two types of stability diagnostics: sliding spans and revision histories (see Findley and al. [4], US Bureau of Census [12]). Some of these diagnostics are used here: the mean and standard deviation of the absolute revisions after $k$ periods; the two most important sliding spans A(%), percentage of dates with unstable adjustments, and MM(%), percentage of dates with unstable month-to-month percent changes.

*7. Characteristics of the irregular component*

The irregular component should not present any structure or residual seasonality. The irregulars derived from the various approaches are analysed both with the TRAMO automatic modelling module and the X-12-ARIMA software. The usual tests proposed by these softwares are used to check the randomness of the irregular components.

### 3.3 Softwares, Programs and Parameters

TRAMO-SEATS (version 98) and X-12-ARIMA (version 0.2.8) have been used in the applications[2]. A dedicated SAS program manages the two softwares and calculates all the quality statistics for the direct and indirect approach and most of them for the spurious indirect approach. Some specific features have been implemented in order to simulate different adjustment policies. For example, the series can be cleaned from calendar effects or outliers before any adjustment is performed. The decomposition model can be, or not, fixed by the user etc.

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[2] The versions of the softwares that can be download the two following addresses: http://www.bde.es/servicio/software/softwaree.htm and http://ftp.census.gov/pub/ts/x12a/final/pc/.

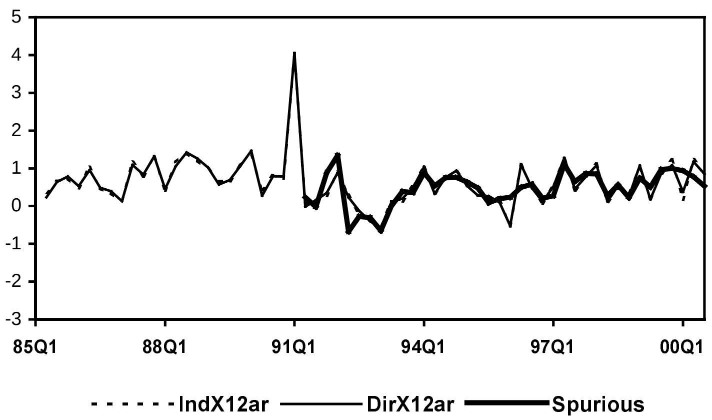
## 4. Quarterly National Accounts

In this application, devoted to a specific aggregate (GDP), we will just present the main results. More detailed tables and graphics can be obtained from the authors.
We used Quarterly Gross Domestic Product in volume, from 1985Q1 to 2000Q3, for the whole economy of the 7 countries compiling Quarterly National Accounts for a long time in the Euro-zone: Belgium, Germany, Spain, France, Italy, Netherlands and Finland. Official Euro-zone GDP series is obtained through an estimation procedure based on seasonally adjusted data from Member states (the so-called spurious series). The sum of seasonal adjusted data of the seven countries will be used for the spurious estimate; it is only available from 1991Q1 to 2000Q3.

**Table 1**: Absolute Percentage Deviation Indicators.

| | Indirect vs Direct | | |
|---|---|---|---|
| Indicator | Seats | X-12 | Best |
| Mean APD (SA) | 0.082 | 0.033 | X12ar |
| Max APD (SA) | 0.428 | 0.120 | X12ar |
| Mean APD (SA), Last 3 years | 0.042 | 0.042 | X12ar |
| Max APD (SA), Last 3 years | 0.160 | 0.120 | X12ar |
| Mean APD (TC) | 0.147 | 0.072 | X12ar |
| Max APD (TC) | 1.470 | 0.785 | X12ar |
| Mean APD (TC), Last 3 years | 0.064 | 0.048 | X12ar |
| Max APD (TC), Last 3 years | 0.133 | 0.093 | X12ar |
| Mean APD (S) | 0.082 | 0.258 | Seats |
| Max APD (S) | 0.427 | 1.001 | Seats |
| Mean APD (S), Last 3 years | 0.042 | 0.261 | Seats |
| Max APD (S), Last 3 years | 0.161 | 1.001 | Seats |

**Figure 1**: Growth rates of the Direct, Indirect and Spurious estimates (X-12-ARIMA).




From Table 1 and Figure 1, we can point out that the differences between the three approaches are quite small, and the Mean Absolute Percentage Deviation is smaller than 0.1%. X-12-ARIMA gives in general smaller differences, especially for the seasonally adjusted series and the trend-cycle. TRAMO-SEATS gives a more similar seasonality.

In general, Direct and Indirect estimates give the same message and the rate of concordance of their growth rates is around 98%. This is a very good point. Nevertheless, we can point out some cases (Table 2) where the Euro-zone GDP does not evolve as the majority of national GDPs. In that case, the indirect approach performs slightly better than the direct approach. For SEATS, the concordance rates between the growth rates of the aggregate and the national component are 100% for the indirect and 98.4% for the direct approach.

**Table 2**: Inconsistency between components and aggregates growth rates; Components mostly decrease and aggregate increases

| | Date | BE | DE | ES | FR | IT | NL | FI | Indirect | Direct |
|---|---|---|---|---|---|---|---|---|---|---|
| Tramo-Seats | 92Q4 | -1.73 | 0.31 | -0.51 | -0.18 | -0.53 | 0.42 | 0.08 | -0.10 | 0.02 |
| X-12-ARIMA | 93Q2 | 0.65 | 0.46 | -0.26 | -0.18 | -0.10 | 0.27 | -0.51 | 0.12 | 0.10 |
| Spurious | 91Q3 | -0.76 | 0.76 | -0.32 | -0.44 | -0.63 | -0.28 | 1.32 | 0.02 | |

**Table 3**: Quality statistics for the seasonal adjustment

| | Indirect | | Direct | |
|---|---|---|---|---|
| Indicator | Seats | X-12 | Seats | X-12 |
| M1* | 0.033 | 0.035 | 0.013 | 0.018 |
| M2* | 0.094 | 0.056 | 0.021 | 0.035 |
| M3* | 0.000 | 0.000 | 0.000 | 0.000 |
| M4 | 0.039 | 0.667 | 0.667 | 0.431 |
| M5 | 0.200 | 0.200 | 0.200 | 0.200 |
| M7* | 0.548 | 0.545 | 0.443 | 0.538 |
| M8 | 1.008 | 1.838 | 0.864 | 0.390 |
| M9 | 0.290 | 0.376 | 0.340 | 0.261 |
| M10 | 1.067 | 1.935 | 0.684 | 0.353 |
| M11 | 0.309 | 0.610 | 0.311 | 0.288 |
| Q | 0.315 | 0.489 | 0.314 | 0.256 |

A comparison between direct and indirect adjustment can be also made with respect to the so-called quality measures proposed by X-12-ARIMA and here extended, where possible, to TRAMO-SEATS results. Those measures, presented in Table 3, shows that there is globally no problem in the adjustments even if the adjustment is better in the direct case (no statistics are greater than one). These results can be view as an empirical confirmation of the consideration proposed in Section 2. In other word, the increasing synchronisation of cycles and the similarity of seasonal components among Member States, lead towards a slight preference in favour of the direct approach.

As far as the smoothness of the components is concerned, the main results presented in Table 4 do not permit to draw very clear conclusions concerning the right approach. SEATS seems to give smoother results than X-12-ARIMA but no real preference for one strategy. Note also that the spurious adjustment gives intermediate results.

**Table 4**: Roughness measures of the components.

| | Indirect | | Direct | | Spurious | Indirect | Seats |
|---|---|---|---|---|---|---|---|
| Indicator | Seats | X-12 | Seats | X-12 | | vs Direct | vs X12 |
| R1 (SA) | 9509.8 | 10387.2 | 9596.3 | 10396.6 | 8175.7 | I | Seats |
| R1 (SA), Last 3 years | 9302.6 | 10915.7 | 9518.2 | 10674.6 | 9692.8 | D or I | Seats |
| R2 (SA) | 0.150 | 0.193 | 0.148 | 0.194 | 0.106 | D or I | Seats |
| R2 (SA), Last 3 years | 0.089 | 0.168 | 0.102 | 0.159 | 0.093 | D or I | Seats |
| R3 (SA) | 0.260 | 0.202 | 0.125 | 0.158 | | D | S or X |
| R3 (SA), Last 3 years | 0.074 | 0.182 | 0.093 | 0.164 | | D or I | Seats |
| Mar (TC, 1) | 8982.9 | 9100.9 | 9098.2 | 9546.2 | | I | Seats |
| Mar (TC, 1), Last 3 years | 9198.2 | 9846.1 | 9200.8 | 9693.3 | | D or I | Seats |
| Mar (TC, 2) | 6063.8 | 4465.7 | 5684.1 | 7028.8 | | D or I | S or X |
| Mar (TC, 2), Last 3 years | 1695.1 | 2757.8 | 2090.5 | 2591.9 | | D or I | Seats |
| Mar (S) | 0.028 | 0.061 | 0.030 | 0.013 | | D or I | S or X |
| Mar (S), Last 3 years | 0.018 | 0.044 | 0.016 | 0.008 | | D | S or X |

**Table 5**: Revision analysis

| | Indirect | | Direct | | Indirect vs Direct | |
|---|---|---|---|---|---|---|
| Indicator | Seats | X-12 | Seats | X-12 | Seats | X-12 |
| Mean AR 1 quarter | 0.215 | 0.122 | 0.170 | 0.195 | D | I |
| Mean AR 2 quarters | 0.219 | 0.132 | 0.178 | 0.193 | D | I |
| Mean AR 3 quarters | 0.237 | 0.123 | 0.191 | 0.216 | D | I |
| Mean AR 4 quarters | 0.216 | 0.128 | 0.180 | 0.225 | D | I |
| Mean AR 5 quarters | 0.239 | 0.150 | 0.195 | 0.229 | D | I |
| Std AR 1 quarter | 0.166 | 0.080 | 0.120 | 0.114 | D | I |
| Std AR 2 quarters | 0.148 | 0.083 | 0.131 | 0.108 | D | I |
| Std AR 3 quarters | 0.147 | 0.083 | 0.143 | 0.122 | D | I |
| Std AR 4 quarters | 0.173 | 0.118 | 0.123 | 0.140 | D | I |
| Std AR 5 quarters | 0.157 | 0.156 | 0.135 | 0.181 | D | I |
| A(%) | 0.000 | 0.000 | 0.000 | 0.000 | D or I | D or I |
| MM(%) | 0.000 | 0.000 | 0.000 | 0.000 | D or I | D or I |

As far as revision analysis is concerned, the result is once more quite unclear (Table 5). SEATS gives better results with the direct approach and X-12-ARIMA with the indirect approach.

**Table 6**: Analysis of the residuals

| | Indirect SEATS | Direct SEATS | Indirect X12 | Direct X12 |
|---|---|---|---|---|
| model_t | (1,0,0)(0,0,0) | (1,0,1)(0,0,1) | (0,0,1)(0,0,0) | (0,0,1)(0,0,0) |
| transf_t | None | None | Log | Log |
| pljung1_t | 0.042 | 0.189 | 0.635 | 0.696 |
| pljung2_t | 0.903 | 0.927 | 0.176 | 0.199 |
| dw | 2.008 | 2.553 | 2.385 | 2 |
| aols | Y | N | N | Y |
| mean | Y | Y | N | N |
| trad | Y | N | N | N |
| east | N | Y | N | N |

The estimated residual components have been analysed with the TRAMO automatic modelling routine. The results are presented in Table 6. Concerning X-12-ARIMA, one can note that the non-seasonal part of the ARIMA model, is identified an MA(1) structure for both approaches. By contrast, the seasonal part of the ARIMA model is completely white, which is for the indirect adjustment in slight contradiction with the M8 measure proposed in Table 3. The situation is more complex for the residuals produced by TRAMO-SEATS. The non-seasonal part of the direct adjustment is characterised by an ARMA(1,1) which means that at least a part of the systematic component was left in the irregular component. By contrast the indirect adjustment is characterised by an AR(1) which is anyway not a good sign since the AR part of the stochastic process generally represents its inertia. Concerning the seasonal part, we observe an MA(1) in the case of direct adjustment, meaning that there is a seasonal component left in the irregular, while the indirect approach shows a white seasonal part. Apart from the outlier detection, the residuals of direct and indirect adjustment produced by X-12-ARIMA are quite similar. By contrast for TRAMO-SEATS, the characteristics of the residual differ considerably, showing that the effect of the model based filter can be quite different when applied directly to the aggregate or individually component by component.

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