

# Proposed changes to the compilation of zone aggregates for monetary aggregates and other variables in the OECD Main Economic Indicators publication

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## Summary

The Main Economic Indicators (MEI) has traditionally published a range of OECD zone aggregates for the narrow money and broad money concepts of monetary aggregates. These zones have been compiled on a fixed weight basis, with the weights being updated every five years coinciding with the change in OECD base year, the last update being in the summer of 2004 with the introduction of base year 2000=100. The current variable used to weight countries data consists of the underlying series value for the country in the year 2000 adjusted for purchasing power parity. There are a number of deficiencies in this current methodology for compiling zone aggregates of monetary aggregates which have lead the OECD to study a new approach. Some of the key problems with the current approach are:

1) Fixed weight zone aggregate indexes are biased for nominal variables such as monetary aggregates. Ideally, a process of annual chain linking should be used for compiling zone aggregates for monetary aggregates which is the current practice for other nominal variables published in the part 1 subject tables of the MEI, namely the consumer price index, producer price index, hourly earnings in manufacturing and unit labour costs.

2) The definition of the weighting variable used for each country should be the same. However, the weighting variable currently used is not the same across all countries. This leads to some countries having either a higher or lower weight than appropriate.

3) For the OECD zone aggregates of 'OECD-total excluding high inflation countries' and 'OECD-Europe excluding high inflation countries', the only country currently excluded is Turkey. However, other countries which experienced high inflation for long time periods in the past (e.g. Mexico, Greece, Portugal) should be excluded from contributing to the historical part of the time series when they experienced high inflation. However, under a fixed weight approach this is not possible, thus significantly reducing the analytical value of these zone aggregates.

This article provides more detail on each of the above problems, and then presents a set of indicative series as proposed new zone aggregates for monetary aggregates. New series for 'OECD-total excluding high inflation countries' are also proposed for consumer prices indices and producer price indices, together with the introduction of chain-linked zone aggregates (with re-weighting and linking every five years) for the index of industrial production and retail trade volume. All (indicative<sup>1</sup>) proposed new series can be reviewed in the Excel spreadsheet available at <http://www.oecd.org/dataoecd/58/20/39733396.xls>. User feedback on these proposed changes is now invited by emailing [stat.contact@oecd.org](mailto:stat.contact@oecd.org). The current intention is to introduce the new series in the February 2008 edition of the MEI.

## 1. Fixed weight vs chain indexes

A fixed weight zone aggregate index uses the same set of country weights for the entire time series. Conversely, chain indexes allow for different weights to be used for different segments of the time series which are then chained together. This chaining may be done frequently, e.g. annually, at regular intervals (e.g. five yearly), or at some other irregular interval. It seems intuitive that a key advantage of chaining over using fixed weights would be that the weights used to aggregate country data relate to a time period which accords with the data being aggregated and thus allows for changes in the relative importance of countries over time.

Algebraically, one can show that fixed weight series are also significantly biased for nominal variables such as consumer prices and monetary aggregates. The same can be true for volume based variables such as the index of industrial production, although this can depend on the weighting variable used. International manuals which provide guidelines for compiling time series at national level for both volume variables (e.g. for components of the national accounts, see IMF 2001) and nominal variables (e.g. producer prices, see IMF 2004) strongly recommend the use of chaining at annual frequency. OECD research has shown that the bias associated with not chaining nominal variables such as consumer prices and monetary aggregates when compiling zone aggregates is significant, although it is less evident for volume series such as the index of industrial production.

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<sup>1</sup> The proposed series are referred to as 'indicative', reflecting the fact that they may undergo slight revisions when implemented within the MEI production system.

The following simplified algebra is presented to demonstrate the bias associated with fixed weight zone aggregate indexes for nominal variables and how frequent chaining can effectively overcome this.

**Notation**

- t = Linking point
- Z<sub>t-1</sub> = Zone estimate before linking point, based on old weights (series of chain links)
- Z<sub>t</sub> = Zone estimate for a data item at time t
- C<sub>i,t</sub> = Value of data item reported for country i at time t (as an index)
- R = Set of countries belonging to zone Z
- w<sub>i</sub> = Weight of country i in the latest weighting period relevant for the current link

**Chain linked formula for zone aggregates of indices**

$$Z_t = Z_{t-1} * \sum_{i \in R} w_i * \left( \frac{C_{i,t}}{C_{i,t-1}} \right) \dots\dots\dots(1)$$

How does this differ from a fixed weight formula?

$$Z_t = \sum_{i \in R} w_i * C_{i,t} \dots\dots\dots(2)$$

Here the value of the zone is recalculated for all time points prior to t (i.e. from the start of the series) whenever the weighting base year is changed

**Why chain link?**

- Intuition, does it make sense to combine countries’ data for 1960 with weights of 2000 or vice versa?
- What does it really mean algebraically?

If we start with the standard fixed weight formula:

$$Z_t = \sum_{i \in R} w_i * C_{i,t}$$

and then multiply by C<sub>i,t-1</sub> / C<sub>i,t-1</sub>

we obtain:

$$Z_t = \sum_{i \in R} (w_i * C_{i,t-1}) * (C_{i,t} / C_{i,t-1}) \dots\dots\dots(3)$$

Expressing the formula in this way we see that the weight of country i’s contribution to the index value is w<sub>i</sub> \* C<sub>i,t-1</sub> and is thus affected by the level of the series i.e. C<sub>i,t-1</sub>. Thus countries whose index values have grown faster since the base year (where all countries start with the same value, i.e. 100) will have a higher impact on the current value of the series and thus the zone will be biased upwards. Equivalently, prior to the base year, for those countries with higher growth rates in the past the C<sub>i,t-1</sub> will decrease faster and the zone estimate will be biased upwards. This means zone aggregate growth rates are actually biased **upwards** after the base year and **downwards** before the base year. Hence the formula and degree of bias is dependent on both the base year and the values of C<sub>i,t-1</sub>. The difference with the chain linking formula is that it only depends on the countries’ growth rate since the last link.

Given that nominal series (e.g. consumer prices, monetary aggregates, hourly earnings) are strongly influenced by inflation which can vary considerably across countries (particularly in the past for OECD countries), the potential for bias in zone aggregates for these series is considerable. This concept is perhaps easier to understand if we look at the formula for zone growth rates.

## Formula for zone growth rates

Fixed weight formula for zone growth rates:

$$Z_t / Z_{t-1} = \frac{\sum_{i \in R} (w_i * C_{i,t-1}) * (C_{i,t} / C_{i,t-1})}{\sum_{i \in R} w_i * C_{i,t-1}} \dots\dots\dots(4)$$

(In the above formula we have used the expanded version of the fixed weight zone formula, i.e. equation (3) as the numerator and the simple version, i.e. equation (2) as the denominator)

Equation 4 can be viewed as a standard weighted average formula where the weight of country i is:  $w_i * C_{i,t-1}$ . That is the weight of country i is dependent on the value of the series  $C_{i,t-1}$  (whose level is dependent on the base year). Hence the zone growth rates are biased upwards after the base year where the value of  $C_{i,t-1}$  gets very high for countries with high growth rates, and biased downwards prior to the base year where the value of  $C_{i,t-1}$  gets very low for countries with high growth rates (e.g. the index value for Turkey in broad money (M3) with a base year of 2000=100 has been rounded to zero by about 1983).

whereas for the chain link formula:

$$Z_t / Z_{t-1} = \left( Z_{t-1} * \sum_{i \in R} w_i * \left( \frac{C_{i,t}}{C_{i,t-1}} \right) \right) / Z_{t-1}$$

$$= \sum_{i \in R} w_i * \left( \frac{C_{i,t}}{C_{i,t-1}} \right) \dots\dots\dots(5)$$

Equation 5 can be viewed as a standard weighted average formula where the weight of country i is  $w_i$  (as the sum of the  $w_i$  is 1). That is the weight of country i is independent of the value of the series  $C_{i,t-1}$  and thus independent of the choice of base year also.

### Main conclusion from the theory

If we reweight our zone aggregates and do not chain link, we risk causing a large bias, in particular for nominal series where annual linking is recommended to minimise the impact of such potential bias. As a consequence, a set of experimental zone aggregate indexes for narrow money and broad money have been compiled on this basis as outlined in Section 4. In addition, it is proposed to use this approach for compiling zone aggregates for retail trade volume and the index of industry production. However, empirical research has shown that five yearly chain-linking is sufficient for these subjects to counter the effects of potential bias.

## 2. Weights used for compiling zone aggregates for monetary aggregates

For monetary aggregates the MEI compiles zone aggregates for:

- 1) Narrow money, for which the target variable is M1, defined as currency in circulation (notes, coins and overnight deposits).
- 2) Broad money, for which the target variable is M3, defined as M1 plus deposits and debt securities with a maturity of up to two years or redeemable with a notice up to three months, repurchase agreements and money market fund shares / units.

The current country weights used are the value of the above series for each country in the year 2000, adjusted for purchasing power parity (PPP) using gross domestic product (GDP) based PPPs. Despite the problems with the use of fixed weights as outlined above, other problems with this approach include:

- Not all countries have available the target series of M1 and M3 and thus the national series which are closest to these definitions are used as proxies. This is generally acceptable for the purpose of assessing the evolution over time of monetary aggregates and making comparisons across countries. However, when used as weights, countries where proxy series are used will be over or underweighted depending on the inclusions or exclusions of the proxy series relative to the target. In some cases this can result in a significant over or under representation of a country in the relevant zone aggregate.
- The current approach uses fixed weights based on country data in 2000 at the time the weights are changed. However, countries may often subsequently revise their time series and such changes are not reflected in the weights.

- Because monetary aggregates are nominal series in national currency, they must be converted to a common currency for the purpose of using them as weights. The standard approach used by the OECD is to convert series to a common currency using PPPs. However, PPPs are based on the relative prices across countries for components of GDP, and therefore GDP based PPPs may not be entirely appropriate for adjusting monetary aggregate series to a common currency. An alternative could be to use exchange rates; however the volatility of exchange rates may lead to large fluctuations in weights between years which is also undesirable.

A solution to the above issue would be to use a weighting variable which is uniform across countries, reflects changes in countries relative economic structures and has a relatively stable development over time. The suggested variable which is commonly used for the purposes of compiling weights for zone aggregates is GDP in national currency at current prices converted to a common currency using GDP PPPs. This is the weighting variable used to compile the experimental indexes as presented in Section 4.

### 3. Producing zone aggregates excluding *high inflation countries*

The Main Economic Indicators has historically published a time series for the OECD-total and OECD-Europe zone aggregates which exclude high inflation countries for the key nominal series of consumer prices, producer prices, hourly earnings in manufacturing and monetary aggregates. The definition of high inflation countries was previously based on a loosely defined definition of *those countries having inflation rates of greater than 10% per annum on average in the previous ten year period where inflation is measured using the GDP implicit price deflator*. At the time of the change in OECD base year to 2000=100 for MEI in the summer of 2004 which included the updating of weights for OECD zones for all subjects, a decision was made that only Turkey met the criterion of a high inflation country, whereas immediately prior Mexico, Poland and Hungary had also been included in this group. As a result, the entire time series for OECD zone aggregates excluding high inflation countries were recompiled only excluding Turkey which lead to substantial upward revisions to the time series of year-on-year growth rates for these series.

It would clearly have been more appropriate to produce a historical series where the composition of the group of high inflation countries is allowed to change over time, which would naturally require the use of chain-linking rather than fixed weight series as a pre-requisite. However, strict application of the above definition of a high inflation country would have lead to many countries being included or excluded for different parts of the time series. It would also have resulted in large countries such as France, Italy, Spain and the United Kingdom being excluded from the zone aggregate for large parts of the historical series which would therefore have diminished the significance of the zone as a statistical benchmark.

Consequently, it became apparent that the OECD needed to develop a historical reference chronology to define periods whereby OECD Member countries would be regarded as ‘high inflation countries’ and use this chronology as the basis for compiling the historical time series for zone aggregates which exclude these high inflation countries. The chronology which has been developed as shown in Table 1 below is derived from the following assessment framework which aimed to be sufficiently robust statistically and also logical from a common sense / practical perspective.

#### *Statistical assessments*

The following two broad statistical assessments were considered in regards to deciding whether a country should be classified as having high inflation over a particular period of time.

(1) A country should exceed some ‘average’ rate of inflation

This is a difficult criteria to apply on its own because the results depend on the type of average used (e.g. if a moving average is used should it be over the last 10 years, 5 years, 3 years?). However the main problem is that average rates of inflation are dependent on the relative economic situation throughout time. For example 10% inflation would be considered very high in 2000 but quite moderate in 1975.

(2) A country should exceed some ‘benchmark’ rate of inflation

A logical point of comparison would be to compare a countries’ rate of inflation as defined by the GDP deflator to the OECD-total. A difficult issue then is to decide how much above the benchmark is tolerable (e.g. 10%?) and whether this should be averaged over some period of time (e.g. 3, 5 or 10 years?). This measure would also be affected by the relative economic situation throughout time; although not to the same extent as in option 1 above (e.g. 20% inflation compared to a benchmark rate of 10% might be considered less significant than 12% compared to a benchmark rate of 2%).

#### Practical issues / interpretability for users

- Only a small number of countries should be classified as high inflation, otherwise the scope of the zone loses relevance.
- A country needs to break a statistical criterion for a certain length of time to qualify as a high inflation country, to avoid its definition changing often throughout time. Also, the number of times a country changes its definition of being a high inflation country or not should be minimised, ideally not more than once in the time series.

- A corollary to the above point is that if a country changes from one definition to another on the basis of the statistical criteria this should be ignored where these changes are of short duration.
- Changes to definitions of a countries inflation status should be made at fixed and rather infrequent intervals, and revisions to historical time series as a result of changes should be minimized.
- A historical chronology of high inflation countries over periods in the past should be established and stay fixed for the construction of the historical segment of all 'OECD zones excluding high inflation countries' which are only compiled for nominal variables.

### ***Combining statistical assessment and practical considerations***

Clearly a degree of subjectivity was required in applying the above statistical assessments with due consideration for the practical issues outlined above. From a statistical perspective the idea of looking at countries' rates of inflation relative to a benchmark was given more weight than considering absolute levels of inflation. A value of 10% more than the OECD-total for the GDP deflator was used as a starting point, but consideration of the economic conditions that existed over the different periods as shown by the general level of inflation was also taken into account. The approach taken was to observe the run of years that a country exceeded the benchmark by 10% or more, ignoring years in between that may be below this if they are irregular (e.g. a year or two here or there) or still relatively high (e.g. exceeding the benchmark by greater than 7%). Short term moving averages above the benchmark (i.e. 3 year or 5 year) were also used as a guide in performing this assessment.

With regards to the practical considerations, it seemed sensible that changes to the composition of 'excluding high inflation countries' zone aggregates be made at 5 year intervals for easy interpretation by users, and also allowing future reviews to take place in conjunction with the five yearly rebase program. If a countries definition were changed, this would be back dated to the latest rebase period and the series linked at this point.

The historical chronology of high inflation countries which resulted from this exercise is outlined in Table 1.

**Table 1: Countries to be declared as 'high inflation' when compiling historical "OECD excluding high inflation countries" zones**

<b>Country</b>	<b>Exclusion Period</b>	<b>Comments</b>
Czech Republic	Until 1995	Time series only considered from 1990
Greece	Until 1995	High inflation from mid 70's to early 90's
Hungary	Until 2000	Time series only considered from 1990
Iceland	Until 1990	Very high inflation in the 70's and 80's
Mexico	Until 2000	Very high inflation until recent years
Poland	Until 2000	Time series only considered from 1990
Portugal	Until 1990	High inflation from mid 70's to late 80's
Slovak Republic	Until 1995	Time series only considered from 1990
Turkey	All periods	Repeat offender

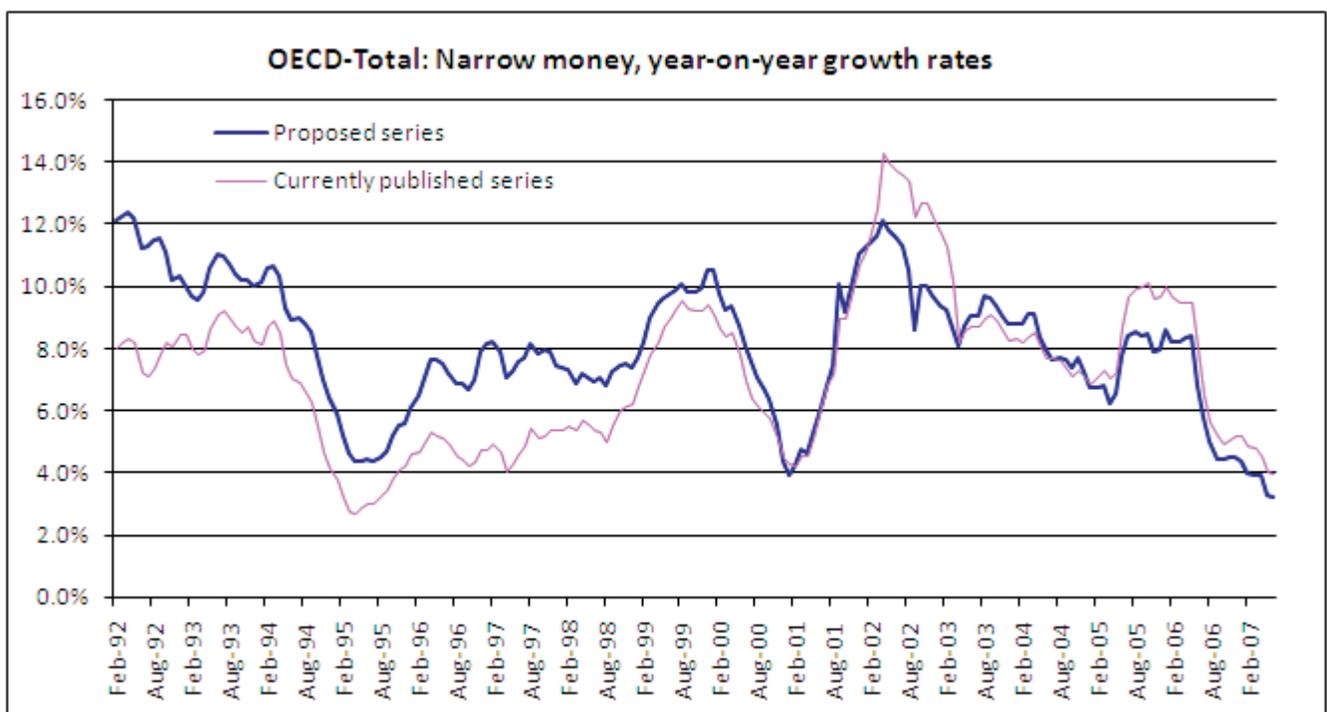
The time series for the former eastern European countries are only considered for inclusion in OECD zone aggregates from the period where they become a market economy, which is approximated as 1990. It should also be noted that the above chronology assumes a starting point for the historical time series of zone aggregates at 1970 at the earliest, which is the case for consumer prices which has the longest time series of zone aggregates.

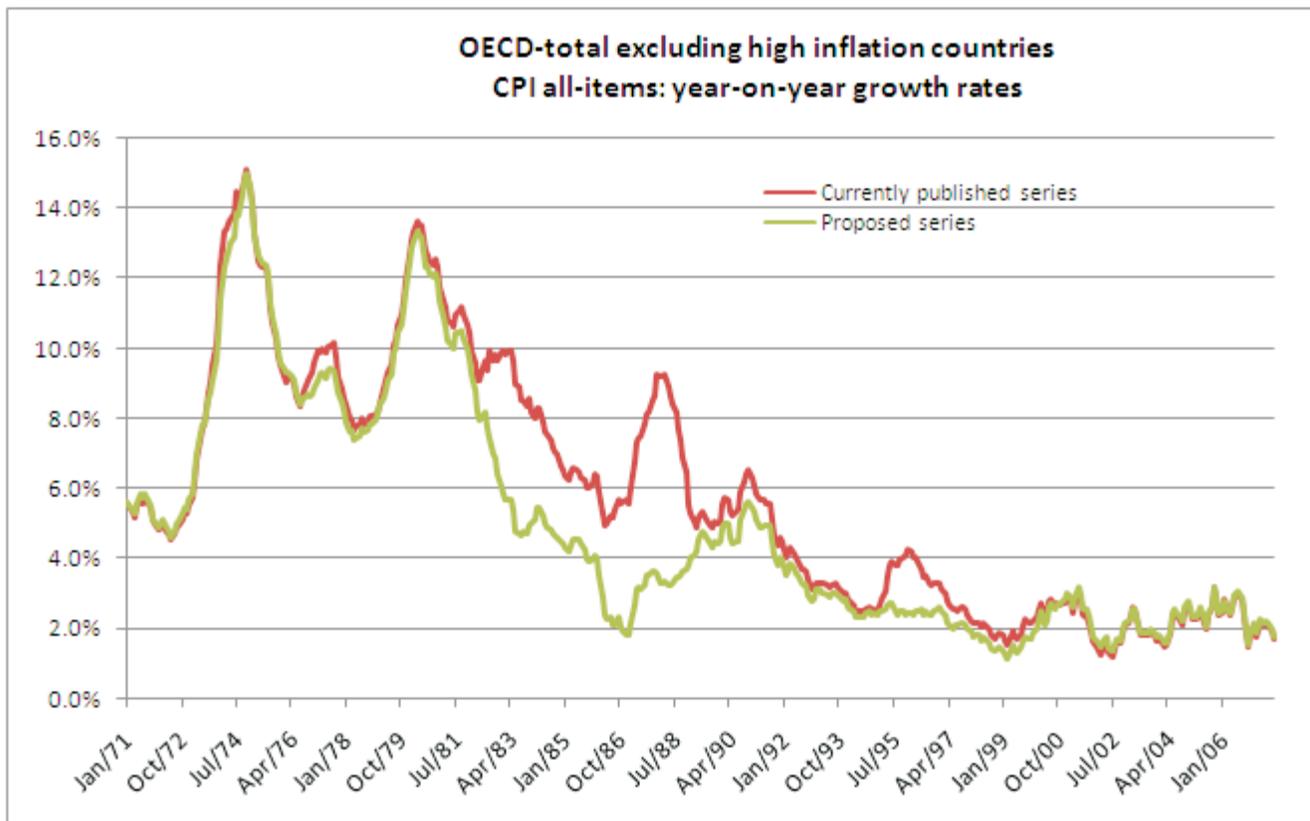
#### 4. New series proposed for the MEI

In accordance with the issues outlined in this document, the OECD proposes to revise a number of its currently published zone aggregates as follows:

- Introduction of annual chain linked indexes for all monetary aggregate zone aggregates with time series back to 1970 in most cases, to replace the current fixed weight series where time series commence in 1990. The weights used will be GDP at current prices adjusted for PPPs.
- Introduction of five yearly chain linked indexes for industrial production and retail trade volume zone aggregates, to replace the current fixed weight series (note five yearly chain linked indexes were introduced for the OECD Composite Leading Indicators in July 2007).
- Compilation of zone aggregates for 'OECD-total excluding high inflation countries' and 'OECD-Europe excluding high inflation countries' based on the historical chronology presented in Table 1. These new series would replace the existing 'excluding high inflation countries' zone aggregates series which only exclude Turkey and are compiled for the nominal variables: consumer price index (all-items, energy, food, and all-items less food less energy); producer price index; hourly earnings in manufacturing and; monetary aggregates (narrow money and broad money).

All newly proposed series in comparison to those currently published which they are intended to replace are shown in the Excel spreadsheet "MEI new zone aggregates.xls" available at <http://www.oecd.org/dataoecd/58/20/39733396.xls>. The charts below show the difference in the time series of year-on-year growth rates between the currently published and proposed series for monetary aggregates, narrow money, OECD-total and the consumer price index, all-items, OECD-total excluding high inflation countries. In the first, the bias in the currently published series is apparent, which is downwards prior to the current base year of 2000 and upwards afterwards as explained theoretically in Section 1. For the second, we see the impact of excluding countries other than Turkey in the historical parts of the time series as discussed in Section 3.





#### References

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