



# United Nations Economic Commission for Africa

## E-Training on GDP Rebasing

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Economic Statistics and National Accounts Section  
ACS, ECA

# Content of the presentation

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# Introduction (1/2)

- A national accounts time series is specific to its base year.
  - For example, the current series with base year 2010 is not comparable to previous series with base year 2000, either in their current or constant price values, if not linked, because of the differences in data sources, methods, classifications, scope, concepts and the level of details adopted in these two series
- Therefore, rebasing introduces a break in the time series
  - The data of all previous series with different base years is no longer comparable with new series data, unless linked.
  - If the country makes no changes in rebasing, and only uses the price of new base year for valuation at constant prices, the current price data of new series will still be comparable with that of earlier series, as the values would be same for the common year in the two series.



# Introduction (2/2)

- Breaks in NA series result in loss of comparable long time series data.
- Users need these data for various purposes.
  - For example, government may need them for monitoring the economy, economic analysis, policy making, fixing growth targets, etc., companies may need them for business and investment decisions, and researchers may need them for analytical work, forecasting and for building econometric models.
- Therefore, it is necessary to reconstruct the past series, so that it becomes comparable and consistent in concepts and classifications with those adopted for the new base year series.
- The reconstruction of earlier time series in terms of new series is called "backcasting", a term somehow derived from "forecasting"
- It is a statistical technique employed to ensure the coherence of the time series across time while maintaining the economic history
- *Backcasting* refers to reconstructing the old series in terms of new series



# Scope of data in backcasting (1/6)

- Scope of data to be backcast depends upon several factors.
- Foremost of these is the identification of detailed levels for backcasting
  - For example, whether it involves only value added at industry level or it includes underlying variables such as, output, IC, VA components, etc.
  - On the expenditure side, whether it extends to detailed products/ purposes, or at the level of main aggregate, such as HFCE/GFCE/GFCF
- At the same time, scope of backcast data need not be same for the entire back series.
  - It can be different for different past periods, depending upon the availability of source data or the published data for those periods
  - A compromise can be the backcasting of data at detailed level for the recent years in the past (say last 10 years or till the previous base year) and at aggregate level for years before that.



# Scope of data in backcasting (2/6)

- Once the scope of data is identified, factors to be considered:
  - availability of detailed data in the old series or in different unlinked past series
  - availability of micro data and other source data in the database that was used by compilers to compile national accounts in the old series.
    - This is particularly useful if the country decides to rework the back series (or at least for the recent past years) using the methods and concepts followed in the new series or the micro-data approach.
    - This method is also particularly useful if the new series introduces changes in classifications of activities and purposes and also in the treatment of certain transactions (for example, an expenditure transaction is treated as intermediate consumption in the old series, but treated as GFCF in the new series), because these changes can be coded in the micro database and the series can be backcast using these new codes.



## Scope of data in backcasting (3/6)

- Other factors to be considered
  - kind of resources (manpower, financial and computing) available to the compilers; and
  - the time frame available for backcasting
- In general, countries should make efforts to backcast all the past national accounts series (linked or unlinked) since beginning,
  - This ensures that no data that was previously compiled is lost due to the compilation constraints (unless it is considered that some of the historical data is unreliable and not suitable for backcasting)



# Scope of data in backcasting (4/6)

- It is most likely that the scope of data compiled may be different in different historical series and definitely fewer than those in the new series.
  - For example, a country may have three old series, linked or unlinked to each other, and a new series
  - 1980 to 1990 (base year 1980) containing only production GDP estimates using ISIC Rev 2;
  - 1990 to 2000 (base year 1990) containing both production using ISIC Rev 3 and expenditure GDP estimates; and
  - 2000 to 2010 (base year 2000) containing estimates of GNI, Saving and net lending in addition to production (using ISIC Rev 3.1) and expenditure GDP estimates; and
  - new series from 2010 onwards (base year 2010), containing these data but compiled in accordance with 2008 SNA recommended classifications (using ISIC Rev 4) and concepts.



# Scope of data in backcasting (5/6)

- In such a case, it is only possible in normal circumstances to produce a consistent backcast series that includes
  - (i) production GDP data for 1980-1989;
  - (ii) production and expenditure GDP data for 1990-1999; and
  - (iii) production and expenditure GDP and additional accounts and aggregates for the period 2000-2009.
- Therefore, the scope of backcast data for different periods in the past, depends on the availability of source data or compiled data or published data to the national accounts compilers for these years.



# Scope of data in backcasting (6/6)

- It is possible to expand the scope for certain earlier time periods even if they were not compiled at that time, provided some source data is available now for those periods.
  - In the above example, it is possible to compile backcast expenditure GDP data for 1980-1989 with additional efforts, if some source data that can now facilitate compilation of these aggregates is available.
  - Mostly, historical data on imports and exports of goods and services should be available. Commodity flow methods can be used to estimate household consumption expenditure and GFCF of machinery and equipment.
  - Links between production and expenditure GDP (government output and GFCE; output of construction and GFCF of construction) can be used to estimate other aggregates.
  - Appropriate price indices (rescaled to new base year) may be available to produce constant price estimates.
- Similarly, estimates of GNI, Saving and net lending/borrowing can be compiled for total economy for previous periods in the backcasting exercise, as data on primary and secondary incomes and capital transfers should be available in the historical series of balance of payments statistics



# Backcasting methods (1/13)

- Three standard methods for backcasting have been recommended in the draft *UN Handbook on National Accounting Backcasting Methodology*.
  - Methods based on detailed re-working of individual data (micro-approaches)
  - Methods based on conversion coefficients (macro-approaches);
  - Methods applying interpolation between benchmarks (combined micro and macro-approaches).
- Within each of these methods, there are several possibilities or options for backcasting depending upon
  - availability of source data, resources, etc.,
  - breaks in the old series, and
  - choice between maintaining additivity and the historical growth rates in the backcast series.



# Backcasting methods (2/13)

- The main considerations for backcasting comprise:
  - changes made in the national accounts while rebasing relating mainly to (a) classifications, (b) source data, and (c) concepts and methods
    - Each of the three standard methods can be used to account for the changes made in the new series in the backcast series
  - scope of data identified for backcasting
    - Discussed earlier
  - methods; and different choices/approaches
    - a) Reworking the time series:* the entire old series is compiled on new base year concepts, classifications and methods (this ensures additivity but changes growth rates)
    - b) Conversion coefficients for the common year:* conversion coefficients for the identified scope of data for common year (base year of new series) are compiled and then applied on the old time series (no change in growth rates, but additivity feature is lost)



# Backcasting methods (3/13)

- c) *Interpolating conversion coefficients*: coefficients are estimated for benchmark years and the periods between the benchmark years, in the time series
- Step 1: conversion coefficients for the identified scope of data are compiled for few benchmark years (at the break points in the old series);
  - Step 2: conversion coefficients for the periods between these break points are estimated through interpolation. This will give separate conversion coefficients for the same variable for different periods in the time series
  - Step 3: conversion coefficients for different periods are then applied on the old series data for the corresponding periods to compile backcast data
  - Alternatively, a single set of conversion coefficients can be compiled as average of conversion coefficients of different periods, and then applied on the entire old time series.



# Backcasting methods (4/13)

- d) *Choice of focus variables*: Choice of variables of interest either for micro data approach or for compiling conversion coefficients could be (i) all the variables of interest (such as output, intermediate consumption, value added, etc.) or a single variable (such as value added) which will be used as a link to estimate other variables of interest by applying technical ratios (such as output to value added, employment to value added, etc.)
- e) *Combination of above approaches and choice of variables*: backcasting can be taken up using one method for certain period and other methods for other years in the same time series. For example, reworking the estimates or micro-data approach for the last 10 years and applying conversion coefficients for years before that



# Backcasting methods (5/13)

## Micro data approach

- mainly used for reclassifying the units according to new classification in the new series, in the micro data that was earlier used to compile estimates in the old series.
  - For example, a unit with the activity of repair of electric lighting equipment was earlier classified under 3150 in ISIC Rev 3.1, but will be reclassified under 3314 in ISIC Rev 4 in this approach.
- For using this approach, source data should be available at unit level, if not for the entire old series, at least for one common
  - For classification changes, this approach consists in double coding the activities of the units with old activity code (according to old activity classification, for example ISIC Rev. 3.1) and the new activity code (according to new activity classification (for example ISIC Rev. 4) and then re-compute the time series on the basis of the new code



# Backcasting methods (6/13)

## Micro data approach

- If micro data is available for certain past period (say, last 10 years), the old series can be reworked on the basis of new codes for this period.
- The procedure involved is as follows:
  - Each unit in the database was previously provided an activity code in line with classification system used in the old series.
  - These units will now be assigned a new principal activity code that is in line with the new classification system used in the new series.
  - The double coding of units with old and new activity codes helps in reclassifying the micro units and expressing the new series in terms of new classification.
  - The re-aggregation of the series simply consists in summing up the data (all the identified variables such as output, intermediate consumption, employment, etc.) corresponding to the various industries defined in terms of new classification.



# Backcasting methods (7/13)

## Micro data approach

- However, in situations where the compilers have limited resources or the micro data is available only for the common year (between the two series), the following procedure is applicable:
  - Procedure of double-coding according to the principal activity of the units is carried out only for the common year.
  - This double coding, for the common year, provides for each unit the conversion between the principal activity expressed in terms of the old and the new classifications.
  - This correspondence is applied to all the years (periods) of the series where the unit appears, providing data according to the new classification



# Backcasting methods (8/13)

## Micro data approach: Advantages over macro approach

- Provides reliable results, if activity codes are assigned to each unit on the basis of detailed and reliable information
- Retains the structural changes of the economy, whereas macro approach assumes fixed ratios of overlapping year, for entire series.
- It does not require the choice of a specific variable to work with. In the macro-approaches, it is necessary to choose a variable of reference for the identification of the conversion factors to be used when retropolating, and it usually is the value added.
  - As a consequence, it is only the structure observed on this variable that determines the conversion matrices, whereas the other possible variable of interests (e.g. turnover, investments etc.) may have a completely different structure.
- Micro data approach is costly, and most developing countries may not have micro data of units



# Backcasting methods (9/13)

## Macro data approach

- The macrodata approach follows a "proportional approach" in which conversion coefficients are compiled at the most detailed possible level of aggregates using the common year data (between old and new series) of these variables.
- These coefficients are then applied on the old series (both at current and constant prices) to form a time series that is consistent with the new series.
- In other words, the proportional method is equivalent to applying the growth rate of the old time series to the revised levels of the new series, for each variable being backcast



# Backcasting methods (10/13)

## Macro data approach: steps involved

- Identify the detailed levels of activities (within these, different variables such as output, intermediate consumption, value added and its components, employment, etc.), products and aggregates that would be covered in the backcasting exercise.
- Prepare concordance tables based on conversions coefficients for each detailed level identified for backcasting.
  - The conversion coefficient at the most disaggregated level is calculated as new series value in the base year divided by the old series value. These coefficients are calculated separately for current and constant prices
- Apply the conversion coefficients on the old series data, at most detailed level to obtain a consistent time series of national accounts.
- When the coefficients are applied, independently at detailed level and for the aggregates, there will be loss of additivity between components and aggregates, though they retain the growth rates of the old series.



# Backcasting methods (11/13)

## Macro data approach

- The conversion coefficients can be applied for all variables within an activity (for example, output, intermediate consumption, value added components, employment, etc.) separately, which may result in the loss of relationship between these variables.
  - For example output minus intermediate consumption may not equal value added (as each of these three variables are estimated separately using separate conversion coefficients).
  - Another option is to compile only one conversion coefficient for an identified variable (for example, value added) and then apply the technical coefficients to estimate output, intermediate consumption, employment, etc. (using the value added to output ratio, value added to employment ratio, etc.).
  - This method will ensure the macro relationships between variables, but will not retain their own structure of evolution over the years.
  - Technical coefficients change in both, short or long term periods, but this method will not capture these changes as it retains the structure of the base year throughout the backcast series.



# Backcasting methods (12/13)

## Methods applying interpolation between benchmarks

- Uses a combination of micro and macro approaches.
- It involves in deriving conversion coefficients for each of the historical old series and assumes the availability of micro data for these benchmark periods
- The steps involved in this procedure are
  - Identify the benchmark periods or the break points in the historical time series
  - Double code the units in the micro data for each of the benchmark years
  - Based on the double coding, estimate conversion coefficients for the benchmark years (say, for the years 2000 and 2010). Then estimate conversion coefficients for each period (for example, from 2001 to 2009) by interpolation
  - As in the earlier two methods, conversion coefficients can be estimated for each variable separately or only for one variable (say, value added) and then use technical ratios to estimate all variables of interest.
  - Another variant of this is to combine all the conversion coefficients (average) of the benchmark years (separately at detailed level and for variables of interest) and then apply these ratios to all the periods of the time series.



# Backcasting methods (13/13)

## Methods applying interpolation between benchmarks

- This method has the advantage of using the data at several benchmark points and captures the major structural changes in the economy that had taken place.
- The interpolation techniques adopted in this method also ensure that the conversion coefficients are more realistic rather than being constant over the entire time series.
- However, the method requires micro data at break points, which is generally limited in the case of developing countries.



# Key issues in backcasting

- The standard methods for backcasting and several variants of the methods have been discussed. These have advantages and drawbacks.
- Developing countries in Africa need to decide on the choices of methods depending upon country practices, capacity and resources available and user understanding of the data.
  - if it is possible to access micro data of businesses, surveys and government accounts, micro-data approach could be adopted, atleast for the recent past.
  - Otherwise, macro data approach is the most feasible option
- The other main practical issues for developing countries could arise on (a) level of details (activities, products, aggregates, variables, etc.) at which backcasting can possibly be taken up; and (b) choice between maintaining growth or additivity



# Key issues in backcasting

## Level of details: activities

- The activity classification at detailed level in the new series may be different from that in the old series.
- For applying proportionate method, it may be necessary to transform the old series data to correspond to that in the new series, in terms of classification and coverage, to the extent feasible and data sources permit, before backcasting.
- For transforming the old series data to correspond to the new series activity groups, there are four possibilities
  - a) No change in the activities and their coverage:** The grouping and the coverage of activities in each of the industries is broadly the same in both the old and new series.
    - For example, meat production from slaughtering is included under livestock (animal production) in both the series for historical reasons, though this is incorrect according to ISIC Rev.4.
    - Backcasting the data using the macro approach may pose less challenges.



# Key issues in backcasting

- b) Changes are made in the activities, but disaggregated data is available in the old series:**
- The grouping and the coverage of activities within the industries differs between the old and new series.
  - However, data is available at detailed level in the old series that can facilitate rearranging the old series data to correspond to the industry grouping and the coverage of activities according to the new series.
  - Concordance between old and new classifications (or double coding at detailed level) can be established at the detailed level for this purpose.
    - For example, meat from slaughtering was included in livestock in old series, but included in manufacturing in new series. The data on meat from slaughtering can be separated from livestock and included under manufacturing in the old series.
    - The rearrangement of old series data makes its classification comparable with that in the new series.
  - The backcasting exercise can then be taken up, once the two series are made comparable in classifications and coverage.



# Key issues in backcasting

- c) **Changes are made in the activities, but data needed at detailed level is not available in the old series.**
- The grouping and the coverage of activities in each of the industries differs between the old and new series.
  - Further, data is not available at detailed level in the old series that can facilitate rearranging the old series data to correspond to the grouping and the coverage of activities according to the new series.
    - For example, some activities were not separately identified in the old series, because they were either less significant or included in a broad group (such as ‘others’, ‘repairs’, etc.).
    - In this case, activities in the old series can be split using the proportions available in the new series
    - For example, growing of flowers was part of ‘others’ in the old series, but is identified separately in the new series. The values in the new series are for flowers: 100 and for others: 400 and in the old series for others: 500. A ratio of 20% ( $100/500$ ) estimated from new series can be applied on ‘others’ in all the years of old series to obtain the value for growing of flowers separately in the old series.



# Key issues in backcasting

- d) The activities in the new series are new and did not exist in the old series:**
- It is possible that the new series introduces new activities that have recently emerged in the economy, for example some of the information and communication services.
  - If their contribution in the recent past can be estimated separately, then the method suggested in (c) can be adopted.
  - Otherwise, efforts should be made to estimate their contribution for the years since these activities started appearing in the economy



# Key issues in backcasting

## Maintaining growth rates or additivity

- The most important guiding factor for backcasting is in ensuring that the resultant data is consistent with the old series in terms of maintaining economic history, as far as possible.
- While maintaining historical growth rates of the old series in the backcast series, additivity is lost between aggregates and their components (for example, gross value added of industries will not add up to total GVA, when growth rates are maintained at industry level and at the overall economy level) and this may not be easily understood by the users.
- On the other hand, if additivity is ensured between components and aggregates, the growth rates at either overall level or at the industry level will differ with those in the old series, which may draw criticism from the users for changing economic history.



# Maintaining growth rates for components and aggregate, but losing additivity

Note that components do not add up to total estimated by proportionate method in 2009 (backcast), but growth rates for 2010 are same in both series for components and aggregate

Industry (GVA)	Old series (base year 2000)			New series (base year 2010)		
	2009	2010	Growth rate (%)	2009 (backcast)	2010	Growth rate (%)
Agriculture	100	110	10.0	250	275	10.0
Mining	50	45	-10.0	155	140	-10.0
Manufacturing, utilities and construction	150	160	6.7	525	560	6.7
Trade and Transport	200	180	-10.0	820	738	-10.0
Other services	500	550	10.0	950	1045	10.0
Total (proportionate method)	1000	1045	4.5	2639	2758	4.5
Total: Sum of industries	1000	1045		2700	2758	



# Maintaining additivity, but changes overall growth rate

Note that components add up to total in 2009 (backcast) and growth rates for industries is same for 2010 in both series, but overall growth rate for 2010 are different in the two series

Industry (GVA)	Old series (base year 2000)			New series (base year 2010)			
	2009	2010	Growth rate (%)	2009 (backcast)	2010	Growth rate (%)	
Agriculture	100	110	10.0	250	275	10.0	
Mining	50	45	-10.0	155	140	-10.0	
Manufacturing, utilities and construction	150	160	6.7	525	560	6.7	
Trade and Transport	200	180	-10.0	820	738	-10.0	
Other services	500	550	10.0	950	1045	10.0	
Total: Sum of industries	1000	1045	4.5	2700	2758	2.1	



# Maintaining additivity and overall growth rate, but change in growth rates of industries

Note that components add up to total in 2009 (backcast) and overall growth rate is same for 2010 in both series, but growth rates for industries is different in the two series for 2010

Industry (GVA)	Old series (base year 2000)			New series (base year 2010)		
	2009	2010	Growth rate (%)	2009 (backcast)	2010	Growth rate (%)
Agriculture	100	110	10.0	244	275	12.6
Mining	50	45	-10.0	151	140	-7.9
Manufacturing, utilities and construction	150	160	6.7	513	560	9.1
Trade and Transport	200	180	-10.0	801	738	-7.9
Other services	500	550	10.0	928	1045	12.6
Total: Sum of industries	1000	1045	4.5	2639	2758	4.5



# Growth rates vs additivity

- Resolving the conflict between losing additivity but ensuring same growth rates; and maintaining additivity but changing the growth rates, is a choice that is left to countries keeping in view the country practices and the users' understanding of the data.
- Ideally, the best method for backcasting is the one in which the growth rates of old series are maintained at all levels in the backcast series, though this results in loss of additivity. Users need to be educated about this statistical feature.
- Different countries follow different approaches for ensuring consistency between backcast series and old series. Some countries may even follow a mix of the above three approaches.
  - For example, they may follow the approaches mentioned in tables (2) or (3) for the recent past years, and table (1) for other years in the past.
  - For example, for the last 5 or 10 years, countries may maintain additivity between components and aggregates (with changes in the growth rates), and for the years prior to that they may ensure that the growth rates of components and aggregates in the backcast series remain same as in the old series (losing additivity feature).



# Summary, Evaluation of results and dissemination of data

- Following the revision of base year, a break in national accounts time series occurs. The previous data is no more comparable with that of new rebased series, either in their current (because of level changes) or constant price values.
- Users need a consistent time series national accounts for various purposes. It is, therefore, essential for countries to transform the old series data so that it is made consistent and comparable with the new series.
- It may not be possible to backcast the entire set of national accounts that was compiled and disseminated in the old series. Therefore, scope of data for backcasting needs to be decided before taking up this exercise.
- There are three standard methods available for backcasting with several variants and options for each of these methods. Each of these methods have merits and drawbacks. Therefore, countries need to choose the best options for backcasting keeping in view the availability of detailed data in the old series, source data, resources and country practices.



# Summary, Evaluation of results and dissemination of data

- The proportionate method is the easiest for developing countries with limited access to micro data or extensively detailed source data, for backcasting.
- Maintaining historical growth rates in the recast time series, should be the prime criterion in backcasting exercise using this approach.
- Whichever methods are used for backcasting, it is essential for countries to apply stringent scrutiny of derived data and evaluate the results with regard to the levels, growth rates, and shares in the GDP in comparison to those in the earlier series.
- Comparative tables showing the old series values, growth rates, proportions, etc. with those of backcast series should be prepared for evaluating the results and could be disseminated to the public for improving transparency in compilations.
- It is important to prepare a sources and methods document for the backcast series describing how the data was compiled. This document together with detailed results and the comparative statements, should be disseminated to the public



# Suggested reading material

- The 2008 SNA (Chapter 15 – Price and volume measures) European Commission, IMF, OECD, UN, World Bank, 2009;
- Handbook on price and volume measures in national accounts- Eurostat, Office for Official Publications of the European Communities, Luxembourg 2016;
- The 2008 SNA - compilation in brief, World Bank, 2014
- National Accounts: A practical introduction, Studies in Methods, Serie F, No.85, UN 2003; chapter XV:Price and volume measurement;
- ESA 2010, Chapter 10 – Price and Volume Measures - Regulation (EU) No 549/2013 of the European Parliament and of the Council of 21 May 2013 on the European system of national and regional accounts in the European Union
- Handbook on National Accounting Backcasting Methodology (draft) (<https://unstats.un.org/unsd/class/intercop/training/ece13/ac258-bk4-e.pdf>)



THANKS / MERCI