

Assessing the efficiency of South Africa's preliminary quarterly GDP announcements

Asanda Fotoyi¹ and Ronney Ncwadi²

Abstract

Gross domestic product (GDP) of any country often influences economic decisions by policy makers, market participants and econometricians on policy recommendations, evaluation and forecasting. However these decisions are often based on preliminary data announcements by statistical agencies. It is therefore important to ensure that the preliminary GDP announcements are efficient and can be relied on.

This study focuses on South Africa's preliminary announcements of the seasonally adjusted and annualised GDP estimates at constant prices. Examining the relationship between the preliminary data and final revisions data, using an Ordinary Least Squares estimation technique, the results of this study suggests that the quarterly preliminary announcements of GDP, GDE and Final Consumption Expenditure by Households for the period 1999 to 2013 are not efficient. This implies that they contain measurement error that could be eliminated in order to become a better forecast of the final value.

Keywords: GDP, preliminary announcements, final data, revision, news and noise.

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¹Asanda Fotoyi is a MCom (Economics-Research) candidate at Nelson Mandela Metropolitan University.

²Ronney Ncwadi is an Associate Professor in the department of Economics at Nelson Mandela Metropolitan University.

1. Introduction

Macroeconomic variables, particularly GDP, often influence economic decisions and policy. However these decisions are often based on preliminary data announcements by statistical agencies. This is mainly due to the need for timely data by users. It is well known that the statistical agencies have incomplete data when they release the preliminary estimates, and that the estimates are subsequently revised as more data become available.

An important question that needs to be addressed is whether or not the preliminary GDP announcements should be relied on as efficient. Efficiency, in this case, is defined by Mckenzie, Tosetto and Fixler (2008) as ensuring that all available information at a particular time is being used in the most efficient way to compile an estimate. According to Mckenzie *et al.* (2008), Aruoba (2008) Garratt and Vahey (2006), Faust, Rogers and Wright (2005), and Baghestani (2004) having efficiently derived preliminary estimates will result in revisions that are due solely to the incorporation of new information rather than the correction of systematic measurement errors, revisions that are unpredictable using the information set at the time of the initial announcement, and an initial estimate that is an unbiased measure of the final estimate.

The study focuses on seasonally adjusted and annualised national accounts aggregates at constant prices; namely, Gross Domestic Product (GDP), Gross Domestic Expenditure (GDE), Final Consumption Expenditure by Households, Final Consumption Expenditure by General Government, Gross Fixed Capital Formation (GFCF), Exports of goods and services, Imports of goods and services, and Gross National Income (GNI).

The paper is structured as follows:

Section 2 presents literature on revisions to GDP estimates. Section 3 highlights the aims of the study. Section 4 indicates the data used. Section 5 illustrates the research methodology. Section 6 presents the results. Section 7 concludes the paper.

2. Revisions to GDP estimates

All initially published estimates of GDP and its components are subject to revisions. Ahmad, Bournot and Koechlin (2007: 6) state that this is a normal feature of any statistical compilation process that estimates values for variables whose source data gradually improves over time, where the definition of the variable is subject to change, or where methodological changes occur.

2.1 Defining revisions

Revisions are defined as any change in the value of an estimate initially published by a statistical agency (Carson, Khawaja and Morrison 2004: 5). According to Carson *et al.* (2004: 5-8), Sleeman (2005: 32-3) and Sim, de Catsro and Pascua (2009: 3-4) the change in the value of initially published GDP estimates may come as a result of the following:

- Incorporation of more comprehensive data, and/or re-estimation of the seasonal factors for seasonally-adjusted series. These are routine revisions which occur in the weeks or months shortly after the initial announcement. For example when imputed values are being replaced by actual values or seasonal factors are being updated following later observations.
- Reconciliation of quarterly and annual measures. These constitute annual revisions for example when monthly, and/or quarterly data are modified with more accurately based annual data.
- Rebasings and re-weighting of the constant price series or introduction of definitional or methodological changes. These are major revisions also referred to as comprehensive, or benchmark revisions. For example when there are major changes in statistical methods and/or changes in concepts, definitions, and classifications.

To formalise the discussion on revisions to GDP estimates, we express the revisions function as follows:

$$r_t^f = y_t^f - y_t^{t+1}$$

Where:

y_t^{t+1} = is the initial announcement of a variable that was realized at time t

y_t^f = is the final or true value of the same variable

r_t^f = is the final revision

Christoffersen (2001: 4) indicates that it is possible that the true final data for many economic series will never be available. This is because benchmark and definitional changes are ongoing and may continue into the indefinite future. However, Christoffersen (2001: 4) further states that in practice final data is defined as those revised figures available at some future point in time, which are no longer subject to revisions for example due to the addition of new information.

2.2 Informative and uninformative revisions

Depending on the reasoning and scheduling as discussed above, revisions to initially published GDP estimates are classified as either informative or uninformative revisions. Informative revisions carry informational content by reflecting the incorporation of new information which was not previously available to the statistical agency (Aruoba 2005: 8). From the previous discussion examples of informative revisions include routine revisions when imputed values are being replaced by actual values or seasonal factors being updated following later observations, and annual revisions when monthly or quarterly data are modified with more accurately based annual data. Uninformative revisions on the other hand are those revisions that are a result of changes in the definition of the variable, or statistical changes such as the change of base year or reweighting (Aruoba 2005: 8). Examples of uninformative revisions include major revisions when there are major changes in statistical methods and/or changes in concepts, definitions, and classifications. Furthermore the informational content carried by informative revisions is either news or noise.

2.3 Revisions: News or noise

Ideally revisions should be due solely to the incorporation of new information, according to McKenzie *et al.* (2008: 2) this would imply that early estimates are efficient forecasts of the later true, or final value.

Revisions to GDP estimates are categorised as news when they bring new information which becomes available for the compilation of the later estimates. According to McKenzie *et al.* (2008: 2) the incorporation of new information from the on-going flow of source data is important given that the general goal of the sequence of estimates is to approach some true value. This is also an important issue for users of the data as they would expect that revisions are adding information

to aid in their decision making processes, rather than providing random changes in previously published estimates. Mckenzie *et al.* (2008: 1) and Aruoba (2008: 327) indicate that under the news characterisation the revision is correlated with the final value but uncorrelated with the data available when the earlier estimate is made. Revisions to GDP estimates are categorised as noise when they are a result of the correction of earlier errors. Mckenzie *et al.* (2008: 2) states that when a revision to a variable contains noise it means that all or part of the revision does not contain any new information, rather the change in the estimate is due to systematic measurement errors that could arise from several factors such as biased estimates due to estimation based on non-representative samples, use of non-optimal imputation methodologies for imputing missing data. Under the noise characterization the revision is uncorrelated with the final value but correlated with the data available when the earlier estimate is made (Mckenzie *et al.* 2008: 1 and Aruoba 2008: 327).

2.4 The reliability of preliminary GDP estimates and revisions

Macroeconomic variables are universally important for decision and policy making and this requires emphasis on the reliability of the estimates. The African Charter on Statistics and the International Monetary Fund's Data Quality Assessment Framework declare that the reliability of statistical outputs is a key dimension of statistical quality.

The reliability of GDP estimates in general is affected by how national accounts aggregates are prepared and the inherent sources of error in estimates. In a given estimate there is a blending of information, for example the quarterly estimates are obtained by interpolating and extrapolating from the most recent annual estimates, and from quarterly and monthly indicators based largely on sample surveys and administrative data. Similarly, the annual estimates in many instances represent extrapolations or interpolations of information available in great detail in the censuses which are conducted every five or ten years. One source of error is that in some cases the coverage and definitions of the available data do not meet the requirements of the national accounts. Even if adjustments are made in an attempt to achieve the desired definitions, errors result. Another source of error is the sampling errors, and biases, inherent in the monthly and quarterly sample surveys used for the national quarterly estimates. The complete 'universe' counts used annually and for the benchmarks also contain biases and other non-sampling errors

(see Young 1974: 6- 10). However, notwithstanding the nature of how national aggregates are prepared and taking into consideration the inherent sources of error in estimates, statistical agencies need to ensure that all available information at a particular time is being used in the most efficient way to compile an estimate of a macroeconomic variable.

Carson and Laliberte (2002: 11), Mazzi and Cannata (2008: 5) and McKenzie *et al.* (2008: 2) indicate that the study of the information content embodied in succeeding revisions is one way to evaluate the reliability of earlier estimates. For information about the expected reliability of existing and future values the properties of the revisions process qualify the degree of confidence users may attribute to interpretations of the course of the indicator. From the perspective of producers, the properties of the revisions process may be used to monitor and better understand the characteristics of the statistical compilation process, enabling potential problems to be identified and improvements to be made.

According to Aruoba (2005: 2-3), from a statistical point of view, the final revision is expected to satisfy three properties in order to consider them 'well-behaved'. First, its mean is expected to be zero. This would imply that the initial announcement of the statistical agency is an unbiased estimate of the final value. Second, the variance of the final revision is expected to be small, compared to the variance of the final value. Finally, the final revision is expected to be unpredictable given the information set at the time of the initial announcement. When the final revision is predictable, the initial announcement of the statistical agency is not an optimal forecast of the final value. The three properties are summarized as follows:

$$P (1): E (r_t^f) = 0$$

$$P (2): \text{var} (r_t^f) \text{ small}$$

$$P (3): E (r_t^f | I_{t+1}) = 0$$

I_{t+1} , is the information set at the time of the initial announcement.

3. Aims of the study

The main aim of the study is to assess whether South Africa's preliminary quarterly GDP announcements are efficient and can be relied on.

Specific objectives are:

- To analyse the statistical properties of the final revisions (we consider whether revisions satisfy the first of the three properties listed in section 2.4)
- To establish whether the final revisions are characterised by news rather than noise.

4. The data

Statistics South Africa (Stats SA) and the South African Reserve Bank (SARB) share responsibility for the compilation of national accounts. Stats SA is responsible for compiling the production side of the national accounts, while the SARB is responsible for compiling the expenditure side of national accounts, as well as the income and savings and the balance of payments. Stats SA and the SARB co-operate closely in revising the national accounts estimates at current as well as constant prices.

The data used in the study is sourced from published copies of Stats SA quarterly GDP release and the SARB Quarterly Bulletin. The research covers the period 1999Q1 to 2013Q4, i.e. there are 60 quarterly observations. Stats SA makes the first GDP announcement for a particular quarter, about 50-60 days after the end of the relevant quarter. The SARB publishes expenditure components in the SARB Quarterly Bulletin a few weeks after, about 70-80 days after the end of the relevant quarter.

To derive the initial announcements (y_t^{t+1}), for each variable the study takes the first announced growth rate for the relevant quarter. To derive the final values (y_t^f), for each variable the study looks at the periods after which there are no more revisions except for benchmark and rebasing revisions. The growth rate final value used in the study thus includes as many revisions as possible, but avoids the inclusion of benchmark and rebasing revisions. To derive the final revisions (r_t^f), for each variable the study subtracts the growth rate final value from the first announced growth rate of the relevant quarter ($y_t^f - y_t^{t+1}$).

5. Research methodology

Two of the most important seminal work in the literature that analyse the nature of revisions are Mankiw, Runkle and Shapiro (1984) where the authors analyse whether the preliminary announcements of money stock are rational forecasts of the true, or final announcements; and Mankiw and Shapiro (1986) where the authors examine the nature (news or noise) of the revisions to GNP estimates.

This study follows the model used by Sleeman (2005), Garrant and Vahey (2006), and McKenzie *et al.* (2008) in the following functional form:

$$\text{Final Revision}_t = \beta_0 + \beta_1 \text{First}_t + \varepsilon$$

Where:

Final Revision_t: is the difference between the final value and the first announcement of the quarterly growth rate estimate.

β_0 : Constant

β_1 (First)_t: First denotes the first announcement of the quarterly growth rate estimate.

ε : Error term

Under the news characterisation it is expected that the two parameters β_0 and β_1 be jointly insignificant from zero. The following hypothesis will therefore be tested.

$$H_0: \beta_0 = \beta_1 = 0$$

$$H_1: \beta_0 \neq \beta_1 \neq 0$$

If we reject null hypothesis we conclude that final revisions are characterised by noise. If we fail to reject the null hypothesis then we conclude that final revisions are characterised by news.

6. Results

In this section the results of the study are presented.ⁱ

Table 1: *Summary statistics of final revisions*

Variable	N	Mean	Minimum	Maximum	Std. Dev	T-Stat
Gross Domestic Product	60	0.50	-0.8	6.1	1.0166	3.7719 (0.0004)
Gross Domestic Expenditure	60	0.39	-5.9	5.9	2.0972	1.4282 (0.1585)
Final Consumption Expenditure by Households	60	0.49	-1.9	3.9	1.0039	3.7935 (0.0004)
Final Consumption Expenditure by General Government	60	0.40	-5.1	9.9	2.1100	1.4562 (0.1506)
Gross Fixed Capital Formation	60	-0.12	-7.5	10.1	3.5573	-0.2686 (0.7892)
Exports of Goods and Services	60	0.73	-23.6	34.6	8.6969	0.6472 (0.5200)
Imports of Goods and Services	60	-0.27	-20.9	18.6	5.7055	-0.3688 (0.7136)
Gross National Income	60	0.46	-3.3	5.5	1.5906	2.2239 (0.0300)

ⁱAll statistical tests in this study uses 5% significance.

Note: Mckenzie 2007, Ahmad *et al.* 2007, and Sim *et al.* 2009, indicate that besides the t-test that can be performed to determine whether the mean revision is statistically different from zero which may give an insight of whether a bias exists in the earlier first estimates, another key interest of the mean revision measure lies in its sign. When this measure shows a positive sign it indicates that on average earlier first releases have been under-estimated (negative sign means overestimated). Also revisions of opposite sign will have a tendency to cancel out, thus to gauge the size of revisions, the mean absolute revision is a useful measure, because it avoids offsetting effects on the indicator from negative and positive revisions (so it is more stable than the mean revision).

In table 1, the results of the summary statistics of the final revisions for the period 1999Q1 to 2013Q4 are shown. The results of the mean final revisions in column three of the table indicate that on average quarterly preliminary announcements of GDP, GDE, final consumption expenditure by households and government, exports of goods and services, and GNI have been underestimated. The quarterly preliminary announcements of GFCF and imports of goods and services have been overestimated. The next two columns report the minimum and maximum final revisions for each variable. The range of the final revisions is quite large for exports and imports of goods and services, and is relatively small for GDP, final consumption expenditure by households, and GNI. The next column reports the standard deviation of the final revisions which measures the spread of final revisions around their mean. The last column of the table reports the probability that the mean final revision is equal to zero. A simple hypothesis was used to test the significance of the mean final revision. The figures in brackets below the estimated t-stat provide the probability that the mean is insignificantly different from zero. The results show that the mean final revisions for GDP, final consumption expenditure by households, and GNI are significantly different from zero. The mean final revision for GDE, final consumption expenditure by general government, GFCF and exports and imports of goods and services are insignificantly different from zero.

Table 2: Tests for news characterisation in the final revisions

Variable	Sample of quarters	β_0	β_1	$\Pr(\beta_0 = \beta_1 = 0)$
Gross Domestic Product	1999Q1-2013Q4	0.5567 (0.2101)	-0.0244 (0.0646)	0.001772
Gross Domestic Expenditure	1999Q1-2013Q4	0.7319 (0.3118)	-0.1050 (0.0507)	0.047129
Final Consumption Expenditure by Households	1999Q1-2013Q4	0.5704 (0.2799)*	-0.0239 (0.0618)*	0.009786
Final Consumption Expenditure by General Government	1999Q1-2013Q4	1.0952 (0.7865)*	-0.1850 (0.1207)*	0.288038
Gross Fixed Capital Formation	1999Q1-2013Q4	-0.4831 (0.7934)*	0.0615 (0.0916)*	0.787119
Exports of Goods and Services	1999Q1-2013Q4	1.3412 (1.1120)	-0.1370 (0.0578)	0.055988
Imports of Goods and Services	1999Q1-2013Q4	0.2392 (0.7542)	-0.0696 (0.0326)	0.104023
Gross National Income	1999Q1-2013Q4	0.5148 (0.2791)	-0.0193 (0.0627)	0.092309

In table 2, the results of the regression estimation are shown. The equations were estimated using Ordinary Least Squares. The estimated values of β_0 and β_1 are shown in the third and fourth columns of the table. The figures in brackets below each estimated parameter provide the standard errors. The last column of the table shows the probability that the regression coefficients are jointly insignificantly different from zero. The results indicate that we reject the null hypothesis for GDP, GDE, and final consumption expenditure by households. We fail to reject the null hypothesis for final consumption expenditure by general government, GFCF, exports and imports of goods and services, and GNI.

*Due to the existence of heteroskedasticity and autocorrelation these standard errors were adjusted using Newey-West (Newey and West, 1987) procedure.

7. Conclusions

Even though revisions in general aim to enhance the information available to users, the change to initially published data may lead to adjustment measures being made to the assessment of the performance of the economy as each revision will cause users to revise existing interpretations of the course of the GDP indicator, and hence possibly change economic forecasts and policy implications. McKenzie (2007: 4) explains that this may occur through a changed interpretation based on the revised data itself or the impact the revision may have on econometric models which may incorporate several statistics, each subject to revision. Major revisions in their nature have an extensive and larger effect. Their effects might even be disruptive, especially when they are associated with changes in statistical methods, concepts, definitions or classifications. In this case users may have to undertake extensive modifications of their databases or models.

The interpretation of the results of the study is that for the period 1999 - 2013:

The quarterly preliminary announcements for GDP, final consumption expenditure by households, and GNI are biased estimates of the final value. The quarterly preliminary announcements for GDE, final consumption expenditure by general government, GFCF, and exports and imports of goods and services are unbiased estimates of the final value.

The final revisions to the quarterly preliminary announced estimates for GDP, GDE, and final consumption expenditure by households are characterised by noise. The final revisions to the quarterly preliminary announced estimates for final consumption expenditure for general government, GFCF, exports and imports of goods and services, and GNI are characterised by news.

The study concludes that not too much confidence be attributed to interpretations of the course of the seasonally adjusted and annualised GDP, GDE, and final consumption expenditure by households, at constant prices. This indicates a lack of expected reliability of existing and future announcements of the variables. It would therefore be recommended that for short-term analysis users focus on different measures.

For those variables whose revisions are characterised by news, the size of revisions based on new information can be minimized by improving the sample size of the data sources and reporting

systems. For those variables whose revisions are characterised by noise, the measurement error contained in the preliminary announcements can be eliminated by improving the sources and methods (i.e representation and coverage of available data, imputation methods for missing data). Stats SA and the SARB are encouraged to consider these in order to improve the efficiency of the national accounts aggregates. The statistical agencies are also encouraged to conduct periodic analyses of revisions and to make these available to users. This is one of the eight practices for data revisions recommended by the Organisation for Economic Co-operation and Development (OECD). This will assist the agencies to monitor and better understand the characteristics of the statistical compilation process, enabling potential problems to be identified and improvements to be made, particularly to the quarterly GDP, GDE, final consumption expenditure by households, and GNI national accounts aggregates.

References

African Charter on Statistics. Available online at:

http://www.au.int/en/sites/default/files/AFRICAN_CHARTER_ON_STATISTICS.pdf

Ahmad, N., Bournot, S. and Koechlin, F. (2007). Revisions to Quarterly GDP Estimates: A Comparative Analysis for Seven Large OECD Countries. Available online at:

<http://www.oecd.org/dataoecd/20/26/34350524.pdf>

Aruoba, S.B . (2008). Data Revisions Are Not Well Behaved. *Journal of Money, Credit and Banking*, Vol. 40.

Aruoba, S.B. (2005). Data Revisions Are Not Well Behaved. Available online at:

<http://www.econ.ku.dk/epru/files/wp/WEB-blaa-2001-15.pdf>.

Baghestani, H. (2004). Are Preliminary Data of Output Growth and Inflation Reliable Predictors? *The Journal of Applied Business Research*, Vol. 20 (3).

Carson, C.S. and Laliberte, L. (2002). Assessing Accuracy and Reliability: A Note Based on Approaches Used in National Accounts and Balance of Payments Statistics. *IMF Working Paper*, No. 02/24.

Carson, C.S., Khawaja, S. and Morrison, T.K. (2004). Revisions Policy for Official Statistics: A Matter of Governance. Available online at:

<http://www.imf.org/external/pubs/ft/wp/2004/wp0487.pdf>

Christoffersen, P., Ghysels, E., and Swanson, N. (2001). Let's Get Real About Using Economic Data. Available at: <http://www.econ.ku.dk/epru/files/wp/WEB-blaa-2001-15.pdf>

Faust, J., Rogers, J.H. and Wright, J.H. (2005). News and Noise in G-7 GDP Announcements. *Journal of Money, Credit and Banking*, Vol. 37 (3). Pp 403-417.

Garratt, A and Vahey, S. (2006). UK Real-Time Macro Data Characteristics. *Economic Journal*, Vol. 116 (509).

International Monetary Fund. (2012). Data Quality Assessment Framework (DQAF) for National Accounts Statistics. Available online at: <http://dsbb.imf.org/Pages/DQRS/DQAF.aspx>

Mankiw, N and M. Shapiro. (1986). News or Noise? An Analysis of GNP Revisions. *NBER Working Paper Series*, No.1939.

Mankiw, N., Runkle, D and Shapiro, M. (1984). Are Preliminary Announcements of the Money Stock Rational Forecasts? *Journal of Monetary Economics*, Vol. 14 (1).

- Mazzi, G. L and Cannata, R. R. (2008). A Proposal for a Revisions Policy of Principal European Economic Indicators (PEEIs).
- McKenzie, R. (2007). Relative Size and Predictability of Revisions to GDP, Industrial Production and Retail Trade: A Comparative Analysis across OECD Member Countries. Available online at: <http://www.cirano.qc.ca/fin/Real-timeData/2007/McKenzie.pdf>
- McKenzie, R., Tosetto, E. and Fixler, D. (2008). Assessing the Efficiency of Early Release Estimates of Economic Statistics. Available online at: <http://www.oecd.org/std/na/41344203.pdf>
- Newey, W and West, K. (1987). A simple positive semidefinite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. *Econometrica*, Vol. 55 (3).
- Organisation for Economic Co-operation and Development. (2007). Data and Metadata Reporting and Presentation Handbook. Available online at: <http://www.oecd.org/std/37671574.pdf>
- Sim, B., de Castro, M., and Pascua, M. (2009). An Analysis of Revisions to Annual GDP Estimates of Six ADB Regional Members. Available online at: <http://www.adb.org/publications/analysis-revisions-annual-gdp-estimates-six-adb-regional-members>.
- Sleeman, C. 2005. Analysis of Revisions to Quarterly GDP: A Real-Time Database. *Reserve Bank of New Zealand Bulletin*, Vol. 69(1).Pp. 31-44.
- Young, A.H. (1974). Reliability of the Quarterly National Income and Product Accounts of the United States (1947-71). *U.S. Department of Commerce, Social and Economic Statistics Administration: Bureau of Economic Analysis*.