Current Period Performance of OECD Composite Leading Indicators (CLIs): Revision analysis of CLIs for OECD Member countries

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CURRENT PERIOD PERFORMANCE OF OECD COMPOSITE LEADING INDICATORS (CLIs)
Revision analysis of CLIs for OECD Member countries

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Current Period Performance of OECD Composite Leading Indicators

ABSTRACT

This paper presents a comprehensive analysis of the current period performance of the OECD composite leading indicators (CLIs) for 21 OECD Member countries and three zone aggregates (OECD area, Euro area and Major Seven countries) for which CLIs are available for a longer time period. The revisions analysis of OECD CLIs is similar to those recently undertaken by the Organisation for a range of quantitative short-term economic indicators. The aim of the current analysis on CLIs is to further evaluate the quality of the indicator in order to: identify areas where their reliability could be improved; and provide further information to users on their use for economic analyses.

The results show that first estimates of CLIs are revised frequently but the size of revisions is rather small for most countries and almost neglectable for zone aggregates and there is no evidence of bias. They also indicate that there is an improvement in the reliability of the second estimates.

The OECD CLI is, however, designed to provide early signals of turning points (peaks and troughs) between expansions and slowdowns of economic activity. It provides qualitative information on short-term economic movements rather than quantitative measures. Therefore, the main message of CLI movements over time is the direction up or down rather than levels. A simple measure which considers the direction is the sign of the movements. The results show that for almost all the countries, around 90% of the time the sign of the initial estimates of year-on-year growth rates and the 6 month rate of change are the same as the ones published one month later. So the initial estimate can be considered as a good indicator of whether economic activity will move up or down in the near term future. However, according to the acceleration/deceleration measure which captures the cyclical dynamic or direction in growth rates, the results show a difference in direction between the first and second estimate of year-on-year growth rates, more than 20% of the time in approximately 60% of the countries. These results indicate that it could be dangerous to draw conclusions on directions up or down in growth rates from one or two months figures for a large number of countries. On the other hand, the difference in direction noted for zone aggregates is much lower, below 10% of the time in the OECD area and the Euro area.

Forecasting turning points is one of the main objectives of the leading indicator technique, because predicting the timing of cyclical turning points is one of the least reliable activities in economic forecasting. The results provide evidence that first and second estimates of year-on-year growth rates give reliable signals of approaching cyclical turning points. The median lag between first and second estimates compared to estimates one month later is zero or at the most one month for all countries and no false signals in terms of extra or missing turning points are recorded for any countries or zones except Mexico. The ability to indicate approaching turning points and to confirm them is secured by the relative smoothness of the CLI for all countries except Mexico and Ireland. However, the number of cyclical turning points registered over the common sample period is relatively small, only 3 cycles, for some countries, so the turning points measures given are not significant in a statistical sense.

Finally, the importance of smoothness of components in the calculation of first and second estimates of the CLI and the overall smoothness of the CLI itself is noted in the findings. The results support the argument that it is not enough to have timely components they also need to be smooth to guarantee small revisions. This further reinforces the argument that smoothness is probably the most

important factor explaining revisions to the OECD CLI. However, timeliness is also important, but only under condition that the timely components are smooth.

Overall, this study has shown that whilst it could be dangerous to draw conclusions on the directions up or down in growth rates from one or two months figures for several countries, the first and second estimates of the CLIs give early signals of approaching turning points which in most cases are not revised later. This capacity of the CLIs to predict turning points is very important and one of the main objectives of the leading indicator technique. However, the findings also highlight the importance of smoothness of components in the calculation of first and second estimates of the CLI. This is an area for further investigation where the quality of the CLIs may be improved by either replacing very irregular components with smoother ones or by introducing a more efficient smoothing technique. Work on this has already started at the OECD as part of a general review of the OECD leading indicator methodology.

RÉSUMÉ

Ce document présente une analyse détaillée de la performance actuelle des indicateurs composites avancés (CLI) de l'OCDE pour 21 de ses pays membres et pour trois agrégats (total OCDE, la zone Euro et les pays du G7), pour lesquels ces indicateurs sont disponibles sur une longue période. L'analyse des révisions des indicateurs composites avancés de l'OCDE est similaire à celles récemment entreprises par l'Organisation pour un certain nombre d'indicateurs économiques à court terme quantitatifs. Le but de cette présente analyse sur les indicateurs composites avancés est non seulement de faire une évaluation approfondie de leur qualité afin d'en améliorer la fiabilité quand cela s'avère nécessaire ; mais aussi de donner une meilleure information quant à leur utilisation pour des analyses économiques.

Les résultats montrent que la première estimation des indicateurs composites avancés est sujette à être fréquemment révisée, mais l'amplitude de ces révisions est relativement petite pour la plupart des pays et presque négligeable pour les agrégats calculés et il n'y a pas d'évidence de biais. Les résultats indiquent aussi une amélioration de la fiabilité de la deuxième estimation (celle publié un mois plus tard).

L'indicateur composite avancé de l'OCDE a été, cependant, conçu pour signaler à l'avance les points de retournement (pics et creux) entre les phases d'expansion et de ralentissement de l'activité économique. Il fournit une information qualitative sur les mouvements économiques à court terme plutôt qu'une mesure quantitative. Ainsi, le message principal des mouvements des indicateurs composites avancés à travers le temps est la direction vers le haut ou vers le bas de ces mouvements plutôt que leurs amplitudes. Une mesure simple, qui rend compte de la direction, est le signe des mouvements. Les résultats montrent que pour la plupart des pays, environ 90% du temps, le signe de l'estimation initiale des taux de croissance en glissement annuel et des taux de variation sur 6 mois est similaire au signe de celle publiée un mois plus tard. Par conséquent l'estimation initiale peut être considérée comme étant un bon indicateur quant à la direction que va prendre, dans un futur proche, l'activité économique. Cependant, selon la mesure accélération/décélération qui capture la dynamique cyclique ou la direction en taux de croissance, les résultats montrent une différence dans la direction entre la première et la seconde estimation des taux de croissance en glissement annuel, de plus 20% du temps, pour environ 60% des pays. Ces résultats suggèrent qu'il peut être dangereux d'émettre des conclusions sur l'évolution des directions entre des données à un ou deux mois d'écart pour un grand nombre de pays. D'un autre côté, la différence dans la direction pour les agrégats est beaucoup plus faible, inférieur à 10% du temps pour le total OCDE et pour la zone Euro.

Prévoir les points de retournement est l'un des principaux objectifs de la technique des indicateurs avancés, car la prévision de la date du point de retournement cyclique est l'une des activités les moins fiables de la prévision économique. Les résultats fournissent la preuve que la première et la seconde estimation des taux de croissance en glissement annuel donnent un signal fiable de l'approche des points de retournement cycliques. L'écart médian entre la première et la deuxième estimation comparée à l'estimation publiée un mois plus tard, est zéro ou au mieux égal à 1 mois pour tous les pays et aucun message d'erreur en terme de point de retournement supplémentaire ou manquant n'a été enregistré pour tous les agrégats et tous les pays à part le Mexique. L'aptitude, à indiquer l'approche des points de retournement et à les confirmer, est assurée par le lissage relatif des indicateurs composites avancés pour tous les pays exceptés le Mexique et l'Irlande. Cependant, le nombre de points de retournement cycliques enregistrés sur la période commune de l'échantillon est relativement petit, seulement 3 cycles, pour certains pays, donc les mesures des points de retournements utilisées ne sont pas significatives d'un point de vue statistique.

Enfin, l'importance du lissage des composantes dans le calcul des premières et secondes estimations des indicateurs composites avancés et du lissage global des indicateurs composites avancés est

notée dans les conclusions. Les résultats étayent l'idée qu'il n'est pas suffisant de n'avoir que des composantes disponibles à temps mais que ces dernières ont aussi besoin d'être lissées afin de ne garantir que de petites révisions. Ceci renforce l'argument selon lequel le lissage est probablement le facteur le plus important expliquant les révisions des indicateurs composites avancés de l'OCDE. Cependant, la disponibilité en temps voulu des composantes est importante mais seulement sous la condition qu'elles soient lissées.

Cette étude a montré, dans sa globalité, que bien qu'il puisse être dangereux de conclure sur l'évolution des directions en taux de croissance entre des données publiées à un ou deux mois d'écart pour un grand nombre de pays, la première et la deuxième estimation des indicateurs composites avancés donnent un signal précoce de l'approche des points de retournement, qui ne sont pas, dans la plupart des cas, révisés ultérieurement. Cette capacité des indicateurs composites avancés à prévoir les points de retournement est très importante et représente un des principaux objectifs de la technique des indicateurs avancés. Cependant, les résultats ont aussi souligné l'importance du lissage des composantes dans le calcul de la première et de la seconde estimation des indicateurs composites avancés. Ce point nécessite plus de recherches dès lors que la qualité des indicateurs composites avancés peut être améliorée soit en remplaçant les composantes très irrégulières par des composantes lissées ou en introduisant une technique de lissage plus efficace. L'OCDE a déjà commencé à analyser ce point comme faisant partie d'une étude générale sur la méthodologie de l'OCDE sur les indicateurs avancés.

0   Summary

This paper presents a comprehensive analysis of the current period performance of the OECD composite leading indicators (CLIs) for 21 OECD Member countries and three zone aggregates (OECD area, Euro area and Major Seven countries) for which CLIs are available for a longer time period. The evaluation covers the period December 1999 to July 2006, where the starting date is determined by the availability of all release versions of the CLIs. The analysis is also performed over sub-periods to examine the performance of the CLIs before and after a major update of the CLIs undertaken in 2002. The performance of the CLIs over the two sub-periods allows an evaluation of the importance of changes to component characteristics on the revisions to the CLIs. The revisions analysis of OECD CLIs is similar to those recently undertaken by the Organisation for a range of quantitative short-term economic indicators (index of industrial production, retail trade volume and quarterly GDP). The aim current analysis on CLIs is to further evaluate the quality of the indicator in order to: identify areas where their reliability could be improved; and provide further information to users on their use for economic analyses. The context for such revisions analysis is provided in the *OECD Main Economic Indicators Original Release Data Revisions Database*.

The main findings from this study are summarized in the following points.

- **Component characteristics and expected revisions**: The composition of the characteristics of the components compiled before the 2002 CLI review show that 80 per cent of the CLIs could be classified to a subjectively defined "revision group" where major revisions would be expected. As a result of the 2002 CLI review this percentage of countries where major revisions might be expected fell to 40 per cent. For the latter period, poor timeliness or lack of smoothness or both factors together for component series, were the reasons why major revisions were still expected for these countries following the review. The lack of timeliness is, for half the number of countries, explained by the fact that quarterly business tendency survey indicators are used as components.

- **Size of revisions**: The mean absolute revision on year-on-year growth rates between first estimates and those published one month later for the period December 1999 to July 2006 are large (greater than 1.5 %) for two countries (Mexico and Ireland) and rather large (greater than 0.6%) for four additional countries (Canada, Denmark, Norway and Portugal) but for all other countries the revision is rather small (less than 0.6% or 0.4% on average) and almost neglectable for zone aggregates (0.2%) and there is no evidence of bias. The mean absolute revision between the 2nd and 3rd estimates is lower in magnitude for all countries (except for Finland) than the ones between first and second estimates. This could suggest that there is an improvement in reliability of the 2nd estimates.

- **Size of revisions before and after the 2002 CLI review**: When comparing the size of the revisions for the periods before and after the 2002 CLI review the conclusion suggests mixed results. For Canada, Mexico, Japan, Ireland, Norway and Switzerland, the results showed an increase of the mean absolute revisions between the first and the second period. The bad results for the second sub-period may be explained by the increase of the number of less smooth components in the revised CLI for most countries and problems with timeliness of newly introduced components for a few countries. For all other countries the mean absolute revisions decreased in the second period, which could suggest an improvement in the reliability of the first estimates.

- **Revisions to CLI and industrial production (IIP)**: The CLI is designed for signaling in advance a turning point in the reference series (IIP) and to do this it is calculated on smoothed component series and to make the comparison of revisions related to IIP valid this later series should also be smoothed. For 75 per cent of the countries, the IIP is much more irregular than the CLI and the smoothing needed

to make it easy to detect turning points would introduce large revisions, however such smoothing is not considered when comparing revisions for the IIP and CLI in this analysis. In addition, the CLI is based on a set of components, on average 7-8, which are subject to revisions except for survey indicators and certain financial series. This means that one would expect to find larger revisions for the CLI compared to a single series like IIP, if revisions in components are dependent from each other. However, the larger revisions noted for the CLI compared to the IIP for most countries does not correspond to the magnitude that one might expect, taking into account sources of revisions to the CLI coming from both the large number of components and the smoothing applied to them. This indicates a degree of robustness of the CLI, at least in relation to the IIP as to observed magnitudes of revisions.

- **Relative mean revision:** The CLI is designed to provide early signals of turning points (peaks and troughs) between expansions and slowdowns of economic activity. The OECD uses the 6 month rate of change (annualised) of the CLI as a pointer to possible turning points. To measure the relative robustness of the first estimate of 6 months rate of change compared to the ones of year-on-year growth rate, the relative mean absolute revision is calculated. For all countries, the relative mean absolute revision for 6 months rate of change is higher than those for year-on-year growth rates. However, the difference between the two measures is not significant for most countries and the 6 months rate of change perform better when it comes to signalling expansions and slowdowns in industrial activity.

- **Sign test**: The OECD CLI provides qualitative information on short-term economic movements rather than quantitative measures. Therefore, the main message for CLI movements over time is the direction up or down rather than levels. A simple measure which considers the direction is the sign of the movements. The results show that for almost all the countries, around 90% of the time the sign of the initial estimates of year-on-year growth rates and the 6 month rate of change are the same as those published one month later. For zone aggregates, the sign is the same over 95% of the time. So the initial estimate can be considered as a good indicator of whether economic activity will move up or down in the near term future.

- **Acceleration/deceleration**: A measure relating revisions to the cyclical movements in economic activity more appropriate than the sign test is the acceleration/deceleration measure. This measure captures the cyclical dynamic or direction in the growth rates. The results show that for twelve countries, more than 20% of the time the first estimate of year-on-year growth rates signals a difference in direction with the 2nd estimates, while for only one country it is less than 10%. An improved picture emerges when 2nd and 3rd estimates are considered, where the difference in direction is less than 10% for seven countries and more than 20% for only six countries. These results indicate, however, that it could be dangerous to draw conclusions on directions up or down from one or two months figures for a large number of countries. On the other hand, the difference in direction noted for zone aggregates is much lower, below 10% of the time in the OECD area and the Euro area for both 1st and 2nd estimates and as low as 3% of the time in the Euro area for 2nd estimates.

- **Acceleration/deceleration and 6 month rate of change**: A comparison between first estimates for the 6 months rate of change and year-on-year growth rate in signaling the cyclical dynamics or direction in the growth rates show that the year-on-year growth rate is less revised than the 6 month rate of change for all countries except three. Both measures show major revisions where the direction of growth rates change more than 30% of the time for 6 countries. However, for about one third of countries, the frequencies of revisions for the two measures are rather close, indicating that both measures are of similar quality in signaling the direction in the growth rates. In addition, the 6 month rate of change formula uses a greater number of more recent observations and thus indicates changes in direction earlier than the year-on-year growth rate, although this also is more susceptible to revisions. Nonetheless, these results indicate that it could be dangerous to draw conclusions on directions up or down from any of the two measures on a single monthly figure for a large number of countries.

- **Early signals of cyclical turning points**: The reliability of first estimates of the CLI to provide early signals of turning points in economic activity is tested on the year-on-year growth rate as they may be calculated for all revision versions for the longest historical period. The cyclical characteristics of the 1st and 2nd estimates against the 2nd and 3rd estimates respectively are calculated as a guide to their performance, both as regards turning points (median lag), smoothness (MCD) and closeness of fit (correlation). Forecasting turning points is one of the main objectives of the leading indicator technique, because predicting the timing of cyclical turning points is one of the least reliable activities in economic forecasting. The results provide evidence that 1st and 2nd estimates give reliable signals of approaching turning points. The median lag of the 1st and 2nd estimates with reference to 2nd and 3rd estimates respectively is zero or at the most one month for all countries and no false signals in terms of extra or missing turning points are recorded for any countries or zone aggregates except Mexico. The ability to indicate approaching turning points and to confirm them is secured by the relative smoothness of the CLI for all countries except Mexico and Ireland. However, the number of cyclical turning points registered over the common sample period is relatively small, only 3 cycles, for some countries, so the turning points measures given are not significant in a statistical sense for these countries.

- **Expected and realized revisions**: Based on the characteristics of their components, countries were classified as 'expecting' to have either major or minor revisions. This classification changed for many countries after the 2002 CLI review (from 80% of countries expecting major revisions to only 40%). Countries were also classified to 'realized' major and minor revisions groups based on their observed revisions to first estimates of year-on-year growth rates before and after the 2002 CLI review. A comparison of expected and realized revisions according to these classifications shows that CLIs compiled before the 2002 CLI review are classified to the same revision group according to both classifications for 80 per cent of the countries. Differences in classification are noted for five countries, but only Mexico shows a major realized revision which is significantly different from the expected minor revision. The results for the period after the 2002 CLI review show differences in classification for eight countries, but only two countries Mexico and Portugal note major realized revision, which are significantly different from the minor revisions that would be expected. These results are of course very much dependent on the threshold values used for the classification to the different revision groups, both in the case of expected and realized revisions.

- **Smoothness, timeliness and revision**: The importance of smoothness of components in the calculation of first and second estimates of the CLI and the overall smoothness of the CLI itself was noted above. These results reinforce the argument that it is not sufficient to have timely components they also need to be smooth to guarantee small revisions. The link between smoothness and mean absolute revision of first estimates of the CLIs is rather good with a correlation coefficient of 0.54. The only countries which fall outside the general pattern, i.e. the higher the MCD value the higher the mean absolute revision, are Ireland and Spain. The link is even stronger for second estimates of the CLIs with an extremely high correlation coefficient of 0.82. These results reinforce further the argument that the degree of smoothness is probably the most important factor explaining revisions. However, as noted above, timeliness is also important, but only under the condition that the timely components are smooth.

The revisions to the CLIs noted in the above findings underline that it could be dangerous to draw conclusions on directions up or down in growth rates from one or two months' figures for a large number of countries. However, the findings also provide evidence that first and second estimates of the CLIs give early signals of approaching turning points which in most cases are not revised later. This capacity of the CLIs to predict turning points is very important and one of the main objectives of the leading indicator technique. The findings also highlight the importance of smoothness of components in the calculation of first and second estimates of the CLI. This is an area for further investigations where the

quality of the CLIs may be improved either by replacing very irregular components with smoother ones or by introducing a more efficient smoothing technique. Work on this has already started at the OECD as part of a general review of the OECD leading indicator methodology.

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1.   Introduction

The performance of leading indicators can be evaluated in different ways. One is to examine the behavior of the indicators in relation to the cyclical turning points of the reference series. Forecasting turning points is one of the main objectives of the leading indicator technique, because predicting the timing of cyclical turning points is one of the least reliable activities in economic forecasting. However, the OECD system of leading indicators is designed not only to give advance warning of turning points, but also to give information about the likely rate and amplitude of movements in the reference series. Hence, it is also useful to examine the "general fit" of the composite indicators in relation to the reference series at all stages of the cycle.

The historical performance of OECD composite leading indicators (CLIs), where the data sets are complete for individual countries are examined regularly and the results are published frequently. These results give a somewhat favourable picture of their historical performance in regards to signaling fluctuations in the growth cycle of the reference series. However, the true value of the CLI is its signal of cyclical fluctuations in the current period, which is, of course, precisely the time when they are potentially of most interest for economic forecasting and analysis. This study focuses on the current period performance, when the CLIs are based on incomplete, or provisional, data sets.

The *OECD System of Composite Leading indicators* was developed in the early 1980's based on the "growth cycle" approach. Until 2006 the OECD compiled composite leading indicators (CLIs) for 22 of its 30 Member countries. Country coverage was expanded in 2006 to include all Member countries (except Iceland) and the major six OECD non-member economies monitored by the organization (Brazil, China, India, Indonesia, Russia Federation and South Africa). This study is, however, restricted to the 21 Member countries (excluding Turkey) for which CLIs are available for a longer time period. The evaluation covers the period December 1999 to July 2006, where the starting date is determined by the availability of all release versions of the CLIs. The analysis is also performed over sub-periods to examine the performance of the CLIs before and after a major update of the CLIs undertaken in 2002.

The revisions analysis of OECD CLIs is similar to those recently undertaken by the Organisation for a range of quantitative short-term economic indicators (index of industrial production, retail trade volume and quarterly GDP). The aim current analysis on CLIs is to further evaluate the quality of the indicator in order to: identify areas where their reliability could be improved; and provide further information to users on their use for economic analyses. The context for such revisions analysis is provided in the *OECD Main Economic Indicators Original Release Data Revisions Database*[1].

2.   Major causes of revisions

2.1   Timeliness/availability

An important consideration in evaluating the current period performance of the leading indicators is that, in the current period, some of the component series may not be available or may only be provisional, so that the composite indicators are based on an incomplete or unreliable set of indicators. The OECD CLIs were reviewed in 2002. Before the review, CLIs were published for a country once at least 40 per cent of the component series were available. After the review, a country CLI is published once at least 60 per cent of the components are available. In addition, some or all of the components may be preliminary figures which will subsequently be revised.

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[1] [1] This database is freely available at: http://stats.oecd.org/mei/default.asp?rev=1

The timeliness criteria of latest data available used here refers to the ability of the component indicator to meet the publication deadline for the OECD's *Main Economic Indicators* publication. CLI data for a given month "*t*" is published at the beginning of month "*t-2*". This implies that component series available at this date would fulfill the timeliness criteria.

2.2   Frequency

Timeliness of latest data available is also dependent on the frequency of the component series. Quarterly data will be untimely in two of three months. The current method to convert quarterly series into monthly series is to copy the quarterly value in a given month of the quarter and to estimate data for the two other months of the quarter by using linear interpolation. Many business tendency surveys are conducted with a quarterly frequency in several countries which makes them less useful as component series in the compilation of monthly composite leading indicators. The interpolation of quarterly data to monthly series will also result in revisions as new data become available.

2.3   Smoothness

Furthermore, in order to aggregate the component series to a country CLI, it is necessary to ensure that they have equal "smoothness". This is to ensure that month-to-month changes in the composite indicator are not unduly influenced by irregular movements in any one indicator series. The OECD procedure is to use the "Months or Quarters for Cyclical Dominance" (MCD/QCD) moving average. This procedure ensures approximately equal smoothness between series and also ensures that the month-to-month changes in each series are more likely to be due to cyclical than to irregular movements. The data lost at the end of the series due to the moving average are restored with an extrapolation by regression over the end of the series. Of course, this procedure introduces revision to the end of the series depending on the length of the moving average (given by the MCD/QCD[2] value) needed to smooth the series. The MCD/QCD value gives an idea of the smoothness of the series. Indicators with small MCD/QCD values are preferred in order to minimize the length of the moving average when performing smoothing. Monthly component series with MCD values above 4 and quarterly components with QCD values of 2 are very irregular and will imply revisions to the series when next data becomes available.

Finally, the trend estimate used to de-trend the series will be subject to, usually small, changes as extra data are added beyond the last turning point. Seasonal adjustment and standardisation of components are further sources of potential revisions.

On the other hand, some indicators such as qualitative business and consumer tendency surveys and many financial and monetary indicators are either never or rarely revised. These types of indicators are also very timely and if available on a monthly basis would be among the best leading indicators for use in real time applications.

How reliable then are the composite indices when they are first released? This issue will be analysed following an investigation of the composition of the CLIs to obtain an indication of the quality or revision pattern that may be expected across countries based on the above considerations of the causes for such revisions.

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[2] MCD (Months for Cyclical Dominance) is defined as the shortest span of months for which the I/C ratio is less than unity. I and C are the average month-to-month changes without regard to sign of the irregular and trend cycle component of the series, respectively. Although it remains approximately constant as the span of months increases, C should increase. Therefore, the I/C ratio, itself a measure of smoothness, should decline and eventually become less than unity. In practice, there are some series for which the I/C ratio at first declines as the span of months increases, and then starts to increase again without ever having dropped as low as 1. Hence, there is a convention that the maximum value of MCD should be six. For quarterly series there is an analogous measure, Quarters for Cyclical Dominance (QCD) which has a maximum value conventionally defined as 2.

3. Characteristics of component series included in CLIs before and after the 2002 CLI review[3]

The 2002 CLI review included the following objectives related to the component series: (1) to replace untimely components series, (2) to replace component series no longer published, (3) to replace quarterly component series with monthly series. This means that one should expect to see major changes before and after the revision in the composition of the component series on the two characteristics: timeliness /availability and frequency of components. In addition to these characteristics, smoothness of components and inclusion of non-revised qualitative survey or financial/monetary components in the CLIs will be investigated to see if any differences are noted in these aspects for the periods before and after the 2002 CLI review which may be used to explain the revision to the first few release versions of the CLIs.

3.1 Timeliness/availability

The share of timely components increased by 24 percentage points after the 2002 CLI review and the OECD average is now 80 per cent. The share of timely components increased or stayed at the same level in all countries after the CLI review. Increases of over 20 percentage points are registered in close to half the number of countries with particularly strong increases in Japan, Austria, Netherlands, Norway, Portugal and Spain. Today, all components are available in time for the CLI publication deadline for the following countries: United States, Austria, Germany, Netherlands, Portugal, Spain and Switzerland (Figure 1).

Figure 1   Timeliness: share of latest data available to meet CLI publication deadline before and after the 2002 CLI review


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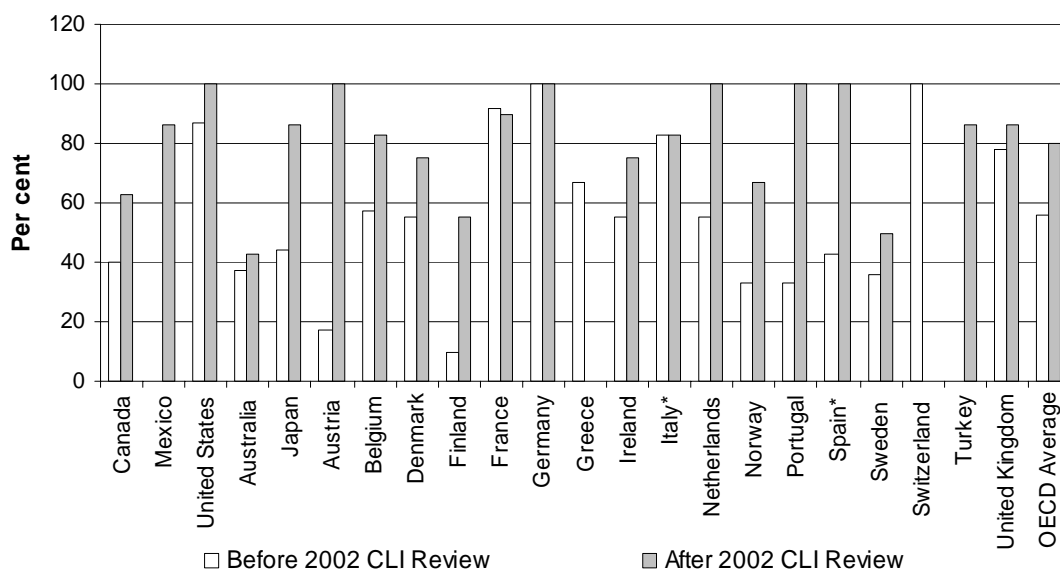
[3] For Italy and Spain, CLI reviews took place in 2001, instead of 2002 for all other OECD Member countries.
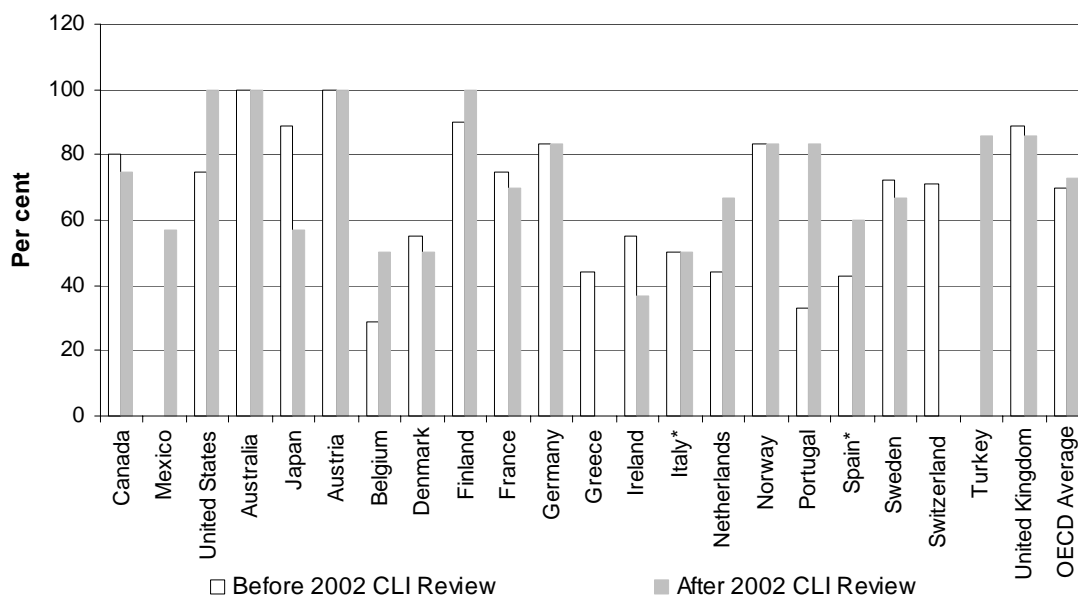
3.2 Frequency

The noted increase in the share of timely components is of course partly explained by the frequency of the component series. The share of monthly components increased by 13 percentage points after the 2002 CLI review and the OECD average is now 89 per cent. The share of monthly components increased or stayed at the same level in all countries except Sweden after the CLI review. Increases of over 20 percentage points are registered in the following countries: Japan, Austria, Denmark, Norway, Portugal and Spain. In over half the number of countries, all components today are of monthly frequency (Figure 2).

Figure 2   Frequency: share of monthly CLI components before and after the 2002 CLI review
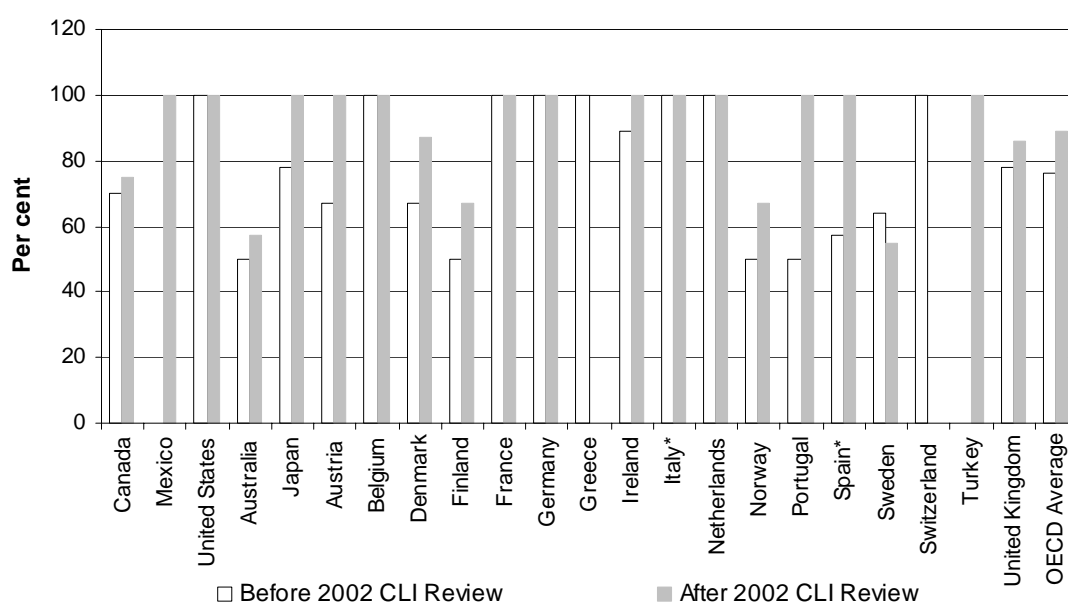
3.3 Smoothness

The share of smooth components, i.e. with an MCD value below 4 or an QCD value below 2, did not change very much after the 2002 CLI review and only a small increase of 3 percentage points was recorded changing the OECD average to 73 per cent. Major changes in the share of smooth components are, however, noted in a few countries: increases by over 20 percentage points are registered in the United States, Belgium, Netherlands, Portugal and Spain while major decreases are registered in Japan and Ireland and minor decreases noted in Canada, Denmark, France, Sweden and the United Kingdom (Figure 3).

Figure 3   Smoothness: share of components with MCD less than 4 and QCD less than 2

Before 2002 CLI Review   After 2002 CLI Review

3.4   Non-revised series

Business and consumer tendency survey series are the most frequently used CLI component series which are never or rarely revised. The share of such components increased by 5 percentage points after the 2002 CLI review raising the OECD average to 47 per cent. Major increases are registered in the United States, Belgium, Denmark, Finland, Ireland and the Netherlands, while major decreases are only registered in Norway and Spain (Figure 4).

A second group of never or rarely revised series includes financial and monetary series. The share of such components remained at about the same level after the 2002 CLI review with the OECD average at 24 per cent. Major decreases are, however, registered in Finland, France, Ireland, Italy, the Netherlands and Sweden, while major increases are only registered in Canada and Japan (Chart 5).

The two groups of non-revised series taken together show an increase of 6 percentage points after the 2002 CLI review lifting the OECD average to 71 per cent. Major increases are registered in Canada, the United States, Austria, Belgium, Denmark, Ireland, the Netherlands and Portugal, while major decreases are only registered in Japan, Finland, Norway and the United Kingdom. The share of non-revised components is today as high as 80 per cent or more in Austria, Belgium, Germany, the Netherlands and Spain (Chart 6).

Non-revised series means series not revised by source. However, they are subject to revisions related to their MCD or QCD value, i.e. how much they need to be smoothed to suppress their irregular behaviour.

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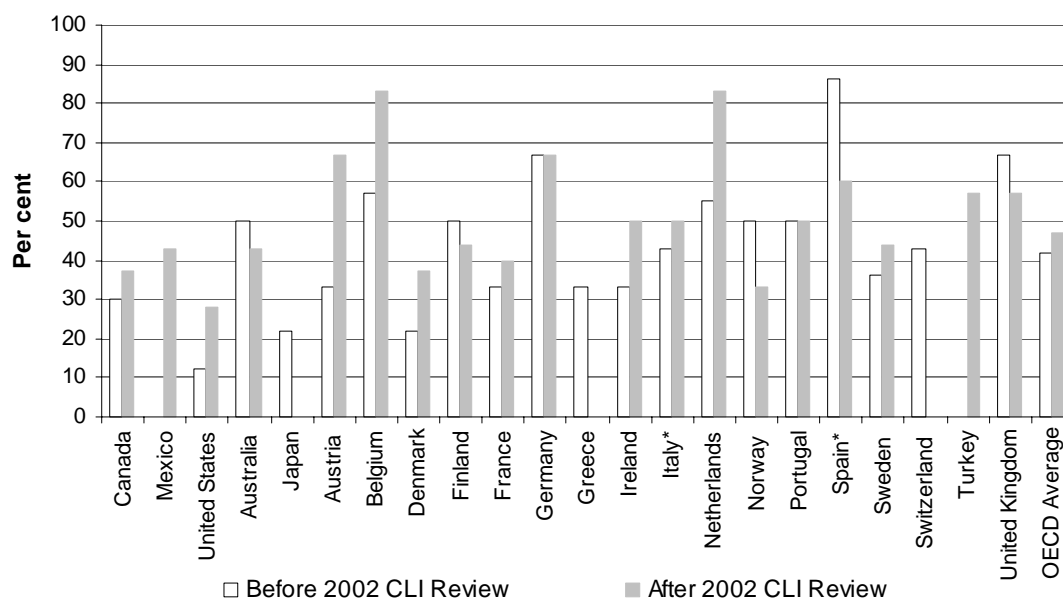**Figure 4   Non-revised series: share of business and consumer tendency survey components**

☐ Before 2002 CLI Review   ■ After 2002 CLI Review

Figure 5   Non-revised series: share of financial and monetary components

☐ Before 2002 CLI Review   ■ After 2002 CLI Review
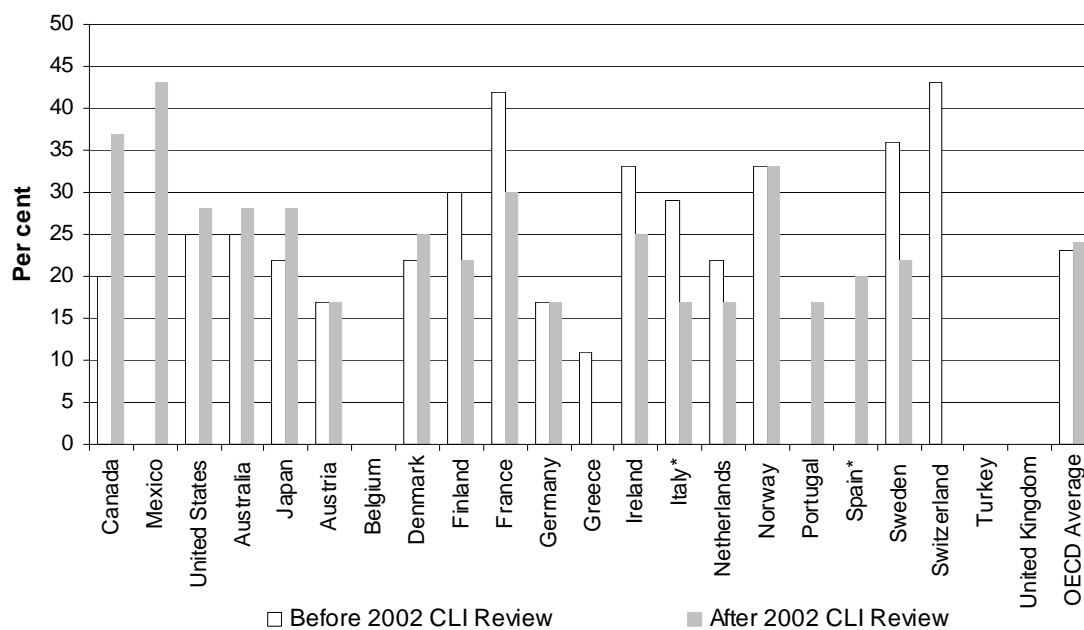
Figure 6   Non-revised series: share of business/consumer tendency survey and financial and monetary components

□ Before 2002 CLI Review   ■ After 2002 CLI Review
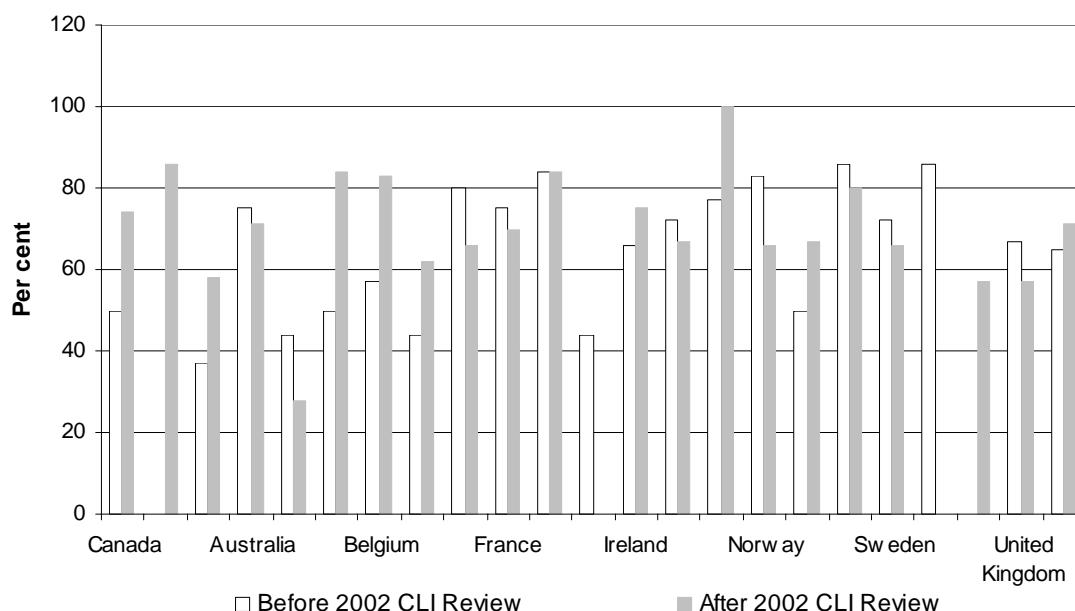
4   Component characteristics and expected revisions to CLIs

The component characteristics important for understanding and explaining revisions to the CLIs are set out in Table 1. The information in this table summarises all component characteristics which were investigated one by one in the previous Section of this paper. This information will now be used in a combined way to classify country CLIs according to the importance of revision that may be expected.

In order to classify the revisions that may be expected to country CLIs, a screening procedure is performed based on the four components characteristics outlined the previous Section. Country CLIs for which only minor revision might be expected are classified to a "non-revision group", if the share is above a certain threshold value on at least three of the following components characteristics:

1. Timeliness/Availability: the share of latest data available at t-2 or earlier is above 80 per cent
2. Frequency: the share of monthly components is above 80 per cent
3. Smoothness: the share of components with MCD less than 4 or QCD less than 2 is above 80 per cent
4. Non-revised series: the share of business/consumer tendency surveys and financial and monetary components is above 60 per cent.

Country CLIs which do not qualify on above criteria are classified to a "revision group" where major revisions may be expected. It should be noted that the component characteristics overlap, which means that if a high share is noted on the timeliness characteristic, a high share will certainly also be found on the frequency characteristic.

Table 1   **Component characteristics of OECD composite leading indicators (CLI) before and after the 2002 CLI review**

Country	Total number of components	Survey or financial non-revised components		Monthly components	Timeliness latest data available at *t-2* or earlier	Smooth-ness components with MCD < 4	Total number of components	Survey or financial non-revised components		Monthly components	Timeliness latest data available at *t-2* or earlier	Smooth-ness components with MCD < 4
		% of total number of components						% of total number of components				
		CLI before 2002 review						**CLI after 2002 review**				
		F	S					F	S			
Canada	10	20	30	70	40	80	8	37	37	75	63	75
Mexico							7	43	43	100	86	42
United States	8	25	12	100	87	75	7	28	28	100	100	100
Australia	8	25	50	50	37	100	7	28	43	57	43	100
Japan	9	22	22	78	44	89	7	28	0	100	86	57
Austria	6	17	33	67	17	100	6	17	67	100	100	100
Belgium	7		57	100	57	29	6		83	100	83	50
Denmark	9	22	22	67	55	55	8	25	37	87	75	50
Finland	10	30	50	50	10	90	9	22	44	67	55	100
France	12	42	33	100	92	75	10	30	40	100	90	70
Germany	6	17	67	100	100	83	6	17	67	100	100	83
Greece	9	11	33	100	67	44						
Ireland	9	33	33	89	55	55	8	25	50	100	75	37
Italy*	7	29	43	100	83	50	6	17	50	100	83	50
Netherlands	9	22	55	100	55	44	6	17	83	100	100	67
Norway	6	33	50	50	33	83	6	33	33	67	67	83
Portugal	6		50	50	33	33	6	17	50	100	100	83
Spain*	7		86	57	43	43	5	20	60	100	100	60
Sweden	11	36	36	64	36	72	9	22	44	55	50	67
Switzerland	7	43	43	100	100	71						
Turkey							7		57	100	86	86
United Kingdom	9		67	78	78	89	7		57	86	86	86
TOTAL	166	39	70	127	93	116	141	34	67	125	113	103
% of total		23	42	76	56	70		24	47	89	80	73

* CLI review undertaken in 2001

The results of the screening procedure is set out in Table 2 which shows that 80 per cent of the CLIs compiled before the 2002 CLI review would be expected to be exposed to major revisions. Only CLIs for France, Germany, Italy and Switzerland would be expected to show minor revisions.

The results for the period after the 2002 CLI review show a widespread improvement with the share of CLIs that would be expected to be exposed to major revisions falling to 40 per cent. The countries for which the CLIs would still be expected to show major revisions are Canada, Australia, Japan, Denmark, Finland, Ireland, Norway and Sweden. In all cases, timeliness or smoothness or both factors together explain the bad scores for these countries. The bad score on timeliness occurs in half the number of countries explained by the fact that quarterly business tendency survey indicators are used as components (Canada, Australia, Norway and Sweden).

Table 2   Expected revisions to OECD composite leading indicators (CLI) before and after the 2002 CLI review

Country	CLI before 2002 review		CLI after 2002 review	
	Minor revisions	Major revisions	Minor revisions	Major revisions
Canada	No	Yes	No	Yes
Mexico			Yes	No
United States	No	Yes	Yes	No
Australia	No	Yes	No	Yes
Japan	No	Yes	No	Yes
Austria	No	Yes	Yes	No
Belgium	No	Yes	Yes	No
Denmark	No	Yes	No	Yes
Finland	No	Yes	No	Yes
France	Yes	No	Yes	No
Germany	Yes	No	Yes	No
Greece	No	Yes		
Ireland	No	Yes	No	Yes
Italy*	Yes	No	Yes	No
Netherlands	No	Yes	Yes	No
Norway	No	Yes	No	Yes
Portugal	No	Yes	Yes	No
Spain*	No	Yes	Yes	No
Sweden	No	Yes	No	Yes
Switzerland	Yes	No		
Turkey			Yes	No
United Kingdom	No	Yes	Yes	No

5 Main findings from revisions analysis of CLI for OECD countries

Data used for analysis comes from the OECD *Main Economic Indicators Original Release Data and Revisions Database*[4]. Data from this database are original data as published in successive monthly editions of the *Main Economic Indicators* publications. The first period covered in the analysis is February 1999 and last period October 2006.

This analysis examines the revision histories of 21 OECD countries and three zone aggregates (OECD area, Euro area and Major Seven countries) for the first and second estimates of trend restored Composite Leading Indicators for year-on-year (YoY) growth rates over the period December 1998/August 2000 to August 2006. The starting date of the analysis is determined by the availability of all CLI revision versions. This date is December 1998 for all major seven OECD Member countries (Canada, United States, Japan, France, Germany, Italy and the United Kingdom) and August 2000 for other countries included in the analysis.

5.1 Size of revisions to trend restored CLI among counties

The size of a revision for a month is defined by the difference between the first and second estimate of the growth rate for the month and also the second and third estimate of the growth rate of the month in question. A positive sign of the revision indicates an underestimation of the growth rate of the first estimate.

Figure 7 shows the mean absolute revision expressed in percentage points. Looking at the mean revision without taking the absolute value is not really useful because this mean will be around zero. Indeed, some revisions will be positive and some others will be negative, and their effect may balance each other. Taking the absolute value allows the canceling out of this positive/negative balance in order to really see the discrepancy that exists between subsequent estimates.

Figure 7   Mean absolute revision to first estimates of year-on-year growth rates for CLI over the period December1998/August 2000 to August 2006


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[4] This database is freely available at: http://stats.oecd.org/mei/default.asp?rev=1
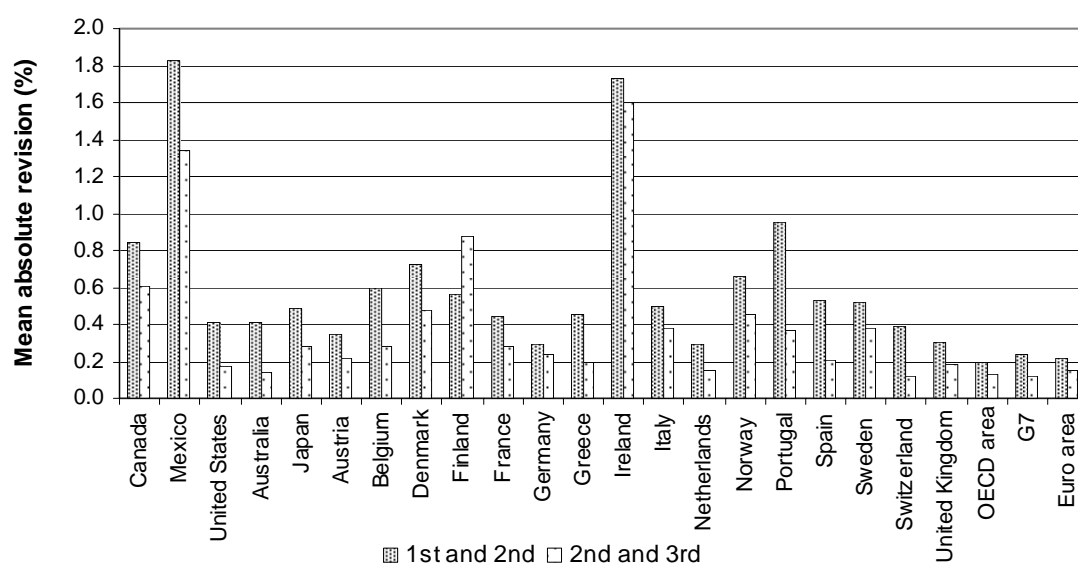
Figure 7 above shows a comparison of the mean absolute revision across countries for year-on-year growth rates for the CLI. For two countries (Mexico and Ireland) revisions are large between first estimates and estimates published one month later. This revision is also larger relative to other countries, i.e. for Canada, Denmark, Norway and Portugal but for all other countries the revision is rather small (less than 0.6% or 0.4% on average) and almost neglectable for zone aggregates (0.2%). In the case of Denmark, Mexico, Ireland and Portugal, the size of the revisions is mainly explained by the high share of very irregular components which introduce revisions to the calculation of the CLI due to the smoothing process. For Canada and Norway, the size of the revisions might be explained by the availability of timely components related to the high share of quarterly components. The year-on-year growth rates are based on trend restored CLI data and thus includes long-term growth rate from the reference series, i.e. industrial production, in addition to purely cyclical movements. This may introduce a bias in revision sizes coming from high industrial production growth which may also explain part of the revision for Ireland which shows very high output growth over the investigation period.

The mean absolute revision between the 2nd and 3rd estimate is low in most countries (except Canada, Mexico, Finland and Ireland where it is greater than 0.5%) and the magnitude is less (except for Finland) than those between first and second estimates. This could suggest that there is an improvement in reliability of the 2nd estimates.

Changes in the size of the revision can also be compared over time. As the OECD reviewed its CLI in 2002, the mean absolute revision can be seen for the entire period of time (December 1998/August 2000 to August 2006) and for two sub-periods of time (December 1998/August 2000 to September 2002 and October 2002 to August 2006) (see Figure 8). The starting date of the analysis for the entire period and the early sub-period is determined by the availability of all CLI review versions for different country groups (see introduction to Section 5 for more details).

Figure 8   **Mean absolute revisions between first estimates and those published one month later of year-on-year growth rates for CLI both for the entire period (December 1998/August00 to August 2006) and for two sub-periods**
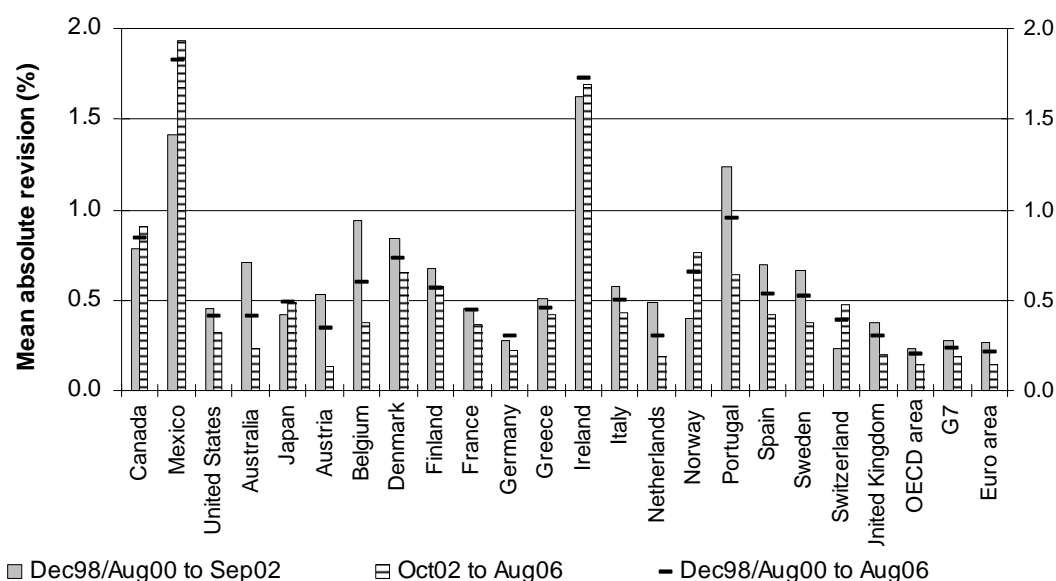
When comparing the two sub-periods of time (from December 1998/August 2000 to September 2002 and from October 2002 to August 2006) the conclusion suggests a mixed result. For Canada, Mexico, Japan, Ireland, Norway and Switzerland, Figure 8 shows an increase of the mean absolute revisions between the first and the second sub-period. Possible explanations for the increased revisions for the second sub-period for the above countries are outlined in the following. For Mexico, no revision of the CLI was undertaken so no further explanation can be offered than the one given above for the revisions over the whole period. In the case of Ireland, the bad results for the second sub-period may be explained by the increase of the number of less smooth components in the revised CLI. For the other countries with an increase in revisions between the first and second sub-period, Canada, and Norway show problems with timeliness of newly introduced components, while Japan has problems with newly introduced noisy components. For Switzerland, no revision of the CLIs was undertaken so no explanation may be offered for the increase in revisions between the first and second sub-period.

For all other countries the mean absolute revisions decreased in the second period, which could suggest an improvement in the reliability of the first estimates.

5.2 Revisions to CLI and Industrial Production

CLIs are calculated for predicting the cycles of total industrial production, which is chosen as a proxy of the whole economy. Hence, it could be useful to compare revisions of the first estimate between CLI and IIP on a year-on-year growth rate basis (Figure 9).

Figure 9   **Mean absolute revisions to first estimates of year-on-year growth rates for CLI and IIP over the period December 1998/August 2000 to August 2006**
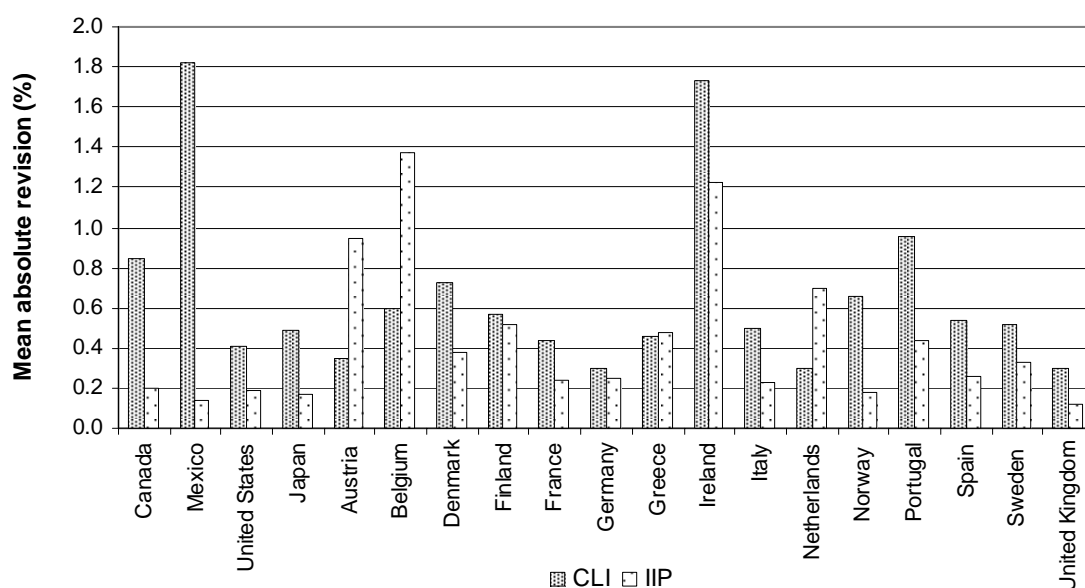
The size of the revision of the IIP, between the 1st and 2nd estimates, is smaller than those of the CLI, except for Austria, Belgium and the Netherlands. For these three specific countries, this could be explained by the fact that half or more of their 6 component series for calculating CLI come from business tendency surveys and are not revised and even nowadays 80% of their components are not revised (see Section 3.4 above.

The CLI is designed for signaling in advance a turning point in the reference series (IIP) and to do this it is calculated on smoothed component series so that turning points can be easily detected. However, smoothing introduces revisions to the CLI and to make the comparison of revisions related to IIP

valid this later series should also be smoothed. For 75 per cent of the countries, the IIP is much more irregular than the CLI and the smoothing needed to make it easy to detect turning points would introduce large revisions which are not taken into account in revisions related to the IIP noted above. In addition, the CLI is based on a set of components, on average 7-8, which are subject to revisions except for survey indicators and certain financial series. This means that one would expect to find larger revisions for the CLI compared to a single series like IIP, if revisions in components are dependent from each other. However, the larger revisions noted for the CLI compared to the IIP for most countries does not correspond to the magnitude that would be expected taking into account sources of revisions to the CLI coming from both the large number of components and the smoothing applied to them.

5.3 Statistical significance of mean revisions to the CLI

Looking at the mean revision in the Figure 10 below, only Mexico stands out as having very high mean revision, which has been confirmed by running the test of statistical significance of the mean revision from zero. (See table A1 in Appendix).

Figure 10   **Mean revision between first estimates of CLI and those published 1 month later and between second and third estimates for year-on-year growth rates over the period December 1998/August 2000 to August 2006**
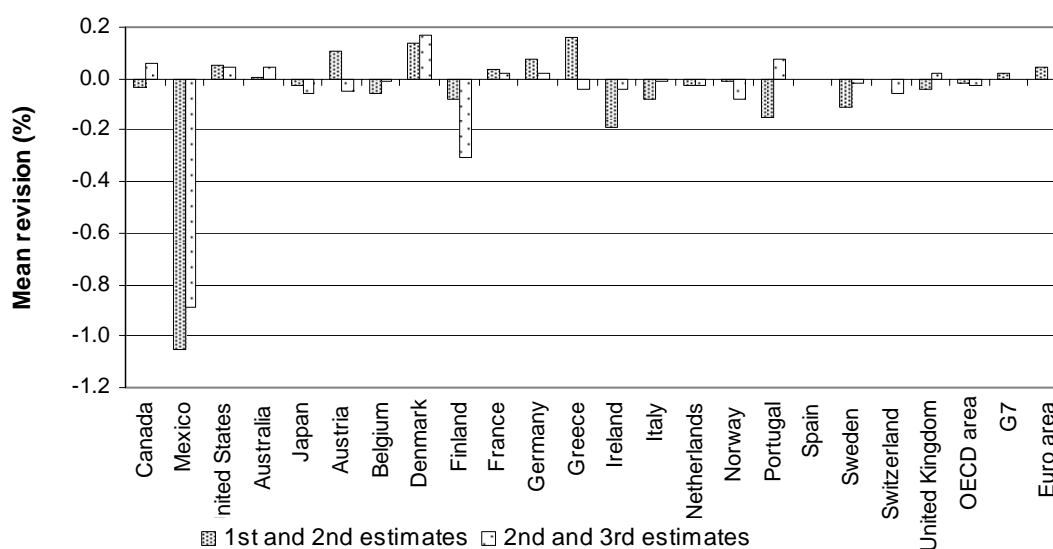
The first estimates of Mexico's CLI growth were revised down on average by 1.0 % point with those published one month later and by 0.9% between the 2nd and 3rd estimates. The mean revisions to year-on-year growth rates were found to be statistically significantly different from zero for Denmark and Switzerland between the 2nd and 3rd estimates for the entire period.

For the first sub-sample period (December 1998/August 2000 to September 2002), mean revisions were statistically significantly different from zero for Japan and Finland between the 1st and the 2nd estimates, and for Australia between the 2nd and the 3rd estimates for year-on-year growth rates. For the second sub-period (October 2002 to August 2006) the test was positive for Mexico between the 1st and the 2nd estimates, and for Mexico, Germany, Netherlands and Switzerland between the 2nd and the 3rd estimates.

For all other countries and zone aggregates, there is no evidence of bias. The mean revisions are fairly small, negative values appear as often as positive ones, and they diminish in size from the first to the second estimate.

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5.4 Reliability of first estimates of the Composite Leading Indicators

The OECD CLI is designed to provide early signals of turning points (peaks and troughs) between expansions and slowdowns of economic activity. The OECD uses the 6 month rate of change of the CLI as a pointer to possible turning points. This rate is calculated on the trend restored CLI and thus includes long-term growth rate in addition to purely cyclical movements. It is calculated by using the ratio between the figure for a given month *m* and the average of the figures from *m-12* to *m-1* (the result is then annualised by rising to the power of 12/6.5). The 6 month rate of change is comparable to the year-on-year growth rate, but provides earlier signals for future turning points than the year-on-year growth rate. However, all release versions of the CLIs in the 6 month rate of change form are only available for the period back to October 2002.

To measure the relative robustness of the first estimate of 6 months rate of change compared to those for year-on-year growth rates, one should calculate the relative mean absolute revision. This is shown in Figure 11 below.

Figure 11   Relative mean revision between first estimates of CLI and those published 1 month later for 6 months rate of change and year-on-year growth rates over the period October 2002 to August 2006
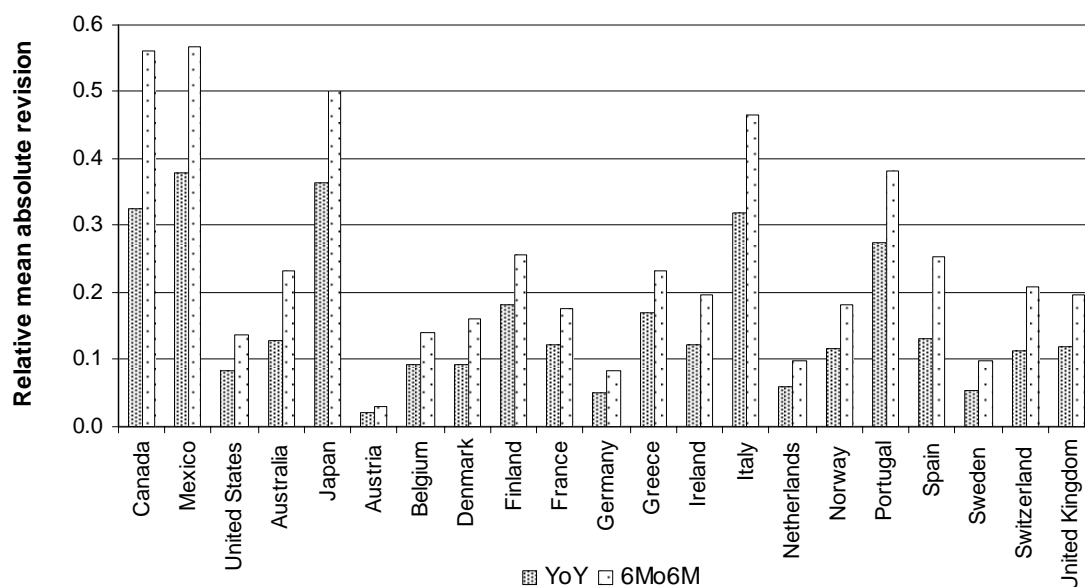
For all countries, the relative mean revision for the 6 months rate of change is higher than those for year-on-year growth rates. For the 6 months rate of change basis, the average ratio is greater 0.45 for Canada, Mexico, Japan and Italy but averages 0.18 across all other countries. This means that the first estimate of 6 months rate of change is expected to be revised by a less than one fifth of its original value within the first month for most of the countries and by around half of its original value for Canada, Mexico, Japan and Italy. The relative mean revision for year-on-year growth rates is lower and 67% of countries have a relative mean revision less than 0.15 (the average ratio is around 0.16 across all countries). However, the difference between the two measures is not significantly great for most countries and the 6 months rate of change perform better when it comes to signalling expansions and slowdowns in industrial activity as outlined in Section 5.5 below (Figure 13).

5.5 Reliability of first estimate as a signal of short-term expansion or slowdown in economic activity

The OECD CLI provides qualitative information on short-term economic movements rather than quantitative measures. Therefore, the main message of CLI movements over time is the direction up or down rather than levels. The above analysis on relative mean absolute revision focuses on the level of revisions and other measures relating revisions to the cyclical movements in economic activity would be more appropriate for the analysis of revisions in the CLIs. A first such measure considers the sign of the movements, i.e. whether they signal an expansion or slowdown in economic activity.

Figure 12   Percentage of months where first estimate of year-on-year growth rate for the CLI has a different sign to the one published one month later and between 2nd and 3rd estimates over the period December 1998/August 2000 to August 2006
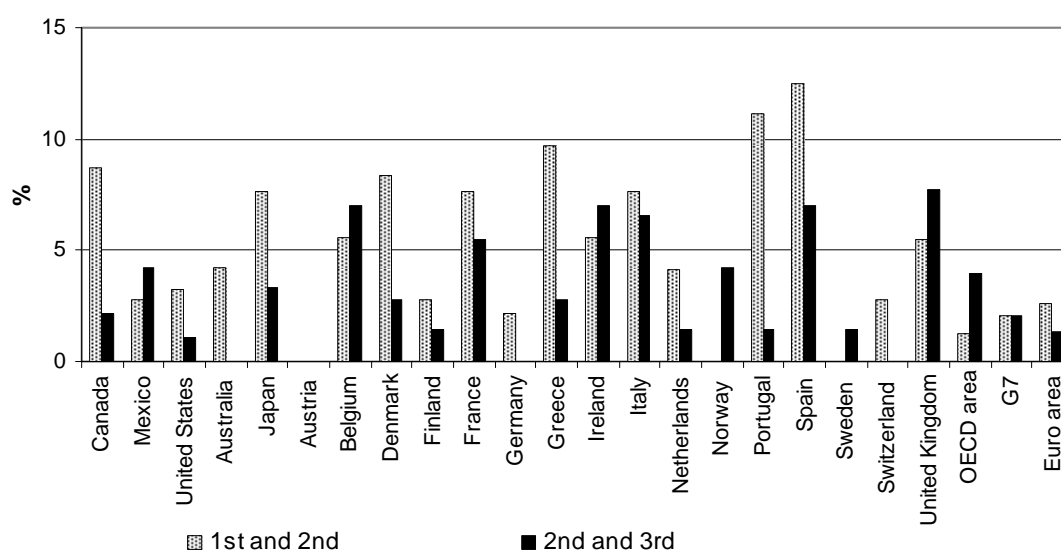
The above figure shows that for almost all the countries, around 90% of the time, the sign of the initial estimates of year-on-year growth rates are the same as that published one month later and for zone aggregates, the sign is the same over 95% of the time. Also, when comparing data published between one and two months later, this percentage increases and is equal to 100% for Australia, Austria, Germany and Switzerland. So the initial estimate can be considered to be a good indicator of whether economic activity will move up or down in the near term future.

Figure 13 shows the comparison between two different measures: 6 months rate of change and year-on-year growth rate in signalling an expansion or a slowdown in economic activity.

Figure 13 **Percentage of months where first estimate of the year-on-year growth rate and 6 months rate of change for the CLI has a different sign as the one published one month later over the period October 2002 to August 2006**
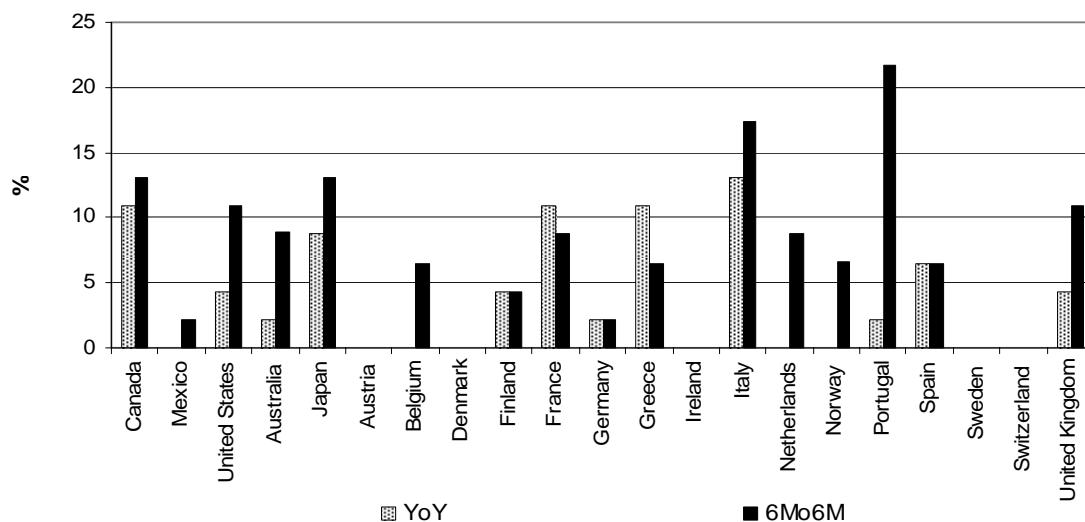
The comparison is performed over the sub-period October 2002 to August 2006 for which the 6 month rate of change measure is available. The results show that the year-on-year growth rate is revised less than the 6 month rate of change for most countries. However, major revisions above 15% according to the 6 month rate of change measure are only registered for Italy and Portugal. This means that initial estimate of the 6 months rate of change for the CLI also gives a reliable indicator for most countries as to whether economic activity will move up or down in the near term future.

Figure 14 **Percentage where the change in growth rate of the first estimate of CLI has a different direction to the one published 1 month later and between second and the third estimates for year-on-year growth rates over the period December 1998/August 2000 to August 2006**
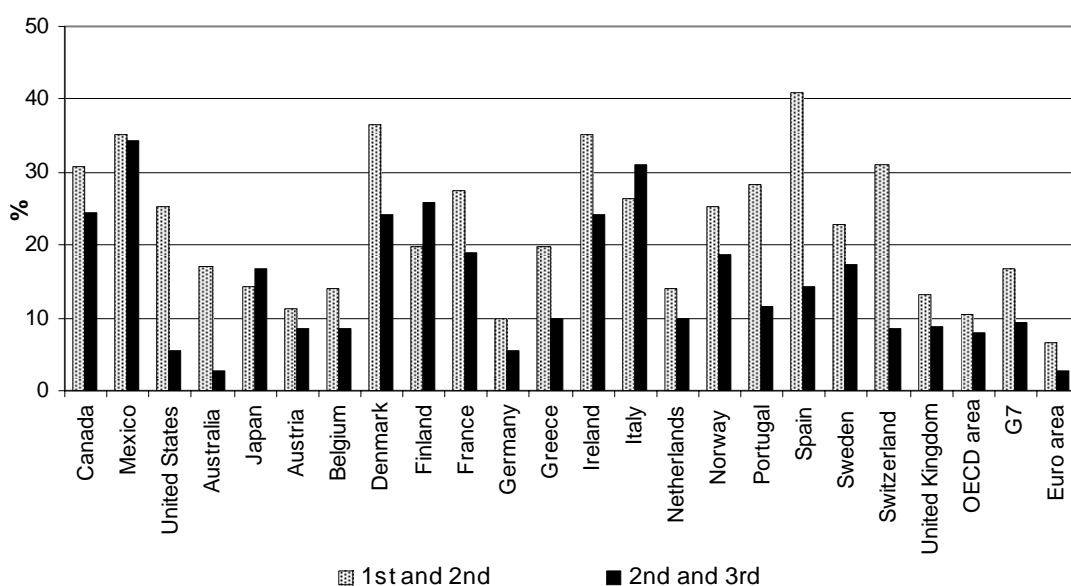
A measure relating revisions to the cyclical movements in economic activity that is more appropriate than the sign test is the acceleration/deceleration measure. This measure indicates the number of times the first estimate indicated acceleration, while the final estimate indicated deceleration or vice versa. In other word it captures the cyclical dynamic or direction in the growth rates.

Figure 14 above shows the percentage of the total number of reference periods where the first estimate indicates acceleration while the final estimate indicates deceleration and vice versa. On one hand, for 12 countries, more than 20% of the time the first estimate signals a difference in direction with the 2nd estimates, while for only one country it is less than 10%. On the other hand, between the 2nd and 3rd estimates this difference in direction is less than 10% for 7 countries (United States, Australia, Austria, Belgium, Germany, Switzerland and United Kingdom) and greater than 20% for only six countries (Canada, Mexico, Denmark, Finland, Ireland and Italy). In contrast, the difference in direction noted for zone aggregates is much lower, below 10% of the time in the OECD area and the Euro area for both 1st and 2nd estimates and as low as 3% of the time in the Euro area for 2nd estimates.

The high share of differences, above 30% for Canada, Mexico, Denmark, Ireland, Spain and Switzerland between 1st and 2nd estimates and above 20% between the 2nd and 3rd estimates for the six countries noted above are explained by the noise in the 1st and 2nd estimates coming from the high number of irregular components among the ones available in time for the calculation of the 1st and 2nd estimates. These results indicate that it could be dangerous to draw conclusions on directions up or down from one or two months figures in particular for these countries.

A comparison between the first estimates for the 6 months rate of change and the year-on-year growth rate in signaling the cyclical dynamics or direction in the growth rates is shown in Figure 15. The comparison is performed over the sub-period October 2002 to August 2006 for which the 6 month rate of change measure is available. The results show that the year-on-year growth rate is less revised than the 6 month rate of change for all countries except Finland, Italy and Spain. Both measures show major revisions above 30% for 6 countries: Canada, Mexico, Denmark, Ireland, Italy and Switzerland.

Figure 15   Percentage of months where first estimate of year-on-year growth rate and 6 months rate of change for the CLI has a different direction as the one published one month later over the period October 2002 to August 2006

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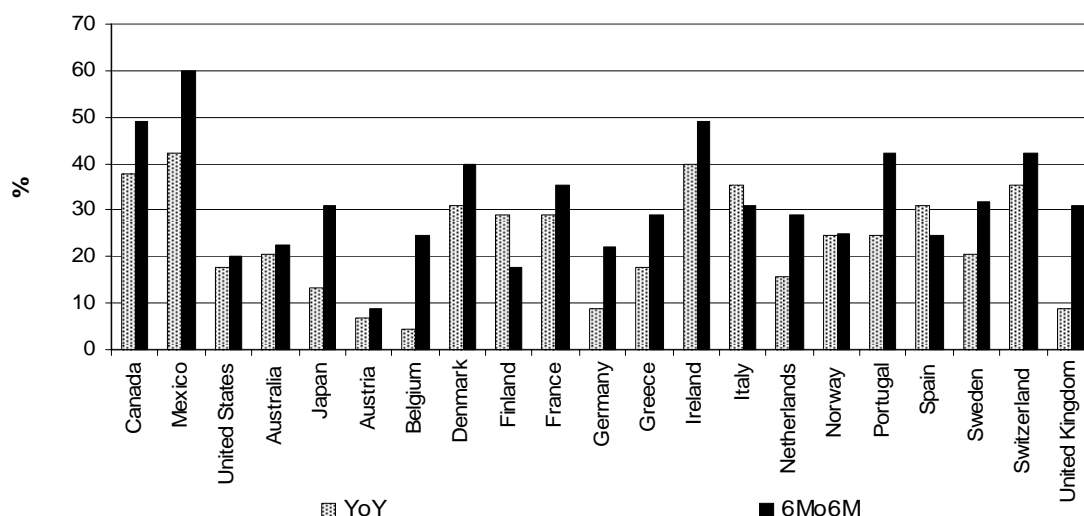
However, for about one third of the countries, the frequency of revisions for the two measures is rather close, indicating that both measures are of similar quality in signaling the direction in the growth rates. Despite the large revisions in general for the 6 month rate of change, it must be borne in mind that the six month rate of change formula uses a greater number of recent observations and thus indicates changes in direction earlier than the year-on-year growth rate, but as a consequence it is more vulnerable to revision. These results indicate that it could also be dangerous to draw conclusions on directions up or down from any of the two measures on a single monthly figure for a large number of countries.

5.6   Reliability of first estimate to provide early signals of turning points in economic activity

The above review of the current performance of the CLI is reasonably reassuring, although the fact remains that it is imprudent to read too much into one or two months' figures.   This section considers the reliability of first estimates of the CLI to provide early signals of turning points in economic activity. To test this, the year-on-year growth rate is used as they may be calculated for all revision versions for the longest historical period. The analysis is performed over the period January 1999 to June 2006 for the major seven OECD Member countries and for the period January 2001 to June 2006 for all other countries.

As noted in Section 5.3, the OECD uses the 6 month rate of change of the CLI as a pointer to possible turning points. This measure is comparable to the year-on-year growth rate, but provides earlier signals for future turning points than the year-on-year growth rate. This means that early signals of turning points provided by the year-on-year growth rate would only be indicative for the reliability of the 6 month rate of change. However, all release versions of the CLIs in 6 month rate of change form are only available for the period back to October 2002, hence the analysis has been performed on the year-on-year growth rate.

The charts in Figure 16 show the evolution of the year-on-year growth rate of the 1st and 2nd estimates of the CLI in the left part and the 2nd and 3rd estimates in the right part. Table 3 gives the cyclical characteristics of the 1st and 2nd estimates against the 2nd and 3rd estimates respectively, as a guide to their performance, with regard to turning points (median lag), smoothness (MCD) and closeness of fit (correlation).

In terms of median lag, the difference is at most one month and concerns about one third of the countries between the 1st and 2nd estimates and less than 20% of the countries between the 2nd and 3rd estimates. No false signals in terms of extra or missing turning points are recorded for any of the countries with the exception of Mexico.

The closeness of fit, as measured by the cross-correlation coefficient (R), is very high and over 0.95 for all countries except Mexico and Portugal between the 1st and 2nd estimates and except Mexico and Denmark between the 2nd and 3rd estimates. However, the CLI is rather irregular with MCD values above one for many countries. In order to distinguish cyclical movements from irregular variation and be able to draw conclusions about turning points from one or two months' figures, the MCD value must be one or two (see section 2.3). Smoothness, as measured by the MCD value, is one or two for 62% of the countries between the 1st and 2nd estimates and 81% between the 2nd and 3rd estimates. However, CLIs' with MCD values above three are only registered for Mexico, Portugal and Spain between the 1st and 2nd estimates and for Mexico and Ireland between the 2nd and 3rd estimates.

The cyclical characteristics recorded in Table 3 and outlined above provide evidence that 1st and 2nd estimates give reliable signals of approaching turning points. The median lag is zero or at the most one month for all countries and no false signals in terms of extra or missing turning points are recorded for any countries or zone aggregates except Mexico. The ability to indicate approaching turning points and to confirm them is secured by the relative smoothness of the CLI for all countries except Mexico and Ireland. However, the number of cyclical turning points registered over the common sample period is relatively small, only 3 cycles, for some countries, so the turning points measures given are not significant in a statistical sense for these countries.

Table 3   Revisions and Early Signals of Cyclical Turning Points

	Number of turning points over common sample period	Extra (x)/ missing (m) turning points between estimates		Median lag (-) and standard deviation (std) at all turning points between estimates				Smoothness (MCD) of 1st and 2nd estimates and Correlation (R) between estimates			
				Lag(-)	std	Lag(-)	std	MCD	R	MCD	R
		1st and 2nd estimate	2nd and 3rd estimate	1st and 2nd estimate		2nd and 3rd estimate		1st and 2nd estimate		2nd and 3rd estimate	
Canada*	6	0	0	0	1.6	-1	3.1	3	0.97	2	0.98
Mexico	3	0	2 m	-1	2.6	0	2.0	6	0.76	6	0.76
United States*	4	0	0	0	1.5	0	0.0	2	0.99	1	0.99
Australia	3	0	0	-1	1.0	0	0.6	2	0.98	1	1.00
Japan*	4	0	0	0	0.8	-1	0.6	2	0.97	2	0.98
Austria	3	0	0	0	0.6	0	0.0	1	0.98	1	0.99
Belgium	5	0	0	0	0.4	0	0.7	1	0.99	1	1.00
Denmark	4	0	0	-1	2.5	0	0.5	3	0.97	2	0.99
Finland	4	0	0	1	1.7	-1	0.6	2	0.99	2	0.94
France*	6	0	0	-1	0.5	0	0.7	1	0.98	1	0.99
Germany*	6	0	0	0	04	0	05	1	0.99	1	0.99
Greece	5	0	0	0	0.8	0	0.7	2	0.95	1	0.99
Ireland	3	0	2 m	0	0.6	0	0.5	3	0.97	4	0.96
Italy*	6	0	0	-1	0.8	-1	2.0	3	0.97	2	0.97
Netherlands	5	0	0	0	0.9	0	0.4	1	0.99	1	1.00
Norway	4	0	0	0	0.8	0	0.0	2	0.98	2	0.99
Portugal	3	0	0	0	0.0	0	0.0	4	0.87	3	0.98
Spain	4	0	0	0	1.0	0	0.0	4	0.96	2	0.99
Sweden	3	0	0	0	0.0	0	0.0	3	0.99	3	0.99
Switzerland	3	0	0	0	1.5	0	0.6	2	0.98	1	1.00
United Kingdom*	6	0	0	-1	0.5	0	0.4	1	0.99	1	0.99
OECD area	6	0	0	0	0.0	0	0.4	1	0.99	1	1.00
Major 7 countries	7	0	0	0	0.6	0	0.4	1	0.99	1	1.00
Euro area	6	0	0	0	0.5	0	0.4	1	0.99	1	0.99

* For Major seven countries: sub-period is January 1999 to June 2006. For all other countries the sub-period is January 2001 to June 2006.

Figure 16 **Evolution of the year-on-year growth rate of the 1st and 2nd estimates and the 2nd and 3rd estimates over the period December 1998/August 2000 to August 2006**

OECD area

OECD area

First published estimate (P)
Estimate published 1 month later (L)

Estimate published 1 month later (P)
Estimate published 2 months later (L)

Major 7 countries

Major 7 countries

First published estimate (P)
Estimate published 1 month later (L)

Estimate published 1 month later (P)
Estimate published 2 months later (L)

Euro area

Euro area

First published estimate (P)
Estimate published 1 month later (L)

Estimate published 1 month later (P)
Estimate published 2 months later (L)

Figure 16   Evolution of the year-on-year growth rate of the 1st and 2nd estimates and the 2nd and 3rd estimates over the period December 1998/August 2000 to August 2006 (cont.)
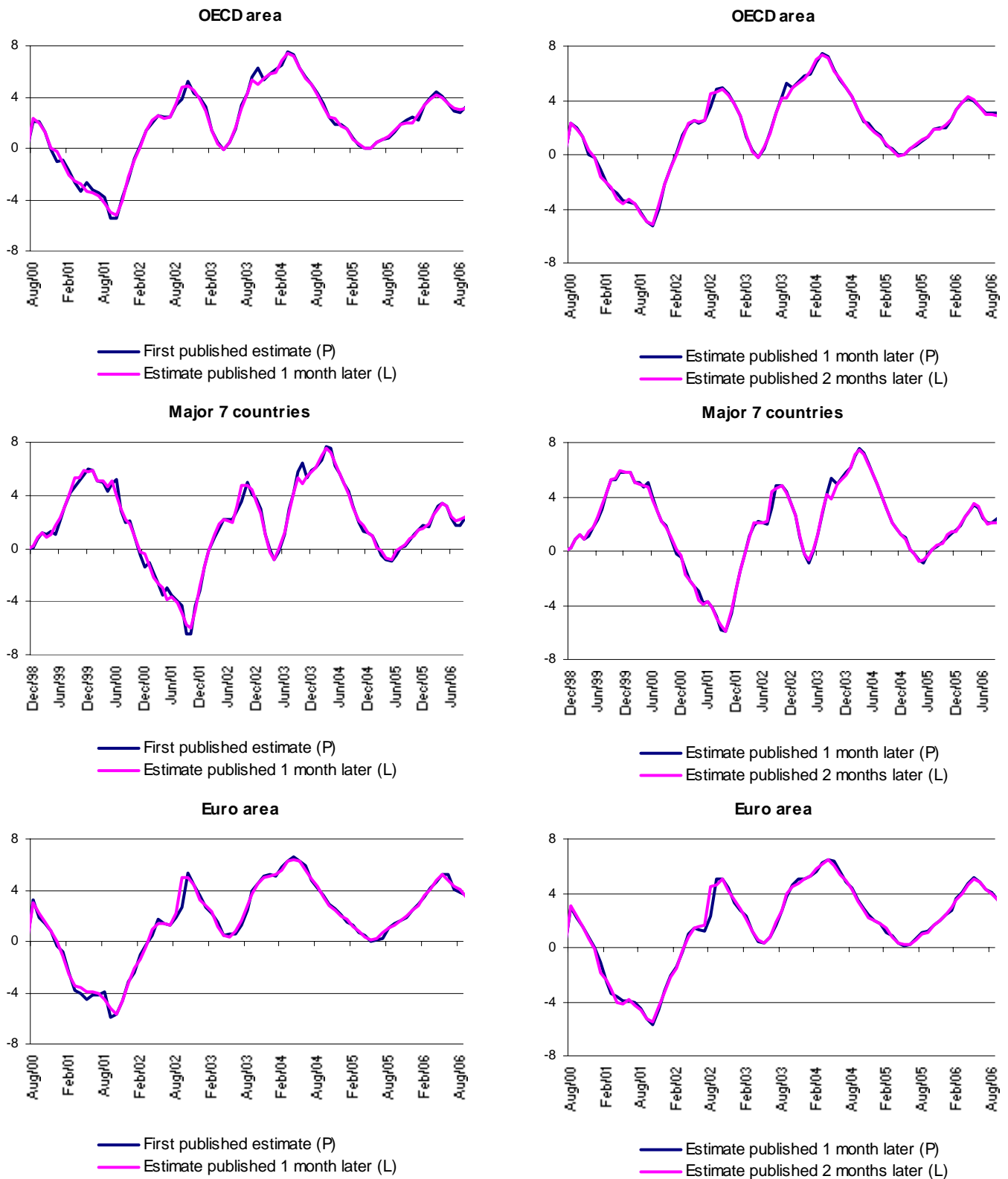

Canada

Canada

First published estimate (P)
Estimate published 1 month later (L)

Estimate published 1 month later (P)
Estimate published 2 months later (L)

Mexico

Mexico

First published estimate (P)
Estimate published 1 month later (L)

Estimate published 1 month later (P)
Estimate published 2 months later (L)

United States

United States

First published estimate (P)
Estimate published 1 month later (L)

Estimate published 1 month later (P)
Estimate published 2 months later (L)

Figure 16 **Evolution of the year-on-year growth rate of the 1st and 2nd estimates and the 2nd and 3rd estimates over the period December 1998/August 2000 to August 2006 (cont.)**
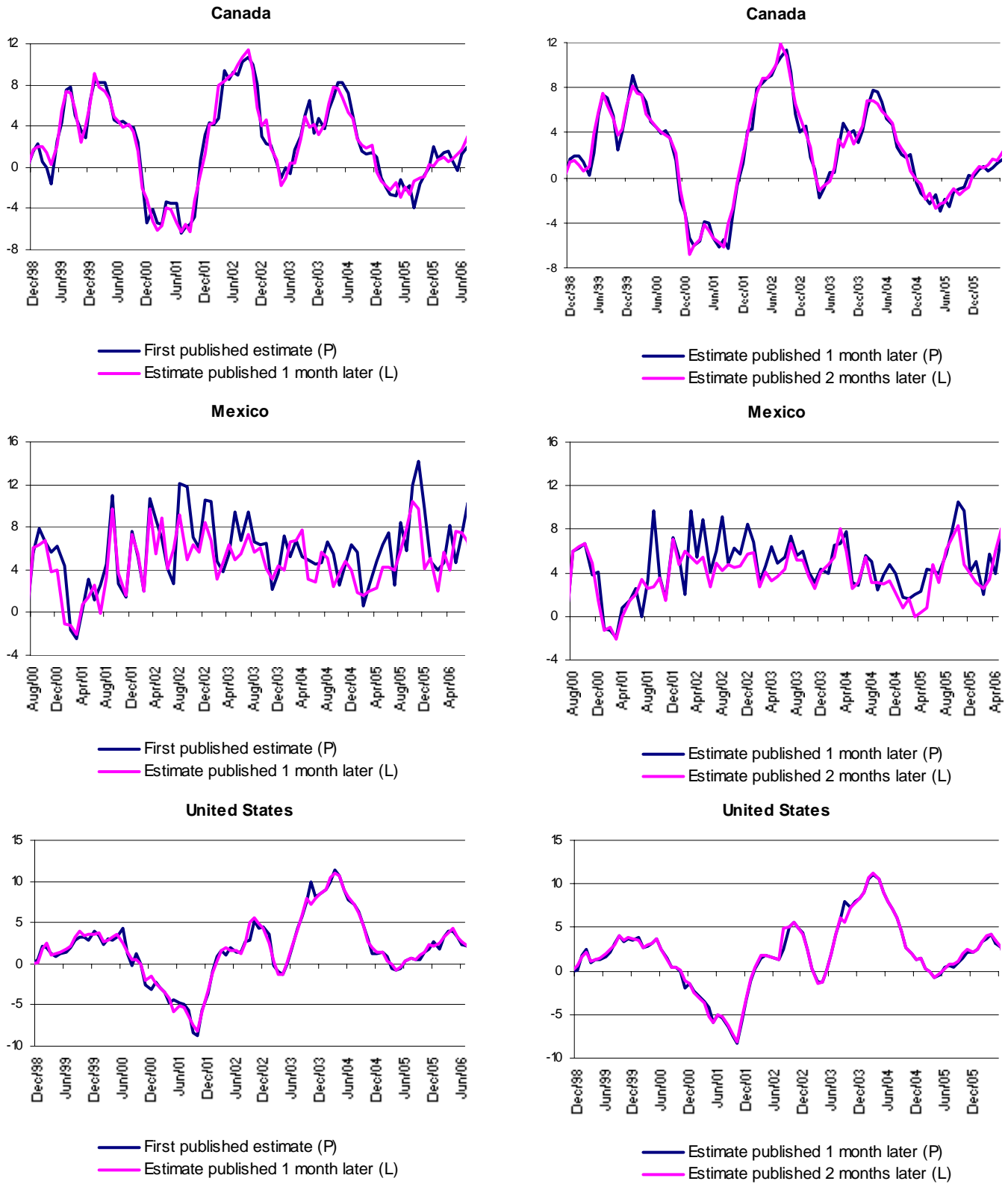

Australia

First published estimate (P)
Estimate published 1 month later (L)

Australia

Estimate published 1 month later (P)
Estimate published 2 months later (L)

Japan

First published estimate (P)
Estimate published 1 month later (L)

Japan

Estimate published 1 month later (P)
Estimate published 2 months later (L)

Austria

First published estimate (P)
Estimate published 1 month later (L)

Austria

Estimate published 1 month later (P)
Estimate published 2 months later (L)

Figure 16   Evolution of the year-on-year growth rate of the 1st and 2nd estimates and the 2nd and 3rd estimates over the period December 1998/August 2000 to August 2006 (cont.)
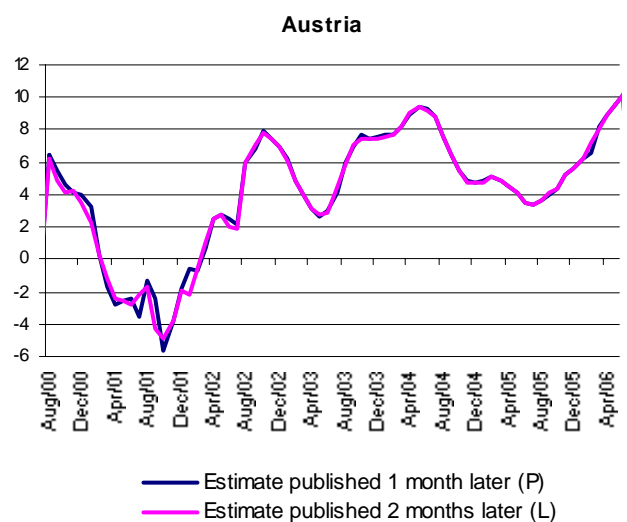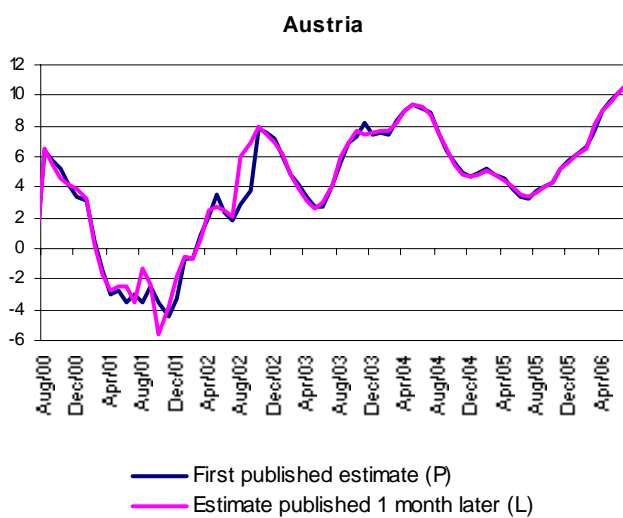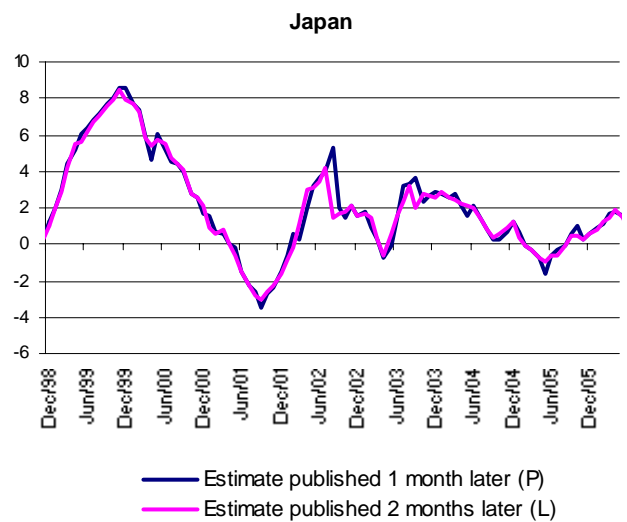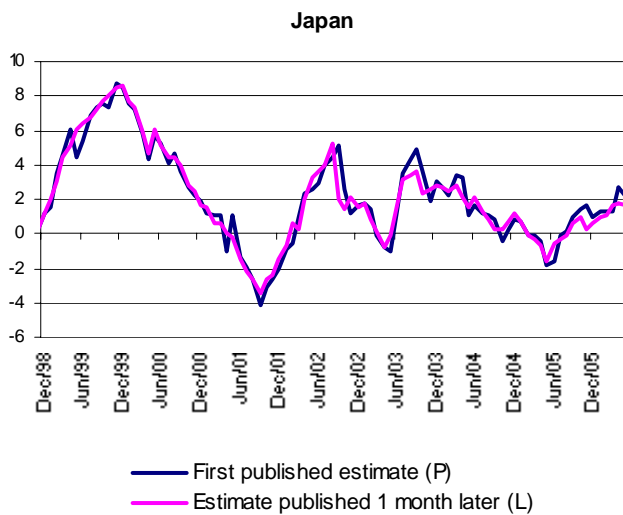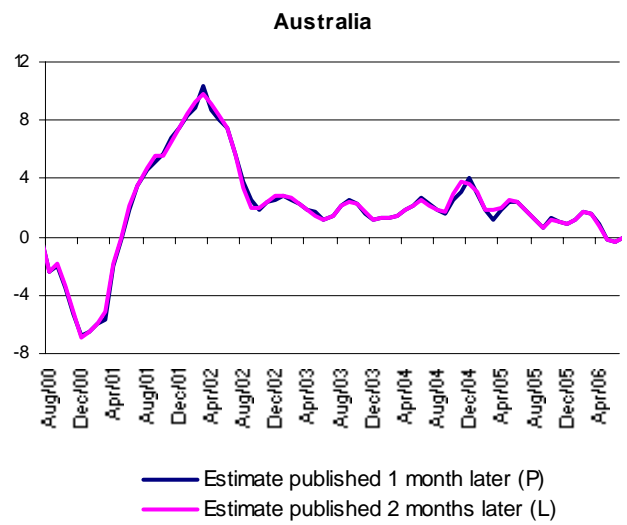

Belgium

Belgium

Denmark

Denmark

Finland

Finland

Figure 16 **Evolution of the year-on-year growth rate of the 1ˢᵗ and 2ⁿᵈ estimates and the 2ⁿᵈ and 3ʳᵈ estimates over the period December 1998/August 2000 to August 2006 (cont.)**

France

— First published estimate (P)
— Estimate published 1 month later (L)

France

— Estimate published 1 month later (P)
— Estimate published 2 months later (L)

Germany

— First published estimate (P)
— Estimate published 1 month later (L)

Germany

— Estimate published 1 month later (P)
— Estimate published 2 months later (L)

Greece

— First published estimate (P)
— Estimate published 1 month later (L)

Greece

— Estimate published 1 month later (P)
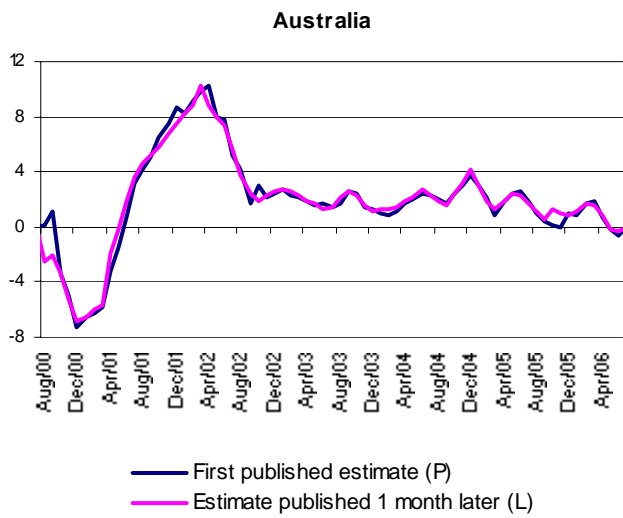— Estimate published 2 months later (L)

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Figure 16   Evolution of the year-on-year growth rate of the 1st and 2nd estimates and the 2nd and 3rd estimates over the period December 1998/August 2000 to August 2006 (cont.)
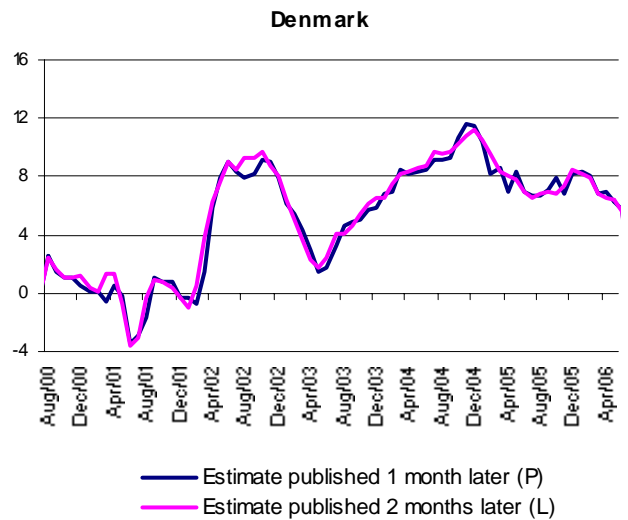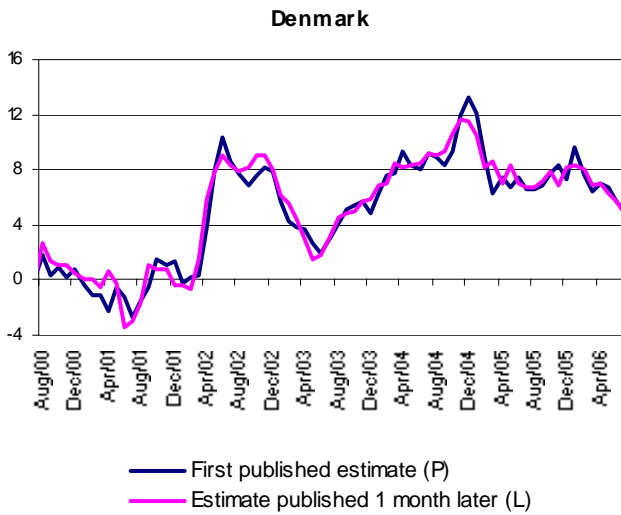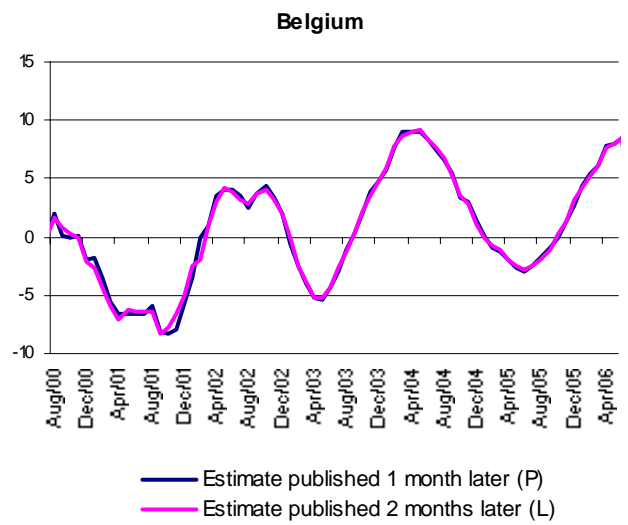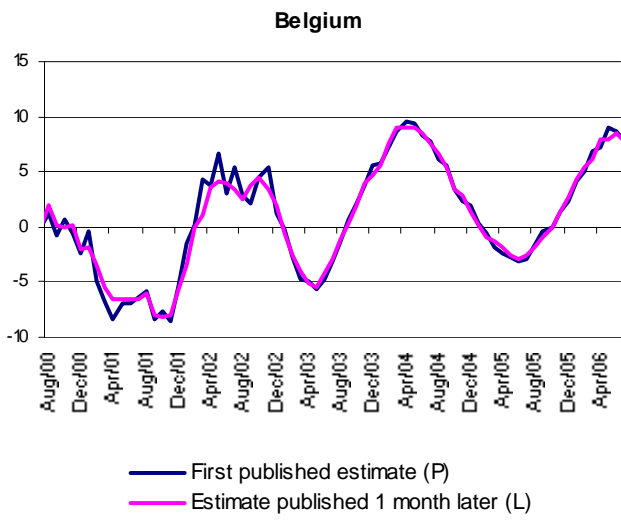

Ireland

Ireland

Italy

Italy

Netherlands

Netherlands

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Figure 16 **Evolution of the year-on-year growth rate of the 1ˢᵗ and 2ⁿᵈ estimates and the 2ⁿᵈ and 3ʳᵈ estimates over the period December 1998/August 2000 to August 2006 (cont.)**

Norway

— First published estimate (P)
— Estimate published 1 month later (L)

Norway

— Estimate published 1 month later (P)
— Estimate published 2 months later (L)

Portugal

— First published estimate (P)
— Estimate published 1 month later (L)

Portugal

— Estimate published 1 month later (P)
— Estimate published 2 months later (L)

Spain

— First published estimate (P)
— Estimate published 1 month later (L)

Spain

— Estimate published 1 month later (P)
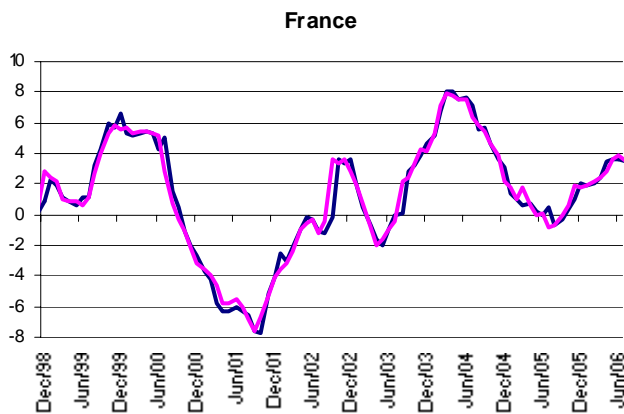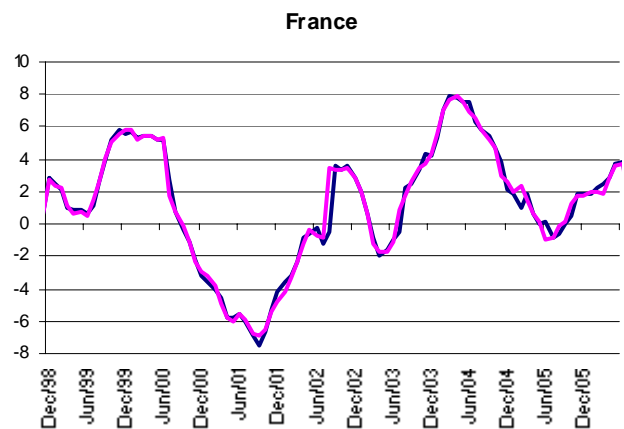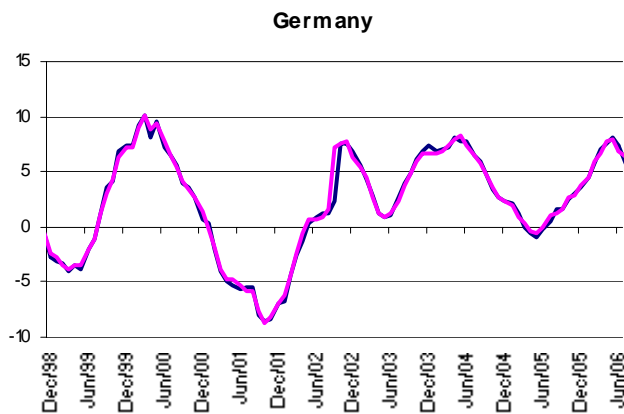— Estimate published 2 months later (L)

Figure 16   Evolution of the year-on-year growth rate of the 1st and 2nd estimates and the 2nd and 3rd estimates over the period December 1998/August 2000 to August 2006 (cont.)
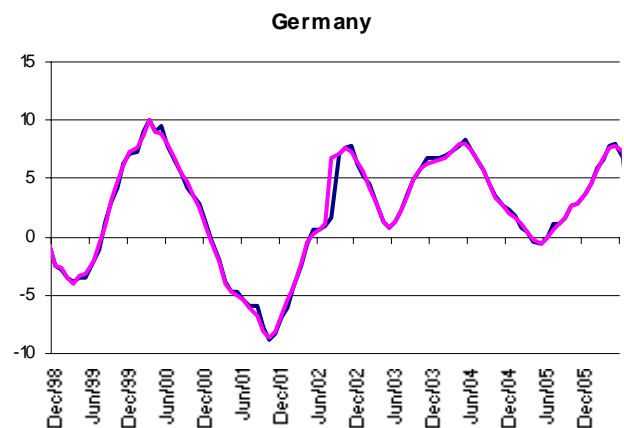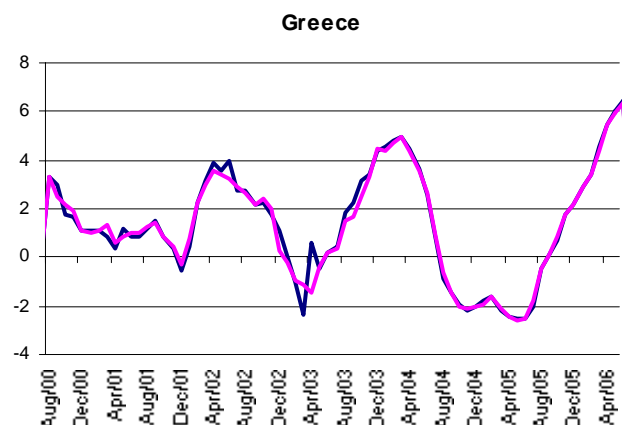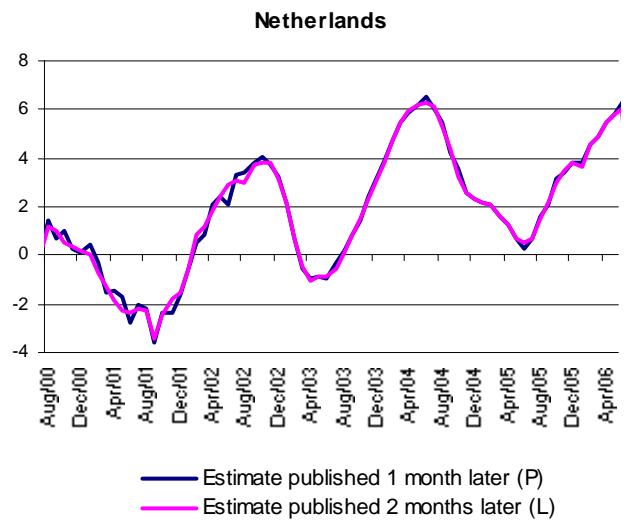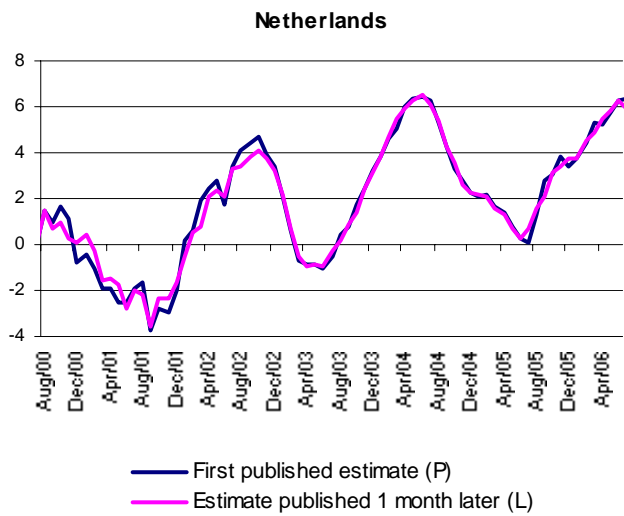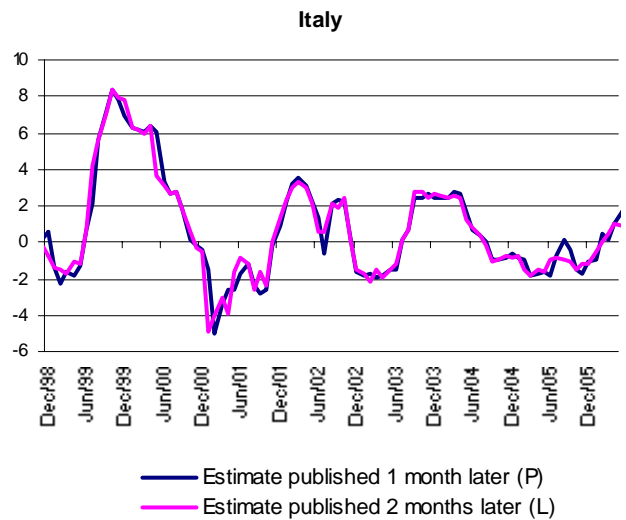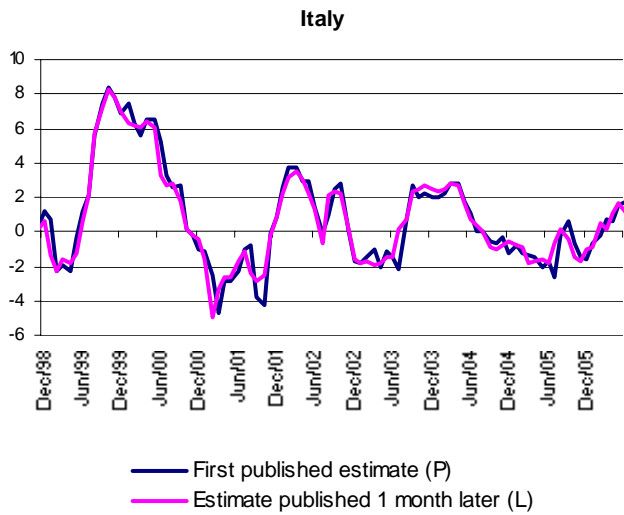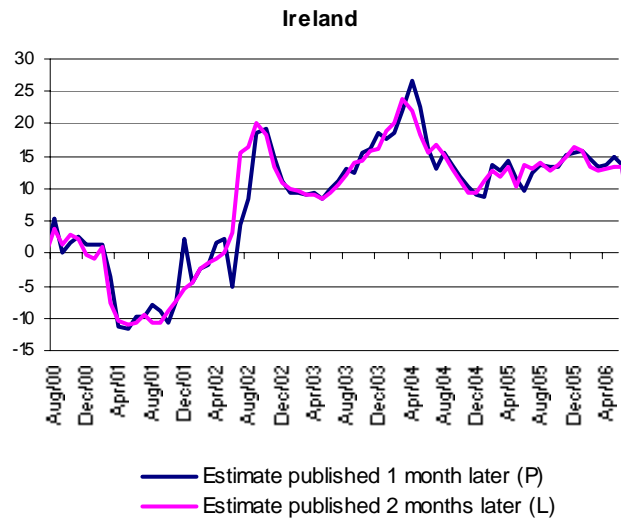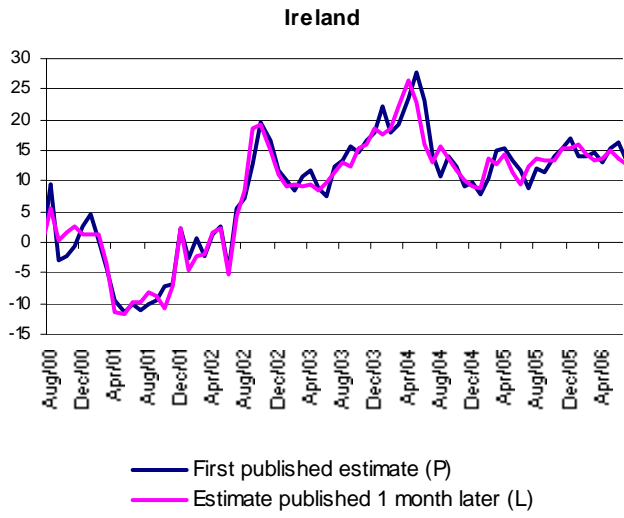

Sweden

Sweden

Switzerland

Switzerland

United Kingdom

United Kingdom

6   Expected and realized revisions

Expected revisions based on information on component characteristics were used in Section 4 above to classify country CLIs into two groups: a "revision group" where major revisions may be expected and a "non-revision group" where minor revisions may be expected. For the classification, the following four component characteristics were used: (1) timeliness/availability, (2) frequency, (3) smoothness and (4) non-revised series. The results of this classification will now be confronted with the results of the revision analysis presented in Section 5 for CLIs compiled before and after the 2002 CLI component revision.

The realized revision to first estimates of year-on-year growth rates are used for the comparison with the expected revisions. Realized revisions are classified as major if the mean absolute revision is above or equal to 0.4 per cent.   The results of the comparison is set out in Table 4 which shows that expected and realized revisions of CLIs compiled before the 2002 CLI review are classified to the same group for 80 per cent of the countries. Differences in classification are noted for five countries, but only

Table 4   Expected and realised revisions to OECD Composite leading Indicators (CLI) before and after the 2002 CLI review

Country	CLI before 2002 review		CLI after 2002 review	
	Expected revision	Realised revision YoY first estimate	Expected revision	Realised revision YoY first estimate
	Major revisions	Mean Absolute Revision >= 0.4	Major revisions	Mean Absolute Revision >= 0.4
Canada	Yes	Yes	Yes	Yes
Mexico	No	**Yes**	No	**Yes**
United States	Yes	Yes	No	No
Australia	Yes	Yes	Yes	**No**
Japan	Yes	Yes	Yes	Yes
Austria	Yes	Yes	No	No
Belgium	Yes	Yes	No	No
Denmark	Yes	Yes	Yes	Yes
Finland	Yes	Yes	Yes	Yes
France	No	**Yes**	No	No
Germany	No	No	No	No
Greece	Yes	Yes	No	**Yes**
Ireland	Yes	Yes	Yes	Yes
Italy*	No	**Yes**	No	**Yes**
Netherlands	Yes	**No**	No	No
Norway	Yes	Yes	Yes	Yes
Portugal	Yes	Yes	No	**Yes**
Spain*	Yes	Yes	No	**Yes**
Sweden	Yes	Yes	Yes	**No**
Switzerland	No	No	No	**Yes**
United Kingdom	Yes	**No**	No	No

Mexico shows a major realized revision which is significantly different from the expected minor revision. The results for the period after the 2002 CLI review show differences in classification for eight countries, but only two countries Mexico and Portugal note major realized revision (1.9% and 1.7% respectively), which are significantly different from the minor revisions that would be expected.

These results are of course very much dependent on the threshold values used for the classification to the different revision groups, both in the case of expected and realized revisions. In addition, the four component characteristics used for the classification of expected revisions overlap for the two characteristics timeliness and frequency which increases the relative importance of these characteristics in the classification. On the other hand, revision and smoothness of components are very much dependent on the availability of smooth components for the calculation of first estimates of the CLI and not only on the number of smooth components as a share of the total number of components.

The importance of smoothness of components in the calculation of first and second estimates of the CLI was illustrated in Section 5.6 where smoothness of the CLI and not individual components was reported. These results reinforce the argument that it is not sufficient to have timely components. They also need to be smooth to guarantee small revisions. Figures 17 and 18 illustrate the link between realized revisions measured by the mean absolute revision and smoothness measured by the MCD value of first and second estimates of the CLIs for the period January 1999/2001 to June 2006.

The link between smoothness and mean absolute revision of first estimates of the CLIs is rather good with a correlation coefficient of 0.54 (Figure 17). The only countries which fall outside the general pattern, i.e. the higher the MCD value the higher the mean absolute revision, are Ireland and Spain. The link is even stronger for second estimates of the CLIs with an extremely high correlation coefficient of 0.82 (Figure 18). These results further reinforce the argument that the degree of smoothness is probably the most important factor explaining revisions. However, as noted above, timeliness is also important, but only under condition that the timely components are smooth.

Figure 17   Smoothness and mean absolute revision of year-on-year growth rates of 1st estimates against 2nd estimates over the period January 1999/2001 to June 2006
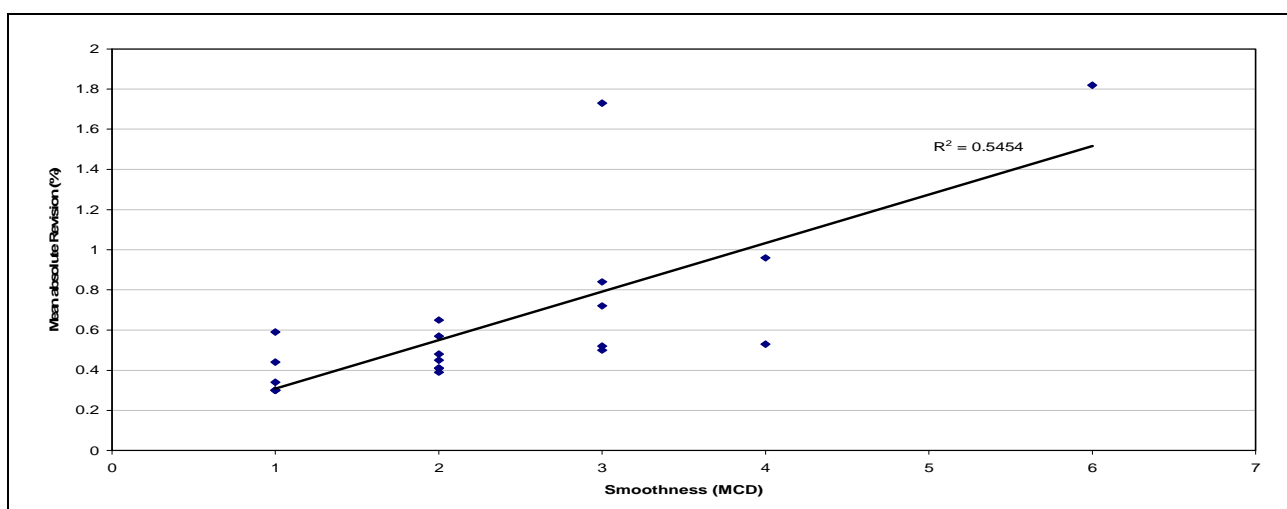
Figure 18   Smoothness and mean absolute revision of year-on-year growth rates of 2nd estimates against 3rd estimates over the period January 1999/2001 to June 2006
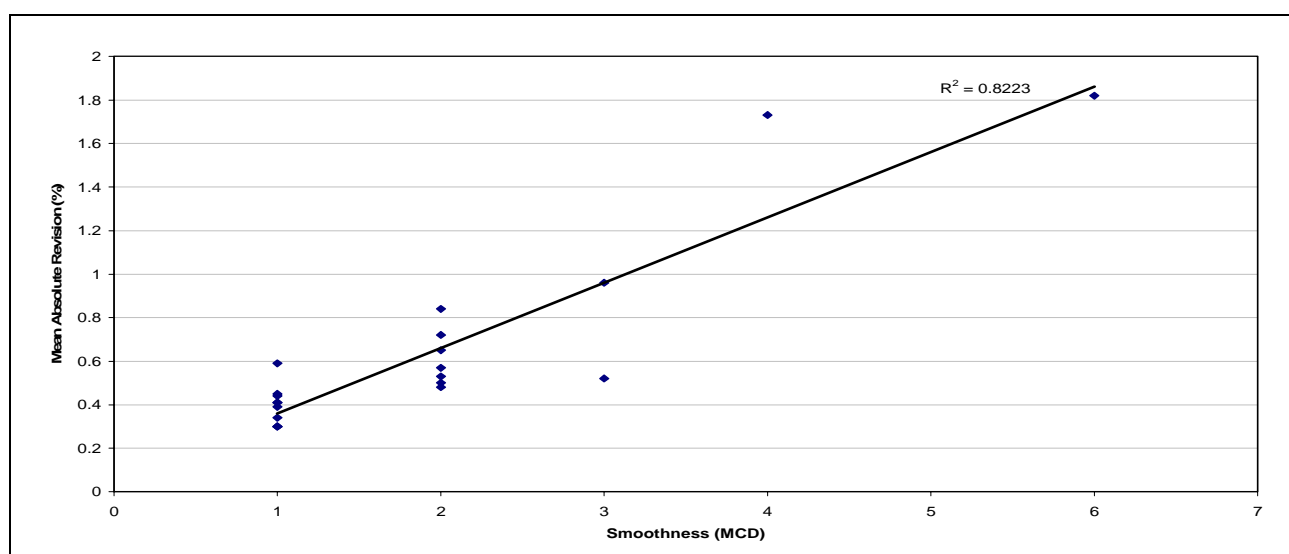
7   Summary and conclusions

This paper presents a comprehensive analysis of the current period performance of the OECD composite leading indicators (CLIs) for 21 OECD Member countries and three zone aggregates (OECD area, Euro area and Major Seven countries) for which CLIs are available for a longer time period. The evaluation covers the period December 1999 to July 2006, where the starting date is determined by the availability of all release versions of the CLIs. The analysis is also performed over sub-periods to examine the performance of the CLIs before and after a major update of the CLIs undertaken in 2002. The performance of the CLIs over the two sub-periods allowed an evaluation of the importance of changes to component characteristics on the revisions to the CLIs. The main findings from this study are summarized in the following points.

- **Component characteristics and expected revisions**: The composition of the characteristics of the components compiled before the 2002 CLI review show that 80 per cent of the CLIs could be classified to a subjectively defined "revision group" where major revisions would be expected. As a result of the 2002 CLI review this percentage of countries where major revisions might be expected fell to 40 per cent. For the latter period, poor timeliness or lack of smoothness or both factors together for component series were the reasons why major revisions were still expected for these countries following the review. The lack of timeliness is in half the number of countries explained by the fact that quarterly business tendency survey indicators are used as components.

- **Size of revisions**: The mean absolute revision on year-on-year growth rates between first estimates and those published one month later for the period December 1999 to July 2006 are large (greater than 1.5%) for two countries (Mexico and Ireland) and rather large (greater than 0.6%) for four additional countries (Canada, Denmark, Norway and Portugal) but for all other countries the revision is rather small (less than 0.6% or 0.4% on average) and almost neglectable for zone aggregates (0.2%) and there is no evidence of bias. The mean absolute revision between the 2nd and 3rd estimate is lower in magnitude for all countries (except for Finland) than those between the first and second estimates. This could suggest that there is an improvement in reliability of the 2nd estimates.

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- **Size of revisions before and after the 2002 CLI review**: When comparing the size of the revisions for the periods before and after the 2002 CLI review the conclusion suggests mixed results. For Canada, Mexico, Japan, Ireland, Norway and Switzerland, the results showed an increase in the mean absolute revisions between the first and the second period. The bad results for the second sub-period may be explained by the increase of the number of less smooth components in the revised CLI for most countries and problems with the timeliness of newly introduced components for a few countries. For all other countries the mean absolute revisions decreased in the second period, which could suggest an improvement in the reliability of the first estimates.

- **Revisions to CLI and industrial production (IIP)**: The CLI is designed for signaling in advance a turning point in the reference series (IIP) and to do this it is calculated on smoothed component series. To make the comparison of revisions related to IIP valid this later series should also be smoothed. For 75 per cent of the countries, the IIP is much more irregular than the CLI and the smoothing needed to make it easy to detect turning points would introduce large revisions, however such smoothing is not considered when comparing revisions for the IIP and CLI in this analysis. In addition, the CLI is based on a set of components, on average 7-8, which are subject to revision except for survey indicators and certain financial series. This means that one would expect to find larger revisions for the CLI compared to a single series like IIP, if revisions in components are dependent from each other. However, the larger revisions noted for the CLI compared to the IIP for most countries does not correspond to the magnitude one might expect taking into account sources of revisions to the CLI coming from both the large number of components and the smoothing applied to them. This indicates a degree of robustness of the CLI, at least in relation to the IIP as to observed magnitudes of revisions.

- **Relative mean revision:** The CLI is designed to provide early signals of turning points (peaks and troughs) between expansions and slowdowns of economic activity. The OECD uses the 6 month rate of change (annualised) of the CLI as a pointer to possible turning points. To measure the relative robustness of the first estimate of 6 months rate of change compared to those for the year-on-year growth rate, the relative mean absolute revision is calculated. For all countries, the relative mean absolute revision for 6 months rate of change is higher than those for year-on-year growth rates. However, the difference between the two measures is not significantly great for most countries and the 6 months rate of change perform better when it comes to signalling expansions and slowdowns in industrial activity.

- **Sign test**: The OECD CLI provides qualitative information on short-term economic movements rather than quantitative measures. Therefore, the main message of CLI movements over time is the direction up or down rather than levels. A simple measure which considers the direction is the sign of the movements. The results show that for almost all the countries, around 90% of the time the sign of the initial estimates of year-on-year growth rates and the 6 month rate of change are the same as those published one month later. For zone aggregates, the sign is the same over 95% of the time. So the initial estimate can be considered as a good indicator of whether economic activity will move up or down in the near term future.

- **Acceleration/deceleration**: A measure relating revisions to the cyclical movements in economic activity more appropriate than the sign test is the acceleration/deceleration measure. This measure captures the cyclical dynamic or direction in the growth rates. The results show that for twelve countries, more than 20% of the time the first estimate of year-on-year growth rates signals a difference in direction with the 2nd estimates, while for only one country it is less than 10%. An improved picture emerges when 2nd and 3rd estimates are considered, where the difference in direction is less than 10% for seven countries and more than 20% for only six countries. These results indicate, however, that it could be dangerous to draw conclusions on directions up or down from one or two months figures for a large number of countries. On the other hand, the difference in direction noted for zone aggregates is much lower, below 10% of the time in the OECD area and the Euro area for both 1st and 2nd estimates and as low as 3% of the time in the Euro area for 2nd estimates

- **Acceleration/deceleration and 6 month rate of change**: A comparison between first estimates for the 6 months rate of change and the year-on-year growth rate in signaling the cyclical dynamics or direction in the growth rates show that the year-on-year growth rate is less revised than the 6 month rate of change for all countries except three. Both measures show major revisions where the direction of growth rates change more than 30% of the time for 6 countries. However, for about one third of countries, the frequencies of revisions for the two measures are rather close, indicating that both measures are of similar quality in signaling the direction in the growth rates. In addition, the 6 month rate of change formula uses a greater number of more recent observations and thus indicates changes in direction earlier than the year-on-year growth rate, although this is also more susceptible to revision. Nonetheless, these results indicate that it could be dangerous to draw conclusions on directions up or down from any of the two measures on a single monthly figure for a large number of countries.

- **Early signals of cyclical turning points**: The reliability of first estimates of the CLI to provide early signals of turning points in economic activity is tested on the year-on-year growth rate as they may be calculated for all revision versions for the longest historical period. The cyclical characteristics of the 1st and 2nd estimates against the 2nd and 3rd estimates respectively are calculated as a guide to their performance, with regard to turning points (median lag), smoothness (MCD) and closeness of fit (correlation). Forecasting turning points is one of the main objectives of the leading indicator technique, because predicting the timing of cyclical turning points is one of the least reliable activities in economic forecasting. The results provide evidence that 1st and 2nd estimates give reliable signals of approaching turning points. The median lag of the 1st and 2nd estimates with reference to 2nd and 3rd estimates respectively is zero or at the most one month for all countries and no false signals in terms of extra or missing turning points are recorded for any countries or zone aggregates except Mexico. The ability to indicate approaching turning points and to confirm them is secured by the relative smoothness of the CLI for all countries except Mexico and Ireland. However, the number of cyclical turning points registered over the common sample period is relatively small, only 3 cycles, for some countries, so the turning points measures given are not significant in a statistical sense for these countries.

- **Expected and realized revisions**: Based on the characteristics of their components, countries were classified as 'expecting' to have either major or minor revisions. This classification changed for many countries after the 2002 CLI review (from 80% of countries expecting major revisions to only 40%). Countries were also classified to 'realized' major and minor revisions groups based on their observed revisions to first estimates of year-on-year growth rates before and after the 2002 CLI review. A comparison of expected and realized revisions according to these classifications shows that CLIs compiled before the 2002 CLI review are classified to the same revision group according to both classifications for 80 per cent of the countries. Differences in classification are noted for five countries, but only Mexico shows a major realized revision which is significantly different from the expected minor revision. The results for the period after the 2002 CLI review show differences in classification for eight countries, but only two countries, Mexico and Portugal, have major realized revision, which are significantly different from the minor revisions that would be expected. These results are of course very much dependent on the threshold values used for the classification to the different revision groups, both in the case of expected and realized revisions.

- **Smoothness, timeliness and revision**: The importance of smoothness of components in the calculation of first and second estimates of the CLI and the overall smoothness of the CLI itself was noted above. These results reinforce the argument that it is not sufficient to have timely components, they also need to be smooth to guarantee small revisions. The link between smoothness and mean absolute revision of first estimates of the CLIs is rather good with a correlation coefficient of 0.54. The only countries which fall outside the general pattern, i.e. the higher the MCD value the higher the mean absolute revision, are Ireland and Spain. The link is even stronger for second estimates of the CLIs with an extremely high correlation coefficient of 0.82. These results reinforce further the argument that

the degree of smoothness is probably the most important factor explaining revisions. However, as noted above, timeliness is also important, but only under condition that the timely components are smooth.

The revisions to the CLIs noted in the above findings underline the point that it could be dangerous to draw conclusions on directions up or down in growth rates from one or two months'figures for a large number of countries. However, the findings also provide evidence that first and second estimates of the CLIs give early signals of approaching turning points which in most cases are not revised later. This capacity of the CLIs to predict turning points is very important and one of the main objectives of the leading indicator technique. The findings also highlight the importance of smoothness of components in the calculation of first and second estimates of the CLI. This is an area for further investigations where the quality of the CLIs may be improved by replacing very irregular components with smoother ones or by introducing a more efficient smoothing technique. Work on this has already started at the OECD as part of a general review of the OECD leading indicator methodology.

APPENDIX A   SIZE OF REVISIONS OF OECD COMPOSITE LEADING INDICATORS

Table A1 Entire period: December 1998/August 2000 to August 2006

	Mean absolute revision				Mean revision				Significance test				% later > Earlier			
	MoM		YoY		MoM		YoY		MoM		YoY		MoM		YoY	
	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd
Canada*	0,63	0,44	0,84	0,60	-0,09	0,03	-0,03	0,06	NO	NO	NO	NO	39,13	53,85	46,74	57,14
Mexico	1,22	1,12	1,82	1,34	-0,26	-0,58	-1,05	-0,89	NO	YES	YES	YES	43,06	30,99	38,89	21,13
United States*	0,32	0,10	0,41	0,17	0,00	0,02	0,06	0,05	NO	NO	NO	NO	53,85	59,34	53,26	57,14
Australia	0,21	0,09	0,41	0,14	0,01	0,03	0,01	0,05	NO	YES	NO	NO	52,11	57,75	60,56	64,79
Japan*	0,37	0,18	0,48	0,28	0,01	-0,01	-0,02	-0,06	NO	NO	NO	NO	46,74	45,05	47,83	41,76
Austria	0,18	0,11	0,34	0,21	0,04	-0,01	0,11	-0,05	NO	NO	NO	NO	56,94	59,15	54,17	52,11
Belgium	0,59	0,26	0,59	0,29	-0,06	0,03	-0,05	-0,01	NO	NO	NO	NO	45,83	52,11	48,61	47,89
Denmark	0,41	0,24	0,72	0,47	-0,04	0,04	0,14	0,17	NO	NO	NO	YES	47,22	52,11	58,33	49,30
Finland	0,15	0,18	0,57	0,88	-0,07	-0,09	-0,08	-0,30	NO	NO	NO	NO	51,39	48,57	48,61	53,52
France*	0,26	0,15	0,44	0,28	0,04	0,00	0,04	0,02	NO	NO	NO	NO	57,61	53,85	53,26	46,15
Germany*	0,24	0,16	0,30	0,24	0,06	0,00	0,07	0,02	NO	NO	NO	NO	59,78	55,56	51,09	47,25
Greece	0,36	0,16	0,45	0,20	0,17	-0,01	0,16	-0,04	YES	NO	NO	NO	52,11	52,86	47,22	43,66
Ireland	1,04	1,00	1,73	1,60	-0,10	-0,08	-0,19	-0,04	NO	NO	NO	NO	44,44	42,25	41,67	38,03
Italy*	0,27	0,19	0,50	0,38	0,00	0,03	-0,08	-0,01	NO	NO	NO	NO	46,74	50,55	39,13	43,96
Netherlands	0,30	0,13	0,30	0,15	-0,01	0,00	-0,03	-0,03	NO	NO	NO	NO	54,17	52,11	51,39	47,89
Norway	0,31	0,22	0,65	0,45	0,06	-0,04	-0,01	-0,08	NO	NO	NO	NO	40,28	35,21	40,28	43,66
Portugal	0,53	0,29	0,96	0,36	-0,07	0,04	-0,15	0,07	NO	NO	NO	NO	51,39	47,89	52,78	52,11
Spain	0,46	0,16	0,53	0,20	0,01	0,00	-0,01	-0,01	NO	NO	NO	NO	50,00	39,44	50,00	43,66
Sweden	0,28	0,23	0,52	0,38	-0,06	0,00	-0,11	-0,01	NO	NO	NO	NO	46,48	47,14	42,25	50,00
Switzerland	0,33	0,14	0,39	0,12	0,04	-0,04	0,00	-0,06	NO	NO	NO	YES	51,39	43,66	51,39	38,03
United Kingdom*	0,22	0,11	0,30	0,18	-0,01	0,01	-0,04	0,02	NO	NO	NO	NO	47,83	40,66	48,91	40,66
OECD area	0,14	0,08	0,20	0,13	0,01	-0,02	-0,02	-0,03	NO	NO	NO	NO	50,65	42,11	36,36	38,16
Major 7 countries	0,17	0,09	0,24	0,12	0,01	0,02	0,02	0,00	NO	NO	NO	NO	44,79	54,74	50,52	46,88
Euro area	0,15	0,09	0,21	0,15	0,05	0,02	0,05	0,00	NO	NO	NO	NO	51,32	64,47	50,65	46,05

* For G7: sample of time: December 1998 to August 2006 ; for all other countries the sample of time is from August 2000 to August 2006

Table A2 Sub-period: December 1998/August 2000 to September 2002

	Mean absolute revision				Mean revision				Significance test				% later > Earlier			
	MoM		YoY		MoM		YoY		MoM		YoY		MoM		YoY	
	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd
Canada*	0,74	0,46	0,78	0,53	-0,08	0,07	0,03	0,08	NO	NO	NO	NO	33,33	54,55	44,44	52,27
Mexico	1,75	1,56	1,42	1,36	-0,29	-0,47	-0,65	-0,61	NO	NO	NO	NO	44,00	37,50	44,00	20,83
United States*	0,42	0,12	0,45	0,16	0,00	-0,02	0,07	0,05	NO	NO	NO	NO	55,56	45,45	51,11	56,82
Australia	0,31	0,14	0,70	0,19	-0,08	0,07	-0,18	0,09	NO	YES	NO	YES	44,00	70,83	48,00	70,83
Japan*	0,40	0,21	0,42	0,24	0,13	-0,03	0,15	-0,01	NO	NO	YES	NO	55,56	43,18	62,22	31,82
Austria	0,35	0,25	0,53	0,49	0,12	-0,03	0,09	-0,17	NO	NO	NO	NO	50,00	41,67	58,33	41,67
Belgium	1,11	0,47	0,94	0,52	-0,16	0,02	-0,18	-0,07	NO	NO	NO	NO	48,00	45,83	48,00	41,67
Denmark	0,49	0,27	0,84	0,50	-0,10	0,08	0,20	0,29	NO	NO	NO	NO	41,67	47,83	52,00	41,67
Finland	0,29	0,41	0,68	1,72	-0,24	-0,39	-0,63	-1,44	YES	NO	YES	NO	47,62	52,38	28,57	57,14
France*	0,38	0,18	0,45	0,21	0,04	-0,03	-0,01	-0,04	NO	NO	NO	NO	53,33	50,00	51,11	45,45
Germany*	0,35	0,22	0,27	0,24	0,10	0,01	0,08	-0,01	NO	NO	NO	NO	57,78	54,55	53,33	54,55
Greece	0,45	0,21	0,50	0,21	0,20	-0,06	0,18	0,01	NO	NO	NO	NO	41,67	47,83	45,83	56,52
Ireland	1,57	1,77	1,62	1,87	-0,06	-0,22	-0,17	-0,58	NO	NO	NO	NO	44,00	39,13	48,00	34,78
Italy*	0,32	0,24	0,57	0,51	-0,08	0,04	-0,19	0,02	NO	NO	NO	NO	44,44	45,45	35,56	47,73
Netherlands	0,57	0,30	0,49	0,29	0,03	0,02	0,00	0,00	NO	NO	NO	NO	52,00	43,48	44,00	45,83
Norway	0,18	0,17	0,40	0,41	-0,01	-0,10	0,04	-0,07	NO	YES	NO	NO	29,17	20,83	41,67	37,50
Portugal	0,87	0,40	1,23	0,45	-0,10	0,15	0,07	0,24	NO	NO	NO	NO	54,17	54,17	58,33	50,00
Spain	0,66	0,17	0,70	0,28	-0,01	0,02	-0,01	0,05	NO	NO	NO	NO	44,00	25,00	44,00	33,33
Sweden	0,40	0,32	0,66	0,45	-0,11	-0,04	-0,30	-0,22	NO	NO	NO	NO	29,17	33,33	29,17	45,83
Switzerland	0,28	0,19	0,24	0,17	0,05	-0,04	0,03	-0,05	NO	NO	NO	NO	48,00	29,17	56,00	33,33
United Kingdom*	0,31	0,13	0,38	0,20	-0,01	0,01	-0,07	0,04	NO	NO	NO	NO	55,56	45,45	55,56	40,91
OECD area	0,20	0,08	0,24	0,13	0,04	-0,02	0,01	0,00	NO	NO	NO	NO	52,00	50,00	52,00	45,83
Major 7 countries	0,22	0,09	0,27	0,12	0,03	0,01	0,06	0,02	NO	NO	NO	NO	46,67	50,00	55,56	47,73
Euro area	0,25	0,12	0,26	0,16	0,14	0,01	0,09	-0,02	YES	NO	NO	NO	56,00	62,50	56,00	50,00

* For G7: sample of time: December 1998 to September 2002 ; for all other countries the sample of time is from August 2000 to September 2002

Table A3 Sub-period: October 2002 to August 2006

	Mean absolute revision						Mean revision					
	MoM		6Mo6M		YoY		MoM		6Mo6M		YoY	
	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd
Canada	0,53	0,40	1,51	1,06	0,91	0,66	-0,11	0,02	-0,15	0,09	-0,10	0,03
Mexico	0,93	0,88	3,44	2,30	1,93	1,28	-0,21	-0,62	-1,99	-1,74	-1,14	-0,96
United States	0,23	0,09	0,54	0,22	0,32	0,14	0,00	0,06	0,06	0,03	0,00	-0,01
Australia	0,14	0,06	0,39	0,18	0,23	0,11	0,04	0,01	0,18	0,08	0,09	0,04
Japan	0,33	0,15	0,85	0,41	0,48	0,23	-0,12	0,02	-0,25	-0,03	-0,13	-0,01
Austria	0,08	0,04	0,19	0,10	0,13	0,07	-0,01	0,00	-0,01	0,00	-0,01	0,01
Belgium	0,30	0,15	0,70	0,30	0,38	0,16	-0,03	0,02	-0,05	0,03	-0,02	0,01
Denmark	0,38	0,22	1,07	0,70	0,65	0,42	0,00	0,00	0,12	0,11	0,08	0,06
Finland	0,10	0,09	0,82	0,90	0,58	0,57	0,00	0,04	0,27	0,32	0,16	0,19
France	0,15	0,12	0,57	0,44	0,36	0,28	0,03	0,02	0,05	-0,03	0,01	0,00
Germany	0,13	0,10	0,38	0,22	0,22	0,15	0,02	-0,03	-0,05	-0,07	-0,04	-0,06
Greece	0,31	0,13	0,78	0,31	0,42	0,20	0,14	0,01	0,26	-0,04	0,14	-0,07
Ireland	0,74	0,59	2,77	1,78	1,69	1,11	-0,10	-0,02	-0,49	-0,24	-0,34	-0,23
Italy	0,24	0,14	0,72	0,45	0,43	0,26	0,08	0,01	0,10	-0,03	0,04	-0,03
Netherlands	0,16	0,04	0,33	0,07	0,18	0,07	-0,02	0,01	-0,05	-0,03	-0,03	-0,03
Norway	0,38	0,25	1,27	0,79	0,76	0,49	0,08	-0,01	0,13	-0,10	0,01	-0,09
Portugal	0,36	0,24	1,08	0,52	0,64	0,31	-0,04	-0,02	-0,16	0,02	-0,06	0,01
Spain	0,33	0,14	0,78	0,30	0,42	0,15	-0,01	-0,01	-0,03	0,02	-0,04	-0,03
Sweden	0,22	0,19	0,66	0,64	0,38	0,36	-0,02	0,02	-0,19	0,21	-0,10	0,10
Switzerland	0,35	0,11	0,88	0,22	0,48	0,10	0,04	-0,04	0,02	-0,07	-0,01	-0,07
United Kingdom	0,13	0,09	0,33	0,24	0,20	0,14	-0,01	0,01	0,00	0,05	0,01	0,03
OECD area	0,10	0,07			0,16	0,11	0,00	-0,01			-0,05	-0,06
Major 7 countries	0,12	0,08			0,18	0,10	-0,01	0,03			-0,03	-0,03
Euro area	0,09	0,06			0,15	0,09	0,00	0,02			-0,02	-0,02

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Table A3 Sub-period: October 2002 to August 2006 (cont.)

| | Significance test | | | | | | % later > Earlier | | | | | |
| | MoM | | 6Mo6M | | YoY | | MoM | | 6Mo6M | | YoY | |
	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd	1st and 2nd	2nd and 3rd
Canada	NO	NO	NO	NO	NO	NO	45,65	55,56	43,48	62,22	47,83	62,22
Mexico	NO	YES	YES	YES	YES	YES	43,48	28,89	36,96	20,00	36,96	22,22
United States	NO	YES	NO	NO	NO	NO	51,11	73,33	52,17	42,22	54,35	57,78
Australia	NO	NO	YES	NO	NO	NO	55,56	51,11	60,00	40,00	66,67	64,44
Japan	YES	NO	NO	NO	NO	NO	36,96	48,89	36,96	37,78	34,78	53,33
Austria	NO	NO	NO	NO	NO	NO	60,87	68,89	34,78	13,33	50,00	57,78
Belgium	NO	NO	NO	NO	NO	NO	43,48	53,33	45,65	46,67	47,83	51,11
Denmark	NO	NO	NO	NO	NO	NO	52,17	51,11	50,00	51,11	60,87	51,11
Finland	NO	NO	NO	NO	NO	NO	50,00	43,18	50,00	46,67	60,87	55,56
France	NO	NO	NO	NO	NO	NO	60,87	57,78	47,83	42,22	54,35	46,67
Germany	NO	NO	NO	NO	NO	YES	60,87	54,55	50,00	33,33	47,83	40,00
Greece	NO	NO	NO	NO	NO	NO	55,56	54,55	43,48	35,56	45,65	37,78
Ireland	NO	NO	NO	NO	NO	NO	45,65	42,22	36,96	35,56	36,96	35,56
Italy	NO	NO	NO	NO	NO	NO	50,00	55,56	41,30	46,67	43,48	42,22
Netherlands	NO	NO	NO	NO	NO	YES	56,52	57,78	41,30	11,11	56,52	51,11
Norway	NO	NO	NO	NO	NO	NO	43,48	42,22	37,78	35,56	41,30	48,89
Portugal	NO	NO	NO	NO	NO	NO	52,17	46,67	45,65	55,56	52,17	55,56
Spain	NO	NO	NO	NO	NO	NO	52,17	46,67	47,83	40,00	52,17	48,89
Sweden	NO	NO	NO	NO	NO	NO	55,56	52,27	46,67	50,00	46,67	54,55
Switzerland	NO	NO	NO	NO	NO	YES	54,35	53,33	50,00	37,78	50,00	42,22
United Kingdom	NO	NO	NO	NO	NO	NO	39,13	35,56	43,48	44,44	43,48	42,22
OECD area	NO	NO			NO	NO	49,02	40,00			27,45	34,00
Major 7 countries	NO	NO			NO	NO	42,00	59,18			45,10	46,00
Euro area	NO	NO			NO	NO	48,00	66,00			47,06	44,00

APPENDIX B   SUMMARY AND DEFINITION OF STATISTICS USED FOR THE REVISION CLI ANALYSIS

Revision (R) is defined as the difference between the later estimate (L) and the preliminary estimates (P).

$$R_t = L_t - P_t$$

Mean revision: is the mathematical average of all the revisions. n is the number of observations.

$$\bar{R} = \frac{1}{n} \sum_{t=1}^{n} (L_t - P_t) = \frac{1}{n} \sum_{t=1}^{n} R_t$$

The mean is a measure of the central tendency of the variable. One of the disadvantages of this average, seen as central value of a sample, is its sensitivity to extreme values. The larger the sample size the more reliable is its mean, and the larger the variation the less reliable is its mean.

Mean absolute revision: as revisions can be positive or negative and thus may offset each other, it is useful to look at the absolute value of the mean revision (i.e. without regard to sign).

$$MAR = \frac{1}{n} \sum_{t=1}^{n} |L_t - P_t| = \frac{1}{n} \sum_{t=1}^{n} |R_t|$$

Relative mean absolute revision: corrects the mean absolute revision for the size of growth of the last estimate.

$$RMAR = \frac{\sum_{t=1}^{n} |L_t - P_t|}{\sum_{t=1}^{n} |L_t|} = \frac{\sum_{t=1}^{n} |R_t|}{\sum_{t=1}^{n} |L_t|}$$

Number of time where Later > Preliminary: indicates the number of positive revisions. It gives an un-weighted indication concerning the distribution of the sign of revisions.

Number of time where Later and Preliminary have different signs: indicates the number of observations where the sign of the Later estimate is different from the sign of the Preliminary estimate. This gives an indication of the sign of the movements, (i.e. signals an expansion or slowdown in economic activity).

Acceleration/deceleration: indicates the number of times the first estimate indicated acceleration, while the final estimates indicated deceleration or vice versa. In other word it captures the cyclical dynamic or direction in the growth rates.

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