



UGANDA

TECHNICAL ASSISTANCE REPORT—REPORT ON THE NATIONAL ACCOUNTS STATISTICS MISSION

September 2017

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UGANDA

REPORT ON THE NATIONAL ACCOUNTS STATISTICS MISSION

(July 23–August 4, 2015)

Prepared by Robin Youll

August 2015

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ABBREVIATIONS

AFE	East Africa Technical Assistance Centre of the IMF
AFR	African Department, IMF
ANA	Annual national accounts
BOP	Balance of payments
BoU	Bank of Uganda
CIF	Cost including insurance and freight
CPI	Consumer price index
FCE	Final consumption expenditure
FISIM	Financial intermediation services indirectly measured
GCF	Gross capital formation
GDP	Gross domestic product
GDP(P)	Gross domestic product based on the production approach
GDP(E)	Gross domestic product based on the expenditure approach
GFCF	Gross fixed capital formation
GO	Gross output
HFCE	Household final consumption expenditure
IC	Intermediate consumption
IMF	International Monetary Fund
ISIC	<i>International Standard Industrial Classification of All Economic Activities</i>
MES	Macroeconomic Statistics Division of UBOS
MSA	Macroeconomic Statistics Advisor
NAS	National accounts statistics
NPISH	Non-Profit Institutions Serving Households
QGDP	Quarterly GDP
QNA	Quarterly national accounts
SNA	<i>United Nations System of National Accounts</i>
STA	Statistics Department, IMF
STX	IMF Short-term Expert
SUT	Supply and Use Tables
TA	Technical Assistance
TiS	Trade in Services
UBOS	Uganda Bureau of Statistics
UGA	Uganda
UGS	Ugandan Shillings
URA	Uganda Revenue Authority
VAT	Value added tax
WIP	Work-in-progress

EXECUTIVE SUMMARY

In response to a request from the Ugandan authorities and in consultation with the African Department (AFR), I undertook a technical assistance (TA) mission to Kampala during July 23–August 04, 2015 to assist with the development of estimates of quarterly GDP for expenditure components. The activity 16STY6100 was undertaken within the context of the following project: Quarterly National Accounts STA_UGA_2011_07.

The Uganda Bureau of Statistics (UBOS) is responsible for producing the National Accounts Statistics governed by the *Uganda Bureau of Statistics Act 1998*. The institution produces annual GDP estimates by activity and expenditure at current and constant prices. Quarterly GDP by activity are also compiled at constant and current prices. No expenditure estimates of GDP are compiled on a quarterly basis.

UBOS completed rebasing and revision of GDP estimates with the assistance of East AFRITAC and disseminated the results in November 2014. The published results included annual and quarterly GDP by activity at current and constant 2009/10 prices as well as annual estimates of GDP by expenditure. Compilation of the Supply and Use Tables (SUT) in developing the 2009/10 base year estimates contributed significantly in improving the coverage of economic activities especially informal sector and non-profit institutions. Nine missions were undertaken between 2011 and 2014 to (i) review the data sources and compilation methodology used to compile quarterly GDP; (ii) assist with developing the methodology for work in progress for agriculture and construction; (iii) advise on improvement of quarterly GDP estimates at constant prices and initiated compilation of current price estimates; and (iv) provide training on the compilation methodology and use of source data.

The previous quarterly national accounts mission, conducted in November 2014, reviewed the source data collected; provided advice on improving data quality and representativeness; and assisted in developing compilation worksheets for the expenditure estimates. Further guidance on data sources and compilation methodology of quarterly GDP by expenditure was offered to all the AFE member countries, which UBOS participated, through a workshop held in February 2015.

The key objective of the current mission was to further develop the estimates of GDP for expenditure components. This was broadly achieved. The previous work undertaken to develop the methodology and a compilation system for producing estimates of GDP based on expenditure components was reviewed. The previous mission, conducted in November 2014, had initiated the development of the compilation worksheets for the expenditure estimates. That mission recommended the continued development of the data sources and the estimation system by local counterparts. However, at the start of the current mission no further work had been undertaken since November 2014 because of a shift in priorities within UBOS. Specifically, UBOS has instead been investigating the potential to produce an independent

estimate of annual GDP based on the production approach. As a result of this change in priorities, the mission was unable to achieve its objective of finalizing the estimates of GDP expenditure components and prepare these for publication.

Therefore, at the outset of the current mission the Short-term Expert (STX) met with UBOS's Director of the Macroeconomic Statistics Division (MES) to agree revised objectives for the mission. It was agreed that the mission should focus on the constant price measure of expenditure GDP, and develop provisional estimates which can be evaluated in the coming period. Particular issues concerned the estimates of Household Final Consumption Expenditure (HFCE), which constitutes around 70 percent of total GDP in Uganda, and the basis of estimation of unit values for imports and exports.

The mission established a systematic basis for estimating HFCE based on a constant price Commodity Flow Model (CFM). The model uses data from the production measure of GDP (GDP(P)) for Gross Output (GO) and Intermediate Consumption (IC). These are available by industry from the GDP(P) system. The CFM uses data on the relationship between industries and products from the 2009/10 SUT to estimate constant price GO and IC by product. The CFM also includes data on trade, investment, government expenditure, taxes, and trade margins to create a 'balance' of total supply and total demand for each of 158 products. The missing components are the demand for HFCE and the change in inventory for each product, which can therefore be derived as a residual in the CFM.

Together with the local counterpart staff, the mission developed an MS Excel framework for producing the CFM. Where possible linkages to existing workbooks were established, including those used to estimate GO and IC from the GDP(P) system.

The second key issue was to develop volume estimates of imports and exports. These can be derived for the administrative data for 'formal' external trade (i.e., for registered traders) collected by the Ugandan Revenue Authority (URA). In addition, UBOS undertakes a large rolling survey of informal cross border trade. In total these sources constitute around 2 million transactions over the period since January 2008. To manage these data the mission developed an MS Access database and integrated this into a 'front end' MS Excel system to produce quarterly Unit Value Indexes (UVIs) for both formal and informal imports and exports. These UVIs were used to compute estimates of the trade flows in constant 2009/10 prices, which were then linked into the CFM system.

One further challenge was to produce estimates of consumer prices for the 158 products in the CFM. These are needed so that estimates of HFCE in current prices can be derived from the constant price series. At present the Consumer Prices Index (CPI) is being rebased by UBOS. The mission met with the relevant team and provided support for the development of a bridging table to convert the CPI (which is classified according to the Classification of Individual Consumption by Product, COICOP) onto a basis consistent with the Central

Product Classification (CPC) used by UBOS in the GDP system. While a provisional bridge table was established, further work is needed to ensure its accuracy.

In addition, some of the other data sources used in the CFM need to be reviewed to improve the consistency with the published series. Notably the data for trade in services (TiS) from the balance of payments (BOP). These exist in more detail than the series made available to the mission. The mission recommended that MES acquire the additional detail from the central bank so that an improved correspondence between the BOP classification and the CPC can be established.

Once the constant prices estimates have been developed to an acceptable quality, the current price series can be derived from another CFM which can be developed from the constant price MS Excel template.

The mission also provided training on the more broad compilation methods required for producing quarterly estimates of GDP(E).

At the end of the mission the key findings and recommendations were discussed with the Executive Director responsible for statistical outputs in UBOS and with the senior management team in MES.

SUMMARY RECOMMENDATIONS

Recommendation	Timing	Priority
Recommendation 1: UBOS should request from the central bank more detailed data on TiS, and establish a correspondence between the SUT product codes and the coding frame used for TiS.	Oct 2015	H
Recommendation 2: UBOS should request from the BoU data on the country of origin of imported TiS, to improve the basis of deflation. In addition, UBOS should investigate the potential to develop Trade Price Indexes (TPIs) for the main imported services products.	Oct 2015	H
Recommendation 3: UBOS should establish a detailed bridging table between the 158 products defined in the SUT with the equivalent COICOP codes used for the rebased CPI, when this becomes available.	Oct 2015	H
Recommendation 4: Once the rebased CPI becomes available, this should be linked into the workbook Comm_Flow_CPI_SUT.xlsx within the CFM system.	Oct 2015	M
Recommendation 5: Taxes on petroleum products should be classified as Excise taxes in both the GDP(E) and GDP(P) systems.	Oct 2015	M
Recommendation 6: The constant price CFM should be finalized before further work is undertaken to develop the equivalent current price model.	Jan 2016	M
Recommendation 7: Before publication, the quarterly CFM estimates of GDP for expenditure components should be constrained to the existing GDP(P) estimates.	Jan 2016	M

PROJECT FRAMEWORK SUMMARY

Project framework summary to improve and expand the QNA statistics in Uganda.

OBJECTIVES

Objectives	Verifiable Indicators	Assumptions
Improvement of Uganda's QNA System	QNA figures meet stakeholders' expectations in terms of quality and timeliness and abilities of the staff.	Assumptions are that the staffing shall be appropriate in terms of numbers and qualification in addition to the availability of TA and appropriate source data.

ACTIVITIES/OUTPUTS

DQAF	Priority	Outcomes Description	Verifiable Indicators	Completion Date	Implementation Status
0.2.1	High	Statistics prerequisites: Increase the current staffing level of NAS Unit by two statisticians in order to implement improvements to QGDP.	Current staffing level of NAS Unit increased from 8 to 10 statisticians.	11/21/2011	Completed. There are currently ten staff members in the NAS Unit including eight statisticians and two data editors.
0.2.1	High	Train NAS staff on the use of improved source data and compilation techniques for producing ANA and QNA.	NAS staff has the appropriate capacity and skills to compile high quality ANA and QNA.	12/31/2014	Training is being provided during missions and workshops. Need to nominate staff for IMF and other NAS courses.
3.1.1		Data sources: Improvement of data sources and indicators used to compile ANA and QNA in current and constant prices.	The indicators are representative and provide adequate coverage for each economic activity, expenditure component and other aggregates.	12/31/2014	A number of new surveys are being implemented to address data gaps, and coordination with other data providers is being improved.

DQAF	Priority	Outcomes Description	Verifiable Indicators	Completion Date	Implementation Status
3.3.1	Medium	Statistical techniques: Rebasing of QGDP	New base year 2009/10 QGDP	11/28/2014	Completed. SUT finalized and benchmark estimates compiled. QGDP series finalized and updated.
3.3.1	High	Improve the methodology for compiling QGDP at constant prices.	Methodology for compiling QGDP at constant prices revised.	05/31/2014	Completed. Improvements have been implemented and the QGDP estimates have been publicly released, with further improvements incorporated in 2013 and 2014.
3.3.1	High	Develop the methodology for compiling QGDP at current prices.	Methodology for compiling QGDP at current prices implemented.	05/31/2014	Completed. Methodology Developed
3.3.1	High	Develop the methodology for compiling quarterly output and intermediate consumption estimates.	Output and intermediate consumption estimates compiled.	05/31/2014	Completed. Methodology and GO and IC estimates developed.
3.3.1	High	Produce QGDP estimates by expenditure share in current and constant prices.	QGDP by expenditure estimates compiled.	12/31/2015	Methodology developed. To be implemented by NAS staff with AFE TA.
3.3.1	High	Produce quarterly estimates of other key NAS aggregates in current prices.	Quarterly estimates of GNI, GNDI, saving, net lending/borrowing in current prices compiled.	12/31/2015	Methodology developed. To be implemented by NAS staff with AFE TA.
5.1.1	High	Dissemination: Release QNA within three months after the reference quarter.	QNA released to the public within three months after the reference quarter.	12/31/2011	Completed. QGDP estimates in constant prices were released to the public in early October

DQAF	Priority	Outcomes Description	Verifiable Indicators	Completion Date	Implementation Status
					2011. UBOS plan to improve timeliness to two months.
5.1.1	High	Release QGDP by economic activity based on one digit on ISIC revision 4. - press release/media - publications/websites	QGDP by activity based on one digit on ISIC revision 4 released.	11/28/2014	Completed.
5.2.1	High	Update and release revised concepts, sources and methods manual for QGDP.	Updated QGDP manual disseminated.	11/28/2014	Completed.

TA ACTIVITIES - COMPLETED AND PLANNED UNDER THE QNA PROJECT

Date	ID	TA Activity Description
11/15/2010 - 11/26/2010	11STW5215	AFE LTE: National Accounts Statistics Mission
05/05/2011 – 05/18/2011	11STZ2714	AFE LTE: Quarterly National Accounts Statistics Mission
11/08/2011 – 11/17/2011	11STZ2718	AFE LTE: Quarterly National Accounts Statistics Mission
05/08/2012 – 05/17/2012	12ST46309	AFE LTE: Quarterly National Accounts Statistics Mission
11/05/2012 – 11/16/2012	12ST46310	AFE LTE: Quarterly National Accounts Statistics Mission
05/20/2013 – 05/31/2013	13ST80910	AFE LTE: Quarterly National Accounts Statistics Mission
11/04/2013- 11/15/2013	13ST80911	AFE LTE: Quarterly National Accounts Statistics Mission
05/05/2014- 05/23/2014	14STG3806	AFE LTE: Quarterly National Accounts Statistics Mission
09/15/2014- 09/26/2014	14STG3816	AFE LTE: Quarterly National Accounts Statistics Mission
11/13/2014- 11/26/2014	14STG3823	AFE LTE: Quarterly National Accounts Statistics Mission
07/23/2015- 08/04/2015	16STY6100	AFE LTE: Quarterly National Accounts Statistics Mission

I. INTRODUCTION

1. This is the technical report of the IMF's East Africa Technical Assistance Center mission which visited Kampala during July 23–August 04, 2015 to assist the Uganda Bureau of Statistics (UBOS) with the development of estimates of quarterly GDP for expenditure components. The activity 16STY6100 was undertaken within the context of the following project: Quarterly National Accounts STA_UGA_2011_07.
2. UBOS is responsible for producing the National Accounts Statistics and is participating in the IMF–DFID: Enhanced Data Dissemination Initiative QNA Module to improve and expand the QNA estimates disseminated. In addition, it has been rebasing the Gross Domestic Product (GDP) estimates to 2009/10. The MSA undertook diagnostic missions during August and November 2010 to review the data sources and compilation methods used to compile the ANA and QNA estimates and to make recommendations for improvements.
3. Six follow-up missions were undertaken by the MSA during the period 2011 to 2013 to assist with improving data sources and methods, including compiling agriculture and construction work-in-progress estimates, improved quarterly constant price and new current price gross domestic product (GDP) estimates, and supply and use tables (SUT); as well as providing related training on the compilation methodology and use of source data. In addition, four short-term expert missions were undertaken during this period to assist with data quality assurance; and the development and compilation of the SUT. A further four missions by consultants from Oxford Policy Management assisted with SUT compilation.
4. The missions in May, September and November 2014 by the MSA assisted in finalizing the SUT and 2009/10 benchmark estimates; provided advice on the compilation of the rebased annual and quarterly GDP by economic activity; and made further improvements to the methodology, including improving the annual and quarterly estimates for public administration, public education, public health, and GDP by expenditure components.
5. The current mission worked closely with the National Accounts Department staff. The cooperation and support of the authorities and counterpart staff is very much appreciated.
6. To assist the reader, this report includes an Executive Summary of the main findings and an updated Project Framework Summary. Following this introduction, Chapter II provides a brief update in relation to the statistics prerequisites. Chapter III provides a summary of the work undertaken during the mission. Chapter IV gives detailed information on the methodology used to compile the estimates of GDP by expenditure components, while Chapter V considers the next steps and recommendations to take forward the work to improve the estimation and to develop the estimates in current prices.

II. STATISTICAL PREREQUISITES

7. Budget funding for the UBOS has been significantly constrained in recent years. However, most of the data needed for compilation of the SUT and GDP rebasing was eventually collected. The main data gaps remaining relate to detailed international trade in services and the detailed product breakdown of IC components by economic activity.
8. The Integrated Trade in Services Survey has now been conducted and the results will be available for the next rebasing exercise. The benchmark industry production surveys need to be improved to collect more detailed IC data.
9. As the next GDP rebase will be for 2015, it is strongly recommended that UBOS secure appropriate budget funding for benchmark surveys and to recruit a suitable expert to provide the 40 weeks of TA that will be required. Both Kenya and Rwanda provide good examples of how this should be done using a single external consultant with support from the AFE MSA, as needed.
10. The current staffing level for the NAS Unit is now nine staff, comprising eight statisticians and one data editor. There is a need to increase staff skills development through attendance at regional/international NAS courses, as well as training during TA missions. The MSA and short-term experts have provided training to NAS compilers during missions on good compilation practices and better use of indicators and price indices in compiling ANA and QNA. In addition, some staff members have been participated in the two-week AFE NAS training course conducted in Tanzania during February 2012; and the AFE QNA training courses in Uganda during September 2012 and February 2014.
11. As recommended previously, consideration needs to be given to reviewing and improving survey and data processing timetables. There is also a need to improve data coordination and understanding of NAS requirements within UBOS and with other data providers. The recommended NAS Technical Committee is yet to be established.

III. WORK UNDERTAKEN DURING THE MISSION

12. The objective of the current mission was to develop quarterly GDP estimates by expenditure components (GDP(E)). The approach to achieving this was discussed with the Director of the Macroeconomic Statistics Division (MES) and his senior term at the start of the mission. It was agreed that the priority should be to aim to produce initially a constant price series for GDP(E), and to use the framework developed for this purpose to later develop current price estimates.
13. Previous AFE missions had initiated the basis of a methodology for estimating GDP(E) at an aggregate level and some preliminary workbooks for some components of GDP(E) had been established. The key components which had not been developed were i) the data sources, methods, and workbooks for Household Final Consumption Expenditure

(HFE), which comprises around 70 percent of total GDP in Uganda, ii) estimates of Trade in Services (TiS), at around 8 percent of total GDP, and iii) external trade in goods in constant prices (including informal cross border trade), which make up some 34 percent of GDP.

14. The approach developed by the mission was to use a Commodity Flow Model (CFM) which allows comparison of the supply and demand for 158 different products each quarter. A 'master' workbook was established for the constant price CFM, with links to the various data sources needed for each component.

15. The CFM shows the constant price supply and demand for each product for a user selected time period (either the quarter or the year). Figures 1 and 2 show the supply and demand flows for the first 25 products for the fiscal year 2009/10.

Figure 1: Supply Componets from Commodity Flow Model

Code	Description	Gross Output	Imports of Goods (Fromal)	Imports IBCI	Imports of Services	Excise Taxes	VAT taxes (non-refundable)	Customs Duty	Dist. & trade margins	Total Supply
	Total	64,263	9,105	165	1,457	1,109	1,625	593	0	78,317
AAA	sugarcane	92	-	0	-	-	-	-	0	93
AAB	Tobacco	68	0	2	-	-	0	0	42	112
AAC	Cotton	69	0	-	-	-	0	-	21	90
AAD	Flowers	84	0	0	-	-	0	0	11	95
AAE	Cocoa	72	0	-	-	-	0	0	21	92
AAF	Coffee	473	1	16	-	-	0	0	35	525
AAH	Tea	60	0	0	-	-	0	0	6	65
AAI	Vanilla	10	-	-	-	-	-	-	3	13
AAJ	Other Cash Crops	18	-	-	-	-	-	-	-	18
ABA	Wheat	17	284	-	-	-	0	0	8	309
ABB	Maize	1,010	1	4	-	-	0	0	280	1,294
ABC	Rice	261	55	-	-	-	-	40	49	404
ABD	Sorghum	183	1	1	-	-	-	0	33	218
ABE	Millet	213	0	0	-	-	-	0	10	223
ABF	Other Cereal Crops	7	8	0	-	-	0	0	2	16
ABG	Vegetables and Melons	415	7	2	-	-	0	0	177	602
ABH	Soya beans	25	0	0	-	-	-	0	6	31
ABI	Ground Nuts	415	4	4	-	-	-	0	74	496
ABJ	SimSim (Sesame)	198	0	0	-	-	-	0	61	258
ABK	Sunflower	21	1	-	-	-	-	0	6	28
ABL	Other Oil Seeds	-	2	0	-	-	0	0	0	2
ABM	Irish Potatoes	132	0	5	-	-	-	0	24	161
ABN	Sweet Potatoes	725	0	0	-	-	0	0	4	729
ABO	Cassava	1,186	2	4	-	-	-	0	95	1,287
ABP	Other Root Crops and Tubers	17	2	0	-	-	0	0	5	25

Figure 2: Demand Components from Commodity Flow Model

Code	Description	Intermediate Demand	Gen. Govt. FCE	Household FCE	NPISH	GFCF	Change in Inv.	Exports of Goods (Formal)	Exports of Services	Exports of Total Uses	Balance		
	Total	27,198	3,929	28,029	715	10,903	819	4	3,187	1,357	2,175	78,317	0
AAA	sugarcane	90	-	2	-	-	0	-	1	-	-	93	-
AAB	Tobacco	76	-	2	-	-	103	-	136	2	-	112	-
AAC	Cotton	73	-	-	-	-	2	-	15	-	-	90	-
AAD	Flowers	38	-	5	-	-	2	-	50	0	-	95	-
AAE	Cocoa	19	-	-	-	-	2	-	72	-	-	92	-
AAF	Coffee	71	-	11	-	-	89	-	530	3	-	525	-
AAH	Tea	56	-	-	-	-	1	-	5	3	-	65	-
AAI	Vanilla	4	-	-	-	-	9	-	-	-	-	13	-
AAJ	Other Cash Crops	18	-	-	-	-	-	-	-	-	-	18	-
ABA	Wheat	307	-	-	-	-	2	-	0	0	-	309	-
ABB	Maize	916	-	245	-	-	36	-	40	58	-	1,294	-
ABC	Rice	206	-	154	-	-	13	-	32	-	-	404	-
ABD	Sorghum	41	-	167	-	-	2	-	3	6	-	218	-
ABE	Millet	29	-	185	-	-	0	-	0	8	-	223	-
ABF	Other Cereal Crops	14	-	-	-	-	0	-	2	0	-	16	-
ABG	Vegetables and Melons	53	-	480	-	-	43	-	2	24	-	602	-
ABH	Soya beans	28	-	-	-	-	1	-	2	1	-	31	-
ABI	Ground Nuts	214	-	268	-	-	7	-	0	8	-	496	-
ABJ	SimSim (Sesame)	169	-	63	-	-	4	-	19	3	-	258	-
ABK	Sunflower	27	-	-	-	-	1	-	1	0	-	28	-
ABL	Other Oil Seeds	2	-	-	-	-	0	-	0	0	-	2	-
ABM	Irish Potatoes	32	-	105	-	-	15	-	-	10	-	161	-
ABN	Sweet Potatoes	160	-	540	-	-	26	-	-	3	-	729	-
ABO	Cassava	456	-	684	-	-	141	-	1	4	-	1,287	-
ABP	Other Root Crops and Tubers	1	-	18	-	-	46	-	51	1	-	25	-

16. In principle, the constant price values for 2009/10 as a whole from the CFM should equal the current price values from the Supply and Use Table for that year. However, there are some differences which arise because:

- The data used for the CFM are taken from the 'live' GDP system, notably the estimates of Gross Output (GO) and Intermediate Consumption (IC). This system is updated each period with the latest data, and so includes all revisions to the time series. As such, it differs from the SUT values. The published GDP series is constrained to exclude such revision. However, the detailed underlying data are not maintained by UBOS and so it is not possible to produce detailed expenditure estimates entirely consistent with the published series or with the SUT, other than by constraining the results, see later.
- Some adjustments were made to the data in the SUT, for example for exports of tobacco which were divided by three, in order to produce a balance. However, the data for trade in goods in the CFM is based on the actual data collected by the Uganda Revenue Authority (URA), and no equivalent adjustments have been made as this would lead to anomalies in the time series unless the adjustments were maintained for all quarters.
- The SUT did not record changes in inventories for many goods, including the major cereal crops which are mainly consumed by households. For the quarterly series, it is unrealistic to assume that these products are consumed at the time they are produced, although over a full year it may be that the aggregate change in inventory may be closer to zero (as in the SUT). In fact, the estimates of GO explicitly include some 'work in progress' which are effectively inventories and so need to be accounted for in the demand components. For these products, the CFM estimates the total HFCE plus the changes in inventories as a residual, and then calculates the HFCE component based on the ratio in

the base year from the SUT of HFCE to total ‘net supply’ (i.e., total supply less exports, capital formation, final expenditures by government and of non-profit making institutions serving households, and the acquisition less disposal of valuables). This produces a quarterly estimate of changes in inventories for these goods.

- Some estimates were added to the SUT for which there is no equivalent quarterly data source. Most notably, the SUT includes estimates of trade in services for ‘Recreational activities’ (ISIC section ‘R’), while the quarterly balance of payments (BOP) records zeros for these activities. The CFM has aimed for consistency with the BOP in this case, which again leads to a difference from the SUT estimates.

17. Table 1 compares the estimated GDP in 2009/10 from the SUT with that from the CFM.

Table 1: Comparison of GDP based on SUT and CFM, (billions UGS)

<i>Estimate based on:</i>	GDP
Commodity Flow Model	41,186
Supply & Use Table	40,946
Difference	240
% Difference	0.6%

18. Because of these differences, the approach taken when developing the CFM was to use the SUT to estimate ratios of components of supply and demand rather than for setting the absolute levels in 2009/10. However, when the GDP(E) series is prepared for publication it will be necessary to constrain the results so that the totals are consistent with the published quarterly series for GDP(P), see Next Steps.

19. Based on the detailed methods described in Chapter IV of this report, a complete set of product flows was established for the following components of supply and demand:

Table 2: Components of the Product Flows

Supply	Demand
Gross Output	Intermediate Demand
Imports of Goods (Formal)	General Government Final Consumption Expenditure
Imports from Informal Cross Border Trade	Household Final Consumption Expenditure
Imports of Services	NPISH Final Consumption Expenditure
Excise Taxes	Gross Fixed Capital formation
VAT taxes (non-deductible)	Change in Inventories
Customs' Duty	Acquisition less disposal of valuables
Distribution & trade margins	Exports of Goods (Formal)
Total Supply	Exports from Informal Cross Border Trade
	Exports of Services
	Total Uses

20. A time series of the estimates of expenditure components and total GDP(E) was also created from these flows. Chart 1 shows the evolution of total GDP(E) in constant 2009/10 prices, and Chart 2 shows the series for the main aggregate components.

Chart 1: GDP(E) in constant 2009/10 Prices

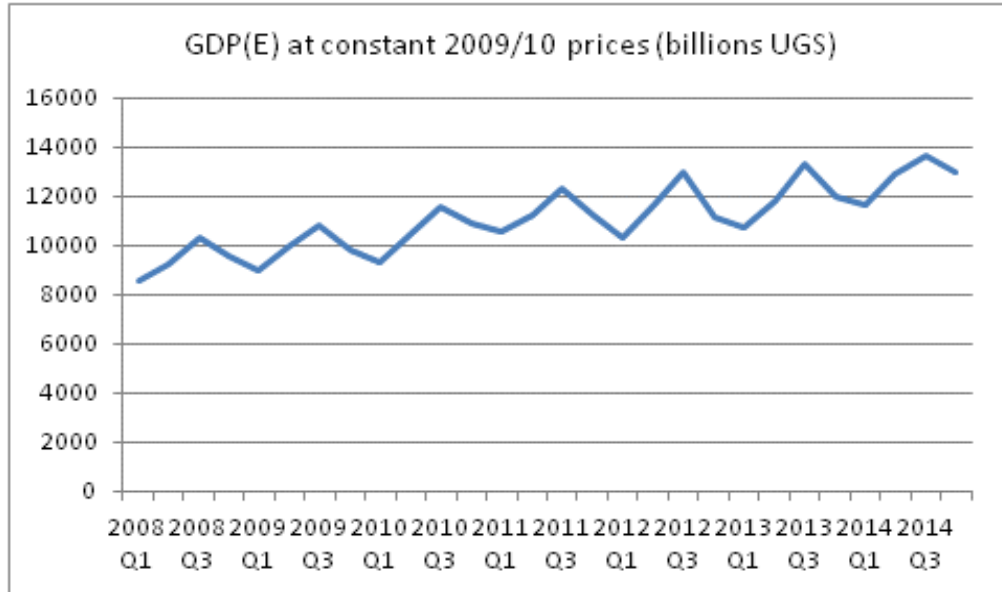
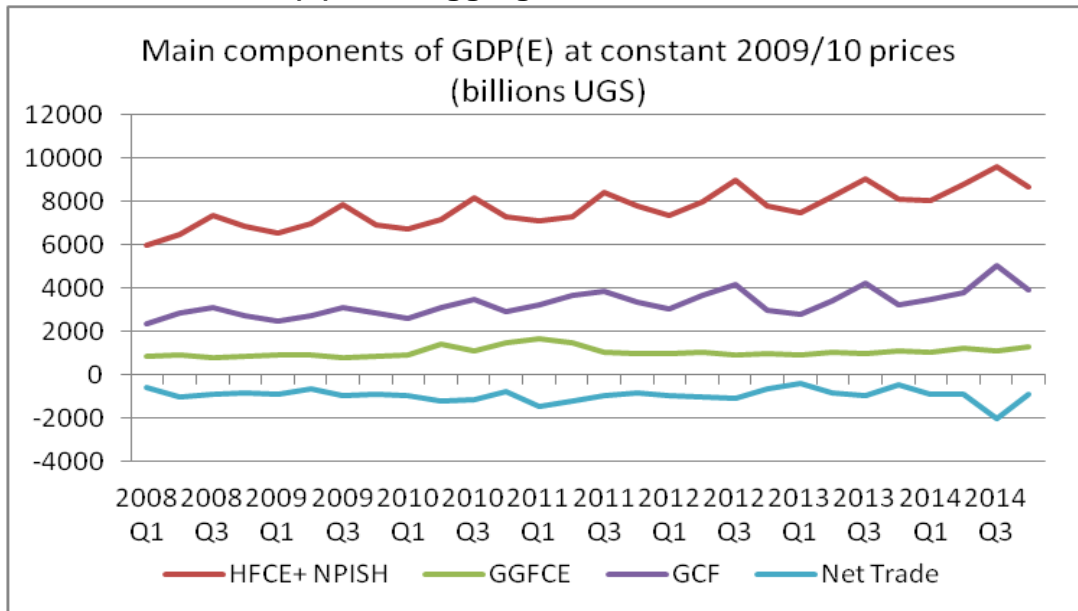


Chart 2: GDP(E) main aggregates in constant 2009/10 Prices



Key:

GGFCE = General Government Final Consumption Expenditure

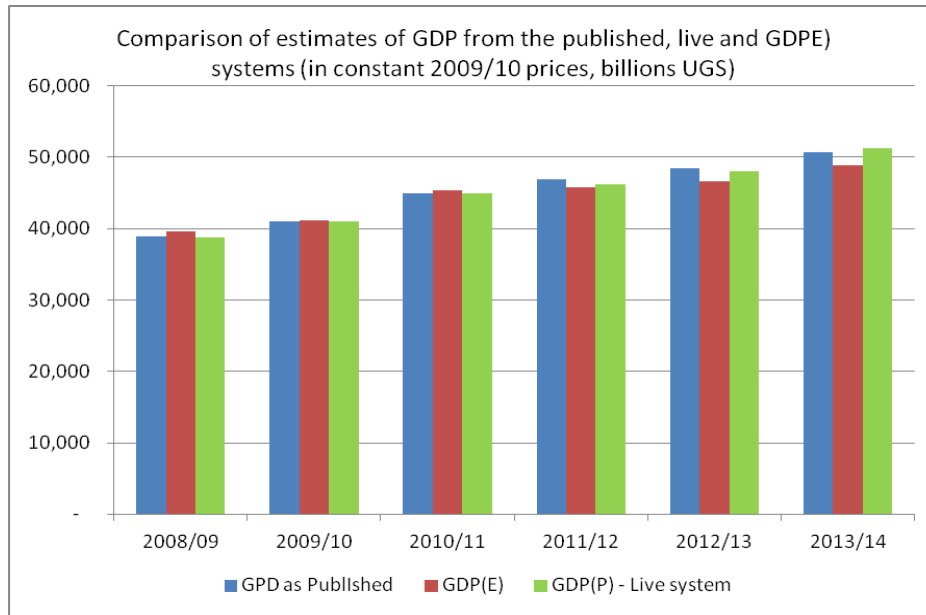
HFCE+ NPISH = Final consumption of households *plus* final consumption of Non-profit making institutions serving households

GFC = Gross Capital formation

Net Trade = Exports of goods and services less Imports of goods and services

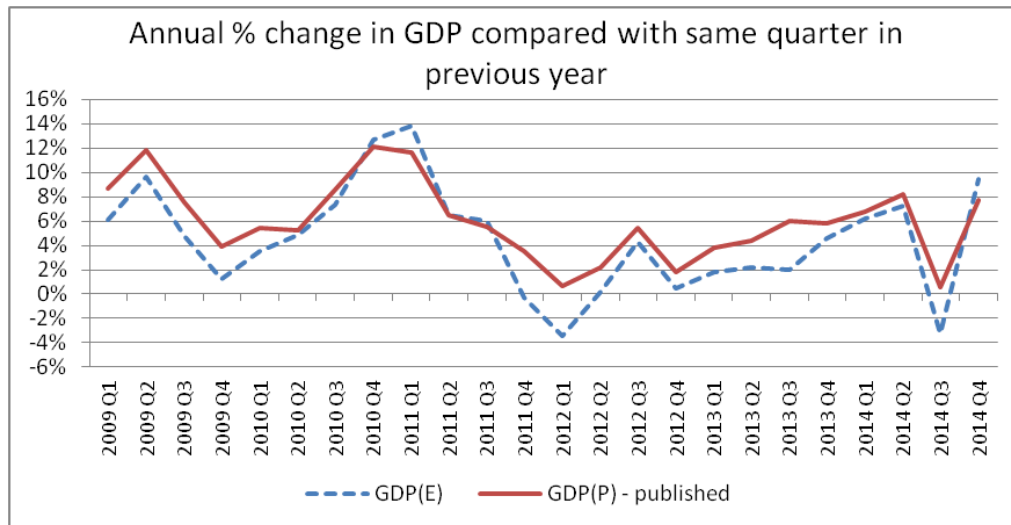
21. Chart 3 compares the estimated levels of GDP based on the published numbers, and those from the ‘live’ GDP(P) system as well as the new GDP(E) estimates for calendar years (all series in 2009/10 constant prices in billions UGS).

Chart 3: GDP based on the Published, Live and Latest GDP(E) Systems



22. The chart illustrates the differences described above which arise for the reason set out in paragraph 16. Chart 4 shows the differences between the annual growth in GDP (comparing equivalent quarters in each year) based on the CFM estimates and the published series. As noted, when the series for GDP(E) is prepared for publication, it will need to be aligned to the actual [published GDP(P) series to ensure consistency (se Next Steps).

Chart 4: Annual Growth in GDP based on the Published, and CFM GDP(E) Series



IV.METHODOLOGY FOR EXPENDITURE COMPONENTS OF GDP

23. This chapter describes in more detailed the methodology used to estimate each component of the product flows, see table 2.

A. Supply Components

Gross Output

24. Estimates of Gross Output (GO) by industry are available each quarter for the live GDP(P) system. The proportions of GO in each industry for each product was used to estimate the GO by product based the industry totals in each quarter. In practice, all but one industry is 'one-to-one' with products, e.g., the 'Sugarcane industry' only produces one product, 'Sugarcane.' The exception is the product 'CAA Processed and preserved of meat' which is produced by five industries. The total GO for this product was estimated by adding together the estimated GO by product from each of the five industries.

Table 3 illustrates the procedure.

Table 3: Calculation of Gross Output for the product 'Processed and preserved of meat'

Percentage of total Gross Output from the SUT 2009/10							
		<i>Industry:</i>					
<i>Product:</i>		Raising of Camels, Horses, Asses, Mules, etc.	Raising of goats	Raising of sheep	Raising of Swine/Pigs	Raising of Rabbits	
1	Live animals	86%	68%	94%	80%	91%	
2	Processed and preserved of meat	14%	32%	6%	20%	9%	
3	Gross Output by industry in 2015 Q1 (billions UGS)	0.2	91.2	12.9	227.2	0.9	
Estimated output for product 'Processed and preserved of meat ' in 2015 Q1							
		<i>Output from industry:</i>					
		Raising of Camels, Horses, Asses, Mules, etc.	Raising of goats	Raising of sheep	Raising of Swine/Pigs	Raising of Rabbits	Total Gross Output
4	Processed and preserved of meat = 2 x 3	0.02	28.99	0.81	45.80	0.08	75.70

25. The calculation runs as follows: take the percentage of total industry output from the SUT for each of the five industries (row 2) and multiply by the actual total industry output (in constant prices) in 2015 Q1 from the GDP(P) system, in row 3. This gives, in row 4, the output of the product 'Processed and preserved of meat' from each industry. Added together this gives the total output in 2015 Q1 for the product, i.e., 75.70 billion UGS (in constant 2009/10 prices). The basic assumption here is that the percentage of output in constant prices for this product from each of these five industries has not changed significantly since the base year, 2009/10, relative to their total GO.

Imports of Goods (Formal)

26. Imports of goods for detailed products in current prices is available from the URA each month. A correspondence table between the Harmonised System for trade in goods (HS) and the product codes used in the SUT had been established by the MES before the mission. This was used to aggregate the current price total imports for each SUT product within each quarter.

27. To estimate the imports in constant 2009/10 prices, it was necessary to estimate, from the Custom's data, the average Unit Values (UVs) in each period for each detailed HS product (i.e., at the 8-digit level of the HS). The UVs are the ratio of the reported value of imports to the reported quantity (expressed in supplementary units, e.g., kgs, litres, tonnes, etc.).

28. The mission established a systematic basis for the estimation of the UVIs for each SUT product based on this method and utilizing a database of the URA import data. The procedure for estimating a price index from these UVs is described in more detail in Annex 2, but in essence it:

- i) Identifies extreme UVs within each HS 8-digit code within each quarter using a log-transformation of the data and applying a normal (Gaussian) test to the resulting log-distribution to remove these outliers. The motivation for taking logs is that the original UV data tend to be log-normal, i.e., they are constrained to be greater than zero, but can take values very much larger than the average. The log of the UVs tends to be closer to a normal distribution, and therefore amenable to a standard normal test for outliers.
- ii) The average of the remaining observations is taken as the average UV for that product in that period.
- iii) Unit Value relatives (between successive quarters) are then calculated for each 8-digit HS code, based on these average UVs.
- iv) Within each SUT product code the geometric mean (i.e., a Jevons type index) of these price relatives is taken as the price relative for the product.
- v) These price relatives are then used to create a Unit Value Index (UVI) whose average is equal to 100 in 2009/10.

29. The current price data for imports are divided by the UVI for the appropriate SUT product to estimate the constant price value of imports.

Imports of Goods (Informal Cross Border Trade)

30. UBOS undertakes a rolling survey of the passage of goods (for both imports and exports) which do not require formal processing by the URA at the border. This is the Informal Cross Border Trade (ICBT) Survey. The ICBT survey includes more than 250,000 transactions since 2008 Q1. The mission established an MS Access database and a systematic basis for the routine updating of the data for imports and exports each period, based on a comma separated values text file which can be created in MS Excel.

31. The system allows the estimation of ICBT for imports and exports in current and constant 2009/10 prices. For current prices, the estimates are simply the sum of the reported values of imports (and exports). For the constant prices series, as with the formal trade, it is necessary to identify extreme UVs in order to calculate stable UVIs. It was not possible to use the procedure established for formal trade for this purpose, because there are too few observations of each HS 8-digit product in each period to perform the log-transform outlier identification (for example, with just two or three observations, it is not possible to apply the standard normal test). Instead, for the ICBT, extreme values are defined as those which are greater than 'x' times the average UV for the HS product, or less than 1/x time the average, where x is defined by the user. The sensitivity to the choice of 'x' was tested, and the resulting UVIs found to be reasonably stable for choices of x between 4 and 10. A value of 6 was used in the case of imports. The UVs identified as 'extreme' using this procedure were replaced by the average UV for all 'non-extreme' UVs for the specified product. Again, a Jevons type index of UVs was then calculated for each SUT product. The constant price value of imports (and exports) was estimated by dividing the current price values by the UVI for the product.

Imports of Services

32. Data from the BOP calculated by the Bank of Uganda (BoU) were downloaded for the BoU website. These provide broad categories of trade in services, for both debits and credits. The classification used by the BoU was bridged to the SUT product codes, approximately, although most BoU categories corresponded to more than one SUT product. For example, the BoU category 'Transport' includes the SUT products: rail transport, land passenger transport, water transport, air transport, freight transport by road, warehousing support services for transport and postal and courier activities. To estimate the trade in services at the level required for the CFM it was necessary to apportion the quarterly BoP data for each broad category into the detailed SUT products using the proportions from the SUT.

33. The constant price series for services imports was derived using the average price deflator for imports of services which was taken from the existing annual GDP(E) system maintained by MES.

34. For BOP services imports, there are two areas of improvement which should be considered. The first is the level of detail which is used to estimate the SUT product flows. This is currently too broad, and MES should acquire the more detailed data used for the compilation of BOP to provide more precise estimates for each SUT product. In addition, the current deflator used for imports needs to be improved. This can be achieved if data on the country of origin of the imported services was also available, or if actual prices of specific services were collected by UBOS as part of the planned development of Trade Price Indexes (TPIs). See the chapter Next Steps.

Taxes on products: Excise

35. Taxes on imports and on local goods by product subject to excise taxes are available directly from the URA trade dataset. The taxes are estimated in constant prices by deflating by the local CPI for each product.

Taxes on products: Customs Duty

36. Data on Customs Duty on imports is available for each product (at the detailed HS 8-digit level) from the URA trade dataset. Customs Duty is estimated in constant prices by deflating by the aggregate deflator for Customs Duties which is calculated in the existing GDP(E) system.

37. An issue here, which also affects Excise taxes is a discrepancy in the treatment of taxes on petroleum between current GDP(E) system and the actual Customs data. The URA data reports taxes on petroleum as being an excise tax, which is the usual treatment. In the existing GDP system taxes on petroleum products are treated as a Customs Duty. The estimated taxes in both current and constant prices (and the deflators) are therefore different between the two systems. This anomaly needs to be corrected, with taxes on petroleum reclassified in the existing annual GDP(E) system as Excise taxes. See Next Steps.

Taxes on products: non-deductible Value Added Tax

38. For non-deductible Value Added Tax (VAT) estimates were based on the reported VAT charged on imports (some of which will be deductible) and the totals for non-deductible charged on locally produced products. The total for non-deductible VAT provided by the URA were used to constrain the non-deductible VAT by product in the CFM.

Trade and transport margins

39. The trade and transport margins represent the output of the domestic trade industries (wholesale, retail and sale of motor vehicles and parts thereof). The 2009/10 SUT provides the percentage ‘mark-up’ for each product, which is the ratio of the margin to the pre-tax supply (domestic plus imported). These mark-ups for each product were applied in the CFM to the sum of GO at constant prices plus imports at constant prices to derive the constant price margins.

B. Demand Components

Intermediate Consumption

40. Estimates of intermediate consumption (IC) *by industry* are available from the GDP(P) system each quarter. These were transformed into estimates by the 158 products in the CFM in constant prices using an equivalent procedure to that used for converting GO by industry into GO by product described above.

41. In the case of IC in constant prices the underlying assumption is that the relative volumes of each product used by each industry remains constant compared with the base year (2009/10). Essentially, this is equivalent to assuming that the production technology has not changed significantly since the base year. For example, in the manufacture of clothing, it is assumed that the volumes of cloth, thread, leather, dye, as well as electricity, rent etc. are the same in volume terms in the current period as in the base year. This is generally accepted as a reasonable assumption in volume terms, if the production technology has not changed significantly. However, in current prices this assumption is unlikely to hold since the relative prices of the inputs can change considerably from period to period. When estimating IC at current prices, therefore, it will be necessary to consider the actual prices of the inputs when ‘reflating’ the constant price IC into current prices. In effect this will amount to ‘double deflation,’ i.e., where different price indicators are used for the inputs compared with the outputs. This issue will be addressed as the current price estimates are developed, see Next Steps.

42. As an example of the procedure in constant prices, we can consider the case of the electricity product as it is used by different industries. In the SUT in 2009/10, electricity is used as IC by 115 different industries. Table 4 summarizes the calculation.

Table 4: Estimation of Intermediate Consumption of the Electricity Product in 2008 Q1

'Electricity' is used in 115 industries (first 15 shown in the table only)			
<i>Industry</i>	% of total industry IC that is Electricity	Total Industry IC in 2008 Q1 (Bn UGS)	IC for Electricity in Q1 2008 (Bn UGS)
	(1)	(2)	(3)+(1)x(2)
Manufacture of Computer, Electronic & Optical Products	25%	0.2	0.0
Repairs & Installation of Machinery & Equipment	13%	1.3	0.2
Water, Sewerage & Waste Management Activities	10%	18.5	1.9
Manufacture of Rubber Prod's	10%	2.4	0.2
Manufacture of dairy products	8%	33.9	2.5
Manufacture of Plastic Prod's	6%	9.9	0.6
Manufacture of Pharmaceuticals, medicinal Chemical & Botanical Products	5%	36.3	1.
Manufacture of Machinery & Equipment n.e.c	5%	4.1	0.2
Manufacture of Basic Metals	5%	17.9	0.9
Manufacture of Electrical Equipment	5%	9.0	0.5
Manufacture of other metal prod's	5%	5.1	0.3
Manufacture of other chemical prod's	5%	6.3	0.3
Manufacture of paint, vanishes & similar prod's	4%	7.3	0.3
Printing & Reproduction of recorded Media	4%	7.9	0.3
etc.	etc.	etc.	etc.
Total Electricity used as IC (sum of (3))			54.0

43. Based on the proportions of the total industry IC which is for electricity in the base year (column (1)), and the actual estimated IC for each industry in 2008 Q1 (column (2)), the estimated total IC for electricity in 2008 Q1 is given by the sum of the product of (1) and (2) shown in column (3), i.e., 54.0 Billion UGS.

44. This procedure is used to estimate IC in each quarter for all 158 products in the CFM. The mission established a systematic basis for undertaking the required calculations.

Government Final Consumption Expenditure

45. The quarterly current price and constant price value indicators for General Government Final Consumption Expenditure (GGFCE) by product are derived by deducting quarterly Government sales revenue from the Government output estimates for each of the main product categories in the CFM which relate to the output of government.

Final Consumption Expenditure of NPISH

46. The estimates of Final Consumption Expenditure (FCE) of Non-Profit Institutions Serving Households (NPISH) are compiled by extrapolating the 2009/10 benchmark FCE estimates using the quarterly current and constant price output of NPISH by product (i.e.,

Agriculture Support Services; Education; Human Health and Social Work; Arts, Entertainment and recreation; and Services of Membership Organizations).

Acquisitions less Disposals of Valuables

47. For Acquisitions less Disposals of Valuables, imports of precious metals and stones, antiques and collectibles are used to extrapolate the 2009/10 benchmark estimate to derive current price estimates. The general CPI is used to deflate the current price estimates to derive the constant price estimates.

Gross Fixed Capital Formation

48. The coverage of Gross Fixed Capital Formation (GFCF) includes estimates of biological assets; imported capital goods, research and development, and mineral exploration. The Work In Progress (WIP) compilation methodology developed in previous TA missions was used to compile the SUT estimates for biological assets and construction GFCF. For biological assets and imported capital goods, the proportion of GFCF to total supply in the SUT is applied to the estimated total supply in the CFM each quarter to derive an estimate of the GFCF for each product. The estimates for research and development; and mineral exploration are derived by extrapolating the 2009/10 benchmark GFCF estimates using the output for Mining and Quarrying and scientific research and development.

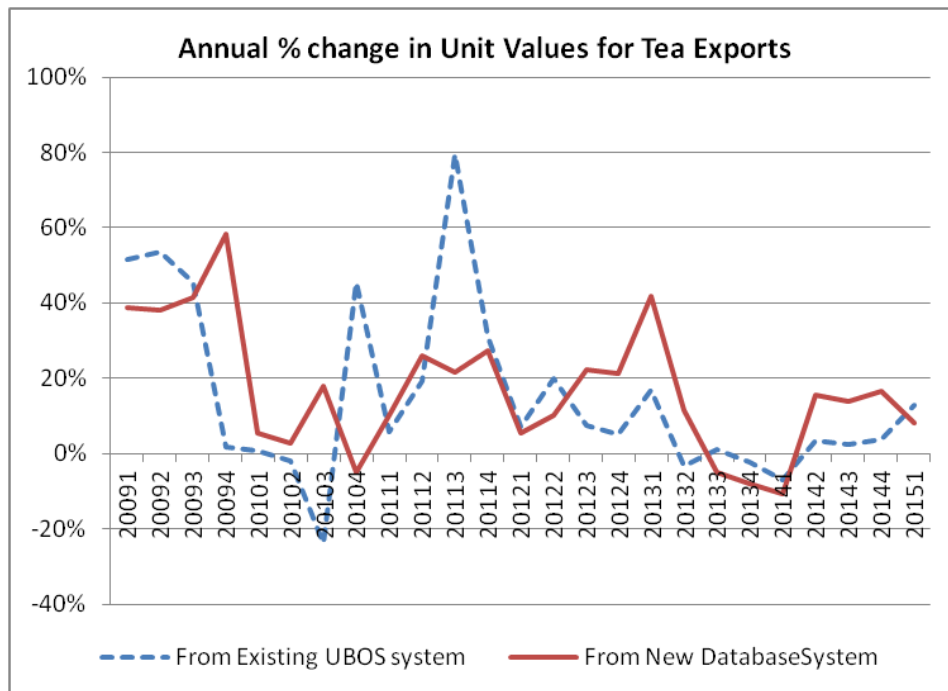
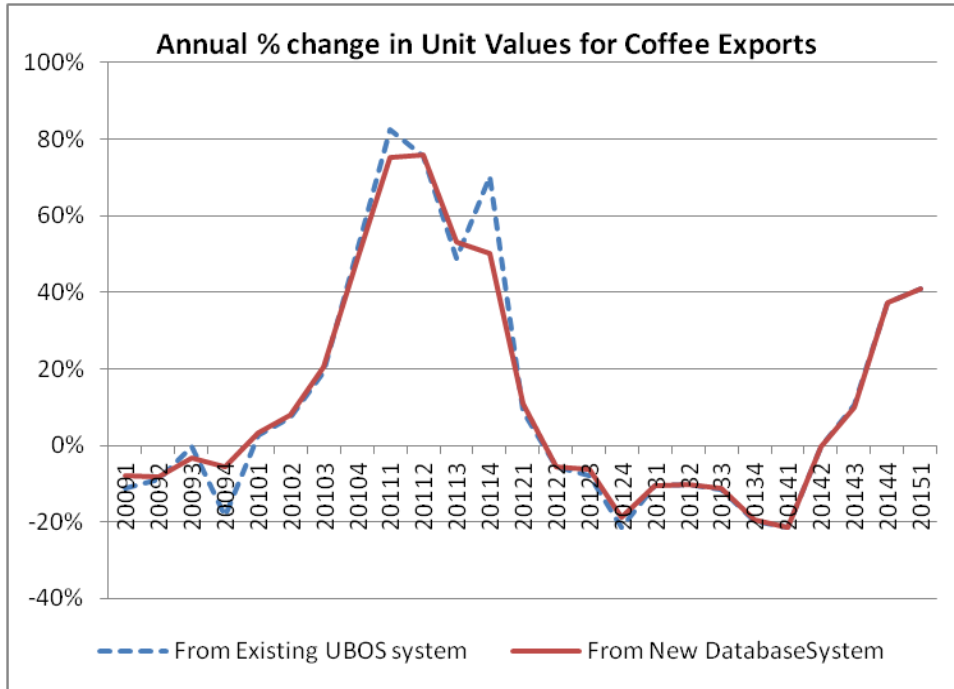
Exports of Goods (formal)

49. As with imports of goods coming through the formal channels, URA external trade data are used to compile the current price estimates. These are deflated using unit prices, calculated using the same methodology described above for the informal imports.

50. This method was used in preference to that used for formal imports (see paragraph 27 above) because there are many fewer export transactions and so the log-transform normal test cannot be applied. The mission established a systematic basis, based on an MS Access database, for the calculation of the current price estimates and the UVIs needed to estimate constant price exports.

51. As an example of the procedure, Chart 6 compares the ‘outlier’ unit value for exports of coffee (Uganda’s main cash crop) with the estimates produced by MES within the trade section). The trade section produce a report for the six main exports each month. The UVI procedure developed by the mission should simply considerably the processing of these data.

Chart 5: Annual Percentage Change in the Estimated Unit Value of Exports of Coffee and Tea (per kilo)
 (comparing the existing estimates produced by MES, with the estimates from the systematic basis developed by the mission)



52. The charts illustrate that the general trend in the growth of Unit Values is similar based on both the 'UBOS method' when compared to the new basis, with the new basis removing some of the more extreme movements in the series through the outliering procedure used.

Exports of Goods (ICBT)

53. The same methodology, and system, described for informal imports is used for informal exports of goods.

Household Final Consumption Expenditure and Changes in Inventories

54. The remaining components of the CFM are Household Final Consumption Expenditure and Changes in Inventories. These can be estimated as a combined total using the so-called 'residual method' which, because total demand must equal total supply for each product, total supply less demand for all other components must equal HFCE plus Changes in Inventories.

55. For products for which there are no inventories, i.e., largely service sector products, the balance must be equal to HFCE. For goods, there may be some change in inventory, which is generally difficult to measure directly. For example, for the food crop 'Maize', this is nearly all produced locally (there is some small imports, mainly informal). So, the GO of Maize, plus the trade margins, plus taxes (which are essentially zero), less any exports (which account for around 10 percent of the total supply) must be used as IC, or consumed by households (i.e., HFCE) or contribute to the change in inventory for Maize. Since in constant prices the IC can be estimated according the method set out above in paragraph 40, what remains is taken as HFCE plus the change in inventory.

56. HFCE for goods is estimated in the CFM by multiplying the total 'net supply' in the current quarter (i.e., total supply less exports, capital formation, final expenditures by government and of non-profit making institutions serving households, and the acquisition less disposal of valuables) by the base year ratio of HFCE to net supply from the SUT.

57. The estimated changes in inventory for each product is then calculated as the difference between total supply less all other uses, including the estimated HFCE, plus any other explicit estimates of changes in inventories (currently these are only calculated for biological assets).

The systems for estimation of the Commodity Flows and External Trade

58. The mission developed a systematic basis for estimating the CFM based on an integrated set of MS Excel workbooks. In addition, the estimation system for trade in goods at current and constant prices was also established, based on an MS Access database which is used to manage the data for formal and informal trade.

59. Table 5 provides a summary of the main files developed.

Table 5: Files used in the Commodity Flow and External Trade Estimation Systems

#	File	Type	Purpose
Commodity Flow Model System			
1	Comm_Flow_Full_KP.xlsm	Excel	Links to the live GDP(P) system files and also the files 3, 3, 5, 8, 9 and 10 to produce the final CFM in constant prices
2	Comm_Flow_IC_Prod_KP.xlsx	Excel	Links to 4 to invert the IC from Industry to Product in constant prices
3	Comm_Flow_GO_Prod_KP.xlsx	Excel	Links to 5 to invert the GO from Industry to Product in constant prices
4	Comm_Flow_GO_IC_Ind_KP.xlsx	Excel	Links to the live GDP(P) system to create a time series for GO and IC by industry in constant prices (KP)
5	Comm_Flow_CPI_SUT.xlsx	Excel	Produces Consumer Price Indexes based on the SUT product codes
6	Comm_Flow_GO_IC_Ind_CP.xlsx	Excel	Links to the live GDP(P) system to create a time series for GO and IC by industry in current prices (CP)
External Trade and UVI processing System			
7	UGA_Ext_Trade.accdb	Access	Stores data for the formal and informal imports and exports.
8	UVI_ASYCUDA_Exports_Results (V1.1).xlsm	Excel	Links to 7, and estimates UVIs for formal exports
9	UVI_ASYCUDA_Imports_Results (V5.2).xlsm	Excel	Links to 7, and estimates UVIs for formal imports
10	UVI_ICBT_Results (V1.1).xlsm	Excel	Links to 7, and estimates UVIs for informal exports and imports

V. NEXT STEPS

60. The mission established a systematic basis for the development of estimates of GDP(E) in Uganda, consistent with those from the GDP(P) system. MS Excel workbooks and an MS Access database were established for processing the constant price estimates. However, some work remains to finalize the constant price estimates and also to develop a current price series. To achieve this, the mission recommends the following actions.

Trade in Services

61. Estimates of trade in services (TiS) were obtained from the BoU website, for 12 aggregate categories. These were apportioned to the SUT products based on an approximate correspondence between the SUT product codes and the categories used by the central bank. However, this correspondence could be considerably improved if more detailed data on TiS were obtained from the BoU. TiS is an important component in the CFM for a number of services products, and the estimates of HFCE will be improved if a more direct correspondence between the TiS codes and the SUT product codes can be established, based on more detailed data for TiS.

***Recommendation 1:** UBOS should request from the central bank more detailed data on TiS, and establish a correspondence between the SUT product codes and the coding frame used for TiS.*

62. In addition, in order to estimate the deflators for each services product, where the exchange rates for the country of origin for imported TiS are used as part of the deflation calculation, information on the source country for imported services will be useful.

63. Alternatively, information from the main importers of services on the prices actually paid would provide an even better basis for deflation of the current price estimates, if such data can be collected.

***Recommendation 2:** UBOS should request from the BoU data on the country of origin of imported TiS, to improve the basis of deflation. In addition, UBOS should investigate the potential to develop Trade Price Indexes (TPIs) for the main imported services products.*

The Consumer Prices Index

64. The Consumer Prices Index (CPI) is used in a number of places in the CFM. During the mission, it was not possible to obtain a version of the CPI classified according to the COICOP, because this has not yet been developed. It is expected that the rebased CPI will be available shortly, based on the COICOP classification. This is important because a bridging

table between the COICOP and the SUT products will allow the aggregation of the detailed 'elementary' CPIs to create more accurate CPIs for each SUT product.

65. During the mission a provisional bridging table was established, but this will need to be finalized by MES staff. The table should take account of how household expenditures were allocated by product in the 2009/10 SUT, and where these same expenditures are allocated in the COICOP classification used for the CPI.

66. Once the rebased CPI becomes available, the detailed sub-class (COICOP level 5) indexes should be linked to the CFM system (into the workbook Comm_Flow_CPI_SUT.xlsx).

Recommendation 3: *UBOS should establish a detailed bridging table between the 158 products defined in the SUT with the equivalent COICOP codes used for the rebased CPI, when this becomes available. Where these are 'one-to-many' (i.e., COICOP to SUT codes), the weights used for the COICOP should be split according to the size of the weights in the SUT, and the relevant CPI should be used as a price index for each of the related SUT products. Where they are many-to-one (i.e., COICOPs to SUT code), the COICOP weights should be aggregated to the level of the SUT products, and a weighted (Laspeyres) index of the relevant COICOPs should be created for the relevant SUT code. Where the correspondence is many-to-many, the CPI with the largest share of the weight should be selected as a proxy for the SUT products.*

Recommendation 4: *Once the rebased CPI becomes available, this should be linked into the workbook Comm_Flow_CPI_SUT.xlsx within the CFM system.*

Taxes petroleum products

67. As noted above, in the GDP system taxes on petroleum products are treated as a Customs' Duty, whereas in the trade in goods data they are regarded as excise taxes, which is the more usual treatment.

Recommendation 5: *Taxes on petroleum products should be classified as Excise taxes in both the GDP(E) and GDP(P) systems.*

Developing the Commodity Flow Model at current prices

68. Some work was undertaken during the mission to develop an equivalent CFM in current prices, notably for the components of GO and IC. However, it is best if this is not taken forward further until the constant price CFM is finalized, because there are likely to be issues during this process which lead to changes in the design and layout of the constant price CFM.

Recommendation 6: *The constant price CFM should be finalized before further work is undertaken to develop the equivalent current price model. The constant price CFM workbook can then be used as a template for an equivalent current price CFM.*

Constraining quarterly GDP(E) to the published quarterly GDP(P)

69. As noted, the estimates of quarterly constant price GDP(E) from the CFM differ from the published estimates of GDP (see paragraph 16). The estimates based on the production approach are currently considered to be definitive and so, before quarterly estimates of GDP(E) are published based on the CFM, these will need to be constrained to the existing quarterly estimates from the GDP(P) system.

Recommendation 7: *Before publication, the quarterly CFM estimates of GDP for expenditure components should be constrained to the existing GDP(P) estimates. The basis of this constraining needs to be considered. For example, it may be that the trade and government components should be regarded as definitive and not subject to adjustment, with the difference between total GDP(P) and GDP(E) being prorated across the other components (HFCE, NPISH FCE, GFCF and Changes in inventories and acquisition less disposal of valuables).*

APPENDIX I. LIST OF OFFICIALS MET DURING THE MISSION

Name	Position	Organization
Government of Uganda		
Mrs Imelda Atai	Executive Director	UBOS
Mr Christopher Mukiza	Director	UBOS
Mr Sam Echoku	Assistant Director	UBOS
Mr John Mayende	Assistant Director	UBOS
Bright Richard	Senior Statistician	UBOS
Alizik Khaulha Lubega	Senior Statistician	UBOS
Solomy Bamanya	Senior Statistician	UBOS
Christopher Tumuhirwe	Statistician	UBOS
Vincent Nsubuga	Statistician	UBOS
Lydia Namono	Statistician	UBOS
Irene Nakate Bright	Statistician	UBOS
Yoyeta Jane Magola	Statistician	UBOS
Iraguha Moureen Mfite	Statistician	UBOS
Godfrey Nsanja	Statistician	UBOS
Hilda Arinaitwe	Statistician	UBOS
Roland Muhumuza	Statistician	UBOS

APPENDIX II. METHODOLOGY FOR CALCULATION OF UNIT VALUE INDEXES FOR IMPORTED GOODS

Overview

Unit Value Indexes for imported goods are needed to estimate the price changes for such goods, to enable estimation in constant prices. These indexes can be generated from the detailed Customs data, based on the reported value and net weight of each Customs' transaction.

However, it is recognized that the quality of the net weight and quantity data, in particular, mean that this may lead to highly volatile and often incorrect estimates of the actual changes in prices. As such, some procedure to 'clean' the data is required in order to proceed.

This note describes the method and processed use to calculate Unit Value Indexes for imported goods.

The calculation is controlled from the workbook '[UVI_ASYCUDA_Import_Results_\(V5.2\).xslm](#)' with the raw data being stored and much of the processing being undertaken in the MS Access database '[UGA_Ext_Trade.accdb](#).' The user can select from the instructions worksheet the period to be calculated (or 'All' periods), as well as the thresholds used for identifying outliers. i.e.,

The following steps are used to calculate the Unit Value Indexes (UVIs) for each SUT product.

Step 1: Calculate the Unit value Prices for each HS8 by Partner by Customs' station for each quarter

- i) The procedure selects all the data in the last four quarters, e.g., in the calculation of the UVI for 2013Q4, take all of the data for 2013. [The reason for this is that the 'sample' of products at HS8 level is sometimes quite small, so by taking a full 4-quarter there are more data to work with to identify outliers, see step iv, below. This

is used only for the purposes of outliering the raw data when calculating the average Unit Value for an HS8 in any quarter, not in the calculation of the index. Only HS8 domains with more than 10 reported prices over the 4-quarters used in the calculation are used in what follows (this threshold can be changed in the calculation program).

- ii) For each import transaction in an HS8, calculate the import price, $P_{HS6,i}^t = [\text{CIF value}]/[\text{Quantity}]$
[Created in VBA in the MS Access table [UV_UnitPrices](#)]
- iii) Calculate (natural) logs of the Ps, i.e., $\text{Ln}(P)$.
- iv) Calculate the mean and standard deviation of the $\text{Ln}(P)$ s within an HS 8-digit across the 4-quarters, and apply a cut-off to the distribution, say of 95 percent, to remove observations outside of this range. This cut-off can be changed in the calculation program.
- v) Based on the remaining (i.e., non-outlier) unit values within the relevant period (e.g., 2013 Q4), calculate the average Unit Value (UV, i.e., prices) for each HS8 as:

$$UV_{HS6}^t = \sum_{i \in HS6} \frac{P_i^t}{Q_i^t}$$

where the Q s are the Quantities and the P s are the prices. i.e., assuming at the HS8 level we can add together the quantities.

[Results are processed in the VBA code [Make_UVs](#) and written to the table: [UVs_Results](#)]

These first four steps have calculated a UV (price) for each HS8 in each quarter.

Step 2: Calculate the Unit Value Indexes Prices for each HS6 for each quarter

- vi) The first step to create the UVIs is to calculate the Quarter to Quarter Price relatives for each period as follows:

$$\rho_{HS6}^t = \frac{UV_{HS6}^t}{UV_{HS6}^{t-1}}$$

[See query: [UVs_PRs](#)]

- vii) To enable class means imputation of the price relatives in periods where there were no reported imports, the current weighted harmonic mean of the price relatives is calculated for the following classes: HS4, HS2 and all imports. For example, for HS4, the current import value weighted price relatives are calculated as follows:

$$\rho_{HS4}^t = \frac{\sum_{HS6 \in HS4} V_{HS}^t}{\sum_{HS6 \in HS4} \frac{1}{\rho_{HS6}^t} V_{HS6}^t}$$

The weights used here are the CIF import values.

[See, for example, query [UVs_Paasche_Ind_HS4](#)]

- viii) The price relatives for each HS8 for each period are imputed such that, if the HS8 price relative is not present for any period, the HS4 relative is used, as calculated in step vii, if this is also missing the HS2 level relative is used, and if this too is missing, the ‘all imports’ relative is used.
[See table [UVI_Results_HS8](#)]

The remaining steps, which calculate the final SUT product UVIs, are undertaken directly in the Excel workbook.

Step 3: Calculate imports at previous quarter prices HS6 8-digit for each quarter

- ix) The price relatives are winsorised to remove any remain outliers, by replacing price relatives which are greater than x or less than 1/x, where x is controlled within the program (for example x=1.25). [See worksheet ‘[UVI_HS8_Win](#)’]
- x) The value of imports in each SUT product is then divided by the (winsorised) price relative for the same period to give a value in ‘previous quarter prices.’ periods are used to create. [See worksheet ‘[Volume PQPs_SUT](#)’]
- xi) Then sum the HS6 value data within each over SUT product. [See worksheet ‘[Value_SUT](#)’]
- xii) Next, divide the SUT product PQPs by the SUT product Value series to get a price (UVI) series. The reference period for this series is simply the first period (in the case Q1 2010). [See worksheet ‘[UVI_Rels_SUT](#)’]
- xiii) Scale the UVIs so that 2011=100, [See worksheet ‘[UVI_SUT](#)’]
- xiv) Imports in constant 2011 prices is then simply the ratio of the value to the UVI. [See worksheet ‘[ConstPrices_SUT](#)’]