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REVISIONS IN QUARTERLY GDP OF OECD COUNTRIES: AN UPDATE

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REVISIONS IN QUARTERLY GDP OF OECD COUNTRIES: AN UPDATE

ABSTRACT

This paper examines the revision histories of 18 OECD countries. It analyses the various vintages of gross domestic product (GDP) estimates, using quarterly estimates from the last quarter of 1994 up to and including the last quarter of 2013. Using a set of summary statistics (mean revision, mean absolute revision and relative mean absolute revision) it aims at discussing the differences across countries in order to improve the overall quality of early estimates.

With respect to earlier OECD studies, the analysis now covers an additional time period (revisions assessed 5 years after the first published data), and a breakdown by GDP main expenditure components excluding inventories. Furthermore, an analysis of changes in acceleration/deceleration of growth and the direction of change has been added. Finally, three periods of time have been distinguished to analyse whether or not revisions have become smaller over time.

The main outcomes of the GDP cross-country analysis are: (1) on average, countries have upward revisions, (2) a group of six countries (Belgium, France, Germany, Italy, Japan and the United Kingdom) have mean revisions that are not statistically significant, (3) for Denmark, the Netherlands and Norway (and to a lesser extent Australia) short term mean revisions are statistically significant, (4) there is no evidence of revisions becoming smaller over the years, (5) the revisions post-2008 appear to be larger than in the periods before, (6) the direction of change and of the acceleration/deceleration of growth is in most of the cases not altered by the revisions, and (7) gross fixed capital formation and imports are main expenditure components for which revisions seem closely related to GDP-revisions.

I. INTRODUCTION

1. The purpose of this paper is to extend the work initiated by Di Fonzo (2005a and 2005b), updated by McKenzie and Adam (2007). It examines the revisions histories of eighteen OECD countries for the first estimates of quarter-on-quarter (QoQ) and year-on-year (YoY) GDP volume growth rates and some of its expenditure components. The analysis is based on the OECD Main Economic Indicators database¹. Each indicator is seasonally adjusted to facilitate international comparisons.

2. The study focuses on eighteen OECD countries because the length of their time series allows for statistical analysis: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Korea, the Netherlands, New Zealand, Norway, Portugal, Spain, Switzerland, the United Kingdom and the United States².

3. A number of changes have been made to the information presented in the previous paper of McKenzie and Adam (2007). The five major additions are:

- Extension of the dataset: GDP estimates from 1994-1995³ up to and including the last quarter of 2013 have been taken into account;
- Additional analysis has been included. An analysis of longer term revisions is now provided, including an assessment of the revisions 5 years after the first published data⁴. Next to that, two other revision intervals are used in the analysis, i.e. an analysis of the revisions between the estimates published one year after the reference period and the estimates published 5 months after the reference period (Y1_M5), in order to detect the impact of more accurate information coming from provisional annual information, and an analysis of the revisions between the estimates published two years after the reference period and the estimates after one year (Y2_Y1), which highlights the importance of additional information added between the two years;
- An analysis of the direction of change and changes in acceleration/deceleration of growth;
- Breakdown by GDP main expenditure components excluding inventories (private consumption expenditure, government consumption expenditure, gross fixed capital formation, exports and imports);
- Breakdown by time periods.

4. The paper is organised as follows. Section 2 presents the methodology, including the main indicators that are used for measuring the revisions. Subsequently, section 3 briefly discusses the main reasons for revisions in order to get a better understanding of how to interpret them. Main results are presented in section 4, first looking at GDP growth rates and then at its components. Section 5 presents the main conclusions.

¹ This interface provides access to time series data for 21 key economic variables as originally published in each monthly edition of the MEI from February 1999 onwards. The data base is accessible on OECD.Stat at the following address: <http://stats.oecd.org/index.aspx?queryid=206>

² The key for country acronyms included in the graphs is: AUS = Australia; BEL = Belgium; CAN = Canada; CHE = Switzerland; DEU = Germany; DNK = Denmark; ESP = Spain; FIN = Finland; FRA = France; GBR = the United Kingdom; ITA = Italy; JPN = Japan; KOR = Korea; NLD = the Netherlands; NOR = Norway; NZL = New Zealand; PRT = Portugal; USA = the United States.

³ Except for Belgian GDP estimates starting from Q3 1996, see Table 1 in V – Appendixes.

⁴ This means that the following periods are used: (P) First published estimate, (M5_P) Revision 5 months later to the first published estimate, (Y1_P) Revision 1 year later to the first published estimate, (Y2_P) Revision 2 years later to the first published estimate, (Y3_P) Revision 3 years later to the first published estimate, (Y5_P) Revision 5 years later and the latest estimate to the first published estimate.

II. METHODOLOGY

5. The methodology used in this paper relies on the previous OECD papers (Di Fonzo 2005a; McKenzie and Adam 2007). The summary indicators used are also similar to the ones used in previous revision studies. The indicators are defined as follows, using the following terminology:

- L_t is the latest estimate,
 - P_t is the preliminary (or earlier) estimate,
 - $R_t = L_t - P_t$ is the revision,
 - n is the number of observations.
- **Mean revision (MR):** The primary interest of this measure lies in its sign and provides an indication of systematic patterns in the revision process. A positive (negative) sign indicates that, on average, earlier releases have been underestimated (overestimated). Large revisions of opposite sign compensate each other in this measure, and, consequently, its size, beyond determining the average direction of revisions, is of limited use.

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

- **Mean absolute revision (MAR):** This measure is more useful than the mean revision to gauge the size of revisions because it avoids offsetting effects on the indicator from negative and positive revisions. Expressed in absolute percentage points, it indicates the average size of revisions, but it cannot provide an indication of directional bias, if any.

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

- **Relative mean absolute revision (RMAR):** This measure corrects the mean absolute revision for the size of growth rates and, so, takes account of the fact that revisions might be expected to be larger in periods of high GDP growth than in periods of slow growth.

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

6. A simple and robust approach based on the Heteroskedasticity Autocorrelation Consistent (HAC) estimate's variance proposed by Newey and West (1987) is used to evaluate the statistical significance of the mean revision and to test the hypothesis that it is equal to zero.

III. INTERPRETING REVISIONS

7. Before analysing revisions, it is important to understand how to interpret them and the reasons why they occur. Even if one may think that the absence of revisions indicates high data quality, it is actually the opposite in many cases. Indeed, just because a statistic is not often revised it may still be inaccurate if it is based on poor data sources that are not updated.

8. Reasons for revisions can broadly be defined by two categories: 1) statistical and 2) methodological/definitional.

- **Statistical revisions** can occur by replacement of early source data or rough estimates with later data that incorporates improved and more comprehensive data. It also encompasses corrections of errors that have been encountered after the first publication of the data. Next to that, it includes updating seasonal and working day adjustment factors which can cause sizeable revisions to quarterly growth rates even if the underlying not seasonally adjusted data is unrevised.
- **Methodological/definitional** changes are generally a one-time occurrence and tend not to reflect inaccuracies in data sources. These revisions occur due to major improvements in the national accounts compilation process (e.g., changing benchmarking techniques for the quarterly estimates or introduction of chain-linking) or when the national accounts are brought in line with international standards, such as moving from SNA 1968 to SNA 1993, or from SNA 1993 to SNA 2008⁵.

9. In analysing the results of revision studies, one has to take into account these two categories, and it would be best if revisions could be distinguished for these two categories, as they may lead to different conclusions. For instance, significant revisions in GDP growth rates that are caused by methodological changes do not imply that there is a bias in the early estimates. It may point out that substantial improvements have been implemented in the methodology. However, when the same significant revisions occur due to statistical revisions, this may be an indication of a bias in the early estimates and an incentive for statistical offices to further investigate the specific causes for these revisions. As more precise quantifications of the reasons for revisions are currently lacking, the results from the analyses have to be interpreted with some caution before drawing sharp conclusions.

10. In analysing the results presented in the next paragraph it should also be borne in mind that, as a longer period of time has been taken into account in the studies, some improvements may already have taken place. Earlier revisions may then distort the current picture and may wrongly signal that action is still needed.

⁵ The System of National Accounts (SNA) consists of a coherent, consistent and integrated set of macroeconomic accounts, balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules.

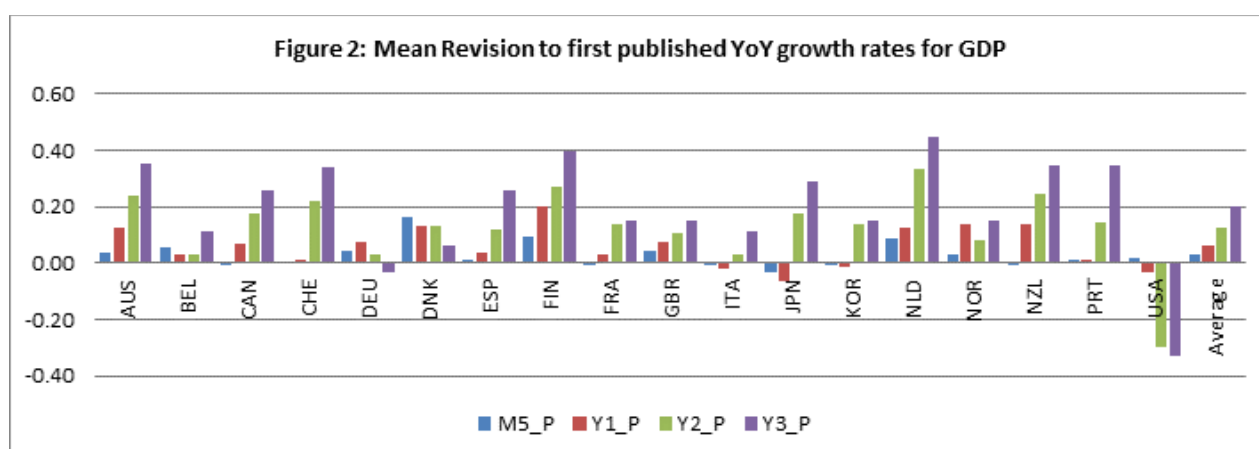
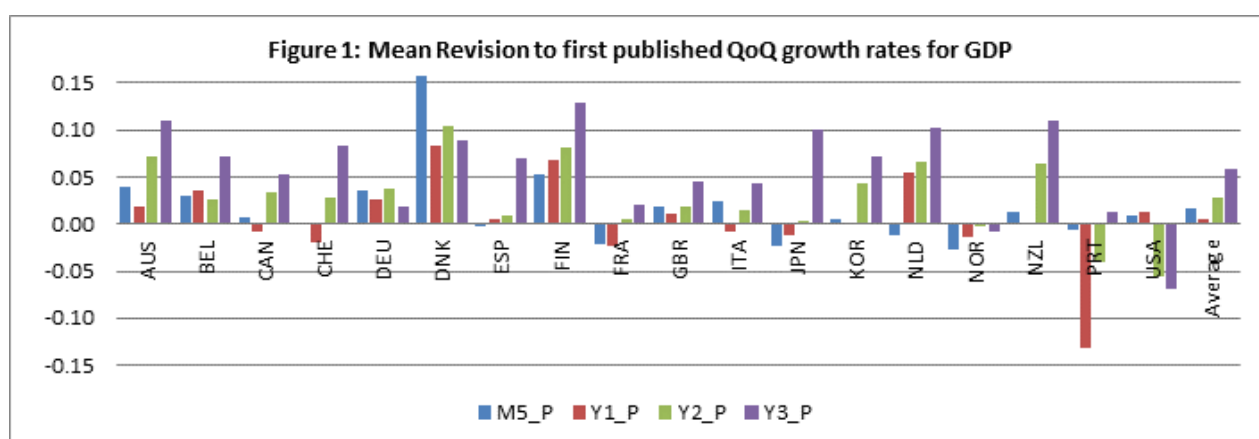
IV. CROSS-COUNTRY ANALYSIS: MAIN RESULTS

A. GDP analysis

a) Mean Revision and assessment of statistical significance

11. Figures 1 and 2 show the mean revision (MR) for respectively QoQ and YoY growth rates at four time intervals: M5_P, Y1_P, Y2_P and Y3_P. It reveals that most countries perform upward revisions for these intervals. Four countries (Australia, Denmark, Finland and Portugal) implement QoQ revisions well above average at all intervals. The revisions amplitude within revisions intervals is particularly high for Denmark and Portugal. However, for Portugal, this is mainly influenced by one specific revision: the estimate for QoQ growth rate in the last quarter of 1995 was minus 4.8%, which increases the average of revisions after one year. Excluding this value, MR at Y1_P decreases to minus 0.06%. For Denmark the revision to first published estimates of QoQ growth rates within five months (M5_P) is especially high.

12. Figure 2 points out that half of the countries (Australia, Canada, Finland, Japan, the Netherlands, New Zealand, Portugal, Spain and Switzerland) revise positively, on average, their YoY growth rates by more than 0.20% within 3 years (and five of them already within two years). On the other hand, the United States revises them negatively by more than 0.30%.



13. In looking at the mean revisions, it is interesting to see for which countries this is statistically significant. Table 1 presents the assessment of statistical significance at the 10% (*), 5% (**), or 1% (***) level for the QoQ and YoY mean revision at the different intervals.

Table 1: Mean revision and assessment of statistical significance at different revision intervals for GDP QoQ and YoY growth rates

Country	M5_P		Y1_P		Y2_P		Y3_P		Y1_M5		Y2_Y1	
	QoQ	YoY	QoQ	YoY	QoQ	YoY	QoQ	YoY	QoQ	YoY	QoQ	YoY
AUS	0.04*	0.04	0.02	0.12*	0.07*	0.24**	0.11**	0.35**	-0.02	0.08	0.05*	0.11*
BEL	0.03	0.06*	0.04	0.03	0.03	0.03	0.07	0.11	0.01	-0.02	-0.01	-0.01
CAN	0.01	-0.01	-0.01	0.07	0.03	0.17**	0.05	0.26**	-0.02	0.08**	0.04**	0.10**
CHE	0.00	0.01	-0.02	0.01	0.03	0.22**	0.08	0.34**	-0.02	0.01	0.05*	0.20***
DEU	0.04*	0.04	0.03	0.07	0.04	0.03	0.02	-0.03	-0.01	0.03	0.01	-0.05
DNK	0.16**	0.16**	0.08	0.13*	0.10*	0.13	0.09	0.06	-0.08*	-0.03	0.02	0.00
ESP	0.00	0.01	0.01	0.03	0.01	0.12	0.07*	0.26**	0.01	0.02	0.00	0.07
FIN	0.05	0.10	0.07	0.20	0.08	0.27*	0.13	0.40**	0.02	0.10	-0.01	0.02
FRA	-0.02	0.00	-0.02	0.03	0.00	0.14	0.02	0.15	0.00	0.04	0.02	0.10*
GBR	0.02	0.04	0.01	0.07	0.02	0.11	0.05	0.15	0.00	0.03	0.01	0.05
ITA	0.02	-0.01	-0.01	-0.02	0.01	0.03	0.04	0.11	-0.03*	-0.02	0.02	0.03
JPN	-0.02	-0.04	-0.01	-0.07	0.00	0.17	0.10	0.29	0.02	-0.02	0.01	0.26*
KOR	0.00	-0.01	0.00	-0.01	0.04	0.14*	0.07	0.15	0.00	0.00	0.04	0.14***
NLD	-0.01	0.09**	0.06	0.12**	0.07	0.33***	0.10*	0.44***	0.06*	0.03	0.01	0.19***
NOR	-0.03	0.03	-0.01	0.14**	0.00	0.08	-0.01	0.15	0.02	0.11*	0.00	-0.08
NZL	0.01	-0.01	0.00	0.14	0.06	0.24*	0.11	0.34**	-0.01	0.15	0.04	0.13
PRT	-0.01	0.01	-0.13	0.01	-0.04	0.14*	0.01	0.34***	-0.13*	-0.01	0.10*	0.12**
USA	0.01	0.02	0.01	-0.03	-0.06	-0.30**	-0.07	-0.33**	0.00	-0.05	-0.07**	-0.24**
Average	0.02	0.03	0.01	0.06	0.03	0.13	0.06	0.20	-0.01	0.03	0.02	0.06

14. Several observations can be made on the basis of the above table and the previous graphic analysis:

- There is no tendency for MR, in both short-term and long term, to be statistically significant for six countries (Belgium, France, Germany, Italy, Japan and the United Kingdom). Indeed, their MRs for QoQ and YoY growth rates are not statistically significant at the 10% level except for one interval at the most.
- Short-term revisions of QoQ growth rates (M5_P and Y1_P) seem to be random and centered around zero for almost every country, except Australia, Denmark and Germany for the M5_P interval. The revisions for YoY growth rates present a similar picture, with five exceptions (Australia, Belgium, Denmark, the Netherlands and Norway).
- The Y2_Y1 indicator, which emphasizes the importance of the additional information added between the two years, is statistically significant at a 5% level for a few countries: Canada, Korea, the Netherlands, Portugal, Switzerland and the United States.

- The average mean revision for all countries involved in the analysis is very close to zero for both QoQ (0.02 and 0.01) and YoY (0.03 and 0.06) growth rates at the short-term intervals. However, at the long-term intervals, the average mean revision for YoY growth rates is relatively higher than the average for QoQ growth rates. Especially the YoY revisions for Y2_P (0.13%) and Y3_P (0.20%) are noteworthy in this respect. Most countries report significant revisions for those intervals. However, this may be caused by effects of changes in methodology which are more plausible to occur in longer time periods.

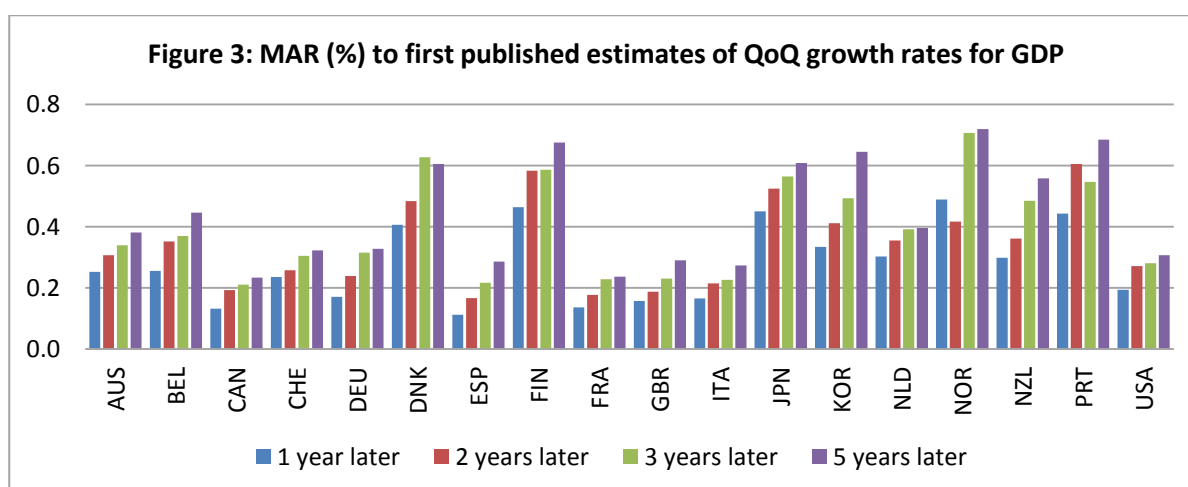
15. The results that are presented above should be analysed according to the comments provided by countries on reasons for revisions that were expressed in the paper by McKenzie and Adam (2007). For more detail on the exact interpretation of the summary statistics presented in the table, please refer to Di Fonzo (2005a).

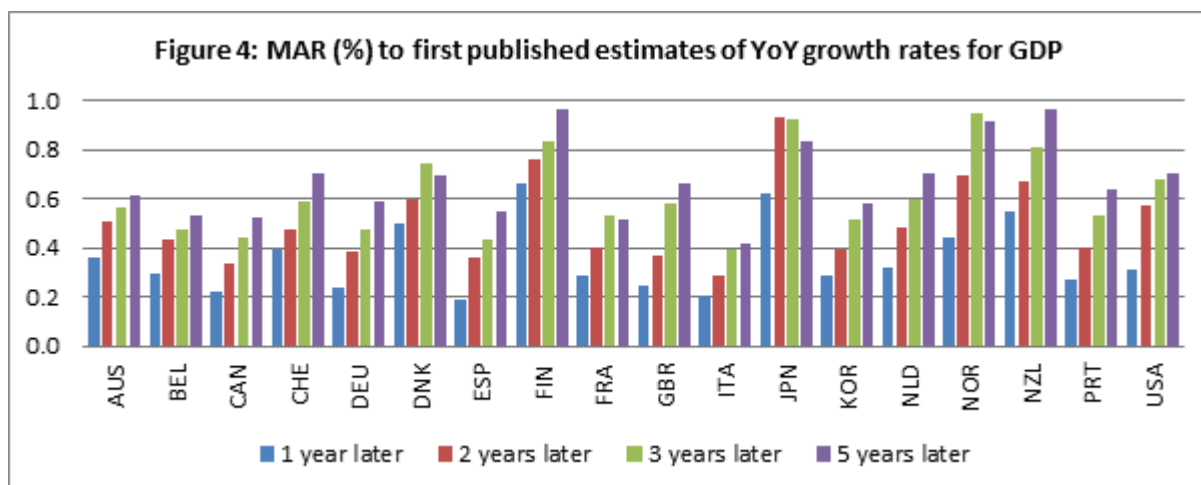
b) Relative size of revisions to GDP growth rates across countries: MAR and RMAR analysis

16. The mean absolute revision (MAR) to first published estimates of GDP QoQ (Figure 3) and YoY (Figure 4) growth rates allows us to determine how large the revisions are, regardless of the sign. For both QoQ and YoY growth rates, the MARs reveal an upward trend in the revisions: the MAR increases the longer the interval from the first published estimate. This is a logical consequence of the revision process because the longer the interval from the first published estimate, the more information is included and also the likelihood of changes in definitions and methodology becomes more apparent, which increases the likelihood of larger revisions. Also, at most intervals, MARs are bigger for YoY growth rates.

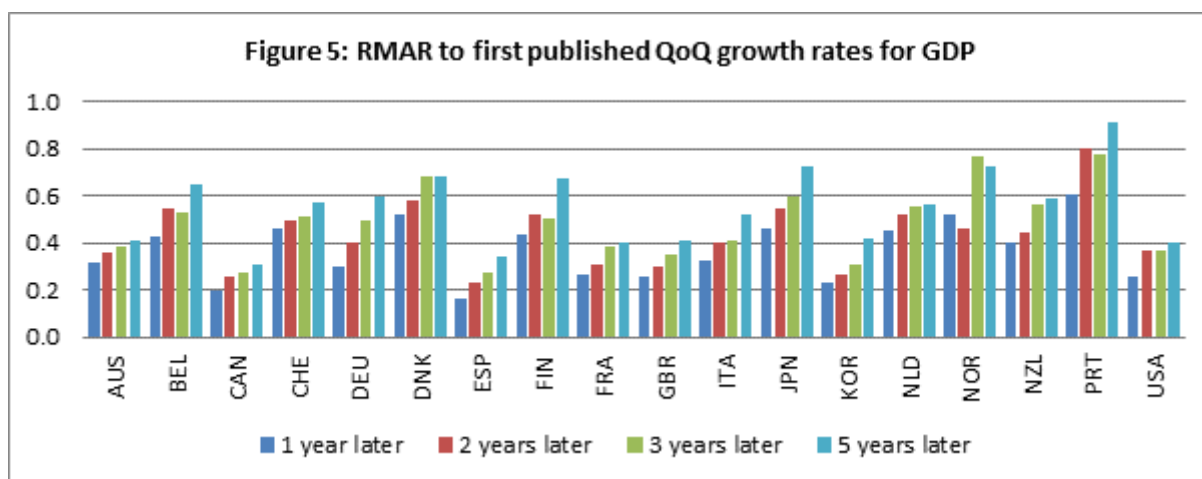
17. Comparing the relative size of revisions of QoQ growth rates in figure 3, the 18 countries can be roughly divided into three groups. First, the smallest revisions (average revision of the 4 intervals below 0.3%) are noted for Canada, France, Germany, Italy, Spain, Switzerland, the United Kingdom and the United States. A second group composed by Australia, Belgium, the Netherlands and New Zealand presents medium size revisions (average revision between 0.3% and 0.45%), while a third group with Denmark, Finland, Japan, Korea, Norway and Portugal records the highest revisions (average revision above 0.45%).

18. Considering YoY growth rates, figure 4 shows a more balanced picture with smaller gaps across countries. According to this scale, Denmark, Finland, Japan, New Zealand and Norway record the highest revisions. The other countries are more or less similar in their size of revisions.

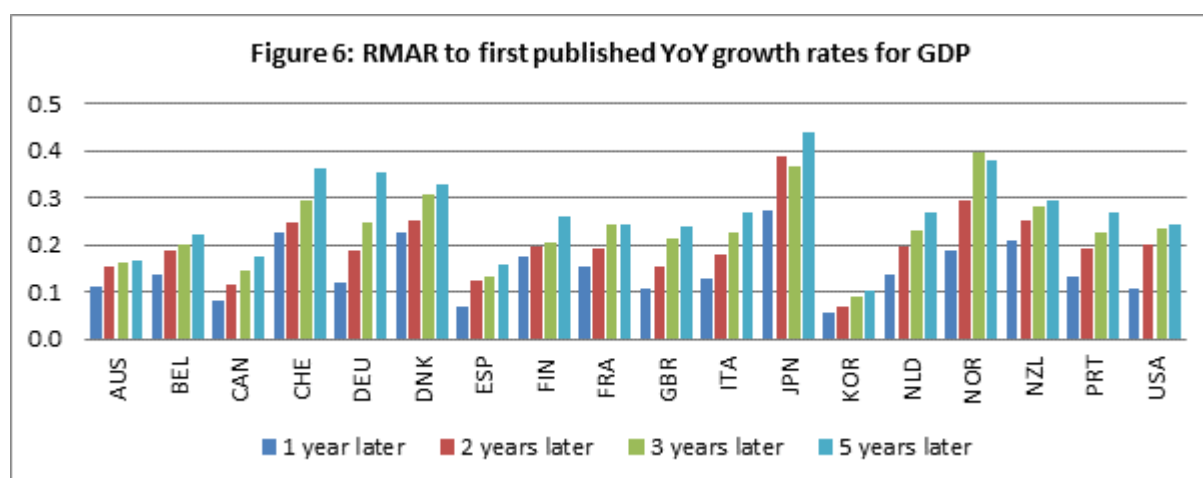




19. In order to take into account the average absolute size of the relevant growth rate over the period of analysis, the relative mean absolute revision (RMAR) can be used to compare the size of revisions across countries. Based on RMAR, figure 5 (QoQ growth rates) shows a slightly different image comparing to the MAR in Figure 3. For each interval, the size of revisions of QoQ growth rates (after 1, 2, 3 and 5 years) based on RMAR is higher than those based on MAR for all countries except for Finland and Korea. Finland moves from the high revision to the medium revision group and Korea moves from the high revision to the low revision group. Vice versa, relatively larger revisions were made by Switzerland (it moves from the low revision to the medium revision group) at all given intervals: the difference between MAR and RMAR is over 0.20%. Belgium also moves up, from the medium revision to the high revision group. In addition, Italy and Portugal (and to a lesser extent Germany and the Netherlands) record relatively larger revisions comparing RMAR to MAR.



20. Figure 6 shows the results for YoY growth rates. The sizes of revisions based on YoY growth rates are lower than those based on QoQ growth rates for all countries. Comparing MAR with RMAR for YoY growth rates, the sizes of revisions based on RMAR are lower than those based on MAR for all countries (quite different from the comparison between QoQ MAR and QoQ RMAR). The countries that record the highest relative mean absolute revisions are Japan and Norway.

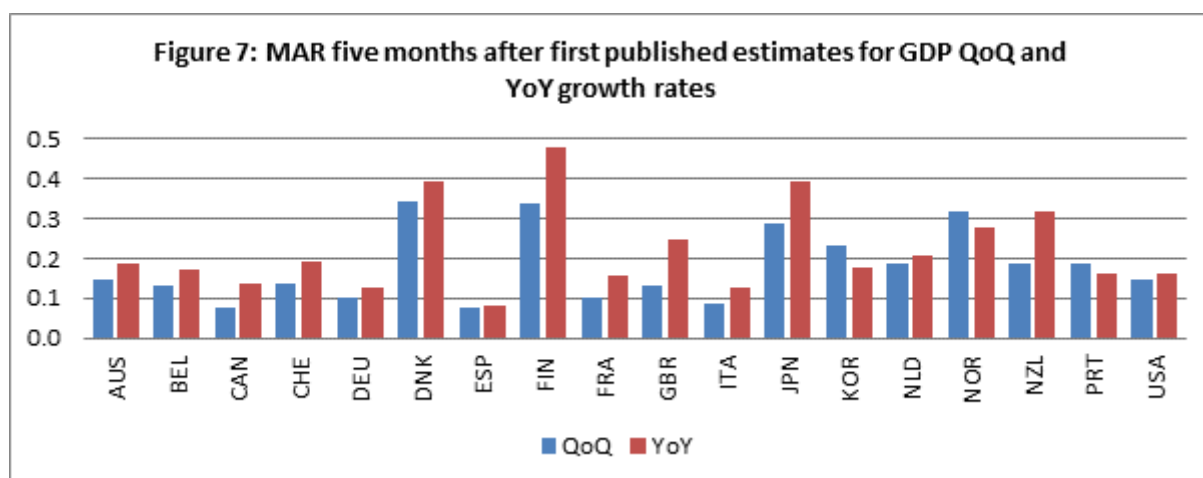


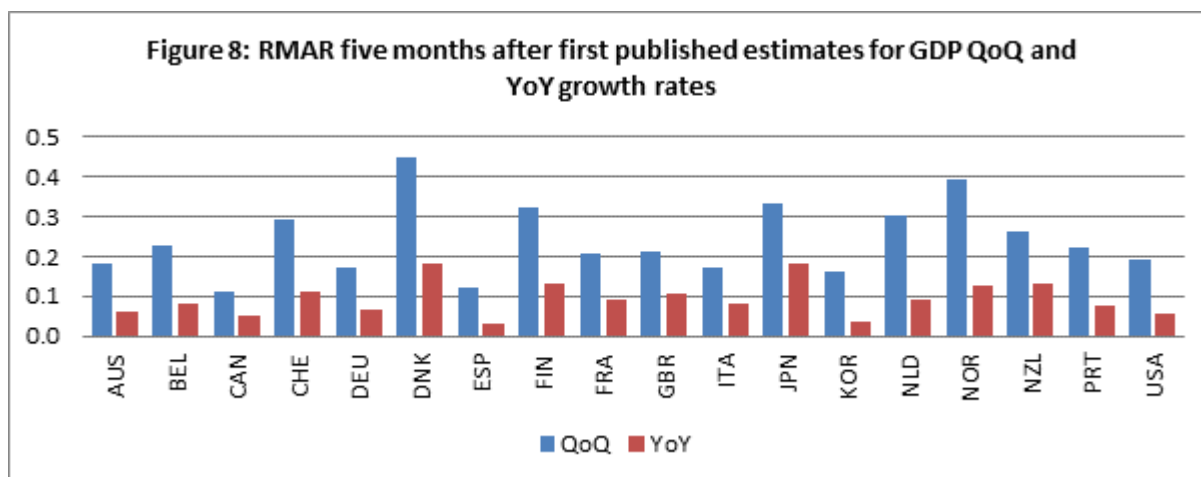
A comparison of short-term revisions for GDP QoQ and YoY growth rates

21. Figure 7 and 8 compare the MAR and RMAR for short-term QoQ and YoY growth rates revisions. Doing so, growth rates published 5 months after the preliminary estimates are compared to the first estimate. This provides some information on the robustness of early estimates. The MAR for QoQ growth rates is lower than the MAR for YoY growth rates in most countries but the opposite holds in all countries when looking at RMAR.

22. Although for estimates published 5 months after the preliminary estimates the positive and negative revisions balance out (on average) for all countries except for Denmark (as could be derived from table 1), figure 7 shows that five countries (Denmark, Finland, Japan and Norway for both QoQ and YoY growth rates and New Zealand for YoY growth rates only) have a MAR above 0.25%, revealing a lower robustness of early estimates compared to the other countries.

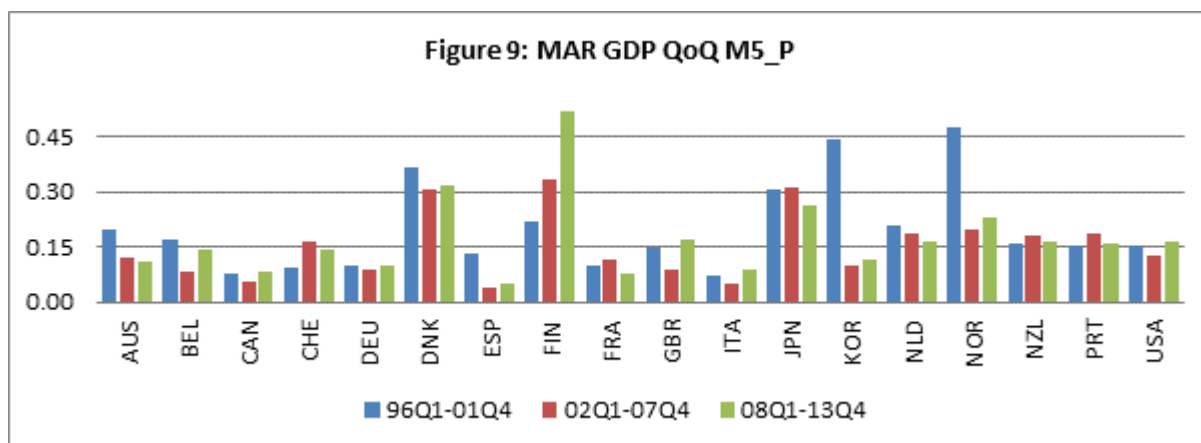
23. Figure 8 indicates that seven countries (Denmark, Finland, Japan, the Netherlands, Norway, New Zealand and Switzerland) record RMAR above 0.25% in the short-term for QoQ growth rates. For YoY growth rates, the RMAR are much lower than for QoQ growth rates.



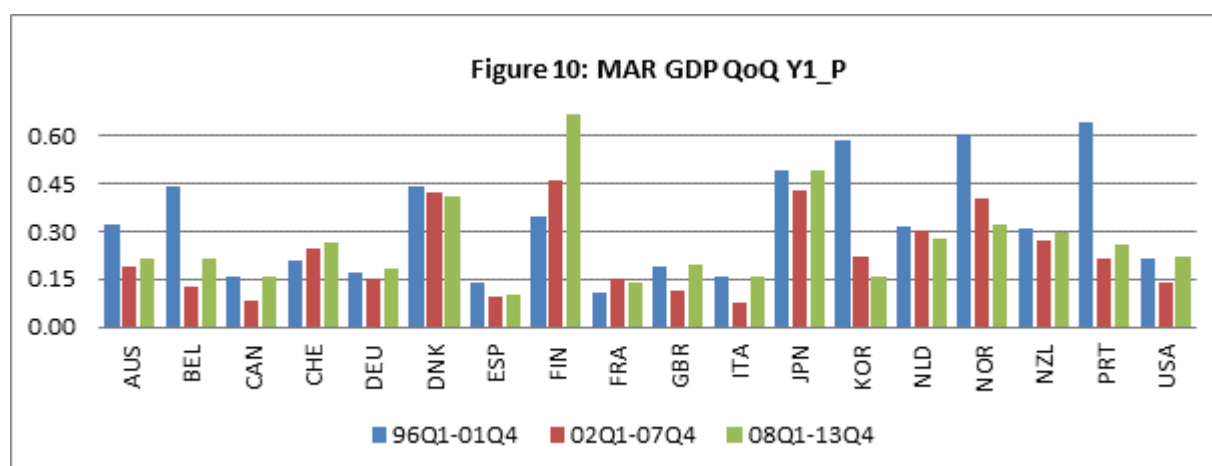


c) Size of the GDP revisions: an assessment over time

24. In this section, it is examined whether revisions are in general becoming smaller over time. For this purpose, the MAR indicator for GDP growth rates has been applied. Figure 9 and figure 10 present the GDP QoQ growth rates MAR (respectively five months and one year after the first published QoQ growth rates) for three time periods⁶. Both figures show different MAR patterns and only a few countries have revisions becoming smaller over time. It is the case for two countries for M5_P (Australia and the Netherlands) and four countries for Y1_P (Denmark, Korea, the Netherlands and Norway). On the contrary, revisions have become larger for Finland (M5_P and Y1_P) and for Switzerland (for Y1_P). For the other countries, patterns are less distinct (e.g. not strictly increasing/decreasing).



⁶ 1996Q1-2001Q4 ; 2002Q1-2007Q4 ; 2008Q1-2013Q4. For Belgium, the first period contains quarters between 1996Q3-2001Q4.



25. The time periods breakdown can also be used for another purpose: catching the trends on the size of revisions in a period of financial turmoil, such as the 2008 world financial crisis. To do so, the last two intervals (pre-2008, post-2008) can be compared to determine whether revisions are influenced by the business cycle. It turns out that revisions were larger for most countries in the period post-2008 (11 countries for M5_P and 13 countries for Y1_P), in line with earlier conclusions of Shrestha and Marini (2013).

d) GDP Direction of change and Acceleration vs. Deceleration

26. A first element of robustness of early estimates is demonstrated by the direction of change (table 2). Indeed, for the same quarter, it is important that GDP initial growth rates estimated at two different intervals (for example, between the first published estimate and the estimate published five months later) have the same sign. This is fulfilled when either condition is satisfied:

- $\Delta GDP_t^a > 0$ and $\Delta GDP_t^b > 0$
positive growth in both cases
- $\Delta GDP_t^a < 0$ and $\Delta GDP_t^b < 0$
negative growth in both cases

Where Δ is the operator calculating the first differences of a series, and a and b stand for two different vintages of quarterly GDP estimates for the same quarter.

27. Generally, the average percentage of times indicating the same direction of growth decreases for both QoQ and YoY growth rates⁷ with the increase of the interval after the first published estimate. At the M5_P time period, 8 out of the 18 countries⁸ detect the same direction of growth above 95% for QoQ growth rates and 9 countries detect it at 100% for YoY growth rates. Australia is the country that performs the best as its percentages of time indicating the same directions are 97% or above for both QoQ and YoY for every interval. In this respect, it can be noted that Australia also recorded the lowest number of negative GDP growth rates over the period covered. On the contrary, Belgium, Denmark, Finland, Japan, the Netherlands, Norway and Switzerland record percentages below average at all intervals for QoQ growth rates, and Japan, Norway and Switzerland had percentages below average for YoY growth rates. As there is a direct link with the number of quarters in which negative growths is reported, this has to be taken into account when analyzing the frequency with which countries report direction changes. When this

⁷ The average for QoQ growth rates increases for L_P.

⁸ Italy excluded as the exact figure is 94.7%.

is regarded, Belgium, Denmark and Finland are the countries that record a relatively higher number of changes in direction.

Table 2: Percentage of times indicating same direction of growth (QoQ and YoY)

Percentage of times indicating same direction of growth (QoQ)							Percentage of times indicating same direction of growth (YoY)						
Country	M5_P	Y1_P	Y2_P	Y3_P	Y5_P	L_P	Country	M5_P	Y1_P	Y2_P	Y3_P	Y5_P	L_P
AUS	100	99	100	97	100	97	AUS	100	100	100	100	100	100
BEL	93	91	81	86	78	81	BEL	98	100	98	98	98	96
CAN	99	99	97	98	96	95	CAN	100	100	100	100	98	99
CHE	92	86	84	83	79	81	CHE	94	90	86	84	78	85
DEU	96	93	85	84	80	82	DEU	99	100	98	95	94	97
DNK	87	81	81	74	75	75	DNK	94	97	95	95	96	95
ESP	99	96	94	97	98	95	ESP	100	97	97	100	100	97
FIN	88	85	78	80	77	78	FIN	96	96	94	95	96	93
FRA	97	92	94	91	88	91	FRA	99	97	95	95	94	96
GBR	97	96	96	95	96	96	GBR	96	96	97	97	98	93
ITA	95	89	96	94	88	87	ITA	100	97	97	94	91	91
JPN	85	85	84	82	79	83	JPN	93	93	86	84	83	78
KOR	99	99	96	97	96	97	KOR	100	100	100	100	100	100
NLD	88	88	87	82	83	84	NLD	100	99	97	94	89	91
NOR	87	85	83	74	83	78	NOR	96	96	92	93	90	92
NZL	93	86	90	85	84	86	NZL	100	94	92	94	98	91
PRT	94	84	72	74	75	78	PRT	100	97	95	97	96	96
USA	99	97	96	95	95	95	USA	100	99	92	97	98	97
Average	94	91	89	87	86	87	Average	98	97	95	95	94	94

28. A second element of robustness can be shown by comparing whether GDP growth rates accelerate or decelerate between two quarters (e.g. whether GDP growth rates increased or decreased more than the previous period). Formally, this is verified when either condition is satisfied:

- $\Delta\Delta\text{GDP}_t^a > 0$ and $\Delta\Delta\text{GDP}_t^b > 0$
both acceleration
- $\Delta\Delta\text{GDP}_t^a < 0$ and $\Delta\Delta\text{GDP}_t^b < 0$
both deceleration

29. The average percentage indicating acceleration or deceleration also decreases for both QoQ and YoY growth rates with the increase of the interval after the first published estimate (except for L_P). Looking at QoQ growth rates, the four countries that perform best are France, Germany, Italy and Korea, while Australia, Finland, New Zealand and Switzerland record the lowest percentages. For YoY the picture slightly differs, with Belgium, Canada, France and Korea performing best, and Australia, Denmark, Finland, Spain and the United Kingdom recording the lowest percentages.

Table 3: Percentage of times indicating Acceleration/Deceleration (QoQ and YoY)

Percentage of times indicating Acceleration or Deceleration (QoQ)							Percentage of times indicating Acceleration or Deceleration (YoY)						
Country	M5_P	Y1_P	Y2_P	Y3_P	Y5_P	L_P	Country	M5_P	Y1_P	Y2_P	Y3_P	Y5_P	L_P
AUS	84	79	65	72	63	59	AUS	81	77	77	77	70	68
BEL	84	69	69	63	57	70	BEL	86	90	85	85	72	84
CAN	93	83	78	77	77	72	CAN	90	90	91	85	81	84
CHE	73	57	60	58	64	64	CHE	88	81	85	84	81	78
DEU	91	87	78	71	76	78	DEU	90	89	85	79	74	76
DNK	95	85	76	75	73	68	DNK	81	80	76	69	70	69
ESP	82	71	80	68	58	72	ESP	88	84	71	71	62	69
FIN	92	76	75	75	63	64	FIN	83	81	74	81	67	69
FRA	89	85	75	75	73	82	FRA	92	90	88	87	91	89
GBR	84	75	72	77	73	71	GBR	82	86	80	79	69	69
ITA	93	93	88	84	70	79	ITA	88	83	85	81	80	78
JPN	88	81	74	67	63	71	JPN	79	74	74	82	72	76
KOR	92	89	79	76	68	79	KOR	90	93	91	87	78	85
NLD	86	75	74	72	73	74	NLD	88	83	74	76	72	74
NOR	88	83	82	67	72	78	NOR	90	83	70	63	65	74
NZL	82	79	78	73	68	63	NZL	82	80	77	81	74	78
PRT	90	79	70	72	67	75	PRT	90	85	74	72	74	76
USA	89	81	75	78	73	70	USA	79	80	79	81	83	73
Average	87	79	75	72	68	72	Average	86	84	80	79	74	76

B. Major expenditure components of GDP (except inventories)

30. So far, the focus of the analysis has been on GDP growth estimates. In order to provide a more comprehensive picture, this section shows the results for GDP growth broken down by its major expenditure components (except inventories): Private Consumption Expenditure (PCE), Government Consumption Expenditure (GCE), Gross Fixed Capital Formation (GFCF), Exports and Imports. This breakdown provides another layer of analysis. Countries with MR's that are statistically significant may derive valuable information from looking at the revisions of these components. However, also for countries with low MR's for GDP growth, it may be interesting to take note of the revisions of these components. As revisions of the components tend to offset each other, the MR of GDP growth can be low, whereas the MRs for the growth rates of the components may still be quite substantial. Furthermore, the expenditure components also are very important economic indicators in themselves. As a consequence, a revisions analysis on the components may provide useful information as well.

31. The magnitude of the various components and their shares in GDP may differ across countries. In some countries trade flows constitute very important components, whereas in other countries GCE may be relatively high. Therefore, if one takes a look at the relation of the revisions of the growth rates of the components to the revisions of GDP growth, this has to be borne in mind. It may thus not be very useful to look at RMAR of the components, as this indicator mainly focuses on the relative robustness of the component itself. A component may have a high RMAR, but if its weight is small in comparison to other

components it may be of less relevance when looking at it in relation to the revisions of GDP growth. If one wants to analyse how the revisions of the growth rates of these components relate to the revisions of GDP growth, it is best to look at their MRs and their MARs. In contrast, if one wants to look at the robustness of the components itself, it is best to look at the RMAR and its statistical significance. For the purpose of this study, the latter has not been done.

32. Two other points need to be mentioned before presenting the results. As GDP can be derived in three different ways (i.e. output approach, final demand/expenditure approach and income approach), the breakdown into expenditure components is only one way to attain more detailed information on GDP revisions. Looking at supply-and-use components or looking at income components may also provide interesting information in this respect. Secondly, one must bear in mind that there is no directional link between these components and GDP. As a consequence, no conclusions can be drawn regarding causal effects. It may be the case that GDP growth is being revised because of an adjustment in the data source on imports, but it can also be the case that the imports are being revised because of a revision in GDP growth due to an adjustment of intermediate consumption for one of the major industries in a country (for example due to a correction in the survey for one of the major companies). More information is needed on the way countries estimate GDP growth rates to make a proper assessment of possible causal effects. This may be undertaken in a next exercise on the basis of country information. For the purpose of this exercise, the analysis only focuses on detecting possible relations between revision of growth rates in GDP and those in the expenditure components.

a) Mean revision

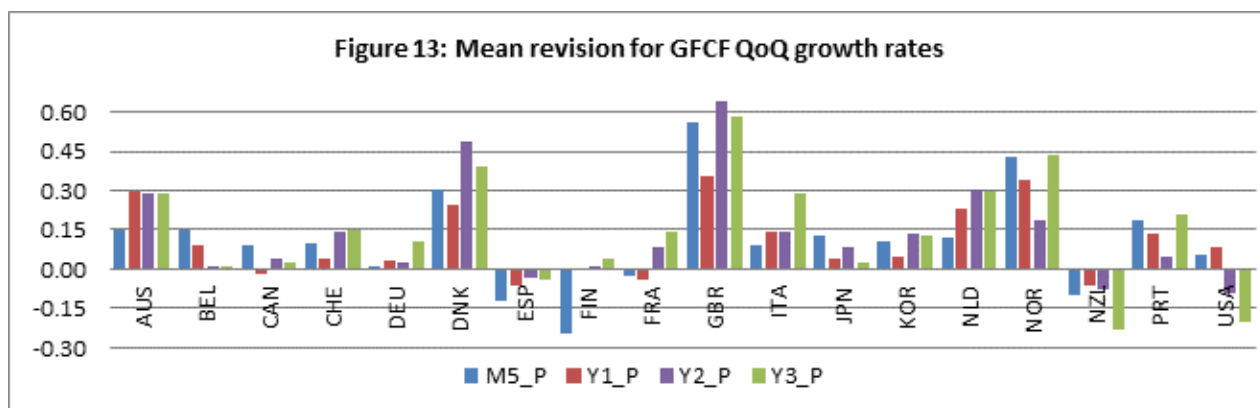
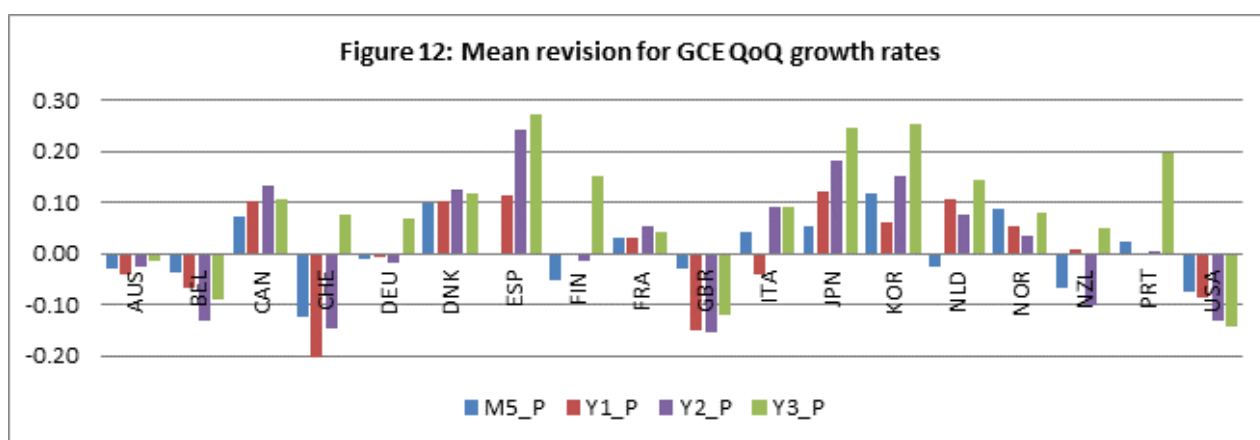
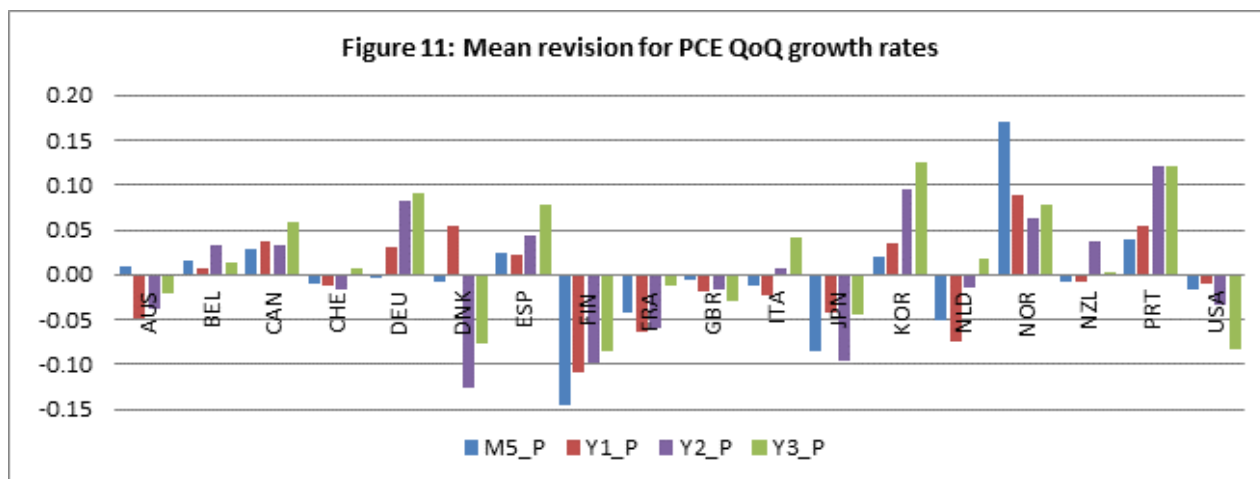
33. Figures 11 to 15 show the mean revisions for PCE, GCE, GFGC, exports and imports for QoQ growth rates. As expenditure components of GDP these can be related to the mean revisions of GDP growth rates as were presented in figure 1. Denmark and Portugal were the two countries with the highest mean revision amplitudes. When the components of GDP are considered, it can be seen that for Denmark the major revisions of GDP growth rates five months after the first estimates seem closely related to revisions in growth rates of GFCF. This is also one of the main components that is revised in later vintages in Denmark. In addition, for a significant number of countries, GFCF shows to be the component subject to the largest revisions, mostly upwards. Eight countries report their largest mean revisions for this item. Next to that, also revisions to GCE, exports and imports are relatively high in Denmark for the revision period five months after the first estimate. Looking at Portugal, GFCF and imports show large revisions. The latter seems to be the major cause for the negative revision that was recorded in the first year after the publication of the first estimate in Portugal.

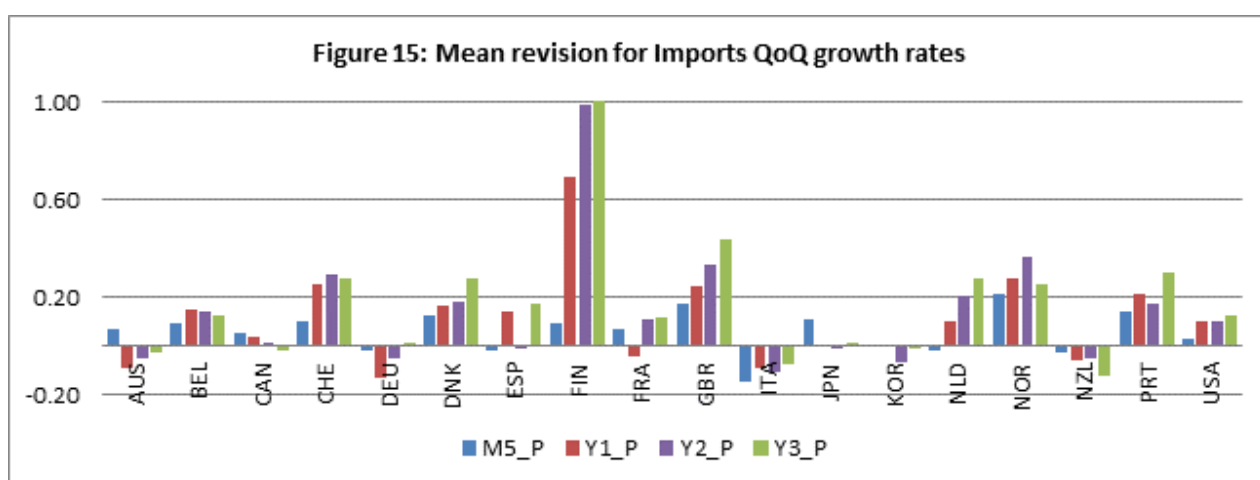
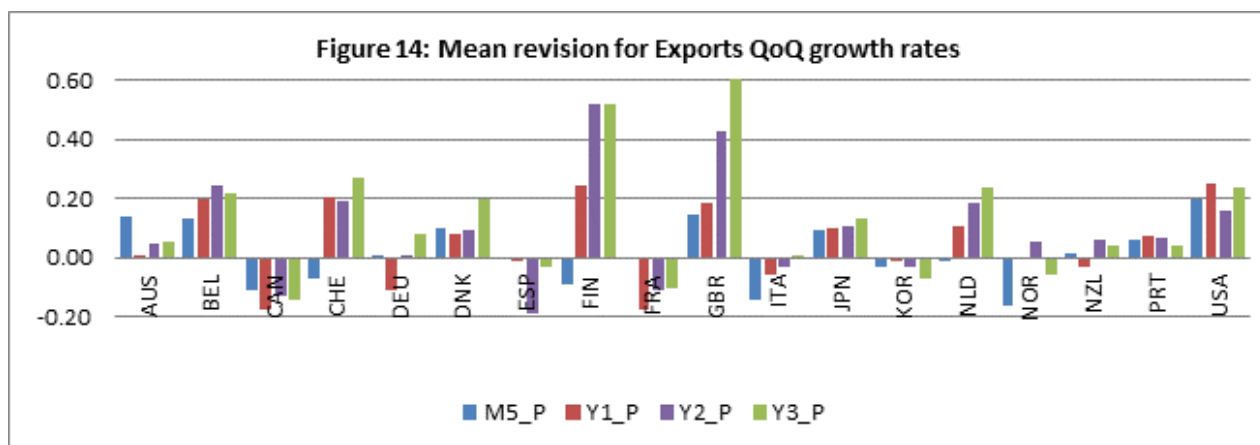
34. Some other observations can be drawn from the figures:

- When looking at the various components of GDP, the revisions for PCE are lowest on average. Half of the countries show upward revisions, whereas the other half records downward revisions. Finland and Norway, the two countries previously mentioned for the highest mean revision for GDP growth, record the largest MR on QoQ growth rates for PCE, with similar amplitude but opposite signs (see figure 11); while Finland's preliminary estimates are overestimated on average, Norway's results show an underestimation.
- In most countries, MRs for GCE are somewhat in the middle when compared to the other components. However, the revisions tend to be high for Japan, Korea, Portugal and Spain (see figure 12). Next to that, most of the countries show an upward revision of GCE growth rates.
- As mentioned before, GFCF is an item that is subject to major revisions over time for several countries (see figure 13). Especially Australia, Denmark, Italy, the Netherlands, Norway and the United Kingdom report high MRs for this item. Next to that, it can be noted that growth

rates for GFCF are mostly revised upwards. Fourteen out of the eighteen countries record upward revisions on average. There is no other component that matches that.

- As can be seen in figures 14 and 15, most trade flows are positively adjusted over time, for some countries quite substantially. Especially Denmark, Finland, the Netherlands, Norway, Portugal, Switzerland, the United Kingdom and the United States record large revisions for either their exports, their imports or both. When both flows are equally adjusted this will not affect the trade balance. However, when the revisions differ in size, this has an impact on the trade balance and therefore may strongly relate with revisions of GDP growth.



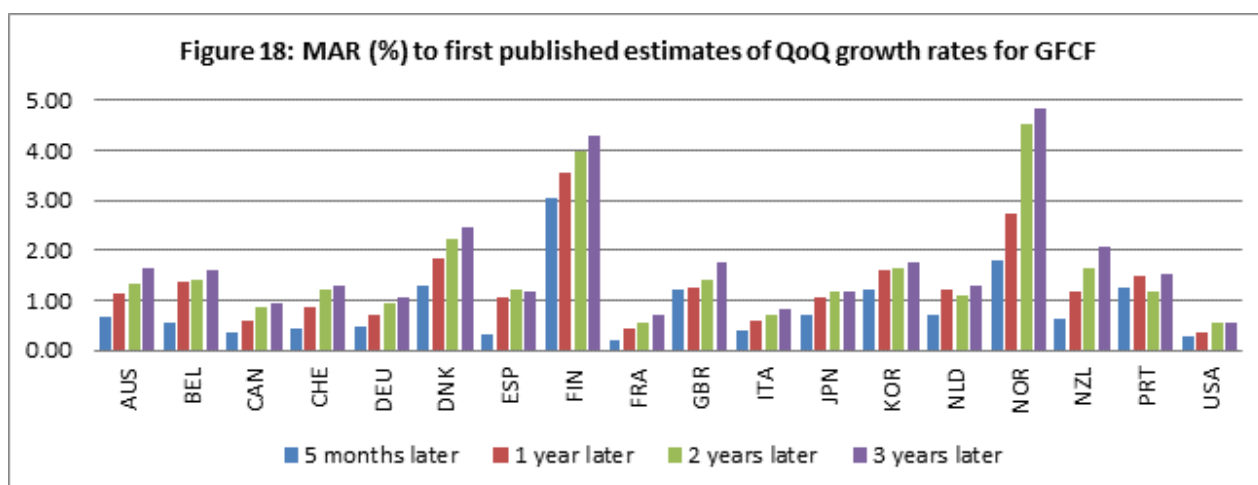
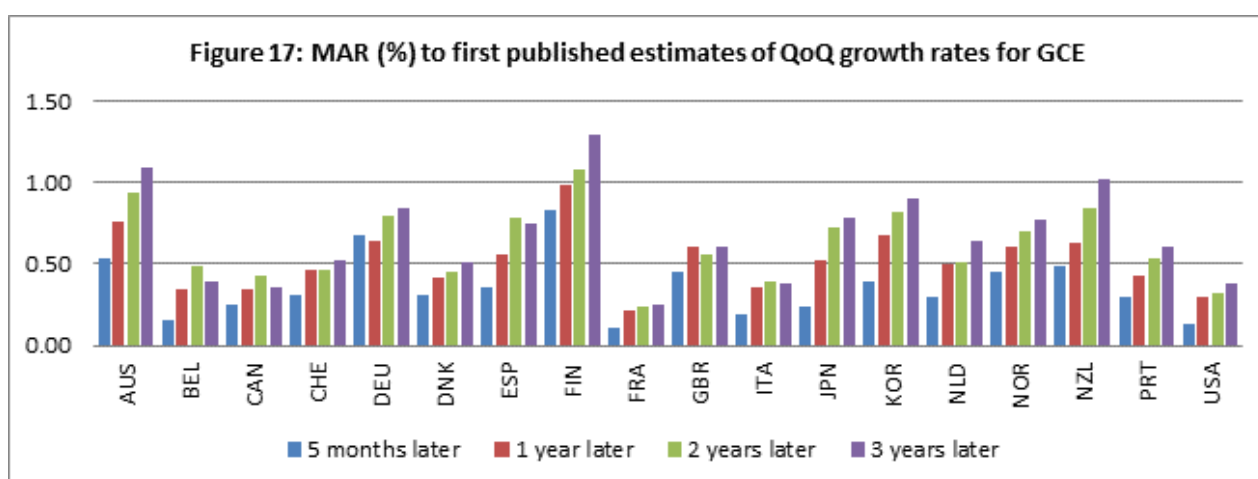
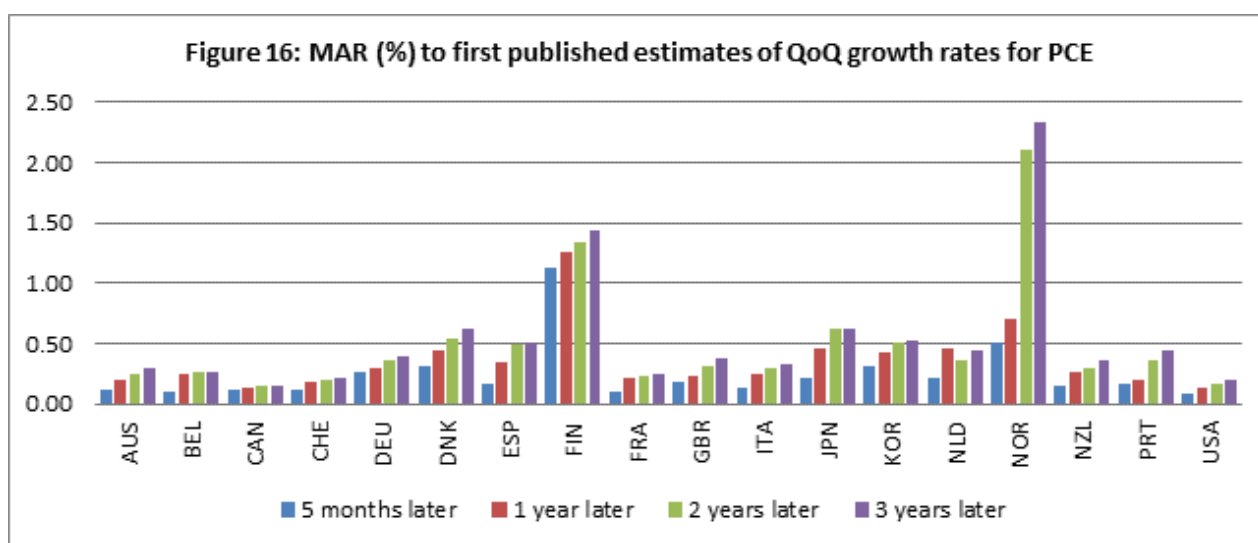


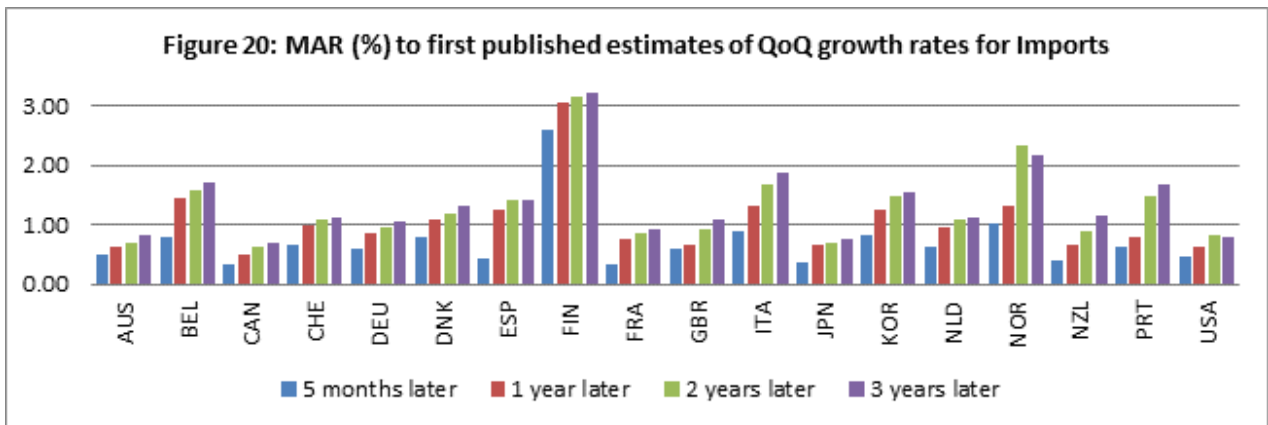
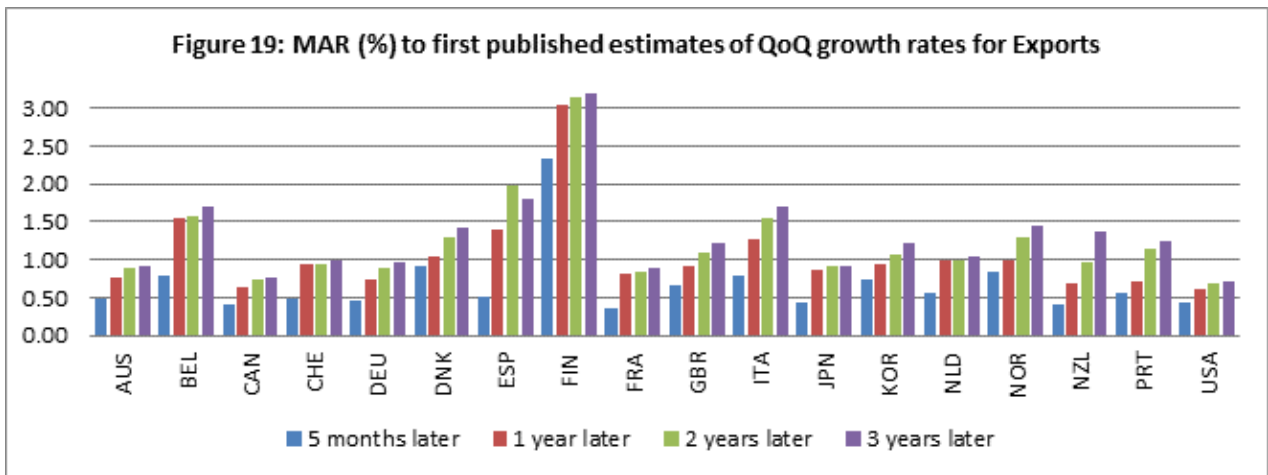
b) Size of revisions of the GDP components' growth rates across countries: MAR analysis

35. Figures 16 to 20 show the MARs of the GDP components growth rates. These can be related to the MARs of GDP growth, as presented in figure 3. Next to Denmark and Portugal, also Finland, Japan, Korea and Norway record relatively high absolute revisions for GDP growth. Looking at the expenditure components, the countries show quite some divergent patterns.

36. Some observations can be made from these figures:

- Finland and Norway are the two countries that record the highest absolute revisions in private consumption expenditure (PCE) (see figures 16). The other countries have MARs below 0.5% at all intervals (except Denmark and Japan for the 2 years indicator).
- Also for gross fixed capital formation (GFCF), Finland and Norway record the highest absolute revisions. It is also clear from figure 18 that the MAR is far bigger for GFCF than for PCE.
- For government consumption expenditure (GCE) the differences between the countries are lower than for PCE and GFCF. However, the levels of MAR are clearly exceeding the ones for PCE. Finland is the country that reports the highest MAR.
- The trade flows also show relatively high MARs. Especially Finland reports large revisions on exports and imports. Also Belgium, Denmark, Italy, Norway and Spain report larger revisions on their trade flows, although to a lesser extent.





V. CONCLUSIONS AND WAY FORWARD

37. This paper analysed the various vintages of volume growth rates in Gross Domestic Product (GDP) and its major expenditure components (except inventories). The main goal of the analysis was to provide useful insights to compilers and users of macro-economic statistics in the robustness of early estimates and in possible areas for investigation to improve estimates if necessary. When the latter is put in place and additional measures to address the revision show to be effective, users of statistical data can benefit from improved data quality. Next to that, the improved insight in revisions may also help users to better interpret data on GDP growth and its expenditure components. However, in this respect, it should be emphasized that the findings presented in this document are subject to external factors that may have brought bias in the size and magnitude of the revisions.

38. From the GDP cross-country analysis, it turned out that, on average, countries perform upward revisions. A group of six countries (Belgium, France, Germany, Italy, Japan and the United Kingdom) shows mean revisions that are not statistically significant. On the other hand, there are some countries that report statistical significant short-term mean revisions (such as Denmark, the Netherlands and Norway, and, up to a point, Australia). In addition, it has been shown that Japan, Norway and Portugal (the latter only for the QoQ growth rates) record the highest relative mean absolute revisions. From the GDP cross-country analysis, it appears that there is no clear evidence of revisions becoming smaller over time. On the contrary, the revisions appear to be larger in the post-2008 period than in the periods before. Finally, it turns out that the direction of change and of the acceleration/deceleration is in most cases not altered by the revisions.

39. Subsequently, the GDP main components analysis identified relations between the GDP revisions and revisions of expenditure components. It turned out that gross fixed capital formation and imports show the most significant revisions, although results differ across countries. In addition, the results show that sometimes revisions of expenditure components can be substantial, whereas the revision to GDP growth is only small. The current analysis only focused on the breakdown of GDP by expenditure components. For the next exercise, it may be interesting to also look at the other two breakdowns for GDP. The application of more advanced statistical analyses may also be interesting to get more insight on correlations between GDP and its components and maybe also on possible causal effects.

40. Countries are invited to comment on the findings in this document. In that, it would be helpful if, especially in the case of larger revisions, they could provide some information on the distinction between statistical revisions and methodological ones. That would give more insight in the reasons for revisions and may help determining the fields where there is still a need to come up with solutions to improve the quality of early estimates. Finally, countries are invited to share their ideas for future work on revisions and related international comparability studies.

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