

WHEN TECHNOLOGICAL COEFFICIENTS CHANGES NEED TO BE ENDOGENOUS

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24st Inforum World Conference

Osnabrueck 29 August 2 September 2016

Import shares in an Inforum Model

When the IO table is available in domestic (or total) and imported flows, a matrix of import shares

MM

is available

MM is a component of the multisectoral model. playing an important role in the price side of the model

Between real side and price side

After the real side loop, a new IO table is built.

Multiplying element by element this 'updated' IO table by MM matrix, the 'updated' import flows matrix is obtained.

The row sum of this matrix gives the vector of imports :

m^{\wedge}

Import (behavioral) equations give the vector of imports:

m

Between real side and price side

In general $m \neq m^{\wedge}$

m comes from behavioral equations so that it
must prevail on m^{\wedge}

Problem : how to shape MM so that its row sum
be equal to m ?

Interdyme Report #1

Douglas Meade - May, 1995

If the model is forced to take more imports than it has demand for a certain industry, then output for that industry will be calculated as negative in Seidel(). This unreasonable result, if not corrected in Seidel(), will then cause other parts of the model to react strangely. For a forecast of imports to be reasonable, then imports must be less than or equal to domestic demand

Modelling matrix MM

MM matrix does not play any role in solving the real side of the IO model.

Actually, it is central in the nominal side

The algorithm for MM

Inforum suggests an algorithm to adjust the MM coefficients

The algorithm provides increases and decreases of import shares (the elements of matrix MM) greater for low shares and lower for great shares under the constraint $mm_{ij} \leq 1$

When this algorithm is unsuitable

If non-zero import shares are all equal to one and imports estimated are greater than imports calculated, $m > m^{\wedge}$,

their differences cannot be 'allocated' by changing MM coefficients

When the growth of imports causes trouble

Imports vs negative outputs

or

Running a model and run into negative outputs

and the model builder's dilemma

fixing or modeling?

The Leontief equation for a two sectors economy

$$\begin{bmatrix} 1 - a_{11} & -a_{12} \\ -a_{21} & 1 - a_{22} \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \end{bmatrix} = \begin{bmatrix} C_1 \\ C_2 \end{bmatrix}$$

Reading the equations by rows

$$(1 - a_{11}) q_1 - a_{12} q_2 = C_1$$

$$-a_{21} q_1 + (1 - a_{22}) q_2 = C_2$$

Reading the equations by columns

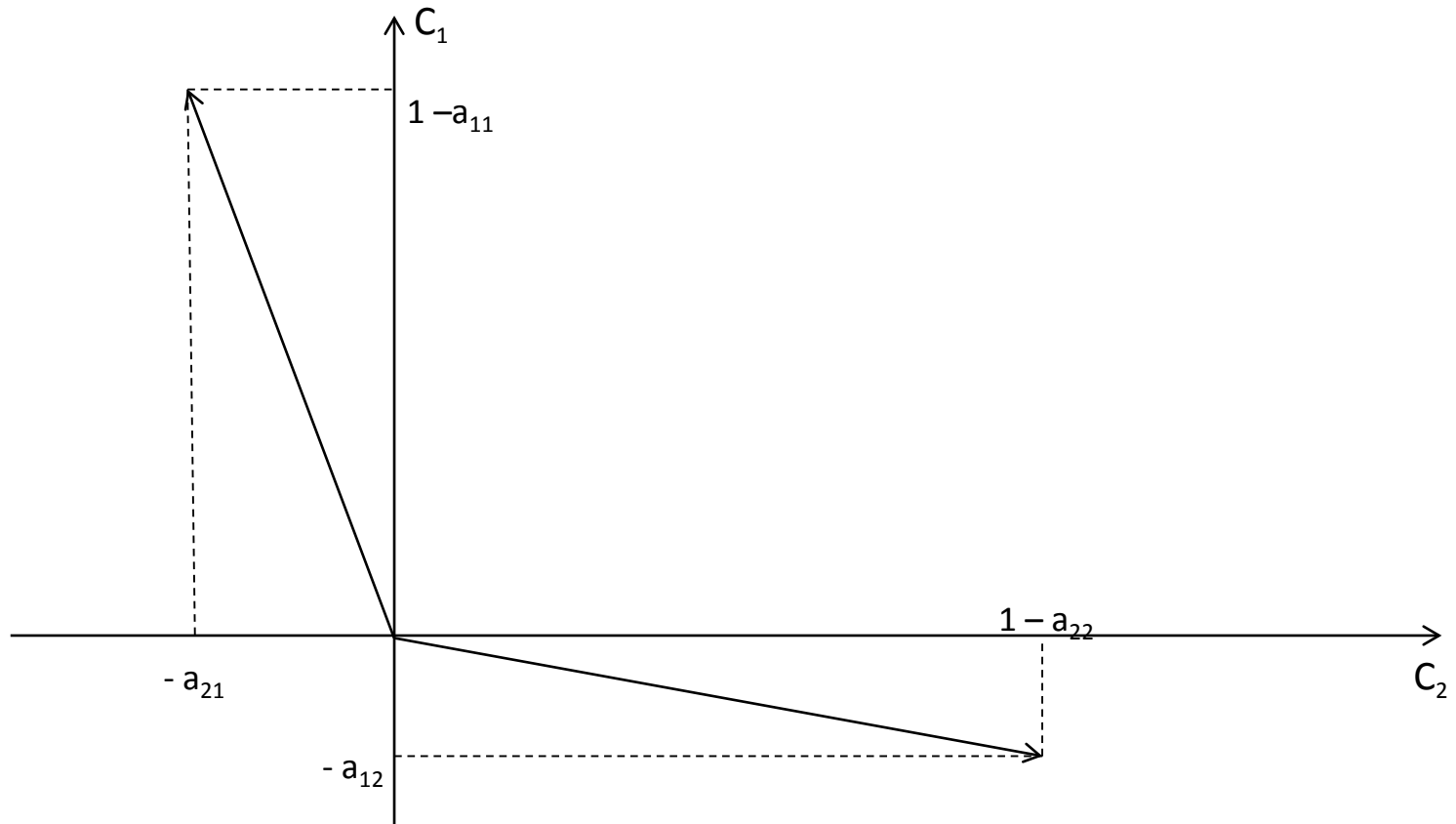
$$\begin{bmatrix} 1 - a_{11} \\ -a_{21} \end{bmatrix} q_1 + \begin{bmatrix} -a_{12} \\ 1 - a_{22} \end{bmatrix} q_2 = \begin{bmatrix} C_1 \\ C_2 \end{bmatrix}$$

The Hawkins-Simon conditions revisited

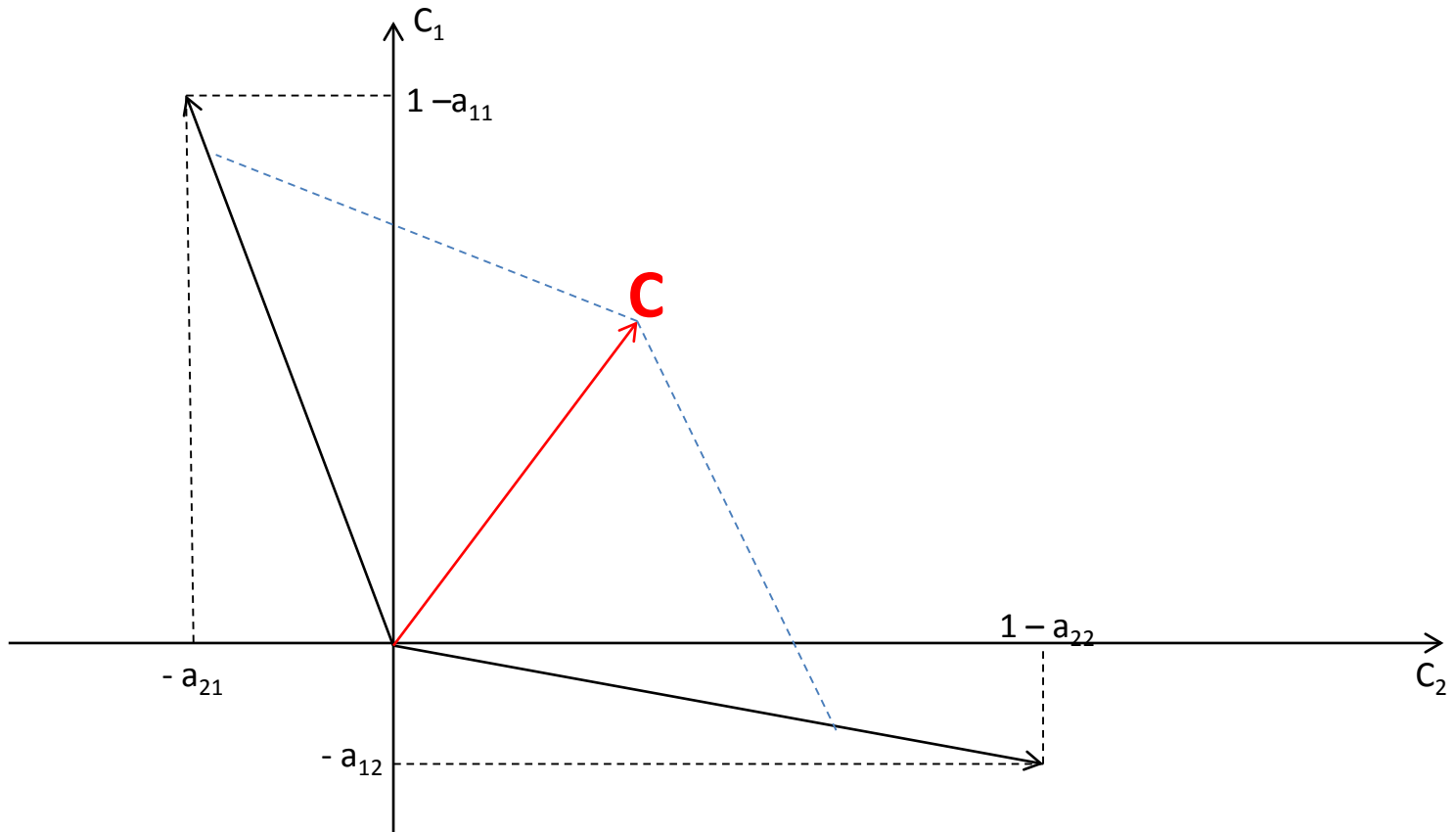
The corollary:

“A necessary and sufficient condition that the q_i satisfying $Aq+f=q$ be all positive for any set $f>0$ is that all principal minors of the matrix A are positive”

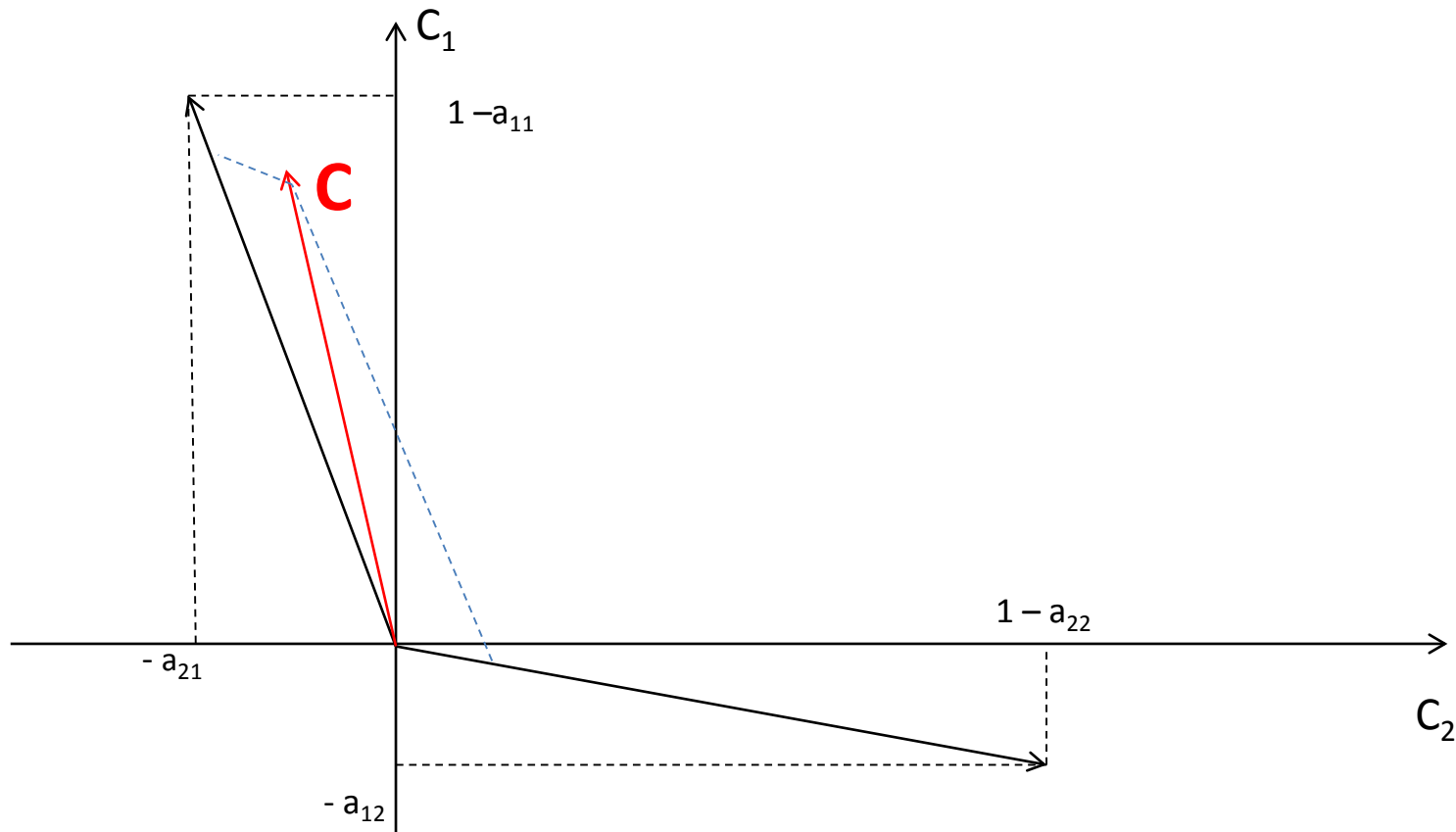
The geometrical analogue of the Leontief equation: the vector basis



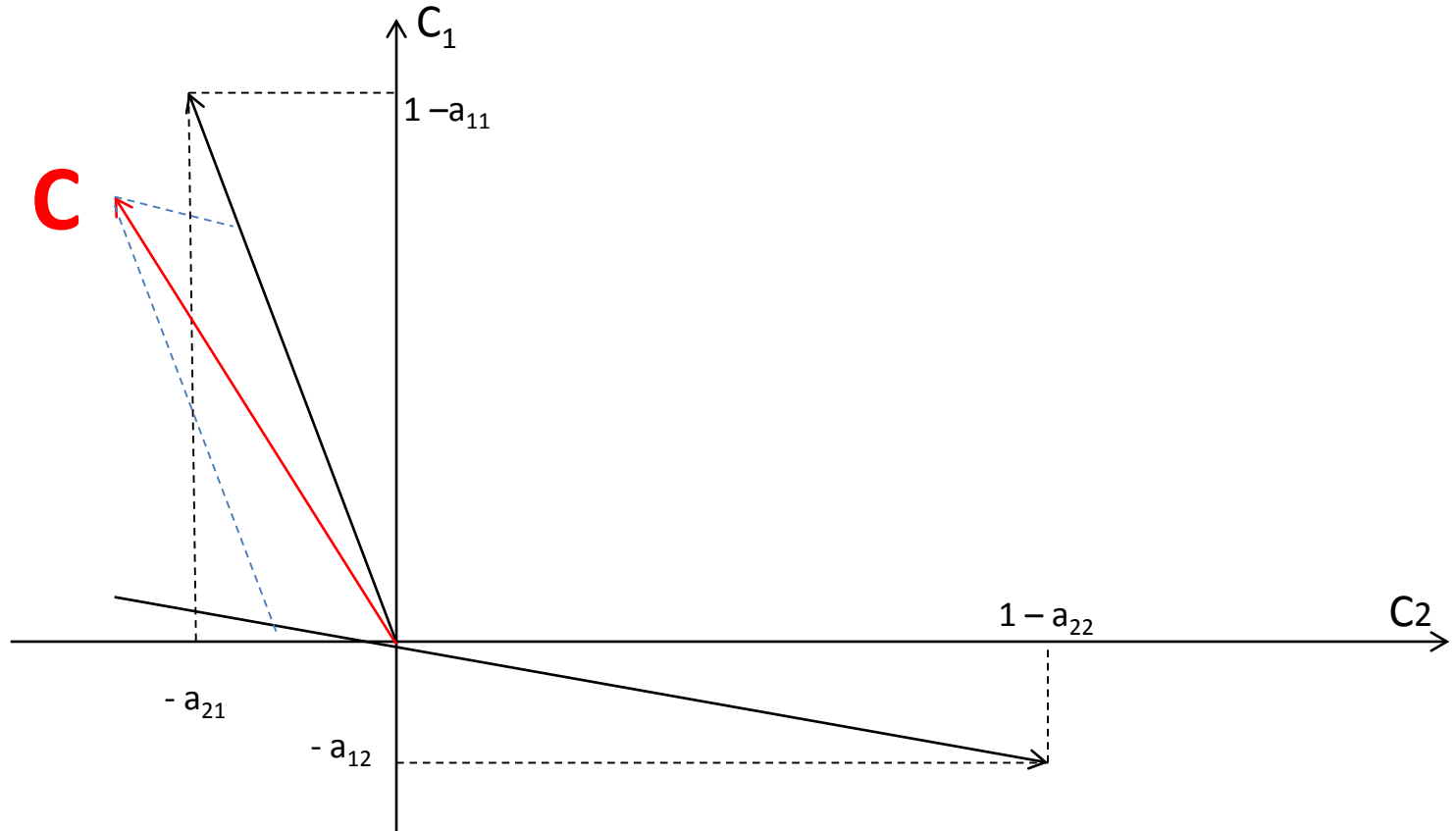
The representation of vector **C** when the Hawkins-Simon conditions are satisfied



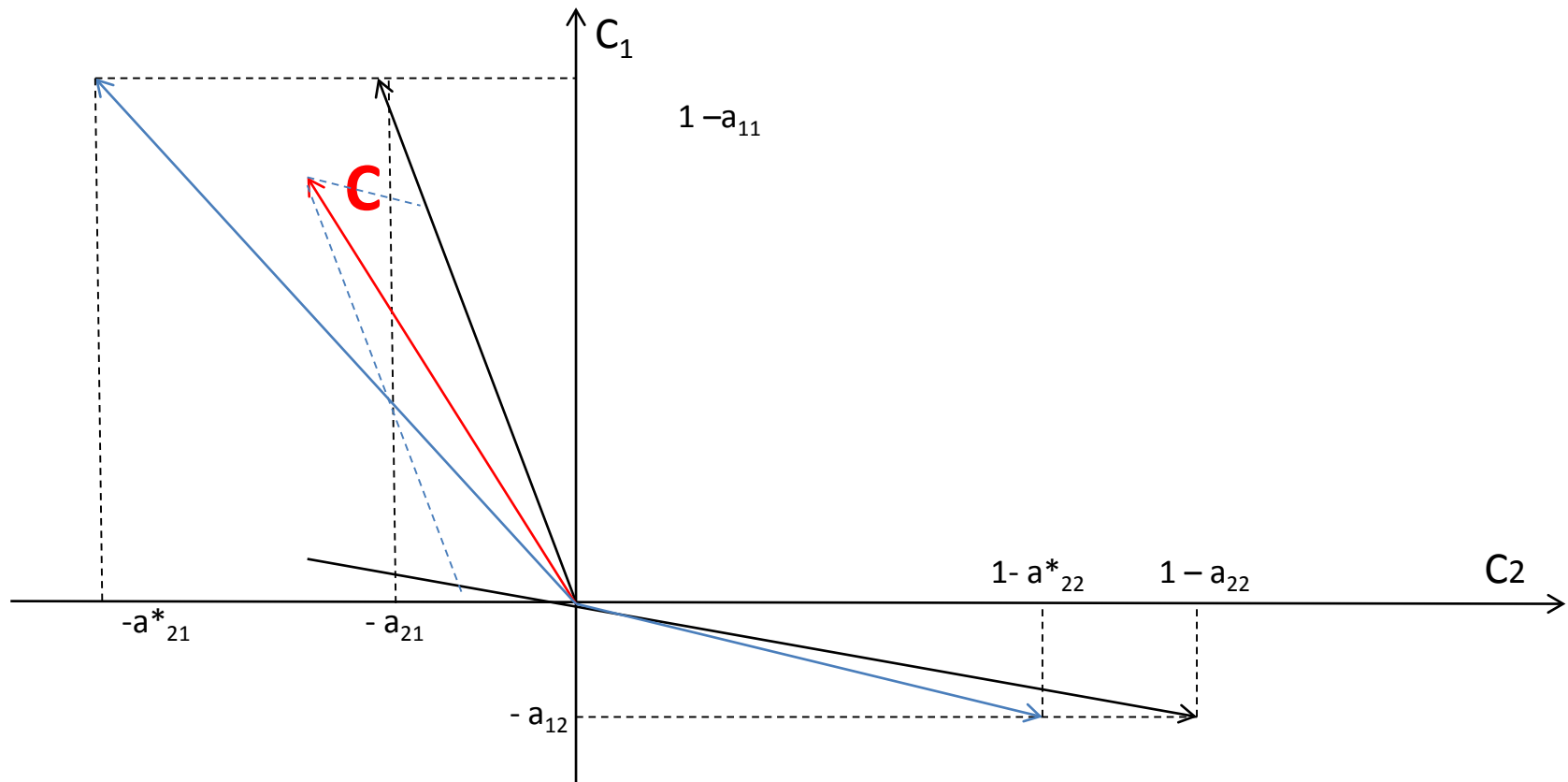
But even if vector **C** is not strictly positive
 q_i 's satisfying $Aq+f=q$ are still positive



Vector **C** is not strictly positive but now q_i 's satisfying $Aq+f=q$ are no longer positive



Changing the vector basis,
 q_i 's satisfying $Aq+f=q$ are positive again



Changing the vector basis

Changing the coordinates

$$a^*_{21} > a_{21} \text{ and } a^*_{22} > a_{22}$$

economically significant solutions are obtained

Changing the Base IO Table

	RESOURCES			USES				
	output	imports	total	Com 1	Com 2	Com 3	DFD	total
Com 1	61	25	86	18	16	18	34	86
Com 2	55	28	83	13	12	10	48	83
Com 3	32	8	40	10	8	7	15	40

The IO Table to be updated

Imports of Com 3 increase

	RESOURCES			USES				
	output	imports	total	Com 1	Com 2	Com 3	DFD	total
Com 1	61	25	86	18	16	18	34	86
Com 2	55	28	83	13	12	10	48	83
Com 3	32	25	57	10	8	7	15	40???

HOW TO TACKLE GROWING IMPORT
SHARES OVER TOTAL RESOURCES

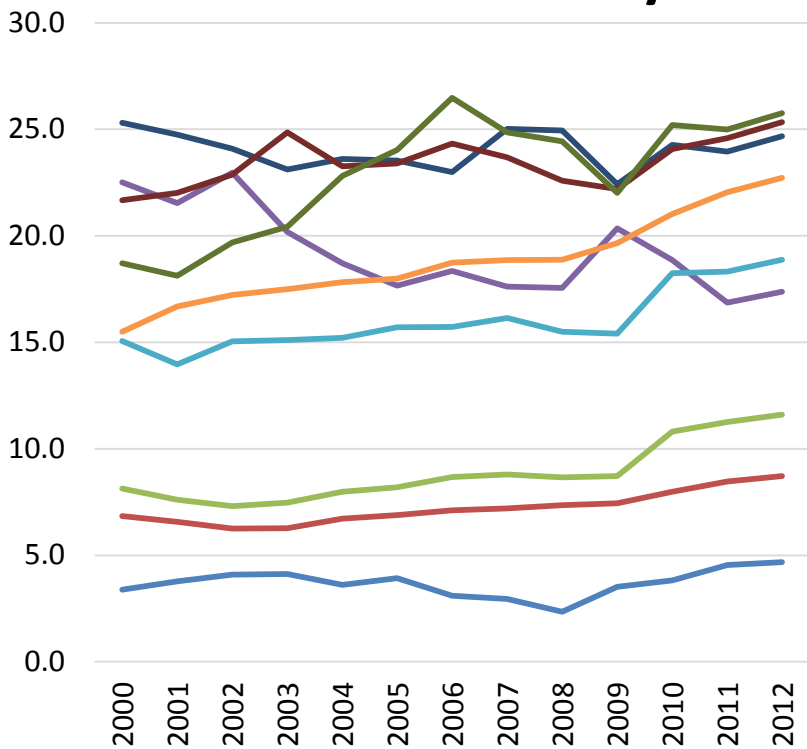
AN INSIGHT THROUGH INFORUM
COUNTRY MODELS

Continue... with numerical examples

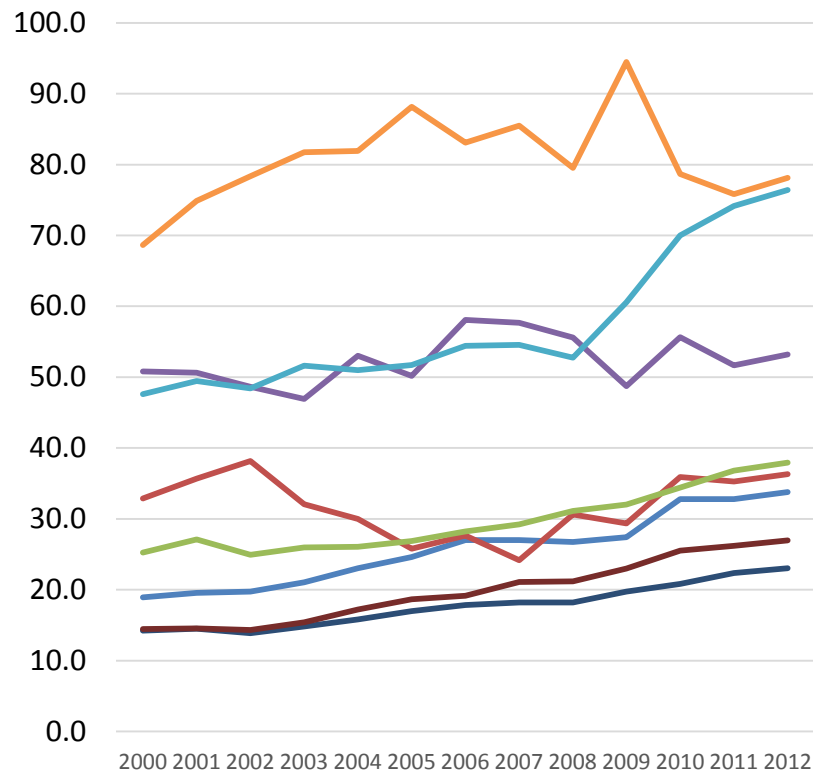
A GLANCE AT IMPORTS SUBSTITUTION IN THE
ITALIAN ECONOMY

ITALIAN ECONOMY IMPORTS-OUTPUT RATIOS

years 2000-2011



- ELECTR — FABR MET — NON-MET
- PETROLEUM — PAPER — FOOD
- MACHINERY — AGR — WOOD

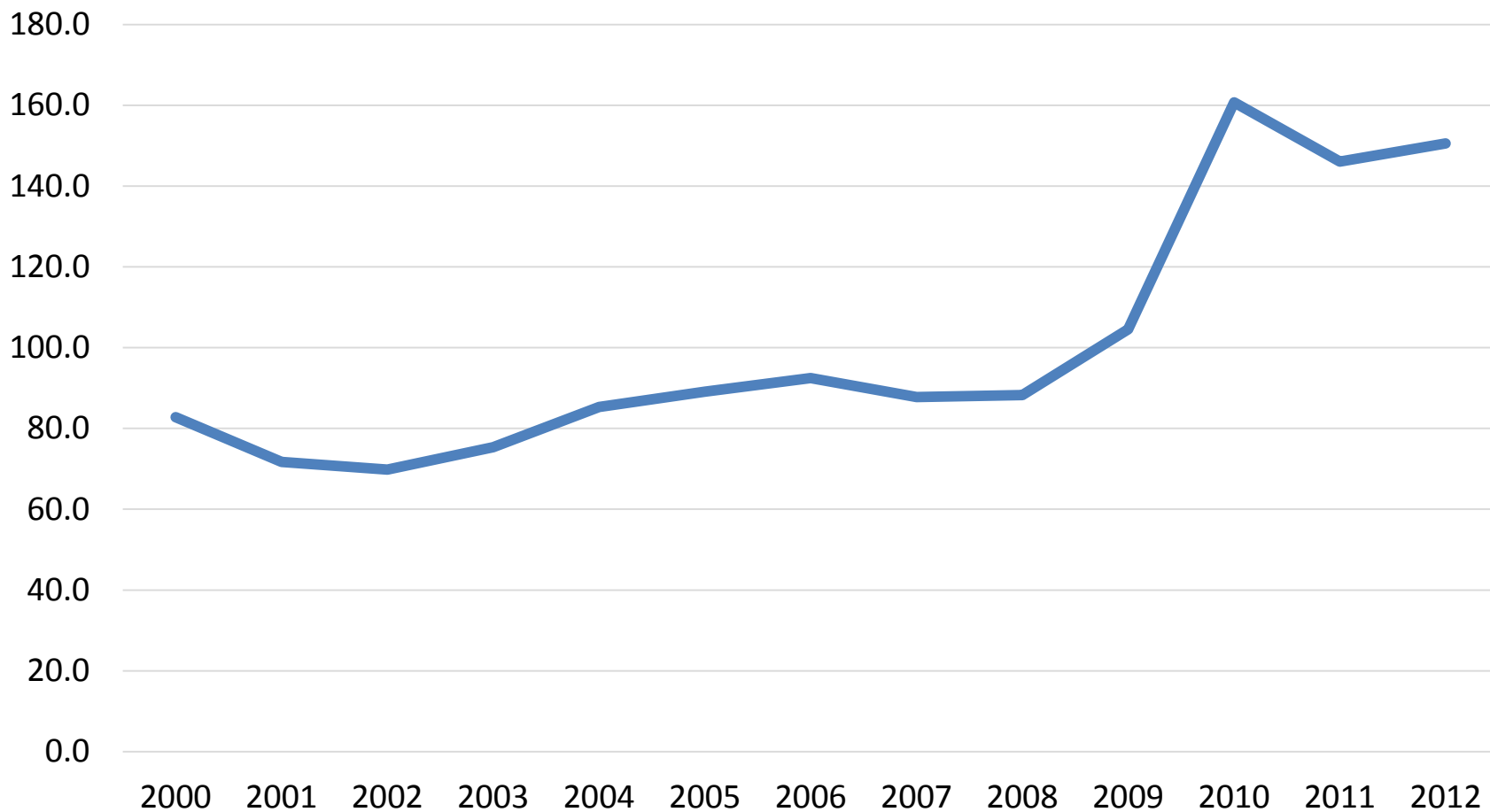


- TEXTILES — OTHER TRAN — EL. EQUIP
- BASIC MET — CHEM — VEHICLES
- RUBBER — FURNITURE

ITALIAN ECONOMY

COMPUTERS IMPORTS-OUTPUT RATIO

years 2000-2011



WARNING

WHEN IMPORTS DISPLAY A GENERAL POSITIVE
TREND, THE TECHNOLOGY OBSERVED IN THE
BASE YEAR (OR IN THE LAST AVAILABLE YEAR)
MAY NOT BE APPROPRIATE TO GENERATE
PLAUSIBLE FORECAST

*(AS SHOWN ABOVE BY MEANS OF GEOMETRICAL
REPRESENTATION)*

TACKLING THE PROBLEM RELYING UPON MAKESHIFTS

A way to tackle such a problem is to make import equations 'silent'.

The present release of the INFORUM French model offers an example of such makeshifts.

The new INFORUM French model

Two makeshifts for imports

```
if(t>=imp.LastDat) imp=ebemul(outc,imprat);
```

.

or

.

```
if(t>=imp.LastDat) {  
    provv=outc.sum();  
    Outsum.set(provv);  
    imp=ebemul(impfac,(Outsum-outc));  
}
```

Makeshifts compromise in the INFORUM Italian model

```
if(t>impshr.LastDat)impshrfunc(rimpshr, imptiml,rp);
```

```
if(t>=imp.LastDat) { importfunc(sc1cpa, impshr, outc);  
    provv=outc.sum();  
imp[4] =ratMinCav[t]*(provv-outc[4]);  
imp[6] =ratAbbi[t]*(provv-outc[6]);  
imp[11]=ratChimici[t]*(provv-outc[11]);  
imp[12]=ratFarma[t]*(provv-outc[12]);  
imp[15]=ratMetalli[t]*(provv-outc[15]);  
imp[17]=ratInforma[t]*(provv-outc[17]);  
imp[20]=ratAuto[t]*(provv-outc[20]);  
imp[33]=ratTAereo[t]*(provv-outc[33]);  
imp[3]=ratPesce[t]*(provv-outc[3]);  
imp[31]=ratTerra[t]*(provv-outc[31]);  
}
```

The compromise

- imports of the sector responsible for generating negative outputs may be linked to the Total output of the economy
- in such cases sectoral imports are computed as share of the economy total output
- This makeshift is useful if applied to a short number of sectors and preferably those where the researcher's interest is minor.

How to avoid makeshifts

A model builder' proposal

Seidel2 implementation

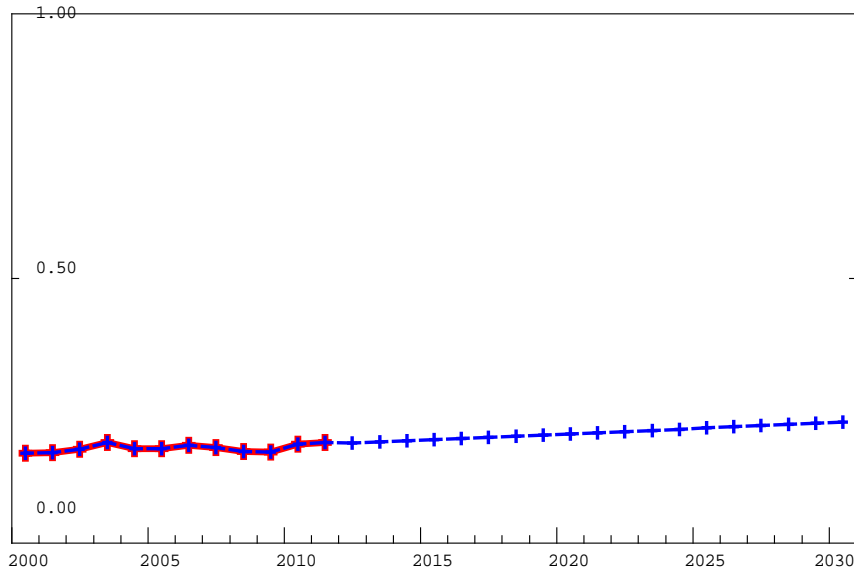
```
sum = f[i];
for(j = first; j <= last; j++) sum += A[i][j]*q[j];
sumNet = sum - f[i];
sum -= A[i][i]*q[i]; // Take off the diagonal element of sum
sum = sum/(1.- A[i][i]);
//     if (i == 31 && iter == 0) {
//         if (sum < 0.0) {
//             ratio =(q[i]-f[i])/sumNet;
//             for(j = first; j <= last; j++) A[i][j] *=ratio;
//             sum = q[i];
//         }
//     }
```


Three Scenarios

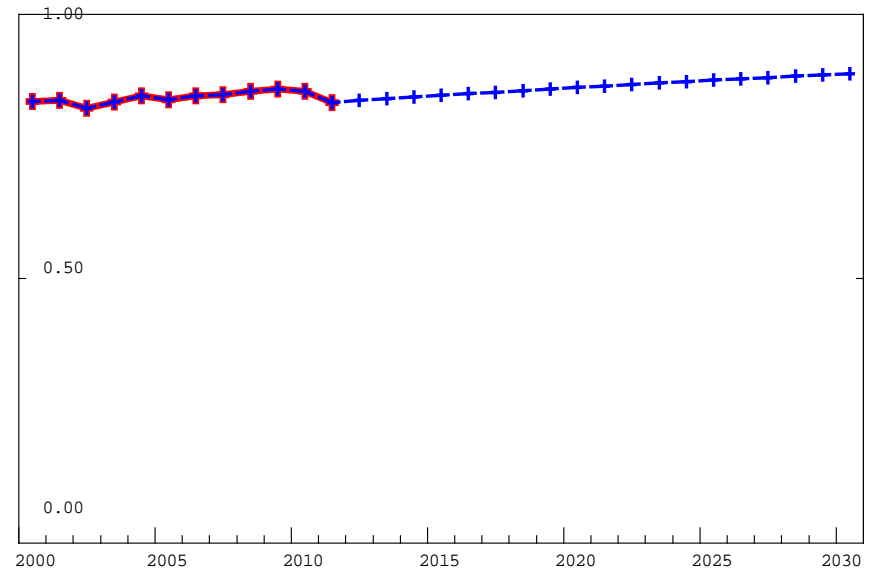
- Scenario A – Land transport services imports are modelled as a ratio of the economy Total output.
- Scenario B - Total resources import shares equations are used to compute sectoral imports.
- Scenario C - Land transport services intermediate consumptions (technical coefficients) are adjusted just when its output becomes negative.

Import shares observed and forecasted in Scenarios B and C

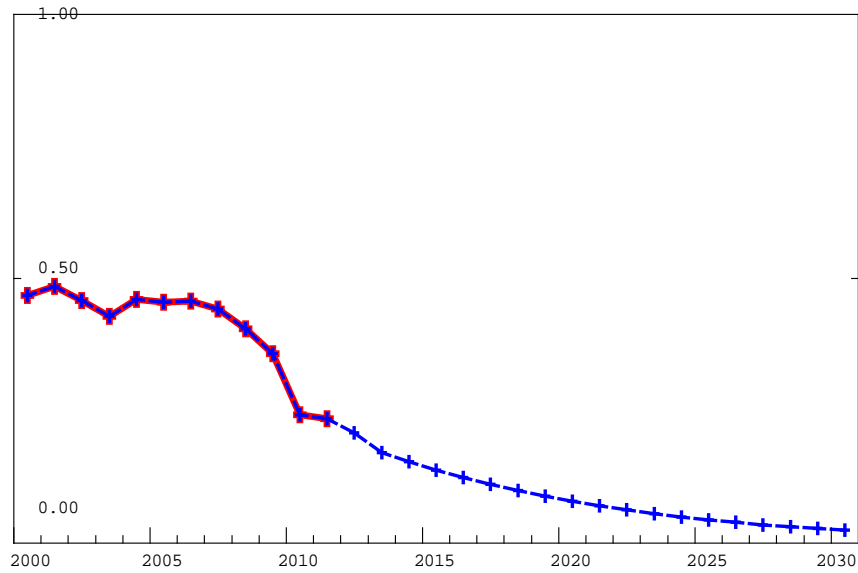
Products of agriculture
import shares observed and forecasted



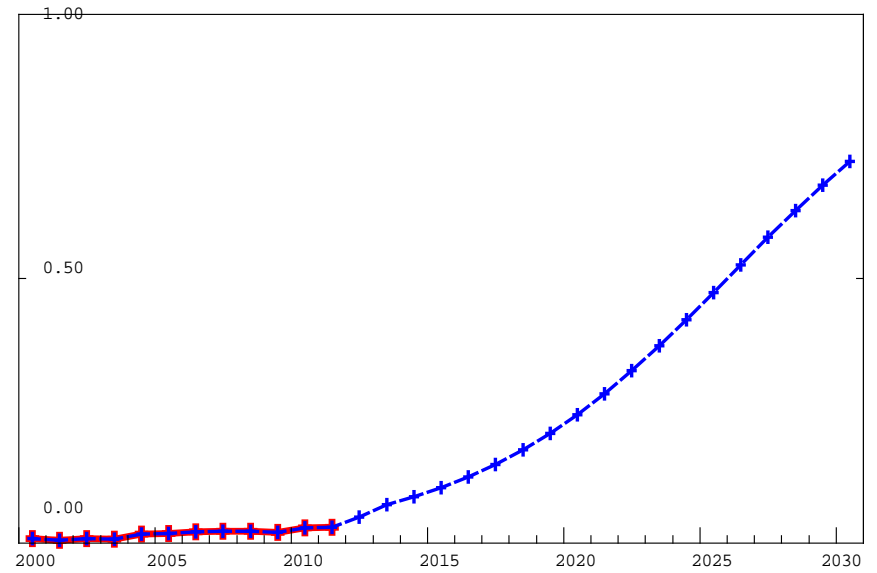
Mining and quarrying
import shares observed and forecasted



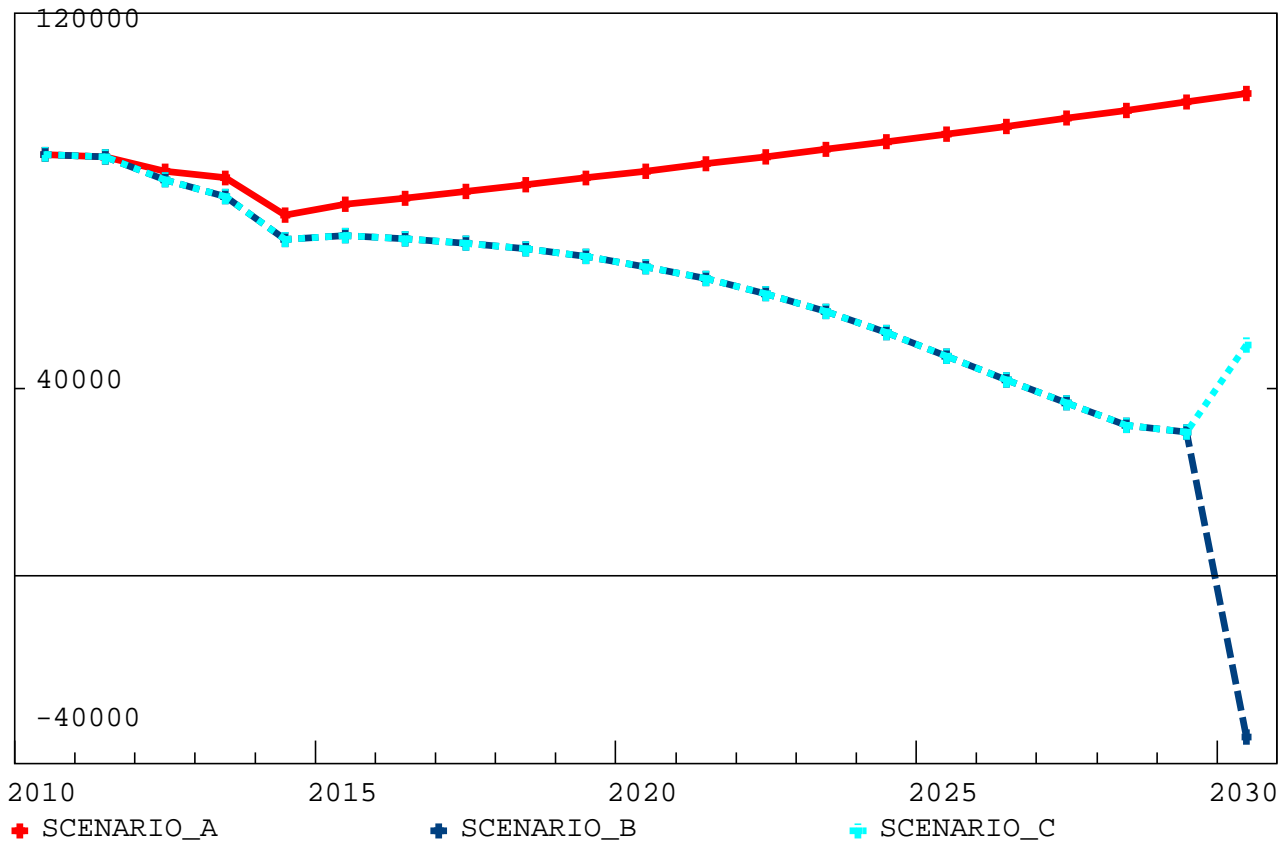
Products of forestry
import shares observed and forecasted



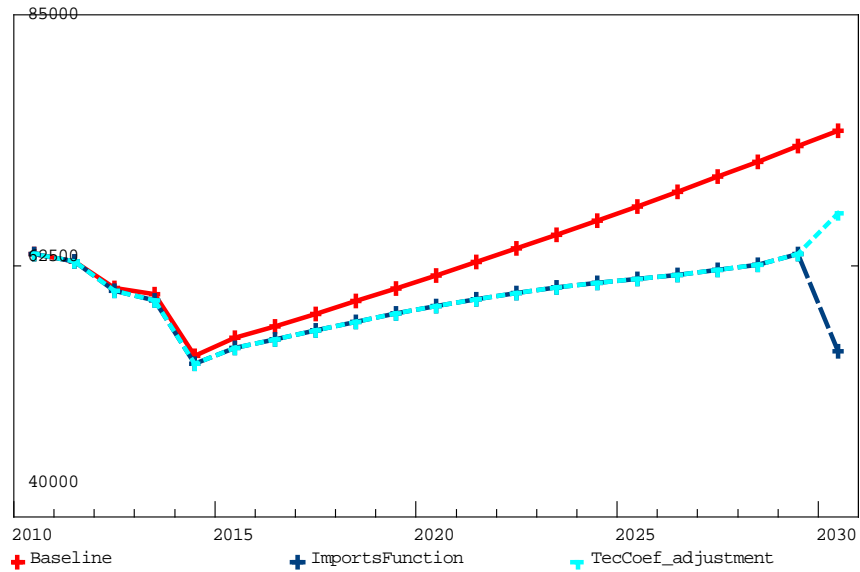
Land transport services
import shares observed and forecasted



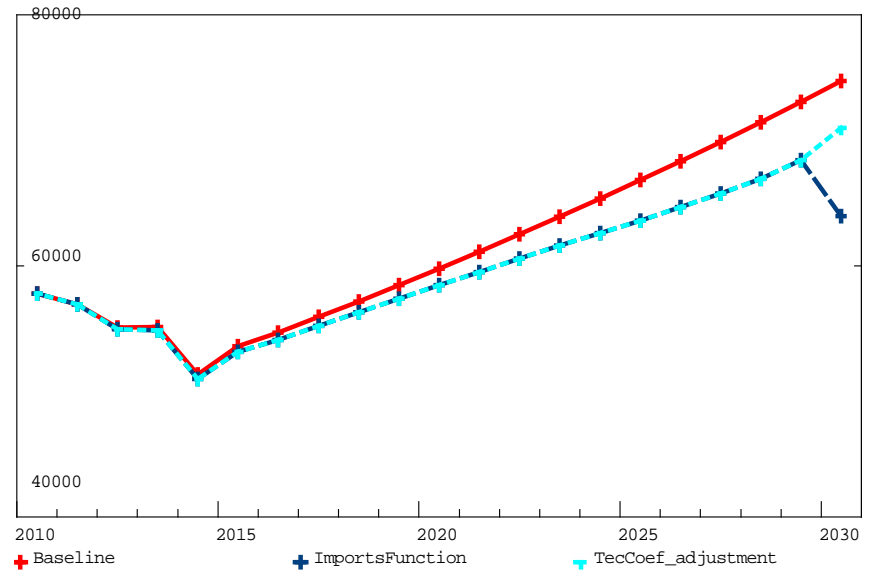
Land transport services output



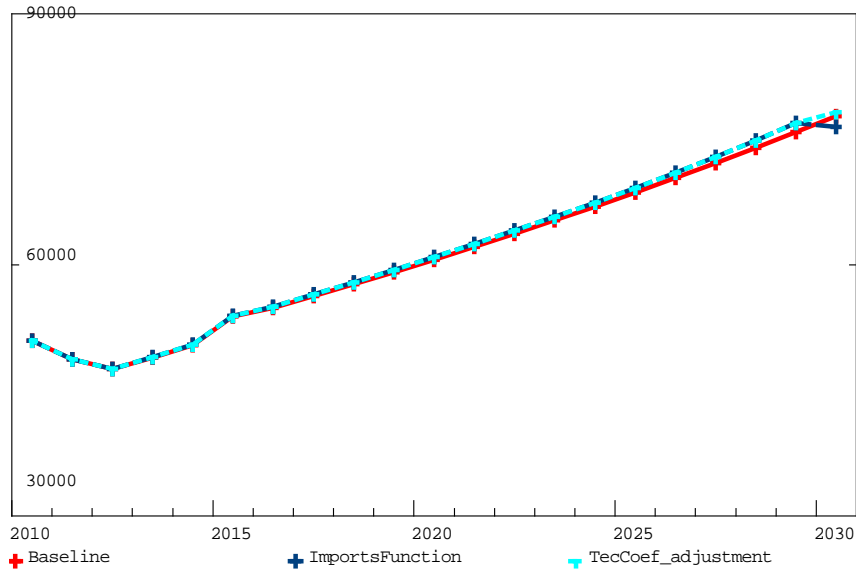
Support services for transportation output



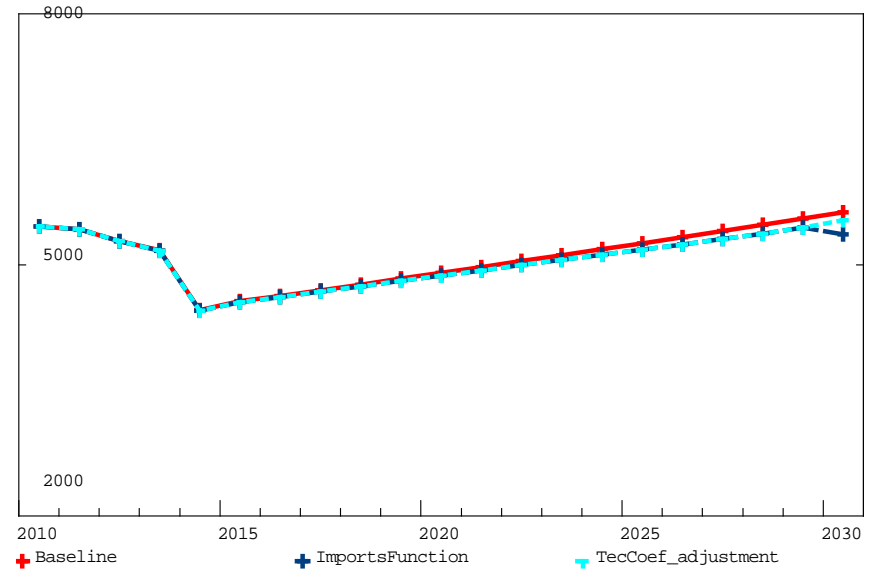
Coke and refined petroleum products output



Chemicals and chemical products output



Postal and courier services output



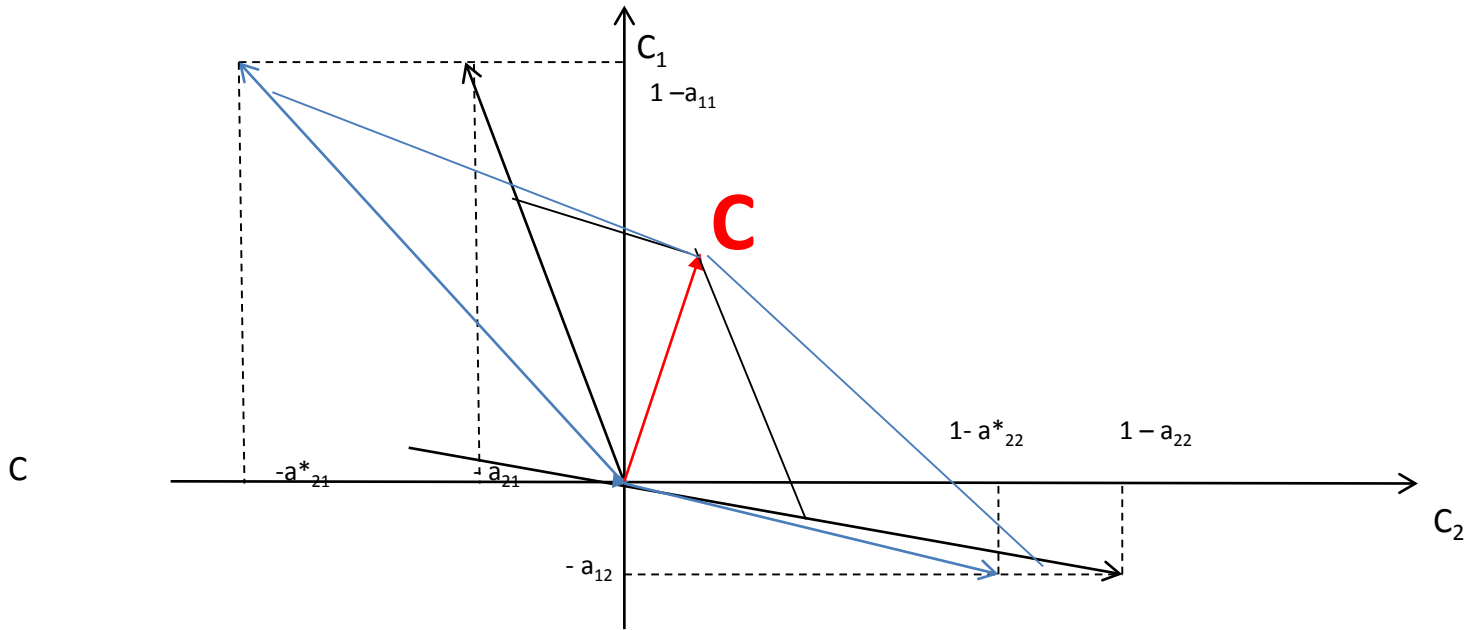
A Scenario number 4

An experiment Adjusting the A matrix
every year

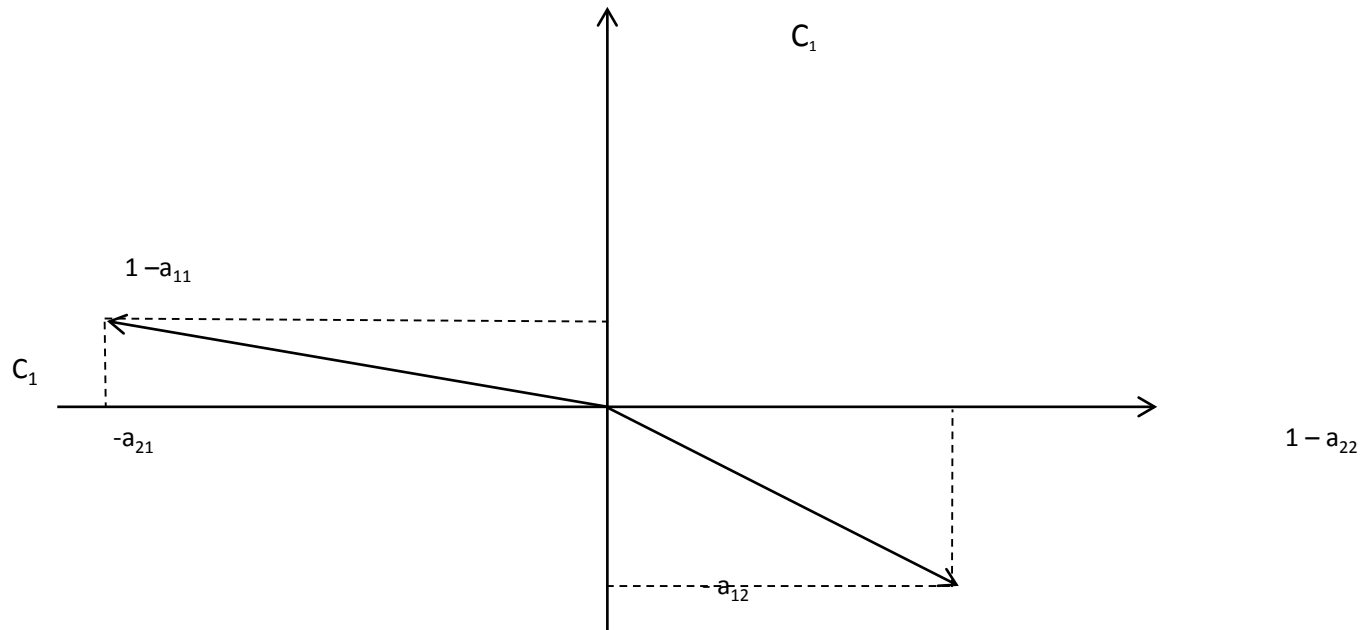
Seidel2 implementation

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//             ratio =(q[i]-f[i])/sumNet;
//             for(j = first; j <= last; j++) A[i][j] *=ratio;
//             sum = q[i];
//         }
//     }
```


Impact of the Vector bases on output

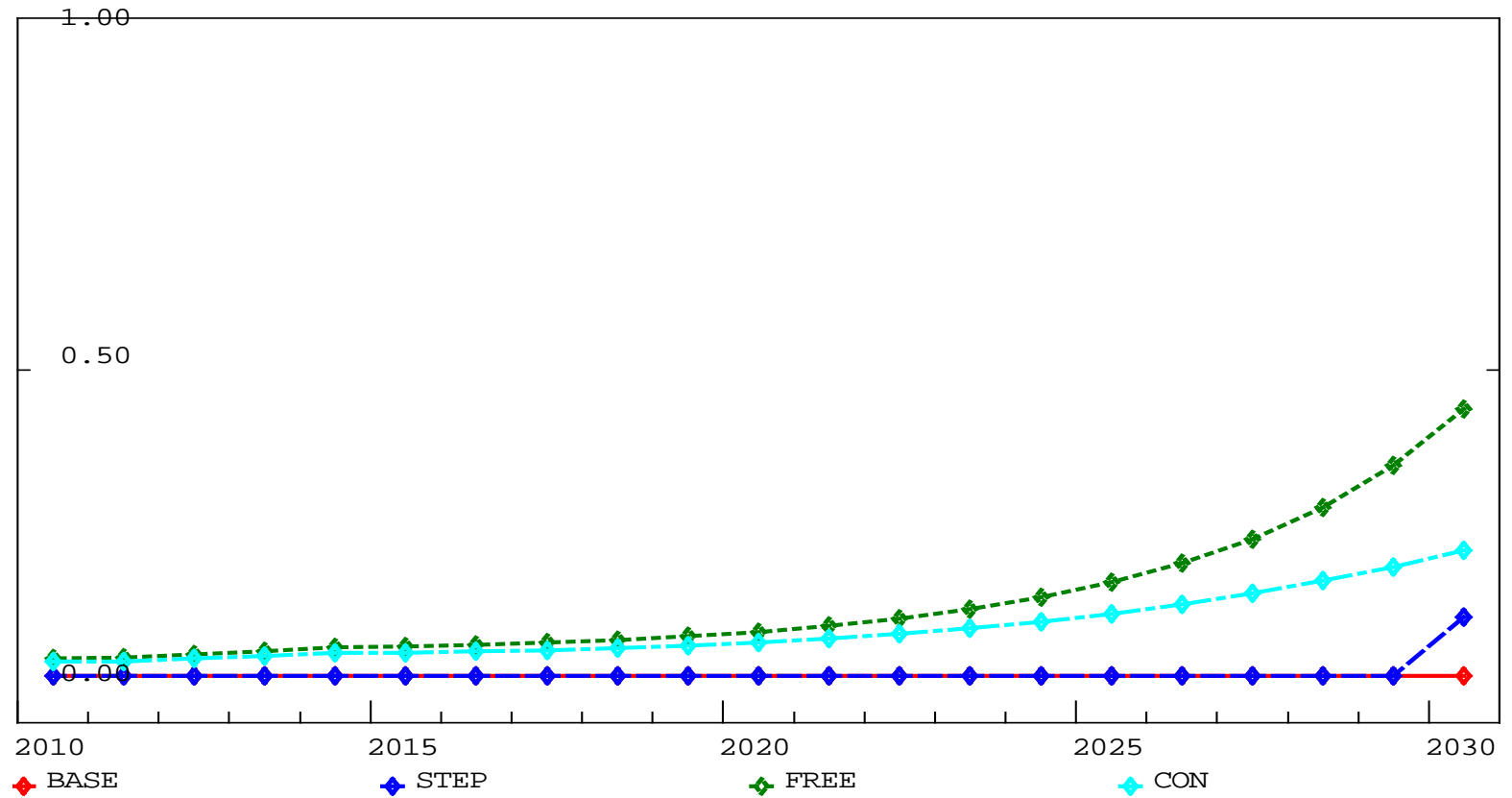


When a vector basis
cannot produce positive outputs



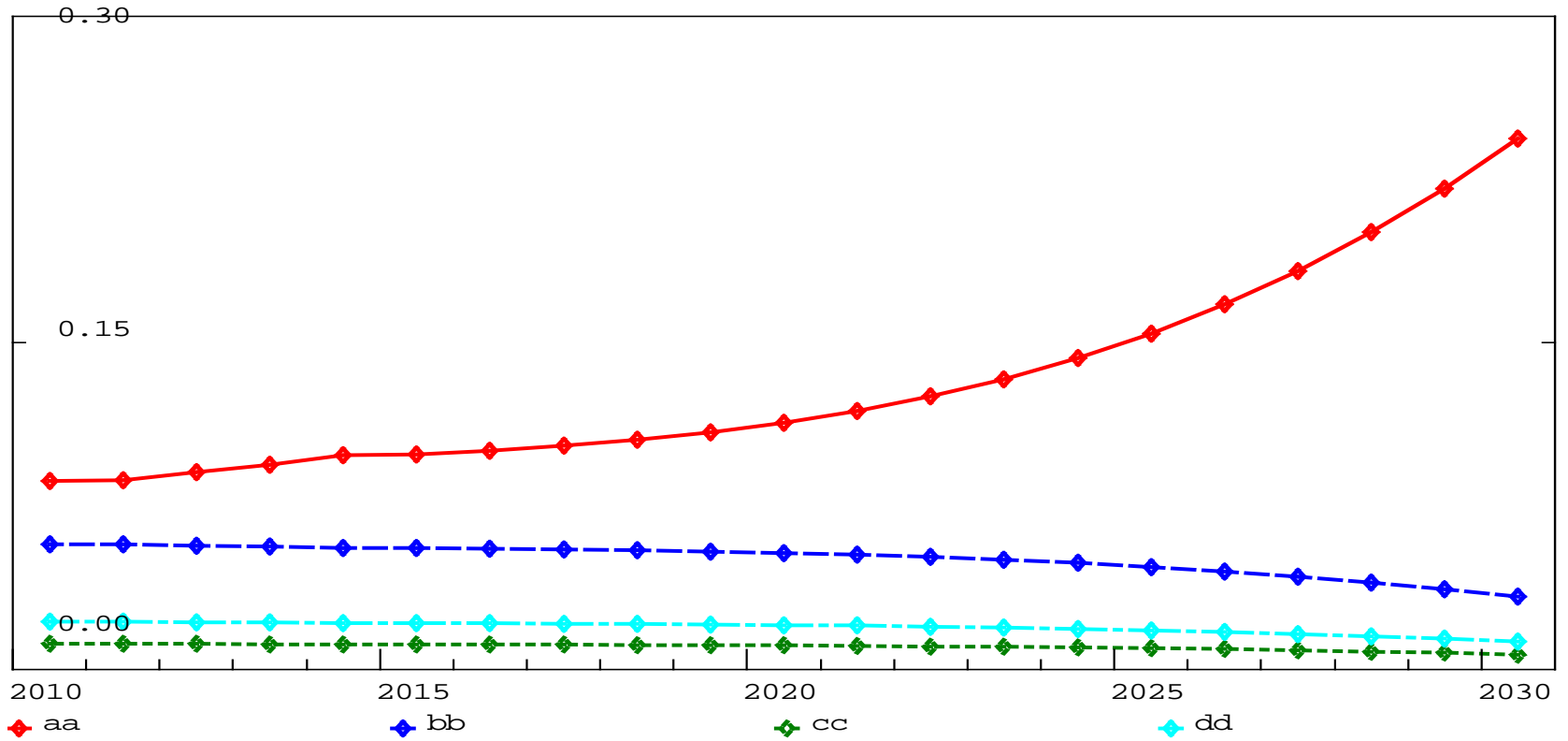
Technical coefficient A31.31

Land transport services



Some Technical coefficients

Land transport services



Continue.....