Integrated Economic-Environmental Modeling for Evidence-Based Public Policy and Investment Design

IEEM Dataset for Chile 2016

Martín Cicowiez

(CEDLAS-UNLP y RMGEO)

Onil Banerjee

(RMGEO)

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IEEM as a Standard Model

- IEEM is coded as a "standard" model → separation between model theory and calibration
  - set of files with GAMS (General Algebraic Modeling System) code
  - Excel files containing data and simulation definitions; typically, country-specific
  - everything that is not linked to an application is part of the model code
    - if you want to make a change, you do it only once - in model files

IEEM as a Standard Model – cont.

- The code is written in such a way that it "captures" what it finds in the dataset that is stored in Excel
  - flexible disaggregation/aggregation
  - alternatives for some key assumptions
    - macro closure rule
    - rules for government receipts and spending
    - rules for non-government payments
    - presence/absence of unemployment
    - presence/absence of regulated sectors
    - special treatment of selected inputs such as fertilizers, pesticides, water, energy products, among others
    - others

Alternatives for Running IEEM

- IEEM can be run using
  - the DOS command line using "bat" files.
  - GAMS Studio; graphical interface to edit and run GAMS files.
  - **ISIM** interface; runs on Excel 2010 or later.
    - has the advantage of avoiding the direct use of GAMS

IEEM File Structure

- IEEM data Excel file; calibration and base scenario
  - SAM, elasticities, unemployment rates, population, environmental information, others
- IEEM simulations Excel file; definition of simulations
  - see ISIM presentation
- IEEM GAMS files - run automatically through ISIM
  - calibration and baseline scenario, simulations, reports

Files to Generate Reference Scenario

- The dataset to implement IEEM consists of three files to generate the reference scenario
  - **app-data.xlsx** (chl2016bc-data.xlsx)
  - **app-data.inc** (chl2016bc-data.inc)
  - app-data2.inc (chl2016bc-data2.inc) (optional)
- In practice, copy an existing dataset, rename files, and replace content.

# Calibration Using Chile 2016 Database

- IEEM is calibrated with a new SAM for Chile 2016
  - "snapshot" of the economy: supply/demand; income generation and distribution
  - the SAM provides initial values for endogenous and exogenous variables and most model parameters
- Data Sources
  - SUT 2016 and IEA 2016
  - Ministerio de Hacienda
- Dimensions SAM- maximum disaggregation (factors and households could be expanded)
  - 111 activities and 181 products
  - 13 factors
  - 4 institutions (households, firms, government, rest of the world)

SAM, Growth Rates, and Other Data

- SAM - provides most of the data for defining the value of the model's parameters and exogenous variables
  - e.g., base year effective tax rates
- Also, other easily compiled data based on observed trends - national accounts, balance of payments, and government revenues and expenditures
  - growth rate of the economy
  - government revenues and expenditures
  - non-government payments
  - world price growth, for exports and imports

GDP Growth Rate for GDP (%)
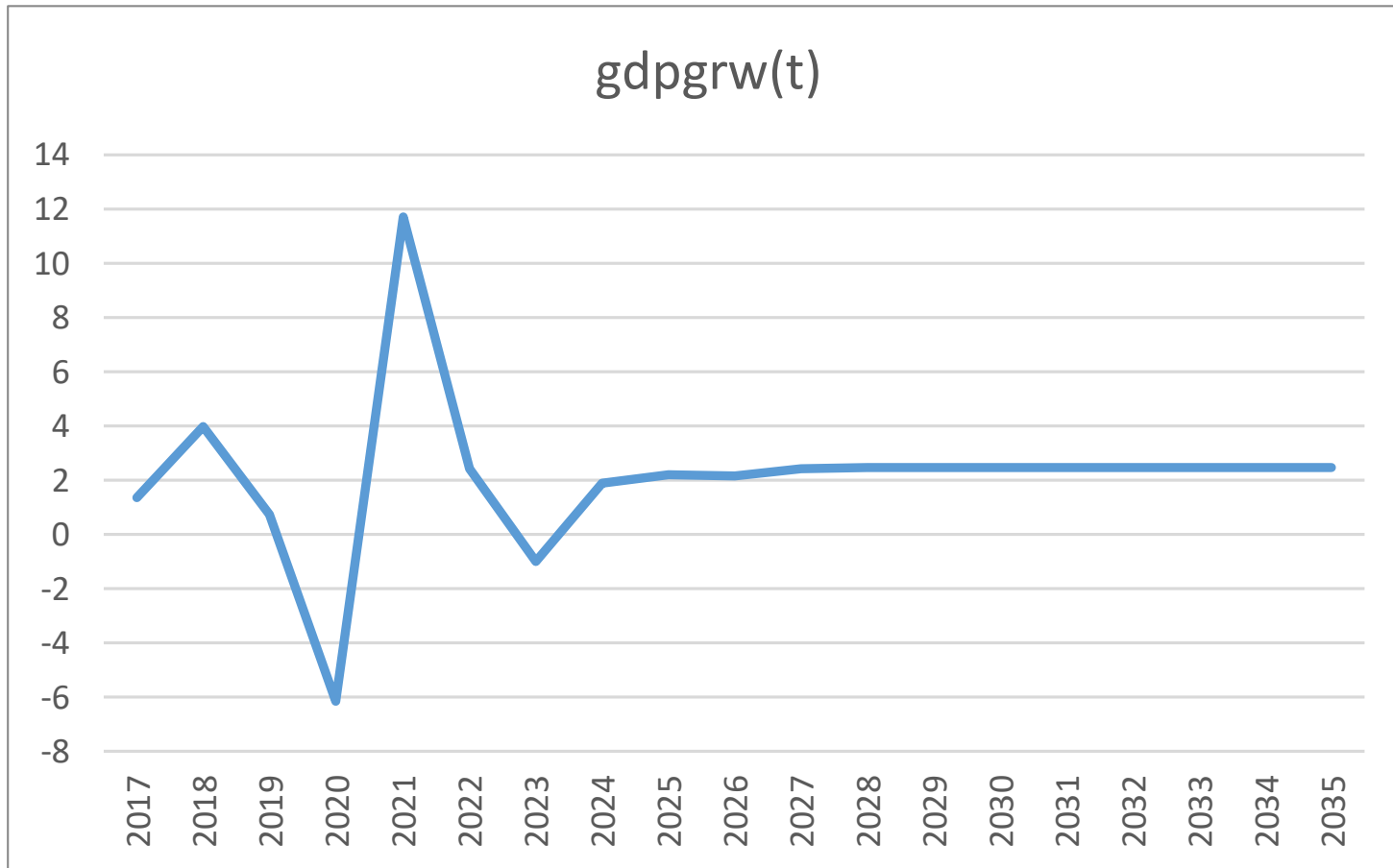
Source: World Economic Outlook Database, April 2023.

Population

- Population data - also easy to compile; population statistics from United Nations, Department of Economic and Social Affairs, Population Division (2022). World Population Prospects 2022, Online Edition.
    - total population
    - working-age population (15-64)

Population and Labor Supply (growth and level)
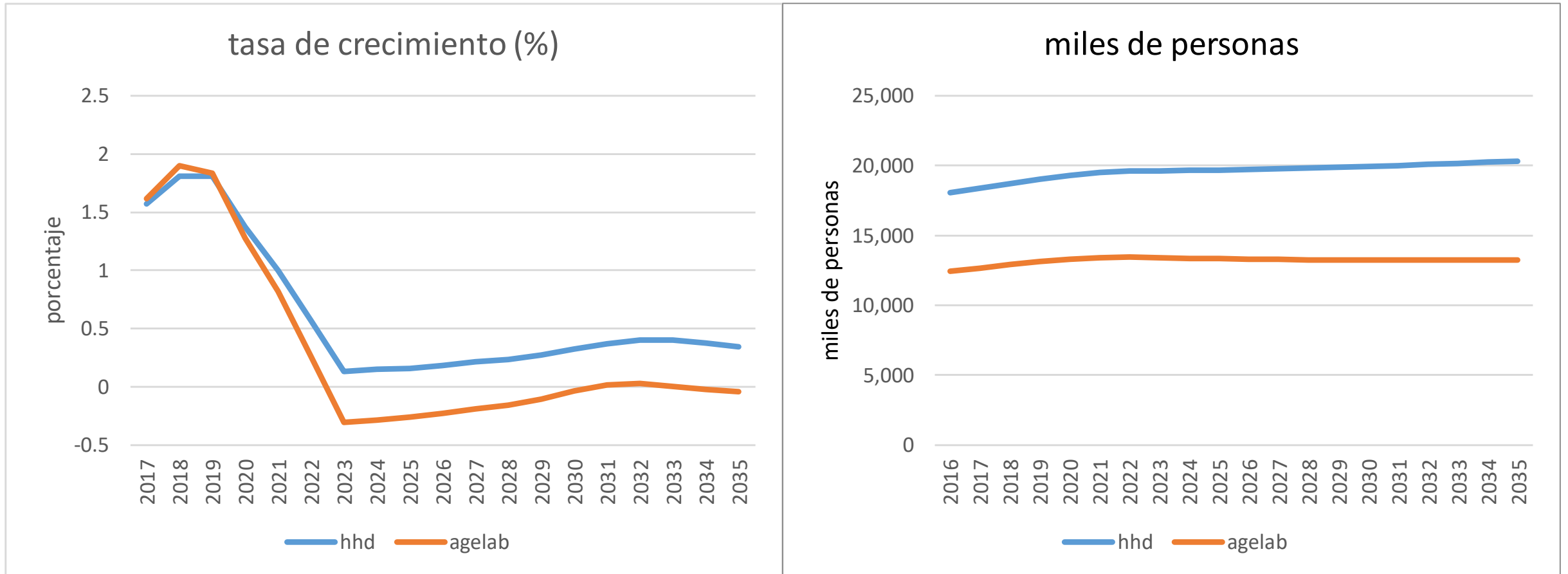
Source: United Nations, Department of Economic and Social Affairs, Population Division (2022). World Population Prospects 2022, Online Edition.

Factors of Production

- In general, this information is easy to obtain using household surveys (i.e., CASEN)
    - employment by labor category and activity for base year; allows for wage to differ between activities
    - labor force participation rate
    - labor underutilization rate (ILOSTAT LU4)
        - f-lab = 14.9%
    - elasticities related to the labor market - more difficult to compile
        - wage elasticity by labor category with respect to its determinants (e.g., unemployment rate; wage curve)

Private Capital Stocks

- In a dynamic model, the initial stocks of government and private capital must be estimated.

- The private capital stock is computed based on the net rate of return (7%; consistent with increasing K/L ratio), the depreciation rate (5%), and the capital factor income recorded in the SAM.

$$QF_{fcap,a}^{00} = \frac{SAM_{fcap,a}}{netprfrat_{fcap} + deprcap_{fcap}}$$

Government Capital Stocks

- IEEM computes government capital stocks that do not appear in the SAM.
  - these capital stocks may influence TFP; also, might be needed for the provision of government services
- In general, the government does not receive capital income from the provision of free public services such as education or health.
- On the other hand, the government may receive capital income from the provision of private goods/services; e.g., oil, CODELCO in Chile.

Government Capital Stocks – cont.

- The initial government capital stocks can be computed in alternative ways
  - assume steady state
  - information on the size of government capital stocks
  - based on SAM investment and growth rate estimate
- In our case, government capital stock according to assumption EE. Ideally, have some estimate for Chile - perpetual inventory method?

Standard Elasticities

- The "usual" elasticities of CGE models are
  - CES function: substitution between primary factors of production, by activity.
  - CES function: substitution between imports and domestic purchases, by commodity (or product)
  - CET function: transformation between exports and domestic sales, by commodity
  - LES system: income-elasticity by good/service

Substitution Elasticity Value Added; source: Hertel et al. (2012)
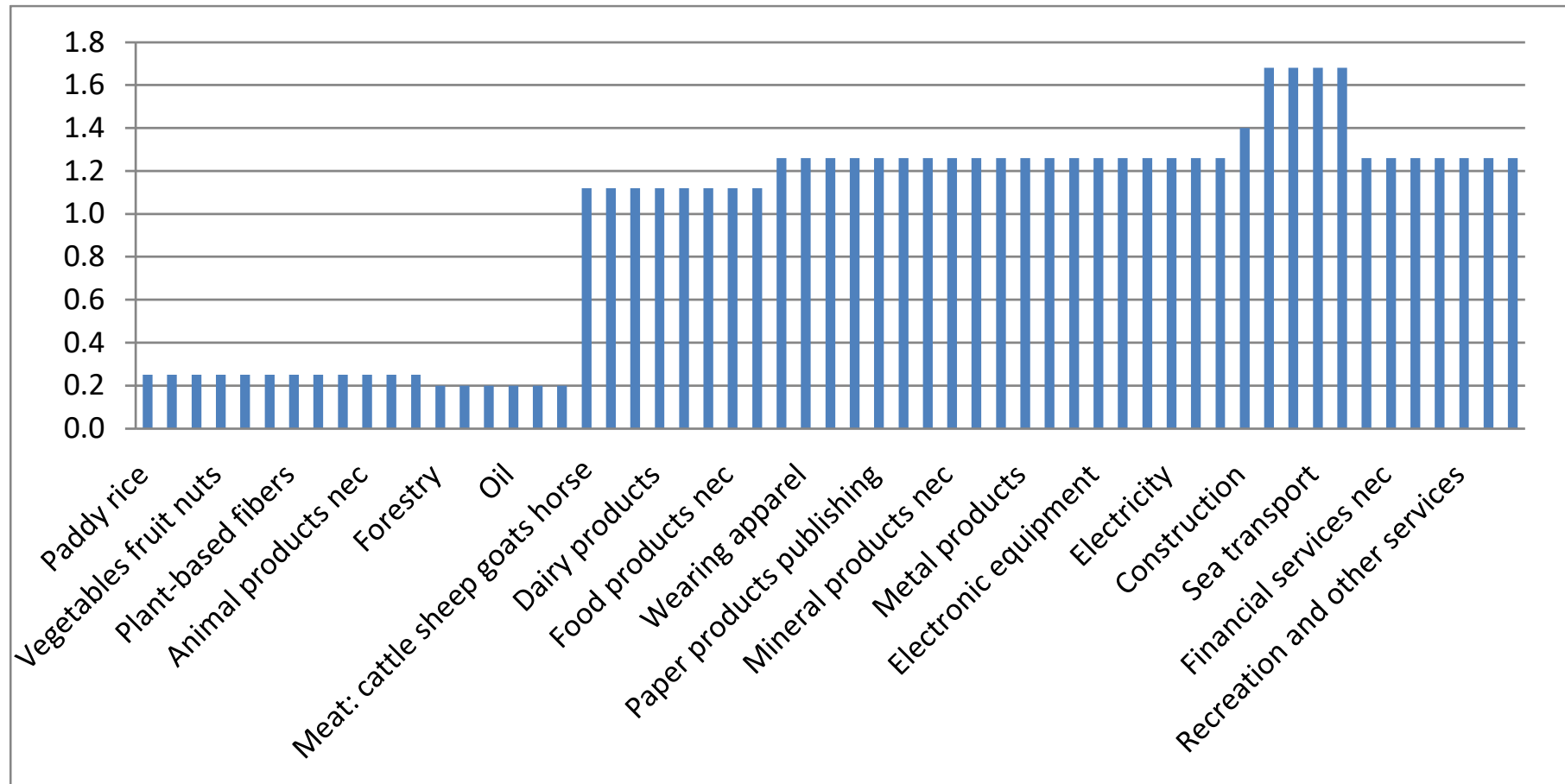
Expenditure Elasticities

Country	Chile
Food, Beverages & tobacco	0.679
Clothing & footwear	0.966
Housing	1.066
House furnishing	1.050
Medical & health	1.321
Transport & communication	1.157
Recreation	1.425
Education	0.921
Other	1.325

Source: USDA-Economic Research Service calculations using 2005 ICP data.

Trade-Related Elasticities

- CES substitution between imports and domestic purchases
  - 2 for primary products
  - 1.5 for manufactures
  - 0.9 for services
- CES transformation between exports and domestic sales, by product
  - 2 for primary products
  - 1.5 for manufactures
  - 0.9 for services

Other Data

- In addition, the model allows using data on volumes produced/consumed of any of the products expressed in physical units
  - e.g., electricity generation or barrels of oil