

**MACROECONOMIC POLICIES AND POVERTY IMPACTS: CASE
STUDIES OF ETHIOPIA AND GHANA**

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SUMMARY

Policy-orientated research on the macroeconomic policy impacts on low income countries (LIC) development outcomes has challenged policy makers within the IMF and within the development community for a long time. The results so far have been widely regarded as unsatisfactory. This paper aims to open up a new area of research utilising formal macroeconomic models and disaggregated poverty and distribution models where available and by using rapid appraisal methods where formal models are unavailable.

The first part of the paper outlines a new approach to estimating the distribution and poverty impact of macroeconomic policies and projections. Where formal macroeconomic models or projections are available, it is suggested that the key results of the macroeconomic model can be “soft linked” to a formal distribution and poverty CGE model, so that the projections of key exogenous or endogenous variables from the macroeconomic model are used to inform the simulations of the poverty impact of macroeconomic policies on the distribution and poverty model. Where formal macroeconomic models or projections are not available, or where a distribution and poverty model is not available, rapid appraisal methods will be required.

The second part of the paper describes a comparative static distribution and poverty Computable General Equilibrium (CGE) model for Ethiopia based on a Social Accounting Matrix (SAM) for 2005/6 and on Robinson et al (2010). The structural characteristics of the Ethiopian economy based on the SAM are also described. Next, two sets of simulations designed to check the feasibility and usefulness of “soft linking” macroeconomic policy changes to the distribution and poverty impacts are described. The first is based on the “Reform” medium term projections in IMF (2010a, 2010b). This projection is not model based. The second set of simulations used to “soft link” to the distribution and poverty model are based on a Dynamic Stochastic General Equilibrium (DSGE) model of Ethiopia designed to explore the implications of a “Gleneagles” simulation, the scaling-up aid to Ethiopia over a 20 year period on the lines of the Gleneagles Initiative (Rayner et al (2011)).

The third part of the paper describes a set of simulations designed to test the feasibility and usefulness of “soft linking” the “Reform” and “Gleneagles” scenarios and provides a qualitative assessment of likely poverty impacts. A full set of results is not available at the moment because of numerical difficulties in estimating the model and will be provided as soon as the numerical difficulties have been overcome. The qualitative results obtained in the third part of the paper on the poverty impact of the macroeconomic policies suggest that the “soft link” approach is likely to be feasible and useful.

CONTENTS

1. INTRODUCTION.....	5
2. BACKGROUND TO THE RESEARCH	5
3. AVAILABLE BUILDING BLOCKS FOR THE NEW RESEARCH ON MACROECONOMIC POLICIES AND DEVELOPMENT OUTCOMES.....	6
3.1 IMF MACROECONOMIC MODELS FOR DISTRIBUTION AND POVERTY IMPACT ANALYSIS	6
3.2 CASE STUDY OR “RAPID APPRAISAL” METHODS FOR MACROECONOMIC IMPACT ANALYSIS	6
3.3 STRUCTURAL MODELS OF INCOME DISTRIBUTION AND POVERTY OUTCOMES	6
3.4 “RAPID APPRAISAL” OF INCOME DISTRIBUTION AND POVERTY OUTCOMES.....	6
4. RAPID APPRAISAL	7
5. SOFT LINKING THE AVAILABLE ESTIMATES OF POLICY INDUCED MACROECONOMIC CHANGE TO INCOME DISTRIBUTION AND POVERTY OUTCOMES	7
5.1 THE CONCEPT OF “SOFT LINKING”	7
FIG 1. “SOFT LINKS” BETWEEN FORMAL AND RAPID APPRAISAL METHODOLOGIES	8
5.2 “SOFT LINKING” IN PRACTICE.....	8
Table 1. Exogenous and Endogenous Variables and “Soft Linking”.....	8
5.3 “SOFT LINKS” IN THE ETHIOPIAN CASE STUDY	9
6. CASE STUDIES OF DISTRIBUTION AND POVERTY IMPACTS OF MACROECONOMIC POLICIES AND PROJECTIONS IN ETHIOPIA	9
6.1 ETHIOPIA MACROECONOMIC POLICIES AND PROJECTIONS FROM IMF 2010	9
Table 2. Ethiopia: Baseline Projections Excluding Monetary Variables 2008/09 to 2014/15	11
6.2 ETHIOPIA MACROECONOMIC MODEL OF GLENEAGLES SCALING UP OF AID.....	12
6.3 POLICY NARRATIVE TO BE MODELLED	12
6.4 THE ETHIOPIA DISTRIBUTION AND POVERTY MODEL	13
6.5 DISTRIBUTION AND POVERTY MODEL CLOSURE.....	14
Table 3: Alternative Macro and Factor Market Closure	14
6.6 THE ETHIOPIA SAM DATABASE AND ECONOMIC STRUCTURE	15
Table 4. Ethiopia Economic Structure 2005-06.....	15
6.7 EXOGENOUS PROJECTIONS FOR ETHIOPIA DISTRIBUTION AND POVERTY MODEL	16
6.7.1 WORLD PRICES: THE IMF VIEW IN HISTORICAL CONTEXT	16
6.7.2 PROJECTING WORLD PRICES FOR THE DISTRIBUTION AND POVERTY MODEL	16
Fig 2. Trend of Ethiopia Price Indices and Terms of Trade, 2005/6-2013/14	17
6.7.3 SELECTED ECONOMIC INDICATORS	17
Table 5. Ethiopia- Selected Economic and Financial Indicators, 2005/06-2014/15	19
7. PLANNED SIMULATIONS AND QUALITATIVE RESULTS	20
Table 6. Scenarios Planned for the Distribution and Poverty Model.....	21
REFERENCES.....	22

LIST OF ABBREVIATIONS AND ACRONYMS

CARIS	Centre for the Analysis of Regional Integration at Sussex
CES	Constant Elasticity of Substitution
CET	Constant Elasticity of Transformation
CPI	Consumer Price Index
CGE	Computable General Equilibrium
DSGE	Dynamic Stochastic General Equilibrium
ERCA	Ethiopian Revenues and Customs Authority
ESF	Exogenous Shocks Facility
GDP	Gross Domestic Product
IMMPA	Integrated Macroeconomics Models for Poverty Analysis
IMF	International Monetary Fund
IFS	International Financial Statistics
LIC	Low Income Countries
LES	Linear Expenditure System
LTO	Large Tax-Payers Office
ODA	Official Development Assistance
PRGF	Poverty Reduction and Growth Facility
SAM	Social Accounting Matrix
TFP	Total Factor Productivity
VAT	Value Added Tax
WEO	World Economic Outlook

1. Introduction

Policy-orientated research on the macroeconomic policy impact on low income countries (LIC's) development outcomes has challenged policy makers within the IMF and within the development community for a long time. The results so far have been widely regarded as unsatisfactory. This paper aims to open up a new area of research utilising formal macroeconomic models and disaggregated poverty and distribution models where available and by using rapid appraisal methods where formal models are unavailable. The GTAP resource paper #3381 (Evans, D., 2010) prepared as a background paper for the Thirteenth Annual GTAP Conference, June 2010, Penang, Malaysia established the feasibility of "soft linking" from IMF Article IV "Reform" macroeconomic projections for Ethiopia (IMF(2010a,b) to a disaggregated Computable General Equilibrium (CGE) model of distribution and poverty to estimate poverty impacts. A second "soft link" of macroeconomic policies to the distribution and poverty model is based on a "Gleneagles" scaling up of aid for Ethiopia (Rayner et al (2011)).

2. Background to the Research

This research applies to any macroeconomic policies, not necessary only from the IMF. It is set out in a modular form so that, within the over-all framework suggested, particular smaller projects can be carried out. It is also set out so that the smaller projects could be executed within a larger project over two or three years.

We highlight four key purposes, to be applied first to African LIC countries:

1. To "soft link" currently available IMF macroeconomic models to available income distribution and poverty models to provide estimates of poverty outcomes of IMF endorsed macroeconomic policies. The term "soft link" is from the climate modelling literature. It means an informal linking of models through the exogenous variables, rather than a formal linking of the models themselves. (See section 5.1 below on soft linking). It is anticipated that the structural models of income distribution and poverty will be much more aggregated on the sectoral side than normally used for poverty analysis, but not factors or households.
2. Where macroeconomic models are unavailable, to upgrade the quality of the macroeconomic rapid appraisal case studies built around IMF macroeconomic policies and projections e.g. IMF Letters of Intent and Article IV reports, so that macroeconomic scenarios can be "soft linked" to income distribution and poverty models. (See section 4 below on rapid appraisal).
3. Where the database for income distribution and poverty models is not available, to develop a rapid appraisal approach to estimating income distribution and poverty impacts using a wide range of readily available structural and poverty indicators.
4. Should the structural data assembled under 3 be sufficiently comprehensive, consideration will be given to building small to medium sized SAMs that can be used to build structural income distribution and poverty model as in 1. Should we be successful in building such intermediate sized SAMs with modest treatment but more disaggregated factor and household data, we would not expect the same degree of comprehensiveness or accuracy as for a full-sized SAM.

The key background idea to the project is applying rapid appraisal methodologies to fill the gaps in modelling availability. The idea is to develop a set of readily available macroeconomic data and a set of structural data on distribution and poverty which, when combined with rules of thumb from economic theory, can be used to form a qualitative analysis of macroeconomic policy impacts and distribution and poverty outcomes.

3. Available Building Blocks for the New Research on Macroeconomic Policies and Development Outcomes

3.1 IMF macroeconomic models for distribution and poverty impact analysis

At present, the Fund has well-developed Dynamic Stochastic General Equilibrium (DSGE) macroeconomic models for only a few African LICs (see Berg et al., 2006). However, the real side of these models is unsuitable for income distribution and poverty impact analysis. The same is true of other macroeconomic models such as the IMMPA suite of models (see Agenor, 2007). Hence the idea is to soft link available DSGE models to structural models of distribution and poverty, as described in 3.3 below, and to develop rapid appraisal methodologies for 3.2.

3.2 Case study or “rapid appraisal” methods for macroeconomic impact analysis

Macroeconomic case studies are available through a wide variety of sources including some IMF Letters of Intent and Article IV reports. Where possible, the available case studies will be used for estimating macroeconomic impact soft links to income distribution and poverty outcome analysis. Where available case studies including the IMF case studies are weak, consideration will be given to develop them using a more systematic rapid appraisal methodology.

3.3 Structural models of income distribution and poverty outcomes

There is a large literature on CGE modelling of income distribution and poverty impacts of economic policy change (see for example Bourguignon, 2008). For some of these countries, there are SAMs suitable for running dynamic recursive income distribution and poverty models. The DSGE macroeconomic models from 3.1 or the macroeconomic impact analysis from the rapid appraisal methods in 3.2 can be used to quantify key exogenous macroeconomic variables under baseline and other scenarios for the structural models of distribution and poverty such as: government and investment expenditure; private, government and foreign savings; and choice of other policies and instruments such as transfers to households, tariffs, direct and indirect taxes and policies to induce increased Total Factor Productivity (TFP).

3.4 “Rapid appraisal” of income distribution and poverty outcomes

Among the African LICs countries, there are large gaps in coverage of SAMs suitable for modelling income distribution and poverty impacts of macroeconomic policies. In these cases, the idea is to develop a rapid appraisal approach to estimating income distribution and poverty impacts using a wide range of readily available indicators.

4. Rapid Appraisal

Among the African LICs countries, there are large gaps in coverage of SAMs suitable for modelling income distribution and poverty impacts of macroeconomic policies. In these cases, the idea is to develop a “Rapid Appraisal” approach to estimating income distribution and poverty impacts using a wide range of readily available indicators. The key elements of rapid appraisal methodologies are the combination of relatively standard and appropriate datasets with suitable analytical methods.

The key ideas for such a Rapid Appraisal approach can be found in the Handbook of Trade and Poverty (Cirera et al., 2001) and in CARIS (2007) which develops rapid appraisal methods for the analysis of regional integration. In the case of CARIS, a programme for assembling appropriate datasets and descriptive statistics for the analysis of regional integration is available from TradeSifts.com with a computer programme designed to source key data requirements from several international sources and to calculate useful descriptive statistics for the analysis of regional integration. The technical reports of structural CGE models implicitly use rapid appraisal methods to assess the likely model results from summary structural data. This is usually obtained from the underlying SAM and is usually reported and used for a preliminary impact analysis of model shocks. For the work of this proposed programme the “back-of-the-envelope” methods developed by Dixon and Rimmer (2002) could potentially be developed into a tool for rapid appraisal of distribution and poverty impacts. Dixon and Rimmer use the CGE model data set and Marshallian supply and demand analysis for their “back-of-the-envelope” checks of the results of the larger CGE model. Replacing the CGE model dataset with the best available set of country indicators relating to distribution and poverty and applying the Dixon-Rimmer Marshallian methodology could greatly strengthen rapid appraisal methodologies for distribution and poverty impacts.

Where possible, such distribution and poverty datasets will be upgraded to small-to medium-sized SAMs for formal structural and distribution and poverty analysis.

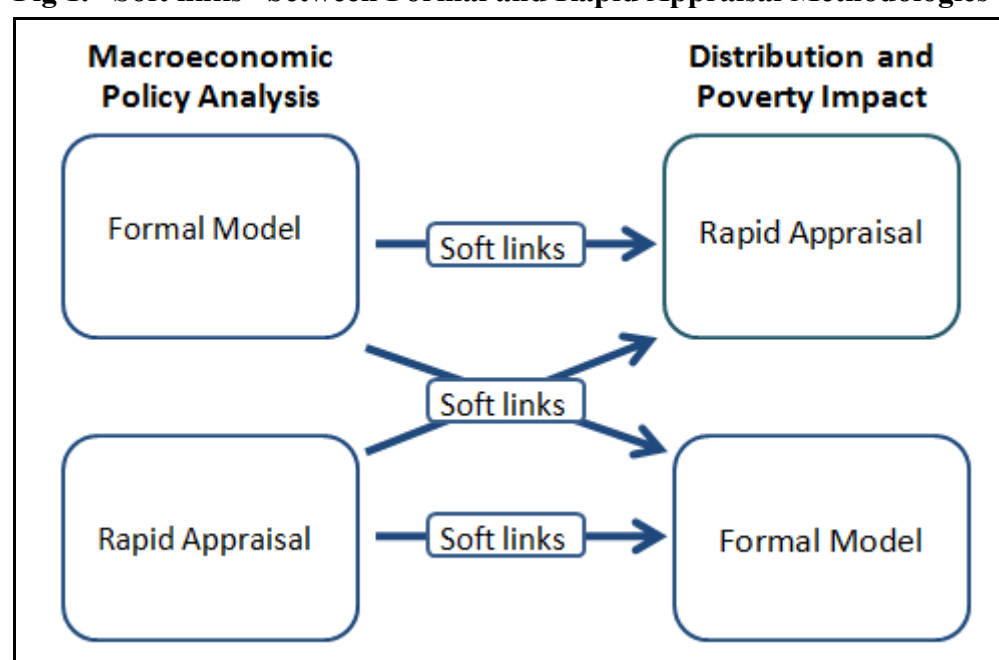
5. Soft Linking the Available Estimates of Policy Induced Macroeconomic Change to Income Distribution and Poverty Outcomes

5.1 The concept of “soft linking”

In climate change modelling, “soft linking” arises when researchers wish to link the results of climate change models that estimate climate change impacts of key variables such as the atmospheric content of CO₂ equivalent gases on economic outcomes projected by economic models. Ideally, the models of climate change and economic outcomes should be built into one model designed to predict the economic outcomes of different climate change scenarios, but in practice this is very difficult to achieve. Hence the idea of “soft linking” the climate change and economic outcome models, often in an ad hoc manner that aims to capture the essence of the climate change impacts and apply these to the economic outcomes model. The key difficulty in any “soft linking” is that the feed backs from the economic outcomes projections back to the climate change model can only be taken into account by ad hoc adjustment to the climate change model, not by a properly modelled feedback mechanism.

The application of the concept of “soft linking” to the case of models or projections of the impacts of macroeconomic policies that impact on distribution and poverty have similar advantages and disadvantages as in the climate change case. The available macroeconomic models at institutions such as the IMF would require a very large research effort to incorporate distribution and poverty issues. Such an enterprise would have to make a very clear distinction between sectoral and household disaggregation in the macroeconomic model to capture those distributional aspects that influence important macroeconomic functions governing, for example, household savings and the demand for money, and normative propositions regarding any policy objective to lower or eliminate poverty. By “soft linking” from a set of macroeconomic projections to a distribution and poverty model or to a rapid appraisal distribution and poverty impact assessment, the research cost of building a new stable of macroeconomic models would be avoided, but as in the case of the climate change models, “soft linking” is inherently an ad hoc process which will require case study experience to fully establish the strengths and weaknesses of the approach.

Fig 1. “Soft links” between Formal and Rapid Appraisal Methodologies



5.2 “Soft linking” in practice

There are potentially just 4 types of variables involved in “soft-linking”, shown schematically in Table 1.

Table 1. Exogenous and Endogenous Variables and “Soft Linking”

Macro	CGE	Example
exog	exog	Tariff Rates
endo	endo	GDP
exog	endo	Average Propensity to Consume
endo	exog	Employment

If the link is from a macroeconomic model to a CGE model, then the combination of exogenous and endogenous variables can be “soft-linked” as follows-

- (i) Exogenous to exogenous variables can be directly linked from the specification in the macroeconomic model. For example- if both models specify tariffs then the same rates of tariff protection should be chosen.
- (ii) Endogenous to endogenous variables could be linked, for example- GDP, by introducing an endogenous technical change shift variable into the CGE model so that GDP in the CGE model always matches that of the macroeconomic model.
- (iii) It may be the case that the average propensity to consume in the macroeconomic model is independent of distribution but, because of household disaggregation in the CGE model, is dependent on the household distribution of income. If the CGE average propensity to consume is sensitive to the distribution of income, it may be necessary to introduce a feedback to the macroeconomic model.
- (iv) Finally, when the level of employment is endogenous in the macroeconomic model but exogenous in the CGE model, “soft-linking” can be achieved by equating the exogenous level of employment in the CGE model to the macroeconomic model levels.

5.3 “Soft links” in the Ethiopian case study

Two sets of soft links have been chosen for a set of feasibility and usefulness checks in the Ethiopia case study. The first updates Evans (2010), where the IMF macroeconomic projects in IMF (2008) are updated to IMF (2010). The 2010 projections are soft-linked to a distribution and poverty CGE model, a substantially updated version of the comparative static CGE model used in Evans (2010). The projections in IMF (2010) reflect current macroeconomic policy issues in Ethiopia and involve relatively small structural changes over time.

The second feasibility and usefulness checks of “soft linking” is based on a Long Run projection based on a DSGE model (Rayner et al, 2011) of Gleneagles scaling-up of aid to the updated comparative static CGE model of distribution and poverty in Evans (2010). The IMF 2010 projections and the Gleneagles scaling-up projections are described in greater detail in section 6.

6. Case Studies of Distribution and Poverty Impacts of Macroeconomic Policies and Projections in Ethiopia

6.1 Ethiopia macroeconomic policies and projections from IMF 2010

The Ethiopia macroeconomic policies and projections in IMF (2010a) were used in the first set of “soft links” to the distribution and poverty impact.

Broadly speaking, the Ethiopian policy context has been driven primarily by strong pro-growth development policies from 2003/4. More recently, it became clear that demand was running ahead of the expansion in the capacity in the economy; that international reserves were falling; and that inflation was being led by rapidly rising food prices partly influenced by rising world oil prices, further straining Ethiopia’s balance of payments.

The Ethiopian policy response was to address the macroeconomic imbalances as well as to absorb the world oil price shock in a manner that would least affect the momentum for growth and poverty reduction. This entailed a more cautious fiscal policy that kept domestic borrowing well within the budget ceiling, and more forceful measures to prevent inflation expectations from becoming ingrained, and to strengthen the balance of payments. As a result, in 2010 the IMF staff recommended urgent steps to raise nominal interest rates, maintain lower reserve money growth, foster monetary policy independence, and enhance financial sector supervision to ensure financial stability. A stepped-up tax collection effort is important to support these objectives. There is evidence of exchange rate misalignment up till 2010. Thereafter significant nominal exchange rate adjustments and exchange rate misalignment has been practically eliminated.

Thus, the structural reform agenda for 2010 focuses on implementing the tax reform strategy; reversing the demonetization trend by raising interest rates and containing reserve money, including through active liquidity management; and strengthening national account statistics.

The macroeconomic policies discussed in the IMF staff report (2010a, 2010b) focus on two medium-term scenarios:

- (i) **Baseline scenario**, in line with the short-term policies as agreed under the ESF (Exogenous Shocks Facility) supported programme. This scenario with status quo policies broadly maintains macroeconomic balances but leaves the economy vulnerable to shocks. The scenario envisages:
 - (a) Public sector domestic financing unchanged from current year levels (around 3 per cent of GDP);
 - (b) Implementation of tax reform strategy;
 - (c) Reserve money growth maintained in single digits (year-on-year); and
 - (d) Gradual exchange rate adjustment in line with inflation differentials.
- (ii) **Stepped-up reform scenario**, with stepped-up reforms to highlight the benefits of further policy reforms. Reform policy scenario combines adjustment policies with stepped-up reforms (enhanced tax reform efforts and reaching real positive interest rates sooner) and further exchange rate adjustments.

Medium-Term Outlook

The IMF staff's medium term projections for the baseline and reform scenarios are shown in Table 2. Under the baseline scenario, GDP growth is projected to fall from almost 10% in 2008/09 to 7.5-8% from 2010/11 to 2014/15. Inflation is projected to fall from 9% to 6% over this period. Compared with 2008/09, government expenditure as a percentage of GDP rises from above 17% to above 20% by 2010/11 and is sustained to 2014/15. Financing of government expenditure (as a percentage of GDP) is above 1% in 2008/09 and reaches a peak of 3.4% in 2010/11, declining to 2.3% by 2014/15. The current account deficit (as a percentage of GDP) is 5% in 2008/09, rising to 9.2% in 2010/11 and falling to just over 5% by 2014/15. With only modest progress in tax reform under the baseline scenario, pro-poor spending is not projected to rise significantly.

The IMF staff projections for the reform scenario presented in Table 2 show that GDP growth is likely to be above 1% p.a higher than for the baseline scenario and inflation about 1.5% p.a less. By the end of the period, government expenditure (as a percentage of GDP) is projected to be almost 1% higher under the reform scenario compared with the baseline whilst the

government financing of expenditure is about the same. That is, the additional government expenditure in the reform scenario is financed from tax reforms. Finally, by the end of the period, the current account deficit as a percentage of GDP under the reform scenario is over 1% less than under the baseline scenario.

Table 2. Ethiopia: Baseline Projections Excluding Monetary Variables 2008/09 to 2014/15
(Percentage of GDP unless otherwise indicated)

Baseline Scenario	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
		Proj.	Proj.	Proj.	Proj.	Proj.	Proj.
GDP growth (annual change)	9.9	7	7.7	7.5	7.5	7.7	7.7
Consumer Price Index, CPI (annual change)	36.4	3.8	9.3	6.5	6	6	6
Total Govt. Expenditure, GEXP	17.2	19.7	20.2	20.3	20.2	20.4	20.5
Total Govt. Savings, GSAV (incl. grant)	-0.9	-2.1	-3.4	-2.7	-2.2	-2.2	-2.3
Current account balance, FSAV (incl. grant)	-5	-7.7	-9.2	-7.5	-6.2	-5.3	-5.3
Reform Scenario	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
		Proj.	Proj.	Proj.	Proj.	Proj.	Proj.
GDP growth (annual change)	9.9	7	7.7	8	8.5	8.7	8.7
Consumer Price Index, CPI (annual change)	36.4	3.8	9.8	7.5	6	4.6	4.4
Total Govt. Expenditure, GEXP	17.2	19.7	20.1	20.4	20.6	20.9	21.2
Total Govt. Savings, GSAV (incl. grant)	-0.9	-2.1	-3.4	-2.7	-2.3	-2.3	-2.4
Current account balance, FSAV (incl. grant)	-5	-7.7	-9.5	-7.1	-5.8	-5.2	-4

Source: IMF Staff Report (2010a), Table 5, pp. 28

Box 1. Some Recent Reforms

Exogenous Shocks Facility: In November 2005, the Executive Board of the IMF approved the establishment of the Exogenous Shocks Facility (ESF) within the Poverty Reduction and Growth Facility (PRGF) Trust. *The ESF provides concessional financing to PRGT-eligible countries facing balance of payments needs caused by sudden and exogenous shocks.*

Tax Reform Strategy: A comprehensive tax reform strategy was finalized in February 2010, based on technical assistances from the Fund on tax policy and administration. The reform strategy aims to improve the efficiency of tax collection significantly by-

- (i) Transferring the collection of direct (business and personal income taxes) and indirect taxes (VAT and excise duty) from Addis Ababa City to the Ethiopian Revenues and Customs Authority (ERCA),
- (ii) Reviewing current exemptions and exemption approval procedures, and
- (iii) Increasing the Large Tax Payers Office (LTO) audit and enforcement resources and capacity.

Exchange Rate Adjustments: In recent years, the Ethiopian authorities have enhanced the flexibility of the exchange rate.

The authorities made another exchange rate adjustment (5 percent devaluation) on January 31, 2010. This adjustment, together with the previous ones in 2009, has brought down the real effective exchange rate (see Table 4 below). While remaining vigilant to ensure that the nominal exchange rate is adjusted to avoid overvaluation in real terms, structural reforms to enhance competitiveness over the medium-term are also critical.

6.2 Ethiopia macroeconomic model of Gleneagles Scaling up of Aid

Ethiopia macroeconomic model of the scaling up of aid is from Rayner et al (2011). At present Official Development Assistance (ODA) to Ethiopia is about US\$37 per capita per year, or 13 per cent of GDP. To reach the Gleneagles goal of US\$85 per capita per year, ODA would have to be scaled-up by US\$48 per capita, or 17 per cent of GDP, to a total of 30 percent of GDP. In aggregate terms, ODA would need to be scaled-up from the current level of about US\$3 billion per year to almost US\$7 billion¹ (Rayner, B., et al, 2011).

The baseline calibration of the scaling-up model matches the Ethiopian national accounts, the central bank's balance sheet and the view of the depth of the domestic financial sector. The authors stress that the model specification and calibration is subject to uncertainty; that the aid shock occurs in an otherwise steadily growing economy which could be subject to other shocks; and that the aid shock itself is uncertain.

The potential macroeconomic impact of scaled-up aid to Ethiopia, consistent with the Gleneagles initiative assesses that a scaling-up may temporarily increase economic growth in Ethiopia, but may also increase inflation, crowd out private investment, and appreciate the real exchange rate. In the note, "The Macroeconomics of Scaling-up Aid: The Case of Ethiopia", a policy response is evaluated that includes increased nominal exchange rate flexibility to control the inflationary impact of a scaling-up, and work to deepen the financial sector to minimize crowding out. Although real appreciation can be tempered if the central bank accumulates some of the aid as reserves, such a policy could significantly reduce economic growth.

Compared with the IMF (2010a, 2010b) medium term projections, the experiments in the scaling-up aid in the medium and long run provide a second set of feasibility and usefulness checks for "soft linking" macroeconomic policy changes to the distribution and poverty impacts.

The core results of the scaling-up model relate to foreign aid as a share of GDP, and the impact of the foreign aid shock on the rate of growth of GDP over a 20-year period, the rate of growth of investment over a 20-year period, the degree of absorption of aid overtime, and the impact on the real exchange rate over a 20-year period. The first results from "soft-linking" with the distribution and poverty CGE model will focus on the size of the foreign aid shock and the effects of the shock on the real exchange rate. This is because the distribution and poverty CGE model is comparative static and is most useful for estimating the poverty impact of the direct aid transfers and indirect effects through the impact on the real exchange rate.

6.3 Policy Narrative to be modelled

Monetary aspects of inflation are reflected in the key macroeconomic variables that are included in the CGE model, namely the exogenous and endogenous variables included in

¹ All figures are in 2004 US\$.

modelling the exchange rate, the current account deficit, and fiscal policy. The exclusion of monetary aspects of macroeconomic policies is normal for the distribution and poverty CGE of Ethiopia used in testing the “soft links” from the IMF macroeconomic projections for Ethiopia. Nevertheless, monetary aspects can be considered in scenario analysis where hypothesised changes in exogenous variables as a consequence of monetary policy can be considered.

As noted in section 6.1, the IMF (2010a, 2010b) sees inflation as driven mainly by food price inflation and world oil prices. The domestic component of food price inflation arising from structural problems with the domestic food market such as the grain markets is not directly modelled by the CGE model but scenarios could be spelt out in which the model mark-ups are modified to reflect potential structure improvements in the domestic grain market. However, imported inflation from increases in world food prices and the oil price is well-captured by the CGE model. Typically, the policy response of the Ethiopian government to imported inflation has been to maintain birr/US\$ nominal exchange rate to prevent the importation of inflation from contributing further to domestic inflation via a depreciation of the birr/US\$ nominal exchange rate. Suppressing the macroeconomic adjustment of the nominal exchange rate to world price increases leads to an excess demand for imports and an increase in the current account deficit. Until recently, the Ethiopian government used quantitative controls on the sale of foreign exchange to suppress the increased demand for foreign exchange whilst tolerating a secondary market for foreign exchange. We have modelled this by direct estimates of the tariff equivalent of the foreign exchange premium by importing sector.

Another aspect of domestic macroeconomic policy in the face of strong budgetary pressure was to expand government expenditure without a commensurate expansion of government revenue (taxation) so further contributing to inflationary pressure. A part of the reform scenario in IMF (2010a) is the inclusion of taxation reform to help bridge this gap.

The next sections outline how the above narrative on aspects of Ethiopian macroeconomic policies can be captured by simulations using the Ethiopian distribution and poverty model to estimate the poverty impacts. Further simulations based on the same model framework are developed to estimate the poverty impact of radical increases in foreign development assistance under the Gleneagles Initiative.

6.4 The Ethiopia distribution and poverty model

The distribution and poverty general equilibrium model or CGE model for Ethiopia used in this research is comparative static (see Robinson et al, 2010). The key modelling assumptions are:

- The distribution and poverty CGE model is calibrated to the 2005/6 SAM. The SAM accounts do not exactly match the national accounts used in the Ethiopia scaling-up model. For present purposes it is assumed that the two sets of accounts are at least in similar proportions for the main national accounts categories in the respective base periods.
- Value added is modelled using constant CES production functions for factor inputs (land, livestock, capital, various types of labour and non-agricultural capital for five regions).
- Intermediate inputs into production are determined as fixed shares of the quantity of output.
- Payments from each factor of production are allocated to households and other institutions using fixed shares derived from the base SAM.

- Household consumption is modelled using a LES specification. The marginal propensity to save is assumed to be a consistent share of income. Imported goods are assumed to be imperfect substitutes for domestically produced goods (Armington assumption)
- Exported goods are imperfect substitutes for domestically produced and consumed goods. (The Constant Elasticity of Substitution or CET assumption)
- The domestic price of each commodity adjusts so that domestic supply equals domestic demand.
- Capital stock is fixed in each sector for all regions. Livestock is specified by region and is allocated so that the marginal return to livestock is equalised for each crop in a given region. Land is specified by region and is allocated so that the marginal return to land is equalised for each crop in a given region. Labour is specified for each sector for all regions so that the marginal return to labour is equalised for each crop and industry.
- Labour markets have the total supply of labour fixed for each skill type. Real wages adjust so that demand for labour is equal to supply unless the real wage for any particular type of labour is fixed so there will be unemployment (e.g. unskilled labour).
- External accounts have fixed foreign savings (foreign capital inflows). With fixed foreign transfers, the trade balance (and current account balance) are also fixed
- The real exchange rate can be fixed and export supply and import demand adjusts, in which case the trade balance is flexible; or the real exchange rate is flexible, in which case the trade balance is fixed.
- The numeraire (i.e. reference price) of the model is the nominal exchange rate (NEXR). Thus, the model determines prices relative to this fixed CPI.
- The “macro closure” assumptions made are discussed below.
- The full set of equations for the distribution and poverty model are set out in Robinson et al (2010)

6.5 Distribution and Poverty Model Closure

The “macro closure” assumptions made in the distribution and poverty model are crucial for the “soft linking” of the IMF Article IV projections for Ethiopia to the distribution and poverty model. Note that in the general equilibrium context, macro closure refers to the choice of exogenous and endogenous variables for saving and investment, for government, for foreign trade and for factor markets. The choices made for the scenarios run for Ethiopia are shown in Table 3 below.

Table 3: Alternative Macro and Factor Market Closure

Exogenous Variables	Endogenous Variables
Investment (INV)	Total Savings (ToTSAV)
Government Expenditure (GEXP)	Government Savings (GSAV)
Foreign Savings (FSAV)	Real Exchange Rate (REXR)
Nomeraire	
Consumer Price Index (CPI)	
Real wage for unskilled agricultural and industrial labour	Unemployed agricultural and industrial labour
Sector specific capital	Endogenous returns to sector specific capital
Stock of livestock and land by region	Endogenous returns to livestock and land by region

6.6 The Ethiopia SAM Database and Economic Structure

Reliable quantitative analysis of sectoral and macroeconomic policy requires sound data and appropriate analytical tools as encompassed in the 2005/6 Ethiopia Social Accounting Matrix (SAM). We use the 2005-06 SAM described in Ahmed et al (2010) in the distribution and poverty model general equilibrium or CGE model for Ethiopia.

It is a highly disaggregated SAM allowing for a large model with 46 activities, 22 commodities, 46 activities, 15 factors and 14 households types households are classified by urban and rural and according to their income size. It also includes a zonal distinction between highlands and lowlands that captures some of the basic elements of differentiation between favourable and less favourable agricultural landscapes. Agricultural activities are divided into five regions as are two factors, land and livestock. Only one out of five types of labour are mobile across activities and regions and capital is used only in industrial and service activities. Foreign trade is divided by regions of origin and destination. In this application, there is no regional disaggregation of trade. Using the SAM, a brief summary of the economic structure of Ethiopia is shown in Table 4 below:

Table 4. Ethiopia Economic Structure 2005-06

Description	Share in	Share in	Share in	Share of	Share of	Share in	Share in
	Domestic	Total	Total	Exports in	Imports in	Household	Rural Poor
	Production	Imports	Exports	Output	Dom. Demand	Consumption	Consumption
Teff	0.012	0	0	0	0	0.017	0.007
Wheat	0.009	0.035	0	0	0.492	0.023	0.038
Maize	0.009	0	0	0.001	0.001	0.013	0.024
Barley and sorghum	0.01	0	0	0.002	0	0.014	0.022
Export agriculture	0.041	0.001	0.336	0.726	0.02	0.029	0.029
Enset	0.004	0	0	0	0	0.006	0.009
Other agricultural products	0.037	0.011	0.043	0.105	0.079	0.058	0.058
Livestock	0.051	0.002	0.047	0.082	0.009	0.065	0.046
Home-produced agricultural products	0.121	0	0	0	0	0.197	0.289
Home-produced processed food, service	0.088	0	0	0	0	0.143	0.195
Flour and milling services	0.008	0.002	0.015	0.167	0.069	0.009	0.008
<i>Agriculture</i>	0.39	0.051	0.441				
Other processed food, beverages, tobacco	0.031	0.033	0.033	0.096	0.23	0.056	0.043
Chemicals	0.009	0.123	0.019	0.2	0.818	0.042	0.036
Electricity	0.008	0	0	0	0	0.005	0
Water	0.006	0	0.003	0.051	0.001	0.003	0.001
Petrol	0	0.122	0	-	1	0.01	0.006
Intermediate and investment goods	0.021	0.092	0.034	0.148	0.568	0.012	0.007
Final consumer goods	0.031	0.336	0.068	0.201	0.776	0.122	0.069
<i>Manufacturing</i>	0.106	0.706	0.157				
Construction services	0.113	0	0	0	0	0	0
Trade and transport services	0.184	0.173	0.295	0.144	0.216	0.025	0.01
Public admin, education, health services	0.108	0.002	0.008	0.006	0.004	0.033	0.02
Other services	0.1	0.068	0.097	0.087	0.02	0.118	0.083
<i>Services</i>	0.505	0.243	0.4				

Source: Ethiopia SAM 2005/6. See Ahmad et al (2010) and Robinson et al (2010)

The structure of the Ethiopian economy follows a pattern of imports, exports, domestic production, and consumption that is familiar for low income developing countries. On the production side, 39% of domestic production is in agriculture, 11% in manufacturing and 50% in services. Of the 39% of domestic production in agriculture, 21% is in home-produced agriculture and service activities. The largest remaining agricultural activities are export agriculture, other agricultural activities and livestock. For trade, on the import side, agricultural products were about 5% of total imports for 2005/6. Other large items imported include chemicals, petrol, intermediate and investment goods, final consumer goods and trade and transport services. In all, manufacturing accounts for about 70% of all imports.

On the export side, agriculture accounts for 44% of total exports of which 34% is for the sector 'Export agriculture'. Manufacturing makes up 16% of total exports, the most important components being processed food and final consumer goods. Trade and transport services (30%) and other services (10%) make up the remaining exports.

On the output side, over 70% of output of the sector 'Export agriculture' is exported. In all other sectors, less than 20% of output is exported. On the import side, with the exception of wheat, the most heavily import dominated sectors are in manufacturing, especially in chemicals (32%), petrol (100%), intermediate and investment goods (57%) and final consumer goods (78%). In the case of wheat, imports are 49% of domestic demand, reflecting the highly protected status of the sector.

Finally, the pattern of household consumption reflects the high percentage of domestic production in home-produced products and services, especially for poor rural households. Compared with the household average, the poor rural households tend to have a lower than average share of manufactures and services compared with household average.

The large degree of sector and regional disaggregation in the SAM is likely to ensure that the poverty and distribution impact results for macroeconomic scenarios are as large as possible.

6.7 Exogenous Projections for Ethiopia Distribution and Poverty Model

6.7.1 World Prices: the IMF view in historical context

During the period 1996/97-2008/09, pressures on macroeconomic balances in Ethiopia, particularly prices and international reserves, heightened. These pressures were largely due to

- (i) high domestic demand, which exceeded the supply capacity of the economy, and
- (ii) exogenous shocks during 2008–09, with commodity price surges and the global recession. Inflation rose to 64 per cent in the twelve months to July 2008 with food prices rising by 92 per cent. (IMF, 2010a)

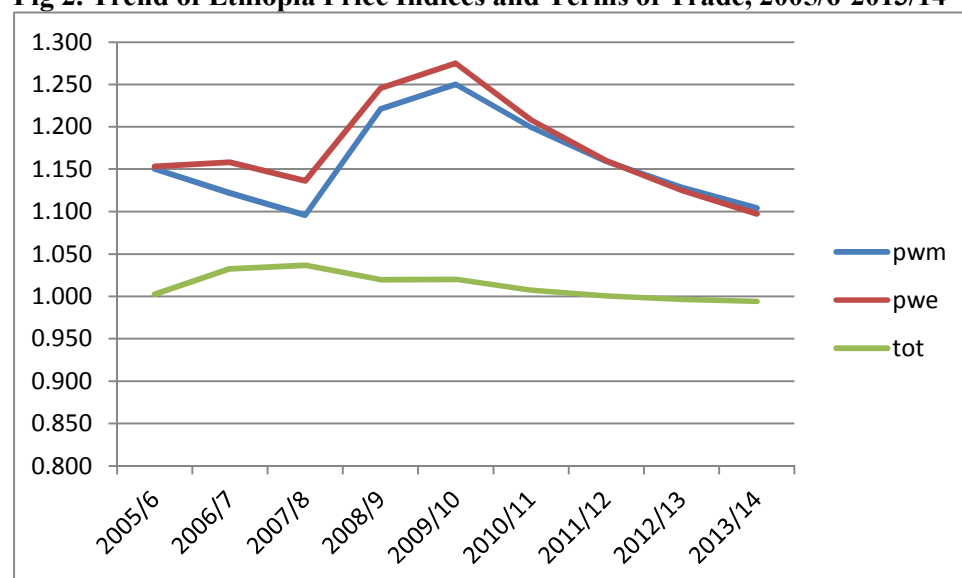
Both domestic and external factors account for the increase in inflation. Estimating the impact of each factor is difficult, given progressing structural changes, but higher inflation than in neighbouring countries points to some Ethiopia-specific factors and imbalances, including demand pressures and increasing inflation expectations. The direct impact through global food price increases has been limited in the light of the small import share of non-aid food. (IMF, 2008). Although progress has been made in reducing macroeconomic imbalances, inflation reached 30 percent in April 2011 as concluded by a recent IMF mission to Addis Ababa in May 2011 so that currently the principal macroeconomic challenge in Ethiopia is controlling inflation.

6.7.2 Projecting World Prices for the Distribution and Poverty Model

For the purposes of the distribution and poverty model for Ethiopia we have constructed a new Ethiopian terms of trade index. The preliminary results of our estimates are shown in Figure 2 below. As can be seen from Figure 2 the overall terms of trade for Ethiopia improve from 2005/6 to 2010/11, declining a little to 2013/14. This picture of the evolution of Ethiopia's terms of trade differs substantially from Robinson et al (2010) which shows adverse terms of trade changes.

The sources used to construct the world price of exports, world price of imports and the terms of trade for the years 2005/6 to 2013/14 are the IMF WEO, IFS and Ahmed et al (2010). The world prices of exports and imports (actual prices to 2008/9 and thereafter projections) from IMF WEO for 56 commodities were allocated to the Microsam commodity categories supplemented by IFS (for industrial commodities). The 69 Microsam commodities were then aggregated to 22 SAM commodities using unweighted averages and SAM concordances from Ahmed et al (2010). The economy wide terms of trade index shown in Figure 2 is an aggregation of the 22 SAM commodity world price trends using the 2005/6 export and import weights.

Fig 2. Trend of Ethiopia Price Indices and Terms of Trade, 2005/6-2013/14



Source: Computed using data from IMF WEO, IMF IFS, Ahmed, H., et al (2010)

6.7.3 Selected Economic Indicators

Table 5 below draws together some of the key economic financial indicators obtained mainly from IMF sources. The table provides a useful focus for the discussion of phases in the evolution of the Ethiopian economy and for the estimation of the tariff equivalent of foreign exchange controls by sector. This is of importance for constructing simulations with the distribution and poverty model covering the short run, the medium run and long run. For modelling purposes we have chosen 2007/8 as the base period, a year of high inflation and relatively low growth. We have defined short run the period from 2007/8 to 2008/9. Model simulations for the Short Run cover some of the historical period. There was strong deflationary pressure on the economy in this period indicated by the sharp fall in the share of government expenditure in the GDP from 19.1% to 17.2% and a rise in the tariff equivalent of foreign exchange controls on the food and manufacturing sectors from 9.4% to 27.5%.

We propose a definition of the medium run from 2007/8 to 2010/11, a three year period which fits with the common sense notion of the medium run. As with the short run, the medium run covers some of the historical period. The long run for model simulations defined so far for the period 2007/8 to 2014/15 extends beyond the immediate historical experience. As can be seen in Table 5 the baseline projections of government expenditure are the same for the medium and the long run. However, note that in Table 4 there are no projections of the

exchange rate variables or the tariff equivalent of the import controls beyond 2010/11 reflected in the repetition of the 2010/11 values as a forward projections.

Note that the estimation of the tariff equivalent of the parallel market exchange rate for food and manufacturing sectors is based on the actual IMF estimate for all imports adjusted using expert judgement from the IMF Ethiopia team for the actual import coverage of the foreign exchange controls. Thus, for 2008/9 the economy wide estimate of the parallel market period of 12.7% is adjusted by the import share of the sectors where the foreign exchange premium of 46% applies.

Table 5. Ethiopia- Selected Economic and Financial Indicators, 2005/06-2014/15

	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
	actual	actual	actual	actual	project.	project.	project.	project.	project.	project.
GDP and Prices										
GDP at current market prices (billions of birr) (i)	131.7	170.9	229.2	313.4	356.5	415.8	476.4	543.9	621.0	668.8
GDP at constant prices (at factor cost) (ii)	11.6	11.4	8.4	9.9	7.0	7.7	7.5	7.5	7.7	7.7
GDP deflator (iii)	-	-	30.5	24.4	6.3	8.3	6.6	6.2	6.0	
Consumer prices (period average) (iv)	12.3	15.8	25.3	36.4	2.8	9.0	7.3	6.0	6.0	6.0
Government Expenditure including baseline projections										
Total Govt Expenditure/GDP % (v)		(20.8)	(19.1)	17.2	19.7	20.2	20.3	20.2	20.4	20.5
External Sector										
NEER (end of period) (vi)	-1.8		-11.8	-5.0	-8.0					
REER (end of period) (vi)	6.3		5.5	26.3	4.7					
Exchange rate (birr per U.S. dollar; period average rate) (vi)	8.7	8.8	9.2	10.4	12.9	15.5	15.5	15.5	15.5	15.5
Parallel exchange rate (birr per U.S. dollar; period average rate) (vi)	3.8	1.7	4.4	12.7	5.4	2.6	2.6	2.6	2.6	2.6
Parallel exchange rate adjusted for import coverage (vii)										
Other process food, beverages, tobacco	8.2	3.7	9.4	27.5	11.7	5.5	5.5	5.5	5.5	5.5
Intermediate and investment goods	8.2	3.7	9.4	27.5	11.7	5.5	5.5	5.5	5.5	5.5
Final consumer goods	8.2	3.7	9.4	27.5	11.7	5.5	5.5	5.5	5.5	5.5
Notes										
(i) From IMF (2008, b, page 5). Projected forward using GDP deflator										
(ii) IMF (2008a, Table 1; 2008b, p5;; 2010a, Table 5)										
(iii) IMF (2008a, Table 1; 2010a, Table 5)										
(iv) IMF (2008a, Table 1; 2008b, p5; 2010a, Table 5)										
(v) IMF (2010a, Table 5).										
(vi) Estimates from IMF staff sources										
(vii) Parallel exchange rate adjusted for import coverage										
estimated from 2005/6 SAM and IMF staff sources.										

7. Planned Simulations and qualitative results

The report above details the preparation of the distribution and poverty model for “soft linking” of the “Reform” and “Gleneagles” simulations. The details of these planned simulations are shown in Table 6 below.

The first and second column of Table 6 describes the exogenous variables from the macroeconomic projections and model and data source. The qualitative interpretation of likely poverty impacts in the third column was informed with reference to the structure of the Ethiopian economy set out in Table 4. Unfortunately, when the model was put together for the calculation of final results using an updated SAM, we ran into numerical problems so we are unable to report full quantitative results of the “soft linking” the “Reform” and “Gleneagles” scenarios to the distribution and poverty model. Nevertheless, we were encouraged by the rich variety of the qualitative results reported in Table 6 and conclude that full set of quantitative results for the Ethiopian case study are likely to be strongly supportive of the proposition that in the manner described in both feasible and useful.

Table 6. Scenarios Planned for the Distribution and Poverty Model

Reform Scenario		
Exogenous Variable Shock	Source of Shock	Possible Poverty Impact
World prices (PSURGE)	As for Figure 4, disaggregated to SAM commodities	In the SR and MR, REXR appreciates as terms of trade improve. Possibly leading to poverty reduction. LR effects are small.
Government Expenditure (GEXP)	Table 1	Impact depends on commodity composition of the net change in final demand and the associated poverty linkages.
Foreign Savings (FSAV)	Table 1	An increase in FSAV directly increases access to imported goods and leads to an appreciation of the REXR. Urban poor and home grown producers likely to benefit from REXR appreciation but final poverty effect an empirical matter.
Tariff Equivalent of foreign exchange controls by sector (TEQ)	Table 5	Large overall welfare reduction in SR; lower welfare reduction in MR; negligible effects in LR. Small REXR appreciation and large redistribution of economic rent to high income urban household. Possible negative impact on poverty.
Indirect Taxes (TIND)	Base tax rates from SAM increase by 3% initially	Indirect tax reform likely to be regressive, net poverty impact- an empirical issue.
Gleneagles Scenario		
Exogenous Variable Shock	Source of Shock	Possible Poverty Impact
Government Expenditure (GEXP) and Foreign Savings (FSAV)	30% increase of GDP after 5 years – Rayner et al (2011)	Combined effect of increase in GEXP and FSAV by 30% of GDP leads to a strong REXR appreciation (7% REXR appreciation estimated in Rayner et al after 5 years). Direct effect of expanding GEXP likely to have strong poverty reduction effects. The appreciation of the REXR likely to have strongest negative impact on poverty through impact on unskilled labour employed in wheat (import competing) and export oriented agriculture. Net poverty effect an empirical matter.

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