

ECA Forecasting modelling system for Africa

Overview Theory and progress

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Economic Commission for Africa**

Outline

- Model design process
- Scope, structure and variables
- Theory and principles
- Key equations
- Equation estimation and calibration
- UNECA and UNDESA-WEFM models



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Model design process

- Review of UNDESA, area wide and other country specific models (Ethiopia, Kenya, etc.) drawing lessons (where applicable);
 - UNDESA not fully reflective of unique African economic characteristics
- Review and research of unique African economic issues to incorporate into the design of the model (e.g. those pertaining to Africa's structural transformation);
- Review of ideal data requirements versus availability;
- Data collection, where ACS played a significant role;
 - Availability of "ideal" variable list led to a shortened model variable list that is replicable across all African economies;
- Model specification and equation design;
- Data read-in & validation, and model implementation & estimation/calibration;
- Model refinement, fine-tuning, rigorous testing and trouble-shooting;
- Project inception, presentation of the model specification and equation design and capacity building training.



Scope, structure and coverage

- Six core countries
 - Algeria (replaced Angola)
 - Nigeria and Ghana
 - Ethiopia and Kenya (ET replaced Egypt)
 - South Africa
 - These economies represent just over half of Africa GDP;
 - A variety of economic structures and geographic locations (commodity and non-commodity economies);
- Rest of Africa (ROA) and Africa blocks
 - More limited variable coverage
 - Over time the ROA countries will transition to the “prototype” model. ROA bloc will be reduced and African continent forecasts will become more accurate (as more economies are modelled in greater detail).



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General categories or blocks

Composed of:

- **Demand:** GDP, consumer spending, investment;
- **Supply:** Capital stock, labour supply, TFP, education, infrastructure, output gap (climate change etc. later);
- **Investment:** FDI (net, inward and outward), domestic private, government;
- **Trade:** Goods, services, commodity and non-commodity goods;
- **Balance of payments:** Current account (trade, income, transfers), capital & financial account, reserves, reserves import cover;
- **Industry:** GVA by three broad sectors, intermediate and final demand;
- **Prices:** CPI, GDP deflators, commodity prices, terms of trade, earnings, labour costs;
- **Financial:** Market and equilibrium exchange rate, interest rate, domestic private sector credit;
- **Fiscal:** Revenue, expenditure, government balance;
- **Demographics:** Total, working age, urban and rural population, dependency rate
- **Labour market:** Participation rate, labour supply, employment and unemployment
- **Social:** Poverty rate and headcount, Gini coefficients.



High level country differentiation

- Despite the “prototype” model having a common structure, its design and assumptions ensure a high level of country differentiation – country specific characteristics;
 - The underpinning data and exogenous forecasts reflect structural differences in economies and supply-side potential;
 - Selection of variables in a block – eg Commodity module reflects the relative importance of commodities to the overall economy, incorporates the most important commodities of each country;
 - Global linkages captures unique global linkages via weights for trade, FDI and remittances;
 - Applies different I-O coefficients depending on low versus medium-income; and commodity vs non-commodity country classification (from African I-O tables).



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Variables and data sources

- Significant amount of data provided by UNECA from a range of sources
 - UN, ILO, IMF, INTRACEN, UNCTAD, World Bank WDI, country statistical agencies and central banks
 - GDP, demographics, trade, CPI, exchange rate, sectoral VA, fiscal, commodity prices
- Gaps/additional data filled through interpolation/extrapolation and other sources including Haver, UN, IMF, World Bank WDI, World Economic Forum and country statistical agencies and central banks, e.g. Gini, investment breakdown
- UNDESA-WEFM model data is used as historical data in some cases
- Some variables constructed/estimated as residuals, proxies, using equations etc.
- Bilateral weights: Trade matrices (WITS), FDI (UNCTAD) and remittances (World Bank)



Theory and principles: Model type

- Neither CGE nor VAR model;
- Best described as an eclectic structural macro econometric model
 - Partly estimated and partly calibrated – we want to tell story behind the data, but also to satisfy stylised facts and be consistent with theory, in particular how the model reacts to shocks;
 - Structural - its equations represent theory of how the economy works;
 - Equilibrium model - market clearing/model closure; restrictions for accounting identities; behavioural equations consistent with optimal behaviour.



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Theory and principles: What the model can and cannot do

- Tool to support economic analysis:
 - Framework for understanding and quantifying how an economy works;
 - Rigorous system for projections to determine appropriate policy;
 - Tool for analysing economic policy changes;
 - Process for generating alternative scenarios to assess risks and design policy to react to the perceived risks;
- However, it is not a black box that gives all the answers:
 - Models inevitably are simplifications of real economies;
 - Data on which the model is based are not always perfect;
 - Not possible to quantify all economic drivers;
 - Model cannot replace thoughtful analysis.



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Theory and principles: Short and long-run

- Keynesian short-run/business cycles and deviation from equilibrium
 - Output and employment are determined by the supply side;
- Neo-classical long-run supply-side features and return to equilibrium
 - The model implements a long-term equilibrium in key equations;
 - Output and employment determined by supply-side factors;
 - Equilibrium forces and model closure – ensure that the model stabilises in the long-term, especially after a shock;
- Unique African features and global linkages;
- Error Correction Model equations are used.



Key equations: Types

Six core countries

- **Exogenous:** Aggregate commodity production, Total factor productivity, Capital stock depreciation rate, Population (total, working age, urban, rural), Labour force participation rate, Infrastructure score, Secondary gross enrolment ratio, Average commodity and non-commodity government , revenue tax rates, Domestic banking credit % GDP, Climate change variable
- **Identities:**
- Behavioural: Theory-based relationships across variables. They describe the short- and long-run behaviour of the variables (Demand, supply, investment, trade, BOP, industry, prices, financial and fiscal);
- **Transformations;**
- **Use of policy rules is limited given the prototype nature of the model – policy rules vary by country;**

ROA and Africa blocks

- ROA grows in line with sum of six core countries
- Africa = six core countries + ROA



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Equation estimation and calibration

- Equation estimation is often seen as the best approach;
- However, **due to significant data quality** (consistency, short time series etc.), this often yields over-fitted models that are not coherent with economic theory;
- These constraints, in addition to the model being a prototype, **we use calibration, rather than estimation, for several behavioural equations**;
- Calibration is based on parameters from estimation of a **large cross-country or individual country long time series** dataset (OE), **or based on theory, published research** (e.g. climate change variables), other models and professional judgement.



Alignment of the ECA model with UNDESA model

- Use of the same global exogenous drivers (e.g. US GDP growth, world oil prices) and use the same bilateral trading partner weights etc.;
- Uses same historic data where variables overlap;
- Use of country forecasts/estimates from the WEFM to test the accuracy of the key variables
- But note the two models operate in different systems: ECA model based on a dedicated software while the WEFM is based on Eviews.



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Value added and status of implementation

- Greater variable coverage and flexibility hence extra policy analysis capability;
- More bespoke, reflective of unique African economic characteristics, and tailored to UNECA requirements;
- User-friendliness of the software;
- Enhanced global linkages and user-friendly global scenario and domestic shock capability;
- Adaptability to roll out “prototype” model to other countries;
- But consistent to some extent with UNDESA-WEF model in terms of its historic data, certain equations, key country forecasts and global exogenous driver assumptions;
- **So far:** Customized for the six countries and more requests are being made.



Thank you for your attention

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