Using the World Economic Forecasting Model

UN / DESA / DPAD

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I. Introduction to the World Economic Forecasting Model (WEFM)
(1) Introduction
(S1) Large-scale macroeconomic models; a bit of history; their strengths and weaknesses; modern modeling philosophy; multi-country models and the WEFM; the Large and Small prototype country models
(S2) Introduction to forecasting and scenario analysis using the WEFM “Small Model” in EViews.

(2) The Small Prototype Country Model and its Use
(S1) “Small Model” overview: its purpose, structure and properties.
(S2) Introduction to the WEFM suite of macros. Single-country forecast production: work-flow and scheduling, resources, assessment, scenarios
Training Materials

(3) Large Prototype Country Model and its Use
   (S1) Large Model overview: modeling philosophy, accounting identities, behavioral equations, policy rules, forecasting equations, data sources
   (S2) Forecasting and scenarios with the Large Model. Model properties and endogenous policy

(4) Model Building and Testing
   (S1) Model building I - estimation: cointegration/error correction, single country and panels; calibration and fitting; identities; model testing
   (S2) Model Building II - group work on model building, “Small” and “Large” model examples

(5) Global Linkages, Summary and Regional Workshop I
   (S1) Global linkages: trade linkages; other linkages; putting it all together
   (S2) Summary session: overview and future directions
Overview

- Some history on Project LINK and the WEFM
- Large-scale macroeconomic models, their rise, fall and renewal, the criticisms and solutions, modern modeling philosophy.
- WEFM: the Large and Small prototype country models and the global linkages
- “Large” Model overview: modeling philosophy, accounting identities, behavioral equations, policy rules, forecasting equations and data sources
- “Small” Model overview: its purpose, structure and properties.
Some Background: The LINK model

- Project LINK starts in the late 1960’s
  - There existed a number of country models built by national modelling centres
  - The idea was to “LINK” these country models together and study the transmission mechanism
- Over the years the number of country models (and national centres) expanded
- 1980’s add more developing countries and the system settles down
  - African Explorer Project: build single country models for a large set of African countries to be used as input to the Project LINK Global Model.
  - LINK Central builds Middle East + Asia + LATAM
The MAXI-LINK

● The Maxi was the global model versus the single country models comprising:
  ⇒ About 65 Single country models + rest-of region aggregates
  ⇒ Trade matrix (80x80)
  ⇒ Other linkages (exchange rates, interest rates, other)
● Single country models developed by LINK national institutions
  ⇒ University groups, statistical offices, central banks, research organisations.
  ⇒ Models converted into common “language” and installed into MAXI
● Each forecast round country groups sent forecast, LINK-central implemented, then modified to conform to common assumptions and so that trade balances clear.
The MAXI-LINK (cont.)

- LINK Meetings twice a year to discuss forecast and other issues
  ⇒ Create scenarios during meetings after discussion
  ⇒ Post-Meeting revision to forecast

- Single-country models evolved over the years, in line with the developments in theory/econometrics
  ⇒ LINK Philosophy “Country modellers know their economies best”
  ⇒ Country models: tremendous variety in terms of size, structure, complexity (Denmark and CPB)
  ⇒ (1970’s) IS-LM Keynesian but could be very large if disaggregated
  ⇒ But evolved as theory/econometric/modelling techniques evolved
  ⇒ Denmark: elaborate supply side with Input-Output Matrix
  ⇒ CPB: vintage capital
  ⇒ LBS model, BOF model: very sophisticated
LINK and the United Nations

- UN had long association with LINK, at least back to the 1970’s (UNCTAD)
  \[\Rightarrow\] Spring Meeting held at UNHQ (back at least to 1982)
- 1989 LINK-Central came to DESA, and DESA ran the forecasting part of the project (Univ of Toronto ran research part)
- Full model in use until 2005
- Mini-LINK
  \[\Rightarrow\] interim model = accounting Identities + Trade matrix
- Now WEFM
LINK Model to WEFM

• The WEFM changes to in-house built prototype country models
  ⇒ Modelling Philosophy changes from heterogeneous set of country models to a few prototypes (so far Large and Small, also looked at Mid-sized and commodity dependent)
  ⇒ but forecast update philosophy remains the same (Country experts submit forecasts, LINK-Central (DESA) puts together).  

• 160+ individual country models linked together via a trade matrix that reconciles global export and import volumes and export and import prices. Other linkages include exchange rates, some world interest rates and commodity prices.
LINK Model to WEFM

- WEFM “Large” prototype follows structure coming out of UK-Treasury tradition
- WEFM “Small” fills in rest of country coverage.
  ⇒ Minimum size that can forecast the variables we need and can perform some basic scenarios.
Some Background on Large-scale macroeconomic models

- A bit of history
- The rise, fall and renewal
- The criticisms and solutions
- Modern modelling philosophy
- The WEFM
“Large” Model heritage: The End and New Beginning of Large Macro-econometric Models

- Large Scale Macro models fell out of favour!! For 3 reasons:
  1. Oil Shock of the 1970’s and 80’s
     - forecast bad + wrong policy advice <= missed impact of supply side and of expectations (no long-run trade-off)
  2. Lucas Critique (reduced form versus structural)
     - Change in policy and given expectations, changes reduced form of equations
     - need structural equations with deep parameters to look at policy
  3. Sims Identification
     - Identification criteria impossible + theory wrong
     - look at VARs
“Large” Model heritage: The End and New Beginning of Large Macro-econometric Models

● Reaction: Mainstream (US) two approaches: small 1st principals models with Rational Expectations and VARs
● Europe and UK tried to address criticism head on:
  ⇒ UK treasury in 1980’s -90’s (LBS, NIESR, BOF, QUEST, INTERLINK, ECB-MCM)
  ⇒ Some of these later models were in the LINK system
● “Large” prototype model comes from this lineage and is a version of the ECB-MCM
Modelling Philosophy

- Reaction to critiques of Lucas (reduced form / structural) + Sims (Identification)
- Developed at UK treasury in 1980/90s (LBS, National Institute, ECB-MCM)

**MP1)** Use *theory* where possible to specify the **Long Run** equations, incl. any cross equation restrictions and fit the **Short Run** to the data.

**MP2)** Use *Cointegration/Error correction* method for estimation but calibrate where necessary

**MP3)** impose sensible properties on the model
- impose long-run static homogeneity properties according to theory and test short-run dynamic homogeneity properties.

**MP4)** forward looking (rational, learning) expectations

**MP5)** *policy variables* are endogenized in a rules-based scheme.
Large Scale Macro Models
Next Generation: Theory

- Theory: New-Keynesian flavour

1) Long run: Neo-classical supply side (Solves supply shocks)

2) Short run: Keynesian demand side
   ⇒ short run rigidities (price/wage stickiness)

3) Expectations (Rational, learning)

4) Policy rules (MP, Fiscal)
   ⇒ Solves Lucas critique (deep structural parameters, x-eq restrictions, expectations)

5) Accounting system that links sectors
Large Scale Macro Models
Next Generation: Estimation

- Estimation: Econometrically estimated approach + MP3

- In contrast to DSGE models with calibrated coefficients (Gali & Gertler)

- Cointegration/Error Correction estimation approach

⇒ Solves Sims: Identification of parameters (using dynamics, not exclusion restrictions) can be done in this framework
Large Scale Macro Models
Next Generation: Estimation

- MP3: Test/impose sensible properties on LR (and in some cases the SR)
  ⇒ homogeneity of price system for example
  ⇒ Calibration used when appropriate (difference to CGE and DSGE less)

- Practical framework: LR-theory relationships + SR(fit the data)
  ⇒ shocks push away from LR equilibrium and EC brings back
  ⇒ LHS is dlog(Yt) = growth rate + SR fits the data => perfect for forecasting
The Large and Small prototype country models

- The WEFM country models are of two types: Large and Small
- Why we need (at least) 2 prototype models
  ⇒ Data requirements and 150+ models
  ⇒ “Large Model” requires a lot of data
  ⇒ “Small Model” is absolutely minimum size
The Large Model

- Simplest version of an econometrically estimated New Keynesian model:
- Captures the Modelling Philosophy
- Long run: Neo-classical supply side
- Short run: Keynesian demand side
- Backward Looking Expectations (Lagged dependent variables)
- Policy rules (Monetary, Fiscal)
- Accounting system that links sectors
Large Model: Brief Description

- 158 equations and 190 variables (significant data requirements)
- Households (consume and save) + Firms (produce and hire) + Government (taxes, spends and monetary policy) + External Sector
  \[ \Rightarrow \text{Banking sector serves as intermediary (clear weakness, but is being worked on)}. \]
- These sectors determine aggregate demand and supply
Consumer Problem

• Optimising problem with two types of households: liquidity constrained (disposable income) and unconstrained (wealth)

• LR Consumption = f (disposable income, wealth)
Firm Problem

• Profit max firm + goods market (monopolistic competition)
• Production function (Cobb-Douglas) with labour-augmenting technological progress
• First order conditions:
  ⇒ demand for K and L and W/P (3 cointegrating vectors)
• Wage bargaining framework (Unions and firms bargain over wage)
  ⇒ Wage = f (Productivity, Unemployment, other) and yields a Phillips curve and a NAIRU
Supply side

• NAIRU is exogenous
• Labour force (not from consumer problem) coupled with NAIRU generates Trend Labour Supply
• Trend Labour supply + K
  \[ \Rightarrow \text{Trend Output + Demand} \Rightarrow \text{Output Gap} \]
  \[ \Rightarrow \text{Output Gap} \Rightarrow \text{Key prices} \]
Government

- Government consumption is exogenous
- Government investment similar to private investment
- Government transfer payments are endogenous
- 3 Taxes: indirect, personal and corporate
- Tax rates follow rules
- Accounting identities for Government deficit and debt
External Sector

- Trade (goods and services)
  ⇒ Export and import volumes and prices
- Current account balance
- Net foreign assets
- Exchange rate
  ⇒ fixed nominal, fixed real, UIP
Prices

- Demand and Supply => Output Gap
- Output Gap + EC(LR P) + Wages + Import prices => Domestic Price Inflation
- Other prices follow
Accounting System

• Set of Identities
• Expenditure + Income + HH, Firm, Gov Balance Sheets + Stock/Flow + Income payments from Asset Stocks
The Small Model

- Small-scale(65) => pseudo time series model
- Max size that allows modelling of [150] countries
- Severe data limitations for some countries
- Simple consumption function and investment function
- Government spending exogenous
- Trade equations are same as in large model
- Labour employment, labour force and unemployment
- Production function => trend growth and output gap
- Inflation depends on output gap and imported inflation
- Implemented as panel estimation by region

=> country models share most but not all coefficients
- But could be individually estimated