

Comparison of compilation methodologies for the Composite Leading Indicators of Euro area

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1. Introduction

The OECD has been publishing a composite leading indicator (CLI) for Euro area to meet the needs for economists, business and policy makers in their assessment of short-term business cycle developments in economies of Euro area since the creation of European Monetary Union in 1999. Euro area CLI has been compiled based on the existing OECD method for zone calculation, which is to aggregate the corresponding CLIs of individual Member countries: eleven countries from 1999 to 2000 and twelve countries from 2001. While it has provided very reliable information for the economic situation of Euro area for over a couple of years, it is still an interesting and open question how the Euro area synthetic indicators should best be compiled. It is mainly because the euro's introduction has resulted in many changes in the availability and presentation of economic statistics, particularly financial indicators in short-run. At the same time, more statistical harmonisation is expected in the future as the economic integration across the Euro area becomes deeper and wider.

Thus, this paper aims to identify the most optimal and robust method to compile Euro area CLI by comparing two different methods: a direct method (DM) where Euro area CLI is to be compiled directly from the Euro area components; an indirect method (IM) where it is compiled by aggregating the corresponding CLIs from the Member countries. Section 2 presents simple description of the two methods. In section 3, the two methods are compared in terms of various criteria which are determined by their economic and statistical relevance. Finally, conclusions and remarks are given in the last section.

2. Description of methods

2.1 Business cycle for Euro area

It is undoubtedly crucial to identify the true business cycle for Euro area, i.e. identifying the turning points of economic fluctuation, in the compilation of a CLI. Unfortunately, however, there is neither official chronology for Euro area business cycle nor a reference series, i.e. consolidated figures for Euro area Gross Domestic Product (GDP) or index of industrial production (IIP). As it is explained in the annex, OECD CLI systems are constructed around a "reference chronology". Ideally, GDP would be used as the reference series, but for many countries, there is often a substantial time lag in the publication of GDP estimates and they are usually available only on an annual or quarterly basis. Thus, in the OECD system, the index of total industrial production is used as the reference series. Industrial production constitutes the more cyclical part of the aggregate economy and the cyclical profiles of industrial production and GDP have been found to be closely related, so that cyclical indicators identified against the industrial production serve well as indicators for the GDP cycles.

The Statistical Office of the European Communities (Eurostat) estimates the Euro area GDP in constant price as a sum of individual countries' GDPs which are converted by using the exchange rates between the

currencies of Member countries and ecu in 1995. And the Euro area IIP is estimated as a weighted average of individual countries' IIPs where the weights are shares of the individual GDPs to the total Euro area GDP in 1995 prices. Applying PAT method to Euro area IIP, four cycles have been identified in the Euro area economy from January 1985 to December 2000. The ratio to final trend series of Euro area IIP in Figure 1 exhibits four possible peaks and troughs for the Euro area. Peaks could have occurred in April 1986, January 1991, May 1995 and March 1998 while troughs in January 1987, July 1993, December 1996 and December 1998. As it can be seen in the Figure 1, however, it is not very easy to confirm the chronology, especially turning points around 1991 and the beginning of 1999. It is partly due to the certain degree of heterogeneity in the economic fluctuations across the Euro area Member countries. As a result, there are multiple turning points around these periods.

Figure 1. Preliminary set of turning points for Euro area

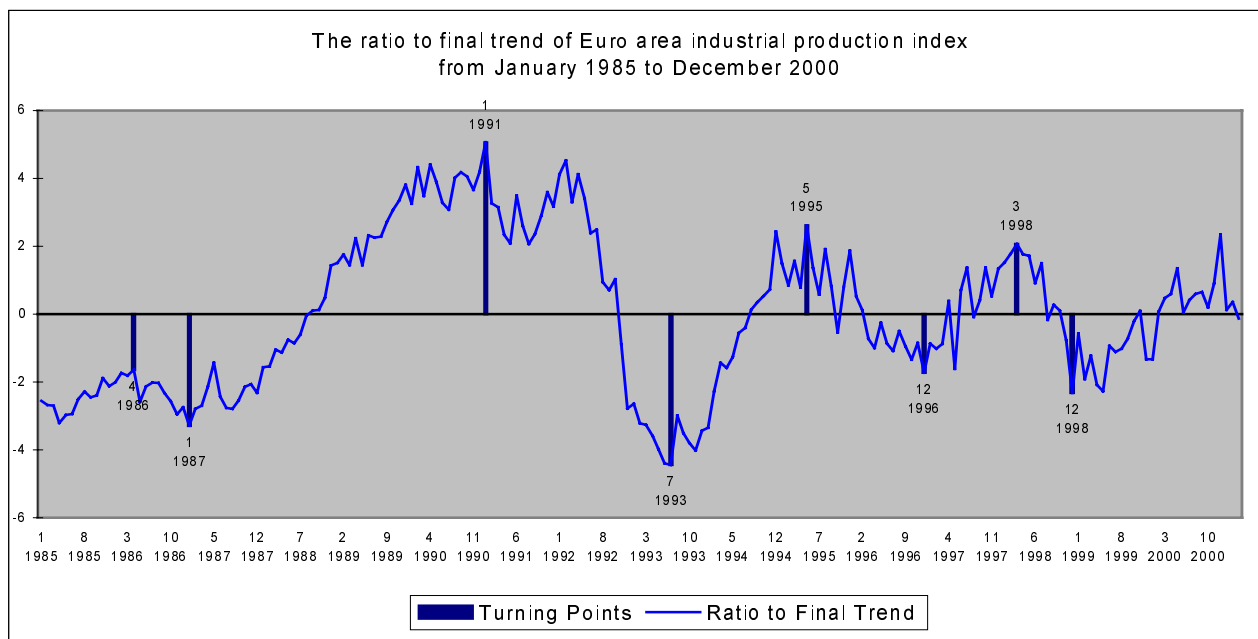


Table 1 presents the final turning points for Euro area and for five largest economies of Euro area. Around 1991, the peak in the economy of each country is different from one another, which could result in the multiple peaks in the Euro area economy as a whole. For the latest trough, however, the most countries are in favour of the second quarter of 1999.

Table 1. Turning points for Euro area and five largest economies of Euro area

| | peak | trough | peak | trough | peak | trough | peak | trough |
|-------------|----------|----------|-----------------|----------|----------|----------|----------|-----------------|
| Euro area | Apr 1986 | Jan 1987 | Jan 1991 | Jul 1993 | May 1995 | Dec 1996 | Mar 1998 | May 1999 |
| Germany | Nov 1985 | Sep 1987 | Feb 1992 | Jul 1993 | Dec 1994 | Oct 1995 | Mar 1998 | Mar 1999 |
| France | Mar 1985 | Jan 1987 | Dec 1991 | Aug 1993 | Mar 1995 | Jan 1997 | Mar 1998 | Apr 1999 |
| Italy | Aug 1984 | Jan 1987 | Sep 1991 | Oct 1993 | Dec 1995 | Dec 1996 | Oct 1997 | May 1999 |
| Spain | Mar 1983 | Jan 1987 | Dec 1991 | Apr 1993 | Apr 1994 | Dec 1996 | Feb 1998 | May 1999 |
| Netherlands | Jan 1987 | Apr 1988 | Jan 1991 | Jun 1993 | Dec 1995 | Jun 1997 | Nov 1997 | Dec 1999 |

After comparing the result with the Euro area GDP, we propose the turning points for the Euro area from 1985 to 2000 as follows:

- Peaks: April 1986, January 1991, May 1995 and March 1998;
- Troughs: January 1987, July 1993, December 1996 and May 1999.

Thus, the only change from the preliminary turning points is the latest trough from December 1998 to May 1999.

2.2 The Direct method

In the direct method (DM), Euro area CLI is compiled as the same way that the corresponding CLI for individual OECD Member country is estimated, i.e. the component series at the Euro area level are used. Thus, in DM, it is crucial to identify the true business cycles for the Euro area since the choice of component series is heavily dependent upon the reference chronology. A selection of optimal set of component series can be made based on the reference chronology that we have identified in the previous section. After the preliminary investigations, we have identified eleven candidate series for a final selection. They are listed in Table 2 along with their statistical properties. We found a CLI composed of seven components performed the best in terms of lead and cross correlation. The component series are production (future tendency, BS), finished goods stock (Level, BS), order books (Level, BS), industrial confidence indicator, share prices, consumer confidence indicator; spread between long-term and short-term interest rates.

Table 2. Properties of component series and CLI candidates

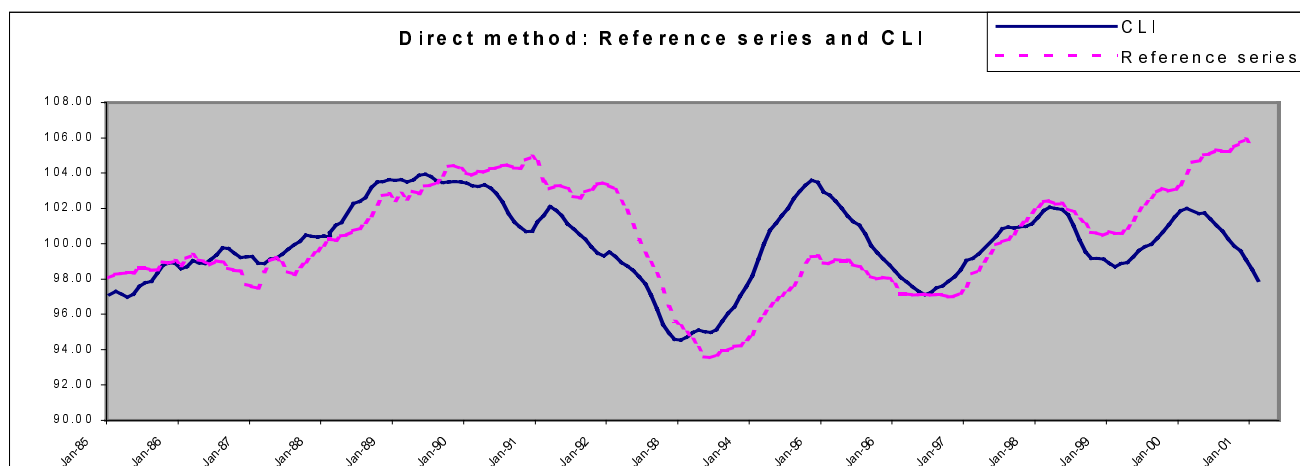
| Indicator series | MCD | Mean lead (+) at turning points | | | Median lead (+) at turning points | | | Standard deviation | Cross-correlation | |
|---|-----|---------------------------------|---|--------|-----------------------------------|---|--------|--------------------|-------------------|-------|
| | | P | T | All TP | P | T | All TP | | Lead (+) | Coef. |
| Production (future tendency, BS) | 2 | 8 | 3 | 5 | 5 | 4 | 5 | 6.7 | 5 | 0.79 |
| Production (tendency, BS) | 3 | | | | | | | | 5 | 0.55 |
| Finished goods stock (level, BS) | 2 | 8 | 5 | 6 | 2 | 3 | 3 | 8.8 | 5 | -0.58 |
| Order books (Level, BS) | 1 | 7 | 1 | 4 | 3 | 0 | 2 | 7.4 | 4 | 0.65 |
| Orders inflow (tendency) | 1 | | | | | | | | 3 | 0.74 |
| Industrial confidence indicator | 1 | 7 | 4 | 5 | 5 | 4 | 5 | 5.7 | 5 | 0.67 |
| Share prices | 2 | 6 | 8 | 7 | 6 | 9 | 9 | 11.5 | 5 | 0.46 |
| Consumer confidence indicator | 2 | -3 | 3 | 0 | 0 | 5 | 1 | 5.9 | 2 | 0.72 |
| Long-term interest rate | 2 | | | | | | | | -15 | -0.33 |
| Short-term interest rate | 3 | | | | | | | | 13 | -0.66 |
| Spread between long-term and short-term interest rate | 3 | 16 | 9 | 11 | 16 | 8 | 8 | 7.1 | 9 | 0.73 |
| CLI1 | 1 | 9 | 6 | 8 | 7 | 7 | 7 | 6.5 | 5 | 0.80 |
| CLI2 | 1 | 9 | 6 | 8 | 6 | 7 | 7 | 6.9 | 6 | 0.74 |
| CLI3 | 1 | 10 | 6 | 8 | 7 | 7 | 7 | 6.9 | 6 | 0.77 |

Note 1) MCD: month of cyclical dominance; P: peak; T: trough; TP: turning points; Coef.: coefficient

Note 2) CLI = K1, S3, O3, C1, SP, CCI, Spread; CLI2 = K1, S3, C1, Spread; CLI3 = K1, S3, O3, C1, SP, Spread.

Figure 2 shows the relationship between reference series and CLI, i.e. dotted and straight lines, respectively. Both graphs are the smoothed ratios to final trends of the original series where the reference series is Euro area IIP and CLI is compiled by using the component series selected in the previous paragraph. The dotted line leads the straight line at almost all the turning points except at the peak in 1998. At the same time, CLI signals all major turning points identified by the reference series.

Figure 2. CLI by the Direct Method



2.3 The Indirect method

Unlike DM, Euro area CLI in IM is compiled independently of the reference chronology. In fact, there is no need for the reference series to be clearly defined to construct the Euro area CLI in IM since the Euro area business cycle is assumed to be an average of those of Member countries. Once the CLIs for twelve Member countries are compiled, the Euro area CLI is to be compiled as a weighted average of the individual CLIs. The weights are calculated from the GDPs in industry and GDP Purchasing Power Parities (PPPs) of the Member countries for 1995. Picture 1 shows the weights for individual countries currently used to compile Euro area CLI at the OECD. Four largest economies of Euro area share 80 % of the total weights. The impact of recent accession of Greece to Euro area was almost negligible to the Euro area CLI, i.e. 1%. However, the weights will vary if the GDP is converted by the exchange rates [see Hong and Beilby-Orrin (1999) and other papers for the further discussion of the weights].

Picture 1. Weights of Member countries in Euro area CLI

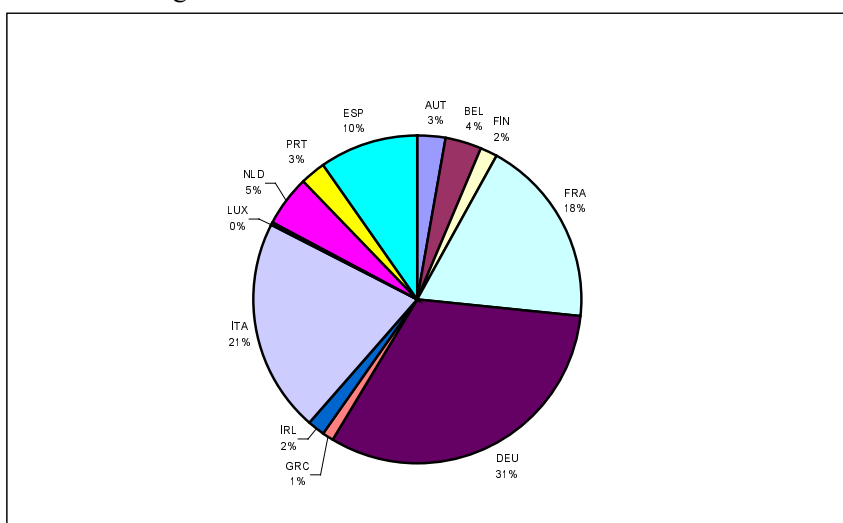
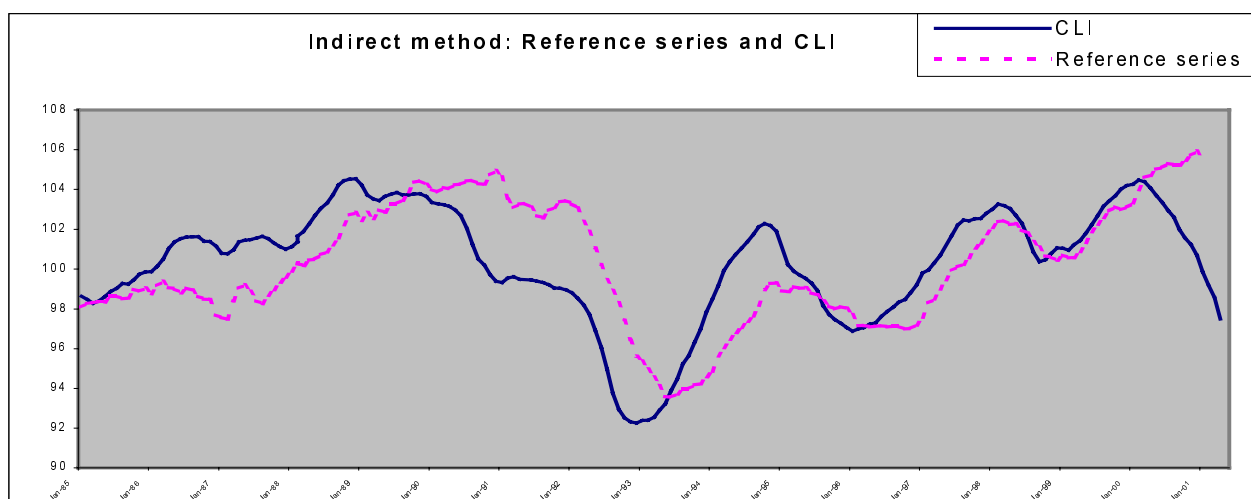


Table 3. Weights used in Indirect Method

| Countries | Weights in Euro area | Weights in Euro area + UK |
|----------------|----------------------|---------------------------|
| Austria | 2.8 | 2.4 |
| Belgium | 3.6 | 3 |
| Finland | 1.7 | 1.5 |
| France | 18.5 | 15.7 |
| Germany | 32.1 | 27.3 |
| Greece | 1.1 | 0.9 |
| Ireland | 1.6 | 1.3 |
| Italy | 21.4 | 18.2 |
| Luxembourg | 0.2 | 0.1 |
| Netherlands | 4.9 | 4.2 |
| Portugal | 2.7 | 2.3 |
| Spain | 9.6 | 8.2 |
| United Kingdom | -- | 14.8 |

Figure 3 shows the relationship between reference series and CLI from IM, i.e. dotted and straight lines, respectively. Both graphs are the smoothed ratios to final trends of the original series where the reference series is Euro area IIP and CLI. The dotted line seems to lead the straight line at almost all the turning points. At the same time, CLI signals all major turning points identified by the reference series.

Figure 3. CLI by the Indirect Method



3. Comparisons of alternative methods

3.1 Availability and Timeliness of data

The availability of relevant statistics for Euro area is the most critical drawback of the DM at least in the short-run. Even though the European statistical authorities such as Eurostat or the European Central Bank (ECB) have been compiling and publishing a wide range of Euro area data around the creation of Euro area in 1999, there still exist much room for an improvement in terms of timeliness and harmonisation of the Euro area data compare to the U.S.

Thus, a set of candidate component series from which a selection can be made is relatively limited. As Table 3 shows, Euro area data for real sector are currently being compiled by aggregating the corresponding national series rather than harmonising or consolidating. The consolidated Euro area data, however, are available for financial sector, e.g. monetary aggregates and balance of payments.

Table 4. Availability of the official Euro area statistics by sectors

| Sectors | Availability of Euro area data | | Frequency | Delay (approximate periods after the reference period) | Availability of national data |
|----------------------|--------------------------------|--------------------|-----------|--|-------------------------------|
| | Consolidated (since) | Aggregated (since) | | | |
| National Account | No | Yes (1995) | Quarterly | 2 months | Yes |
| Production | No | Yes (1985) | Monthly | 6 weeks | Yes |
| Manufacturing | No | Yes (1990) | Monthly | 2 months | Yes |
| Business survey | Yes (1985) | -- | Monthly | 1 week | Yes |
| Domestic demand | No | Yes (1995) | Monthly | 2 months | Yes |
| Labour | | | | | |
| -employment | Yes (1991) | -- | Quarterly | 4 ½ weeks | Yes |
| -unemployment | Yes (1990) | -- | Monthly | 5 weeks | Yes |
| Price | | | | | |
| - consumer price | Yes (1990) | -- | Monthly | 2 weeks | Yes |
| - producer price | No | Yes (1990) | Monthly | 1 month | Yes |
| Finance | | | | | |
| - monetary aggregate | Yes (1980) | -- | Monthly | 1 month | No |
| - credit and loan | Yes (1980) | -- | Monthly | 1 month | Yes |
| - interest rate | Yes (1994) | -- | Monthly | 1 day | Yes |
| - share price | Yes (1994) | -- | Monthly | 3 weeks | Yes |
| Foreign trade | Yes (1995) | -- | Monthly | 6 weeks | Yes |
| Balance of Payments | Yes (1997) | -- | Monthly | 2 months | No |

Note:

- 1) information on finance, balance of payments and employment for Euro area are from the ECB; others are from the Eurostat.
- 2) unemployment is a standard unemployment rate.
- 3) consumer price is HICP.
- 4) a few short-term interest rates such as 3-month inter-bank rates are not available at the national level.
- 5) --: not applicable

Thus, the quality of the resulting Euro area data is suffered due to overestimation (GDP) or choice of the improper weights (IIP), etc. At the same time, Euro area data are available for only a limited historical period at the moment, i.e. normally from 1990s. Thus, they are inadequate for component series for CLI. A similar problem of lack of data availability exists for the IM as well even though it is not as serious as is in DM. Most of data for financial sector at the national level are disappearing and/or less relevant as a result of the creation of single currency.

In the longer run, DM can be more attractive method as far as the availability of data is concerned. More and longer historical data at the Euro area level are expected to be available in the near future as a result of EURO-SCIS project of the Eurostat. At the same time, more data will only be available at the Euro area level.

One of disadvantage of DM, however, is the fact that there still exist much room for an improvement in terms of timeliness and harmonisation of the Euro area data compare to the U.S. data, even though the European statistical authorities such as Eurostat or the European Central Bank (ECB) have been compiling and publishing a wide range of Euro area data. Thus, a set of candidate component series from which a selection can be made is relatively limited.

Component series used in the compilation of the DM are very timely. This is not the case for all the component series used at individual countries' level. However, this comparison is not very fair: series used in DM CLI have been selected from business survey results and financial series since these are the only EMU series available for at least 15 years. These two types of series are also known to be more timely than production, domestic demand or foreign trade series.

The biggest drawback for the IM is that CLIs for all the Member countries are needed in order to compile Euro area CLIs more accurately. Thus, the quality of Euro area CLI from the IM can be affected by the incompleteness of information or by the naive estimation for missing values.

3.2 Statistical properties

Figure 4 and Table 5 show that the statistical properties of the methods are not very different from each other. Small differences are noted in the average length and stability of leads. In 1990s, the lengths of lead at the peaks are similar in both methods while IM provided earlier signal at the troughs. However, DM seems to be more correlated with the reference series. Nevertheless, the number of observation is too small for the result to be robust. It is worth notifying that the lengths of the leads are similar for the two latest peaks.

Figure 4. Comparison of Euro area CLIs compiled by DM and IM

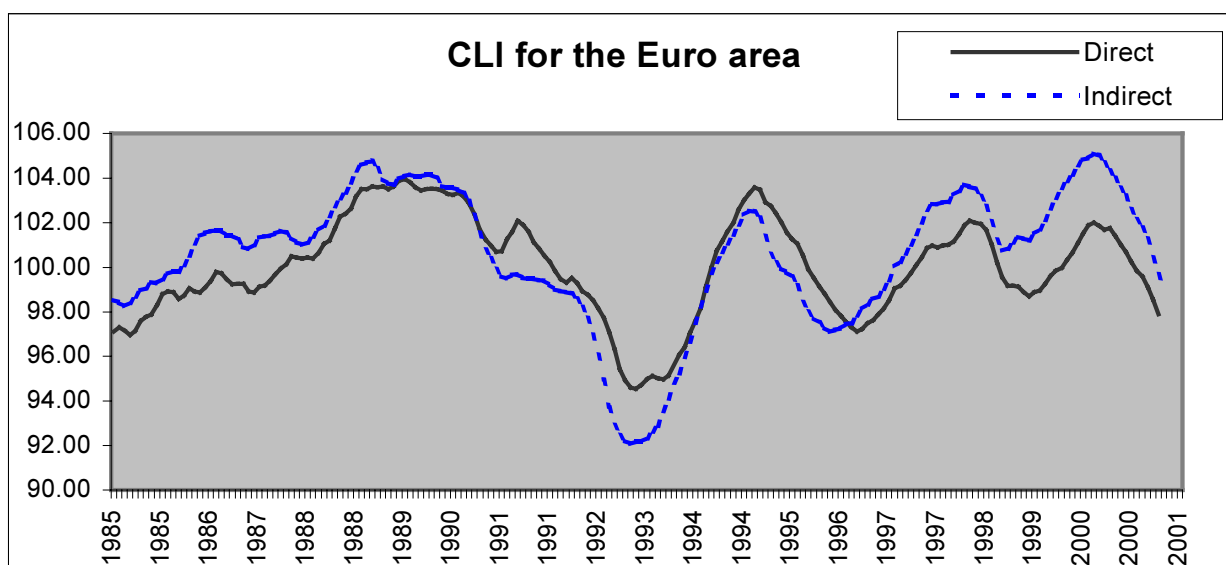


Table 5. Statistical properties of DM and IM

| CLI | Extra or Missing Cycles | MCD | Mean lead (+) at turning points (TP) | | | Median lead (+) at turning points (TP) | | | Standard deviation | Cross-correlation | |
|-----------|-------------------------|-----|--------------------------------------|--------|--------|--|--------|--------|--------------------|-------------------|----------|
| | | | Peak | Trough | All TP | Peak | Trough | All TP | | Lead (+) | Coef. |
| DM | 0 | 1 | 9 | 6 | 8 | 7 | 7 | 7 | 6.5 | 5 | 0.80 |
| IM | 0 | 1 | 6 | 8 | 7 | 6 | 7 | 7 | 4.4 | 6 | 0.76 (*) |

3.3 Interpretation

DM enables users to explain the changes of Euro area CLI in terms of the changes in the economic activities of the Euro area as whole, while CLI from IM enables geographical comparison or explanation. It is expected that the economies of Euro area Member countries would converge [see a report by the National Institute of Economic and Social Research] and so as for the economic statistics of Euro area Member countries. This means that the differences in the set of component series for individual Member country will become smaller and the economies of individual countries will evolve closely one another.

Therefore, analysis by economic activities will become more and more relevant compared to analysis by countries. As a consequence, DM will become a favourable method.

3.4 Robustness to the Euro area enlargement

Table 6 presents the turning points chronologies of Euro area enlargement, i.e. with and without the United Kingdom (UK) in Euro area. As there were identified with bold, more than a half of turning points of Euro area from 1985 have been affected by the inclusion of the UK. In fact, all the peaks are influenced by the economic movements of the UK, where there is a missing cycle between 1994 and 1999.

Table 6. Turning points for the Euro area with and without the UK

| | peak | trough | peak | trough | peak | trough | peak | trough | peak |
|----------------------|-----------------|----------|-----------------|----------|-----------------|-----------------|-----------------|----------|-----------------|
| Euro area without UK | Apr 1986 | Jan 1987 | Jan 1991 | Jul 1993 | May 1995 | Dec 1996 | Mar 1998 | May 1999 | May 2000 |
| Euro area with UK | Nov 1985 | Jan 1987 | Feb 1992 | Jul 1993 | Dec 1994 | Oct 1996 | Apr 1998 | May 1999 | Aug 2000 |
| UK | Jun 1985 | Aug 1986 | Sep 1988 | May 1992 | Sep 1994 | -- | -- | Feb 1999 | Aug 1999 |

--: missing turning points

4. Conclusions and remarks

While the present study showed that the IM was more favourable, we are not confident on the robustness of the result in the future. It is mainly because of the lack of indicators at Euro area level to be used for the present analysis, while the indicators at the individual country level are longer, timely and reliable. However, the availability of data at the individual country level would become deteriorated as ones at the Euro level improve. At the same time, the economic cycles in individual countries will converge as the economic and social integration of Euro area progresses. Thus, In the longer-run, DM seems more plausible.

As they were mentioned in the previous section, the biggest challenge for the compilation of Euro area CLI is unfixed nature of Euro area as well as lack of relevant data to be used. Unlike the U.S., Euro area is expected to be widened in the coming decades. This will require further harmonisation of component series to be used in DM. This would encourage the compilers to be in favour of IM over DM.

In conclusion, the work of Eurostat and ECB in the compilation of new harmonised Euro area data and of historical data will need to be carefully followed in the coming years and the similar comparisons should be carried out in the future as more indicators with longer historical data at the Euro area level become available.

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