METHODOLOGY

FOR COMPILING QUARTERLY MACROECONOMIC AGGREGATES FOR THE REGIONAL ECONOMIC COMMUNITIES AND THE AFRICAN UNION

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# **ACRONYM AND ABBREVIATIONS**

AfCFTA	African Continental Free Trade Area
QNA	Quarterly National Accounts
AFRISTAT	Economic and Statistical Observatory of Sub-Saharan Africa
AUC	African Union Commission
AU	African Union
AfDB	African Development Bank
UNECA	United Nations Economic Commission for Africa
GDP	Gross Domestic Product
AFRITAC	IMF's Regional Technical Assistance Center for Africa
CVS	Correction of Seasonal Variations (CVS)
EU	European Union
REC	Regional economic community
SNA 1993	System of National Accounts of 1993
SNA 2008	System of National Accounts of 2008
IMF	International Monetary Fund
MS	Member State
PAS	Pan African Statistics Programme

#### INTRODUCTION

The African Union Assembly of Heads of State and Government celebrated in May 2013, the establishment of the Organization of African Unity / African Union. During this celebration, African leaders adopted the Development Agenda for Africa for the next 50 years, referred to as "Agenda 2063". One of the flagship programs of Agenda 2063 is the establishment of the African Continental Free Trade Area (AfCFTA). The African Union summit, which was held from March 17 to 21, 2018 in Kigali, Rwanda, resulted in the signing of the agreement providing for the establishment of the Continental Free Trade Area (AfCFTA) entered into force on May 30, 2019. On July 7, 2019, the Assembly of Heads of State and Government of the African Union officially launched the African Continental Free Trade Area (AfCFTA).

For better monitoring and evaluation of the implementation of this agreement, it is necessary to have reliable, accurate, and high-quality statistical data. This requires strengthening the capacities of national statistical systems.

One of the key statistics for monitoring and evaluation for AfCFTA is quality national accounts aggregates, including quarterly national accounts. According to the IMF Manual (2001), Quarterly National Accounts (QNA) constitute a system of integrated quarterly time series built on an accounting framework. Its compilation requires a minimum set of short-term statistics, in particular the industrial production index, the turnover index, etc.

QNA4s essential role in economic life was quickly understood by the United States, which published the first quarterly aggregates in 1940 using the direct method. They were followed by Norway, the United Kingdom, and France during the 1960s, and at a later stage by other countries in the world.

Since 2000, the Pan-African organizations (AUC, AfDB, ACBF, and UNECA), the Economic and Statistical Observatory of Sub-Saharan Africa (AFRISTAT), and the five regional technical assistance centers of the International Monetary Fund (AFRITACs) have been supporting African countries in producing quarterly national accounts and short-term indicators.

Many African countries have embarked on the production of national accounts thanks to the political will and the commitment of the various actors of the national statistical systems. Up to 2011, only four countries were compiling and disseminating quarterly national accounts— Egypt, Tunisia, Morocco, and South Africa. They were followed by Seychelles, Mauritius, Nigeria, Ghana, Kenya, Senegal, Cameroon, Burkina Faso, and Côte d'Ivoire. Currently, 28 African countries regularly compile quarterly national accounts with the support of development partners.

The significant efforts made in recent years by African Union member states in compiling quarterly national accounts made it possible to estimate quarterly Gross Domestic Product (GDP) at the RECs and the continental levels, by proper aggregation. These supra-national quarterly accounts are useful for short-term decision-making.

This document presents a technical framework for estimating the quarterly GDP of the African Union using a pragmatic approach. It is made up of five chapters: the first chapter provides a general presentation on what quarterly national accounts are. The second sets out the theory of the temporal disaggregation of national accounts at the regional or continental level. The third chapter provides the state of the art of national accounts in African countries. Chapter four deals with allocation of the annual continental GDP to the 4 quarters ("quarterization").The last chapter is focused on revision policies and dissemination of the planned continental quarterly GDP.

# CHAPTER I: PURPOSE OF THE QUARTERLY NATIONAL ACCOUNTS<sup>1</sup>

Quarterly national accounts (QNA) constitute a coherent set of indicators available at short notice and providing recent information on economic activities. The current chapter presents the purpose and use of quarterly national accounts as well as approaches to allocate annual accounts figures to the 4 quarters.

#### I-1 THE PURPOSE OF QUARTERLY NATIONAL ACCOUNTS

The main purpose of QNA is to provide more recent infra-annual information than annual national accounts and more consistent and complete than individual short-term indicators. QNA allow an analysis of the economic dynamic, particularly, leads and lags.

**Box 1**: Understanding the quarterly GDP purpose at continental or REC levels.

The objective of quarterly accounts at continental (AU) or REC level is based on the desire to have a short-term economic analysis tool to inform decision-making. In particular, this means having the aggregate quarterly growth rates of the RECs or the AU within 100 to 120 days after the end of the quarter.

The goal is therefore not to have quarterly growth rates for each member country of the AU or the REC. The information that such an indicator can provide to decision-makers and actors of the regional economy represents a contribution to short-term decision support. Quarterly GDP is used for economic anticipation and allows companies and all decision-makers to take measures adapted to the economic situation and its evolution. It should allow the RECs in the region to anticipate their reaction according to the evolution of economic activity.

In this context, the levels of the GDP of the AU or of the RECs are given by the annual national accounts (ANA) while the quarterly accounts (QA) are used to determine the quarterly changes in economic activity.

#### I-1-1 Allocation of annual accounts of the past to the quarters

This exercise involves breaking down the annual national accounts aggregates and to allocate them to the 4 quarters<sup>2</sup>, using a set of indicators. The indicators choice is crucial and implies making a better choice among an infinite number of combinations of quarterly accounts whose sum respects the annual level. So:

Quarterly accounts = Function (quarterly Indicators)  $SC \sum Quarterly accounts = Annual account$ 

The constraint can, of course, be lifted by dividing the annual accounts by four, to derive the quarterly accounts. But, as the objective of QNA is to trace the infra-annual movements of the aggregates (production, value-added, etc.), this method is not satisfactory as it does not single out each quarter. For example, in some African countries, agricultural production is generally higher in the fourth quarter compared to those of the previous three quarters of the year.

#### I-1-2 Provide a quick overview of the recent macroeconomic development

Over a year, many economic indicators can provide information on the recent economic situation. Their compilation in the form of quarterly accounts makes it possible to synthesize

<sup>&</sup>lt;sup>1</sup> INSEE - Methodology of quarterly accounts, INSEE Methods n ° 108 Jérôme Fabre and Catherine Prost

<sup>&</sup>lt;sup>2</sup> This method is sometimes used for very small annual aggregates

them in a coherent accounting framework and to estimate standard macroeconomic aggregates (GDP for example) every quarter and release them 2 to 3 months after the quarter under review.

Quarterly GDP is widely used by researchers, economists, modelers, policymakers, and the media as the main synthetic indicator that provides relevant information on the current and very short-term economic situation.

## I-1-3 To provide first estimates of the economic growth

The four quarterly accounts, of a given year, provide first estimates of annual GDP and its main aggregates. This allows maintaining consistency of quarterly accounts vis-à-vis the annual ones. For example, in the United States and Canada, annual accounts are obtained by aggregating quarterly accounts. In countries where quarterly and annual accounts are compiled separately, reconciliation of quarterly with annual accounts is met in different ways. In France, for example, quarterly accounts publication calendar was different from the one of annual accounts, so the quarterly accounts appear as "quick estimates" of the annual ones. Because reconciliations are made between the two sets of accounts, discrepancies can be explained.

## I-2 USE OF QUARTERLY NATIONAL ACCOUNTS

## I-2-1 Quarterly accounts and cyclical analysis

Quarterly accounts are at the heart of economic analysis. They allow identification and a better understanding of turning points (inflections) in the economy. By contrast, individual economic indicators are many and sometimes difficult to interpret. Besides, individual indicators related to the same subject may differ in their scope, data sources, etc.

Also, while the conceptual framework of national accounts is essential for producing highquality macroeconomic and budgetary forecasts, their periodicity, generally the year, may prove to be too long. For this reason, sub-annual aggregates as the quarterly national accounts are essential for monitoring recent developments in the economy.

#### I-2-2 Quarterly national accounts and macroeconomic studies

Quarterly national accounts provide inputs for macroeconomic and economic cycles' analysis: investment, production, productivity and employment, prices and wages, income and consumption, etc. For example, a long series of quarterly national accounts allows a more accurate analysis of the dynamics of the economy. Also, stylized facts about economics can be analyzed by measuring correlations between the main macroeconomic aggregates such as gross fixed capital formation, production, imports, exports, etc.

#### I-2-3 Dissemination calendar and revision of quarterly national accounts

According to the IMF's Special Data Dissemination Standard (SDDS), detailed QNA results should be available no later than 90 days after the end of the quarter. However, this deadline can be shortened when the timeline for producing the required indicators for QNA shortened.

QNAs are based on estimation methods that seek to fill the gaps in the information to anticipate as well as possible future annual accounts. As a result, quarterly national accounts result from a trade-off between timeliness and quality. Consequently, revisions of quarterly accounts are inevitable, in particular, due to:

- a change in the economic indicator: the indicators are often revised, especially over the past few months or quarters, as more information becomes available;
- a modification of the annual accounts: the quarterly accounts incorporate the new data from the annual accounts when the first results for the first quarter of year N are published;
- a methodological change: this is often a change of indicator, linked either to the disappearance of a data source or to the adoption of a new indicator considered to be better than the old one;
- a change of base year: the national accounts regularly carry out "rebasing", which leads to rebuilding all of the quarterly accounts. Substantial changes are therefore added on top of usual revisions relating to the final and semi-final accounts: changes in nomenclature, concepts, and methods.

## I-3 METHODS OF ALLOCATION OF ANNUAL ACCOUNTS TO THE QUARTERS

Quarterly national accounts methods are two folds: the direct procedures and the indirect ones. The direct ones require each quarter, the same data sources (subject to some simplifications) as those used for annual accounts compilation.

Indirect procedures consist of splitting annual national accounts into quarterly figures using mathematical or statistical techniques. Reference indicators may be used for extrapolation of the current year quarterly accounts.

Indirect procedures are widely used in Africa. They are subdivided into two main groups: numerical methods and statistical ones (Bloem et al., 2001).

## I-3-1 Numerical methods

Numerical methods consist of deriving quarterly series that are consistent with the annual aggregates, and, at the same time, preserve the short-term movements of quarterly economic indicators. These methods include the set of least-squares-based methods developed by Denton (1971) et al., Bassie's method, and the one of Ginsburgh (1973). They are more suited to the context of less developed statistical systems. Appendix 1 provides details of Denton's method.

#### I-3-2 Statistical methods

The modeling approach includes the methods based on ARIMA models proposed by Hillmer and Trabelsi (1987), the state-measurement models proposed by Durbin and Quenneville (1997), and a set of regression models proposed by various experts from Statistics Canada. Besides, Chow and Lin (1971) proposed a multivariable generalized least squares regression method for interpolation, distribution, and extrapolation of time series. It is a one-step method that performs both calibrating and benchmarking and reconciliation. Methods based on econometrics are often data intensive. However, they have the advantage of better taking into account the autocorrelation structure of errors, and thus, improve the estimate of the current year.

In general, the procedure used to compile the quarterly accounts is the "benchmarkingreconciliation" method. Several other methods are available depending on statistical refinement or the number of steps (one or two). Annex 2 presents the details on benchmarkingreconciliation.

# CHAPTER II: THEORY OF TEMPORAL DISAGGREGATION OF ANNUAL AND QUARTERLY ACCOUNTS AT THE REGIONAL OR CONTINENTAL LEVELS

The compilation of accounts for supranational entities such as the African Union (AU), the European Union (EU), regional economic communities (RECs), etc. shall follow the same set of internationally agreed definitions and rules that apply to any country. These principles are set out in the System of National Accounts (1993 SNA or 2008 SNA). However, data sources are quite different: Member States' national accounts are compiled using a wide range of data sources such as administrative data from tax authorities and social insurance schemes, enterprises and household censuses and surveys. In contrast, the AU accounts is to be compiled from Member States accounts, without direct reference to national raw data. This chapter<sup>3</sup> provides information on the compilation of the main aggregates of accounts such as GDP, investment, or final consumption for the RECs and the AU. It does not cover specific accounts such as public accounts, sector accounts, or input-output tables.

## **II.1 METHODOLOGY OF ANNUAL ACCOUNTS COMPILATION IN AFRICA**

## II.1.1 General issues

The AU's annual accounts are the results of the aggregation of its 55 member states' national ones. Aggregation methods depend on the variable concerned: summation of member states figures for series in value, and the weighted average for growth rates and index series. By default, the AU aggregates are derived by summing national series, without consolidating flows between member states. Other series such as growth rates, indices, and ratios are derived from values or volume rather than direct aggregation of national growth rates, indices, and ratios. This requires fulfilling the following two conditions.

## • First, full coverage of member states

AU member states shall send their national accounts data to the AU within a deadline set by the Commission. Missing data (the last year of the accounts in most cases) will be filled by the AU internal estimates. These estimates can be based on forecasts made by the country or international organizations (AfDB, IMF, World Bank).

# • The second condition requires member states to express their figures in a common currency

To address this issue, the AU decided to convert all data in local currency to the United States (US) dollars before aggregation. Exchange rates used are annual averages of the reference period from the International Financial Statistics published on the IMF website<sup>4</sup>:

- For data expressed at current prices, current year exchange rates apply.

<sup>&</sup>lt;sup>3</sup> This chapter is based on the methodology for preparing the annual and quarterly national accounts of the European Union and the Euro zone.

<sup>&</sup>lt;sup>4</sup> <u>https://data.imf.org/?sk=4C514D48-B6BA-49ED-8AB9-52B0C1A0179B&sId=1390030341854</u>

- For data expressed at the previous year's prices, the exchange rates of the previous year are used.

These two conditions being met, the compilation of the AU accounts is only a sum of the Member States figures expressed in US dollars. So, there is no need to assign explicit weights to the Member States. Their weight will be implicitly fixed by the level of their series of national accounts and will simply be their share in the total. At current prices, the weights will, therefore, be different between variables and between years.

#### Box 2: Brief literature review on annual national accounts compilation at the supranational level

**The United Nations Statistics Division (UNSD, 2019)** requests countries and regions to annually provide through National Accounts Questionnaire (UN-NAQ), their latest available national accounts estimates. They are also requested in the same vein, to indicate how the scope and coverage of these data differ from the definitions and classifications recommended by the 1993 SNA or 2008 SNA. Total GDP and GDP per capita are converted into US dollars using appropriate annual monthly means or annual averages of the exchange rates at the end of the month. As a rule, the market exchange rates used are taken from the International Financial Statistics of the International Monetary Fund (IMF).

However, national accounts aggregates expressed in US dollars should be used with caution as the data can be distorted by exchange rate fluctuations and domestic inflation movements. This is because changes in a country's exchange rate between two periods reflect changes in domestic prices relative to changes in prices in the United States. To minimize these distortions, the data is assessed (numerical analysis and visual assessment of graphs) to identify countries for which changes in total GDP and GDP per capita converted to US dollars are not consistent with the economic developments of the country.

After compiling all data in the national currency, constant price data is converted to 2015 prices and then converted to US dollars using 2015 exchange rates.

Regional aggregates are defined as the sum of the data in USD for the countries, areas, and territories within the regional grouping. Growth rates and implicit price deflators are calculated from regional aggregates and not as an average of country-level growth rates or implicit price deflators.

Eurostat (2016) aggregates the annual series at the national level by summation, without consolidating flows between the Member States. Other series such as growth rates, indices, and ratios are by-products of levels rather than direct aggregations of national growth rates, indices, and ratios. Exchange rates are provided by the European Central Bank (ECB). The exchange rates used are annual averages of the reference period. For chain-linked data, the base year exchange rates apply to the whole series. For data at the prices of the previous year, the exchange rates of the previous year apply.

It should also be noted that to date, no consolidation of flows between the Member States is carried out at the EU level. In particular, this means that exports and imports of the EU (or the Eurozone) includes flows within the EU (or the Eurozone). However, the external balance is not affected, because the unconsolidated flows of exports and imports cancel each other out in the balance.

AU aggregates shall meet some consistency requirements:

 geographical consistency refers to the consistency of the data of a geographic aggregate with the data of its components. Consistency requirement depends on the variable; AU total should be equal to the sum of its Member States figures;  accounting consistency refers to some equations relating some variables. The most important of them is the GDP by expenditure components: GDP = consumption + investment + exports - imports.

Accounting consistency of this kind is not necessarily ensured by summing data from the Member States. It is therefore applied to the annual accounts of the AU at current prices and at the previous year's prices. However, for chained volume series, they are, by definition, not additive and are only consistent for the base year and the subsequent year. Enforcing consistency depends on each equation; discrepancies are either added to one of the variables of the equation or proportionally distributed among them.

It should also be noted that no consolidation of flows between the Member States is done when compiling AU aggregates. This means in particular that exports and imports data for the AU (or the RECs) includes the flows within the AU (or the RECs). However, the external balance is not affected, because the unconsolidated flows of exports and imports cancel each other out.

#### II.1.2 Volume measure of annual accounts

The compilation of the annual accounts of the AU expressed at current prices is done by a simple summation of Member States figures expressed in a common currency (in US dollars).

#### II.1.3 Volume measure of annual accounts

Aggregating volume data is much more complicated than aggregating value data. Calculating an aggregate in volume involves the weighting of its components by their price. Two choices are possible:

- Calculation of volumes at constant prices for the base year: volume at the prices of a fixed year "constant volumes";
- Calculation of volumes at the prices of the previous year: For a year N, the elementary aggregates are weighted by their most recent relative price in year N-1.

According to the 2008 SNA, Paragraph 15.112: "To calculate a set of additive supply and use tables in volume, the appropriate way to proceed is first to express the table in the prices of the previous year"

This choice could be justified by the two major advantages of volume estimates at the prices of the previous year (before chaining) in the resources and uses balances (RUB):

- preservation of accounting equality at the aggregate level;
- a more up-to-date description of the economic situation.

Analysis of annual accounts mainly consists of presenting changes in aggregates in the form of linked data for a reference year. This reference year is for many countries the base year of the annual accounts. This is done using the data series at current prices and the prices of the previous year. With chain-linking, there is often a loss of additivity for all years except the base

year and the subsequent one. Therefore, there is a loss of the accounting identity in summing the chain-linked data from member states to get the chained AU accounts. For better coverage, the annual accounts of the AU are calculated by aggregating the accounts at the prices of the previous year of the member countries, then chain-linked without recourse to member states chain-linked data.

For countries that produce accounts at constant prices (of a fixed base year<sup>5</sup>), reconciliation is performed to convert data at constant prices to data at prices of the previous year. This reconciliation uses data at constant prices (**DCONST**) and data at current prices (**DCOURT**) according to the following formula:

**DPRED** (t) = **DCOURT** (t-1) / **DCONST** (t-1) \* **DCONST** (t) = DCOURT(t-1) \* annual growth rate (t)

With DPRED: data at prices of the previous year and t the current year.

The loss of additivity also complicates the calculation of the aggregate at the higher levels. For example, the series of chained volumes of domestic demand, defined as the sum of consumption expenditure and gross capital formation, cannot be simply obtained as the sum of the chained series of these two components. Instead, the values at the previous year's prices should be summed up before being chained. For countries whose annual national accounts data are published directly at the previous year's chained prices, the AU proceeds as follows:

- send a request to the countries concerned to obtain their data at the prices of the previous year; or
- consider their chain-linked data as data at constant prices and proceed as described above.

# II.2 METHODOLOGY OF QUARTERLY ACCOUNTS (QNA) IN AFRICA

#### II.2.1 General issues in the quarterly accounts

Twenty-eight (28) out of the fifty-five (55) AU member states compile Quarterly National Accounts (QNA). Therefore, the quarterly accounts of the AU will be incomplete if derived from aggregating the quarterly national accounts of only 28 countries.

These 28 countries have a coverage rate of around 85%<sup>6</sup> of the total GDP of AU member states, and an aggregation of their QNA figures serves as a quarterly indicator to construct the quarterly GDP of the AU. However, the aggregation of quarterly data is much more complicated than that of annual data for four reasons: (i) differences between the quarterly national accounts systems of AU member states, (ii) different quarterly coverage and delays in releasing QNA, (iii) seasonal adjustment procedures; and (iv) revision policies.

<sup>&</sup>lt;sup>5</sup> Most English speaking countries in Africa compile their annual accounts at fixed base year prices.

<sup>&</sup>lt;sup>6</sup> Table 1 in appendix presents the list of these countries and the coverage rate.

The main reason for deriving quarterly national accounts benchmarked to AU annual accounts is the high demand for short-term aggregates for timely business analysis. The business cycle analysis requires quarterly results much earlier than the annual data. Another reason is that quarterly accounts are consistency with annual accounts. Quarterly accounts should be both consistent with annual accounts (e.g. the sum of quarterly GDP values should equal the annual GDP value) and respect accounting identities (e.g. the sum of the quarterly GDP expenditure components should equal to the sum of the quarterly values of the GDP).

#### Box 3: Brief review of the literature on quarterly national accounts at the supranational level

According to Eurostat (2016), information available for estimating the EU quarterly accounts are a) the annual totals figures of all the EU member states and b) the quarterly of the Member States for which data are available. The share of the latter in the total depends on the time of the estimates and the variable for which the estimate is made. In practice, for the GDP, this share is between 75 and 99 percent.

The basic principle is to decompose the full annual aggregate known for the EU into quarterly figures using the sum of only partially available quarterly country data as an indicator. This approach is known as timeseries disaggregation. A Member State for which no quarterly data is included will always influence the quarterly European aggregate because its annual values enter the model.

It can be argued that small Member States tend to have higher growth rates and publish quarterly accounts data later and less complete than large Member States, thus, the quarterly indicator would be biased towards too low growth. However, this is not verified. This situation will not result in a bias in the EU estimates, as the binding annual data always contains all Member States and the estimated regression parameters will take this effect into account.

The summation of national values in the set of indicators requires that they are expressed in a common currency, namely ECU / Euro as for the annual aggregates. For estimates at current prices, quarterly exchange rates are used. For chained volumes, the average exchange rate of the base year applies to the whole series. For data at the prices of the previous year, the average exchange rates of the previous year apply.

Eurostat compiles the quarterly volume estimate by disaggregating the annual series at the prices of the previous year, COPPY according to the indicator at the prices of the previous year, COPPY. The resulting estimates at the previous year's prices are then chained (using the annual overlap technique) to derive quarterly chained-linked volume series (CLV). Performing a time disaggregation on COPPY series has the drawback of applying a technique dedicated to time series on data that does not constitute a true time series. Eurostat, therefore, produced second estimates in parallel by disaggregating the annual series using the quarterly CLV indicator. It should also be noted that neither the annual European CLV nor the quarterly can be directly derived from the national CLV because of their lack of additivity. Since the two estimates give very similar results, Eurostat chose to estimate COPPY first and then derive the CLV by chaining, as this gives a fully consistent set of estimates. On the other hand, estimating the CLV series first would require substantial additional work to achieve consistency.

As in the annual case, the quarterly chained volumes are not additive, but the quarterly COPPY series are. Customized aggregations must, therefore, be constructed separately from the sum of the COPPY series and their chaining. As in the annual case, changes in stocks and the external balance (and any other variable that can take negative and positive values) cannot be linked in a chain. For these, the only expression of volume available is at the prices of the previous year.

Currently, the seasonal adjustment or correction of seasonal variations of the African series can be done by applying adjustment techniques to unadjusted series of the Member States that do not compile seasonal adjusted QNA.

#### II.2.2 Quarterly estimation method

Available information for the estimation of the AU quarterly accounts is:

- (i) annual accounts of member states (described above);
- (ii) available quarterly figures from the member states.

The basic estimation principle is to decompose the AU annual aggregate into quarterly figures using the available quarterly data provided by countries (the sum or other appropriate aggregations) as an indicator. This approach is known as time series disaggregation. In practice, this involves two steps:

- 1) For a given variable, for example, GDP, a quarterly indicator is constructed by synthesizing Member States quarterly accounts data. By default, no explicit estimation is made for the missing values of the Member States in the construction of the set of quarterly indicators;
- 2) The annual value of the variable is broken down into quarterly series that preserve the quarterly movements of the indicator with the sum of the four quarters equals to the annual value. This is done by applying the Denton method.

The summation of national values be the annual aggregates or for deriving the set of indicators requires them to be expressed in a common currency, namely the US dollar. For series at current prices, quarterly exchange rates are used. For data at prices of the previous year, the average exchange rates of the previous year apply.

There is no weight assigned to each country in the estimation of African totals. The weights are implicitly derived during the estimation process and vary among variables. They will largely coincide with each country's share of the annual total. However, it should be noted that the movement of the indicators for the last quarter will largely depend on the available quarterly figures at the time of the estimation of the AU figures. As a result, countries that provide their quarterly data on time influence the estimate of the last quarter's figures.

#### II.2.3 Quarterly national accounts measure in value

Quarterly national accounts at current prices are obtained using Denton's proportional method applied to the corresponding annual and quarterly aggregates as described above.

#### II.2.4 Quarterly national accounts volume measure

Quarterly volume indicators are based on quarterly data from member states at the previous year's prices and not on chained prices, as only the previous year's prices are additive.

Deriving quarterly indicators is a little bit tricky due to the differences in AU member states' quarterly accounts price systems. Thus, the quarterly indicators are obtained in four steps:

1) For a country where quarterly data at the previous year's prices (**DPRED**) are not available and the chained volume series (**DVLCH**) is, the data at the previous year's prices are calculated as follows:

**DPRED** (t, j) = **DVLCH** (t, j) \* annual deflator (t-1)

With t representing the year and j the quarter

Deflator index (t) = **DCOURT** (t) / **DVLCH** (t).

- 2) For a given country where no **DPRED** or **DVLCH** series are available, but only constant price series (DCONST) are, the **DCONST** series is considered as a **DVLCH** series and the chaining reversed as indicated in point 1.
- 3) The final indicator at the previous year's prices is obtained by aggregating the data at the previous year's prices from all member states producing quarterly accounts.
- 4) The quarterly overlap technique or annual overlap can, therefore, be used for the compilation of a chained volume indicator for a chosen reference year. The AU opted for the annual overlap technique as the annual sum of the four quarters of aggregate gives the annual aggregate. This technique is briefly presented in the box below.

Box 4: The Annual Overlap (AO) Technique (IMF Manual 2017 chapter 8, page 185)

The AO technique requires quarterly volume measures at previous year's prices and annual current price data. It consists of the following three steps:

**Step 1**: The volume index for a given quarter is equal to the volume for the quarter measured at the average price of the previous year divided by the quarter average price of the previous year. In mathematical terms:

$$q^{t-1\to(s,y)} = \frac{k^{t-1\to(s,y)}}{C^{y-1}/4}$$

for y=2,3,... and s=1,...,4

where:

 $k^{t-1 \rightarrow (s,y)}$  is the volume measure in quarter s of year y at the prices of the previous year and C<sup>y-1</sup> is the current price data for year y-1

Step 2: Chain-linked the quarterly volume indices using annual overlaps

 $q^{1 \to (s,y)} = Q^{1 \to 2} * Q^{2 \to 3} * \dots * Q^{t-1 \to t} * \dots * Q^{y-2 \to y-1} * q^{y-1 \to (s,y)} * 100$ 

where:  $Q^{t-1 \rightarrow t} = \frac{K^{t-1 \rightarrow t}}{C^{t-1}}$  are the annual links (i.e., the annual growth rates),

 $K^{t-1 \rightarrow t}$  is the volume measure of year t at the prices of the previous year t-1,

et  $C^{y-1}$  is the current price data for year y -1.

Step 3: Re-reference the quarterly chain series to a chosen year

By construction, the reference year of the quarterly chain indices  $q^1 \rightarrow (s, y)$  is year 1.

It is possible to re-reference the chain series to any other year, denoted by r, by dividing the chain series with the corresponding annual chain index: that is,

$$Pq^{r\to(s,y)} = \frac{q^{1\to(s,y)}}{q^{1\to r}}$$

where :  $Q^{1 \to r} = Q^{1 \to 2} * Q^{2 \to 3} * ... * Q^{r-1 \to r}$  is the annual chain index for year r

 $K^{t-1 \rightarrow t}$  is the volume measure of year t at the prices of the previous year t-1,

et  $C^{y-1}$  is the current price data for year y -1.

The chain volume indices can be presented in monetary terms by multiplying them by the current value of the reference year. Quarterly values are to be divided by 4.

Explicitly, the AU quarterly volume estimate is obtained, as explained above, by disaggregating the annual DPRED series according to the DPRED indicator. The resulting estimates at the previous year's prices are then chained (using the annual overlap technique) to derive quarterly DVLCH series. Performing a temporal disaggregation on the DPRED series has some limits, as this implies, using a technique dedicated to time series on data which does not constitute a true time series. However, it worth mentioning that Eurostat uses the same technique, but produces the second estimate in parallel by disaggregating the annual series of DVLCH using the quarterly indicator of DVLCH. Since the two estimates give very similar results, Eurostat chooses to estimate the DPRED first and derive the DVLCH by chaining, as this gives a completely consistent set of estimates. On the other hand, estimating the DVLCH series first would require substantial additional work to achieve accounting consistency.

Besides, according to A. Poissonnier<sup>7</sup> (2017), it is possible to favor the calibration of unchained volumes which are additive, in particular intending to balance the SUT.

As in the annual case, the quarterly chained volumes are not additive, but the quarterly DPRED series are. Customized aggregations should, therefore, be constructed from the sum of the DPRED series before proceeding with their chaining.

<sup>&</sup>lt;sup>7</sup> The same technique is also suggested by A. Poissonnier. Strategy for a gradual development of quarterly accounts. Article published in STATÉCO N ° 111, 2017.

## CHAPTER III: SITUATION OF NATIONAL ACCOUNTS IN AFRICAN COUNTRIES

This chapter deals with data collection in the AU Member states, a summary of data collected, and difficulties encountered.

## **III.1 PROCEDURE FOR DATA COLLECTION**

According to the AU recommendations, the calculation of the continental quarterly GDP should be done with official data from the National Statistical Institutes (INS) of the 55 member states. The data collection process favors the information available on the websites of NSIs or institutions in charge of compiling national accounts in the country. Should there be any difficulties in downloading a country's data, an official correspondence was sent by the AU to the country, requesting information according to a standardized format. In addition, direct contacts with national accounts staff from NSIs were initiated to collect the required information. The information necessary for the compilation of the continental quarterly GDP must be long series, at least from 2010 onward. They include:

- The annual national accounts according to the three sides (production, expenditure and income) at current prices, constant or at the prices of the previous year;
- Quarterly national accounts from both sides (production and expenditure) at current and constant prices.

Whenever necessary, alternative sources were consulted: regional and international institutions such as Regional Economic Communities (RECs), the African Development Bank (AfDB), the United Nations Statistics Division, the International Monetary Fund (IMF) or the World Bank (WB). Table 9 in the annex presents the summary of the information collected on the AU 55 member states.

## **III.2** SUMMARY OF DATA COLLECTED

Data collection covered annual information for all the AU 55 member states and quarterly information for 28 African countries that produce and disseminate this data. The details of information collected are summarized in the following table:

Designation	Number	Observations
Annual data collected from NSIs	46	Total or partial annual information was obtained from the websites for 2010-2019. Requests will be sent to some countries to complete their series.
Annual data collected via international institutions	08	No information available on the websites. Requests will be sent to them to obtain their data. However, no information is available for the Sahrawi Arab Democratic Republic.
Quarterly data collected from NSIs	28	Full or partial quarterly information was obtained from the websites for 2010-2019. Requests will be sent to some countries to complete their series

#### Table 1 : Summary of data collected

All African Union member states compile their accounts according to the 1993 System of National Accounts (1993 SNA) or the 2008 SNA with the exception of Sudan that still implements the 1968 SNA. The annual series collected are based on the system of national accounts of the country. Their use in the development of continental GDP is made without any adjustment for consistency with the definitions of the SNA (1993 or 2008).

Table 2 reviews the methods and tools used for the 28 countries that produce and publish QNAs in Africa.

Country	System of compilation of QNA in place in 2020	System of compilation f QNA in place in 2020 Methodology used Tools		Seasonal adjustment	Length of the series
Algeria	YES	Calibration-Benchmarking	arking Language R		2000
Angola	YES	Extrapolation based on Denton	QNA – Excel Tool		2002
Benin	YES	DENTON (The VA is projected as these data are available from the ANAs. The back-casting process in still in progress)	vallable from the ANAs. The XLPBM vack-casting process in still in progress)		1999
Botswana	YES	Benchmark to the Annual National Accounts	Excel Add-in software		1994
Burkina Faso	YES	Benchmarking-Reconciliation according to Denton method	XLPBM	YES	2015
Cabo Verde	YES	Extrapolation based on Denton	XLPBM		2007
Cameroon	YES	Benchmarking-Reconciliation according to improved Denton method	XLPBM	YES	1999
Cote d'Ivoire	YES	Numerical method according to Cholette & Dagun	XLPBM		2014
Egypt, Arab Rep.	YES				
Eswatini	YES	Benchmarking to the Annual Estimates and Extrapolation method is used.	NADABAS (Combination of MS Excel and Access) is used for compilation of ONA	YES	2013
Ghana	YES	Extrapolation based on Denton	XLPBM		2006
Kenya	YES				
Lesotho	YES				2007
Madagascar	YES	Benchmarking-reconciliation	iliation Excel		2007
Mali	YES	Benchmarking-Reconciliation according to econometric methods	ECOTRIM		2004
Mauritius	YES		EXCEL	YES	1995
Morocco	YES		EVIEWS, language R	YES	1998
Mozambique	YES	XLPBM		YES	2007
Namibia	YES	NADABAS			2000
Nigeria	YES				1981
Rwanda	YES	MS Excel			2006
Senegal	YES	Numeric methods (Cholette Dagum, Denton) and econometric methods (with ECOTRIM)	Macro-Excel XLPBM (FMI), ECOTRIM	YES	2007

Table 2: List of countries compiling at least QNA according to the production side

Country	System of compilation of QNA in place in 2020	Methodology used	Tools	Seasonal adjustment	Length of the series
Seychelles	YES	Denton Proportional Method as benchmarking technique to split annual GDP estimates into quarters	Excel (XLBPM add-in)	YES	2006
South Africa	YES			YES	1993
Tanzania	YES				2010
Tunisia	YES	Benchmarking-reconciliation	Ecotrim and R for benchmarking- Reconciliation	YES	2000
Uganda	YES		XLPBM	YES	
Zambia	YES		Excel (XLBPM add-in)		2010

Source: e-meeting on QNA, July 6-7, 2020

## **III.3 DATA PROCESSING**

GDP breakdown by industry was collected according to the classification of activities in force in each country. A harmonized format has been developed to allow data aggregation for all 8 RECs and the AU.

AU annual GDP is obtained by aggregating all the AU member states annual GDP except for the Sahrawi Arab Democratic Republic. For the 28 countries producing QNAs, the following table summarizes the coverage rates according to the RECs.

#### Table 2: Coverage rate of QNA per REC (%)

CER	2016	2017	2018	Average 2016-2018
1. Arab Maghreb Union (UMA)	89	90	89	89
<ol> <li>Common Market for Eastern and Southern Africa (COMESA)</li> </ol>		66	66	66
3. Community of Sahel-Saharan States (CEN-SAD)	87	86	86	86
4. East African Community (EAC)	89	91	96	92
<ol> <li>Economic Community of Central African States (ECCAS)</li> </ol>	61	61	62	61
<ol> <li>Economic Community of West African States (ECOWAS)</li> </ol>	96	95	95	95
7. Intergovernmental Authority on Development (IGAD)	36	34	35	35
8. Southern African Development Community (SADC)	92	90	90	91
AU	83,7	81,7	84,2	83,2

Poor coverage of QNA

Estimation of quarterly accounts feasible but results could be questionable! Good coverage of QNA

Overall, the coverage rate of QNA of the RECs are acceptable except for the Intergovernmental Authority for Development (IGAD). This means that for the seven other RECs, quarterly accounts can be compiled from member states QNAs, without direct reference to the original source data. Efforts should be made to improve the coverage rate of the IGAD.

The QNA coverage rate of the African Union member states is over 83% on average. This rate is higher than 75% which is the minimum rate recommended by the European Union.

Some African Union member states are in the experimental phase of QNA compilation. This is the case for Burundi, Ethiopia, Niger, and Malawi. The integration of QNA data from these countries when available will improve the QNA coverage rate of the RECs and the African Union (90%).

## CHAPTER IV: COMPILATION OF THE CONTINENTAL QUARTERLY GDP

This chapter is organized in for sections: description of the proposed nomenclature of activities for compiling quarterly GDP at the RECs and continental levels, an overview of the adopted estimation methodology, the preliminary results, the limitations of the exercise, and recommendations.

## **IV.1** NOMENCLATURE OF ACTIVITIES

The GDP can be estimated in 3 ways:

- by accounting goods and services produced in the territory and the added value generated by this production (production approach);
- by accounting the final uses (demand approach);
- by adding income (income approach).

The GDP in its production approach was compiled according to the classifications of activities in line with the International Standard Industrial Classification of All Economic Activities (ISIC rev. 4, 2009).

This working nomenclature, called the "Harmonized classification of African Economic Activity (CAEA)", is a synthesis of the classification of economic activities used by the AU member states to publish their national accounts. It is aggregated in 10 positions for easy setting up bridge tables with individual nomenclatures of the 55 AU member states, as presented below.

Code NAEA	NAEA description	Code ISIC Rév.4	ISIC Rev. 4 Description
AFR01	Agriculture, Livestock, Forestry and Fishing	А	Agriculture, Forestry and Fishing
AFR02	Extractive activities (mining, crude oil, gas, etc.)	В	Mining and quarrying
AFR03	Manufacturing activities	С	Manufacturing
AFR04	Production and distribution of electricity, gas, water and sanitation	D & E	Electricity, gas, steam and air conditioning supply; Water supply; sewerage, waste management and remediation activities
AFR05	Construction	F	Construction
AFR06	Trade, catering and accommodation	G et I	Wholesale and retail trade; repair of motor vehicles and motorcycles; Accommodation and food service activities
AFR07	Transport, warehousing and communication	H et J	Transportation and storage; Information and communication
AFR08	Finance, real estate and business services	K, L, M & N	Financial and insurance activities; Real estate activities; Professional, scientific and technical activities; Administrative and support service activities
AFR09	Public administration and social security	0	Public administration and defence; compulsory social security
AFR10	Other service activities	P, Q, R, S & T	Education; Human health and social work activities; Arts, entertainment and recreation; Other service activities; Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use

# Table 3 : Bridge table NAEA-ISIC 4

This working nomenclature may be further disaggregated more provided all AU member states share more detailed national accounts data. The implementation by all African countries of the 2008 SNA, and therefore, of the ISIC rev. 4, will ensure the homogeneity of the branches of activities, and therefore, lead to better aggregation.

#### IV.2 CONTINENTAL QUARTERLY GDP ESTIMATE METHODOLOGY

#### IV.2.1 Aggregation of annual and quarterly data

Countries annual and quarterly data were processed according to the methodology described in Chapter II. The bridge table above provides the annual and quarterly GDP at current prices and at the prices of the previous year, broken down according to the harmonized nomenclature of African Economic Activity (NAEA). Country data in national currency was converted into US dollars using exchange rates from the International Financial Statistics, IMF, and then sum up to have AU aggregates. Chart 1 and Table 4 present the annual and quarterly GDP of Africa at current prices according to the NAEA for 2014-2019.





The nominal GDP of the AU is estimated at approximately \$2,368.8 billion in 2018. Taxes less subsidies on products represent on average 5% of the African GDP over the period 2010-2018.

Marak		Quarters					
fear	1	2	3	4			
2014	517 031	536 308	558 987	554 145			
2015	488 109	479 675	490 862	487 161			
2016	454 482	459 489	460 749	441 111			
2017	430 394	441 903	473 439	480 844			
2018	471 257	474 545	410 611	415 451			
2019*	380 660	393 106	401 597	362 939			

*Table 4 : AU quarterly GDP at current prices for 2014-2018 (in million USD)* 

Source: PAS NKEs estimations based on country data \*missing data for some countries

#### IV.2.2 Allocation of the AU GDP to the quarters and software used

The approach used to break down the continental annual GDP into quarters is Denton's proportional method, which is one of the numerical methods recommended by the IMF (2017) manual on QNA. It has the advantage (i) of applying to short series, and (ii) of being less demanding than econometric methods which require, for example, the normality and the non-autocorrelation of the model residuals.

The statistical tool used is the Excel XLPBM macro developed by the Real Sector Division of the IMF's Statistics Department, to assist countries in compiling quarterly national accounts.

For a given REC, the tool is used to disaggregate its consolidated annual accounts, using a cyclical indicator built by aggregating the available quarterly national accounts of its member states. The same approach is applied to disaggregate the AU's consolidated annual accounts into quarterly accounts. Two major results are thus obtained:

- the quarterly GDP of the REC or the AU at current prices;
- the quarterly GDP of the REC or the AU at the prices of the previous year.

After this step, the Excel software is used to implement the QNA chaining technique, in particular the annual overlap technique recommended by the IMF Manual 2017. The final results are quarterly GDP chained volume for RECs and the AU.

## IV.3 PRELIMINARY RESULTS OF THE RECS' QUARTERLY GDP

#### IV.3.1 Preliminary results of the Arab Maghreb Union (AMU)

The UMA represents on average 16 per cent of the AU GDP. Three (3) countries out of the Community's five member states compile and disseminate quarterly GDP. The quarterly indicator constitutes on average 90% of the GDP of the UMA. Table 6 shows the quarterly GDP at current prices of the AMU over the period 2014-2019.

		Quarter					
Year	1	2	3	4			
2014	112 380	111 352	106 979	99 550			
2015	90 135	88 038	86 403	84 716			
2016	82 857	84 944	85 498	86 705			
2017	88 715	90 574	92 893	93 823			
2018	98 340	98 342	97 510	97 196			
2019	96 874	95 817	97 116	98 469			

Tableau 5 : Nominal Quarterly GDP of AMU for 2014-2018 (in millions of US dollars)

Source: estimations based on country-data

*Graph 2 : Evolution of the "Agriculture" industry value added and its annualized indicator for the AMU* 



Source: estimations based on country-data

The indicator of the Agriculture value-added is the sum of the VA of the agriculture industry of the AMU member states that compile QNA. This indicator is used to approximate the quarterly profile of this activity in nominal value. In Graph 2 below, it appears that the evolution of the indicator satisfactorily reflects the dynamics of the value-added of Agriculture.

In particular, the drop in activity that occurred over the period 2013-2015 and the recovery that took place after 2015 are perfectly reflected.

Chart 3 shows the evolution of quarterly chained volume GDP of the Arab Maghreb Union over the period 2014-2019.



Graph 3: Evolution of the UMA quarterly GDP in chained volume

Source: estimations based on country-data

On Graph 3 below, it appears that the year-to-year change in quarterly GDP in chained-volume of the AMU is contrasted. In particular, 2017 was marked by strong growth rates in quarterly GDP, particularly in the fourth quarter.

#### IV.3.2 Preliminary results of the East African Community (EAC)

The EAC represents on average 8 per cent of the AU GDP. Four (4) out of the six of its member states compile and publish quarterly GDP. The quarterly indicator constitutes on average 94% of the GDP of the EAC.

Vacar	Quarters				
readr	1	2	3	4	
2014	45 230	43 361	41 954	43 282	
2015	45 871	43 396	39 680	39 602	
2016	41 776	43 844	41 669	41 852	
2017	46 463	47 166	45 436	46 263	
2018	50 913	50 907	49 365	49 464	
2019	54 914	54 951	51 802		

Table 7: EAC's nominal quarterly GDP for 2014-2019 (in millions of US dollars)

Source: estimations based on country-data

The charts below give an idea of the correlation between the annualized indicators and the annual GDP.



Graph 4 shows the evolution of quarterly chained volume GDP for the East African Community over the period 2016-2019.



Graph 4: Evolution of quarterly GDP for the East African Community (EAC)

Source: estimations based on country-data

# IV.3.3 Preliminary results of the Economic Community of West African States (ECOWAS)

ECOWAS represents on average 27 percent of the continental GDP. Eight (8) member states out of the fifteen of the Community compile and disseminate quarterly GDP. The quarterly indicator constitutes on average 95% of ECOWAS GDP.

Graph 5 shows the change in quarterly chained volume GDP of the Community of West African States over the period 2015-2019.



Graph 5a: Evolution of the growth rate of quarterly GDP in chained volume of ECOWAS

Source: estimations based on country-data

On graph n °5 above, it appears that the year-to-year change in quarterly GDP in chained volume of ECOWAS is contrasted. In particular, 2016 was marked by declines in quarterly GDP growth rates, particularly in the first, second and third quarters. This contraction can be mainly due to the repeated attacks by rebel groups against oil installations in Nigeria and the weakness of oil prices (see graph 6) over the four quarters of 2016.



#### Graph 5b: Evolution of ECOWAS mining activities VA

Source: estimations based on country-data

#### IV.3.4 Preliminary results of the Community of Sahel-Saharan States (CEN-SAD)

CEN-SAD represents on average 53.2 percent of the continental GDP. Eleven (11) member states out of the twenty-eight of the Community compile and disseminate quarterly GDP. The quarterly indicator constitutes on average 86% of CEN-SAD's GDP.

The charts below give an idea of the correlation between the annualized indicators and the annual GDP and also for some industries.





Graph 6: Evolution of the growth rate of quarterly GDP in chained volume of CEN-SAD



Source: estimations based on country-data

## IV.3.5 Preliminary results of the Economic Community of Central African States (ECCAS)

ECCAS represents on average 11 per cent of the AU GDP. Three (3) out of its eleven member states compile and disseminate quarterly GDP. The quarterly indicator constitutes on average 61% of the GDP of ECCAS.

The charts below give an idea of the correlation between the annualized indicators and the annual GDP and also for some industries.



Overall, there is an average correlation between the annualized indicator (quarterly GDP of the member states that disseminate QNA) and the annual GDP of the ECCAS. The same is true for "Extractive industries" and "Agriculture, livestock, forestry, and fishing."



The benchmarking-reconciliation, then the chaining makes it possible to obtain the preliminary quarterly GDP growth rate of ECCAS in chained volume.

Graph 7: Evolution of the growth rate of quarterly GDP in chained volume of ECCAS



IV.3.6 Preliminary results of the Southern African Development Community (SADC)

SADC represents on average 30 percent of the AU GDP. Twelve (12) out of its sixteen member states compile and publish quarterly GDP. The quarterly indicator constitutes on average 90% of SADC's GDP. The charts below give an idea of the correlation between the annualized indicators and the annual GDP and also for some industries.



Overall, there is a strong correlation between the annualized indicator (quarterly GDP of countries disseminating QNQ) and the annual GDP of all SADC member states. It is the same for the two following industries.



Benchmarking-reconciliation and then chaining provide the preliminary quarterly GDP growth rate of SADC in chained volume.

Graph 8: Evolution of the growth rate of quarterly GDP in chained volume of SADC



IV.3.7 Preliminary results of the Common Market for Eastern and Southern Africa (COMESA)

COMESA represents on average 33 percent of the AU GDP. Ten (10) of the 21 member states compile and publish quarterly GDP. The quarterly indicator constitutes on average 66% of the GDP of COMESA. The charts below give an idea of the correlation between the annualized indicators and the annual GDP and also for some industries.



Overall, there is an average correlation between the annualized indicator (quarterly GDP of MS compiling QNA) and the annual GDP of COMESA. The same is true for Manufacturing, and Trade, restaurants, and hotels.



Benchmarking-reconciliation, and then chaining provide the preliminary quarterly GDP growth rate of COMESA in chained volume.

Graph 9: Evolution of the growth rate of quarterly GDP in chained volume of COMESA



IV.3.8 Preliminary results of the Intergovernmental Authority on Development (IGAD)

IGAD represents on average 12 percent of mainland GDP. Two (2) out of its 10 member states compile and publish quarterly GDP. The quarterly indicator constitutes on average 35% of IGAD's GDP. The charts below give an idea of the correlation between the annualized indicators and the annual GDP and also for some industries.



Overall, there is a weak correlation between the annualized indicator (quarterly GDP of member states compiling QNA) and the annual GDP of IGAD as a whole. The same is true for the following industries.



Benchmarking-reconciliation, followed by chaining, yields to the IGAD's preliminary quarterly GDP growth rate in chained volume.

Graph 10: Evolution of the growth rate of quarterly GDP in chained volume of IGAD



# IV.4 PRELIMINARY RESULTS OF CONTINENTAL QUARTERLY GDP

By way of illustration, the following graphs show the correlation between annual GDP and the annualized quarterly indicator for some industries over the period 2012-2017. It should be noted that the data collected for 2018 and 2019 are still incomplete and shall be updated to carry forward the graphic until 2019.



Overall, the benchmarking graphics show that the quarterly indicators retrace fairly well the changes in the annual value added of the industries.

In this context, the estimates of quarterly GDP chained volume by the annual overlap technique allow to obtain the following graph:



Graph 11: AU quarterly GDP growth rate in chained volume (in %)

#### COMPARISON OF THE AU'S PRELIMINARY RESULTS WITH THOSE OF OTHER INSTITUTIONS

First of all, it is important to highlight that so far, no regional or international institution compiles quarterly GDP for Africa. In this context, the comparison of the preliminary results of the AU with other sources can only be done at the level of the annual GDP and growth rate. The information used for the comparison comes from the United Nations Statistical Division (UNSD) database and data from the African Development Bank (AfDB) Statistical Yearbook.

#### Graph 12: GDP comparison (in millions US dollars)



The 3 graphs of annual GDP are generally similar, reflecting the closeness between the current estimates and those made by the AfDB and the UNSD.

However, the current estimates of Africa's GDP are higher than those of the UNSD and the AfDB, due to the inclusion of updated data from some countries and the integration of the rebasing results (Burkina Faso, Benin, etc.) which are not yet updated in the databases of these two institutions.





Besides, the estimated real GDP growth rates are close, except for 2013.

## IV.5 DIFFICULTIES ENCOUNTERED AND LIMITATIONS

Econometric approaches allow an evaluation of the significance of the estimators of the QNA coefficients. Numerical methods do not allow such analyzes.

An important issue in applying econometric methodologies is the availability of data at a detailed level over a long period (at least twenty years). This is rarely met in most of the African Union member states. On the contrary, numerical methods can be applied for a series of five years.

The AU may start the development of the quarterly GDP of the 8 RECs and the AU using numerical methods; once longer series on country QNAs become available, it can move to apply econometric methods including Chow Lin, Hilmer & Trabelsi, and Quenneville methods.

The data collected on the sites of African Union MS present some shortcomings:

- Some countries have changed the base year of national accounts and have not conducted back casting exercise over a long period.
- others have not yet estimated national accounts for the year 2018; also some quarterly
  national accounts for 2018 and 2019 are still missing;
- another group does not have any information on the websites. For these countries, where possible, the database of international organizations was used to fill the gap.

# CHAPTER V: DISSEMINATION OF CONTINENTAL GDP

In this chapter, topics related to the treatment of missing data, seasonal adjustment, the dissemination of the continental quarterly GDP, and the revision policy will be discussed.

#### V.1 PROCESSING OF MISSING DATA

AU member states will be required to send their annual and quarterly national accounts data to the AU within a deadline set by the Commission. However, for missing annual national accounts of member states, the Commission can make estimates, either by applying the growth rate forecasts to the last value available in terms of level or using data from regional and international organizations, such as the RECs, the AfDB, the IMF, the World Bank, the United Nations Statistics Division, etc. These estimates will be replaced by countries' data as soon as they become available.

As for quarterly national accounts, the AU will not make estimates for missing data. However, it will be necessary to ensure that the quarterly accounts of the member states for which data are available cover at least 70% of the continent's total annual GDP.

#### V.2 SEASONAL ADJUSTMENT OR CORRECTION OF SEASONAL VARIATIONS

The unadjusted QNA do not allow a good understanding of the infra-annual development of the economy, as they can be misled by seasonal effects. In countries which do not compile adjusted QNA, the estimates for a given quarter are compared with those of the corresponding quarter of the previous year, to remove the seasonal effects. This approach has limitations. It does not capture recent economic developments attributable solely to non-seasonal economic activity, nor economic recession. For example, if the seasonal profile of the economic series remains stable from one year to another, while increasing at an annual rate, the short-term analysts or the quarterly accounts experts may not be able to separate the share of the increase from the series between two consecutive quarters due to usual seasonality. To address the issue, the seasonal adjusted quarterly continental GDP allows early detection of turning points, for the authorities (African Union Commission) to implement appropriate policies according to the economic cycle.

This justifies why it is important to compile quarterly adjusted accounts. To this end, the implementation of quarterly continental GDP adjusted for seasonal variations is more than necessary.

A time series can be desegregated into a trend part, a seasonal part, and an irregular part. Seasonal adjustment consists on removing the seasonal component from a time series, to highlight the cyclical message it contains (the trend part and the irregular part). The seasonal component is defined as fluctuations within the same year (monthly or quarterly) which are repeated more or less regularly from one year to the next. According to Dominique Ladiray, the main causes of seasonality are:

i. climatic seasonality: attributable to climatic variations;

- ii. institutional seasonality: attributable to social conventions or administrative rules;
- iii. induced seasonality: attributable to seasonality in other sectors.

#### The general approach

Most countries correct QNAs by seasonally adjusting the indicators first, before benchmarking aggregates with seasonally adjusted indicators. Another approach is to seasonal adjust the quarterly aggregate obtained after the benchmarking-adjustment procedure. Both approaches produce seasonally adjusted series consistent with the annual accounts.

Moreover, since the sum of the four seasonally-adjusted quarters is not equal to the sum of the four unadjusted quarters<sup>8</sup>, the adjusted aggregates are reconciled with the unadjusted ones. To this end, it is useful to carry out an additional benchmarking of the seasonally adjusted indicator on the annual average of the indicator to force the identity of the benchmarking models.

#### Scheme 2 Scheme 1 Unadjusted indicator Unadjusted indicator Î Î Adjusted indicator Benchmarking Ĵ Î Benchmarking Reconciliation Ĵ ļļ Reconciliation Unadjusted ļĮ Adjusted accounts Adjusted accounts

#### Chart 12: Seasonal adjustment scheme

Some AU member states apply a correction for seasonal variations on the raw indicators to obtain the quarterly seasonal-adjusted accounts. Thus, the seasonal adjustment of the quarterly continental GDP does not consist on directly applying a correction to the raw data of the member states, but rather by considering the seasonally adjusted series of the countries that apply the seasonal adjustment. For countries which do not compile adjusted QNA, the African Union Commission may apply an adjustment to the raw QNA data before proceeding with the aggregation.

The diversity and variability of the seasonal adjustment methods across the African Union MS make it difficult to compare adjusted QNA between countries. Efforts to harmonize the AU member states seasonal adjustment methods should be carried out. For example, the European Union published in 2008 "ESS guidelines for seasonal adjustment". This activity could be

 $<sup>^8</sup>$  Refer to A. Poissonnier (2017). Strategy for a gradual development of quarterly accounts. Article published in STATÉCO N  $^\circ$  111, 2017

carried out by sub-regional organizations such as AFRISTAT, RECs or the African Union Commission.

# **V.3 DISSEMINATION CALENDAR**

The compiling and disseminating calendar of the continental quarterly GDP data depends on:

- the full coverage of annual data and at least 70 per cent of quarterly data of member states;
- the workload of the AU team;
- the timeline of the preparation of AU economic policy documents.

Thus, the quarterly accounts of the AU will be published according to the following dissemination policy: Two publications each quarter: the first is a rapid one (flash) at around 100 days, covering only the quarterly GDP of the AU and its breakdown by industry. The second regular release is scheduled around 120 days after the end of the quarter, adding releases on the eight (8) RECs, and more detailed breakdowns. All quarterly and annual AU series for all reference periods are subject to revision.

# V.4 DATA REVISION

Revisions play an essential role in producing high-quality quarterly national accounts (QNAs) because they provide users with the most up-to-date and accurate information possible. These revisions are an opportunity to incorporate new and more accurate information, and therefore, to refine the estimates without introducing breaks in the time series.

AU annual national accounts aggregates are subject to the following revision policy. The aggregates are updated with each regular publication of the quarterly national accounts. The dates are released in the AU publication calendar. For the moment, four flashes and four regular publications are envisaged each year, and therefore four updates of the annual accounts of the AU. Between AU publications, member states can revise their figures. However, the AU will publish the new Member States' accounts but will not recalculate the quarterly AU accounts until the next release.

Geographical coherence will be lost for a short time. Nevertheless, the stability of the annual aggregates is ensured, so the annual and quarterly aggregates of the AU will be consistent by default.

Besides, the AU will consider conducting an analysis of revisions on quarterly accounts data. This is essential for monitoring the reliability of estimates and contribute to enhance transparency by informing users on the margin of error. Real-time databases (or revision triangles) and revision indicators will be developed in a timely manner and updated regularly as part of the continental quarterly GDP compilation process. Best practices also recommend to conduct and publish periodically revision studies of QNA data and to disseminate timely to the public databases and revision indicators of the main aggregates of quarterly accounts.

#### **GENERAL CONCLUSION AND WAY FORWARD**

This methodological note aims to describe the approach developed for the compilation of quarterly GDP within the eight (8) regional economic communities and the African Union (AU). This process can be summarized in five main steps:

- 1) the collection of annual and quarterly national accounts from the AU Member States and the estimation, if applicable, of missing data;
- the processing of the data collected including (i) the possible switch to the prices of the previous year for data at constant prices; (ii) the transition to the Aggregated Nomenclature of African Economic Activity (NAEA); and (iii) conversion into US dollars;
- 3) the aggregation of annual and quarterly series at current prices and at the prices of the previous year converted into US dollars;
- 4) benchmarking-reconciliation of aggregated quarterly data to aggregated annual data by the proportional Denton method using the XLPBM tool;
- 5) the calculation of quarterly GDP chained volume by the annual overlap technique.

The methodology presented above is valid both for the calculation of the continental quarterly GDP according to the production and the expenditure approaches. However, the guide is currently limited to the implementation of the continental quarterly GDP from the production side.

Looking forward, future work will be focused, in decreasing order of priority, on:

- 1) correction of seasonal variations or seasonal adjustment;
- 2) examining the implementation of alternative methods for estimating quarterly GDP for countries that do not produce them;
- 3) compilation of quarterly GDP by expenditure at current prices and in chain-linked volume.

#### **BIBLIOGRAPHIE**

- 1. Adriaan M. Bloem et al. (2001). Manuel des comptes nationaux trimestriels Concepts, sources statistiques et compilation. Fonds Monétaire International (FMI). DC.
- 2. Poissonnier (2017). Stratégie pour un développement progressif des comptes trimestriels. Article paru dans STATÉCO N°111, 2017
- 3. EUROSTAT (2016). Compiling annual and quarterly national accounts main aggregates for the European Union and the euro area.
- 4. IMF (2018). Quarterly National Accounts Manual 2017 Edition
- 5. INSEE (2012). Méthodologie des comptes trimestriels. INSEE Méthodes n° 126.
- 6. INSEE Méthodologie des comptes trimestriels, INSEE Méthodes n°108 Jérôme Fabre et Catherine Prost
- 7. ONU, OCDE, FMI, BM (1993 et 2008). Système de comptabilité nationale (SCN)
- 8. United Nations (2019). Methodology for the National Accounts Main Aggregates Database. New York: United Nations Publications.

#### **APPENDIXES**

#### Appendix 1: Denton numerical methods

The Denton-type benchmarking method group is based on the principle of the preservation of the movements. They apply least squares to a criterion to be optimized. The construction of the criterion or loss function depends on the way in which the principle of the preservation of the movements is applied. Denton (1971) considers a particular class of loss function: a quadratic form of the differences between the values of the original x and adjusted z series.

#### **Proportional Denton Method**

In this version, Denton's proportional benchmarking ensures that the adjusted series remain as proportional as possible to that of the indicator by minimizing (least squares) the differences in relative adjustments to neighboring quarters subject to the constraints of the annual benchmarks. Mathematically, the basic version of Denton's proportional method is expressed as follows:

$$Min\{X_{1}, \dots, X_{4b}, \dots, X_{T}\} \sum_{t=2}^{T} \left(\frac{X_{t}}{I_{t}} - \frac{X_{t-1}}{I_{t-1}}\right)^{2} \text{ sc } \sum_{t=1}^{T} X_{t} = A_{y} \text{ , } y \in \{1, \dots, \beta\}$$

The constraint expresses the equality between the sum of the four quarterly accounts and the value of the annual account for each benchmark year. The ratio  $\frac{X_t}{I_t}$  is the quarterly indicator ratio (BI). Note that:

t is the time period, with t = 4y-3 the rank of the first quarter of year y and 4y that of the fourth quarter of year y;

 $X_t$  *is* the QNA estimates for quarter t; It is the value of the indicator for quarter t;  $A_y$  represents the value of the annual accounts for year y;  $\beta$  is the last year for which an annual benchmark is available; T is the last quarter for which quarterly data is available.

Denton's proportional method consists of implicitly establishing from the observed annual indicator ratios, a time series of estimates-indicator ratios (quarterly BI ratios) of the benchmarked quarterly estimates of the QNAs which is as smooth as possible, with, in the case of the series of flow:

for the retrospective series  $y \in \{1, ..., b\}$ , the average of the quarters is equal to the annual BI ratios for each year y.

for the prospective series  $y \in \{b + 1,...\}$ , the quarterly ratios are kept constant and equal to the ratio for the last quarter of the last benchmark year.

#### Cholette-Dagum proportional method with AR error (1)

Cholette and Dagum (1994) proposed a method based on the least square-generalized. This method provides an alternative solution to the method of Denton. It is based on a generalized least squares regression model and consists of two steps.

$$\begin{cases} I_t = a_t + X_t + e_t & \text{for } t = 1, ..., q \\ A_n = \sum_{t=4n-3}^{4n} X_t + w_n & \text{for } n = 1, ..., y \end{cases}$$

With: It the quarterly indicator,

Xt represents the quarterly series of aggregates for example (production, imports, etc.);

et: the quarterly error at: deterministic effects q: the number of quarters An: the annual series of national accounts; Wn: the annual error Y: the number of years

To eliminate the bias between the indicator and the annual aggregate, an adjustment indicator is calculated as follows:

$$I_t^a = d \cdot I_t$$
  
$$d = \frac{\sum_{n=1}^{y} A_n}{\sum_{t=1}^{4y} I_t}$$
 (average BI ratio)

The quarterly error is assumed to be both auto-correlated and heteroscedastic. The assumption on heteroscedasticity is necessary to make the adjustment of the error proportional to the value of the indicator. To take into account the proportionality, the quarterly error is rescaled at the indicator level by the following equation:

$$e_t' = \frac{e_t}{I_t^a}$$

To ensure that movements are preserved, the quarterly error (transformed) is assumed to follow a first order autoregressive pattern.

Thus, the proportional method of Cholette-Dagum with an AR (1) is presented as follows:

$$\begin{cases} I_t^a = X_t + e'_t \cdot I_t^a \\ A_y = \sum_{t=1}^q X_t \\ e'_t = \phi e'_{t-1} + v_t \\ e'_t = \phi e'_{t-1} + v_t \end{cases} \quad |\phi| < 1 \text{ and } v_t \text{ white noise} \end{cases}$$

For extrapolation, the QNAs are equal to the difference between the adjusted indicator and the estimated quarterly error:

$$\widehat{X_{4y+t}} = I^a_{4y+t} - \widehat{e'_{4y+t}}. I^a_{4y+t}$$

with:

$$\widehat{\mathbf{e}_{4y+t}'} = \widehat{\boldsymbol{\varphi}}^{\mathrm{t}} \mathbf{e}_{4y}'$$
  
avec  $\widehat{\boldsymbol{\varphi}} = 0.84$ 

With a  $\phi$  close to 1 (e.g.  $\phi$ =0.999), we end up with the Denton method.

#### Appendix 2: Statistical methods

#### Benchmarking

The statistical method of quarterly accounts aims to find the best correlation between the information contained in the sub-annual indicators and that of the annual accounts. For the sake of simplicity, the desired benchmarking relationship is a simple linear equation between the annual accounts and the annualized indicator, which is written for all years "a":

 $C_a = \alpha + \beta \times I_a + u_a$  where  $C_a$  is the annual account for year a,  $I_a$  the annualized indicator, i.e.

the annual sum of the quarterly indicator :  $I_{a} = \sum_{r=1}^{4} I_{a,r}$ , and  $u_{a}$  the annual error term associated with the observed benchmarks, which represents the changes in the account which are not sufficiently transcribed by those of the benchmarked indicator.

To optimize the estimate, three types of models are used, depending on the statistical characteristics of the error term. One seeks in fact to reduce the effects of the residue  $\mathcal{E}_a$ .

The estimation is performed on the level model, when the error term is stationary and not autocorrelated by ordinary least squares or when error term exhibits autocorrelation by quasigeneralized least squares. The following equations are estimated by:

 $C_a = \alpha + \beta \times I_a + \varepsilon_a$  The annual error term  $u_a$  is equal to the estimator residue  $\varepsilon_a$ .

 $C_a = \alpha + \beta \times I_a + u_a$  with the assumption that :  $u_a = \rho \times u_{a-1} + \varepsilon_a$ 

The model is estimated in differences, when the error term is non-stationary. This model is a limit case of the previous model with  $\rho = 1$ . The following equation is estimated by ordinary least squares:

$$\Delta C_a = \gamma + \beta \times \Delta I_a + \varepsilon_a \text{ La cale } u_a \text{ est alors telle que } u_a = u_{a-1} + \varepsilon_a$$

Taking into account the persistence of the error term makes it possible to improve the estimate of the account over the current year (residuals auto-correlated or not).

The choice between the three models is made using different statistical criteria. The coat rack test rejects the model or models for which the residual of the estimated equation is autocorrelated. The standard deviations of the residuals make it possible to compare three methods over the entire period, while the standard deviations of the recursive residuals center the comparison on the predictive power.

This relationship between the account and the annualized indicator is assumed to be stable so it remains valid over the very recent past and allows the best possible forecasts of years when the annual account is not known. The estimated coefficients  $\alpha$  and  $\beta$  are then applied to the indicator, so the first estimate of the quarterly account corresponds to:

$$C_{a,t} = \frac{\alpha}{4} + \beta \times I_{a,t}$$
 with  $C_{a,t}$ , is the accounts of quarter t of year as

#### The reconciliation

The quarterly series obtained with the benchmarking technique are not consistent with the annual series. This is explained by the insufficient coverage of the activity by the indicators, the approximations and inaccuracies due to the use of default indicators, etc. To comply with the published annual data, it is necessary to adjust the quarterly estimates, by taking into account the error made in dealing with the annual accounts using the models with indicators.

Reconciliation consists of distributing the annual residual resulting from the difference between the sum of the benchmarked, then annualized aggregates (by summation over the four quarters) and the annual variable. In practice, the smoothing method makes it possible to distribute the residue over the different quarters. This method consists in minimizing the sum of the squares of the deviations of the errors of two consecutive quarters with the constraint that the sum of the four quarterly accounts provides the annual account. It corresponds to an additive and nonproportional Denton method.

The quarterly series obtained with the benchmarking technique are not consistent with the annual series.

 $\sum_{t=1}^{4} \tilde{y}_{i,t} + \vec{E} = Y_t$ with: t = 1,...,T $\tilde{y}_{i,t}$ : first assessment of the quarterly account (not observed)  $E_t$ : unknow

The reconciliation, therefore, consists in distributing the annual residual resulting from the difference between the sum of the sub-annual indicators and the annual variable between the four quarters:

$$\vec{E} = Y_t - \hat{a}_{mco} \sum_{i=1}^{4} I_{i,t} - \hat{b}_{mco}$$

The residue  $\vec{E}$  does not reveal any cyclical information. In practice, the smoothing method makes it possible to distribute the residue over the different quarters. The error term are thus all "smoothed" as evenly as possible.

The quarterly account therefore becomes:  $C_{a,t} = \frac{\alpha}{4} + \beta \times I_{a,t} + u_{a,t}$ 

Where  $u_{a,t}$  is the quarterly error term for quarter t of year a obtained by smoothing the annual

error term  $u_a$  in order to have  $\sum_{t=1}^{4} u_{a,t} = u_a$  for all years.

The statistical nature of the error term defines the model that shall be used to perform the allocation of the accounts to quarters. The model depends on whether the error terms are non-auto-correlated, self-correlated and non-stationary.

For the model, the error term is not auto-correlated therefore:

$$u_p = u_{p+1} = 0$$

where P is the year of the provisional account.

If the error term is auto-correlated, but stationary,  $u_p = \hat{\rho} u_{p-1}$  et  $u_{p+1} = \hat{\rho} u_p$ 

If the error term is non-stationary,

 $u_p = u_{p+1} = u_{p-1}$ 

The smoothing procedure is carried out after this extrapolation of the annual error term, which makes it possible not to create a break between the reconciliated quarters and the quarters corresponding to the provisional accounts.

#### **Chow Lin method**

Chow and Lin (1971) proposed a multivariable generalized least squares regression method for interpolation, distribution and extrapolation of time series. The IMF national accounts manual indicates that this method is similar to the statistical approach, in particular to Statistics Canada's regression models.

Let y be a vector of quarterly aggregates of dimension (4n, 1) to be estimated.

Let B be a matrix of dimension (n, 4n) allowing 4n quarterly observations to be aggregated into n annual observations. B is of the following form:

$$\mathbf{B} = \begin{bmatrix} \mathbf{c}' & \mathbf{0} & \cdots & \mathbf{0} \\ \mathbf{0} & \mathbf{c}' & \cdots & \mathbf{0} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{0} & \mathbf{0} & \cdots & \mathbf{c}' \end{bmatrix};$$
$$\mathbf{c} = (\mathbf{1} \quad \mathbf{1} \quad \cdots \quad \mathbf{1})'$$

With

Suppose that y can be obtained by a multiple linear regression of the form  $y = X\beta + u$  (1)

with X a matrix of dimension (4n, k) of k explanatory variables for which we have quarterly observations and u a random vector of dimension (4n, 1) of zero mean and of variance covariance matrix V of dimension (4n, 4n). The usual assumptions on the residuals and the observation matrix are made.

By indicating the preceding variables by a (annual), and using matrix B, the equation on quarterly aggregates can be transformed into a regression on annual aggregates.

$$y_a = By = BX\beta + Bu = X_a\beta + u_a$$
(2)

To perform the Chow-Lin procedure, it is first necessary to apply the Generalized Least Squares (GLS) to the equation on the annual aggregates. We obtain  $\hat{\beta} = (X'_a V_a^{-1} X_a)^{-1} (X'_a V_a^{-1} y_a)$  (3) with  $V_a = CVC'$  then it follows  $\hat{u_a} = y_a - X_a \hat{\beta}$  and finally the estimator BLUE of y is :

$$\hat{\mathbf{y}} = \mathbf{X}\hat{\boldsymbol{\beta}} + \mathbf{V}\mathbf{C}'(\mathbf{C}\mathbf{V}\mathbf{C}')^{-1}\widehat{\mathbf{u}_{a}}$$
(4)

It can be observed that the aggregation constraints are satisfied:

$$\mathbf{B}\hat{\mathbf{y}} = \mathbf{B}\mathbf{X}\hat{\boldsymbol{\beta}} + \mathbf{B}\mathbf{V}\mathbf{B}'\mathbf{V}_a^{-1}\hat{\mathbf{u}}_a = \mathbf{X}_a\hat{\boldsymbol{\beta}} + \hat{\mathbf{u}}_a = \mathbf{y}_a$$

A very important feature of this estimation approach is the ability to obtain an indicator of the precision of the estimates using the estimation error covariance matrix (Bournay and Laroque, 1979):

$$E[(\hat{\mathbf{y}} - \mathbf{y})(\hat{\mathbf{y}} - \mathbf{y})'] = (\mathbf{I}_N - \mathbf{LB})\mathbf{V} + (\mathbf{X} - \mathbf{LX}_a)(\mathbf{X}_a \mathbf{V}_a^{-1} \mathbf{X}_a')(\mathbf{X} - \mathbf{LX}_a)'$$

Indeed, the estimation error covariance matrix can be used for:

calculate the confidence intervals of  $\hat{\mathbf{y}}$  under the assumption  $\mathbf{u} \sim N(\mathbf{0}, \mathbf{V})$ 

The main obstacle with the above approach is that the matrix V is not known. Several authors have looked at the question following Chow and Lin who proposed two hypotheses: (i)  $V = \sigma^2 I_{4n}$  et (ii) $u_t = \rho u_{t-1} + e_t$  with  $e_t$  a white noise and  $|\rho| < 1$ 

The stochastic models proposed are as follows:

- a. the model AR(1) (Bournay et Laroque, 1979):  $u_l = \rho u_{l-1} + \varepsilon_l$   $|\rho| < 1$
- b. The random walk model (Fernàndez, 1981):  $u_l = u_{l-1} + \varepsilon_l$ ,  $u_0 = 0$
- c. The random walk model of Markov (Litterman, 1983, Di Fonzo, 1987):

$$u_l = u_{l-1} + e_l \ e_l = \mu e_{l-1} + \varepsilon_l, \quad |\mu| < 1, \quad u_0 = e_0 = 0.$$

# Appendix 3: Overview on countries' available data

	0		Ye	ar	
Ħ	Country	2015	2016	2017	2018
1	Algeria	165 979	160 034	167 390	173 757
2	Angola	116 194	101 124	122 124	105 902
3	Benin	8 454	8 579	9 269	10 412
4	Botswana	14 421	15 646	17 406	18 615
5	Burkina Faso	11 823	12 823	14 170	16 200
6	Cabo Verde	1 596	1 663	1 770	1 977
7	Cameroon	30 905	32 644	35 009	38 694
8	Cote d'Ivoire	33 119	35 321	38 148	43 028
9	Egypt, Arab Rep.	317 745	270 255	195 135	249 751
10	Eswatini	4 073	3 841	4 446	4 711
11	Ghana	49 182	55 010	58 995	65 535
12	Kenya	64 008	69 189	78 757	87 906
13	Lesotho	2 465	2 305	2 579	2 631
14	Madagascar	11 323	11 849	13 176	13 851
15	Mali	13 095	14 043	15 376	17 172
16	Mauritius	11 692	12 232	13 259	14 220
17	Morocco	101 179	103 312	109 714	117 921
18	Mozambique	15 951	11 937	13 219	14 717
19	Namibia	11 651	11 286	13 566	14 519
20	Nigeria	494 583	404 649	375 770	421 821
21	Rwanda	8 278	8 475	9 136	9 510
22	Senegal	17 761	19 040	20 940	23 809
23	Seychelles	1 377	1 428	1 503	1 590
24	South Africa	317 416	296 341	349 007	368 094
25	Tanzania	47 379	49 774	53 276	57 145
26	Tunisia	43 173	41 802	39 813	39 895
27	Uganda	25 098	25 423	27 208	30 098
28	Zambia	20 859	21 453	25 868	27 283
GDP of	countries compiling QNA	1 960 778	1 801 476	1 826 030	1 990 763
Total of	Africa's annual GDP	2 306 279	2 152 313	2 234 233	2 365 243
Share of	f countries compiling QNA (%)	85,0	83,7	81,7	84,2

Table 6 : Annual GDP of the African countries compiling QNA (million US dollars)

Source: United Nations (2019): Main Aggregates Database (https://unstats.un.org)

#	Country	ANA base year	Volume measure	SNA version used	ISIC version used	ANA compilation sides	Compilatio n of ANA <sup>2</sup>	Compilatio n of QNA	Available QNA series	QNA compilation sides	QNA released on the Internet	Internet link 1	Internet link 2
1	Algerie		Chain-linked	SCN 1993	ISIC rev3	Production- Expenditure- Income	Yes	Yes	Yes	Production- Expenditure	Yes	http://www.ons.dz/	
2	Angola		Constants	SCN 1993	ISIC rev3	Production- Expenditure- Income	Yes	Production- Expenditure	Yes	Production- Expenditure	No	http://www.ine-ao.com/	
3	Benin	2015	Chain-linked	SCN 2008	ISIC rev4	Production- Expenditure- Income	Yes	Yes	Yes	Production	Yes	https://www.insae-bj.org/	
4	Botswana	2006	Constants		ISIC rev3	Production- Expenditure- Income	Yes	Yes	Yes	Production- Expenditure	Yes	http://cb.botswana.opendataf orafrica.org /nanhvtg/national-summary- data-page-nsdp	
5	Burkina Faso	2015	Chain-linked	SCN 2008	ISIC rev4	Production- Expenditure- Income	Yes	Yes	Yes	Production	Yes	http://www.insd.bf/n/	
6	Burundi	2005	Chain-linked	SCN 1993	ISIC rev3	Production- Expenditure- Income	Yes	Non				https://www.isteebu.bi/	
7	Cabo Verde	2007	Chain-linked			Production- Expenditure- Income	Yes	Yes	Yes	Production- Expenditure	Yes	http://ine.cv/fr/quadros/ contas-nacionais-2007-2017/	
8	Cameroon	2005	Chain-linked	SCN 2008	ISIC rev4	Production- Expenditure- Income	Yes	Yes	Yes	Production- Expenditure	Yes	http://www.stat.cm/	
9	Central African Republic	2005	Chain-linked	SCN 1993	ISIC rev3	Production- Expenditure- Income	Yes	Non				https://icasees.org/index.php ?q=icasees&r=mot_dg	
10	Chad	2005	Chain-linked	SCN 1993	ISIC rev3	Production- Expenditure- Income	Yes	Non				https://www.inseed-td.net/	
11	Comoros	2007	Chain-linked	SCN 1993	ISIC rev3	Production & expenditure	Yes	Non				http://www.inseed.km/	
12	Congo, Dem. Rep.		Chain-linked	SCN 1993	ISIC rev3	Production & expenditure	Yes	Non				http://ins.mkbco.pro/	
13	Congo, Rep.		Chain-linked	SCN 1993	ISIC rev3	Production & expenditure	Yes	Non				http://www.cnsee.org/	
14	Cote d'Ivoire	2009	Chain-linked	SCN 1993	ISIC rev3	Production & expenditure	Yes	Yes	Yes	Production	Yes	http://www.ins.ci/n/	
15	Djibouti	2013		SCN 2008	ISIC rev4	Production & expenditure	Yes	Non				http://www.insd.dj/index.ht ml	

# **<u>Table 7</u>**: Summary of data collected from countries websites

#	Country	ANA base year	Volume measure	SNA version used	ISIC version used	ANA compilation sides	Compilatio n of ANA <sup>2</sup>	Compilatio n of QNA	Available QNA series	QNA compilation sides	QNA released on the Internet	Internet link 1	Internet link 2
16	Egypt, Arab Rep.			SCN 2008	ISIC rev4	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	http://www.capmas.gov.eg/ HomePage.aspx	http://mpmar.gov.eg/en/Natio nal_Accounts.aspx#0
17	Equatorial Guinea	2006	<b>_</b>	SCN 1993	ISIC rev3	Production & expenditure						http://www.inege.gq/	
18	Eritrea						Non	Non				https://eritrea.opendataforafr ica.org/ vcsspuf/national-account-of- eritrea	
19	Eswatini	2011	Constants	SCN 1993	ISIC rev3	Production & expenditure	Yes		Yes			http://www.gov.sz/	http://www.gov.sz/images/na cf.pdf
20	Ethiopia	2015/ 2016	Constants	SCN 1993	ISIC rev3	Production & expenditure	Yes	??				http://www.csa.gov.et/	https://ethiopia.opendataforaf rica.org/aizxtxc/national- accounts-main-aggregates- database
21	Gabon	2001	Constants	SCN 1993	ISIC rev3	Production & expenditure	Yes	Non				https://www.statgabon.ga/	https://gabon.opendataforafri ca.org/oqmjptg/produit- interieur-brut
22	Gambia, The	2013	Constants	SCN 1993	ISIC rev3	Production & expenditure	Yes	Non				http://www.gbos.gov.gm/	https://gambia.opendataforafr ica.org/xdvdwld/national- accounts-gdp
23	Ghana	2013	Constants	SCN 2008	ISIC rev4	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	https://www.statsghana.gov.gh/	
24	Guinea	2010	Constants	SCN 1993	ISIC rev3	Production & expenditure	Yes		Production- Expenditur e			http://www.stat-guinee.org/	
25	Guinea-Bissau	2005	Constants	SCN 1993	ISIC rev3	Production & expenditure	Yes					http://www.stat- guinebissau.com/publicacao/ publicacao.htm	https://guinebissau.opendataf orafrica.org/nxixfog/national- accounts-main-aggregates- database
26	Kenya	2009	Constants	SCN 1993	ISIC rev3	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	https://www.knbs.or.ke/	
27	Lesotho	2012	Constants	SCN 2008	ISIC rev4	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	http://www.bos.gov.ls/	
28	Liberia						Yes	non	non		non	http://www.lisgis.net/	
29	Libya						Yes	??				http://www.bsc.ly/	
30	Madagascar	2007	Constants	SCN93	ISIC rev3	Production & expenditure	Yes	Yes	Yes	production	Yes	www.instat.mg	
31	Malawi	2007	Constants	SCN2008	ISICrev4	Production & expenditure	Yes	Non	Non		non	http://www.nsomalawi.mw/	
32	Mali	1999	Constants	SCN93	ISICrev4	Production & expenditure	Yes	Yes	Non	production	non	http://www.instat-mali.org/	http://www.instat- mali.org/index.php/publicatio ns/statistiques-

#	Country	ANA base year	Volume measure	SNA version used	ISIC version used	ANA compilation sides	Compilatio n of ANA <sup>2</sup>	Compilatio n of QNA	Available QNA series	QNA compilation sides	QNA released on the Internet	Internet link 1	Internet link 2
													conjoncturelles/comptes- nationaux
33	Mauritania	2014	Constants	SCN2008	ISICrev4	Production & expenditure	Yes	Non	Non		non	http://www.ons.mr/	
34	Mauritius		Chain-linked	SCN2008	ISICrev4	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	http://statsmauritius.govmu. org/ English/Publications/Pages/ QNA_3Qtr19.aspx	
35	Morocco	2007	Constants	SCN2008	ISICrev4	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	http://bds.hcp.ma/indicators/ 11	
36	Mozambique	2014	Constants	SCN2008	ISICrev4	Production & expenditure	Yes	Yes	Non	production	Yes	http://www.ine.gov.mz/estati sticas/estatisticas- economicas/contas- nacionais/trimestrais/contas- nacionaisiii-trimestre- 2019_novembro.pdf/view	
37	Namibia	2015	Constants	SCN2008	ISICrev4	Production & expenditure	Yes	Yes	Yes	production	Yes	https://nsa.org.na/page/publi cations/	
38	Niger	2015	Chain-linked	SCN2008	ISICrev4	Production & expenditure	Yes	Non	Non	non	Non	http://www.stat- niger.org/statistique/index.p hp	
39	Nigeria	2010	Constants	SCN2008	ISICrev4	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	https://www.nigerianstat.gov .ng/	
40	Rwanda	2014	Constants	SCN2008	ISICrev4	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	http://statistics.gov.rw/statist ical- publications/subject/gdp- quarterly-publications	
41	Sahrawi Arab Democratic Republic							Non					
42	Sao Tome and Principe							Non				https://www.ine.st/	
43	Senegal	2014	Chain-linked	SCN2008	ISICrev4	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	http://www.ansd.sn/index.ph p?option= com_ansd&view=titrepublic ation&id=17	
44	Seychelles	2006	Constants	SCN93	ISICrev3	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	https://www.nbs.gov.sc/dow nloads/economic- statistics/quarterly-national- accounts/2016	
45	Sierra Leone	2006	Constants	SCN93	ISICrev3	Production & expenditure	Yes	Non	Non	Non	Non		•
46	Somalia						Yes	??					

#	Country	ANA base year	Volume measure	SNA version used	ISIC version used	ANA compilation sides	Compilatio n of ANA <sup>2</sup>	Compilatio n of QNA	Available QNA series	QNA compilation sides	QNA released on the Internet	Internet link 1	Internet link 2
47	South Africa	2010	Constants	SCN93	ISICrev3	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes	http://www.statssa.gov.za/pu blications/P0441/P04414thQ uarter2019.pdf	
48	South Sudan					Production & expenditure	Yes	Non	Non	Non	non		
49	Sudan					Production & expenditure	Yes	Non	Non	Non	non	http://cbs.gov.sd/index.php/e n/home/index	
50	Tanzania	2015	Constants			Production & expenditure	Yes	Yes	Yes	Production	Yes	https://www.nbs.go.tz/nbs/ta kwimu/na/Highlights_QNA _Q3_2019.pdf	
51	Togo	2016	Chain-linked	SCN2008	ISICrev4	Production & expenditure	Yes	Non					
52	Tunisia	1997	Chain-linked	SCN93	ISICrev3	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes		
53	Uganda	2016	Constants	SCN93	ISICrev3	Production & expenditure	Yes	Yes	Yes	Production- Expenditure	Yes		
54	Zambia	2010	Constants	SCN2008	ISICrev3	Production & expenditure	Yes	Yes	Yes	production	Yes	https://www.zamstats.gov.z m/index.php/publications/cat egory/10-national-accounts	
55	Zimbabwe						Yes	??					

Year	Agriculture, Livestock, Forestry and Fishing	Extractive activities (mining, crude oil, gas, etc.)	Manufacturing activities	Production and distribution of electricity, gas, water and sanitation	Construction	Trade, catering and accomm odation	Transport, storage and communication	Finance, real estate and business services	Public administration and social security	Other service activities	Total value added at basic prices	Taxes net of subsidies on products	GDP current prices
2010	285 027	319 764	204 125	18 030	94 241	268 221	166 485	197 077	175 793	127 151	1 855 914	99 842	1 955 756
2011	316 596	379 625	223 836	22 841	105 332	297 868	185 904	223 219	225 553	130 777	2 111 551	110 579	2 222 131
2012	339 540	425 050	244 294	33 232	119 127	331 781	201 932	259 057	228 309	146 333	2 328 654	101 679	2 430 333
2013	357 076	384 731	255 766	35 070	130 526	350 161	214 170	274 101	238 790	136 136	2 376 526	109 435	2 485 961
2014	382 331	339 222	277 640	37 656	141 674	380 153	230 918	297 328	254 298	128 127	2 469 347	122 297	2 591 643
2015	366 095	211 144	253 878	36 735	132 308	359 219	214 076	281 923	235 266	119 081	2 209 725	127 439	2 337 164
2016	347 082	174 393	236 436	35 803	129 033	344 428	198 335	262 030	219 705	115 418	2 062 663	130 713	2 193 375
2017	361 196	216 963	242 210	37 250	136 837	343 098	200 417	256 658	219 899	124 755	2 139 281	140 475	2 279 757
2018	363 158	265 254	251 066	32 802	143 746	346 326	206 356	260 601	211 301	140 726	2 221 336	147 523	2 368 860

# Table 10: Annual GDP of the AU at current prices by industry (million USD)

Table 11: Quarterly GDP of the AU in volume (chain-linked) by industry (million USD)

Year	Agriculture, Livestock, Forestry and Fishing	Extractive activities (mining, crude oil, gas, etc.)	Manufacturing activities	Production and distribution of electricity, gas, water and sanitation	Construction	Trade, catering and accommo dation	Transport, storage and communication	Finance, real estate and business services	Public administratio n and social security	Other service activities	Total value added at basic prices	Taxes net of subsidies on products	PIB en volume chaîné
Q1_2014	85 085	86 791	66 822	8 858	33 276	89 138	52 869	69 944	61 100	33 302	586 909	26 832	613 743
Q2_2014	87 533	87 338	67 682	8 996	33 579	89 453	57 181	71 892	61 884	37 027	602 347	27 695	630 044
Q3_2014	101 997	91 796	69 791	9 341	34 477	94 772	56 417	74 212	64 232	33 097	629 940	29 469	659 417
Q4_2014	96 936	88 448	71 101	9 636	36 466	102 274	59 695	76 635	67 637	33 769	642 101	32 344	674 477
Q1_2015	85 763	86 421	66 766	8 918	33 514	92 818	54 779	71 311	63 025	34 090	596 942	28 960	625 946
Q2_2015	90 603	86 764	66 687	9 273	35 570	91 926	59 206	75 122	65 657	33 501	614 156	29 725	643 923

Year	Agriculture, Livestock, Forestry and Fishing	Extractive activities (mining, crude oil, gas, etc.)	Manufacturing activities	Production and distribution of electricity, gas, water and sanitation	Construction	Trade, catering and accommo dation	Transport, storage and communication	Finance, real estate and business services	Public administratio n and social security	Other service activities	Total value added at basic prices	Taxes net of subsidies on products	PIB en volume chaîné
Q3_2015	107 600	85 215	70 917	9 720	36 509	97 658	59 547	78 364	66 167	32 043	644 341	34 109	678 627
Q4_2015	102 914	79 547	72 506	9 885	38 429	104 562	62 754	79 395	68 306	34 305	653 365	34 095	687 618
Q1_2016	89 229	84 046	67 483	8 902	36 249	93 303	57 359	73 506	64 433	33 666	607 431	30 632	638 154
Q2_2016	94 103	84 125	68 323	9 448	37 034	92 424	61 204	76 444	65 971	34 528	623 572	30 861	654 449
Q3_2016	110 881	80 199	71 280	9 813	37 044	97 929	61 337	79 034	66 573	33 825	650 868	37 497	689 083
Q4_2016	104 182	78 107	74 482	9 993	39 791	106 868	64 054	79 699	68 147	36 943	666 243	35 500	702 095
Q1_2017	93 732	77 937	67 490	9 188	37 348	94 150	58 521	73 712	64 687	33 801	612 182	32 936	645 519
Q2_2017	99 054	81 836	67 867	10 041	38 618	95 024	62 167	78 079	67 126	35 206	636 342	32 997	669 521
Q3_2017	115 228	89 982	74 839	10 258	39 210	101 319	62 687	80 758	67 364	35 451	677 923	37 179	715 679
Q4_2017	109 808	94 428	81 712	10 304	43 985	113 617	69 295	82 653	71 251	40 890	718 856	36 449	755 355
Q1_2018	101 787	91 844	75 595	9 101	41 389	103 131	63 942	79 019	67 201	40 068	673 137	33 579	706 579
Q2_2018	107 852	91 924	77 120	9 609	42 187	103 314	69 466	82 553	69 068	43 550	697 426	33 035	729 914