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Undertaking Revisions and Real-Time Data Analysis using the OECD Main Economic Indicators Original Release Data and Revisions Database

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Undertaking Revisions and Real-Time Data Analysis using the OECD Main Economic Indicators Original Release Data and Revisions Database

OECD Statistics Working Paper

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September 2006

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ABSTRACT

The first releases of official statistics are often revised in subsequent releases, sometimes substantially. Such revisions can impact on policy decisions, as revisions to first published data may alter the previous assessment of the state of the economy. This may occur through a changed interpretation based on the revised data itself or the impact the revision may have on econometric models which may incorporate several statistics, each subject to revision. Whilst this is a recognised issue of key importance, most producers of official statistics do not quantify expected revisions to their data and economists do not have the required data to test the sensitivity of their econometric models to revisions in input data. This important gap in knowledge required to effectively use official statistics, and demands from central banks motivated the OECD to develop a unique new product: the *Main Economic Indicators Original Release Data and Revisions Database*, now freely available at: http://stats.oecd.org/mei/default.asp?rev=1 . Accessing this source of originally published data will enable analysts to test the likely effectiveness of econometric models in simulated real-time. It will also enable producers of official statistics to study the magnitude and direction of subsequent revisions to published data which can lead to a better understanding of the statistical compilation process, enabling problems to be identified and improvements to be made. Revisions analysis also provides important information to users on the robustness of first estimates.

This paper describes the contents and intended uses of this database and presents key findings from comprehensive revisions analysis studies of Gross domestic product, Index of industrial production and Retail trade volume for OECD countries and selected non-member economies. In addition a simple model to predict Private final consumption expenditure is evaluated to demonstrate the use of the database for simulated real-time data analysis to assess model performance, together with an assessment of the impact of revisions on model parameters. The revisions analysis studies presented show that revisions to growth rates are non-ignorable in all countries and become larger the longer the period from the first published estimate. Furthermore, some countries show substantial mean absolute revisions and / or have mean revisions which are statistically significantly different from zero. In the case of the Index of industrial production and Retail trade volume the studies also found that on average across all countries first estimates of month-on-previous-month growth rates are revised by approximately two thirds of their first published values within one year. For a large number of countries this renders these first estimates of month-on-previous-month growth rates of little practical use to analysts and thus more robust measures should be considered for short-term analysis. The revisions analysis study for the Index of industrial production (IIP) was also extended to investigate the timeliness of data release and coherence with GDP in industry across countries. The main findings were that for most countries a high degree of coherence exists between the IIP and GDP in industry and that there was no empirical evidence to support the hypothesis that a trade-off exists between timeliness of publication and accuracy for the IIP.

Acknowledgements

I would like to thank Ms Soyoung Park for her assistance in performing the statistical analysis presented in this paper. Rachida Dkhissi, Russell Penlington & Soyoung Park also contributed significantly to establishing the *Main Economic Indicators Original Release Data and Revisions Database* and associated web interface.

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September 2006

RÉSUMÉ

Les premières publications des statistiques officielles sont souvent révisées dans des publications ultérieures, parfois substantiellement. Les révisions des données initiales peuvent avoir une incidence sur les décisions de politique économique car elles peuvent modifier l'appréciation portée antérieurement sur l'état de l'économie. En effet, l'analyse même des données révisées peut donner lieu à une nouvelle interprétation et la révision peut avoir une incidence sur les modèles économétriques intégrant parfois plusieurs statistiques, chacune sujette à révision. Bien qu'il s'agisse d'une question dont l'importance centrale est reconnue, la plupart de ceux qui produisent des statistiques officielles ne quantifient pas les révisions attendues de leurs données et les économistes ne disposent pas des données nécessaires pour tester la sensibilité de leurs modèles économétriques aux révisions des données utilisées pour les établir. Cette lacune importante dans les connaissances requises pour utiliser efficacement les statistiques officielles et les exigences des banques centrales ont incité l'OCDE à élaborer un nouveau produit unique : la *Base de données de l'OCDE : « Principaux indicateurs économiques : première publication des données et révisions ultérieures. »,* désormais accessible gratuitement sur le site : http://stats.oecd.org/mei/default.asp?rev=1. L'accès à cette source de données initiales permettra aux analystes de tester l'efficacité probable des modèles économétriques en temps réel simulé. Il permettra aussi aux producteurs de statistiques officielles d'étudier l'importance et l'orientation des révisions apportées ultérieurement aux données publiées, ce qui devrait conduire à une meilleure compréhension du processus d'établissement des statistiques, faciliter la mise en évidence des problèmes et donner lieu à des améliorations. L'analyse des révisions fournit aussi des informations importantes aux utilisateurs sur la robustesse des premières estimations.

Cet article décrit le contenu et les utilisations possibles de la base de données et présente les principaux résultats des études analytiques complètes des révisions apportées aux données concernant le produit intérieur brut, l'indice de production industrielle et le volume du commerce de détail pour les pays de l'OCDE et certaines économies non membres. En outre, un modèle simple de prévision des dépenses privées de consommation finale est évalué afin de montrer comment la base de données peut être utilisée pour réaliser une analyse simulée en temps réel et déterminer ainsi la performance du modèle, l'incidence des révisions sur les paramètres du modèle étant aussi évaluée. Les études analytiques des révisions qui sont présentées font apparaître que les révisions des taux de croissance ne sont pas négligeables dans tous les pays et sont d'autant plus marquées que la période écoulée depuis la première estimation publiée est longue. En outre, pour certains pays, les moyennes des révisions en valeur absolue sont importantes et/ou les révisions moyennes sont significativement différentes de zéro. Dans le cas de l'indice de production industrielle et du volume du commerce de détail, les études montrent aussi que, en moyenne dans l'ensemble des pays, les premières estimations des taux de croissance en glissement mensuel sont révisées dans une proportion d'environ deux tiers par rapport aux premières valeurs publiées, sur une période d'une année. Pour un grand nombre de pays, ces premières estimations des taux de croissance en glissement mensuel n'ont donc guère d'utilité pratique pour les analystes et des mesures plus robustes doivent être prises en compte pour une analyse à court terme. L'étude analytique des révisions pour l'indice de production industrielle (IPI) a aussi été élargie pour déterminer la rapidité de publication des données et la cohérence avec le PIB industriel des différents pays. Pour la majeure partie des pays, on a constaté pour l'essentiel une grande cohérence entre l'indice de production industrielle et le PIB dans l'industrie et aucune donnée empirique n'a corroboré l'hypothèse d'un arbitrage possible entre la rapidité de publication et l'exactitude pour ce qui concerne l'IPI.

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1 Introduction

1. The first releases of official statistics are often revised in subsequent releases, sometimes substantially. Such revisions can impact on policy decisions, as revisions to first published data may alter the previous assessment of the state of the economy. This may occur through a changed interpretation based on the revised data itself or the impact the revision may have on econometric models which may incorporate several statistics, each subject to revision. Whilst this is a recognised issue of key importance, most producers of official statistics do not quantify expected revisions to their data and economists do not have the required data to test the sensitivity of their econometric models to revisions in input data. This important gap in knowledge required to effectively use official statistics and demands from researchers and central banks motivated the OECD to develop a unique new product: the *Main Economic Indicators Original Release Data and Revisions Database*, now freely available at: http://stats.oecd.org/mei/default.asp?rev=1 . Accessing this source of originally published data will enable analysts to test the likely effectiveness of econometric models in simulated real-time[1]. It will also enable producers of official statistics to study the magnitude and direction of subsequent revisions to published data which can lead to a better understanding of the statistical compilation process, enabling problems to be identified and improvements to be made. Revisions analysis also provides important information to users on the robustness of first estimates.

2. This paper describes the contents and intended uses of this database and presents key findings from comprehensive revisions analysis studies undertaken by the OECD for Gross domestic product, Index of industrial production and Retail trade volume for OECD countries and selected non-member economies. The revisions analysis study performed for the Index of industrial production was also broadened to review three important aspects of statistical data quality: timeliness; accuracy; and coherence – and the main results from these investigations are also presented. Finally, to demonstrate the use of the database for real-time analysis, the performance of a simple model to predict Private final consumption expenditure is evaluated in simulated real-time, together with an assessment of the impact of revisions on model parameters.

2 The OECD Main Economic Indicators Original Release Data and Revisions Database

3. The OECD *Main Economic Indicators Original Release Data and Revisions Database* allows both users and producers of official statistics to study the magnitude and direction of subsequent revisions to official statistics and for economists to test the likely effectiveness of econometric models in simulated real-time. The user interface at http://stats.oecd.org/mei/default.asp?rev=1 provides direct access to the following data and information.

- Full time series as far back as 1960 in some cases for 21 key economic variables as originally published in each monthly edition of the OECD *Main Economic Indicators* (MEI) CD-Rom from February 1999 onwards for OECD countries, the Euro area, China, India, Brazil, South Africa and the Russian Federation. This database is updated on a monthly basis and provides the raw data needed by economists to test the performance of their econometric models in simulated real-time.

- Access to comprehensive revisions analysis studies performed by the OECD for Gross domestic product, Index of industrial production and Retail trade volume.

[1] For a detailed definition of what is meant by 'real-time' analysis, please see paragraph 45 in section 5.1

- Automated programs and a detailed user guide allowing both producers and users of official statistics to perform their own revisions analysis based on the OECD methodology for any country and variable combination available in the database. Alternatively producers of official statistics can use the automated programs to perform revisions analysis on their own data for any variable, provided they have access to their own source of vintage datasets.

- Information on reasons for revisions, together with recommended practices to aid producers of official statistics in establishing a transparent revisions policy for economic statistics.

4. The following variables are included in the database: GDP and its expenditure components; Industrial production and Production in construction; OECD Composite leading indicators; Retail trade, Consumer price index; Standardised unemployment rate; Civilian employment; Hourly earnings in manufacturing; Monetary aggregates; International trade in goods and Current account balance. This list of variables was based on feedback from a survey of central bank contacts to determine which economic variables were the most important to include in such a database – based on the restriction that they had been published in the MEI. Market based financial variables (e.g. Interest rates, Exchange rates, Share prices etc.), Business tendency and Consumer opinion survey data which are also often part of econometric models are not included in the database as they are not revised. Consequently the originally released data for these statistics will be the same as that in currently available time series. Such time series published in the MEI can be downloaded at: http://stats.oecd.org/mei/default.asp

3 Revisions policies and undertaking revisions analysis for official statistics

5. The OECD *Data and Metadata Reporting and Presentation Handbook* (OECD, 2006), Section 7.1 contains a detailed discussion outlining the main reasons for data revisions to official statistics, how they should be interpreted[2] and actions national statistics institutes (NSIs) should take to establish a transparent revisions policy as part of their statistical publication strategy[3]. A summary of the main reasons for revisions, generally applicable to a wide range of official statistics for economic variables, is given in Table 3.1.

Table 3.1 Reasons for revision of official statistics

1. Incorporation of source data with more complete or otherwise better reporting (e.g. including late respondents) in subsequent estimates.
2. Correction of errors in source data (e.g. from editing) and computations (e.g. revised imputation).
3. Replacement of first estimates derived from incomplete samples (e.g. sub-samples) judgmental or statistical techniques when data become available.
4. Incorporation of source data that more closely match the concepts and / or benchmarking to conceptually more correct but less frequent statistics.
5. Incorporation of updated seasonal factors.
6. Updating of the base period.
7. Changes in statistical methodology, concepts, definitions, and classifications.

[2] One important interpretation is that revisions per se should not be viewed in a negative light. They are a necessary by product of the statistical production process which aims to produce the highest quality outputs given the available information sources at a particular point in time. Therefore, if a particular statistic is never revised one should not assume that the data is of high quality without reviewing the associated compilation methods and data sources used.

[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.

6. The above reasons are approximately 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 few subsequent releases to 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 monthly data is benchmarked to quarterly data sources. 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. Feedback from countries in response to the revisions analysis study for the Index of industrial production (see Section 4.2) confirmed that each of the above reasons for revisions were relevant in practice.

7. Analysis of revisions for key economic variables such as those included in the OECD *Main Economic Indicators Original Release Data and Revisions Database* enables national statistical institutes to evaluate their performance against a key dimension of statistical quality – accuracy. Ultimately this can lead to a better understanding of the statistical compilation process and enable problems to be identified and improvements to be made. This is one of the reasons why the International Monetary Fund's Special Data Dissemination Standards (SDDS) encourages countries to undertake revisions analysis and 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. Indeed these very same reasons provided the impetus for the OECD to host a workshop[4] on revisions analysis with the UK Office for National Statistics in October 2004, which established a set of principles that governed the development and presentation of revisions analysis statistics and served as the catalyst for the OECD Database. Despite this recognised importance, to date few national statistical institutes perform detailed revisions analysis on an ongoing basis for their key economic statistics as obtaining the necessary data and developing the programs required is a resource intensive task. However this new OECD facility provides the opportunity for NSIs to easily and quickly undertake such analyses.

3.1 Terminology

8. The terminology used in this paper is consistent with that recommended in the OECD *Data and Metadata Reporting and Presentation Handbook* (OECD, 2006). Some key terms regularly used and their definitions are presented below in Table 3.2.

Table 3.2 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) and Quarter-on-previous-quarter (QoQ) growth rate	Month-on-previous-month (and QoQ) growth rates are rates of change expressed with respect to the previous month (quarter), i.e. $(M_t/M_{t-1}) -1$ or $(Q_t/Q_{t-1}) - 1$
Annual growth rate	Annual growth rates are annual rates of change expressed over the previous year, i.e. $(Y_t/Y_{t-1}) -1$

[4] See the proceedings of this workshop: http://www.oecd.org/document/23/0,2340,en_2825_497146_33729303_1_1_1_1,00.html

4 Main findings from OECD revisions analysis studies

9. Three comprehensive revisions analysis studies using the data available in the *MEI Original Release Data and Revisions Database* were undertaken by the OECD in 2005 and 2006. These were for Gross domestic product, Index of industrial production and Retail trade volume. The detailed results from these studies and data used can be accessed through the *MEI Original Release Data and Revisions Database* interface .

10. For each of these studies detailed revisions analysis spreadsheets and a wide range of summary statistics were produced for each country[5]. A description of the contents of these revisions analysis spreadsheets and definitions of the summary statistics produced is given in Appendix 1. Ideally, revisions should have a tendency to be random; that is, equally likely to be positive or negative and centred around zero. Therefore an important output of a revisions analysis study are the tests to determine whether mean revisions (calculated at a range of different time lengths from the first estimate) are statistically significantly different from zero. In the case where mean revisions are statistically significant, this implies that data have a significant tendency to be revised in a particular direction (i.e. up or down) and that the compilation methodology for early estimates should be reviewed. This is just one good example of how revisions analysis studies can be very useful as a catalyst for identifying problems with compilation practices which require investigation by the producers of official statistics.

11. The outputs of OECD revisions analyses can generally be expected to be comparable across countries hence direct comparisons are made in the results presented in the following sections. However revision practices vary across countries and this ultimately will have some impact on the results. Consequently, countries were invited to provide comments on the reasons for revisions and this information is provided together with the detailed results from each study.

4.1 Analysis of revisions for Gross domestic product

12. The revisions analysis study for Gross domestic product (GDP) examines the revisions histories of eighteen OECD countries for the first estimates of GDP constant prices, seasonally adjusted quarter-on-previous-quarter (QoQ) growth rates as published in successive monthly issues of the *Main Economic Indicators* (MEI) publication from May 1995 to May 2006. The initial study (DiFonzo, 2005) was presented at the OECD Working Party on National Accounts in October 2005 and the update of this study (Tosseto, 2006) from which the data below is sourced will be presented at the October 2006 meeting.

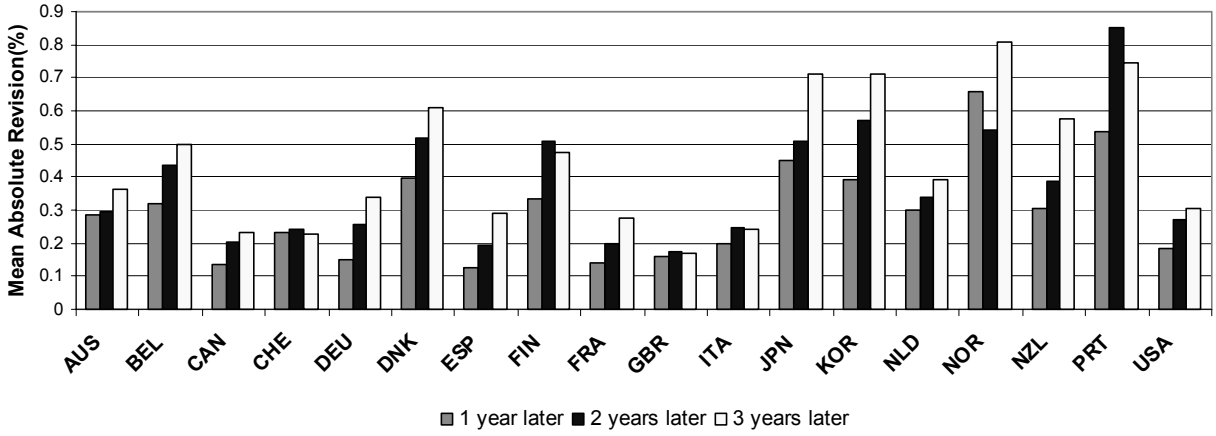
[5] It should be noted that as the data used to perform these studies has been received from countries and subsequently processed and published by the OECD, there are a number of issues which may arise that could impact on any revisions analysis performed – in comparison to that based on actual nationally published data. Such issues are listed in detail in Section 2 of the technical note Revisions analysis for official statistics which is also accessible through the database interface. The key for country acronyms included in the graphs is:

AUS = Australia; AUT = Austria; BEL = Belgium; BRA = Brazil; CAN = Canada; CHE = Switzerland; CZE = Czech Republic; DEU = Germany; DNK = Denmark; EMU = Euro area; ESP = Spain; FIN = Finland; FRA = France; GBR = United Kingdom; GRC = Greece; HUN = Hungary; IND = India; IRL = Ireland; ITA = Italy; JPN = Japan; KOR = Korea; LUX = Luxembourg; MEX = Mexico; NLD = Netherlands; NOR = Norway; POL = Poland; PRT = Portugal; RUS = Russian Federation; SVK = Slovak Republic; TUR = Turkey; USA = United States; ZAF = South Africa.

4.1.1 Relative size of revisions to GDP across countries

13. Figure 4.1 shows the mean absolute revision between first published estimates of QoQ growth rates for GDP and those published at subsequent one, two and three year intervals. The relevant time periods are estimates published for the reference periods between 1995Q1[6]:2004Q4.

Figure 4.1: Mean absolute revision to first estimates of quarter-on-previous-quarter growth rates for GDP



14. For the majority of countries revisions to first published estimates become larger over time –with mean absolute revisions after three years generally being noticeably larger than revisions after one year[7]. This implies that in general subsequent revisions to estimates do not cancel out previous revisions. Mean absolute revisions are noticeably larger[8] in some countries than others, in particular for Japan, Korea, Norway and Portugal.

4.1.2 Statistical significance of mean revision to first estimates of QoQ growth rates

15. As outlined in paragraph 10 above, revisions should have a tendency to be random; 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 compilation methodology that need to be investigated – particularly where these occur at shorter intervals[9] (e.g. revisions assessed after 1 year). For the GDP study, the mean revision to first estimates of QoQ growth rates assessed after 1 year was found to be statistically significantly different from zero for Denmark.

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[6] Reference periods covered start later for Germany (95Q2), Portugal (96Q1), Belgium (96Q4) and Korea (99Q4).

[7] Exceptions are observed for the Czech Republic and United Kingdom where the mean absolute revision after one year is similar in magnitude to those at other intervals.

[8] Whist the mean absolute revision (MAR) has been used here as a basis for comparison across countries, it is also useful to observe the mean absolute revisions to growth rates relative to the mean size of the growth rates themselves – referred to as the relative mean absolute revision (RMAR). The RMAR may often give a different ordering for the size of revisions across countries. The more detailed paper on GDP by Tosetto & Lequiller (2006) show results for both MAR and RMAR across countries.

[9] Revisions may have a greater tendency to be in a particular direction the longer the revision interval (e.g. after 3 years) if, for example, there is a systematic impact of major methodological changes applied to the entire time series.

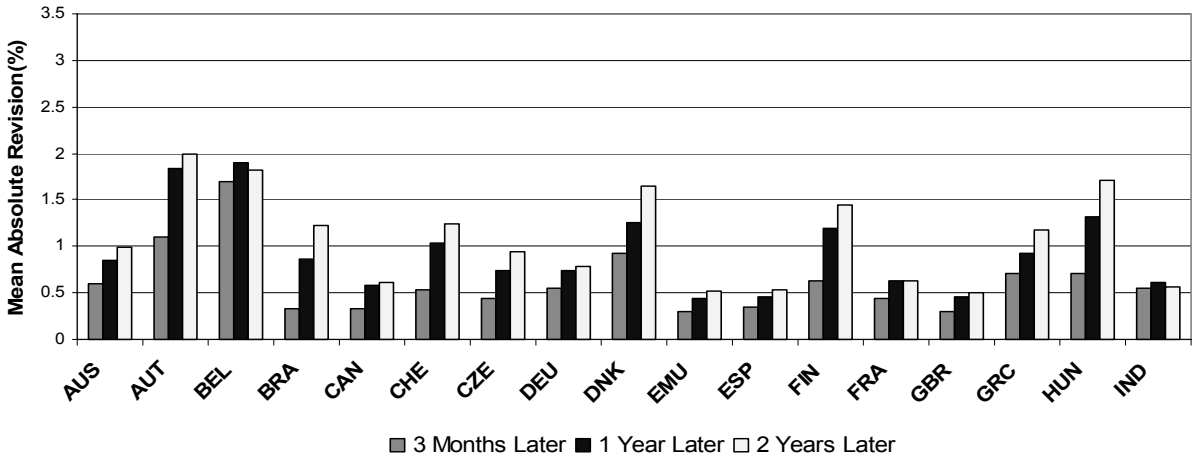
4.2 Analysis of revisions and assessment of quality for the Index of industrial production

16. The index of industrial production (IIP) 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. An aspect of this error concerns the frequent, sometimes significant, revisions that are made to first published estimates. This issue and many others associated with three important dimensions of statistical data quality – accuracy, timeliness and coherence – were presented (McKenzie & Park, 2006) at the June 2006 OECD Short-Term Economic Statistics Working Party meeting. The data used for the study was the Index of industrial production, seasonally adjusted, as published at monthly frequency[10] in the OECD *Main Economic Indicators* (MEI) between February 1999 and February 2006. All OECD Member countries with the exception of Iceland were included together with the Euro area, Brazil, India, the Russian Federation and South Africa. The study considered revisions to first estimates of the IIP for both month-on-previous-month (MoM) and year-on-year (YoY) growth rates, the relative timeliness of release of the IIP across countries and its relationship to size of revisions and the coherence between countries estimates for IIP and GDP in industry.

4.2.1 Relative size of revisions to the IIP across countries

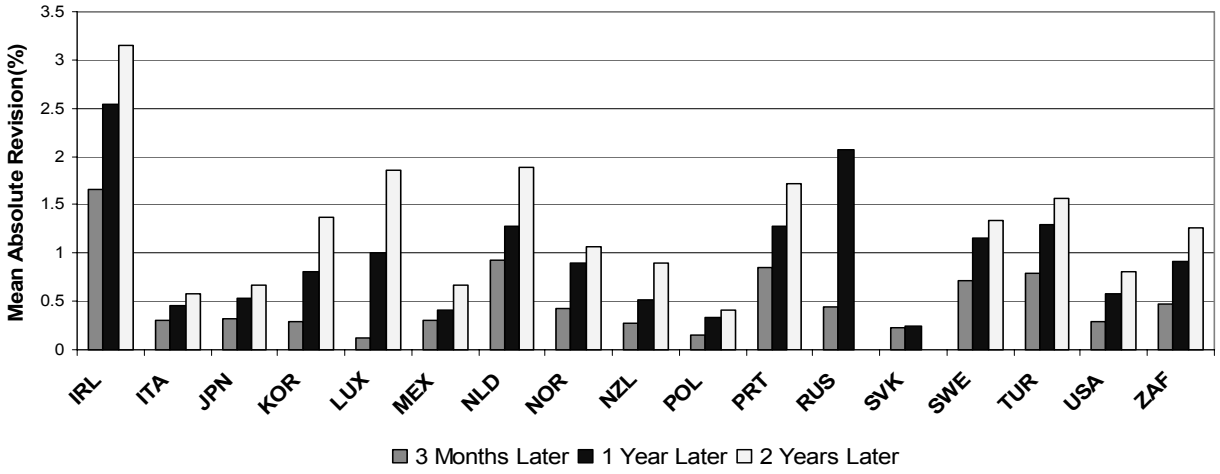
17. In almost all countries the size of mean absolute revisions to first estimates of month-on-previous-month and year-on-year growth rates for the IIP are non-ignorable and increase the longer the interval from the first estimate, with revisions being much larger after an interval of 1 and 2 years compared to a shorter interval of 3 months. Figure 4.2 compares these revisions across countries for year-on-year growth rates. Some countries stand out as having high revisions although many countries exhibit a similar revisions pattern. More detailed analysis of the revisions spreadsheets reveals that three of the countries with large mean absolute revisions: Ireland, Austria and Luxembourg; most likely introduced major methodological changes[11] to their IIP in the analysis period which should be taken into consideration.

Figure 4.2 Mean absolute revision to first estimates of year-on-year growth rates for the IIP



[10] 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.

[11] This assumption 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.



4.2.2 Statistical significance of mean revisions to the IIP

18. 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 – that is whether they have a significant tendency to be revised either upwards or downwards. 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. Appendix 2 contains graphs and tables showing the mean revision to MoM and YoY growth rates and related summary statistics for all countries included in the study.

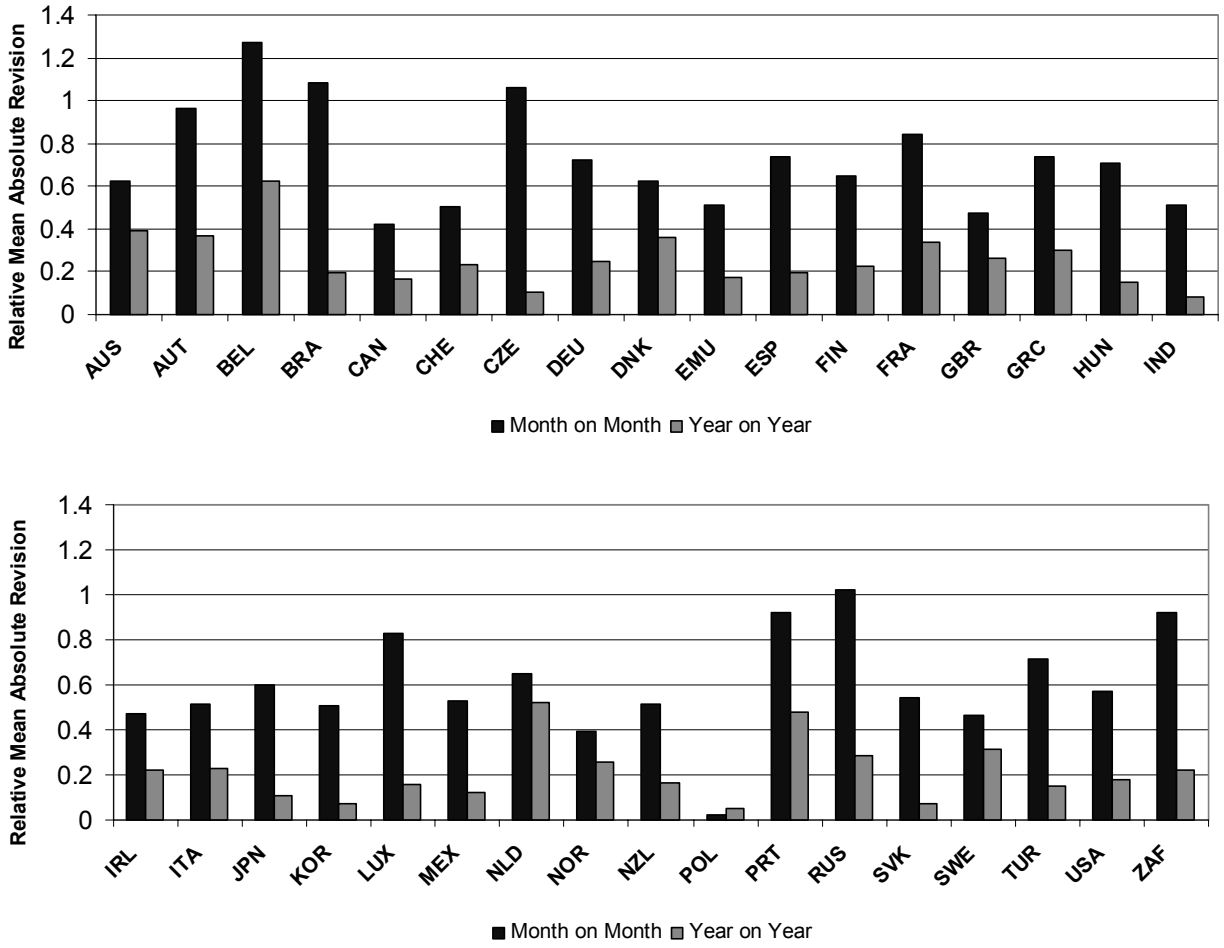
4.2.3 Reliability of first estimates for the Index of industrial production - which estimates should users focus on?

19. Analysts often refer to the latest available (i.e. first published) estimates of the month-on-previous-month growth rate of seasonally adjusted IIP as an indicator to assess the current state of the economy – in regards to expansions and contractions in production activity and the general state of the business cycle. 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. If first estimates of month-on-previous-month growth rates for a country have a history of being largely revised, then users would be advised to focus on a more robust statistic such as the year-on-year growth rate or some other measure[12].

20. One way to assess the relative robustness of first estimates of MoM and YoY growth rates is to calculate 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 4.3 for both year-on-year and month-on-previous-month growth rates, where revisions have been assessed one year after the initial published estimate.

12 For example, the United Kingdom's Office for National Statistics encourages users to focus on the growth rate of the three month moving average of the IIP which is the headline indicator for their press release, although their press releases also quotes the month-on-previous-month growth rate.

Figure 4.3 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



21. The charts show 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[13] 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 rates are 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 in most countries, 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.

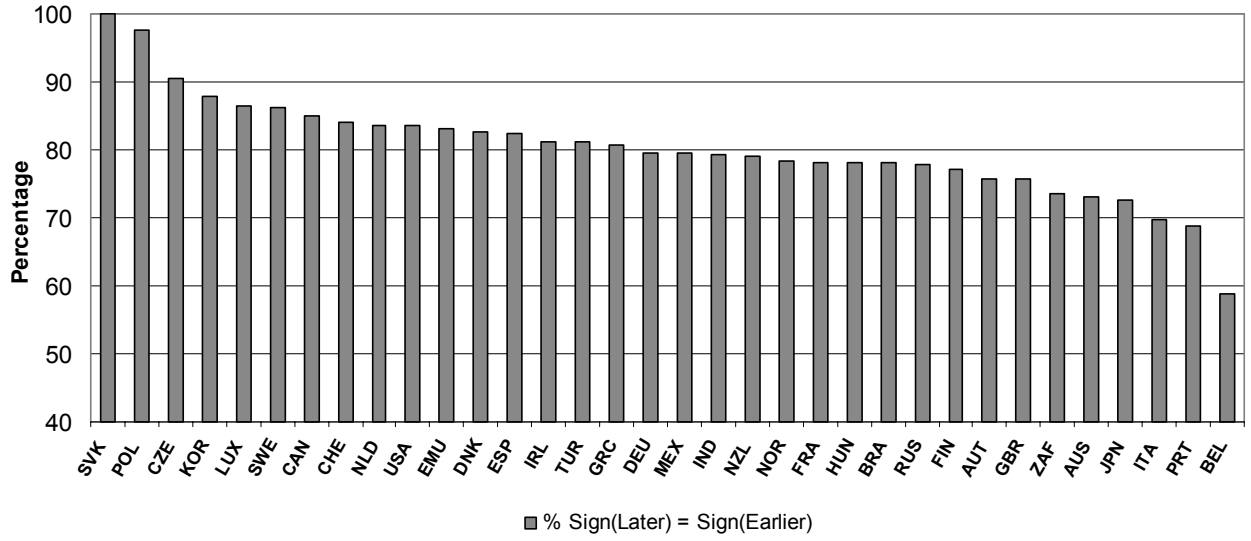
[13] And greater than 0.4 for 95% of countries

4.2.4 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

22. 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[14].

23. Nonetheless, the conclusion that users should avoid placing too much emphasis on the magnitude of first estimates of month-on-previous-month growth rates for a majority of countries 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 Figure 4.4 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[15].

Figure 4.4 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



24. 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 those 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.

[14] 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.

[15] Clearly this analysis is only partially useful, because MoM growth rates are not centred around zero and those countries with higher trend growth in IIP are more likely to have higher positive MoM growth rates and thus be less likely to be revised from +ve to –ve (or vice versa). For example, average MoM growth rates over the analysis period in Poland are 0.57% compared to -0.09% for Italy. The average MoM growth rate across all countries is 0.27%.

4.2.5 Do revisions affect the identification of turning points in the growth cycle of the IIP?

25. As the IIP is used by analysts as one of the major indicators of the business cycle a key issue concerns the detection of possible turning points in the growth cycle[16] which is the focus of most current business cycle analyses. One major concern with revisions to the IIP is that they may affect the ability for analysts to detect turning points in the growth cycle, or may lead to false judgements of the timing of turning points.

26. As part of the process for producing the OECD Composite leading indicators (CLI), the OECD has compiled a list of turning points in the growth cycle for each country's IIP which is used as the reference series for the CLI. These turning points are determined using the Bry-Boschan routine (NBER, 1978). In short, this method assigns turning points as peaks and troughs in the series of deviations from long-term trend, where the long term trend is computed from a 75 term moving average.

27. It is not possible from the data available in this study to re-compute turning points using the Bry-Boschan routine based on a series of first estimates of the IIP. However, one can consider using the year-on-year growth rate series as a proxy to visually observe turning points in the growth rate cycle, and to analyse if a different assessment of turning points would be made from the series of first estimates of year-on-year growth rates compared with those published at a later period after revisions – say two years later. Such an analysis is not possible using month-on-previous-month growth rates as this series is far too volatile to visually observe turning points. The following approach was used to investigate this issue:

- 52 turning points for the IIP dated as part of the OECD CLI system based on the Bry-Boschan routine across 19 countries over the period 1999 – 2003 were evaluated in the analysis.

- For 41 of these 52 turning points, a turning point was also visually evident in the year-on-year growth rate series at either the same month or within 3 months either side of the dated turning point.

- Of these 41 visually observable turning points in the year-on-year growth rate series, 34 (83%) occurred at the same month for both the year-on-year growth rate series based on first estimates and those published two years later. Of the 7 turning points which did not coincide, both the series based on first estimates and those published two years later showed turning points within 2 months of each other.

28. Whilst this analysis is by no means comprehensive, it gives further support to the notion that first estimates of year-on-year growth rates for the IIP are robust and useful for assessing the current state of the business cycle and production activity in a country.

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

29. Users of official statistics generally place high importance on their timeliness of release, particularly for important short-term economic statistics such as the IIP. However producers of official statistics have often theorised (e.g. Ryten, 1997) that improvements in timeliness cannot be made without a deterioration in accuracy – and one accepted measure of accuracy[17] is the mean absolute revision between

[16] Growth cycles are recurrent fluctuations in the series of deviations from trend. Thus, growth cycle contractions include slowdowns as well as absolute declines in activity, whereas business cycles contractions includes only absolute declines (recessions).

[17] 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

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.

30. 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. 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[18] 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 (see Appendix 3 for a graph).

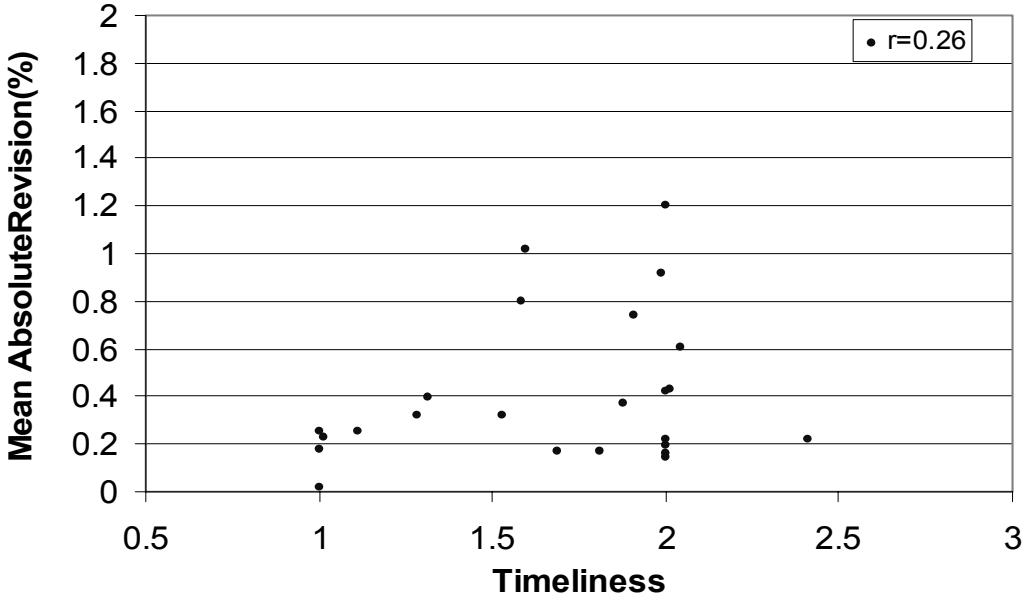
31. To partially test whether a trade-off exists between timeliness and accuracy, one can plot across all countries mean timeliness (i.e. number of months between the end of the reference period and first publication in the MEI) and mean absolute revision (between first estimates of month-on-previous-month growth rates and those published two months[19] 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, Figure 4.5 below shows that 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.

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.

[18] 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.

[19] 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.

Figure 4.5 Mean absolute revision between first estimates of month-on-previous-month growth rates and those published two months later vs timeliness for the IIP



32. A similar result is visually apparent when one considers mean timeliness of publication in the MEI for Gross Domestic Product (see Appendix 3) compared to the size of revisions (see Figure 4.1 in Section 4.1) across countries. McKenzie (2005) also made further investigations for four countries that had improved the timeliness of their IIP in the analysis period and found no evidence that accuracy (as measured in terms of revisions) deteriorated after the improvement in timeliness was made. In fact, three of these countries had lower mean absolute revisions to first estimates after the improvement in timeliness compared to the period before. These results therefore provide some evidence to support the more recent theory (i.e. McKenzie, 2005) that timeliness can be improved without loss in accuracy for short-term economic statistics if improvements are made to the statistical production process at the same time.

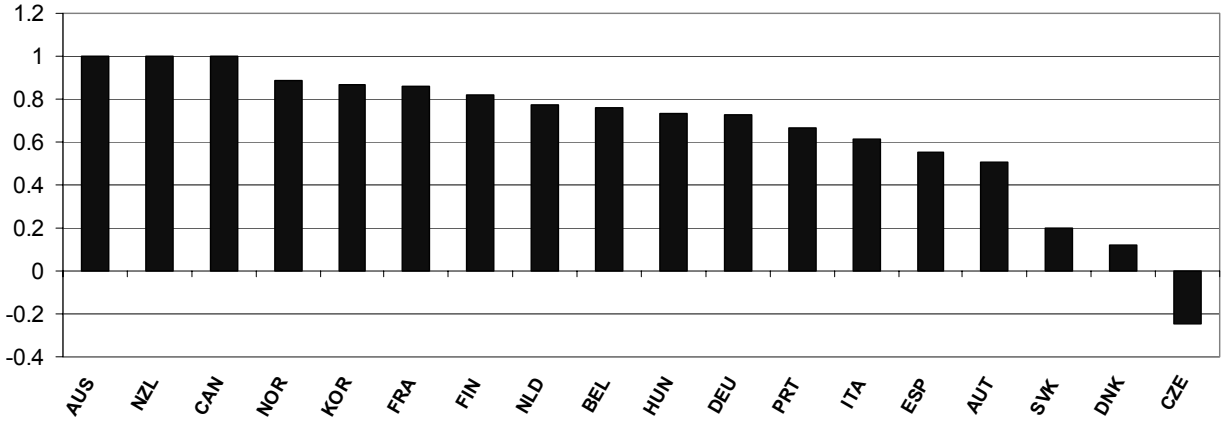
4.2.7 Assessing coherency between the IIP and GDP in industry

33. 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 one statistical program are logically consistent with related statistics from another. 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. In fact, some countries (e.g. Netherlands) 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 as noted in Table 3.1.

34. 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 4.6 below 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 4.7 below presents

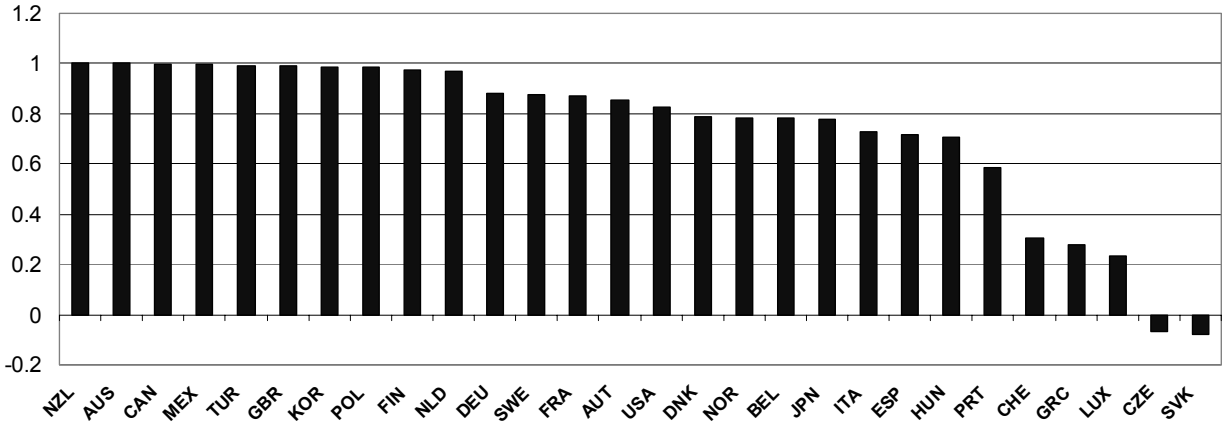
the correlation between IIP annual growth rates and the annual growth rate of value added volume in industry from the annual national accounts for all OECD countries.

Figure 4.6 Correlation between quarter-on-previous-quarter growth rates of the IIP and value added volume in industry from the quarterly national accounts



35. 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 4.7 Correlation between annual growth rates of the IIP and value added volume in industry from the annual national accounts



36. 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 4.7 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.

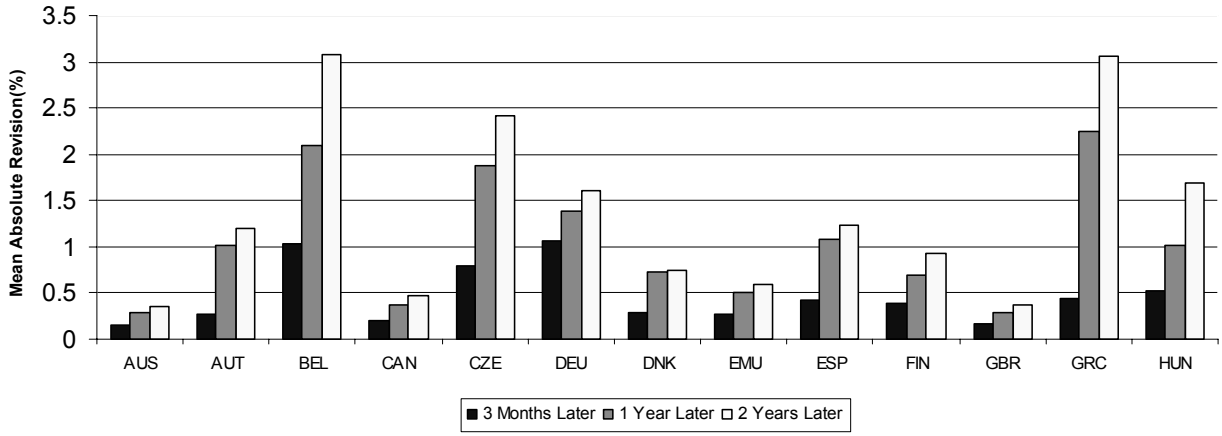
4.3 Analysis of revisions for Retail trade volume

37. Using a similar approach as for the revisions analysis study for the IIP, the OECD has also completed a comprehensive revisions analysis for Retail trade volume. The data used for the study was Retail trade volume, seasonally adjusted, as published at monthly frequency[20] in the OECD *Main Economic Indicators* (MEI) between February 1999 and May 2006. All OECD Member countries with the exception of France, Iceland, Luxembourg, Slovak Republic, Switzerland and Turkey were included together with the Euro area, South Africa and the Russian Federation. The study considered revisions to first estimates of Retail trade volume for both month-on-previous-month (MoM) and year-on-year (YoY) growth rates.

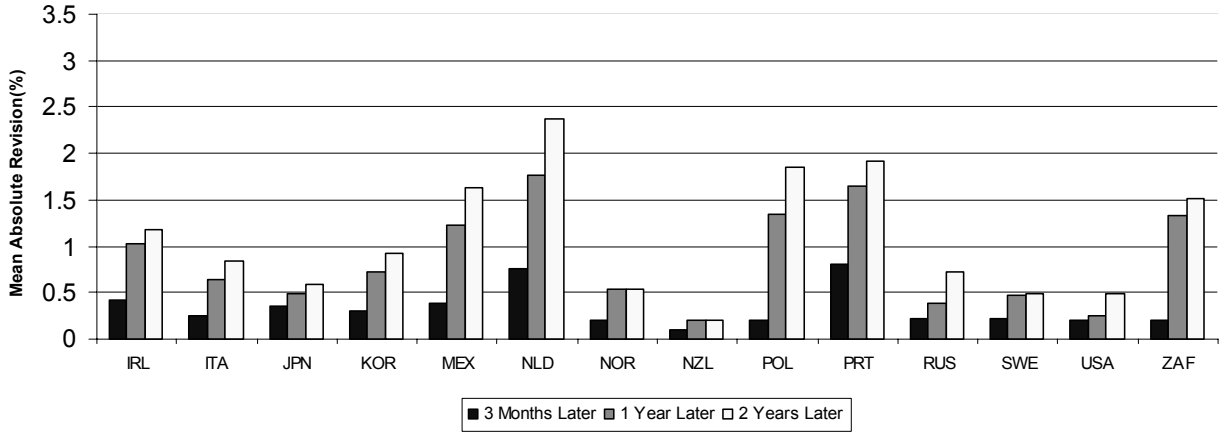
4.3.1 Relative size of revisions to Retail trade volume across countries

38. In almost all countries the size of mean absolute revisions to first estimates of month-on-previous-month and year-on-year growth rates for Retail trade volume 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. Figure 4.8 below compares these revisions across countries for month-on-previous-month growth rates, were one can observe that a number of countries stand out as having high revisions relative to other countries.

Figure 4.8 Mean absolute revision to first estimates of month-on-previous-month growth rates for Retail trade volume



[20] All countries included in this study publish Retail trade volume at monthly frequency with the exception of Australia and New Zealand which are quarterly. Also, for the majority of the analysis period the Retail trade volume series published in the MEI for Japan, Greece, Netherlands, Poland and Spain were compiled by the OECD by deflating Retail trade value with the Consumer price index.



4.3.2 Statistical significance of mean revisions to Retail trade volume

39. Mean revisions to Retail trade volume 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 – that is whether they have a significant tendency to be revised either upwards or downwards. Mean revisions to month-on-previous-month growth rates were found to be statistically significantly different from zero for Canada and those for year-on-year growth rates were found to be statistically significantly different from zero for Germany, Czech Republic, Korea and the Netherlands. Appendix 4 contains graphs and tables showing the mean revision to MoM and YoY growth rates and related summary statistics for all countries included in the study.

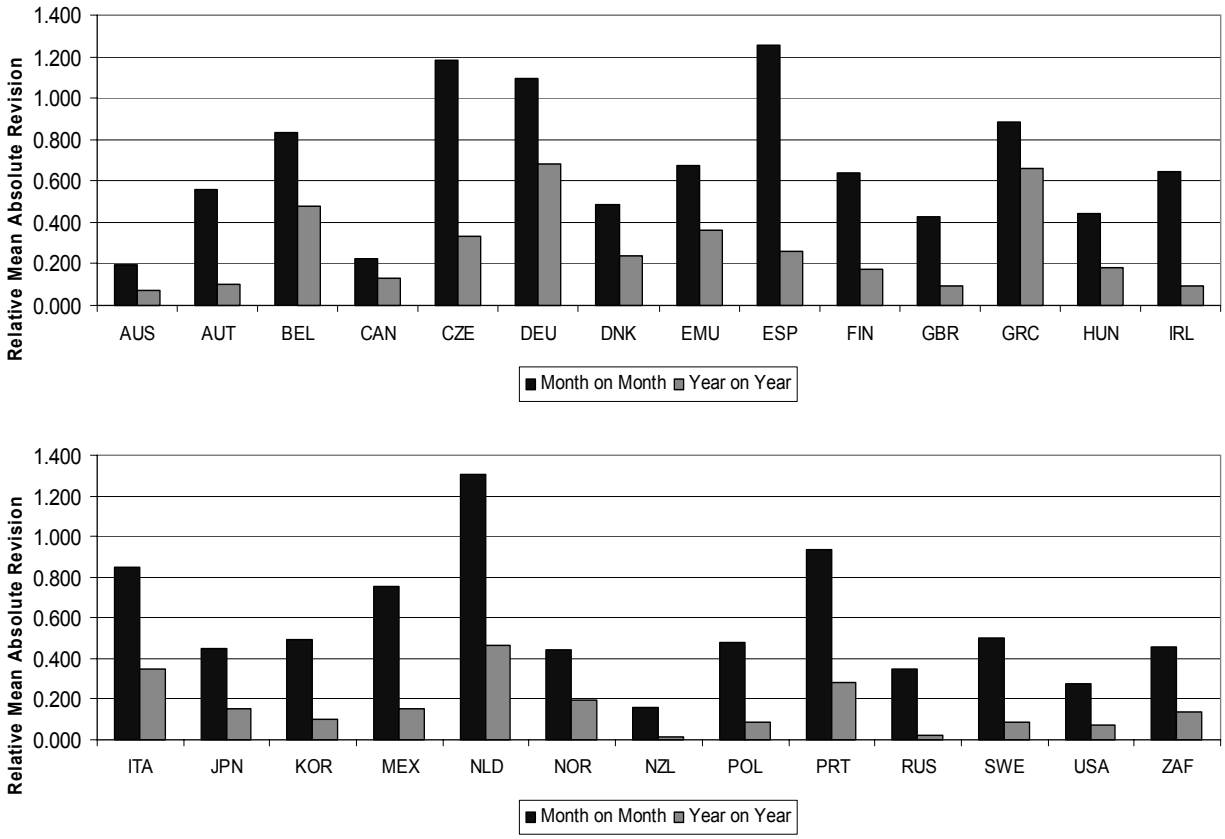
4.3.3 Reliability of first estimates for Retail trade volume - which estimates should users focus on?

40. Analysts often refer to the latest available (i.e. first published) estimates of the month-on-previous-month growth rate of seasonally adjusted Retail trade volume as an early indicator of consumer demand. 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 consumer demand. If first estimates of month-on-previous-month growth rates for a country have a history of being largely revised, then users would be advised to focus on a more robust statistic such as the year-on-year growth rate or some other measure[21].

41. As for the IIP we can assess the relative robustness of first estimates of MoM and YoY growth rates by calculating the relative mean absolute revision – which compares the mean absolute revision to the mean absolute size of later estimates. It is shown below in Figure 4.9 for both year-on-year and month-on-previous-month growth rates, where revisions have been assessed one year after the initial published estimate.

[21] For example, the United Kingdom's Office for National Statistics encourages users to focus on the growth rate of the three month moving average for Retail trade volume which is the headline indicator for their press release, although their press releases also quotes the month-on-previous-month growth rate.

Figure 4.9 Relative mean absolute revision between first estimates of Retail trade volume and those published one year later for month-on-previous-month and year-on-year growth rates



42. The chart shows that for many countries the relative mean absolute revision for month-on-previous-month growth rates is quite high with the ratio being greater than 0.5 for over half the countries[22] with the average ratio across all countries being 0.63. This is a remarkably similar result to that observed for the IIP and thus implies that on average across all countries the initial estimate of month-on-previous-month growth rate for Retail trade volume is expected to be revised by almost two thirds of its original value within the first year. Consequently, users would also be well advised not to place too much emphasis on the initial estimate of month-on-previous-month growth rates of Retail trade volume for a large number of countries. By contrast, the relative mean absolute revision for year-on-year growth rates is much lower, being less than 0.2 for about two thirds of the countries and averaging 0.22 across all countries. Therefore, for most countries users should be wary when interpreting first estimates of month-on-previous-month growth rates for Retail trade volume and could be advised to pay attention to more robust measures such as the year-on-year growth rate[23] for short-term analysis.

[22] And greater than 0.4 for 81% of countries

[23] As for the analysis of IIP, the size of the denominator in these calculations is expected to be larger for YoY growth rates than MoM growth rates which influence the comparison. Across all countries included in the study the mean absolute value of MoM growth rates was 1.45% compared to 4.35% for YoY growth rates.

5 Real-time analysis of econometric models

43. A key purpose for constructing the *Main Economic Indicators Original Release Data and Revisions Database* was to provide economists with the data needed to test econometric models in simulated real-time. This Section defines real-time analysis and demonstrates using the database to assess the performance of a simple model for predicting Private final consumption expenditure in simulated real-time. In addition the impact of revisions on model parameters is evaluated.

5.1 Constructing and testing econometric models using original release data: simulated real-time analysis

44. In general when undertaking research to construct an econometric model (e.g. to forecast GDP growth) economists are restricted to using the latest available time series of variables under consideration for inclusion in the model. A general approach is to undertake empirical analysis to construct the model of best fit, and then test the performance of this model using a set of 'out-of-sample' data. This out-of-sample data consists of observations (i.e. data points for a subset of time periods) of the variables which were not included in the empirical analysis which determined the parameters of the model.

45. This assessment of model performance using out-of-sample data is intended to show how the model can be expected to perform when applied in practice. However, where the latest available time series is used as the source for the out-of-sample data to evaluate the model it will consist of variables where each data point (except the most recent) will most likely have been revised from its first published value. However, it is these first published values[24] that will be used by the model when applied in practice. Consequently economists, in particular those at central banks responsible for monetary policy, are wary that such 'expost' analyses of model performance can be misleading (Dennis, 2005; Orphanides 2001). Having access to past versions of first published values for all data points in the time series such as those available in the *MEI Original Release Data and Revisions Database* to use for the out-of-sample analysis overcomes this problem, and therefore allows a more realistic assessment of the expected performance of the model in practice. Such analysis is referred to in the economic literature as 'real-time' analysis, although in this paper we often include the term 'simulated' to indicate that historically published data is being used. Furthermore, this data source provides the necessary information for economists to test the sensitivity of model parameters to revisions in the independent and dependent variables when constructing their models. That is, to evaluate whether the relationship between first published data of independent variables and the dependent variables they aim to predict are different to the relationship obtained from an empirical analysis using latest available time series where data points may have been revised several times.

5.2 Real-time analysis of a simple model for Private final consumption expenditure

46. The Retail trade volume series is used as an indicator of consumer demand and is generally very timely and available at high frequency (e.g. monthly) in most countries. Therefore one would expect a relationship to exist between growth rates in the Retail trade volume series and those of Private final consumption expenditure in the quarterly national accounts, with the Retail trade volume data being published earlier. To evaluate this relationship the correlation between quarter-on-previous-quarter growth rates for Retail trade volume and Private final consumption expenditure were calculated for all countries included in the Retail trade volume revisions analysis study (see Section 4.3).

[24] For example, a model to forecast GDP will generally use the latest available data points from indicators related to GDP. However, such a model may also use data points at different lags. It should therefore be noted that the database contains not only first published data but all subsequent releases, and thus provides the data needed to perform simulated real-time analysis for models which contain lagged observations of variables.

47. The correlation between quarter-on-previous-quarter growth rates of Retail trade volume and Private final consumption expenditure derived from the most recently available time series varied across countries, and was highest for the United States with a value of 0.83. Therefore the United States was chosen to construct a simple least squares regression model where the QoQ growth rate for Private final consumption expenditure is the dependent variable and the QoQ growth rate for Retail trade volume is the independent variable.

48. The purpose of the exercise was to construct a model using the latest available time series (as published in May 2006) and then test the performance of the model using two different out-of-sample datasets – one which contains data points from the latest available time series which may have been revised several times and one which contains the first published data points. The latter evaluation should provide the best indicator of the likely performance of the model in practice when it would be applied to first published data points, and allows a comparison with the out-of-sample evaluation based on data points from the latest available time series (which is normally the only data available from which to perform the out-of-sample analysis).

5.2.1 Evaluating model performance in simulated real-time for the United States

49. As at May 2006, time series of quarter-on-previous-quarter growth rates were available for both Private final consumption expenditure (PC) and Retail trade volume (RT) from 1980Q1 – 2006Q1. It was therefore decided that data up to 2002Q4 would be used to construct the model (i.e. from 1980Q1 – 2002Q4) and the remainder of the time series from 2003Q1 – 2005Q4[25] would be used for the out-of-sample analysis. The estimated model[26] was:

PC = 0.43 + 0.39*RT (Adjusted R-square = 0.72, RMSE residuals = 0.34)

50. Table 5.1 below assesses the out-of-sample performance for the model using two sets of values for the independent variable RT over 2002Q1 – 2005Q4: those in the published time series as at May 2006 compared to the series of first published data points. The definitions of the terms used in Table 5.1 to describe the respective observed data and model estimates are given below. Figure 5.1 then plots the predicted values of PC generated from the model using latest release data of RT compared to the actual latest release data of PC, and Figure 5.2 plots the predicted values of PC generated from the model using first release data of RT compared to the actual first release data of PC.

PC(P)	First published QoQ growth rate for Private final consumption expenditure
PC(L)	Latest QoQ growth rate for Private final consumption expenditure as at May 2006
RT(P)	First published QoQ growth rate for Retail trade volume
RT(L)	Latest QoQ growth rate for Retail trade volume as at May 2006
PC*(RTL)	Predicted value of PC from the model using RT(L) as the independent variable
Error(PCL)	Difference between adjacent predicted value of PC and latest release data for PC
PC*(RTP)	Predicted value of PC from the model using RT(P) as the independent variable
Error(PCP)	Difference between adjacent predicted value of PC and first release data for PC
Root MSE	Root mean square error for the respective column

[25] Note that data for the 2006Q1 time point could not be used in the out-of-sample analysis because it is the first published estimate and therefore has not yet had the possibility of being revised.

[26] A range of other standard regression outputs were reviewed to evaluate that the model satisfied the basic assumptions of general least squares regression.

Table 5.1 Comparison of out-of-sample model performance using latest and first published data for Retail trade volume as the independent variable

Time	PC(P)	PC(L)	RT(P)	RT(L)	PC*(RTL)	Error(PCL)	PC*(RTP)	Error(PCP)	Error(PCL)
03Q1	0.34	0.62	0.65	0.94	0.80	0.18	0.69	0.35	0.07
03Q2	0.83	0.90	1.95	1.12	0.87	-0.03	1.19	0.36	0.29
03Q3	1.61	1.43	3.16	2.77	1.52	0.09	1.67	0.06	0.24
03Q4	0.64	0.76	0.65	0.63	0.68	-0.08	0.69	0.05	-0.07
04Q1	0.93	1.15	2.60	2.50	1.41	0.26	1.45	0.52	0.30
04Q2	0.39	0.47	1.62	1.74	1.11	0.64	1.07	0.68	0.60
04Q3	1.14	1.07	1.44	1.54	1.03	-0.04	0.99	-0.15	-0.08
04Q4	1.14	1.06	2.50	2.36	1.36	0.29	1.41	0.27	0.34
05Q1	0.87	0.86	1.06	1.23	0.92	0.06	0.85	-0.02	-0.01
05Q2	0.82	0.83	2.52	2.52	1.42	0.59	1.42	0.60	0.39
05Q3	0.96	1.0	1.59	1.59	1.05	0.05	1.05	0.09	0.05
05Q4	0.28	0.22	0.31	0.23	0.52	0.30	0.55	0.27	0.33
					Root MSE	0.30	**Root MSE**	0.36	0.32

Figure 5.1 Model forecasts for Private consumption using latest data for Retail trade volume compared to actual latest data for Private consumption

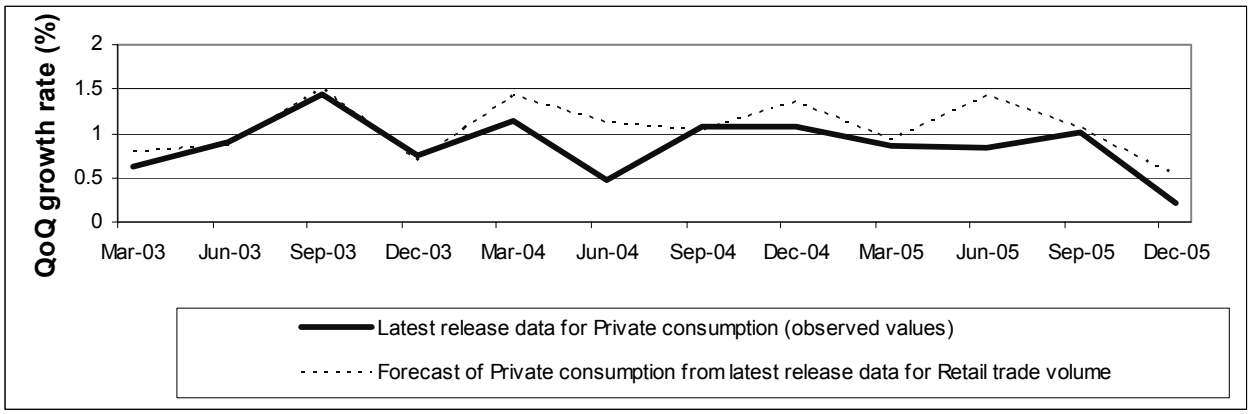
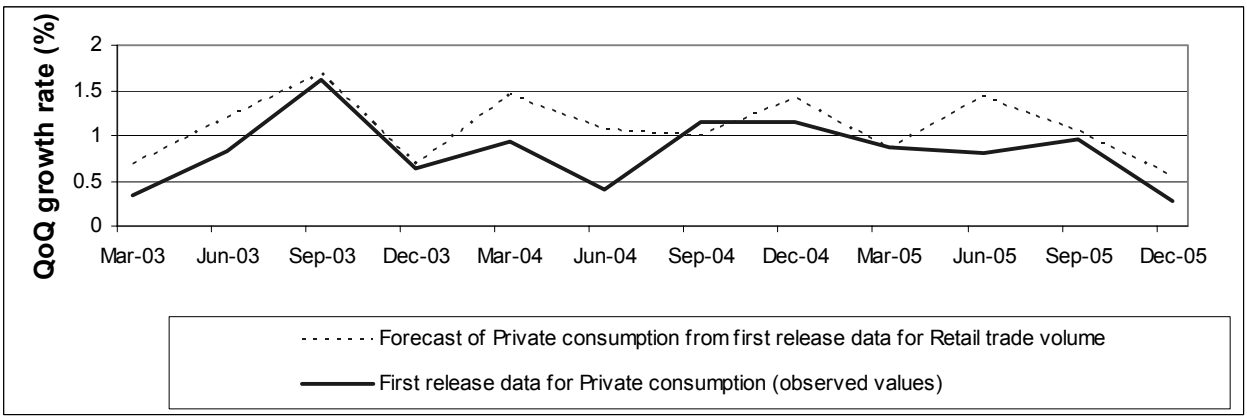


Figure 5.2 Model forecasts for Private consumption using first release data for Retail trade volume compared to actual first release data for Private consumption



51. A number of interesting observations can be made from the data in the Table 5.1 and consequently from visualising some of this data in Figures 5.1 and 5.2:

- In general the revisions for both PC and RT are small over the 12 data points considered. The maximum revision for PC (i.e. the difference between first release data PC(P) and latest release data PC(L)) is 0.28% in 2003Q1, and for 8 out of the 12 data points the revision is than 0.1%. Revisions for RT are somewhat high in 2003 with a maximum of 0.83% in 2003Q3, but are much lower in 2004 and 2005 and overall 6 out of the 12 data points are revised by not more than 0.1%. It is noticeable that revisions are higher for both variables for earlier data points (i.e. revisions are higher in 2003 than in 2004 which are again higher than those in 2005) supporting the finding made earlier in the paper that data continues to be revised over time (given that the latest release data relate to the time series as published in May 2006).

- The performance of the model in predicting the latest release data of PC is only slightly better where the latest release data of RT are used (RMSE = 0.30) in comparison to the first release data (RMSE = 0.32). This is not surprising given that the first and latest release data for the independent variable RT don't differ much as noted in the point above (i.e. the revision is 0.1% or less for half the data points).

- In real-time, the model would have used the first release data for RT (i.e. RT(P)) to predict the first release data for PC (i.e. PC(P)). For this simulated real-time assessment the model performs noticeably worse (RMSE = 0.36) than in the 'ex-post' analysis where the latest release data of PC (i.e. PC(L)) are predicted from the latest release data of RT (i.e. RT(L)), for which the RMSE is 0.30.

5.2.2 Main findings from the real-time analysis

52. The main conclusion that can be drawn from this example is that even in the case where revisions are small for both the independent and dependent variables, the model performance is noticeably worse when assessed in real-time (RMSE = 0.36) than ex-post (RMSE = 0.30). Thus even this simple example illustrates the importance of assessing model performance in real-time because this is likely to differ from an ex-post assessment, supporting findings of more comprehensive studies on this issue (e.g. Orphanides, 2001).

53. It should also be noted that the United States has relatively low revisions for Retail trade volume compared to other countries as shown in Figures 4.8 and 4.9. Consequently, one might expect more substantial differences when assessing out-of-sample performance using first release data compared to latest available data for countries which exhibit larger revisions in the independent (and dependent) variables. Unfortunately the relationship between RT and PC was not strong enough in other countries to compile a sufficiently robust model using such a simple approach to perform a similar comparison as for the United States. Ideally, more sophisticated models containing several variables should be constructed to study this issue in greater detail and for this the OECD invites economists and researchers to perform such work using the wealth of information available in the database.

5.2.3 Stability of model parameters

54. As the above simple model for Private final consumption expenditure is reasonably robust for the United States the analysis was extended to observe the impact on model parameters due to revisions, by constructing a range of models based on different combinations of first published and latest available data for PC and RT. However, as time series of first published data in the *MEI Original Release Data and Revisions Database* commence in 1999 only 28 data points (from 1999Q1 to 2005Q4) were available to

construct the models which limits the usefulness of the analysis to some extent. All models presented in Table 5.2 satisfy the basic assumptions of least squares regression and the terms used are the same as those described in paragraph 50.

Table 5.2 Stability of model parameters for the United States

Reference period for data used	Model		Adjusted R-square	RMSE residuals
1980Q1 – 2002Q4	**A:**	PC(L) = 0.43 + 0.39*RT(L)	0.72	0.34
1999Q1 – 2005Q4	**B:**	PC(L) = 0.52 + 0.26*RT(L)	0.57	0.26
1999Q1 – 2005Q4	**C:**	PC(L) = 0.53 + 0.22*RT(P)	0.38	0.31
1999Q1 – 2005Q4	**D:**	PC(P) = 0.53 + 0.25*RT(P)	0.41	0.32

55. The main observations that can be drawn from this analysis are:

- The reduced time period from which to construct the models affects the goodness of fit, as can be seen by the difference in Adjusted R-square values for the model used in the analysis presented in Section 5.2.1 (model A) and model B which are both derived from the latest time series as at May 2006. Note also that the parameters for the reference model (i.e. model A) are quite different to those based on the reduced dataset (and these differences are statistically significant).

- The model with the poorest fit is model C, which is aiming to predict the latest value (i.e. expected to be closest to the true final value) of Private final consumption expenditure QoQ growth rate from first release data for Retail trade volume QoQ growth rate. This model also has the greatest difference in parameter for RT compared to the others compiled over the same time period (i.e. models B and D), although this difference is not statistically significant.

- The model which aims to predict first release data of Private final consumption expenditure from first release data of Retail trade volume (i.e. model D) is very close to model B (which is derived from the latest time series for each variable), although has a much poorer fit[27].

6 Conclusions

56. This paper has outlined the main features of the OECD *Main Economic Indicators Original Release Data and Revisions Database* which can be used to study the magnitude and impact of revisions to official statistics and to assess the likely effectiveness and stability of econometric models in simulated real-time. The main results from comprehensive revisions analysis studies for OCED Member countries and selected non-member economies were presented for Gross domestic product, Index of industrial production and Retail trade volume – with the study for the Index of industrial production being extended to review three important aspects of statistical data quality: timeliness; accuracy; and coherence. In addition the performance of a simple model to predict Private final consumption expenditure was evaluated in simulated real-time, together with an assessment of the impact of revisions on model parameters.

57. The main conclusions which can be drawn from the range of analyses and information presented in this paper are summarised in the following points.

[27] Also, for this model the residuals had a weak but significant first order correlation of 0.337

- The database interface provides the tools needed for countries to undertake their own revisions analysis for a wide range of short-term economic indicators. This will allow them to assess an important dimension of quality for their published statistics, and may provide opportunities for improving their compilation practices. In addition it will enable them to present information to users on the robustness of their indicators. The OECD encourages National Statistical Institutes to undertake and publish the results of these analyses, and to clearly stipulate a revisions analysis policy for the range of short-term indicators they produce.

- In almost all countries included in the revisions analysis studies the size of mean absolute revisions to first release data for quarter-on-previous-quarter (for GDP), month-on-previous-month and year-on-year (for IIP and Retail trade volume) growth rates are non-ignorable and increase the longer the interval from the first release data.

- 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 and the ordering of the size of mean absolute revisions across countries can differ depending on the revisions interval considered (e.g. revisions after 3 months, 1 year, 2 years etc.). Nonetheless, it is apparent in each of the studies that some countries have noticeably higher revisions than the majority of others. In particular, Japan, Korea, Norway and Portugal stand out as having high revisions to GDP, Belgium for IIP and Belgium, Greece, Czech Republic and the Netherlands for Retail trade volume.

- Ideally, revisions should have a tendency to be random; that is, equally likely to be positive or negative and centred around zero. In the case where mean revisions are statistically significant, this implies that data have a significant tendency to be revised in a particular direction (i.e. up or down) and that the compilation methodology for early estimates should be reviewed. Mean revisions to GDP (for QoQ growth rates), IIP and Retail trade volume (for MoM and YoY growth rates) between first release data and those published 1 year later were assessed for statistical significance for all countries included in the respective studies. Those countries found to be statistically significantly different from zero in the case of GDP was Denmark; in the case of IIP Greece, Belgium and India for MoM growth rates and Belgium, India, Russia, Turkey, Germany, Euro area, France, United Kingdom and Korea for YoY growth rates; in the case of Retail trade volume for Canada (MoM growth rates) and Germany, Czech Republic, Korea and the Netherlands for YoY growth rates.

- In the majority of countries first estimates of month-on-previous-month growth rates for the IIP and Retail trade volume should not be considered as reliable early indicators of the magnitude of short-term changes in the volume of industrial output or consumer demand respectively. This is due to the fact that on average across all countries, first estimates of month-on-previous-month growth rates for both the IIP and Retail trade volume are revised by approximately two thirds of their initial value within one year. 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% (IIP) and 22% (Retail trade volume) of their initial value within one year. Furthermore, turning points in the growth rate cycle for IIP dated by the Bry-Boschan routine tended to coincide relatively well with turning points visually evident in the series of first estimates of year-on-year growth rates for the IIP in most countries.

- The relationship between timeliness of first release data (measured as the average delay between the reference period and first publication in the MEI) and accuracy (measured by size of mean absolute revisions to first estimates) was investigated as part of the IIP and GDP studies. Whilst slightly limited in their scope to perform a comprehensive evaluation, the analyses performed

found 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 first release data have a greater tendency to have lower mean absolute revisions. 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.

- In evaluating a simple model to predict Private final consumption expenditure in the United States, it was shown that the out-of-sample performance of the model in real-time assessed using first published data was noticeable poorer than for the ex-post analysis using the latest available (i.e. revised) data. This illustrated the importance of performing real-time analysis and that ex-post analysis of model performance can be misleading. Furthermore, revisions were shown to have an impact on model parameters, although these were small. The OECD now invites economists and researchers to use the *MEI Original Release Data and Revisions Database* to test the performance of more sophisticated models in real-time, and to evaluate the robustness of model parameters in light of revisions to the independent and dependent variables. This Database represents the most comprehensive freely available source in the world to perform such analysis.

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OECD Statistics Directorate
September 2006

Appendix 1 Interpretation of summary statistics provided with OECD revisions analysis studies

Each OECD revisions analysis study produces a series of outputs for each country which can be accessed through the *MEI Original Release Data and Revisions Analysis* interface at http://stats.oecd.org/mei/default.asp?rev=1. The revisions analyses spreadsheets by country were originally designed by Professor Tommaso DiFonzo (see DiFonzo, 2005) and have the following content:

- 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 (or quarter on-previous-quarter depending on the publication frequency) growth rates and year-on-year growth rates (Index of industrial production and Retail trade volume studies only). Summary information is provided at the top of each worksheet showing the original estimate and values published at a range of latter intervals (e.g. 3 months later, 1 year later, 2 years later, 3 years later, latest estimates).
- 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 (in the case of the GDP analysis one spreadsheet for quarter-on-previous quarter growth rates is provided). These analyse the statistical significance of revisions between the initial estimate and that published at different later intervals (e.g. 3 months later, 1 year later, 2 years later, 3 years later and the latest estimate) and also between different revision intervals (e.g. comparing the difference in estimates published 1 year later with that published 2 years later etc.).
- A range of summary statistics and tests of significance for mean revisions are presented for each revision interval and these are described in detail below, together which graphs showing the distribution of revisions for all data points included in the study. These summary statistics are also summarised for all revisions intervals in a summary worksheet.

Example and definitions for summary statistics produced with OECD revisions analysis studies

The table below is an extract of a summary table taken from a revisions analysis study. Following this are the definitions and formulas for each of the statistics included in the summary table.

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.

Appendix 2 Size of mean revisions and tests of statistical significance for the IIP

The countries which stand out in the graphs below 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 A2.1 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.

Figure A2.1 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

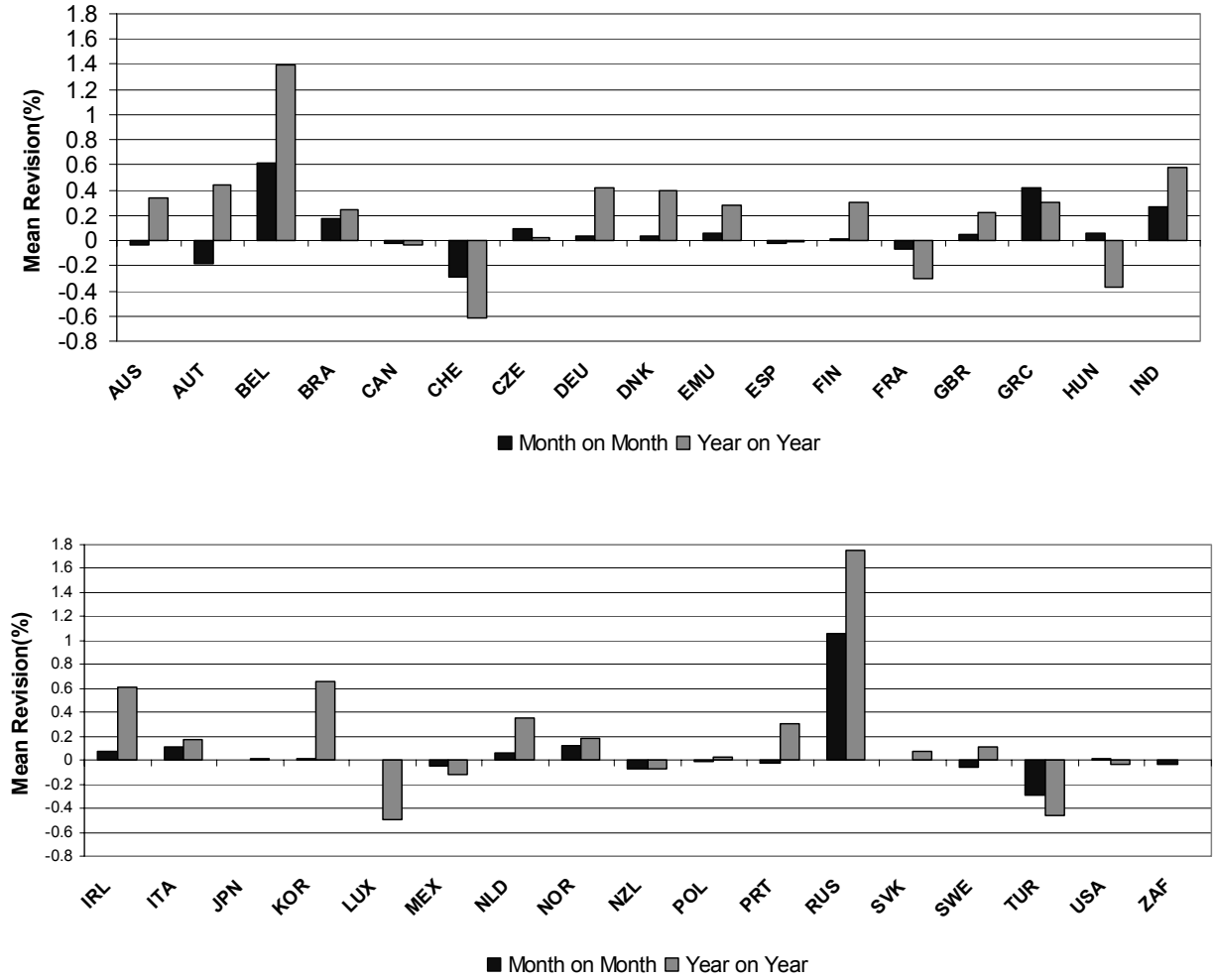


Table A2.1: Summary statistics and tests of significance for mean revisions between first estimates of the IIP and those published one year later for month-on-previous-month and year-on-year growth rates

	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

Appendix 3 Timeliness of release of countries data in the MEI for IIP and GDP

Figure A3.1 Average number of months[28] between the end of the reference period and publication in MEI for the IIP

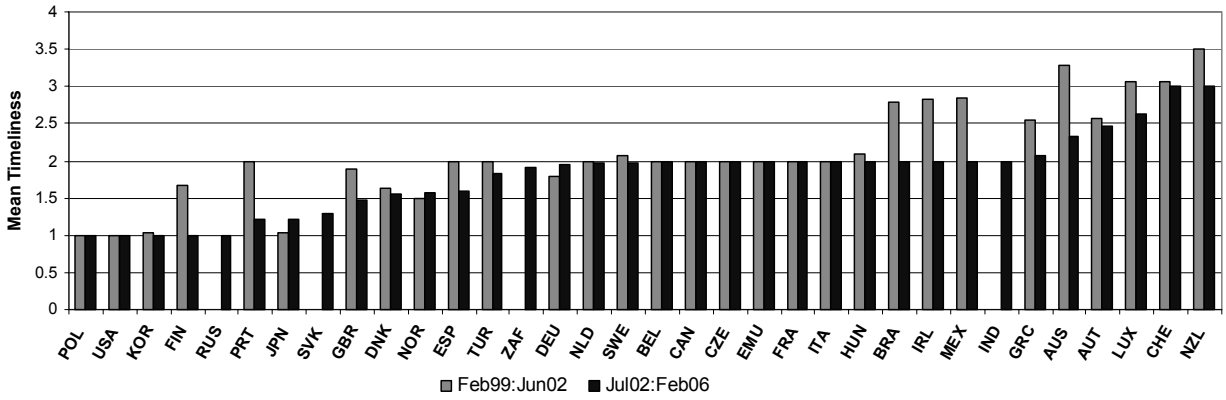
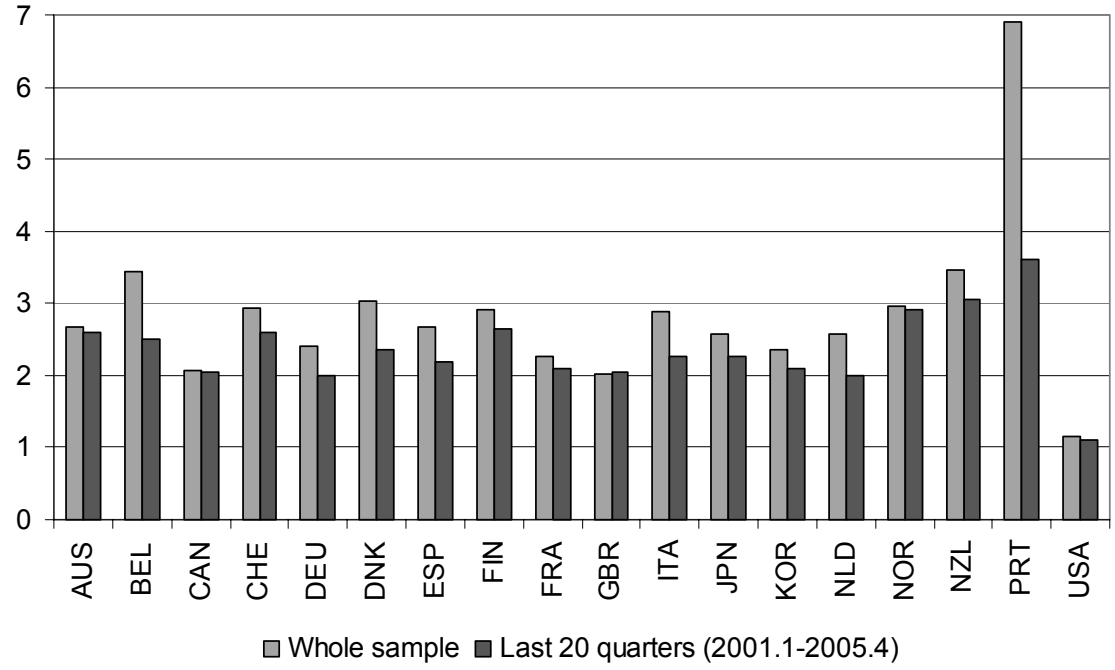


Figure A3.2 Average number of months between the end of the reference period and publication in MEI for GDP

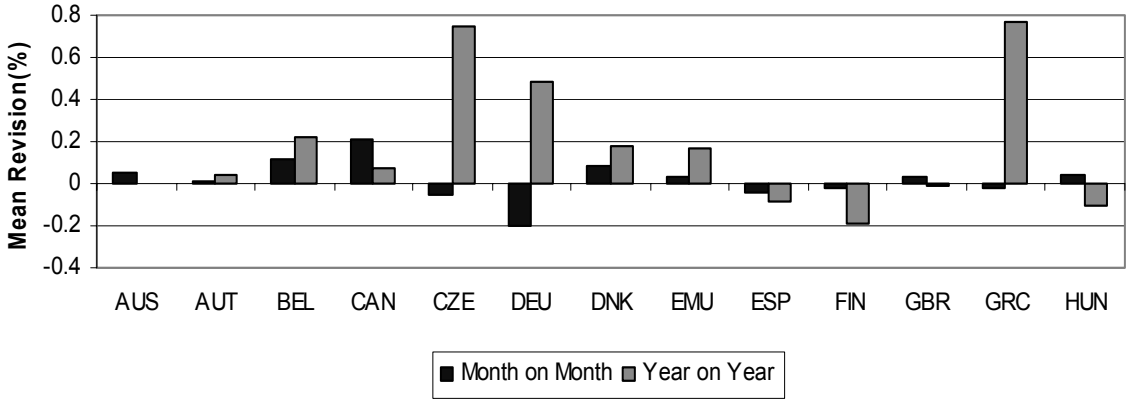


[28] As the MEI is published early in the month, timeliness is assessed as the number of months between the end of the reference period and the MEI publication month where the data point first appears. For example, if data for January 1999 was first published in the April 1999 MEI, the timeliness measure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

Appendix 4 Size of mean revisions and tests of statistical significance for Retail trade volume

The countries which stand out in the graphs as having noticeably high mean revisions for month-on-previous-month growth rates are Canada, Germany and Portugal and for year-on-year growth rates Czech Republic, Germany, Greece, Korea and the Netherlands. These mean revisions are confirmed in Table A4.1 to be statistically significantly different from zero in the case of MoM growth rates for Canada and YoY growth rates for Czech Republic, Germany, Korea and the Netherlands.

Figure A2.1 Mean revision between first estimates of Retail trade volume and those published one year later for month-on-previous-month and year-on-year growth rates



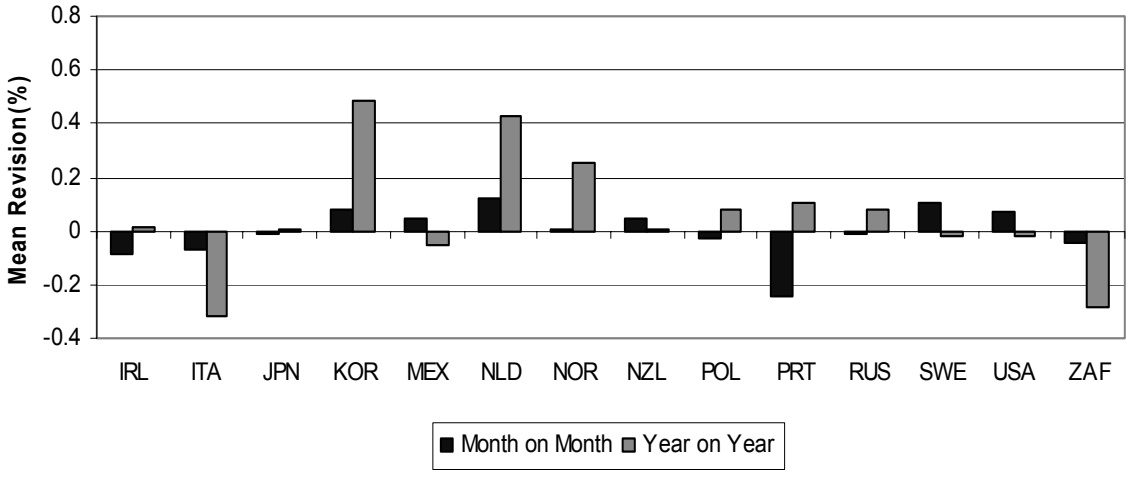


Table A4.1: Summary statistics and tests of significance for mean revisions between first estimates of Retail trade volume and those published one year later for month-on-previous-month and year-on-year growth rates

	Sample	Mean Absolute Revision		Mean Revision		Significance Test		% Later > Earlier	
		MoM	YoY	MoM	YoY	MoM	YoY	MoM	YoY
AUS	99.Mar-04.Dec	0.282	0.334	0.051	-0.003	NO	NO	44.444	55.556
AUT	98.Oct-05.Jan	1.013	0.301	0.007	0.041	NO	NO	48.684	46.053
BEL	98.Oct-05.Jan	2.099	1.581	0.113	0.221	NO	NO	52.632	52.632
CAN	98.Nov-05.Jan	0.376	0.493	0.210	0.077	YES	NO	72.000	52.000
CZE	99.Apr-05.Feb	1.872	1.390	-0.050	0.747	NO	YES	50.704	61.429
DEU	98.Nov-05.Jan	1.384	1.153	-0.195	0.480	NO	YES	47.945	65.753
DNK	98.Oct-05.Jan	0.724	0.775	0.085	0.180	NO	NO	53.947	44.156
EMU	99.Jun-05.Feb	0.512	0.526	0.033	0.168	NO	NO	60.870	57.971
ESP	99.Apr-05.Jan	1.083	0.713	-0.038	-0.082	NO	NO	47.143	40.845
FIN	99.Jan-05.Jan	0.685	0.674	-0.025	-0.191	NO	NO	45.205	28.767
GBR	98.Dec-05.Feb	0.291	0.429	0.037	-0.015	NO	NO	57.333	54.667
GRC	98.Oct-05.Feb	2.248	3.254	-0.021	0.771	NO	NO	49.333	48.000
HUN	98.Oct-05.Feb	1.012	1.271	0.046	-0.108	NO	NO	50.000	50.000
IRL	98.Oct-05.Feb	1.034	0.486	-0.083	0.014	NO	NO	52.632	46.053
ITA	98.Aug-05.Jan	0.633	0.538	-0.072	-0.321	NO	NO	39.744	42.308
JPN	98.Dec-05.Feb	0.487	0.295	-0.015	0.006	NO	NO	48.000	49.333
KOR	98.Dec-05.Feb	0.728	0.606	0.078	0.483	NO	YES	50.667	80.000
MEX	98.Nov-05.Jan	1.226	0.674	0.044	-0.055	NO	NO	45.333	41.333
NLD	98.Nov-05.Jan	1.769	1.202	0.120	0.428	NO	YES	54.667	56.000
NOR	98.Dec-05.Feb	0.534	0.594	0.006	0.252	NO	NO	56.000	65.333
NZL	99.Jun-04.Dec	0.195	0.081	0.048	0.005	NO	NO	61.538	38.462
POL	99.May-05.Feb	1.346	0.630	-0.024	0.078	NO	NO	44.286	54.286
PRT	98.Oct-05.Feb	1.647	1.178	-0.245	0.106	NO	NO	46.753	37.662
RUS	00.Dec-05.Jan	0.384	0.228	-0.013	0.078	NO	NO	41.667	60.417
SWE	98.Nov-05.Feb	0.479	0.447	0.107	-0.022	NO	NO	59.211	42.105
USA	98.Oct-05.Feb	0.249	0.448	0.069	-0.023	NO	NO	36.364	37.662
ZAF	01.Mar-04.Dec	1.330	0.876	-0.042	-0.286	NO	NO	42.857	45.161

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