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Revisions analysis of the index of industrial production for OECD countries and major non-member economies

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REVISIONS ANALYSIS OF THE INDEX OF INDUSTRIAL PRODUCTION FOR OECD COUNTRIES AND MAJOR NON-MEMBER ECONOMIES

0 Executive Summary

This paper presents a comprehensive revision analysis of the (seasonally adjusted) index of industrial production (IIP) for OECD Member countries, the Euro area, Brazil, India, South Africa and the Russian Federation using data extracted from the recently established OECD *Main Economic Indicators Original release data and revisions database*. The study allowed three key dimensions of statistical quality – accuracy, timeliness and coherence – to be evaluated for each country's index of industrial production. The main findings from this study can be summarised in the following points.

- In almost all countries the size of mean absolute revisions to first estimates of year-on-year growth rates for the IIP are non-ignorable and increase the longer the interval from the first estimate, with revisions being much larger after an interval of 1 and 2 years compared to a shorter interval of 3 months.

- It is relatively difficult to distinctively group countries into those with say high, medium or low mean absolute revisions as there appears to be a degree of similarity across a large number of countries. Taking into account the size of mean absolute revisions to first estimates of year-on-year growth rates for 3 different intervals (after 3 months, one year, 2 years), one could say that Belgium appears to have the highest revisions and Poland the lowest. The ranking of other countries varies slightly depending on which revision interval is considered and the degree of difference between countries is not substantial.

- Mean revisions to the IIP between first estimates of month-on-previous-month and year-on-year growth rates and those published 1 year later were assessed for statistical significance for all countries. Mean revisions to month-on-previous-month growth rates were found to be statistically significantly different from zero for Greece, Belgium and India. Mean revisions to year-on-year growth rates were found to be statistically significantly different from zero for Belgium, India, Russian Federation, Turkey, Germany, Euro area, France, United Kingdom and Korea. The existence of mean revisions to IIP growth rates that are statistically significantly different from zero represents a quality concern for these countries IIP. National Statistical Institutes are encouraged to review in detail the tests of statistical significance to mean revisions for all revisions intervals presented in the analysis spreadsheets at http://www.oecd.org/document/0/0,2340,en_2649_34237_36508672_1_1_1_1,00.html for both month-on-previous-month and year-on-year growth rates.

- First estimates of month-on-previous-month growth rates for the IIP should not be considered a reliable indicator of the magnitude of short-term changes in the volume of industrial output. On average across all countries, first estimates of month-on-previous-month growth rates are revised by two thirds of their initial value within one year. However, first estimates of the month-on-previous-month growth rate in the IIP can be assumed to give a reasonably reliable signal of the direction (i.e. expansion or contraction) of recent changes in industrial activity, with the sign of first estimates (i.e. + or –) being the same as that one year later more than 70% of the time in over 90% of countries. On the other hand, first estimates of year-on-year growth rates are shown to provide a more robust measure in terms of magnitude, being revised on average across all countries by only 24% of their initial value with one year.

- There is no systematic empirical evidence to support the hypothesis that a trade-off exists between timeliness and accuracy. In fact, this study finds some weak evidence to support the contrary conclusion that those countries with more timely estimates have a greater tendency to have lower mean absolute revisions. Furthermore, of the four countries investigated that had improved the timeliness of their IIP within the analysis period, three had lower mean absolute revisions to first estimates after the improvement in timeliness compared to the period before. This is perhaps consistent with recent theories that timeliness can be improved without loss in accuracy for short-term economic statistics if improvements are made to the statistical production process.

- A reasonably high degree of coherence between growth rates of the IIP and valued added volume in industry from the national accounts is apparent for most countries. However, exceptions to this rule exist for Denmark, Slovak Republic, Czech Republic, Luxembourg, Greece and Switzerland which casts quality concerns over these countries' IIP.

- There does not appear to be systematic empirical evidence that those countries that benchmark the index of industrial production to annual value added volume in industry from the national accounts have higher long-term revisions (i.e. measured 2 years after the initial estimate of IIP) relative to other countries which do not benchmark.

The OECD proposes to develop a website that provides appropriate context regarding the causes for revisions, highlighting the need for national agencies to develop a transparent revisions policy across the range of statistics compiled. The website would allow access to the OECD *Main Economic Indicators Original release data and revisions database* and the results from revisions analyses studies such as the one presented in this paper for the IIP and the revisions analysis conducted in September 2005 for quarterly GDP.

Issues on which STESWP participant comments are sought

In response to this paper, STESWP participants are invited to comment on the following issues:

- Are there any inconsistencies between the revisions analysis of the IIP performed in this study for your country in comparison to any similar studies that may have been performed within your own institute?
- Countries are invited to provide comments on the reasons for revisions to their IIP as presented in this paper and the accompanying revisions analysis spreadsheets, and to outline aspects of their current revisions policy for the IIP. These would be included with the results of the revisions analysis study on the OECD website.
- Do STESWP participants regard such revisions analyses as important and a vehicle through which the quality of their short-term economic statistics can be evaluated and improved? As such, OECD intends to make freely available the tools used in this analysis such that countries can perform their own revisions analysis on a wide range of key short-term economic statistics.
- Provide comments on the variables and revision intervals chosen for analysis in this study, and any other aspects of the paper such as the analytical approach taken, etc.

1 Introduction

1 The importance of understanding the impact of revisions on official statistics is highlighted by the recent attention being paid to the magnitude and predictability of revisions by users of official statistics compiled by national statistical institutes (NSIs). This attention is one of the reasons why the International Monetary Fund's Special Data Dissemination Standards (SDDS) gives considerable prominence to the need for national agencies to develop a revisions policy that is both transparent (as to the underlying cause(s) of revisions) and consistent across the range of economic statistics (both structural and short-term) compiled.

2 This paper presents a comprehensive revision analysis of the (seasonally adjusted) index of industrial production (IIP) for OECD Member countries and major non-member economies using data extracted from the recently established OECD *Main Economic Indicators Original release data and revisions database*. Similar analyses were undertaken in September 2005 (DiFonzo, 2005) for revisions of quarterly GDP for which an update is planned in September 2006. Analysis of revisions allows evaluation of performance against a key dimension of statistical quality[1] – accuracy. The study presented in this paper also considers the interaction of this quality dimension with two others – timeliness and coherence. More specifically, the paper will cover the following issues:

- identify the major causes of revisions to the index of industrial production;
- describe the data used in this study and provide access to detailed revisions analysis triangles and summary statistics for all countries;
- compare the relative size of mean absolute revisions to the IIP across countries and assess whether mean revisions are statistically significantly different from zero;
- evaluate the reliability of first estimates of month-on-previous-month growth rates of IIP as a short-term measure of expansions and contractions in industrial output;
- investigate the relationship between timeliness of release of the IIP and short-term revisions to first estimates (i.e. revisions after two months);
- evaluate the coherence between growth rates of the IIP and those for value added volume in industry from the national accounts and cross reference this with the size of revisions for those countries who benchmark the IIP to annual national accounts.

3 The analysis presented in the paper draws on data published at monthly frequency[2] in the OECD *Main Economic Indicators* (MEI) publication between February 1999 and February 2006. All OECD Member countries with the exception of Iceland are included together with the Euro area, Brazil, India, South Africa and the Russian Federation.

4 The OECD proposes to develop a website that provides appropriate context regarding the causes for revisions, highlighting the need for national agencies to develop a transparent revisions policy across the range of statistics compiled. The website would allow access to the OECD *Main Economic Indicators Original release data and revisions database* and the results from revisions analyses studies such as the one presented in this paper for the IIP and the revisions analysis conducted in September 2005 for quarterly GDP. NSIs will be given the opportunity to respond to all revisions analyses performed by the OECD and their comments would be included with the outputs of the revisions analysis studies on this website.

[1] Accuracy, timeliness and coherence are three of the seven dimensions of statistical quality as defined in the OECD statistical quality framework. These dimensions also appear in statistical quality frameworks presented by other national statistical institutes.
[2] All countries included in this study publish their index of industrial production at monthly frequency with the exception of Australia, New Zealand and Switzerland, which are quarterly.

1.1 Terminology

5 The terminology used in this paper is consistent with that recommended in the OECD *Data and Metadata Reporting and Presentation Handbook* (OECD, 2005). Some key terms regularly used and their definitions are presented below in Table 1.

Table 1 Definition of key terms used in this paper

Term	Description
Year-on-year (YoY) growth rate	Year-on-year growth rates are rates of change expressed over the corresponding period (month or quarter in relation to the frequency of the data) of the previous year, i.e. (M_t/M_{t-12}) -1 or (Q_t/Q_{t-4}) -1.
Month-on-previous-month (MoM) growth rate	Month-on-previous-month growth rates are rates of change expressed with respect to the previous month, i.e. (M_t/M_{t-1}) -1
Annual growth rate	Annual growth rates are annual rates of change expressed over the previous year, i.e. (Y_t/Y_{t-1}) -1

2 Major causes of revisions to the index of industrial production

6 The OECD *Data and Metadata Reporting and Presentation Handbook* (OECD, 2005), Section 7.1 contains a detailed discussion outlining the main reasons for data revisions to official statistics, how they should be interpreted and actions NSIs should take to establish a transparent revisions policy as part of their statistical publication strategy[3]. In the context of the source of data for this analysis – the Index of Industrial Production as published in the MEI over the period February 1999 – February 2006, the following seven broad reasons could be the cause(s) of the revisions observed in the OECD analysis that are reported in this paper:

1. incorporation of data from late respondents, or incorporation of more complete or more accurate data from initial respondents;
2. corrections to errors in source data (i.e. from editing), computations (e.g. revised imputation) or data transmission (i.e. corrections to incorrect data published by the OECD);
3. use of different statistical techniques or estimation methodologies for first estimates in comparison to subsequent estimates (e.g. initial estimates may be based on sub-samples);
4. incorporation of updated seasonal factors (including for those countries[4] where seasonal adjustment is performed by the OECD);
5. benchmarking to related less frequent statistics (e.g. quarterly or annual value added in industry from the national accounts);
6. updating of the base period;
7. changes in statistical methodology, concepts, scope, definitions, classifications etc.

[3] Much of the material on this topic in the OECD Handbook was derived from an IMF Working Paper, *Revisions Policy for Official Statistics: A Matter of Governance*, first presented at the August 2003 International Statistical Institute (ISI) and subsequently revised the following year.

[4] The OECD performs the seasonal adjustment of the index of industrial production for the following countries: Austria, Czech Republic, Greece, Luxembourg, Poland, Slovak Republic, Switzerland, Turkey, Brazil, India, Russian Federation and South Africa.

7 The above reasons are ordered in accordance with the time frame within which they are likely to cause revisions to first estimates. The first three reasons are more likely to cause revisions in the short-term, that is within the first 2 or 3 months of the initial published figure. Reasons four and five may also cause revisions in the short-term, e.g. if seasonal parameters are re-estimated each month or quarter or if IIP is benchmarked to quarterly value added in industry. However, in most countries reasons four and five would be more likely to cause revisions in the medium term, for example, if the updating of seasonal factors and any benchmarking were performed annually. The last two reasons are more likely to cause revisions in the longer term, i.e. less frequently than annually.

3 The OECD revisions analysis database for the index of industrial production

8 The OECD has recently developed a unique facility permitting users to undertake revisions analysis of 21 key economic variables published at monthly frequency since February 1999 in the OECD *Main Economic Indicators* publication. This facility, which will be made freely available on the OECD website before the summer of 2006, will be known as the *Main Economic Indicators Original release data and revisions database* and builds on the pioneering work in this field performed by Professor Tommaso DiFonzo during his sabbatical at the OECD in 2005 (see DiFonzo, 2005).

9 For this study on the index of industrial production, detailed revisions analysis spreadsheets from which a wide range of summary statistics were produced, formed the basis of analysis for the findings presented in this paper. These revisions analysis spreadsheets and summary statistics together with documentation describing how they should be interpreted are available for each country included in this analysis at: http://www.oecd.org/document/0/0,2340,en_2649_34237_36508672_1_1_1_1,00.html. The following points briefly outline the information available in these spreadsheets from which a wide range of further analyses could be performed:

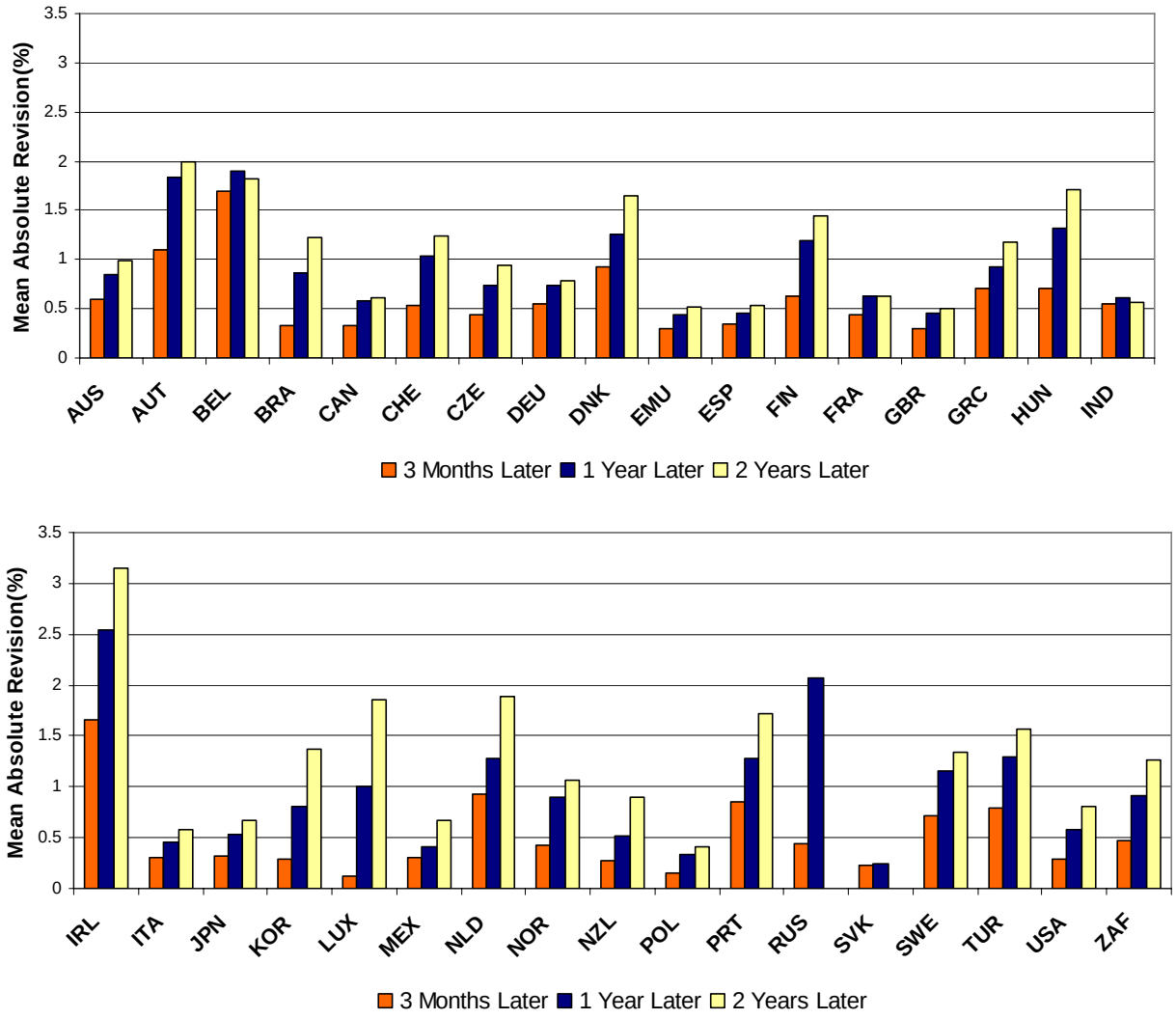
- A spreadsheet with separate worksheets providing original published data and their subsequently revised values in each following monthly publication for levels, month-on-previous-month growth rates and year-on-year growth rates. Summary information is provided at the top of each worksheet showing the original estimate and values 2 months later, 3 months later, 1 year later and 2 years later.
- Additional worksheets in the same spreadsheet showing the time series of revisions to each data point's initial estimate of month-on-previous-month and year-on-year growth rate.
- Two analysis spreadsheets, one for month-on-previous-month growth rates and the other for year-on-year growth rates. These analyse the statistical significance of revisions between the initial estimate and that published 2 months later, 3 months later, 1 year later, 2 years later and the most recent estimate. A range of summary statistics are presented such as the mean absolute revision, mean revision, relative mean absolute revision, etc. together with a t-test of significance for the mean revision. A list of all summary statistics available and their interpretation can be found in Appendix 1.

4 Assessing the size of revisions to the index of industrial production at different intervals

10 Given the theoretical context of the likely cause of revisions to the IIP as presented in Section 3 above, one may hypothesize that the mean absolute size of revisions between first and subsequent estimates assessed at various intervals might increase over time. On the other hand, if later revisions to an estimate are in the opposite direction to initial revisions there could be some cancelling out affects. To

assess this empirically, Figure 1 below presents the mean absolute revision between first estimates of year-on-year growth rates and those observed 3 months[5], 1 year and 2 years later.

Figure 1 Mean absolute revision to first estimates of year-on-year growth rates for the IIP



11 A very similar pattern appears to be present amongst most countries where the size of the mean absolute revision to first estimates increases almost uniformly over the 3 intervals assessed – providing strong support to the hypothesis that the size of mean absolute revision to first estimates is likely to increase over time. More marked is the definite increase between revisions 3 months later and those of the later periods of 1 year and 2 years, although the difference between these latter periods is also quite noticeable in the majority of countries. The main exceptions seem to be Belgium and India where revisions assessed at the three intervals are similar although Belgium has a very high level of revision for all periods relative to other countries.

12 It is relatively difficult to distinctively group countries into those with say high, medium or low revisions as there appears to be a degree of similarity across a large number of countries. More detailed

[5] In the case of Australia, New Zealand and Switzerland who publish data only at quarterly frequency, this assessment was made 5 months after the initial published estimate.

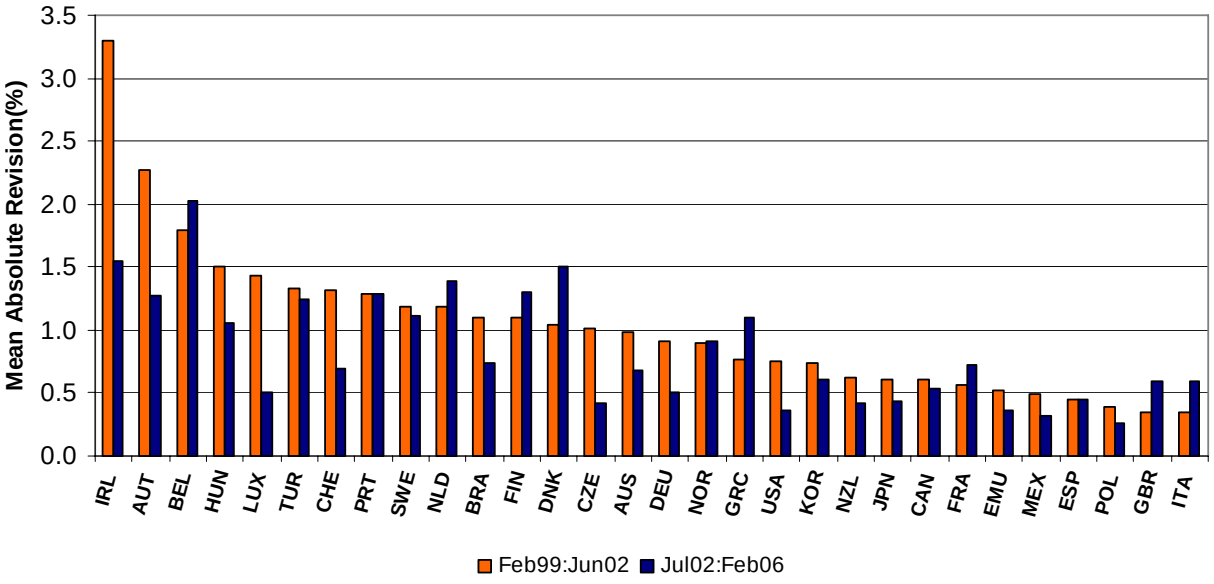
analysis of the revisions spreadsheets reveals that three of the countries with large mean absolute revisions, namely Ireland, Austria and Luxembourg; introduced major methodological changes[6] to their IIP over the analysis period which should thus be taken into consideration. Taking into account the size of mean absolute revisions for each of the three intervals, one could say that Belgium appears to have the highest revisions and Poland the lowest. The ranking of other countries varies slightly depending on which revision interval is considered and the degree of difference between countries is not substantial.

4.1 Have revisions to the IIP become smaller in recent years?

13 As NSIs in general are always reviewing the quality of their statistics and attempting to make improvements over time, one might expect that the size of mean absolute revisions to the IIP in recent years may have decreased thus indicating an improvement in quality. On the other hand pressure to improve timeliness may have the opposite effect of NSIs producing first estimates based on lower response rates or using different estimation techniques for first estimates which could lead to an increase in revisions, or at least short-term revisions (i.e. assessed after 2 or 3 months). This latter issue is explored in detail below in Section 7. Furthermore, the more recent implementation of benchmarking techniques to ensure coherence with related statistics such as value added volume in industry from the national accounts could be another possible factor leading to larger revisions in recent years for some countries. Coherency between the IIP and value added volume in industry from the national accounts for all OECD countries is also assessed in detail in Section 8 below.

14 To investigate the issue of whether revisions to IIP have become smaller in recent years, the analysis period was split into two halves, data published from February 1999 to June 2002 compared to that published form July 2002 to February 2006. The analysis variable computed for each of these two periods was the mean absolute revision between first estimates of year-on-year growth rates and those published 1 year later.

Figure 2 Mean absolute revision between first estimates of year-on-year growth rates and those published 1 year later for the IIP – before and after June 2002



[6] This assumption has not yet been confirmed with these countries. However it has been surmised from the data by the fact that the country stopped submitting their IIP to the OECD for a number of months during the analysis period after which major revisions to historical growth rates were evident once reporting recommenced.

15 The countries have been ordered in Figure 2 according to the size of mean absolute revisions for the first half of the analysis period. As noted in paragraph 12; the large drop in size of revisions between the two periods for Ireland, Austria and Luxembourg was due to the introduction of major methodological changes which caused substantial revisions in the first half of the analysis. Excluding these three countries with somewhat abnormal circumstances it can be observed that the size of revisions between the two periods has decreased noticeably for a large number of other countries: Hungary, Switzerland (denoted by CHE in Figure 2), Brazil, Czech Republic, Australia, Germany, United States, Korea, New Zealand, Japan, Euro area, Mexico and Poland. On the other hand the size of revisions appear to be noticeably larger for the later period in the Netherlands, Finland, Denmark, Greece, France, United Kingdom (denoted by GBR in Figure 2) and Italy.

16 It is difficult to draw any general conclusions from this analysis about whether the size of revisions to IIP is becoming larger or smaller on average across the countries analysed. Each country is likely to have its own set of special circumstances influencing their result and thus it would be unfair to classify those countries whose revisions have decreased in recent years as having improved the quality of their IIP relative to other countries whose mean absolute revisions may have increased. However, Figure 2 is still useful to obtain a feel for the better performing countries in terms of size of revisions over the full period of analysis and for those where marked improvements appear to have been made in recent times.

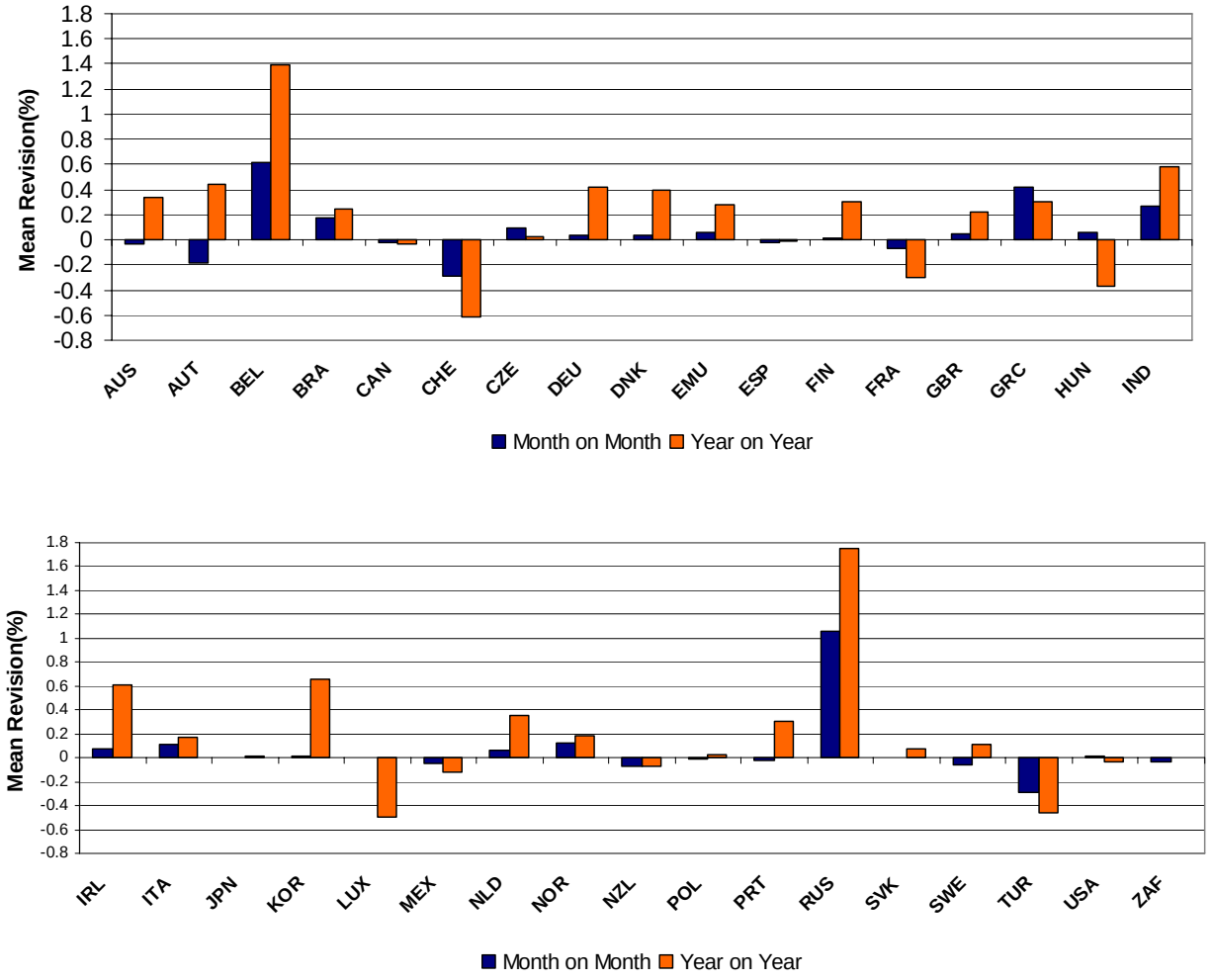
5 Assessing the statistical significance of mean revisions

17 The analysis presented so far in this paper has mainly focused on the size of mean absolute revisions as a quality indicator. However, the size of mean revisions is perhaps of equal importance. Ideally, revisions should have a tendency to be independent; that is, equally likely to be positive or negative and centred around zero. However if revisions have a greater tendency to be in one direction this could indicate flaws in the estimation methodology for a countries' IIP which need to be addressed. The OECD revisions analysis spreadsheets provide three important statistics (see Appendix 1 for technical details) which allow an investigation of these issues:

- the mean revision;
- t-test of significance of the mean revision;
- % of data points for which the later estimate (e.g. one year later) is greater than the first estimate;

18 These three statistics, together with the mean absolute revision are presented below in Table 2, for revisions between first estimates and those published one year later for both month-on-previous-month and year-on-year growth rates. Figure 3 below compares the size of these mean revisions across all countries included in the analysis.

Figure 3 Mean revision between first estimates of the IIP and those published one year later for month-on-previous-month and year-on-year growth rates



19 The countries which stand out in the graphs as having noticeably high mean revisions for both month-on-previous-month and year-on-year growth rates are Belgium, Russian Federation, India, Turkey and Greece. These mean revisions are confirmed in Table 2 to be statistically significantly different from zero for both measures in the case of Belgium and India; only for month-on-previous-month growth rates in the case of Greece and only for year-on-year growth rates in the case of the Russian Federation and Turkey. Furthermore, the mean revision to year-on-year growth rates were also found to be statistically significantly different from zero for Germany, Euro area, France, United Kingdom and Korea. This result could be considered to be quite alarming for these latter countries. Other countries for which the mean revision to year-on-year growth rates was close to statistical significance were Australia, Denmark, Switzerland, Hungary and Netherlands.

Table 2: Summary statistics and tests of significance for mean revisions between first estimates of the IIP and those published one year later for month-on-previous-month and year-on-year growth rates

	Sample	Mean Absolute Revision		Mean Revision		Significance Test		% Later > Earlier	
		MoM	YoY	MoM	YoY	MoM	YoY	MoM	YoY
AUS	98.Jun-04.Sep	0.58	0.85	-0.04	0.33	NO	NO	50.0	61.5
AUT	98.Oct-04.Nov	2.33	1.84	-0.19	0.44	NO	NO	51.4	58.1
BEL	98.Nov-04.Nov	1.57	1.90	0.61	1.39	**YES**	**YES**	68.5	80.8
BRA	00.Oct-04.Nov	1.68	0.86	0.17	0.24	NO	NO	56.0	58.0
CAN	98.Nov-04.Nov	0.28	0.57	-0.02	-0.04	NO	NO	49.3	47.9
CHE	98.Sep-04.Sep	0.90	1.04	-0.29	-0.62	NO	NO	84.0	36.0
CZE	98.Nov-04.Nov	1.69	0.74	0.10	0.03	NO	NO	49.3	43.8
DEU	98.Nov-04.Nov	0.62	0.73	0.04	0.42	NO	**YES**	47.9	68.5
DNK	99.Apr-04.Dec	1.30	1.26	0.03	0.40	NO	NO	56.5	56.5
EMU	99.Jul-04.Nov	0.35	0.44	0.06	0.27	NO	**YES**	55.4	66.2
ESP	98.Nov-04.Dec	0.61	0.45	-0.02	-0.01	NO	NO	55.4	50.0
FIN	98.Nov-04.Dec	1.06	1.19	0.02	0.30	NO	NO	45.9	51.4
FRA	98.Nov-04.Nov	0.42	0.63	-0.06	-0.30	NO	**YES**	41.1	34.2
GBR	98.Nov-04.Dec	0.26	0.46	0.05	0.23	NO	**YES**	55.4	70.3
GRC	98.Nov-04.Nov	1.47	0.92	0.42	0.31	**YES**	NO	63.0	61.6
HUN	98.Nov-04.Nov	1.36	1.31	0.06	-0.37	NO	NO	42.5	38.4
IND	02.Jul-04.Nov	0.53	0.61	0.27	0.59	**YES**	**YES**	69.0	93.1
IRL	98.Oct-04.Nov	2.52	2.55	0.08	0.61	NO	NO	55.4	47.3
ITA	98.Nov-04.Nov	0.42	0.46	0.11	0.17	NO	NO	56.2	54.8
JPN	98.Dec-04.Dec	0.72	0.53	0.01	0.02	NO	NO	45.2	49.3
KOR	98.Nov-04.Dec	0.84	0.81	0.02	0.66	NO	**YES**	48.6	68.9
LUX	98.Oct-04.Nov	1.94	1.00	0.00	-0.49	NO	NO	41.9	40.5
MEX	98.Oct-04.Nov	0.36	0.41	-0.05	-0.12	NO	NO	41.1	43.2
NLD	98.Nov-04.Nov	1.23	1.27	0.06	0.36	NO	NO	53.4	63.0
NOR	98.Nov-04.Dec	0.88	0.90	0.12	0.18	NO	NO	48.6	51.4
NZL	99Mar-04.Dec	0.75	0.52	-0.07	-0.07	NO	NO	54.2	50.0
POL	98.Dec-04.Dec	0.93	0.33	-0.01	0.03	NO	NO	46.6	54.8
PRT	98.Nov-04.Dec	1.65	1.28	-0.02	0.30	NO	NO	47.3	55.4
RUS	04.Apr-04.Dec	1.92	2.07	1.06	1.75	NO	**YES**	55.6	88.9
SVK	04.Apr-04.Dec	0.83	0.24	0.01	0.07	NO	NO	44.4	55.6
SWE	98.Nov-04.Nov	0.79	1.15	-0.05	0.11	NO	NO	41.1	46.6
TUR	98.Nov-04.Dec	2.44	1.29	-0.29	-0.46	NO	**YES**	51.4	41.9
USA	98.Dec-04.Dec	0.25	0.58	0.01	-0.04	NO	NO	45.2	47.9
ZAF	02.Mar-04.Dec	1.35	0.91	-0.03	0.01	NO	NO	32.4	47.1

6 Reliability of short-term signals from the index of industrial production - which estimates should users focus on?

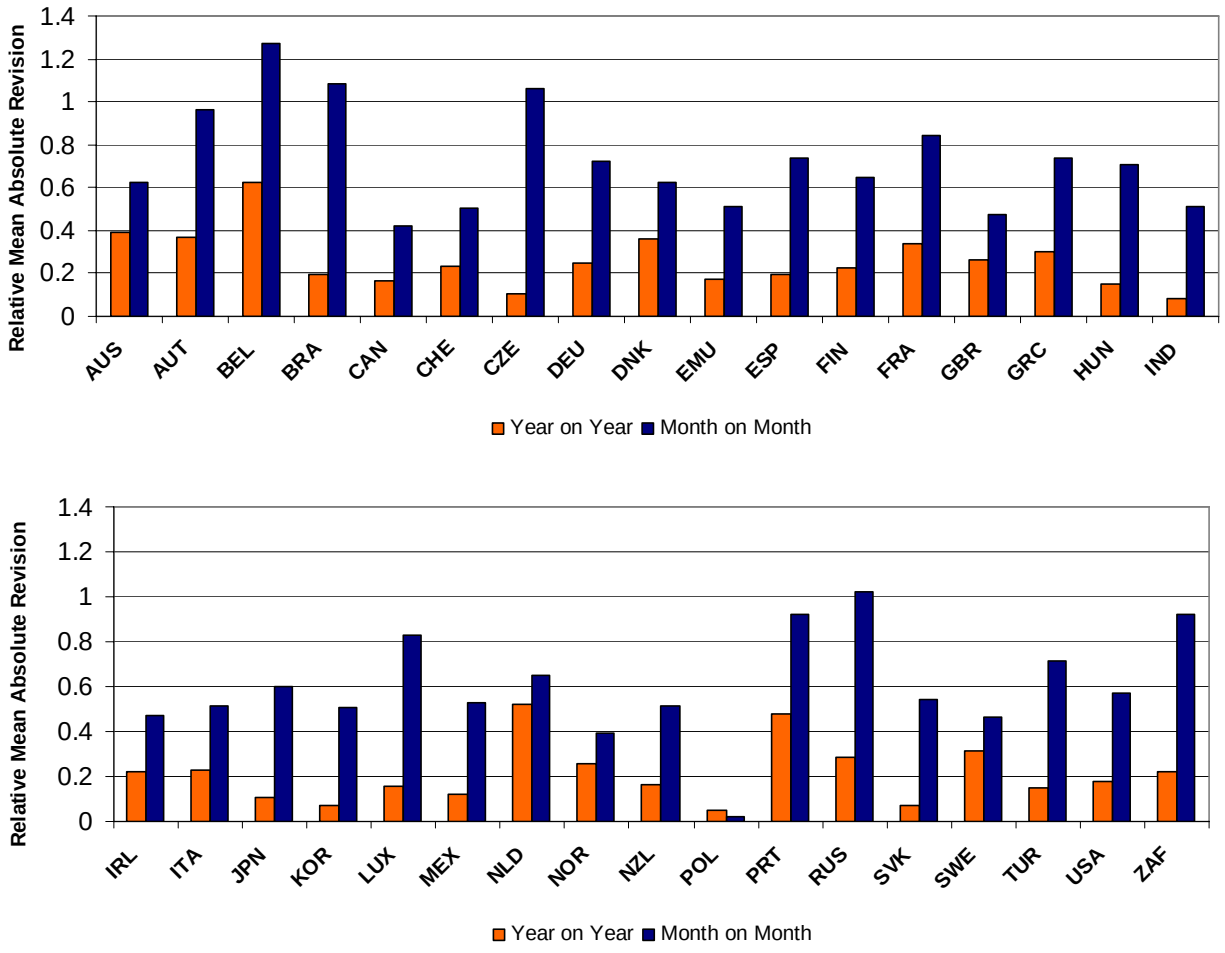
20 The index of industrial production is generally regarded as the best short-term quantitative indicator of expansions and contractions in production activity for an economy. However it is also renowned for its volatility in the short-term which can reflect both the nature of industrial activity and the degree of error associated with compiling this statistic. If one then considers that initial estimates are

frequently revised, sometimes significantly, this raises the question of what measure (e.g. month-on-previous-month growth rate, year-on-year growth rate etc.) users should focus on when interpreting first published short-term movements in the index. This revisions analysis study has allowed an investigation of these issues in general across all countries and to observe countries where first published short-term movements in the IIP might be considered more reliable than others.

21 The first estimate of month-on-previous-month growth rate in seasonally adjusted terms for the IIP in concept provides the most up-to-date measure of the size of the most recent expansion or contraction in industrial output. However, the degree of reliability to which users should place on this statistic depends largely on the extent to which this initial estimate is likely to be revised in future months such that the subsequent revisions may paint a different picture of the current state of industrial activity. Alternatively, users may prefer to focus on the year-on-year growth rate which is generally regarded to be a more robust measure.

22 One way to assess the relative robustness of these two measures is to consider the relative mean absolute revision. This statistic compares the mean absolute revision to the mean absolute size of later estimates. It is shown below in Figure 4 for both year-on-year and month-on-previous-month growth rates, where revisions have been assessed one year after the initial published estimate.

Figure 4 Relative mean absolute revision between first estimates of the IIP and those published one year later for month-on-previous-month and year-on-year growth rates



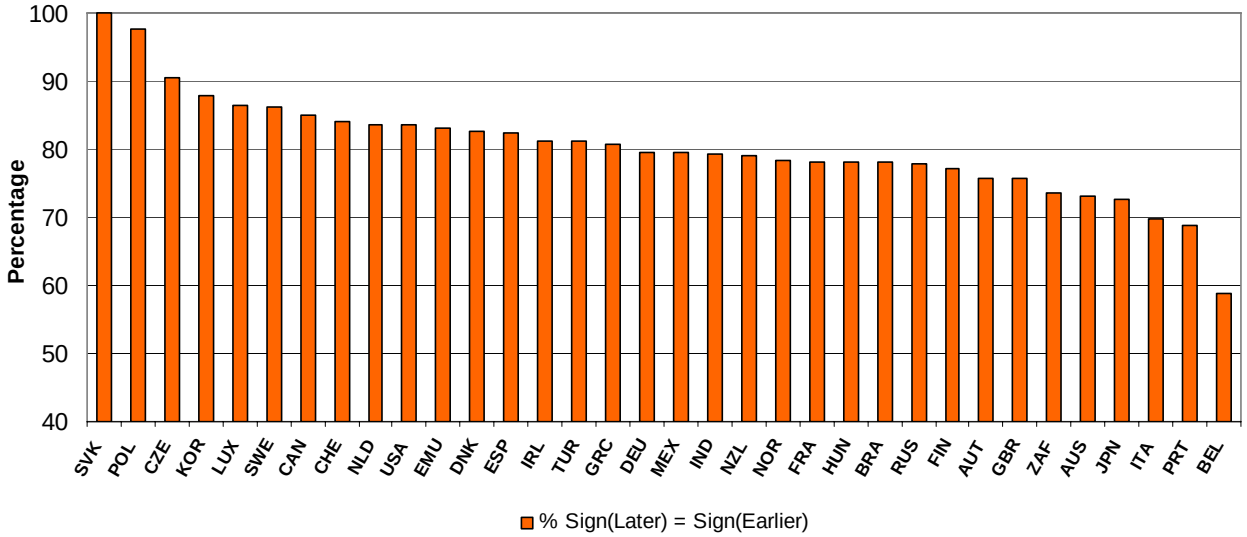
23 The chart shows that for almost all countries the relative mean absolute revision for month-on-previous-month growth rates is quite high. In fact, the average ratio is greater than 0.5 for more than 75% of countries[7] with the average ratio across all countries being 0.67. In layman terms, this means that the initial estimate of month-on-previous-month growth rate is expected to be revised by two thirds its original value within the first year. Consequently, users would be well advised not to place too much emphasis on the initial estimate of month-on-previous-month growth rates of the IIP, at least for its magnitude. By contrast, the relative mean absolute revision for year-on-year growth rates is much lower, being less than 0.2 for half the countries and averaging 0.24 across all countries. Therefore, the first estimate of the year-on-year growth rate may be considered a more robust measure of the current rate of expansion or contraction of industrial activity in an economy.

6.1 Reliability of first estimates of month-on-previous-month growth rates in the IIP as a signal of short-term expansion or contraction of industrial activity

24 The above analysis on relative mean absolute revision needs to be considered in context of the expected size of the denominator – the mean absolute size of initial estimates of month-on-previous-month and year-on-year growth rates. Assuming an upward trend over time for the IIP which is generally applicable in most countries, one would expect the absolute size of initial estimates of year-on-year growth rates to be larger than that for month-on-previous-month growth rates, thus influencing the above comparison due to the larger denominator[8].

25 Nonetheless, the conclusion that users should avoid placing too much emphasis on the magnitude of first estimates of month-on-previous-month growth rates still holds. However, one would hope that the sign of these movements, i.e. whether they signal an expansion or contraction of industrial activity in the most recent month, would be more robust and thus provide useful information to users. Figure 5 below provides useful information on this issue, showing the percentage of months where the sign of the initial estimate of month-on-previous-month growth rate is the same one year later.

Figure 5 Percentage of months where the first estimate of month-on-previous-month growth rate for the IIP has the same sign as that published one year later



[7] And greater than 0.4 for 95% of countries

[8] Analysis of first estimates of month-on-previous-month growth rates across all countries yields an average absolute value of 1.58% compared to 4.61% for year-on-year growth rates.

26 For more than 80% of the time half of the countries have the same sign for initial estimates of month-on-previous-month growth rates and that published one year later, and for only three countries is this less than 70% (Italy, Portugal and Belgium). In general the data support the conclusion that initial estimates of month-on-previous-month growth rates for the IIP provide a reasonably reliable indicator in most countries of whether industrial activity has expanded or contracted in the most recent period.

7 Assessing timeliness and its relationship to revisions for the IIP

27 Timeliness is a key aspect of quality for the index of industrial production. Over the past few years there has been a strong push particularly in European Union countries to improve the timeliness of the IIP through the European Action Plan for Principle European Economic Indicators (PEEIs). Consequently, several countries have subsequently improved the timeliness of their first release for the IIP.

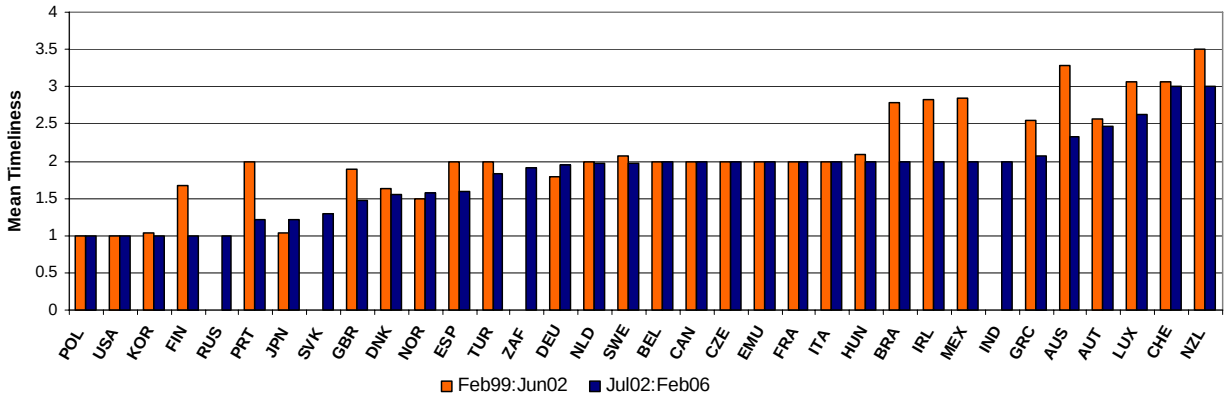
28 As timeliness is generally measured as the number of days from the end of the reference period until the first release of a statistic the monthly publication schedule of the MEI is not frequent enough to pick up small improvements in timeliness in terms of days. Also the timeliness of publication of country data in the MEI depends on other factors such as the efficiency of data transfer, data validation and error resolution and the MEI processing schedule[9] for the month. Nonetheless, one can get a general idea of the relative timeliness of different groups of countries by observing the average number of months between the end of the reference period and first publication of the relevant data point in the MEI publication[10].

29 Countries are ordered in Figure 6 below by their average timeliness for the IIP assessed over each MEI monthly publication from July 2002 – February 2006 in the blue (darker) bar. This is contrasted with their average timeliness assessed over each MEI monthly publication from February 1999 – June 2002 as shown in the orange (lighter) bar. Timeliness improvements are thus evident between the two periods for several countries. For some countries a large part of this improvement is due better arrangements for data capture procedures in the MEI (e.g. for Brazil) but for most others it is due to a substantial improvement in the timeliness of release of national statistics (e.g. for Finland).

[9] The MEI publication process commences on the first Monday of the month with data published on the Friday – referred to as the 'MEI week'. New data will generally be included in the MEI for the current month if it is received from the country (or downloaded from their website if available) prior to 12:00 noon the Wednesday of MEI week.

[10] As the MEI is published early in the month, timeliness is assessed as the number of months between the end of the reference period and the MEI publication month where the data point first appears. For example, if data for January 1999 was first published in the April 1999 MEI, the timeliness measure would be 2 (i.e. a lag of February and March).

Figure 6 Average number of months between the end of the reference period and publication in MEI for the IIP



7.1 Is there a trade-off between timeliness and accuracy for the IIP?

30 Historical references on improving timeliness for short-term economic statistics often theorised (e.g. Ryten, 1997) that improvements in timeliness could not be made without a deterioration in accuracy. One accepted measure of accuracy[11] is the mean absolute revision between first published (timely) estimates and subsequent releases of the same data. The general argument for this supposed trade-off between timeliness and accuracy as measured by revisions is that earlier estimates are likely to be based on lower response rates and may be compiled with limited data validation or editing. Consequently, the estimate for a data point will be revised and be more accurate in the coming months once late respondents are included and data has been more thoroughly edited. However, more recent theories (Oberg, 2002) and research (McKenzie, 2005) have suggested that gains in timeliness can be made without losses in accuracy if improvements are also made to the statistical production process in the compilation of short-term economic statistics.

31 The MEI revisions analysis database for the IIP provides data to at least partially test empirically whether a trade-off does exist between timeliness and accuracy through investigating the following two issues:

1. is there an inverse relationship between mean timeliness for the IIP as measured from the MEI and mean absolute revision between first published estimates and their values two months later[12] as assessed across all countries[13] included in this study;

2. for countries where a known improvement in timeliness has occurred at a certain point in time, does the size of mean absolute revisions between initial estimates and their values two months later increase after the improvement in timeliness?

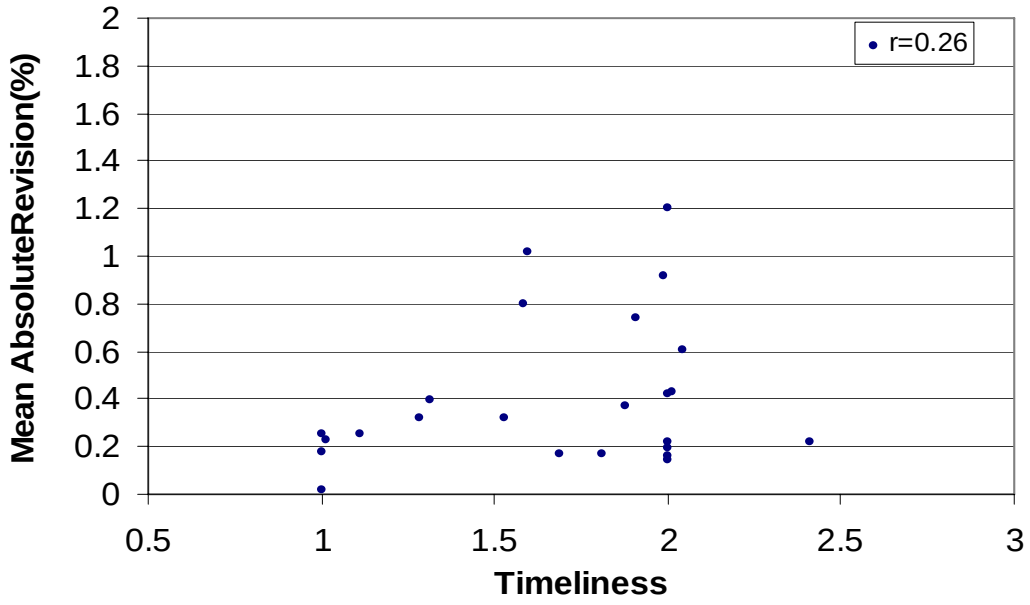
[11] The other most generally accepted measure of accuracy is the difference between an estimate of a variable derived from a survey and its true (unknown) value in the population. This measure of accuracy is the sampling error for an estimate. It may bare some relation to the size of revisions particularly if early estimates are based on smaller sample sizes than later estimates as sample size is a parameter in the calculation of sampling error.

[12] A period of two months was chosen as one might safely assume that all later respondents have been received and errors corrected within the two month period following the initial published estimate.

[13] Australia, New Zealand & Switzerland have been excluded from this analysis as their IIP is only published at quarterly frequency. Brazil, India, South Africa, Greece, Luxembourg, Austria and Ireland were also excluded as there were too many gaps in the publication frequency of these countries data in the MEI over the assessment period that mean absolute revision after two months could not be reliably assessed.

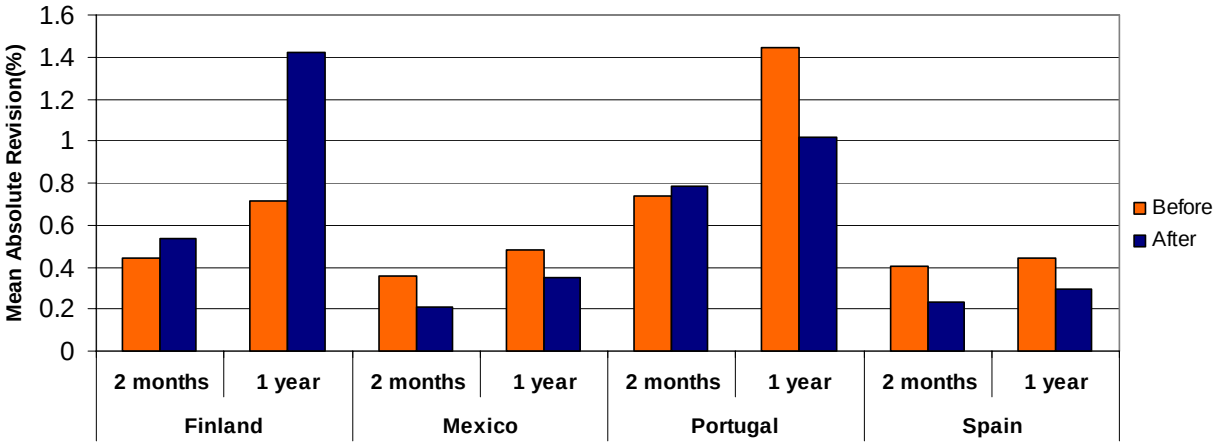
32 The first of these hypotheses can be assessed by reviewing Figure 7 below which plots mean timeliness against the mean absolute revision between first estimates of month-on-previous-month growth rates and those published two months later. If a trade-off exists between timeliness and accuracy one would expect to see points in the graph from the top left hand corner to the bottom right – that is as mean timeliness increases (i.e. deteriorates) mean absolute revisions become smaller. However, the contrary appears to be the case, in that a weak positive relationship (correlation = 0.26) appears to exist between the mean absolute revision and mean timeliness. That is, countries which publish estimates of IIP more slowly have a slight tendency to have higher revisions. If year-on-year growth rates are considered, the relationship is even stronger with a correlation of 0.37.

Figure 7 Mean absolute revision between first estimates of month-on-previous-month growth rates and those published two months later vs timeliness for the IIP



33 The above analysis could be criticised to some extent in that it assumes that all countries are directly comparable whereas there could be other factors which result in some countries having higher revisions than others irrespective of their timeliness. However, for a small number of countries the OECD has been able to determine more precise points where timeliness improvements have been made. This allows one to review the mean absolute revision for these countries before and after the timeliness improvement, and this is shown for year-on-year growth rates in Figure 8 below. Here, the mean absolute revision at both 2 months and 1 year after the first estimate are presented.

Figure 8 Mean absolute revision to first estimates of year-on-year growth rates for the IIP before and after an improvement in timeliness for selected countries



34 The results are somewhat mixed across countries. One sees that short-term revisions (i.e. after 2 months) increased slightly after the timeliness improvement for Finland and Portugal but decreased more substantially for Mexico and Spain. In the case of revisions after 1 year, one sees that these all decreased by at least 25% in Mexico, Portugal and Spain but almost doubled in Finland. Nonetheless, across this small sample of countries there is only evidence in one out of the four (Finland) cases to support the hypothesis that improvements in timeliness would lead to a deterioration in accuracy.

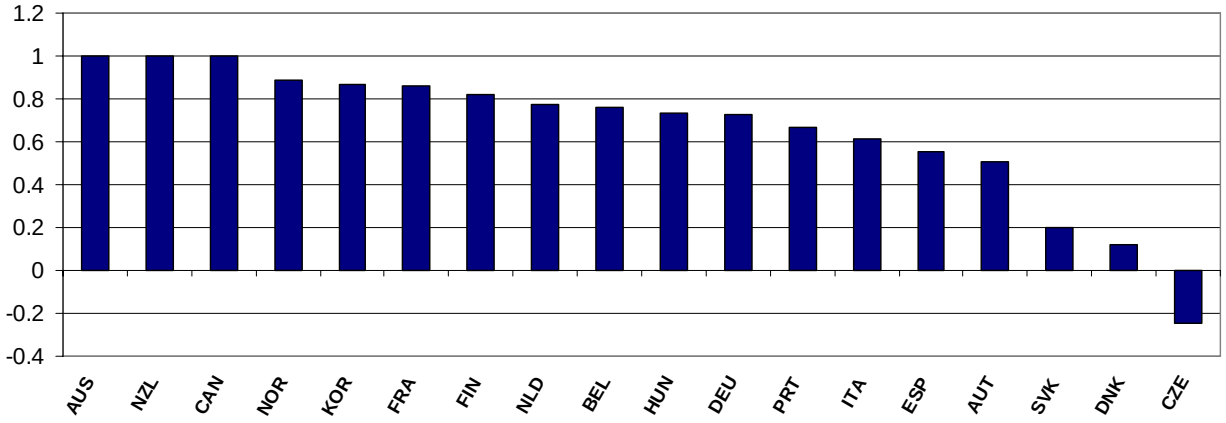
35 In summary, results from this study tend to support the more recently asserted theory that timeliness need not be considered as a trade-off with accuracy for short-term economic statistics provided improvements are also made to the statistical production process at the same time.

8 An assessment of coherence for the index of industrial production

36 There is a growing user requirement for the dissemination of "related" statistics to be coherent – hence the term appears as a dimension in most statistical quality frameworks. The coherency of statistics reflects the degree to which series derived from a single statistical program are logically consistent with related statistics. As the index of industrial production aims to measure short-term changes in the volume of production (or value added) of industrial activity, one could logically expect a degree of coherence with estimates of value added volume in industry as measured in quarterly and annual national accounts. Indeed several countries have a process of benchmarking the index of industrial production to value added volume in industry from the national accounts, a reason identified as one of the likely causes of medium-term revisions to the IIP in paragraph 6.

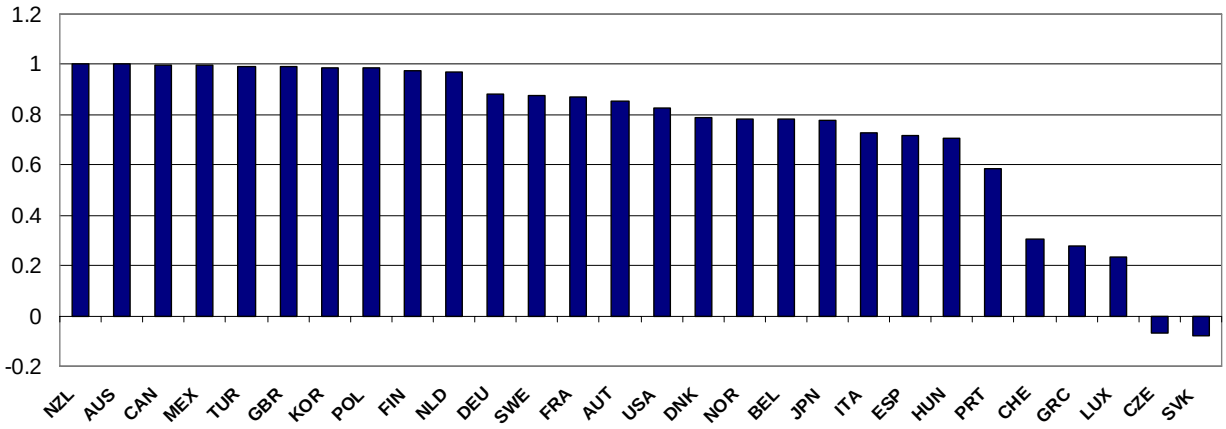
37 Coherence of the IIP has therefore been assessed by calculating the correlation between quarterly and annual growth rates of the IIP and those derived from value added volume in industry from the quarterly and annual national accounts. The period of analysis is for 1995 – 2005 and was performed only for OECD Member countries. Figure 9 presents the correlation between IIP quarter-on-previous-quarter growth rates and the quarter-on-previous quarter growth rate of value added volume in industry for those countries for which OECD collects data on quarterly production accounts. Figure 10 presents the correlation between IIP annual growth rates and the annual growth rate of value added volume in industry from the annual national accounts for all OECD countries.

Figure 9 **Correlation between quarter-on-previous-quarter growth rates of the IIP and value added volume in industry from the quarterly national accounts**



38 The correlations for quarter-on-previous-quarter growth rates for Australia, New Zealand and Canada should be ignored given that for these countries the index of industrial production is a direct output of their quarterly national accounts system – hence the correlation of 1. For other countries where the correlation of quarter-on-previous-quarter growth rates can be performed one observes a reasonable degree of coherence for Norway, France, Finland, Netherlands, Belgium, Hungary and Germany who have correlations between 0.72 and 0.88. Coherence is somewhat lower for Portugal, Italy, Spain and Austria (correlation between 0.5 and 0.66) and alarmingly low for the Slovak Republic, Denmark and the Czech Republic.

Figure 10 **Correlation between annual growth rates of the IIP and value added volume in industry from the annual national accounts**



39 The high correlations (i.e. very close to 1) between annual growth rates of the IIP and value added volume in industry for some countries as seen in Figure 10 suggests that benchmarking of the IIP to annual national accounts may be performed for these countries. Most other countries also appear to have a high degree of coherence with correlations ranging from 0.88 for Germany down to 0.71 for Hungary. Portugal with a correlation of 0.59 separates the five countries with very low correlations and thus poor coherence – Switzerland, Greece, Luxembourg, Czech Republic and Slovak Republic. The poor coherence for these countries raises question marks over the quality of their IIP.

8.1 Do countries with a high degree of coherence have higher revisions due to benchmarking?

40 Forced coherence between the index of industrial production and value added volume in industry from the annual national accounts performed through statistical benchmarking techniques are a potential source of revision for the IIP as noted in paragraph 6. As the process of benchmarking can often cause significant revisions, one might expect that the ten countries with correlations close to 1 in Figure 10 have employed such benchmarking techniques. Consequently, they may therefore have a tendency for larger revisions, particularly at the longer intervals of 1 and 2 years after the initial published estimates of the IIP as presented in Figure 1 of Section 4. However, there does not appear to be any systematic evidence to support this assertion. Whilst one can observe that four of these ten countries with high correlations (Netherlands, Finland, Turkey and Korea) have relatively high revisions between first estimates of year-on-year growth rates and those published 2 years later; the contrary is also the case for four of these ten countries (Canada, Mexico, United Kingdom and Poland) who have relatively low revisions.

9 Conclusions

41 This paper presents a comprehensive analysis of revisions to the index of industrial production for OECD Member countries and for India, Brazil, South Africa and the Russian Federation based on data published in the OECD *Main Economic Indicators* publication from February 1999 to February 2006. The study has allowed three key aspects of statistical quality – accuracy, timeliness and coherence – to be evaluated for each countries index of industrial production. The main findings from this study are summarised in the following points.

- In almost all countries the size of mean absolute revisions to first estimates of year-on-year growth rates for the IIP are non-ignorable and increase the longer the interval from the first estimate, with revisions being much larger after an interval of 1 and 2 years compared to a shorter interval of 3 months.

- It is relatively difficult to distinctively group countries into those with say high, medium or low mean absolute revisions as there appears to be a degree of similarity across a large number of countries. Taking into account the size of mean absolute revisions to first estimates of year-on-year growth rates for 3 different intervals (after 3 months, one year, 2 years), one could say that Belgium appears to have the highest revisions and Poland the lowest. The ranking of other countries varies slightly depending on which revision interval is considered and the degree of difference between countries is not substantial.

- Mean revisions to the IIP between first estimates of month-on-previous-month and year-on-year growth rates and those published 1 year later were assessed for statistical significance for all countries. Mean revisions to month-on-previous-month growth rates were found to be statistically significantly different from zero for Greece, Belgium and India. Mean revisions to year-on-year growth rates were found to be statistically significantly different from zero for Belgium, India, Russian Federation, Turkey, Germany, Euro area, France, United Kingdom and Korea. The existence of mean revisions to IIP growth rates that are statistically significantly different from zero represents a quality concern for these countries IIP. National Statistical Institutes are encouraged to review in detail the tests of statistical significance to mean revisions for all revisions intervals presented in the analysis spreadsheets at: http://www.oecd.org/document/0/0,2340,en_2649_34237_36508672_1_1_1_1,00.html for both month-on-previous-month and year-on-year growth rates.

- First estimates of month-on-previous-month growth rates for the IIP should not be considered a reliable indicator of the magnitude of short-term changes in the volume of industrial output. On

average across all countries, first estimates of month-on-previous-month growth rates are revised by two thirds of their initial value within one year. However, first estimates of the month-on-previous-month growth rate in the IIP can be assumed to give a reasonably reliable signal of the direction (i.e. expansion or contraction) of recent changes in industrial activity, with the sign of first estimates (i.e. + or –) being the same as that one year later more than 70% of the time in over 90% of countries. On the other hand, first estimates of year-on-year growth rates are shown to provide a more robust measure in terms of magnitude, being revised on average across all countries by only 24% of their initial value with one year.

- There is no systematic empirical evidence to support the hypothesis that a trade-off exists between timeliness and accuracy. In fact, this study finds some weak evidence to support the contrary conclusion that those countries with more timely estimates have a greater tendency to have lower mean absolute revisions. Furthermore, of the four countries investigated that had improved the timeliness of their IIP within the analysis period, three had lower mean absolute revisions to first estimates after the improvement in timeliness compared to the period before. This is perhaps consistent with recent theories that timeliness can be improved without loss in accuracy for short-term economic statistics if improvements are made to the statistical production process.

- A reasonably high degree of coherence between growth rates of the IIP and valued added volume in industry from the national accounts is apparent for most countries. However, exceptions to this rule exist for Denmark, Slovak Republic, Czech Republic, Luxembourg, Greece and Switzerland which casts quality concerns over these countries' IIP.

- There does not appear to be systematic empirical evidence that those countries that benchmark the index of industrial production to annual value added volume in industry from the national accounts have higher long-term revisions (i.e. measured 2 years after the initial estimate of IIP) relative to other countries which do not benchmark.

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April 2006

Appendix 1 Interpretation of summary statistics for the IIP revisions analysis

Detailed summary statistics are provided for each country at http://www.oecd.org/document/0/0,2340,en_2649_34237_36508672_1_1_1_1,00.html to assess revisions to first and subsequent estimates of both month-on-month and year-on-year growth rates in the IIP for a range of different intervals i.e. 2 months after initial publication; 3 months; 1 year; 2 years; latest estimate; difference between estimates at 2 and 3 months; difference between estimates at 2 months and 1 year; difference between estimates at 1 year and 2 years. An example of these summary statistics is provided in the table below, followed by an explanation of the statistics and their relevant formulas.

Estimate published 1 year later (L) vs.	First published estimate (P)
sample	98.Nov-04.Dec
n	74
mean absolute revision	1.1871
mean revision (Rbar)	0.3034
st. dev(Rbar) - HAC formula	0.2193
mean squared revision	2.7642
relative mean absolute revision	0.2261
t-stat	1.3839
t-crit	1.9930
Is mean revision significant?	NO
Correlation between L and P	0.9583
Min Revision	-6.3
Max Revision	4.3
Range	10.6
% L > P	51.4
% Sign(L) = Sign(P)	95.9
Variance of L	30.1158
Variance of P	32.7492
UM %	3.33
UR %	7.77
UD %	88.90

Revision is defined as $R_t = L_t - P_t$ where L_t is the later estimate and P_t is the preliminary (or earlier) estimate. n is the number of observations.

The following are the relevant formulas for the main statistics included in the summary statistics tables.

- *mean revision*:

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

- *mean absolute revision*:

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

- *relative mean absolute revision:*

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

- *mean squared revision*:

$$MSR = \frac{1}{n}\sum_{t=1}^{n}\left(L_t - P_t\right)^2 = \frac{1}{n}\sum_{t=1}^{n}R_t^2$$

In order to test whether mean revision is significantly different from zero, we perform a *t* test with the test statistic

$$t = \frac{\bar{R}}{\text{st.dev(Rbar) - HAC Formula}}$$

where *st.dev(Rbar)-HAC Formula*, or the *heteroscedasticity and autocorrelation consistent standard deviation of mean revision* is defined as the square root of:

$$\text{var}(\bar{R}) = \frac{1}{n(n-1)}\left\{\sum_{t=1}^{n}\hat{\varepsilon}_t^2 + \frac{3}{4}\sum_{t=2}^{n}\hat{\varepsilon}_t\hat{\varepsilon}_{t-1} + \frac{2}{3}\sum_{t=3}^{n}\hat{\varepsilon}_t\hat{\varepsilon}_{t-2}\right\},$$

with $\hat{\varepsilon}_t = R_t - \bar{R}$.

Other statistics useful for evaluation of various aspects are

- *Range=Max Revision-Min Revision*
  Max Revision: value of the highest revision
  Min Revision: value of the lowest revision

- *% Later>Earlier:*
  The percentage of observations where the later estimate is larger than the earlier estimate, i.e. revision is greater than 0.

- *% sign(later)=sign(earlier):*
  The percentage of observations where the sign of later estimate and the sign of earlier estimate are the same.

Decomposition of the mean-squared revision

Mean squared revision measures the variance of revision based on a symmetric and quadratic loss function. *MSR* decomposed and divided by itself gives:

$$1 = UM + UR + UD$$

with

$$UM = \frac{\bar{R}^2}{MSR}$$

$$UR = \frac{\left(S_p - \rho S_l\right)^2}{MSR}$$

$$UD = \frac{(1-\rho^2)\,S_l^2}{MSR}$$

where S_p is the variance of earlier estimates, S_l the variance of the later estimates, and ρ the correlation between them.

UM is the proportion of *MSR* due to mean revision not being equal to zero. It is thus also known as mean error.

If we consider a linear regression model of the earlier and later estimates $L_t = \alpha + \beta P_t + u_t$, *UR* is the proportion of MSR due to the slope coefficient β being different from 0, or the slope error.

UD is the disturbance proportion of MSR, i.e. the proportion of MSR that is not caused by systematic difference between earlier and later estimates.

Good preliminary estimates have low values of *UM* and *UR* and a high value of *UD*.

More detailed information on these statistics can be found in a paper written by Professor Tommaso DiFonzo, available at http://www.oecd.org/dataoecd/55/17/35010765.pdf . In particular Appendix A and B contain comprehensive technical details on the test statistic.

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