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From first to last: the National Accounts revisions

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Abstract
This article analyses the revisions to the Quarterly National Accounts in Portugal, using real-time data for the period from 2010 to 2022, including the period of the COVID-19 pandemic. We assess the revisions of quarterly estimates for real GDP and its components on both the expenditure and supply sides, as well as the reliability of the GDP flash estimate. The revisions to the annual data due to the inclusion of the final Annual National Accounts are also studied, and in the case of GDP the analysis is extended to nominal and deflator revisions. The first GDP revisions are in general small, but considering a longer revision period, they become significant and tend to be positive. The expenditure components related to external trade, in particular imports and GFCF, are the ones with the largest revisions. GVA revisions are higher than those for GDP, suggesting that supply-side estimates are less reliable. (JEL: C49, C89, E01)

1. Introduction

The Quarterly National Accounts (QNA) are a very important tool for macroeconomic analysis and to support economic policy and the decisions of economic agents. Over time, the Portuguese national accounts, as in most European countries, have been released on a progressively more regular and timely schedule. As the trade-off between the timeliness and reliability of statistics is well known, the usefulness of the QNA is largely due to the fact that they provide a coherent set of macroeconomic indicators with a short time lag. However, the first estimates of the QNA are, by nature, preliminary and subject to revisions throughout time, reflecting the integration of data sources only available at later stages. Given the importance of these statistics, an analysis of the magnitude and evolution of the revisions is a useful tool for a better understanding and evaluation of these data at the various points in time.

The quality of statistical information involves several dimensions, the most important of which are accuracy (that is, the degree of similitude to the true value of

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the variable being measured) and timeliness, both of which are fundamental for the information to be relevant to users. When assessing the quality of national accounts statistics, in addition to accuracy and timeliness of release, other criteria must also be considered, such as coverage, coherence and comparability with data from other countries (see, for example, Eurostat (2021)). However, in national accounts it is difficult to directly assess the accuracy of estimates, and the main tool in this regard is revision analysis. The analysis of revisions consists of comparing an estimate at a given point in time with those released at later points in time for the same reference period. On the assumption that revisions improve accuracy of statistics, the analysis of revisions, and, in particular, revisions bias, should be seen as indicators of reliability rather than accuracy (see, for example, Symons (2001) and Zwijnenburg (2015)). Thus, the reliability of an initial estimate refers to the consistency between that initial estimate and subsequent estimates of the same variable, although this may not have a direct correspondence in terms of accuracy.

It should be noted that revisions are part of the statistical production process, so it should not be inferred that a statistic with smaller revisions is necessarily of higher quality than a more revised one. For example, in some cases, the absence of revisions means that more accurate or higher quality data sources are not available afterwards, while, on the other hand, the delay in the availability of more complete statistical sources may justify more significant revisions later on, maintaining the usefulness of the less accurate preliminary estimates. However, the existence of significant revisions can harm the assessment of the economic situation and its forecast, which is why it is important to quantify the magnitude of the revisions.

The analysis of revisions to macroeconomic data, in particular the revisions to GDP and its components released in QNA, has been carried out for several countries over the last few years. See, for example, Aruoba (2008) for the USA, Meader (2007) for the UK, Kholodilin and Siliverstovs (2009) and Strohsal and Wolf (2020) for Germany, Helliesen and Skjerpen (2022) for Norway or Bishop *et al.* (2013) and ABS (2021) for Australia. It should be noted that this issue has been repeatedly addressed by various international institutions such as the ECB and the OECD (for example, Branchi *et al.* (2007) for the euro area, and McKenzie (2006) and Zwijnenburg (2015) for comparative analyses of GDP revisions for various OECD countries). More recently, Jorda *et al.* (2020) and ONS (2022) examine GDP revisions for the United States and the United Kingdom in the exceptional context of the COVID-19 pandemic.

For Portugal, José (2004) evaluated the revisions of Portuguese QNA for the period between the last quarter of 1991 and the first quarter of 2004 and Cardoso and Rua (2011) studied the revisions for the period between the last quarter of 2002 and the first quarter of 2011. This article seeks to revisit the reliability of the Portuguese QNA for the most recent period, considering the period of QNA releases between the first quarter of 2010 and the last quarter of 2022.

The article is organized as follows. Section 2 presents the data and methodology, describing the type of revisions and the statistical criteria used for evaluation. Section 3 assesses the quarterly revisions to GDP and the main expenditure and GVA aggregates. Despite the large amount of information available in this type of analysis, we give

greater prominence to the revisions of real GDP as it is the main macroeconomic aggregate in monitoring the evolution of activity. Section 4 analyses the annual revisions resulting from the inclusion of the Annual National Accounts (ANA), extending the analysis to nominal and deflator revisions. Section 5 concludes.

2. Data and methodology

2.1. Data

In this article, we assess the revisions to GDP and its components using the data disclosed in all of Statistics Portugal's QNA releases since the first quarter of 2010 to the fourth quarter of 2022. Compared to the periods analysed in previous studies, this sample period corresponds to a more regular and homogeneous set of releases, in terms of both the detail of the estimates and the calendar release schedule.

The first QNA release considered coincides with the beginning of the compilation of the QNA on a 2006 basis, when important methodological changes were introduced, namely the introduction of the new classification of economic activities (NACE Rev.3) and new aggregates for GVA. These led to a revision of the whole QNA series at the time of the release of the first quarter of 2010.

From now on, we refer to the **first estimate** as the data corresponding to the first complete release of the QNA for a given quarter (including GDP and its main expenditure components as well as GVA breakdown), which is currently disclosed 60 days after the end of the reference quarter (this deadline was 70 days until the publication of the first quarter of 2014). For the entire period under analysis, each release includes a collection of quarterly data for the period from the first quarter of 1995 to the reference quarter. Revisions to any of the previous quarters can occur in each release simultaneously with the first estimate for the reference quarter.

The data to be analysed correspond to GDP and the main expenditure components, as well as GVA and its breakdown by main branches of activity, with particular emphasis on GDP revisions. The revisions to these aggregates will therefore be assessed using a set of 52 data collections (known as vintages in the literature) corresponding to the releases over the 13-year period mentioned above.

In addition to the full release of the QNA, Statistics Portugal discloses in advance a **flash estimate** only for the GDP volume rate of change (in year-on-year and in quarter-on-quarter terms), without the respective levels or any breakdown by GDP components. Since the release for the second quarter of 2020, the flash estimate is currently disclosed 30 days after the end of the reference quarter (whereas previously it was released 45 days after the end of the quarter). These flash estimates will be assessed in a separate subsection, given the different nature and lesser detail of this publication, and only the revision implied in the first QNA estimate will be analysed.

It is also possible to analyse the revisions implicit to the annual figures obtained by aggregating the quarterly figures, i.e., revisions to the ANA estimates. For each year, the first estimates of the ANA are published at the same time as the QNA for the fourth quarter of the respective year and simply correspond to the aggregation of the

four quarters of that year. In addition to these estimates (which are called preliminary annual accounts and with the detail of the QNA release), there are two types of ANA publications, with much greater detail and using additional sources (namely annual sources): the provisional ANA with an intermediate detail, and the final ANA, compiled in greater detail and incorporating a wider range of statistical sources. Currently, in September of each year n, final annual accounts for year $n-2$ are released at the same time as the provisional accounts for year $n-1$. The quarterly estimates of the immediately subsequent release include and are consistent with these annual figures.

In order to assess the revisions to the QNA due to the inclusion of the ANA, we have to take into account the release calendar of the ANA for each year. In the case of ANA, which could potentially lead to more significant revisions, the release lag underwent some changes during the period under analysis. Table 1 presents the release calendar for the final ANA published during the period under study, as well as the lag in quarters compared to the first ANA estimate (implicit in the QNA publication for the fourth quarter of the reference year). Currently, the final ANA are reflected in the QNA publication with a lag of seven quarters vis-à-vis the preliminary estimate for the whole year. The provisional ANA correspond to annual estimates that are more complete than the preliminary estimate obtained on the basis of quarterly data, but still with less detail than the final ANA. The provisional ANA started to be released in September 2018 (for the year 2017), when Statistics Portugal began to reflect information, albeit partial, from the *Informação Empresarial Simplificada* (IES). Since then, the provisional ANA have been released in September of each year without any changes to the calendar (i.e., three quarters after the first estimate for the whole year).

Reference year of ANA	Date of ANA release	First release of QNA after ANA release	Lag *vis-à-vis* the release of the 4th quarter of the corresponding year (in quarters)
2007	9 Jun. 2010	Q1 2010	9
2008	31 Mar. 2011	Q1 2011	9
2009	9 Dec. 2011	Q3 2011	7
2010	7 Dec. 2012	Q3 2012	7
2011	29 Aug. 2014	Q2 2014	10
2012	26 Mar. 2015	Q1 2015	9
2013	23 Sep. 2015	Q3 2015	7
2014	23 Sep. 2016	Q3 2016	7
2015	22 Sep. 2017	Q3 2017	7
2016	21 Sep. 2018	Q3 2018	7
2017	23 Sep. 2019	Q3 2019	7
2018	23 Sep. 2020	Q3 2020	7
2019	23 Sep. 2021	Q3 2021	7
2020	23 Sep. 2022	Q3 2022	7

TABLE 1. Release calendar of final annual national accounts (ANA)

In addition to the release calendar, it is also important to mention some of the methodological changes that took place during the period under analysis. One important issue refers to base year changes, which occur approximately every five years in order to incorporate significant changes in statistical sources, methodologies and the conceptual framework. Besides the change to the 2006 base that occurred with the first

vintage analysed here, this period also encompasses the change to the 2011 base (with the release of the final 2011 ANA and the QNA for second quarter of 2014) and the change to the 2016 base (with the release of the final 2017 ANA and QNA for third quarter of 2019). Simultaneously with the base year change, Statistics Portugal carries out a retropolation exercise and publishes revised data for the entire period since 1995 (annual and quarterly) providing series compliant with the most recent base. The change to the 2011 base occurred at the same time as the adoption of the European System of Accounts 2010, leading to substantial methodological changes, which, according to Statistics Portugal, justified revisions of larger magnitude than usual. It should also be noted that key data sources for compiling national accounts (such as the IES, which currently covers around 500,000 firms) were made available or their coverage extended. In addition, in the first release of the QNA after the change to the 2011 base (referring to the second quarter of 2014, see Statistics Portugal (2014a) and Statistics Portugal (2014b)), the QNA data started being adjusted for seasonality and calendar effects, whereas previously the quarterly data were only seasonally adjusted. In the change to the 2016 base, the methodological changes were less relevant than those seen in the previous base change (see Statistics Portugal (2019)).

It should be noted that for the revision analysis, this article only takes into account the QNA releases. However, there are interim data updates on Statistic Portugal's website that do not give rise to QNA releases. In particular, with the release of the Quarterly Accounts by Institutional Sector (85 days after the reference quarter), Statistics Portugal may change the QNA data for the same quarter (disclosed 60 days after the quarter) but these revisions, which are usually minor, are not reflected in a new QNA publication. Similarly, in recent years, Statistics Portugal has revised the QNA data available in the website at the time of the release of the ANA data (in September of each year), but in this article we consider that the revisions occur in the first release of the QNA after the ANA dissemination (which currently takes place in the following November).

2.2. *Methodology*

Simultaneously with the release of the first estimate for quarter t, it is published the second estimate of quarter $t-1$, the third estimate of quarter $t-2$ and so on. Given the previously discussed database, it is possible to analyse several types of revisions.

In the case of quarterly data, we analyse revisions to volume rates of change, in year-on-year terms and *vis-à-vis* the previous quarter. Among the various possible revision horizons, we focus the analysis on a set of more relevant revisions. In this sense, it is important to assess whether the estimates are likely to be significantly revised in a short period of time (one or two quarters later). On the other hand, it is important to assess the extent to which the initial estimates are significantly revised when ANA (which imply annual restrictions to the quarterly data) are included. Bearing in mind the annual accounts calendar release presented above, so that all quarters of the year include the provisional annual accounts (as mentioned above, only released for the most recent

years), it is necessary to analyse the revisions after six quarters.[1] In a similar fashion, all quarters of a given year only reflect the final annual accounts after two and a half years after the first estimate.

Hence, we present: the **first revision**, which corresponds to the revision from the second estimate vis-à-vis the first one; the **second revision**, which results from comparing the third estimate to the second; the **revision six quarters later** and the **revision three years later**, both compared to the first estimate allowing to assess the impact of including provisional and final ANA, respectively. The flash estimate, which is only available for GDP rate of change, was assessed separately. In this case, the **flash estimate revision** implicit in the first estimate of QNA is evaluated.

The analysis of quarterly revisions has been carried out using a set of statistical measures usually considered in this type of study (see, for example, Di Fonzo (2005) and Cardoso and Duarte (2009)). For ease of exposition, a revision is defined as the difference between the rates of change (year-on-year or quarter-on-quarter, in the case of quarterly data) between a final estimate and an initial estimate (here understood as the estimates after and before the revision).

As a sign indicator, the mean revision is computed. The closer the mean is to zero, the less biased the initial estimate is. In this sense, a test of the statistical significance of the mean was carried out, i.e., a test of whether the mean is statistically different from zero. A statistically significant and positive (negative) mean indicates that the variable is undervalued (overvalued) in the initial estimate, suggesting a bias in the estimates. The proportion of revisions with a positive sign can also be seen as an indicator of the sign of the revision of the initial estimate (a high proportion of negative or positive revisions indicates bias of the initial estimate).

Since revisions of opposite sign offset each other, the main indicator used to measure the size of revisions is the mean absolute revision, i.e., the average of the absolute values of the revisions. Alternatively, in order to take into account the scale of the variable, the relative mean absolute revision was also computed, i.e., the ratio between the average of the absolute values of the revisions and the absolute values (in this case, of the rates of change) of the variable under analysis (corresponding to the final estimate). This measure can be interpreted as the proportion of the estimate that is revised on average during the revision period. Although the usefulness of this measure is limited when analysing rates of change (since for very low rates, this measure can reach very high values), it can be useful, particularly for comparing aggregates with different scales (for example, GDP and GFCF). In addition, the proportion of sign concordance for the rates of change (when comparing the initial estimate with the final estimate) as well as for the direction of rates (acceleration/deceleration) has been computed. The measure of concordance in terms of sign consists of calculating, for each type of revision, the proportion of cases in which the sign of the rate of change does not change before and after the revision. Similarly, concordance in terms of direction consists of the proportion

1. Note that when the provisional ANA are released, the figures for the fourth quarter of the respective year incorporate the third revision while those for the first quarter already incorporate six quarters of revisions to the first estimate.

of cases in which the direction of the rate of change (i.e., acceleration or deceleration) is identical before and after the revision.

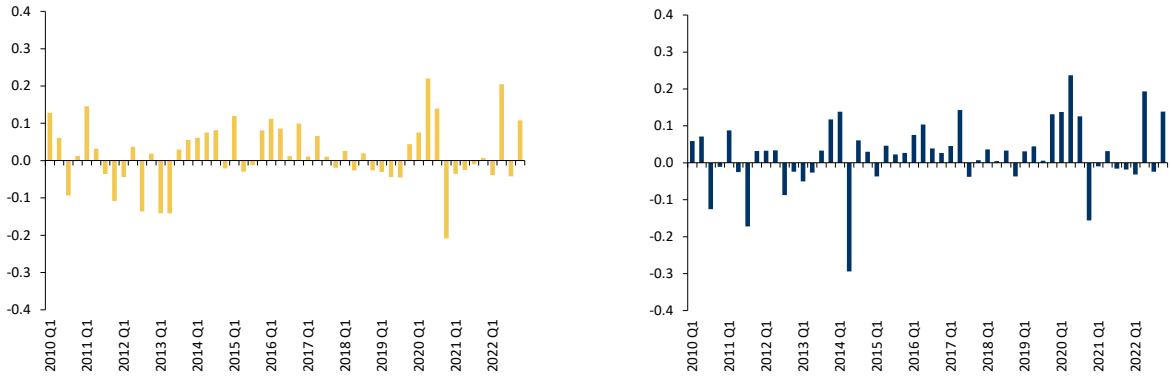
Revisions should not only be small, but also have low volatility. In addition to the revision size indicators, the standard deviation of revisions and the noise-to-signal ratio are presented as volatility indicators. The noise-to-signal ratio corresponds to the ratio between the standard deviation of the revisions and the standard deviation of the final estimate, which accounts for the volatility of the variable. In the case of the noise-signal ratio, a ratio greater than one means that the noise (standard deviation of revisions) is greater than the signal (standard deviation of revisions). Other reference values for this measure to be considered "low" are relatively *ad-hoc*, with a value of less than 0.5 being considered relatively low (see Cardoso and Duarte (2009)).

We also compute the correlation coefficient between the revisions and the revised estimate and test its statistical significance. Significant correlations indicate that in periods of more marked changes in GDP (positive or negative), revisions tend to be larger and in the same direction, which may be associated with some conservatism in the first estimates.

3. Analysis of quarterly revisions

3.1. Revision of the GDP flash estimate

In this subsection, we analyse the revisions to the GDP rates of change released with the flash estimate. Figure 1 shows the revisions to the year-on-year and quarter-on-quarter rates of change for GDP in volume terms.



(A) Revision to the year-on-year rate of change

(B) Revision to the quarter-on-quarter rate of change

FIGURE 1: Revisions to the GDP flash estimate, in percentage points.

Table 2 presents a set of summary measures regarding these revisions. In general, the revisions are small in magnitude. The average of the revisions is approximately zero and the average in absolute terms is less than 0.1 p.p.. The largest absolute revisions to the year-on-year rates of change occurred during the first year of the COVID-19 pandemic (0.22 p.p. revision in the second quarter of 2020 and -0.29 p.p. in the fourth

	Year-on-year rate of change	Quarter-on-quarter rate of change
Mean	0.02	0.02
Mean absolute revision	0.07	0.07
Relative mean absolute revision	0.09	0.34
Minimum	-0.21	-0.29
First quartile (25^{th} percentile)	-0.03	-0.02
Median value (50^{th} percentile)	0.01	0.03
Third quartile (75^{th} percentile)	0.08	0.06
Maximum	0.22	0.24
Standard deviation	0.09	0.09
Noise-to-signal ratio	0.02	0.03
Correlation between revision and estimate	-0.01	-0.14
Proportion of positive revisions	0.58	0.65
Sign concordance	1.00	0.96
Direction concordance	0.90	0.96

TABLE 2. Descriptive statistics of the revisions to GDP flash estimate, in volume

Note: The measures are in percentage points with the exception of the following: relative mean absolute revision, noise-to-signal ratio, correlation between revision and estimate, proportion of positive revisions and concordance in terms of sign and direction.

quarter of 2020). In the case of the quarter-on-quarter rates of change, the greatest positive revision also occurred in the second quarter of 2020 and the most negative value occurred in the second quarter of 2014, which coincides with the first release on a 2011 basis incorporating the change to ESA2010 which, as mentioned above, involved important methodological changes. The revisions to the flash estimate have both a relatively low standard deviation and noise-to-signal ratio. However, it should be noted that the relative mean absolute revision (i.e., taking into account the scale of the variable) is greater in the case of the quarter-on-quarter rates of change than in year-on-year rates of change. In general, the results obtained point to a high information content of the flash estimate when compared to the first estimate.

3.2. QNA GDP revisions

Table 3 shows the main summary measures regarding the revisions to the rates of change in real GDP (year-on-year and quarter-on-quarter) implicit in the QNA releases. This table presents the measures for the first revision, the second revision and the revisions after six quarters and three years compared to the first estimate for each quarter. Figure 2 displays the corresponding revisions over the period analysed in the case of the first revision and the revisions after six quarters and three years. Naturally, the revisions after six quarters can only be calculated to the second quarter of 2021 and the revisions after three years for the period to the fourth quarter of 2019.[2]

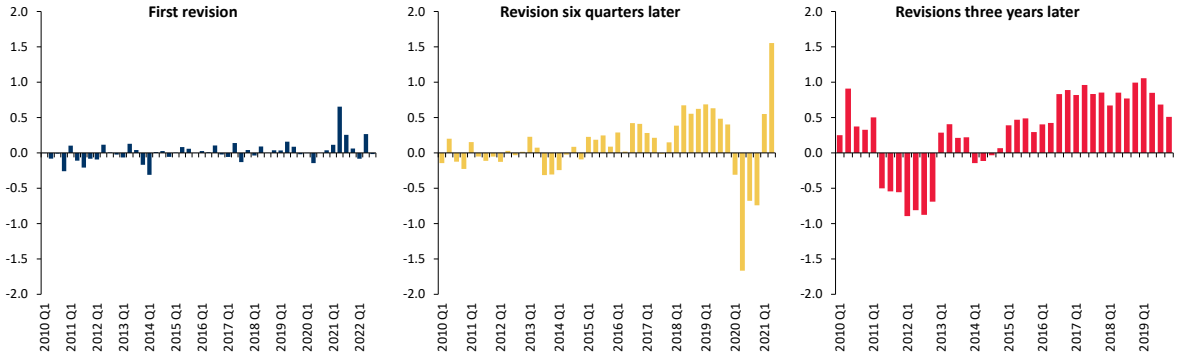
Firstly, it should be emphasised that the first and second revisions of GDP growth rates, in year-on-year and quarter-on-quarter terms, are on average small. For longer

2. As a sensitivity analysis, revisions to GDP data to the fourth quarter of 2019, i.e., excluding the period affected by the pandemic, were also assessed for the same revision horizons and the results are qualitatively similar.

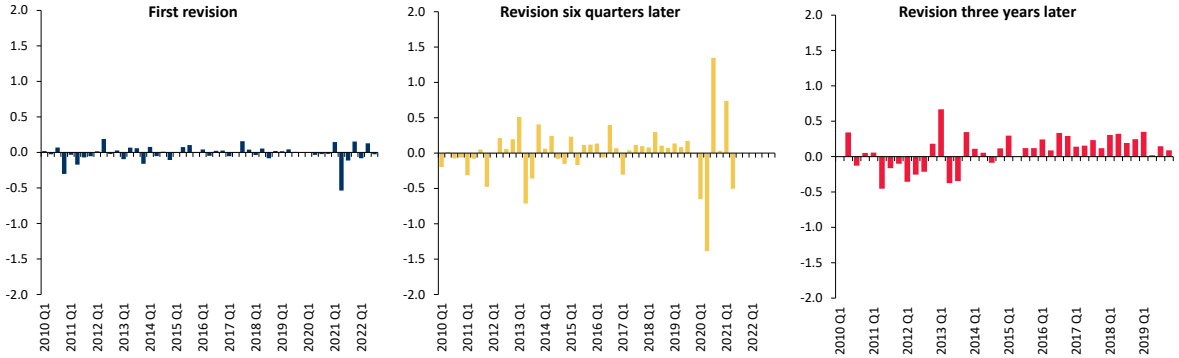
	Year-on-year rate of change				Quarter-on-quarter rate of change			
	First revision	Second revision	Revision six quarters later	Revision three years later	First revision	Second revision	Revision six quarters later	Revision three years later
Mean	0.01	0.01	0.10	0.31*	-0.01	-0.01	0.01	0.08*
Mean absolute revision	0.09	0.08	0.33	0.57	0.07	0.06	0.26	0.21
Relative mean absolute revision	0.03	0.02	0.12	0.24	0.05	0.04	0.19	0.15
Minimum	-0.31	-0.40	-1.67	-0.89	-0.54	-0.20	-1.39	-0.45
First quartile (25th percentile)	-0.06	-0.03	-0.11	0.04	-0.05	-0.06	-0.08	-0.02
Median value (50th percentile)	0.00	0.01	0.09	0.40	0.00	-0.01	0.06	0.12
Third quartile (75th percentile)	0.07	0.05	0.36	0.82	0.04	0.01	0.14	0.24
Maximum	0.65	0.41	1.55	1.06	0.19	0.47	1.35	0.67
Standard deviation	0.14	0.12	0.47	0.56	0.12	0.10	0.40	0.24
Noise-to-signal ratio	0.03	0.02	0.10	0.11	0.04	0.03	0.12	0.07
Correlation between revision and estimate	0.45*	0.43*	0.81*	0.82*	-0.14	0.18	0.81*	0.42*
Proportion of positive revisions	0.53	0.54	0.61	0.75	0.55	0.42	0.61	0.73
Sign concordance	1.00	1.00	1.00	1.00	0.98	1.00	0.96	0.95
Direction concordance	0.98	0.98	0.89	0.90	0.94	0.86	0.87	0.83

TABLE 3. Descriptive statistics for quarterly GDP revisions in volume

Notes: The measures are in percentage points with the exception of the following measures: relative mean absolute revision, noise-to-signal ratio, correlation between the revision and estimate, proportion of positive revisions and sign and direction concordance. In the case of the mean and the correlation between the revision and the estimate a * corresponds to a value statistically different from zero with a significance level of 5%.



(A) Revisions to the year-on-year rates of change



(B) Revisions to the quarter-on-quarter rates of change

FIGURE 2: Revisions to the real rates of change of GDP in the QNA, in percentage points.

revision periods, GDP estimates are more revised, although on average the revisions remain relatively contained. In the case of year-on-year rates of change, the average revision is 0.1 pp when considering the revision after six quarters, i.e., already incorporating the provisional ANA. After three years, when the final ANA for the

quarter in question are already available, the average of the revisions is positive and higher than the one after six quarters, rising to 0.3 p.p., which is statistically different from zero. In the case of quarter-on-quarter rates of change, the average revision after three years is 0.08 p.p., which is also statistically different from zero. The existence of a positive mean revision is not specific to the Portuguese case. For example, Zwijnenburg (2015) analyses the revisions for a number of countries and concludes that in general GDP growth is underestimated in the initial estimates.

The correlation coefficient between the revisions and the rate of change in GDP volume is statistically significant, suggesting that periods of larger GDP changes (growth or decreases) are associated with more substantial revisions in the same direction.

It should be noted that the largest revisions occurred during the COVID-19 pandemic (such as the 1.7 p.p. revision to the year-on-year rate of change in GDP in the second quarter of 2020 after six quarters). This result is not unique in the literature. In this regard, Jorda *et al.* (2020) establish a relationship between periods of greater economic turbulence and larger GDP revisions. Nevertheless, considering revisions after three years (which can only be calculated to 2019), there are substantial revisions to year-on-year rates of change between 2016 and 2019, with an average revision of around 0.8 p.p. over this period. For the period as a whole, the average absolute revision after three years is close to 0.6 p.p. for the year-on-year rates of change and around 0.2 p.p. for the quarter-on-quarter rates of change (with mean relative absolute revisions of 24% and 15%, respectively).

As for the proportion of positive revisions, this percentage is close to half in the case of the first and second revisions, but three years after the first estimate the proportion of positive revisions is clearly higher (75% of positive revisions in the case of year-on-year rates of change and 73% in the case of quarter-on-quarter rates of change), signalling an underestimation of the initial estimates compared to the final ones.

The measures of sign and direction concordance (acceleration/deceleration) suggest that the first estimates are highly informative regarding the profile of GDP evolution, especially in the case of year-on-year rates of change, and slightly lower in the case of the quarter-on-quarter rates of change as the revision period increases. Nevertheless, considering the revisions of the quarter-on-quarter rates of change after three years, the sign of the rate of change remains unchanged from the first estimate in 95% of the cases and the direction remains unchanged in 83% of cases.

3.3. Revisions to the main expenditure components

The above analysis can be conducted to the main expenditure components as a way of gauging which GDP components are subject to the largest revisions (see Tables A.1 and A.2 in the Annex). The first revisions of the main expenditure components are generally higher than those of GDP. While exports present an average revision of approximately zero, the components of domestic demand and imports are generally revised upwards, resulting in far less significant revisions to the GDP aggregate. Based on the mean or mean absolute revision of the first revisions by main aggregate, the most revised

expenditure component is GFCF, followed by imports. The average of the first revisions to the year-on-year rates of change for GFCF is almost 0.6 p.p. and for imports 0.3 p.p., both statistically different from zero. The mean absolute revision is over 0.6 p.p. in both cases. In average terms, the least revised components are public and private consumption, with the average not being statistically different from zero. However, taking into account the volatility of the respective rates of change, i.e., considering the relative mean absolute revision, the most revised component is public consumption, if we exclude the change in inventories whose revisions are measured in contributions to the change in GDP and not in rates of change. Considering a higher level of detail, it should be noted that in average terms the consumption of durable goods is more revised than the consumption of non-durable goods and within GFCF, the most revised component is GFCF machinery. Regarding foreign trade aggregates and considering the mean absolute revision, it should be noted that imports are more revised than exports, in particular goods. For both exports and imports, the services component is more revised than the goods component in mean absolute terms.

As for the dispersion of revisions, the aggregates with the largest standard deviation are imports, GFCF and exports. Within GFCF, the components with greater dispersion are those with the highest import content (GFCF machinery and GFCF transport equipment). Concerning exports and imports, the revisions of services also present a larger volatility than the goods component.

Year-on-year rate of change

	Private consumption	Public consumption	GFCF	Change in inventories[(a)]	Exports	Imports
Private consumption	1					
Public consumption	-0.15	1				
GFCF	-0.05	0.03	1			
Change in inventories[(a)]	0.05	0.06	0.27	1		
Exports	-0.36*	0.07	0.18	-0.08	1	
Imports	0.17	0.27	0.46*	0.69*	0.40*	1

Taxa de variação em cadeia em volume

	Private consumption	Public consumption	GFCF	Change in inventories[(a)]	Exports	Imports
Private consumption	1					
Public consumption	-0.15	1				
GFCF	-0.03	0.03	1			
Change in inventories[(a)]	-0.09	0.09	0.12	1		
Exports	-0.33*	0.14	-0.30*	-0.18	1	
Imports	0.18	0.29*	0.24	0.63*	0.28*	1

TABLE 4. Correlation matrix between first revisions to GDP components, in volume

Notas: [(a)] Contribution to the GDP rate of change. Values marked with * correspond to a value statistically different from zero at a 5%.

Given that GDP is generally less revised than its components, it is interesting to analyse whether the revisions between the various components are correlated. The existence of significant correlations between revisions could indicate common sources of revision that may or may not offset each other at the GDP level. Table 4 shows the

correlations between the first QNA revisions, for the year-on-year and the quarter-on-quarter rates of change, of the main expenditure components. Positive and significant correlations can be identified between the revisions to imports and the expenditure components with the highest import content, namely investment (GFCF and change in inventories). These correlations reflect the fact that these expenditure variables are estimated using import indicators, and it is natural that a revision of imports also translates into a revision of domestic demand aggregates. For example, in the case of revisions to the year-on-year rate of change, the correlation coefficient between the revision of imports and that of the change in inventories (as a contribution to the change in GDP) is 0.69 and the correlation coefficient between imports and GFCF is 0.46. Thus, despite imports being significantly revised, given that part of these revisions is reflected in the other expenditure components, the impact on GDP is mitigated.

On the other hand, the negative correlation between the revisions to exports and private consumption is probably related to the methodology used to estimate private consumption. In particular, the fact that some short-term indicators of private consumption correspond to indicators of consumption in the economic territory (for example, indicators of sales or turnover in the national territory) makes it difficult to break them down into consumption by residents and consumption by non-residents (classified in national accounts as exports). This breakdown is typically supported by the use of balance of payments information on tourism. Therefore, it would be natural for revisions in this export component (not accompanied by a revision in the territory consumption indicators) to be reflected in an opposite revision in the consumption by residents. This is further corroborated by the fact that this correlation at a more detailed level is more significant in the case of the relationship between the revisions of non-durable consumption and exports of services including tourism, since expenditure on durable goods is essentially attributed to consumption by residents.

Regarding the revisions after three years by expenditure aggregates, it should be noted that these are larger than the first revisions for most components. In the case of year-on-year rates of change, all the main aggregates present positive mean revisions and are statistically different from zero in most cases (with the exception of public consumption). The most revised components, both on average and in absolute terms, are again GFCF, with an average revision of over 1.0 p.p., and imports (average revision close to 0.9 p.p.). In the case of quarter-on-quarter rates of change, the revisions after three years are also generally positive, but in contrast to year-on-year rates of change, only the revisions to GFCF and GDP are statistically different from zero. The revisions to imports are on average higher than that of exports, both in year-on-year and quarter-on-quarter terms. It should be noted that in the case of quarter-on-quarter revisions, the mean absolute revision is over 1.0 p.p. for both foreign trade flows, visible for both goods and services, as well as for GFCF.

Concerning concordance, both in terms of the sign of the rate of change and the acceleration/deceleration between the various estimates, it is quite high for most expenditure aggregates, signalling that the evolution profile is not substantially changed by revisions to the estimates, even after three years. However, it should be emphasised that the percentages of concordance are, in general, higher in the case of the year-on-year

rate of change estimates than in the quarter-on-quarter rate of change, suggesting that the former are more reliable.

3.4. Revisions to GVA and its components

Regarding the supply side, it is also possible to assess the revisions to the QNA by analysing the same set of descriptive statistics for the quarterly GVA and its main aggregates (see Tables A.3 and A.4 in the Annex). Likewise the expenditure components, the first revisions and revisions after three years are reported, for both year-on-year and quarter-on-quarter rates of change. Considering the first revisions, the average is generally not statistically different from zero, both in the case of total GVA and for most of the main sectors published in the QNA. Only in the case of GVA in construction and for the quarter-on-quarter rates of change is the average of the revisions significant. It should be noted that this sector has a mean value and mean absolute revision to quarter-on-quarter rates of change higher than for year-on-year revisions. This lower reliability of quarter-on-quarter rates of change when compared to year-on-year rates of change (which is also the case for some expenditure aggregates, namely GFCF in construction) seems to be associated with significant one-off changes in the seasonal profile of the series, and may suggest difficulties in adjusting for seasonality. In the case of GVA and GFCF in construction, there was a significant revision of the quarter-on-quarter rates with less impact on the year-on-year rates of change with the release for the second quarter of 2014, when the QNA data began to be adjusted not only for seasonality but also for calendar effects. Taking the mean absolute revision, the revision of total GVA is slightly higher than that of GDP. Among the most revised aggregates, both year-on-year and in quarter-on-quarter terms, the GVA in agriculture, forestry and fishing and in energy, water supply and sewerage stand out.

The revisions to total GVA after three years are more significant than those to GDP, with averages statistically different from zero. For example, considering the revisions to year-on-year rates of change after three years, the mean absolute revision to total GVA is 0.76 p.p. while that of GDP is 0.57 p.p. (mean revisions of 0.53 p.p. and 0.31 p.p., respectively). By branch of activity, in average terms, the year-on-year rates of change present revisions significantly different from zero in the cases of industry, transport and other services. In terms of mean absolute revision, the agriculture and energy sectors continue to be the most revised. These are also the aggregates with the highest standard deviation of year-on-year revisions, followed by construction. In terms of the sign and direction concordance of the estimates, it should be noted that these percentages are generally lower in the case of the GVA components when compared to the main expenditure aggregates, although they remain relatively high, especially in terms of year-on-year rates of change. This suggests that the initial supply-side estimates are less reliable, which may be related to the fact that detailed sectoral information was not available when the first QNA estimates were published. In fact, the reliability and timeliness of expenditure side indicators is typically greater, which means that the compilation of Portuguese QNA tends to favour the calculation of GDP from the expenditure side.

3.5. International comparison

Given that the revision process is common to other countries, it can be informative to assess how revisions in Portugal compare with other cases. To this end, a comparison was made with the revisions observed for the euro area as a benchmark and, additionally, with the United States of America. Table 5 summarises the measures from the analysis of quarterly real GDP revisions, considering the same sample period and comparable timetables to those used in the rest of the article for Portugal. Such a comparison should be read with caution because, although we consider the same revision horizons, the available information at each point in time might differ from country to country.

Regarding the revision of the first estimate in year-on-year rates of change, the measures for Portugal do not differ significantly from the results for the euro area and the USA, particularly considering the mean revision or the mean absolute revision. In the case of the euro area, the mean revision is slightly higher and statistically different from zero and the percentage of positive revisions is well above 50%, suggesting a downward bias in the first estimates that is not visible for Portugal. In the case of the first revisions to the quarter-on-quarter rates of change, the results are similar.

	Mean	Mean absolute revision	Relative mean absolute revision	Standard--deviation	Noise-to--signal ratio	Proportion of positive revisions	Sign concordance	Direction concordance
Year-on-year rate of change								
First revision								
Portugal	0.01	0.09	0.03	0.14	0.03	0.53	1.00	0.98
Euro area	0.05*	0.08	0.03	0.09	0.03	0.71	1.00	0.88
USA	0.01	0.11	0.04	0.17	0.07	0.59	1.00	0.92
Revision three years later								
Portugal	0.31*	0.57	0.24	0.56	0.11	0.75	1.00	0.90
Euro area	0.25*	0.32	0.15	0.29	0.09	0.80	0.98	0.85
USA	0.00	0.32	0.12	0.42	0.18	0.60	1.00	0.78
Quarter-on-quarter rate of change								
First revision								
Portugal	-0.01	0.07	0.19	0.12	0.04	0.55	0.98	0.94
Euro area	0.03*	0.04	0.17	0.05	0.02	0.63	1.00	0.92
USA	0.02	0.08	0.35	0.12	0.07	0.63	0.98	0.96
Revision three years later								
Portugal	0.08*	0.21	0.15	0.24	0.07	0.73	0.95	0.83
Euro area	0.08*	0.15	0.15	0.16	0.06	0.68	0.97	0.73
USA	0.02	0.26	0.26	0.34	0.20	0.50	0.97	0.65

TABLE 5. Descriptive statistics for revisions to the GDP volume rate of change – international comparison

Notes: The measures are in percentage points with the exception of the following: relative mean absolute revision, noise-to-signal ratio, proportion of positive revisions and concordance in terms of sign and directon. In the case of the mean, * corresponds to a value statistically different from zero at a significance level of 5%.

Focusing on the revisions after three years, the comparison is less favourable for Portugal, especially when it comes to revisions to year-on-year rates of change. Both the mean and the mean absolute revision, which is a more relevant indicator for measuring the magnitude of revisions, is higher in Portugal that the recorded for the euro area and USA. For this type of revisions, and for both types of rate of change, likewise in the euro area, the fact that the means are significantly different from zero and the high percentage

of positive revisions suggest a bias in the estimates towards lower rates of change than those that will be published after the release of the ANA. In contrast, in the US there is no such bias.

4. Revisions with ANA

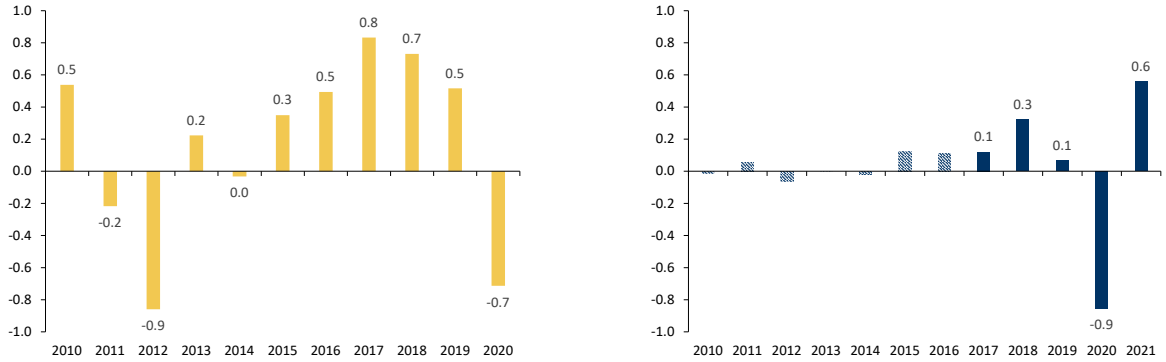
This section analyses the revisions resulting from the release of ANA, both provisional ANA and, more importantly, final ANA. The revisions will be analysed on an annual basis, and the revisions for each year after the inclusion of the respective ANA (provisional or final) will be compared with the first estimate for each year (called by Statistics Portugal as the preliminary annual estimate) corresponding to the annual value implicit in the first release of the QNA for the fourth quarter of each year.

These results roughly correspond to the revisions after three years in the case of the final accounts and the revisions after six quarters for the provisional accounts presented in section 3, but now analysed in annual terms. In this case, we have the final revisions until 2020 (as there are only two years between the first annual estimate, implicit in the fourth quarter of each year, and the final accounts) and the revisions until 2021 for the provisional accounts.

4.1. Revisions to the annual rates of change in real GDP

Figure 3 displays the revisions to the year-on-year rates of change of real GDP that occurred with the inclusion of the ANA. In Figure 3(A), the revision presented corresponds to that which occurred with the release of the final ANA for each year. As mentioned above, the time lag between the estimates was not identical throughout the period, with the last few years corresponding to seven quarters after the release of the first estimate of the year. Figure 3(B) displays the revision that occurred with the release of the provisional ANA for the years in which they were published (from 2017 onwards) compared to the first estimate of the year released in the QNA. For previous years, the shaded bars in the graph correspond to the revision that occurred with the same time lag as the provisional ANA are currently released (i.e., three quarters after the first estimate).

Concerning the revisions with the final ANA, the revisions to the rates of change in volume are generally positive. However, this is not the rule, and there were years when these revisions were negative, with the most significant downward revisions in 2012 and 2020. With the exception of 2013, in all the years in which the change in GDP was negative, there were downward revisions with the inclusion of the final ANA, while in the period of economic growth from 2015 to 2019, the revisions were systematically upward. This profile of revisions seems to suggest some pro-cyclicality in the revisions of real GDP. This may be related to the QNA estimation methodology, which, using econometric methods based on the relationships between national accounts variables and indicators available quarterly, introduces some smoothing into the estimates. Thus, in periods of greater variation (whether of growth or decline in activity), the first estimates will tend to reveal some conservatism that will be corrected in later estimates



(A) Revisions with final ANA (B) Revisions with provisional ANA

FIGURE 3: Revisions of annual volume rates of change due to inclusion of ANA, in percentage points.

using more detailed sources of information. For example, Symons (2001), after analysing revisions to UK GDP, concluded that these revisions are biased upwards in years of higher growth and downwards in years of recession. In addition, the years with the highest revisions to the rates of change (in absolute terms) seem to be associated with periods of greater variation in activity, as was the case in 2012 and 2020 with significant falls in GDP associated with the sovereign debt crises and the COVID-19 pandemic and, in the opposite direction, in the years 2017 and 2018, which correspond to the years of higher growth. This suggests, as mentioned in Jorda *et al.* (2020), that, in the presence of marked fluctuations in activity, the uncertainty regarding the rates of change in absolute terms seems to increase.

With regard to the revisions due to the provisional ANA, it can be seen that these revisions were small until 2017, and became more significant from that year onwards, when the provisional ANA began to be published. The provisional ANA incorporate detailed annual sources that were not available when the preliminary estimate for the fourth quarter of the year was released, namely IES data. For this reason, the revisions for the most recent period also reflect the existence of a wider range of information available in a shorter period of time than before (when the main annual sources were only taken into account for the final accounts).

Comparing the revisions resulting from the provisional (in the years actually available) and final ANA, it can be seen that the release of the provisional accounts makes it possible to partially anticipate the revisions resulting from the final accounts, as these intermediate revisions go in the same direction as the final revisions. The provisional ANA for 2021 corroborate the idea of larger revisions in periods of higher change (as is the case for the 2020-2021 period, which was particularly affected by the pandemic) and that the sign of the revisions is generally associated with the sign of the change in GDP. In fact, the 2021 ANA implied a significant upward revision of the real change in GDP in 2021 and were released at the same time as the final 2020 ANA, which confirmed the downward revision of 2020 (albeit lower than that suggested by the respective provisional accounts).

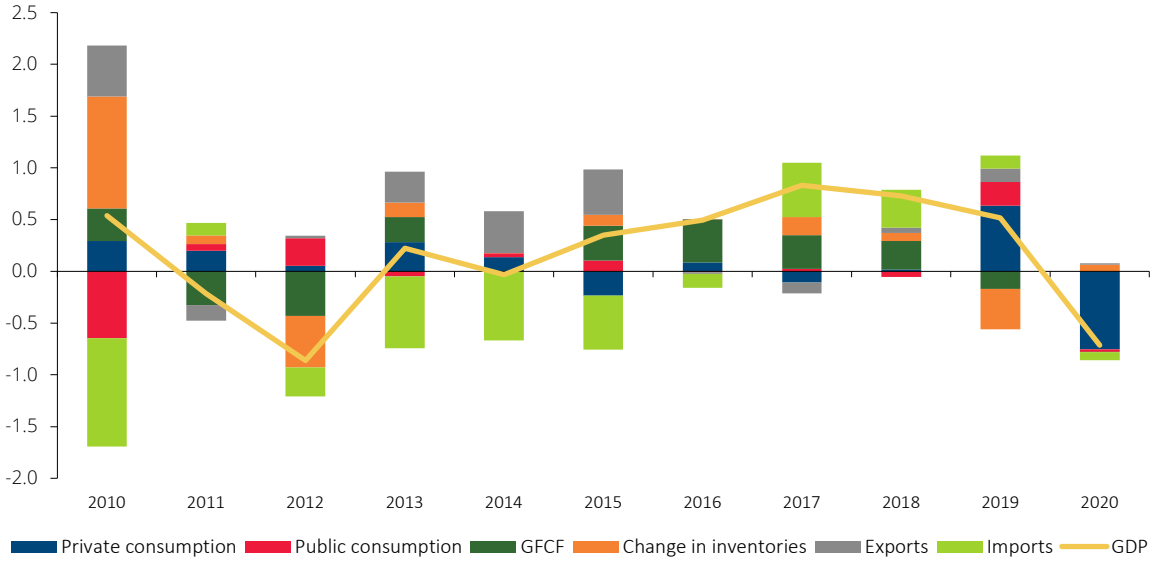


FIGURE 4: Contributions of expenditure components revisions to the annual GDP volume rates of change revisions, due to the inclusion of the final ANA, in percentage points.

In addition, it is important to see which components contributed the most to the GDP revisions due to the inclusion of the ANA. Figure 4 shows the contributions to the revisions to the annual rate of change of real GDP by expenditure components, taking into account the revision resulting from the final ANA. Naturally, the contribution to the revision takes into account both the magnitude of the revisions to each expenditure aggregate and their respective relative weight in GDP.

The year 2010 underwent revisions with significant contributions to the revision of GDP from various components, namely imports and investment, the latter mainly due to changes in inventories. According to Statistics Portugal, these more significant revisions are related to the entry into force this year of the Accounting Standardisation System, which introduced profound changes to the accounting information reported in the IES (main source of information) and, additionally, to a reassessment of external trade data using complementary administrative information. In the recession of 2011-2012, the downward revision of GDP resulted mainly from the revision of investment. In the 2013-2015 period, the GDP revision was relatively small, and the revisions to external trade variables, particularly imports, were more significant. In these years, the revisions to exports and imports were in the same direction, so the impact on GDP was mitigated. It should be noted that an upward revision in imports is reflected in a negative contribution to the revision of the change in GDP. In general, the components with the greatest contribution to the annual GDP revisions to 2018 were imports and investment which, as previously documented with quarterly data, are the most revised components. In 2019 and 2020, the revisions to private consumption made a significant contribution to the GDP revision (upwards in 2019 and downwards in 2020). The downward revision of GDP in 2020, a year particularly affected by the pandemic, is almost entirely explained by the revision of private consumption.

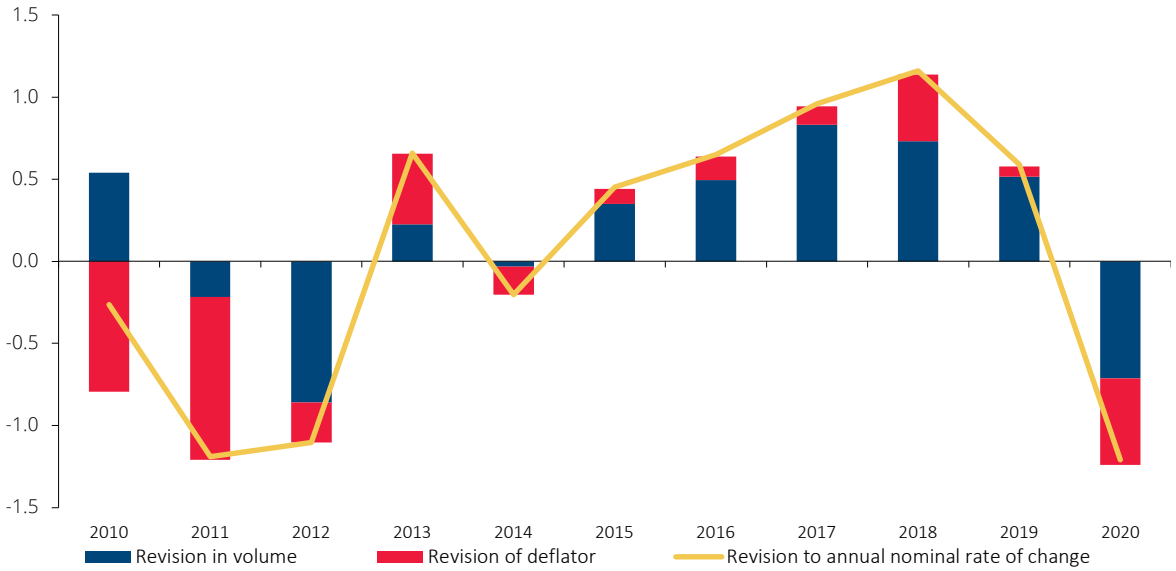


FIGURE 5: Revisions to the annual GDP rates of change, in nominal terms, volume and deflator, due to inclusion of the final ANA, in percentage points.

4.2. Revisions to the annual rates of change in nominal GDP and deflator

The inclusion of the ANA leads to revisions in the nominal rates of change, which in turn reflect re-assessments of the change in volume and/or the deflators. Figure 5 shows the revision of the annual rates of change in nominal GDP broken down into the revisions of the rates of change in volume, already discussed above, and the GDP deflator. In 2010 and 2011, the downward revision of the nominal change mainly reflects a downward revision of the deflator. Between 2015 and 2019, the revision to the nominal rate of change mainly reflects upward revisions to the real change in GDP, but also smaller revisions in the same direction to the rate of change in the deflator. The downward revision in 2020 reflects the downward revision of the volume and the deflator. Thus, the volume revisions in the period after 2015 are smaller in magnitude than the nominal revisions, since the deflator revisions in these years were in the same direction as the volume revisions.

Given that the breakdown of the revision in volume has already been analysed above, it is now interesting to see which expenditure components contribute the most to the revision of the GDP deflator. Figure 6 shows the contributions by expenditure component in the case of the revisions resulting from the inclusion of the final ANA. In general terms, it can be concluded that the components whose price evolution is most revised are external trade flows (which, as in the case of volume, are more marked in imports) and investment. In the case of private consumption, despite its high weight, it is generally not the component that contributes the most to the revision of the GDP deflator, given that the main source for compiling the private consumption deflator is the Consumer Price Index, which is not subject to revisions. Exceptionally, in 2011 there was a significant contribution from private consumption to the downward revision of the GDP deflator, which may be related to changes in the structure of consumer spending, namely an increase in the weight of rents. It should be noted that this revision

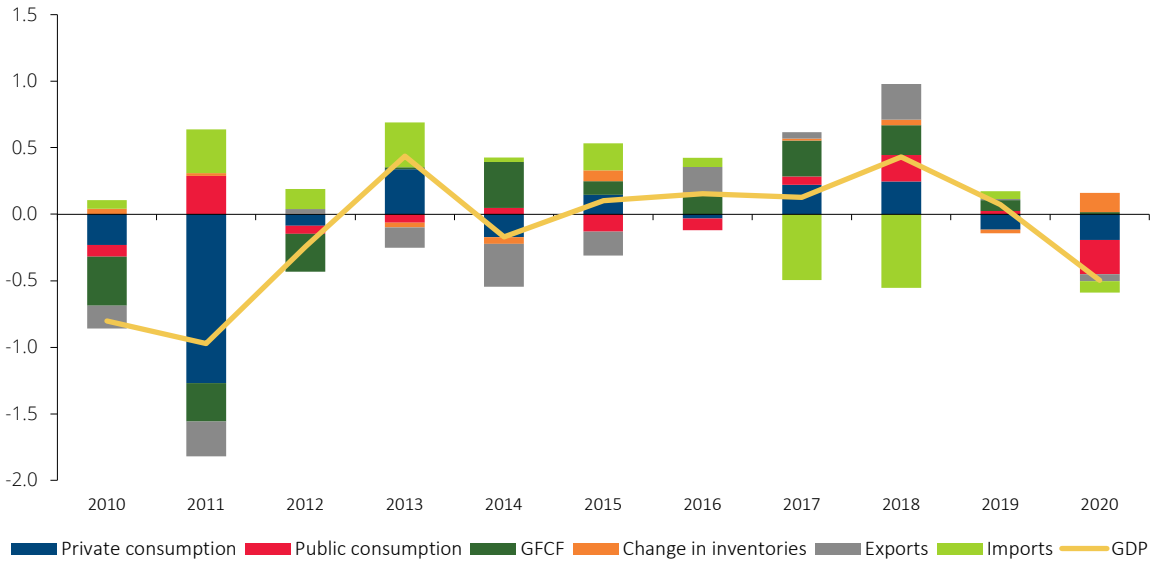


FIGURE 6: Contributions of expenditure components revisions to the annual GDP deflator rates of change revisions, due to the inclusion of final ANA, in percentage points.

incorporates the 2011 ANA, the publication of which, as already mentioned, coincides with the introduction of the ESA 2010 and the change to the 2011 base, which included new structural sources, namely the 2011 Census and the 2010-2011 Household Survey.

5. Conclusions

This article analyses the revisions to the QNA data for the main macroeconomic aggregates, with special focus on GDP. We considered real time data corresponding to the releases for the period from the first quarter of 2010 to the fourth quarter of 2022 and a set of statistical measures commonly used in the literature were computed.

The results show that the GDP flash estimate is not substantially revised at the time of the first complete QNA are released. In the releases immediately following the first estimate for each quarter, the revisions are also not significant. However, when longer revision periods are assessed, the revisions take on larger magnitudes. In particular, revisions after three years have positive and statistically significant means. In addition, the percentage of positive revisions for longer revision horizons is clearly higher than 50 percent, suggesting a downward bias in the first GDP estimates. This evidence, which is not unique to the Portuguese case, seems to indicate some conservatism of the first estimates, in the absence of more complete information relevant to the compilation of the final ANA. However, measures such as the concordance in terms of the sign and direction of the rates of change suggest a high level of information content of the first estimates, as the evolution profile does not differ significantly with revisions over time.

When comparing the first revision for real GDP for the euro area and the United States over the same period, the Portuguese QNA have a reliability slightly better than the euro area and similar to the US. However, considering revisions for longer periods

that already include information from the ANA, the revisions for Portugal are larger than those for the euro area as a whole and the United States.

In terms of the GDP components from the expenditure side, GFCF and imports have the largest revisions. However, positive and significant correlations between the revisions to imports and the other expenditure components, mitigate the impact on GDP revisions. From the supply side, it should be noted that GVA is revised more than GDP and the information by branches of activity is, in general, less reliable than that from the expenditure side.

Regarding the annual revisions that occurred after the inclusion of the final accounts for the years 2010 to 2020, it should be noted that the revisions to the real rates of change are generally positive. The profile of the revisions seems to be pro-cyclical, with negative revisions in the years in which the change in GDP was negative, except for 2013, while in the period of economic growth from 2015 to 2019, the revisions were systematically upwards. Revisions to nominal GDP are generally higher than those to real GDP. The impact on volume is partially mitigated by the existence of revisions to the GDP deflator, generally in the same direction as the nominal revisions.

It should be noted that one of the reasons for the revisions due to the final ANA results from the late arrival of quasi-census data regarding the supply side. However, since the publication of provisional ANA, the GDP of the subsequent release of QNA has presented revisions of a larger magnitude than those previously observed with the same time lag. Comparing the revisions that occurred with the release of the provisional ANA with the revisions of the final ANA, we observe that the inclusion of provisional ANA allows to anticipate the revisions of the final accounts. This result shows the importance of obtaining more complete and reliable information as early as possible, allowing any revisions to be reflected in the data in a timelier manner. Despite the natural process of revisions to which national accounts statistics are subject, the increasing use of other sources of information may also help to mitigate revisions by widening the range of information available in real time. Naturally, the continuous search for new indicators and the improvement of the statistical relationships used to compile the QNA estimates are also a way of mitigating revisions and strengthen the reliability of national accounts in real time.

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Appendix

	Mean	Mean absolute revision	Relative mean absolute revision	Standard--deviation	Noise-to--signal ratio	Proportion of positive revisions	Sign concordance	Direction concordance
First revision								
GDP	0.01	0.09	0.03	0.14	0.03	0.53	1.00	0.98
Private consumption	0.06	0.17	0.05	0.27	0.05	0.63	1.00	1.00
Durable goods	0.11	0.37	0.03	0.65	0.04	0.43	1.00	1.00
Non-durable goods and services	0.06	0.18	0.06	0.28	0.06	0.63	1.00	0.92
Public consumption	-0.01	0.39	0.21	0.64	0.25	0.57	0.96	0.84
GFCF	0.52*	0.63	0.10	0.60	0.07	0.82	0.96	0.92
GFCF machinery	1.78*	2.14	0.24	2.04	0.15	0.75	0.94	0.84
GFCF transport equipment	-0.23	1.52	0.08	2.80	0.10	0.55	0.98	0.94
GFCF construction	0.11	0.44	0.06	0.64	0.07	0.57	1.00	0.94
GFCF other	0.24	0.90	0.31	1.39	0.33	0.65	0.94	0.94
Change in inventories[(a)]	-0.02	0.12	0.31	0.19	0.32	0.49	0.88	0.88
Exports	-0.02	0.39	0.05	0.53	0.05	0.53	1.00	0.94
Goods exports	-0.02	0.38	0.06	0.49	0.06	0.53	0.96	0.94
Services exports	0.00	0.68	0.05	1.42	0.07	0.59	0.98	1.00
Imports	0.23*	0.63	0.08	0.80	0.09	0.73	1.00	0.94
Goods imports	0.31*	0.70	0.09	0.83	0.09	0.73	1.00	0.94
Services imports	-0.24	1.02	0.11	2.23	0.18	0.61	0.94	0.96
Revision three years later								
GDP	0.31*	0.57	0.19	0.56	0.11	0.75	1.00	0.90
Private consumption	0.27*	0.40	0.11	0.44	0.09	0.75	1.00	0.93
Durable goods	1.73*	2.30	0.20	2.13	0.15	0.78	1.00	0.93
Non-durable goods and services	0.13	0.44	0.15	0.58	0.13	0.55	1.00	0.80
Public consumption	0.09	1.09	0.55	1.47	0.56	0.65	0.92	0.73
GFCF	1.02*	2.13	0.33	2.20	0.26	0.73	0.95	0.93
GFCF machinery	0.34	4.91	0.56	7.02	0.53	0.63	0.87	0.73
GFCF transport equipment	-0.77	9.49	0.46	13.54	0.47	0.50	0.95	0.75
GFCF construction	0.94*	1.75	0.24	1.90	0.21	0.65	1.00	0.88
GFCF other	3.29*	3.36	0.93	2.23	0.54	0.93	0.55	0.63
Change in inventories[(a)]	0.02	0.46	1.03	0.60	1.02	0.55	0.74	0.65
Exports	0.64*	0.77	0.10	0.74	0.07	0.80	0.97	0.85
Goods exports	0.25	0.75	0.11	1.02	0.12	0.55	0.97	0.83
Services exports	1.50*	1.91	0.20	1.77	0.09	0.83	0.89	0.95
Imports	0.86*	1.39	0.19	1.46	0.16	0.83	1.00	0.85
Goods imports	0.88*	1.48	0.21	1.61	0.18	0.78	1.00	0.88
Services imports	0.77*	1.73	0.22	2.20	0.18	0.78	0.95	0.85

TABLE A.1. Descriptive statistics of revisions to year-on-year rates of change by expenditure components, in volume

Notes: [(a)] Contribution to the GDP rate of change. The measures are in percentage points with the exception of the following: relative mean absolute revision, noise-to-signal ratio, proportion of positive revisions and concordance in terms of sign and direction. In the case of mean and correlation, * corresponds to a value statistically different from zero at a significance level of 5%.

	Mean	Mean absolute revision	Relative mean absolute revision	Standard--deviation	Noise-to--signal ratio	Proportion of positive revisions	Sign concordance	Direction concordance
First revision								
GDP	-0.01	0.07	0.05	0.12	0.04	0.55	0.98	0.94
Private consumption	0.01	0.21	0.14	0.35	0.10	0.49	0.86	0.96
Durable goods	-0.07	0.62	0.11	1.10	0.13	0.47	0.94	1.00
Non-durable goods and services	0.02	0.24	0.18	0.41	0.13	0.49	0.86	0.94
Public consumption	0.03	0.19	0.17	0.30	0.23	0.55	0.98	0.98
GFCF	0.58*	0.69	0.26	0.80	0.22	0.78	0.84	0.98
GFCF machinery	2.07*	2.38	0.50	2.30	0.27	0.78	0.84	0.82
GFCF transport equipment	0.09	1.77	0.12	3.25	0.13	0.57	0.98	0.96
GFCF construction	0.06	0.70	0.23	1.33	0.40	0.59	0.92	0.92
GFCF other	0.01	0.41	0.38	0.62	0.51	0.61	0.80	0.86
Change in inventories[(a)]	0.01	0.17	0.44	0.24	0.49	0.57	0.82	0.90
Exports	-0.03	0.39	0.10	0.55	0.07	0.53	0.90	0.96
Goods exports	0.00	0.46	0.13	0.63	0.08	0.45	0.94	0.98
Services exports	-0.14	0.62	0.12	0.98	0.11	0.59	0.96	0.92
Imports	0.28*	0.57	0.16	0.75	0.12	0.73	0.96	0.92
Goods imports	0.38*	0.64	0.17	0.79	0.12	0.75	0.96	0.96
Services imports	-0.32	0.96	0.17	1.91	0.27	0.51	0.92	0.98
Revision three years later								
GDP	0.08*	0.21	0.15	0.24	0.07	0.73	0.95	0.83
Private consumption	0.07	0.46	0.28	0.61	0.18	0.60	0.89	0.80
Durable goods	0.20	2.42	0.48	3.02	0.37	0.50	0.79	0.68
Non-durable goods and services	0.05	0.54	0.37	0.66	0.22	0.50	0.74	0.73
Public consumption	0.01	0.39	0.32	0.54	0.41	0.65	0.84	0.85
GFCF	0.67*	1.66	0.67	1.99	0.56	0.68	0.89	0.75
GFCF machinery	1.57*	3.82	0.93	4.78	0.56	0.63	0.71	0.68
GFCF transport equipment	-0.54	7.89	0.59	11.18	0.44	0.55	0.89	0.85
GFCF construction	0.25	1.82	0.66	2.29	0.69	0.53	0.82	0.78
GFCF other	0.81*	1.12	0.97	1.32	1.09	0.73	0.53	0.73
Change in inventories[(a)]	-0.01	0.39	0.84	0.52	1.06	0.53	0.68	0.75
Exports	0.12	1.03	0.29	1.32	0.17	0.55	0.84	0.83
Goods exports	0.05	1.18	0.32	1.51	0.19	0.50	0.87	0.85
Services exports	0.25	1.35	0.33	1.74	0.19	0.63	0.76	0.70
Imports	0.34	1.31	0.39	1.78	0.28	0.68	0.82	0.80
Goods imports	0.42	1.57	0.45	2.21	0.34	0.68	0.82	0.80
Services imports	-0.08	1.90	0.41	2.73	0.39	0.58	0.89	0.90

TABLE A.2. Descriptive statistics of revisions to quarter-on-quarter rates of change by expenditure components, in volume

Notes: [(a)] Contribution to the GDP rate of change. The measures are in percentage points with the exception of the following: relative mean absolute revision, noise-to-signal ratio, proportion of positive revisions and concordance in terms of sign and direction. In the case of mean and correlation, * corresponds to a value statistically different from zero at a significance level of 5%.

	Mean	Mean absolute revision	Relative mean absolute revision	Standard--deviation	Noise-to--signal ratio	Proportion of positive revisions	Sign concordance	Direction concordance
First revision								
GVA	0.03	0.15	0.06	0.22	0.05	0.51	1.00	0.94
Agriculture, forestry and fishing	0.08	1.79	0.47	2.94	1.00	0.59	0.86	0.80
Industry	0.04	0.30	0.10	0.48	0.08	0.49	0.96	0.94
Energy, water supply and sewerage	-0.16	0.99	0.35	1.59	0.35	0.43	0.92	0.92
Construction	0.13	0.33	0.06	0.50	0.08	0.55	1.00	0.94
Trade, hotels and restaurants	0.13	0.26	0.05	0.66	0.07	0.63	0.98	0.94
Transportations and communications	0.07	0.49	0.13	0.91	0.14	0.59	0.98	0.90
Financial and real estate activities	-0.11	0.40	0.37	0.59	0.27	0.39	0.86	0.92
Other services	0.07	0.29	0.12	0.45	0.12	0.63	0.96	0.94
Revision three years later								
GVA	0.53*	0.76	0.31	0.71	0.16	0.78	0.97	0.85
Agriculture, forestry and fishing	0.14	3.70	1.09	4.54	1.54	0.55	0.74	0.63
Industry	1.60*	1.91	0.60	1.72	0.28	0.83	0.79	0.85
Energy, water supply and sewerage	0.80	4.56	1.38	5.44	1.21	0.63	0.50	0.50
Construction	0.15	2.77	0.47	3.50	0.54	0.48	0.89	0.83
Trade, hotels and restaurants	0.28	0.91	0.19	1.07	0.11	0.60	0.92	0.78
Transportations and communications	0.98*	2.03	0.61	2.23	0.33	0.65	0.74	0.70
Financial and real estate activities	-0.47	1.47	1.40	1.88	0.85	0.50	0.76	0.68
Other services	0.78*	1.18	0.56	1.30	0.35	0.78	0.95	0.63

TABLE A.3. Descriptive statistics of revisions to year-on-year rates of change by GVA components, in volume

Notes: The measures are in percentage points with the exception of the following: relative mean absolute revision, noise-to-signal ratio, proportion of positive revisions and concordance in terms of sign and direction. In the case of mean and correlation * corresponds to a value statistically different from zero at a significance level of 5%.

	Mean	Mean absolute revision	Relative mean absolute revision	Standard--deviation	Noise-to--signal ratio	Proportion of positive revisions	Sign concordance	Direction concordance
First revision								
GVA	-0.03	0.14	0.11	0.19	0.07	0.51	0.94	0.96
Agriculture, forestry and fishing	0.04	0.53	0.59	0.84	0.78	0.63	0.78	0.84
Industry	0.02	0.50	0.24	0.86	0.17	0.45	0.90	0.86
Energy, water supply and sewerage	-0.17	0.55	0.35	0.94	0.45	0.45	0.90	0.90
Construction	0.24*	0.48	0.17	0.81	0.32	0.67	0.96	0.90
Trade, hotels and restaurants	0.03	0.36	0.14	0.72	0.11	0.51	0.92	0.90
Transportations and communications	-0.07	0.43	0.21	0.72	0.20	0.47	0.92	0.88
Financial and real estate activities	-0.16	0.47	0.51	0.70	0.82	0.45	0.76	0.88
Other services	-0.02	0.21	0.16	0.35	0.13	0.53	0.92	0.94
Revision three years later								
GVA	0.15*	0.37	0.31	0.42	0.14	0.73	0.89	0.83
Agriculture, forestry and fishing	0.08	1.14	1.14	1.42	1.32	0.53	0.61	0.70
Industry	0.45	1.39	0.65	1.73	0.33	0.58	0.71	0.65
Energy, water supply and sewerage	0.14	1.88	1.15	2.57	1.23	0.55	0.68	0.70
Construction	0.15	1.88	0.73	2.36	0.92	0.50	0.68	0.78
Trade, hotels and restaurants	0.03	0.62	0.24	0.81	0.13	0.45	0.79	0.78
Transportations and communications	0.32	1.18	0.67	1.53	0.42	0.60	0.58	0.58
Financial and real estate activities	-0.22	0.84	1.11	1.04	1.22	0.45	0.79	0.75
Other services	0.25*	0.52	0.44	0.66	0.24	0.55	0.79	0.68

TABLE A.4. Descriptive statistics of revisions to quarter-on-quarter rates of change by GVA components, in volume

Notes: The measures are in percentage points with the exception of the following: relative mean absolute revision, noise-to-signal ratio, proportion of positive revisions and concordance in terms of sign and direction. In the case of mean and correlation * corresponds to a value statistically different from zero at a significance level of 5%.