Testing In Advance If a DSGE Model and its Partner Database Will Forecast Well

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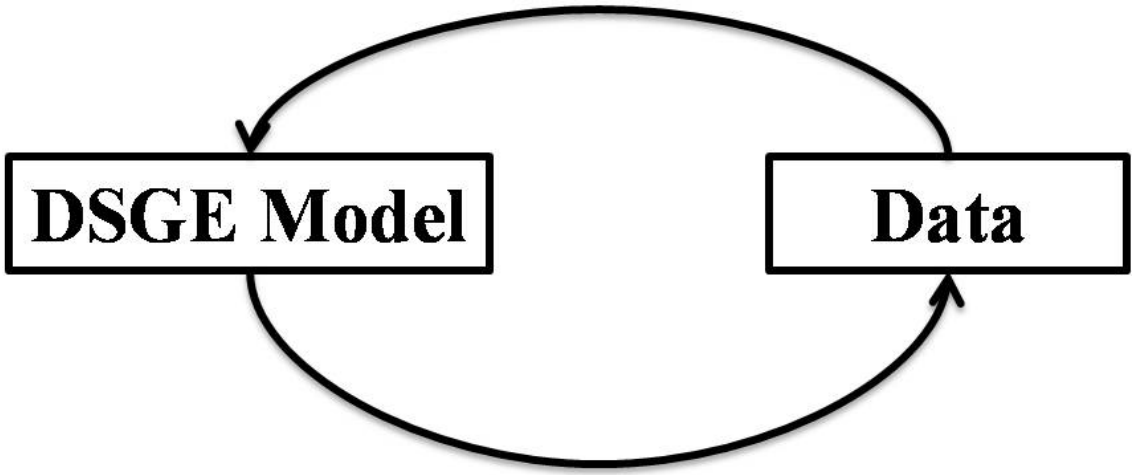
Outline

Standard DSGE modelling practice versus what we should do

- Standard practice: First build the model and then make up some data
- But really we should iterate between building the DSGE model and constructing the data, especially if we want to forecast



- This paper is about an early warning test if the model database marriage works. Model building has large fixed costs.

Example: tradable and nontradable

- Political economy in LA and OEM dictates a tradable-notradable sector difference.

Tradable (goods)

Agriculture, forestry and fishing.

Mining and quarrying.

Manufacturing.

Electricity, gas, steam and air conditioning supply.

Water supply; sewerage, waste management and remediation activities.

Non tradable (services)

Construction.

Wholesale and retail trade; repair of motor vehicles and motorcycles.

Transportation and storage.

Accommodation and food service activities.

Information and communication.

Financial and insurance activities.

Real estate activities.

Professional, scientific and technical activities.

Administrative and support service activities.

Public administration and defence; compulsory social security.

Education.

Human health and social work activities.

Arts, entertainment and recreation.

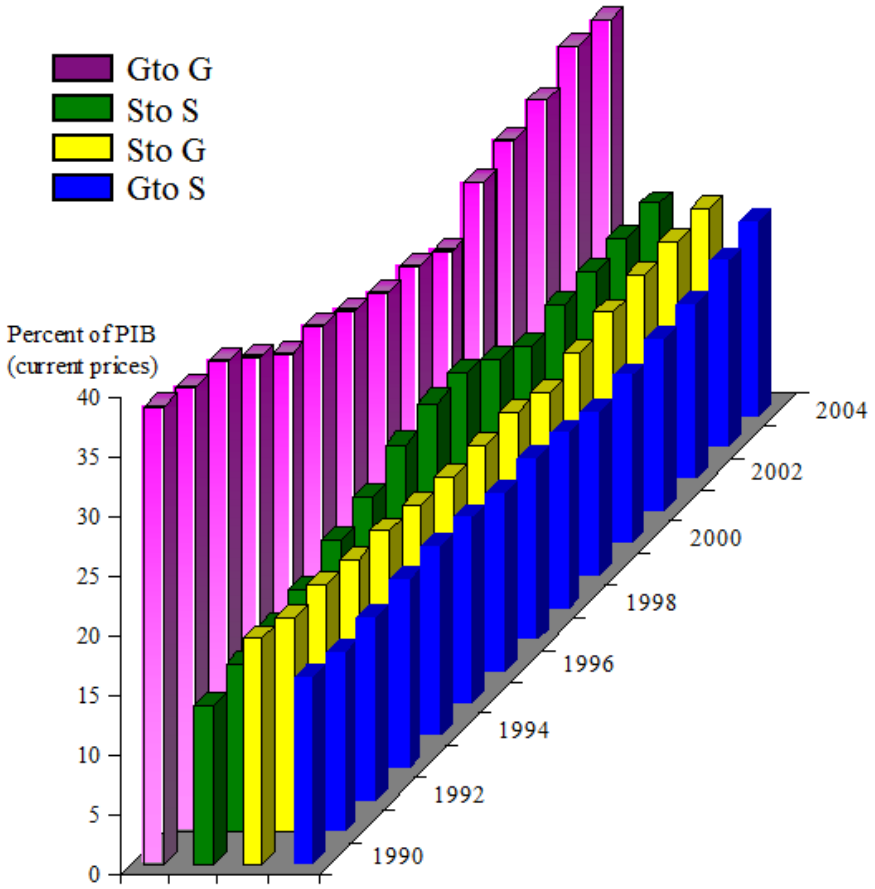
Other service activities.

Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use.

Activities of extraterritorial organizations and bodies.

Size of intermediate trade in Colombia

But can the data support the split? The main problem is intermediate trade.

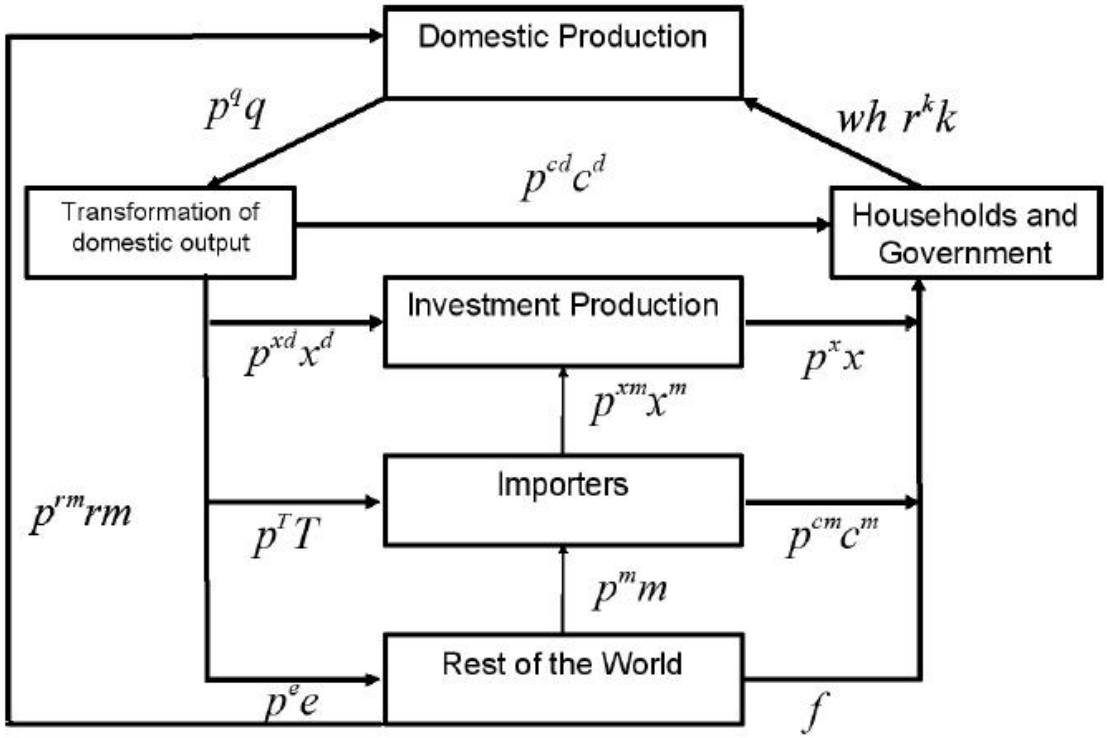


Similar problems splitting out the public sector

PATACON

- Compromise with data and policy needs. Focus on import transformation, transport and commercialization channels. Avoids splitting labour markets.

Figure: PATACON structure



Missing data

- Even then, tremendous data requirements to support a sectoral model for Colombia.
- We need to build data on types of imports (consumption, intermediate, investment goods): volume and price.

Variable	Explanation
$P_t^{cm}, C_t^m, P_t^{cm} C_t^m$	Consumption by households and government of direct imports
$P_t^{cd}, C_t^d, P_t^{cd} C_t$	Consumption by households and government of domestic production
$P_t^{md}, M_t^d, P_t^{md} M_t^d$	Aggregate capital and consumption imports after transformation
$P_t^{mp}, M_t^p, P_t^{mp} M_t^p$	Aggregate capital and consumption imports before transformation
$P_t^T, T_t, P_t^T T_t$	Distribution sector input into transforming consumption and capital imports
$P_t^{rm}, RM_t, P_t^{rm} RM_t$	Raw material imports
$P_t^{xm}, X_t^m, P_t^{xm} X_t^m$	Imported physical investment
$P_t^{xd}, X_t^d, P_t^{xd} X_t^d$	Domestically produced physical investment

Construction Strategy

1. Use input-output data where available to construct some annual nominal shares for the sectoral series.
2. Interpolate and extrapolate those shares to cover our whole sample at a quarterly frequency.
3. Get some data on the price and volume split of at least one component from other parts of National Accounts data or from other sources.
4. Combine that with the data on the aggregate concept on prices and volumes that was also available to derive a series on the missing component's price. To do this we need to bring in some economic theory to extract the separate price and volume of the other component.

The basic problem of a missing series

- Thus even we had data for the series P_{1t}, P_t, Z_{1t}, and Z_t in

$$P_{1t}Z_{1t} + P_{2t}Z_{2t} = P_tZ_t$$

- That would not be enough to derive P_{2t} and Z_{2t} separately. For this there are three solutions:
  1. Make some strong assumptions about relative prices, for example that they are fixed ($P_{1t} = P_{2t}$).
  2. Use the theoretical price aggregators consistent with the theoretical model to derive the volume or price of the component.
  3. Index numbers or utility aggregators to construct those series. Here we used index numbers for data and aggregators to check. This permits a test.

Demand equation in CES share form

$$s_{cd,t} = \left(\frac{P_t^{cd}}{P_t^c} \right)^{1-\omega} \gamma_t$$

$$s_{cd,t} = \left(\frac{P_t^{dat,cd}}{P_t^c} \right)^{1-\omega} \gamma_t \left(\frac{P_t^{cd}}{P_t^{dat,cd}} \right)^{1-\omega}$$

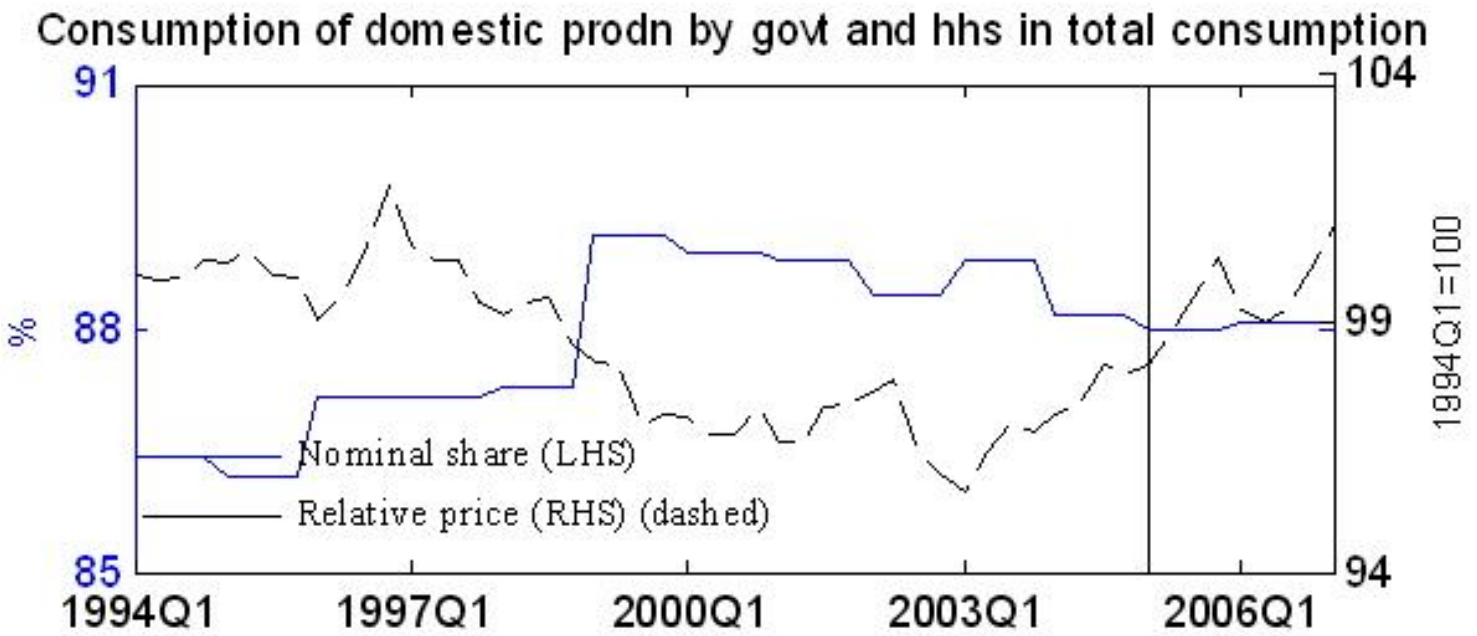
with

$$\vartheta_t = \gamma_t \left(\frac{P_t^{cd}}{P_t^{dat,cd}} \right)^{1-\omega}$$

a residual is OK, as long as we can forecast it.
$\omega = 0$ is Leontieff, $\omega = 1$ is Cobb-Douglas and $\omega = \infty$ is Perfect Substitutes

The forecast challenge for imported consumption

Figure: Share and relative price



The Kalman filter

The observation equation is:

$$\mathbf{y}_t = \begin{bmatrix} 0 & 1 \\ 1 & (1-\omega) \end{bmatrix} \alpha_t$$

and the state equation is:

$$\alpha_t = \begin{bmatrix} \phi_{11} & 0 \\ 0 & \phi_{22} \end{bmatrix} \alpha_{t-1} + \begin{bmatrix} (1-\phi_{11}) & \xi_1 \\ (1-\phi_{22}) & \xi_2 \end{bmatrix} + \mathbf{u}_t$$

with

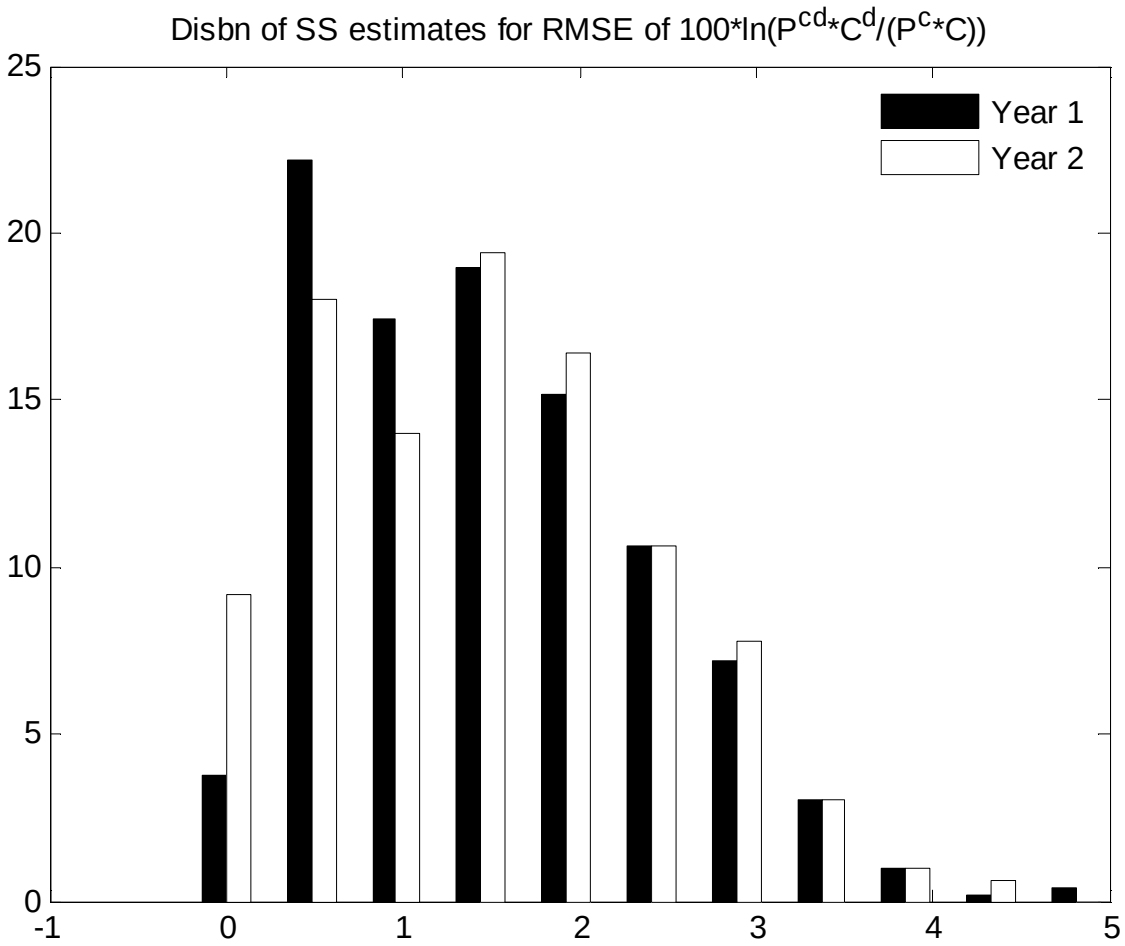
$$\alpha_t \equiv [\ln(\vartheta_t), \ln(x_t)]^T$$

$$\mathbf{y}_t \equiv \begin{bmatrix} \ln(\frac{P_t^{cd}}{P_t^c}) & \ln(s_{cdt}) \end{bmatrix}^T$$

$$\mathbf{u}_t \equiv \begin{bmatrix} u_{1t} & u_{2t} \end{bmatrix}^T$$

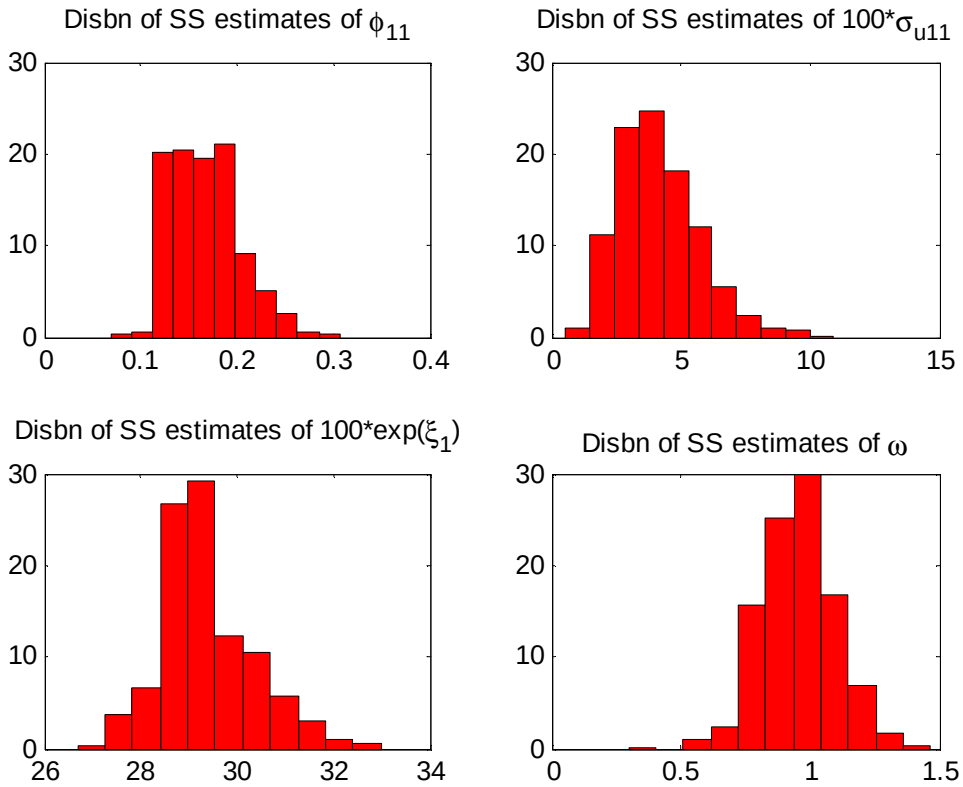
Results

Figure: For consumption: distribution of parameter values and RMSE



Summary of test

Figure: Domestic consumption of government and households

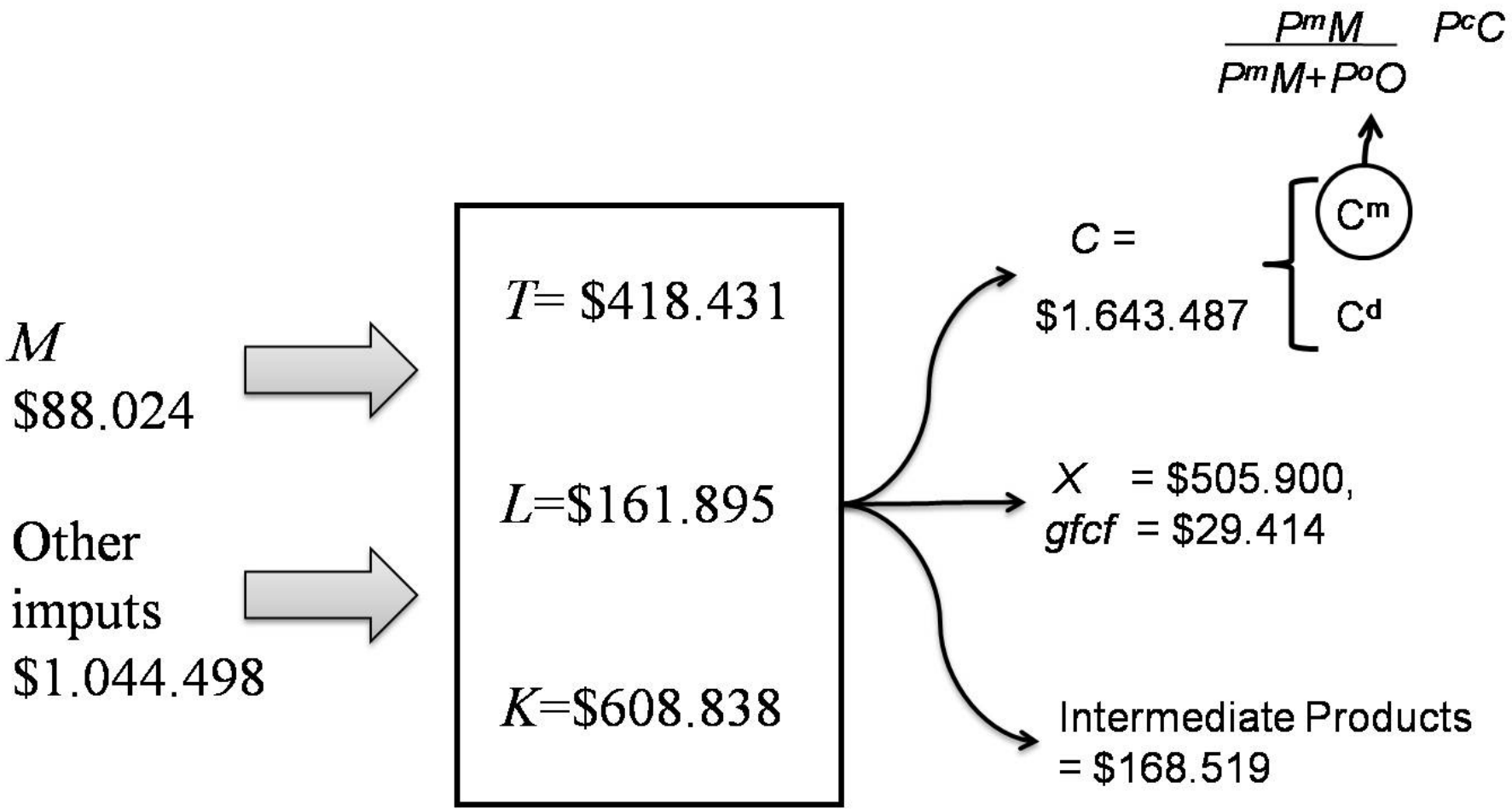


What we have shown

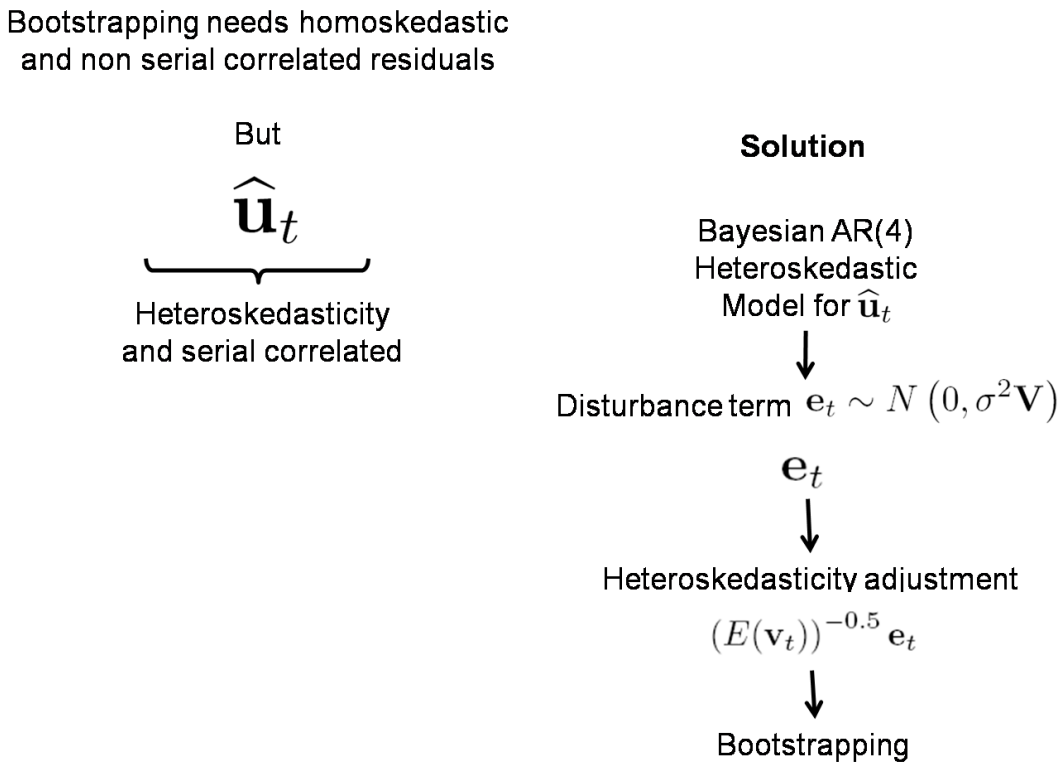
- The consumption demand part of the model and data will probably forecast quite well. This was not true of all other parts of the model for example total investment.
- Key messages:
  - Anyone who is mad or bored enough can make a database from the national account input output tables
  - But it is important to test the model with its accompanying database.
  - We developed an early warning test of whether the combination of model and database is likely to forecast well.
- This also, could be adapted to look into the effect of data revisions on the model-database combination, or to compare two different data series for the same concept.

An example

Figure: Input transformation mechanism. Cocoa's example



Bootstrapping



- Monte Carlo Markov Chains sampling, for 10100 draws ommiting 100. Stability conditions were imposed on the AR coeficients using Gibb sampling and the mean aceptance rates were all over 80%.