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HOW DID THE OECD COMPOSITE LEADING INDICATORS PERFORM DURING THE GREAT RECESSION? A REAL-TIME ANALYSIS WITH A FOCUS ON G7 COUNTRIES

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HOW DID THE OECD COMPOSITE LEADING INDICATORS PERFORM DURING THE GREAT RECESSION? A REAL-TIME ANALYSIS WITH A FOCUS ON G7 COUNTRIES

By Roberto ASTOLFI, Michela GAMBA, Emmanuelle GUIDETTI and Pierre-Alain PIONNIER

1. INTRODUCTION

This Paper discusses the performance of the OECD System of Composite Leading Indicators (CLIs) during the Great Recession. The OECD CLIs, first developed in the 1970s, are qualitative indicators designed to early detect turning points in economic activity. They anticipate turning points by combining into a robust and timely signal the information that can be derived from a set of leading components (OECD, 2012).

The performance of the OECD CLIs is assessed here using real-time analysis. Real-time analysis is based on the provisional and partially revised data that were actually available at the time of compiling and disseminating the relevant CLIs. The analysis evaluates the ability of OECD CLIs to announce the peak and the subsequent trough of the Great Recession in G7 countries, and the extent to which the initial signal has been maintained. Results suggest that the CLIs were able to anticipate the Great Recession in G7 countries some months in advance, although, by their very nature, they could not give an indication on the depth of the coming crisis. Our results confirm the conclusions previously reached by Gyomai and Guidetti (2011) based on an *ex-post* analysis.

The remainder of this Paper is organised as follows. Section 2 provides a synthetic overview of the timing of the detection of turning points and their subsequent announcement to the public. Section 3 presents the results of the real-time analysis of the CLIs' performance during the Great Recession, whereas section 4 focuses on the performance of the underlying leading components. Section 5 concludes.

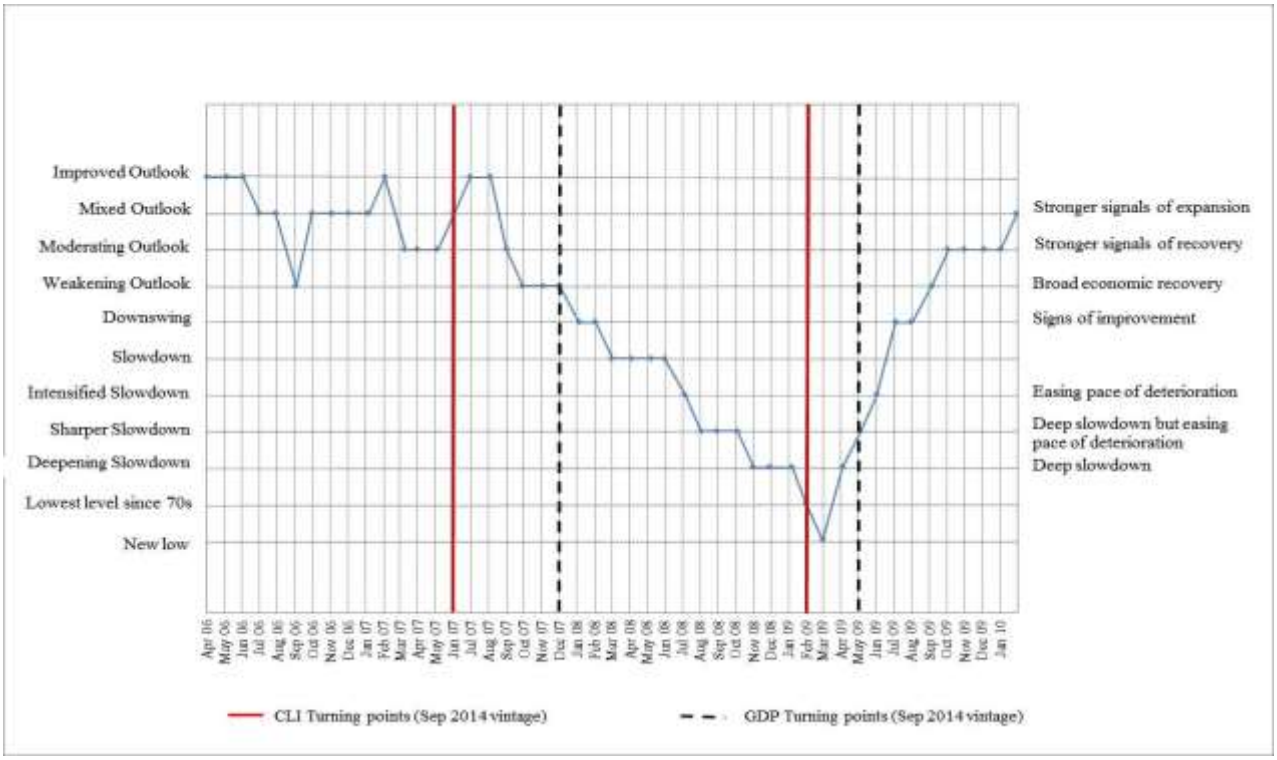
2. WHEN WERE THE TURNING POINTS OF THE GREAT RECESSION IDENTIFIED AND FIRST ANNOUNCED?

In September 2007, the CLI for the OECD area as a whole had recorded a significant decline, which suggested deterioration in economic activity[1]. Hence, the OECD CLI Press Release headlined "*moderating outlook*". Over the following months, the CLIs confirmed the initial symptoms. "*Weakening outlook*" and

[1] Until April 2012, the Index of Industrial Production (IIP) was used as the reference for operational purposes. This reflected the fact that real GDP figures needed to quantify the reference business cycle were available on a quarterly basis for only half of the member countries (and initially none was available on a monthly basis). Instead, the IIP was available for all OECD member countries on a monthly and quarterly basis (Fulop and Gyomai, 2012). Of note is also the fact that the IIP represents the most "cyclical" component of GDP, accounting for approximately 35% share of gross value added in the mid-1980s. The industrial sector, being a significant consumer of services activities, also drives supply in a significant part of the private service sector. Since April 2012, in response to improvements in national statistical information systems (all OECD countries now produce quarterly estimates of GDP) and because of the industrial sector's diminishing share of total GDP (direct and indirect) in recent decades in most OECD economies, the CLI system switched to using GDP as the reference series.

"*Continued weakening outlook*" were the headings of the Press Releases in the last quarter of the year. In January 2008, the signal further worsened and the message was therefore turned into "*downswing*". Over the following months, the reading of CLI evolutions sharply declined to eventually reach levels as low as those seen during the Oil Crisis in the 70s ("*Lowest level since 70s*" in February 2009) and even lower than that, with "*New low*" announced in March 2009. Figure 1 illustrates the evolution of the headings[2]. On the recovery side, the CLI identified the first signs of a likely improvement in economic activity in May 2009. In that occasion, the OECD headlined "*strong slowdown in the OECD area but the pace of the deterioration is easing*."

Figure 1 Evolution of CLIs Press Releases headlines during the great recession, OECD area



Note: The vertical lines identify the turning points detected by the CLIs for the OECD area as a whole (peak in June 2007 and trough in February 2009, marked in red) and GDP (marked in dotted black, with a peak in December 2007 and a trough in May 2009).

Source: CLI Press Release, OECD.

The OECD was able to signal the approaching turning points thanks to the continuous monitoring of CLI growth rates, which initially recorded a significant reduction and then turned negative. With hindsight[3], the CLI for the OECD area as a whole peaked in June 2007, hence seven month ahead of the corresponding peak for GDP, which took place in December 2007. Similarly, ex-post data suggest that the CLI for the OECD area troughed in February 2009 while GDP reached its minimum in May 2009 (both CLI and GDP turning points are included in Figure 1).

2 See Appendix 1 for further details on how quantitative scores are assigned to the headlines of CLI Press Releases.

3 Based on CLIs as available in September 2014.

The remainder of this paper addresses two questions based on the experience of the Great Recession: (1) does the OECD System of CLIs allow detecting turning points timely enough?; and (2) how stable is the location of turning points in economic activity? To address these two questions, we use both ex-post and real-time analysis. While the former is based on the information available today, the latter only uses the historically available data.

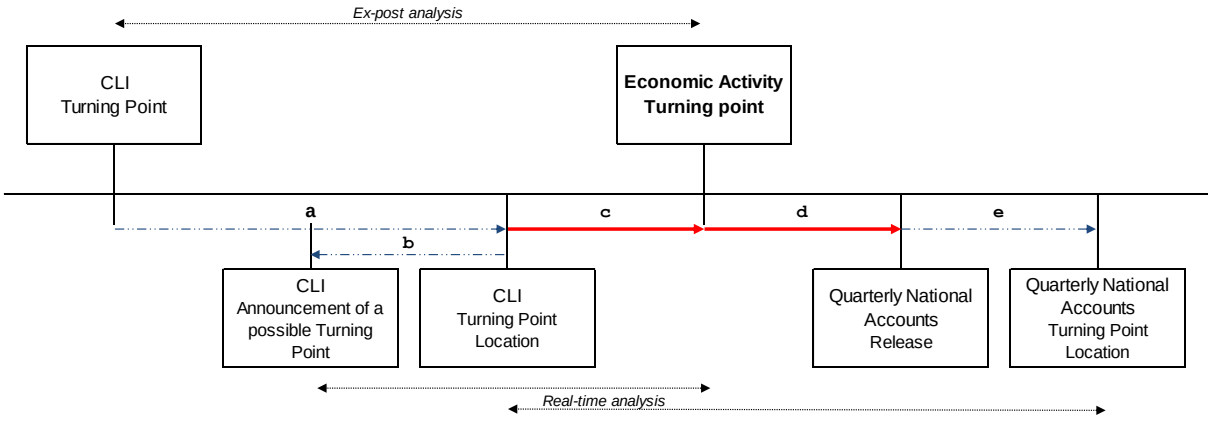
3. TURNING POINT DETECTION

Before reporting on the results of the ex-post and real-time analysis, we briefly present a chronology of events related to the detection of the turning points of both the CLIs and the reference series. This allows clarifying what exactly is measured when assessing the performance of the CLIs.

3.1. Chronology of events

Although the OECD CLIs are designed to lead turning points in the reference series, the exact dating of turning points requires some time after they manifest. This is because any dating algorithm[4] necessitates a certain number of observations after the turning point to be able to single out a maximum (peak) or a minimum (trough) in the time series (distance *a* in Figure 2). Nonetheless, a constant monitoring of the evolution of CLI growth rates allows the OECD to anticipate the formal identification of the turning points and therefore to announce to the public the possibility that a turning point is approaching (distance *b* in Figure 2).

Figure 2 Chronology of events



The early announcement of approaching peaks or troughs may lead by a certain number of months the beginning of recessions and recoveries in economic activity (distance *b*+*c* in Figure 2). However, recessions and recoveries can only be measured when Quarterly National Accounts (QNA) are released (distance *b*+*c*+*d*). They are then formally identified when subsequent QNA data become available (distance *e*).

Hence, the *ex-post* analysis evaluates to what extent CLI turning points, located with hindsight using all the information available today, lead peaks and troughs in GDP (distance *a*+*c*). Real time analysis is interested in (1) the lag between the initial announcement of a possible turning point and the date at which

[4] The OECD employs a simplified version of the Bry-Boschan algorithm to date the turning points (Gyomai et al 2015).

it occurs in economic activity (distance *b*+*c*); and (2) the interval between the formal identification of turning points in the CLI and GDP (distance *c*+*d*+*e*).

3.2. Assessment of CLI leading properties based on the latest CLI vintage

The *ex-post* analysis shows that CLIs anticipated turning points in GDP for all G7 countries both at the onset and at the end of the Great Recession. At the beginning of the crisis, the CLI for the United States, for instance, peaked in June 2007, 4 months before GDP had reached its own peak. In March 2009, the US CLI anticipated a trough that also correctly led the following trough in US GDP. In the latter case, however, the leading period was shorter as the CLI and the GDP troughs were only two months apart. For more details of this ex-post analysis, reference is made to Gyomai and Guidetti (2011).

3.3. Real-time analysis

Results presented in the previous section on the performance of the G7 CLIs during the Great Recession need to be complemented with a real-time analysis. Indeed, the ex-post analysis is based on the current set of CLIs which may give a too favourable picture of their historical performance in signalling fluctuations in the reference series. This is because currently available CLIs are evaluated after the underlying data have been revised and more information has become available. Diebold and Rudebusch (1991) were among the first to make this claim and to show that the forecasting performance of the Index of Leading Economic Indicators (LEIs) released by the Conference Board in the US deteriorated significantly in a real-time framework.

From their initial estimate to their latest release, the OECD CLIs may undergo both regular and exceptional revisions:

- Regular revisions of the CLIs can be the result of a revision of the components by National Statistical Offices[5] or can be due to the filtering process once new data points become available. Since filters (extraction of the cycle, seasonal and trading-day adjustment, and outlier detection) operate on the whole sample, the inclusion of a new data point may produce a revision of the entire time series.
- Beyond the regular revision process, exceptional revisions can occur due mostly to the implementation of new methodologies. For example, in December 2008 the OECD replaced the Phase Average Trend (PAT) method with a double Hodrick Prescott (HP) filter in order to extract the cyclical component of time series (Nilsson and Gyomai, 2011). Revisions can also be ascribed to changes in the set of the indicators which are used to compile a CLI. Indicators may be replaced should their performance deteriorate over time and new series can be added to reflect structural changes in the economy.

The occurrence of regular revisions and changes in the methodology of CLIs are strong arguments in favour of a real-time performance analysis. The OECD publishes on its website all CLI vintages since the end of the 1990s or the beginning of the 2000s[6], depending on the country. This limits the real-time performance analysis to the last 15 years, but the Great Recession is fortunately covered in the real-time dataset.

In what follows, real-time data are used to assess the ability of the OECD CLIs to identify the peak and the trough during the Great Recession for all G7 countries by: (1) verifying that the location of these

[5] Although, as mentioned above, the impact of these revisions is limited since an important criterion for the selection of indicators entering the construction of the CLIs is precisely that they should not be subject to significant revisions.

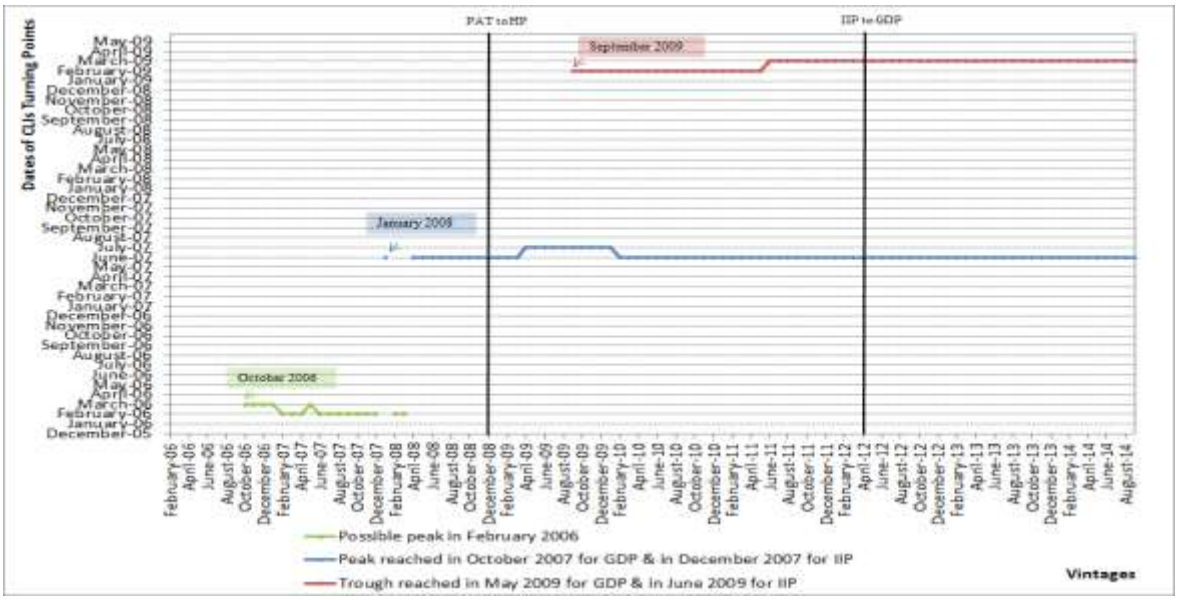
[6] No electronically-supported files are available for earlier CLI releases.

turning points has remained stable from one CLI monthly release to the next; and (2) determining when these turning points could actually be identified.

3.3.1. Stability of turning points in real time

A real-time assessment of the OECD CLIs' performance during the Great Recession shows that the location of CLI turning points[7] remains broadly stable over time. From one release to the next, turning points generally remain in a 3-month corridor, a result that can be considered fully satisfactory for economic policy purposes. For example, Figure 3 below shows that the June 2007 peak and the March 2009 trough identified for the United States remain very stable from one vintage to the next. In January 2008, it was estimated that the CLI had reached a peak in June 2007 (see blue line). A rather stable pattern can also be observed for the through anticipating the possible end of the crisis. Initially located in September 2009, the date has been shifted a month ahead in mid-2011 and has remained unchanged since then (see red line).

Figure 3 Stability over vintages of turning points in the US CLI at the time of the Great Recession



Note: The horizontal axis refers to CLI vintages and the vertical axis to the dates of CLI turning points. For instance, the blue line shows that the June 2007 peak in the current US CLI (see vertical axis) was first detected in January 2008 (see horizontal axis) and was already located in June 2007 at that time. US GDP reached a peak in October 2007, as indicated in the legend.

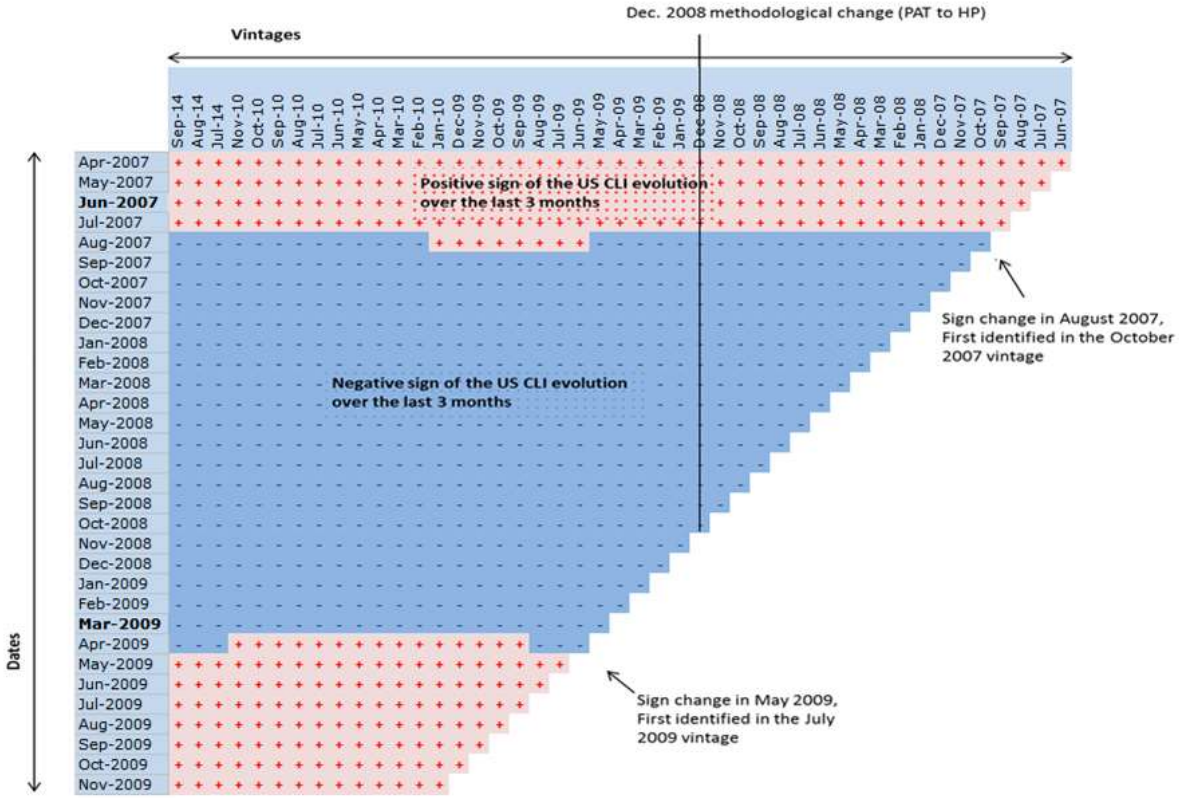
Source: Main Economic Indicators, OECD.

The revision analysis of the sign of CLI growth rates over the last three months provides additional insights on the stability of turning-point dating. In practice, this is what the OECD does to interpret the latest CLI results for the monthly Press Releases. Figure 4 shows that the dates at which the CLI evolution over a period of three months changes sign also remain stable over time.

[7] The OECD relies on the Bry-Boschan (1971) algorithm for the formal identification of turning points in economic activity on past data. In a nutshell, this algorithm identifies local peaks and troughs in the CLIs and, following this, checks that minimum phase (distance between adjacent peaks and troughs) and cycle length criteria are met. Turning points that are initially identified outside of these limits are eliminated in the end.

Figure 4 Sign of the US CLI evolution over 3 months

by date and vintage



Note: The horizontal axis refers to CLI vintages and the vertical axis to time. Periods where the 3-month CLI evolution is negative are marked in blue, those where the 3-month CLI evolution is positive are marked in red. What can be derived, for example, from the figure is that the US CLI evolution over 3 months turned negative in August 2007 (see vertical axis). This sign change was first detected in the October 2007 release of the US CLI (see horizontal axis). The 3-month evolution of the current US CLI (September 2014 vintage: first column) also changes sign in August 2007 (see horizontal axis).

Source: Main Economic Indicators, OECD

Of particular note is the fact that in October 2007 (see the relevant "vintage" in Figure 4), the 3-month evolution of the US CLI showed a change for the first time, indicating that the CLI had started declining back in August 2007 (see the relevant "date" in Figure 4). The message was then confirmed in November 2007 and, on that occasion, the OECD announced a "*Possible downturn in the United States*", two months in advance compared to the formal identification of the peak (January 2008).

3.3.2. Timeliness of the formal identification of turning points

The formal identification of turning points requires time after they manifest because dating algorithms necessitate a certain number of observations after the turning point to be able to single out a maximum (peak) or a minimum (trough) in the time series. Table 1 and Table 2 below first show a comparison of the location of turning points in CLIs (column 1) and GDPs (column 2). The difference between the two corresponds to distance ($a+c$) in Figure 2. Tables 1 and 2 also allow comparing the location of turning points in CLIs (column 1) and the date at which they were first formally identified (column 3). The difference between these two corresponds to distance a in Figure 2.

With only a few exceptions, CLI turning points could be formally identified approximately six months after they had occurred, thus roughly at the same time as the first quarterly GDP release, or even slightly before, thus providing reliable information to policy makers on the forthcoming evolution of GDP.

Two additional points that are not assessed in Tables 1 and 2 are worth noticing:

- Thanks to informal identification based on the sign of CLI growth rates (see above), the OECD may have been able to announce CLI turning points before they could be formally located. For instance, this is the case for the United States, for which the CLI peak was announced in November 2007, two months before its formal identification.
- The identification of turning points in GDP based on QNA data also requires some time (distance *e* on Figure 2) which is not shown in Tables 1 and 2, thus providing a relatively negative evaluation of the CLIs in this performance assessment.

Table 1 Identification of the 2007/2008 peak

Countries	Location of CLI peaks (based on currently available data)	Lead (number of months) and location of GDP peaks		CLI release where the CLI peak was first formally identified	GDP release date (quarter corresponding to the peak) [8]
OECD Total	Jun 2007	6		n.a.	n.a.
Canada	Jun 2007	12	(Jun 2008)	Feb 2008	Aug 2008
France	Jun 2007	7	(Jan 2008)	Jan 2008	May 2008
Germany	Jan 2007	14	(Mar 2008)	[9]	May 2008
Italy	May 2007	9	(Feb 2008)	Oct 2007	May 2008
Japan	Jan 2007	13	(Feb 2008)	[10]	Aug 2008
United Kingdom	Jun 2007	7	(Jan 2008)	Jan 2008	Apr 2008
United States	Jun 2007	4	(Oct 2007)	Jan 2008	Jan 2008

Source: Main Economic Indicators, OECD.

8 This refers to the first release of quarterly GDP. It may correspond to a flash estimate in countries where this type of estimate exists.

9 In December 2006, our routine tentatively detected a peak in May 2006 for Germany. The signal remained stable until October 2008 when the same turning point was gradually shifted ahead to reach May 2007. Subsequent revisions have placed that peak in the interval January-May 2007.

10 A downturn in the CLI for Japan in January 2006 was first identified in September 2006. Since then, this turning point has been shifted to January 2007 as indicated in Table 1 (first column). However, it would be misleading to consider that the January 2007 turning point was announced as early as September 2006.

Table 2 Identification of the 2009 trough

Countries	Location of CLI troughs (based on currently available data)	Lead (number of months) and location of GDP troughs		CLI release where the CLI trough was first formally identified	GDP release date (quarter corresponding to the trough)
OECD Total	Feb 2009	3		n.a.	n.a.
Canada	Feb 2009	4	(Jun 2009)	Sep 2009	Aug 2009
France	Feb 2009	4	(Jun 2009)	Jul 2009	Sep 2009
Germany	Feb 2009	4	(Jun 2009)	Sep 2009	Aug 2009
Italy	Mar 2009	2	(May 2009)	Jul 2009	Oct 2009
Japan	Mar 2009	1	(Apr 2009)	Oct 2009	Sep 2009
United Kingdom	Jan 2009	5	(Jun 2009)	Aug 2009	Sep 2009
United States	Mar 2009	2	(May 2009)	Sep 2009	Sep 2009

Source: Main Economic Indicators, OECD.

4. CONCLUSIONS

The conclusions that can be derived from this real-time performance analysis are that the OECD CLIs were able to early detect turning points in the economic activity during the Great Recession in G7 countries. The same conclusions had already been reached in an ex-post analysis, using the currently available set of CLIs. Admittedly, the leading properties of the OECD CLIs are less good if real-time CLIs are considered. However, statistical and methodological revisions that occurred since the crisis do not seem to have shifted CLI turning points to earlier dates, or to have artificially improved the CLI performance. The main reason why real-time data are less favourable to the performance of the OECD CLIs is that some time is needed to identify turning points once they occur. About six months are typically required for the formal identification of turning points.

Analysing the forecasting errors made by the OECD during the Great Recession in G7 countries, Pain *et al.* (2014) show that the information provided by the real-time CLIs could have helped to better identify the early stages of the recovery in 2009 (Appendix 7 in Pain *et al.* 2014). Economists and statisticians at the OECD are currently working together in order to better align the messages coming from the CLIs and the short-term indicator models.

REFERENCES

Bry G. and Boschan C. (1971): Cyclical Analysis of Time Series: Selected Procedures and Computer Programs. *NBER Technical Paper N°20.*

Diebold F.X. and Rudebusch G.D. (1991): Forecasting Output with the Composite Leading Index: A Real-Time Analysis. *Journal of the American Statistical Association, Vol.86, N°415, pp. 603-610.*

Fulop G. and Gyomai, G. (2012): Transition of the OECD CLI system to a GDP-based business cycle target. *OECD background note*. http://www.oecd.org/std/leading-indicators/49985449.pdf. http://www.bde.es/f/webbde/SES/Secciones/Publicaciones/PublicacionesSeriadas/DocumentosTrabajo/12/Fich/dt1240e.pdf

Gyomai G., Ahmad N. and Astolfi R. (2015): The OECD System of Composite leading indicators Chapter 8. In *Eurostat Handbook on cyclical composite indicators*, Luxembourg (forthcoming).

Gyomai G. and Guidetti E. (2011) The Performance of the OECD's Composite Leading Indicator during the 2007 Financial Crisis, The Statistics Newsletter - OECD Issue No. 51http://www.oecd.org/std/47632702.pdf

Nilsson R. and Gyomai G. (2011): Cycle Extraction: A comparison of the Phase-Average Trend Method, the Hodrick-Prescott and Christiano-Fitzgerald Filters. *OECD Statistics Directorate Working Paper N°39.* http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=std/doc%282011%294&doclanguage=en

OECD (2012): OECD System of Composite leading indicators. http://www.oecd.org/std/leading-indicators/41629509.pdf

Pain N., Lewis C., Dang T-T., Jin Y. and Richardson P. (2014): OECD Forecasts during and after the Financial Crisis: A Post-Mortem. *OECD Economics Department Working Paper N°1107.* http://www.oecd-ilibrary.org/economics/oecd-forecasts-during-and-after-the-financial-crisis_5jz73l1qw1s1-en

APPENDIX 1

This Appendix illustrates the method used to assign a score to press release headlines (Figure 1). Selected keywords in monthly Press Releases have been translated into scores. The selection of such keywords has been made so that the core message of the CLI signal could be fully captured. A positive sign has been assigned to messages identifying a recovery phase and a negative sign to messages identifying a slowdown. Scores are reported in Table 3 below.

Table 3 - CLI Press release s: keywords and associated scores

CLI Press release s key words, Left side (entering crisis)	Assigned scores	CLI Press release s key words, Right side (exiting crisis)
Improved / continued positive outlook	4	--
Mixed outlook	3	Stronger signals of expansion
Moderating outlook	2	Stronger signs of recovery
Weakening outlook	1	Broad economic recovery
Downswing	0	Signs of improvement
Slowdown	-1	--
Intensified slowdown	-2	Easing pace of deterioration
Sharper slowdown	-3	Deep slowdown but the pace of deterioration is easing
Deepening slowdown	-4	Deep slowdown
Lowest levels since 1970s	-5	--
New low	-6	--

Note: the sign "--" indicates that there is no message associated with the score.

Source: CLI Press releases, OECD.