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 ≠ m^

m comes from behavioral equations so that it must prevails on m^

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 ad lower for great shares <u>under the constraint $mm_{ij} <= 1$</u>

When this algorithm is unsuitable

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

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"

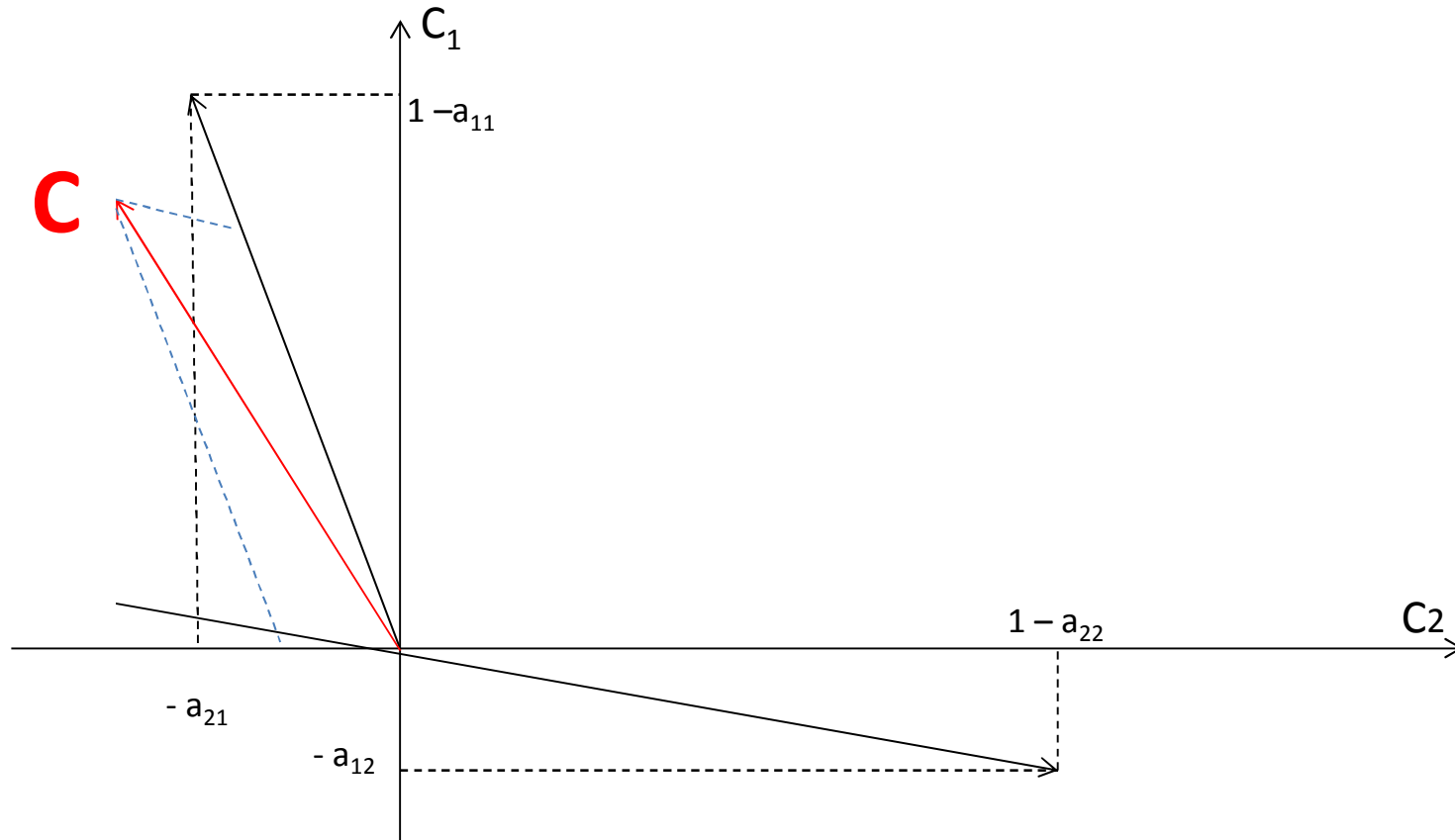# The geometrical analogue of the Leontief equation: the vector basis
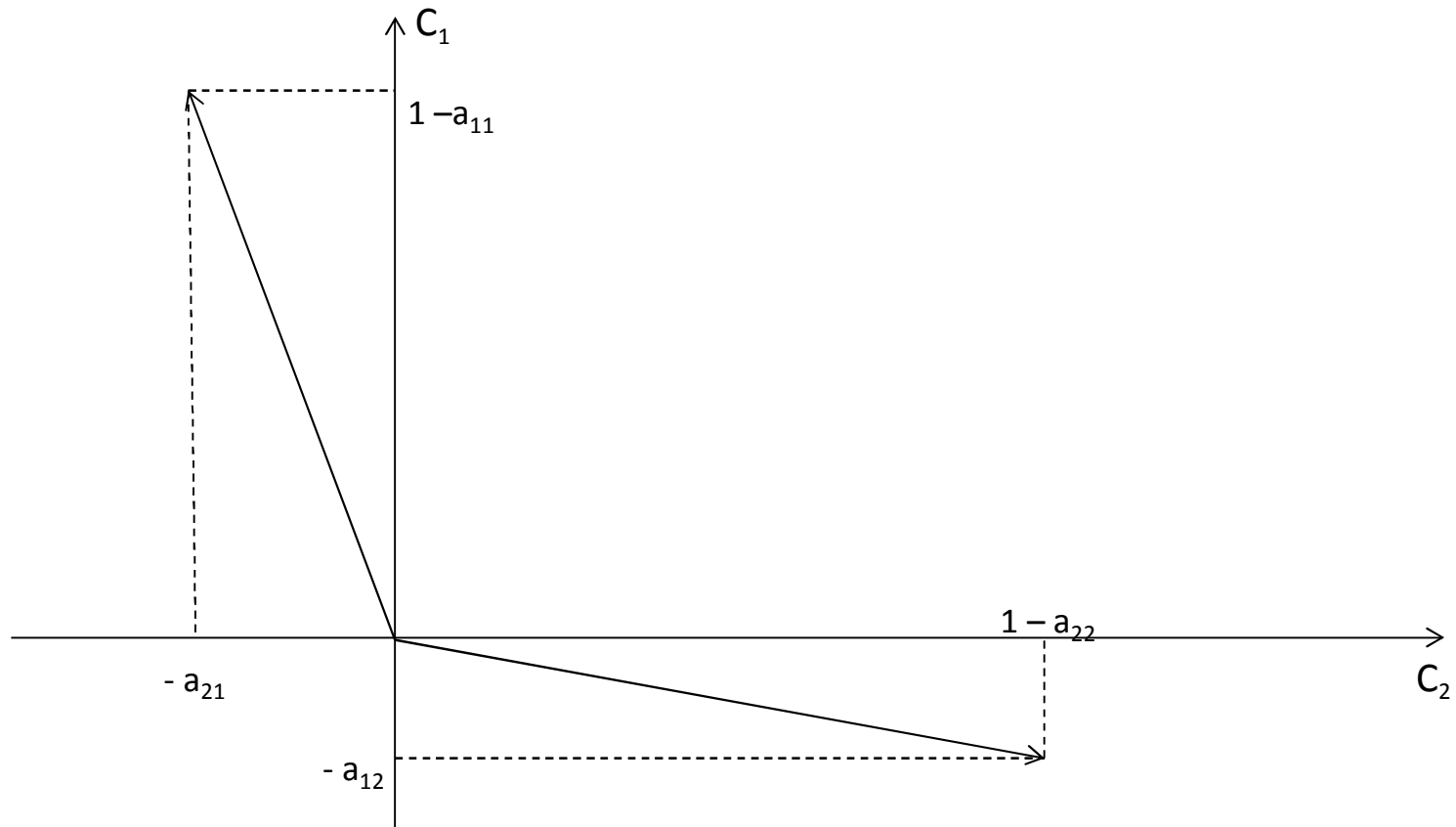
The representation of vector C
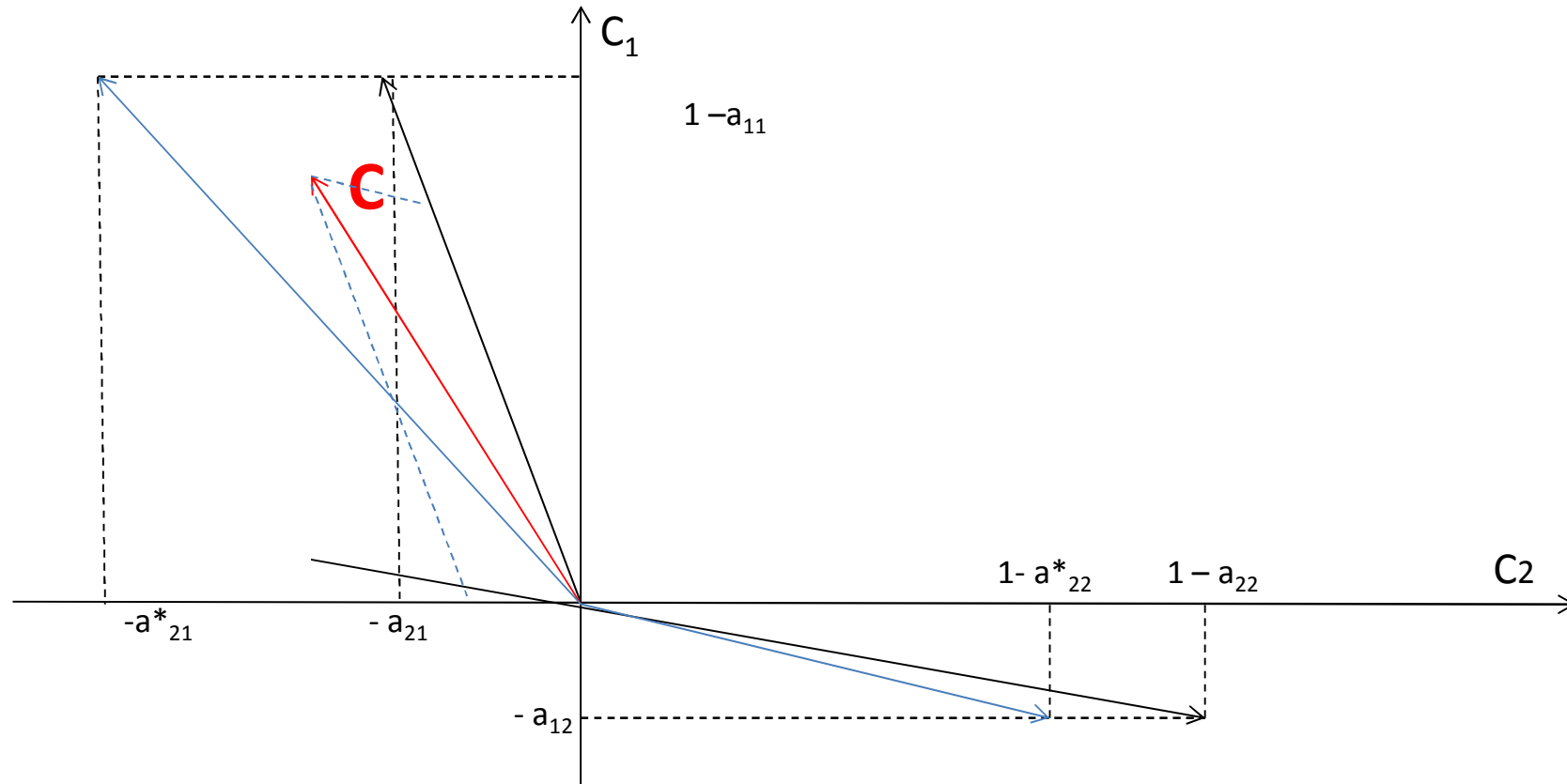# when the Hawkins-Simon conditions are satisfied
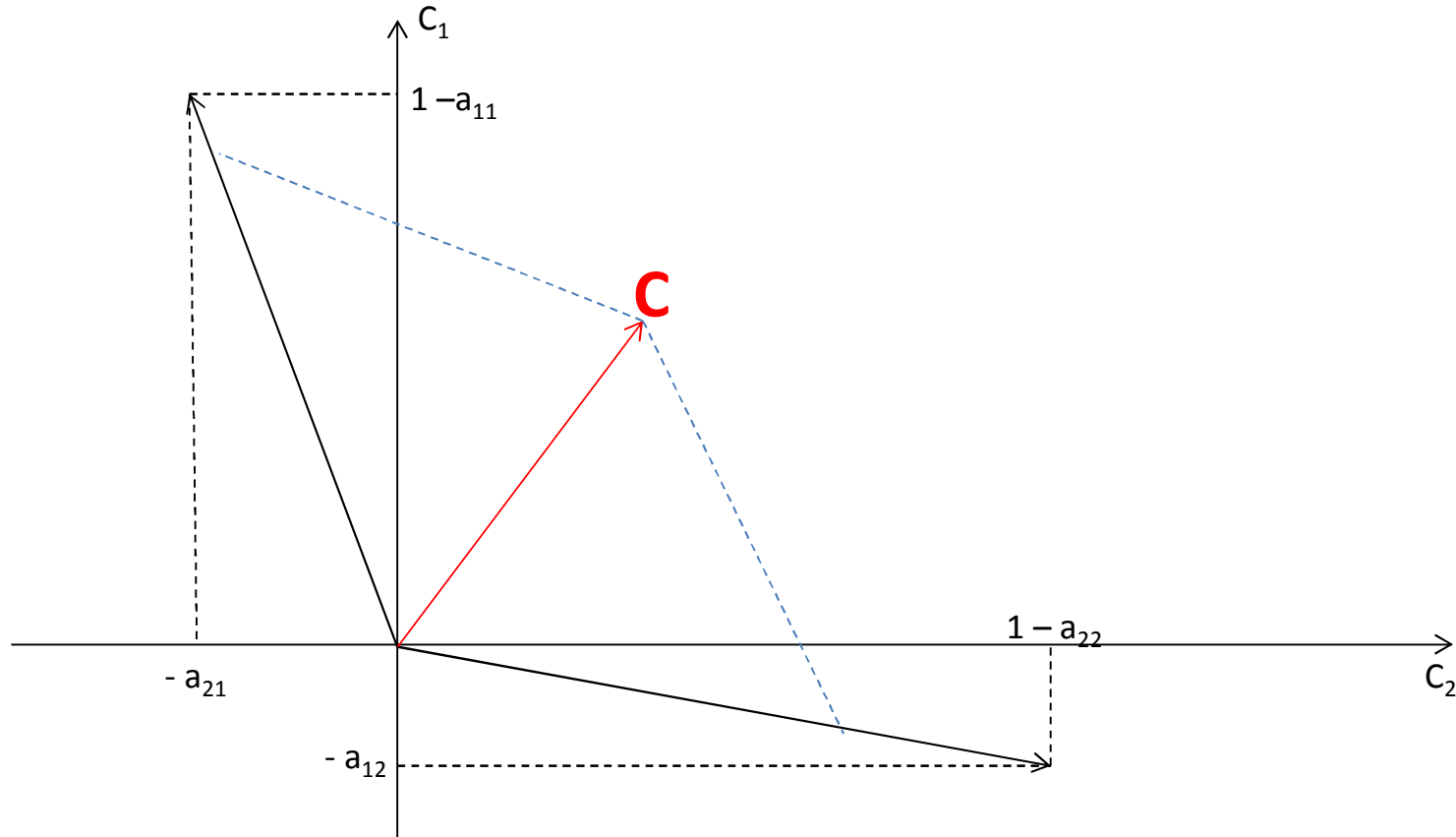
But even if vector C is not strictly positive q_i's satisfying $Aq+f=q$ are still positive
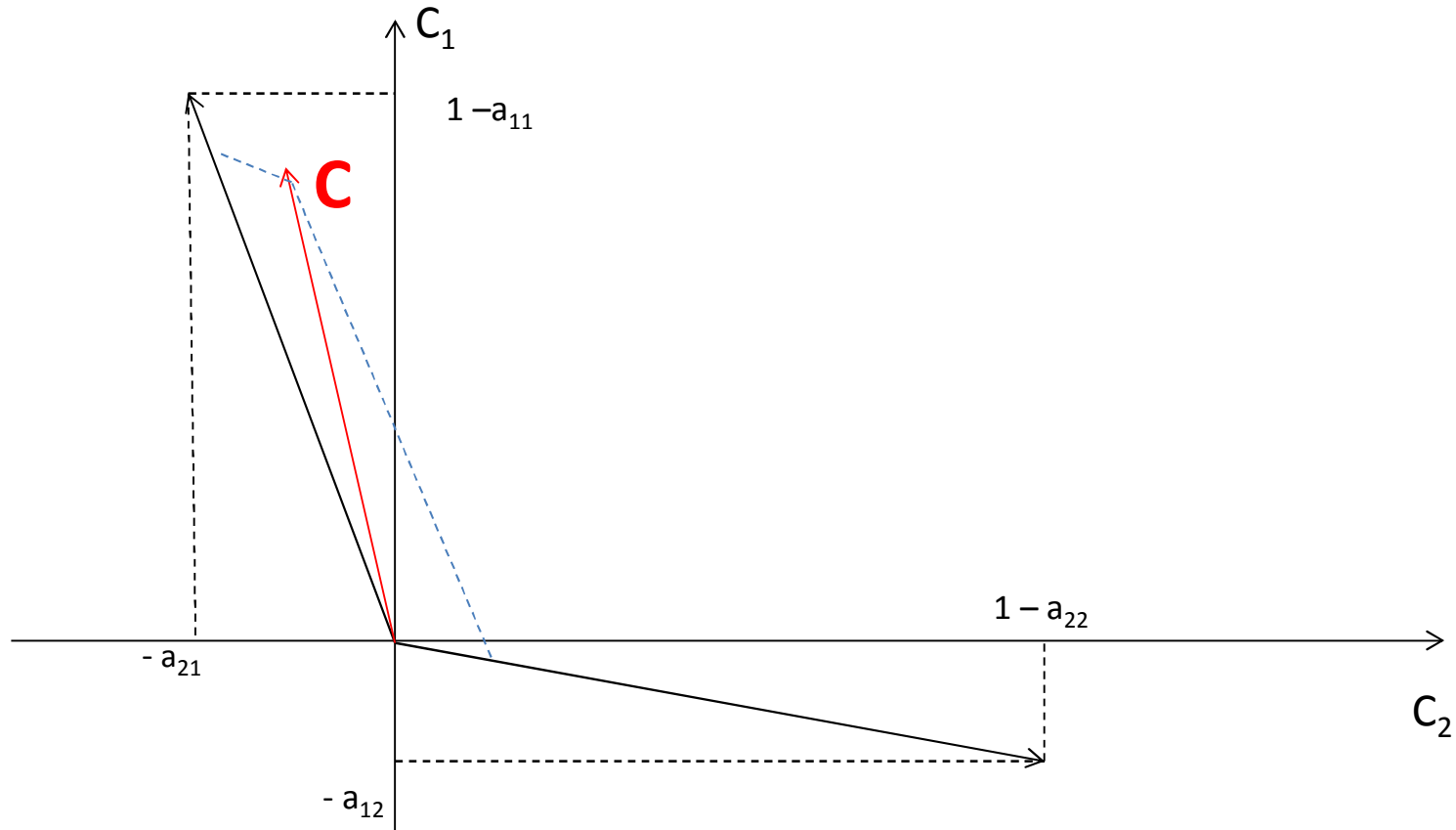
Vector C is not strictly positive but now q_i's satisfying $Aq+f=q$ are no longer positive

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

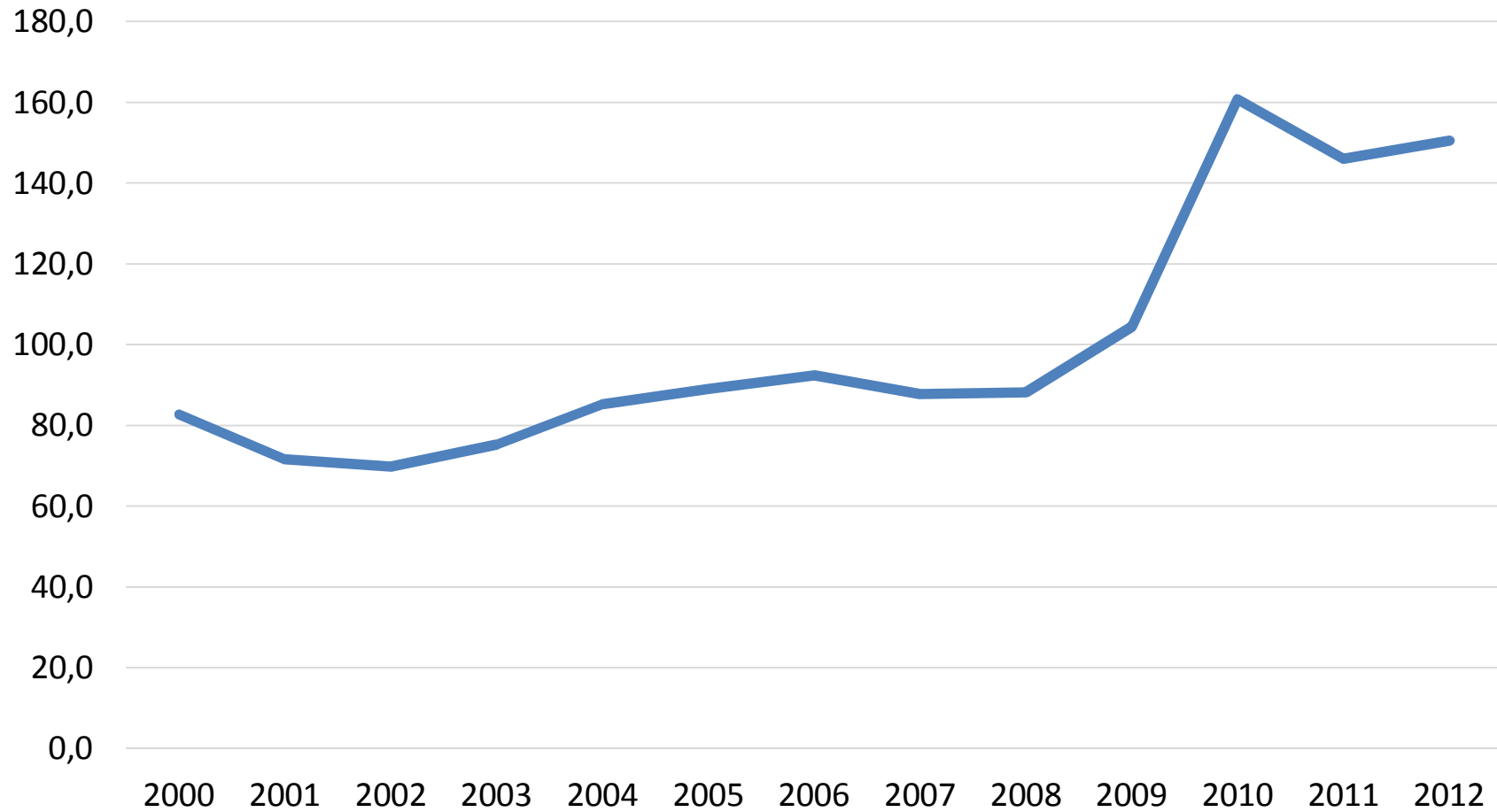# ITALIAN ECONOMY
IMPORTS-OUTPUT RATIOS
years 2000-2011
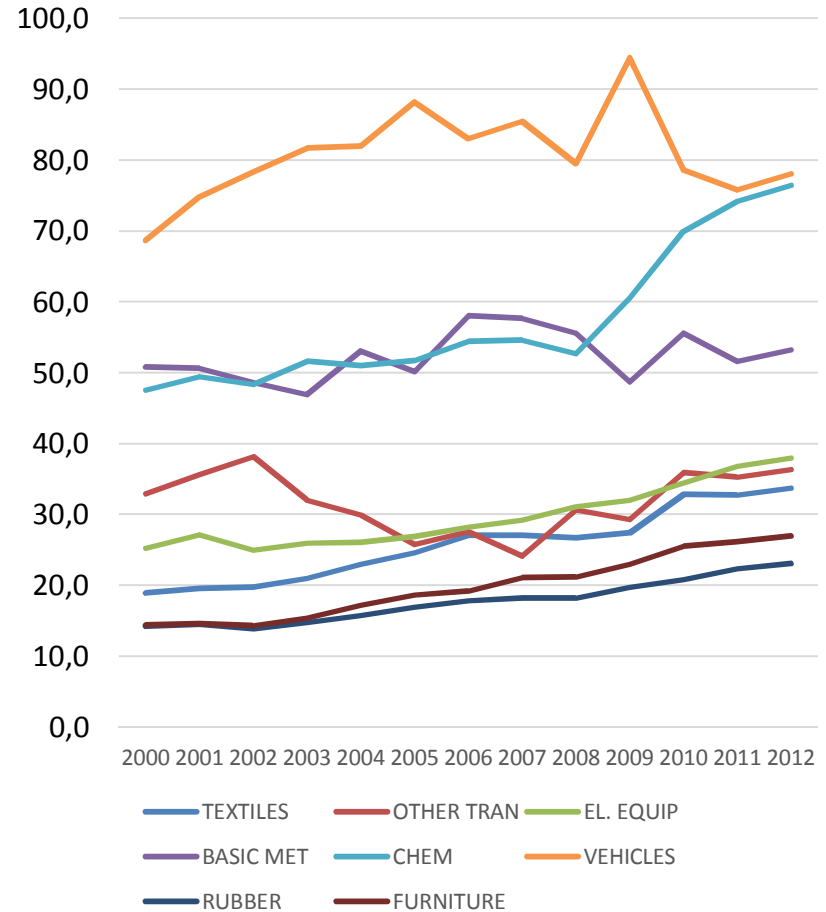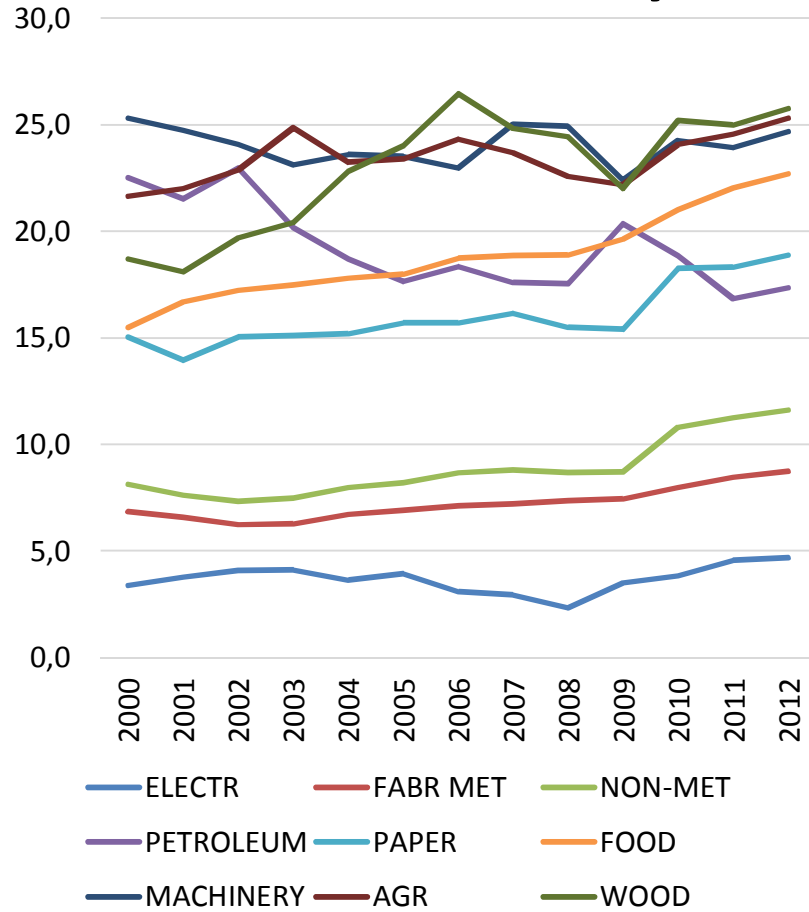
ITALIAN ECONOMY
COMPUTERS IMPORTS-OUTPUT RATIO
years 2000-2011

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
RELYNG 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(rimpsh, 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
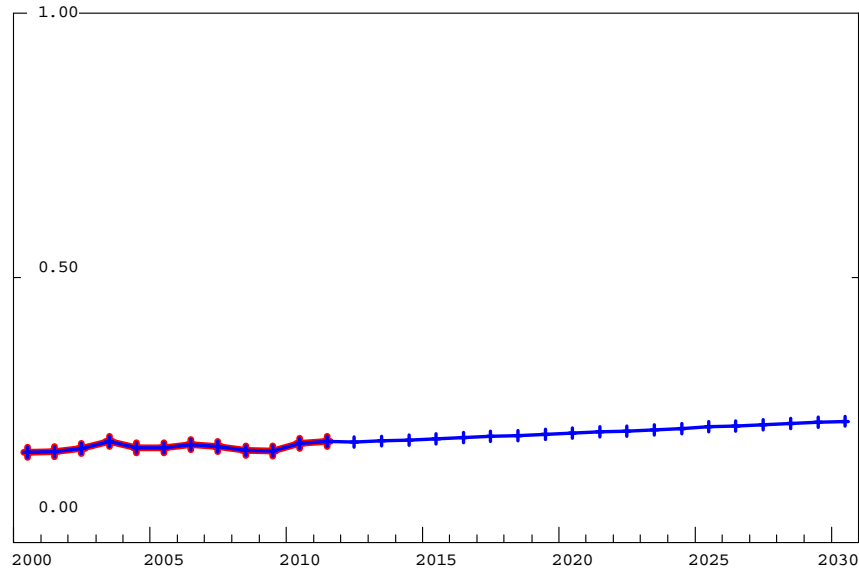
A model builder' proposal

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 <u>ratio of the economy Total output</u>.

- **Scenario B** - Total <u>resources import shares equations</u> are used to compute sectoral imports.

- **Scenario C** - Land transport services intermediate consumptions (<u>technical coefficients</u>) are <u>adjusted</u> just when its output becomes negative.
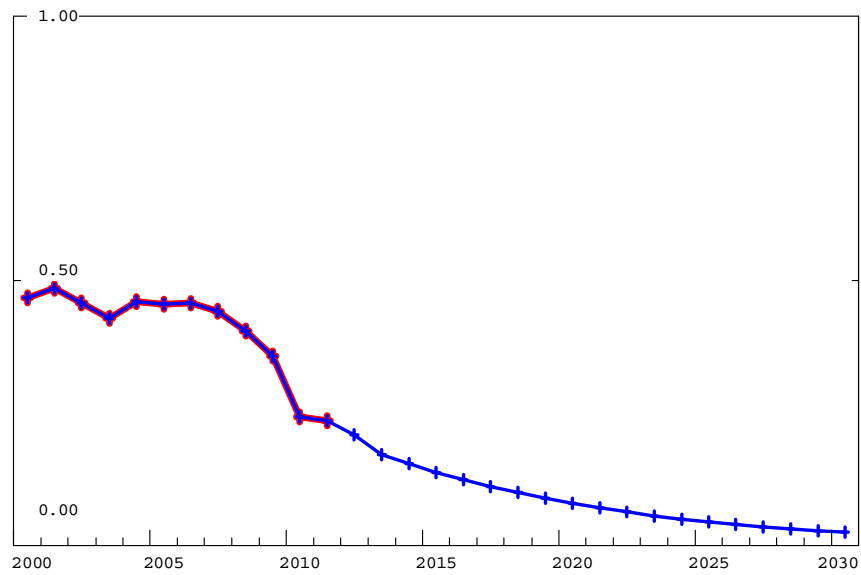
Import shares observed and forecasted in Scenarios B and C

Products of agriculture
import shares observed and forecasted

Mining and quarrying
import shares observed and forecasted
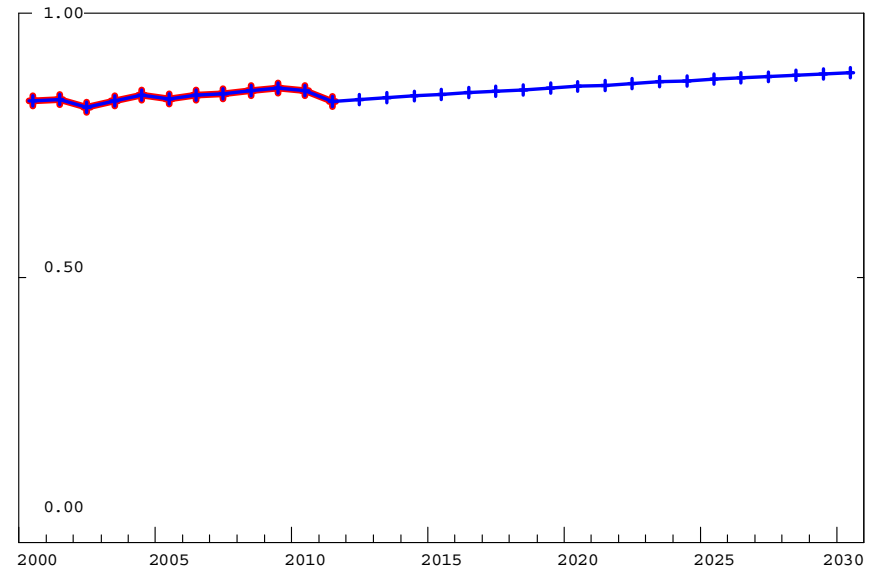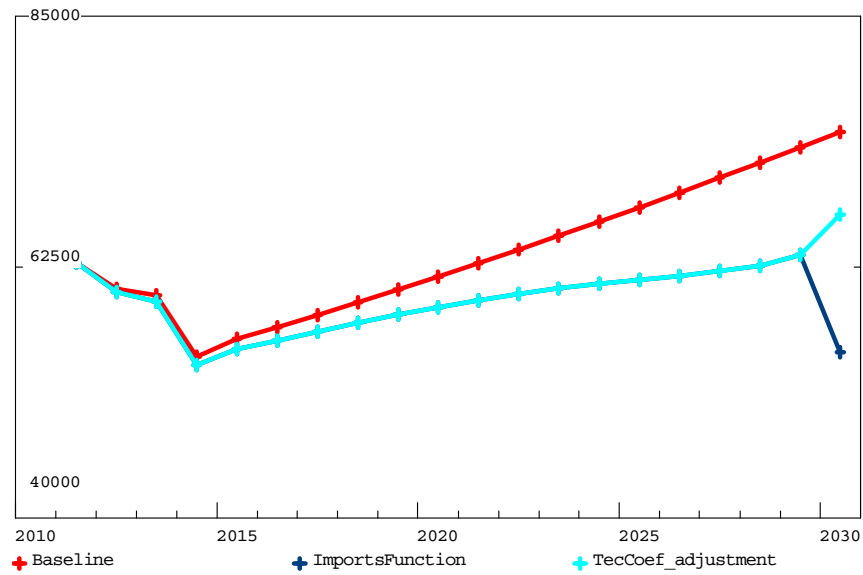
Products of forestry
import shares observed and forecasted

Land transport services
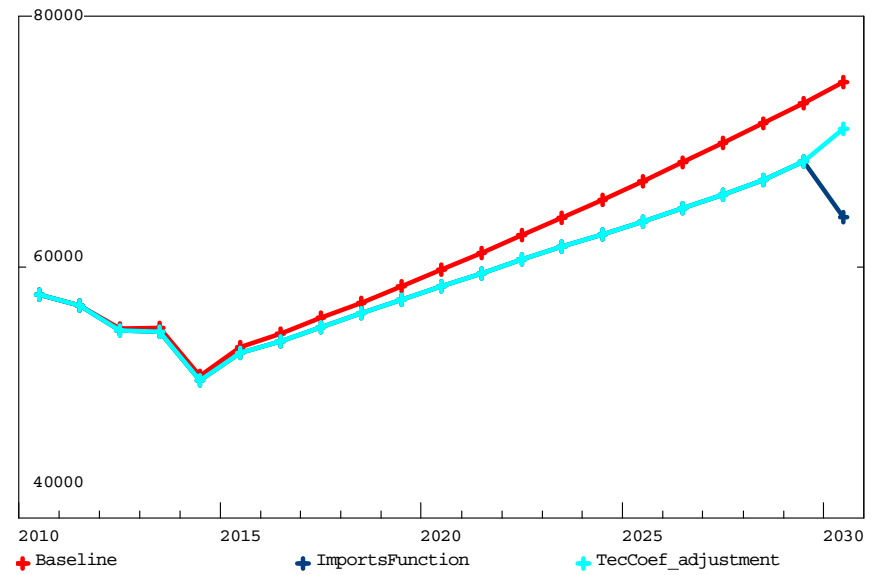### import shares observed and forecasted
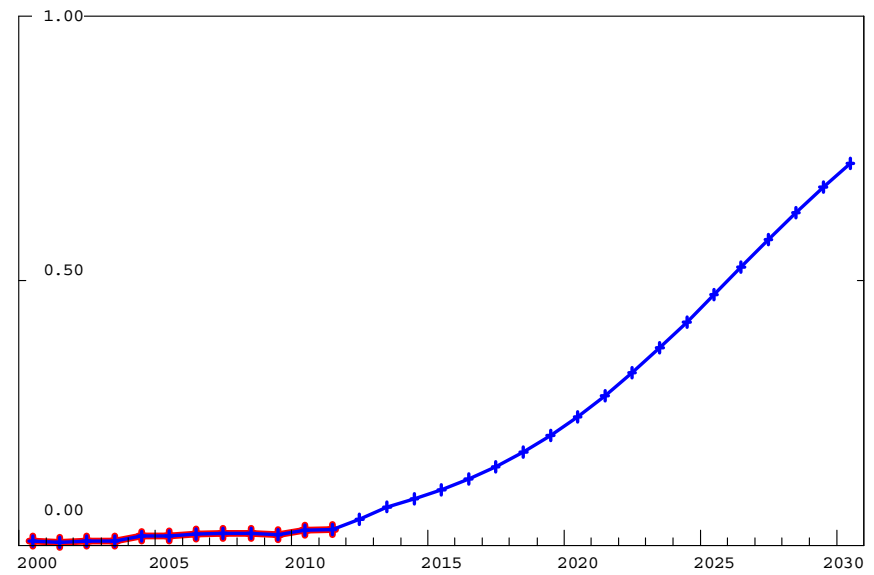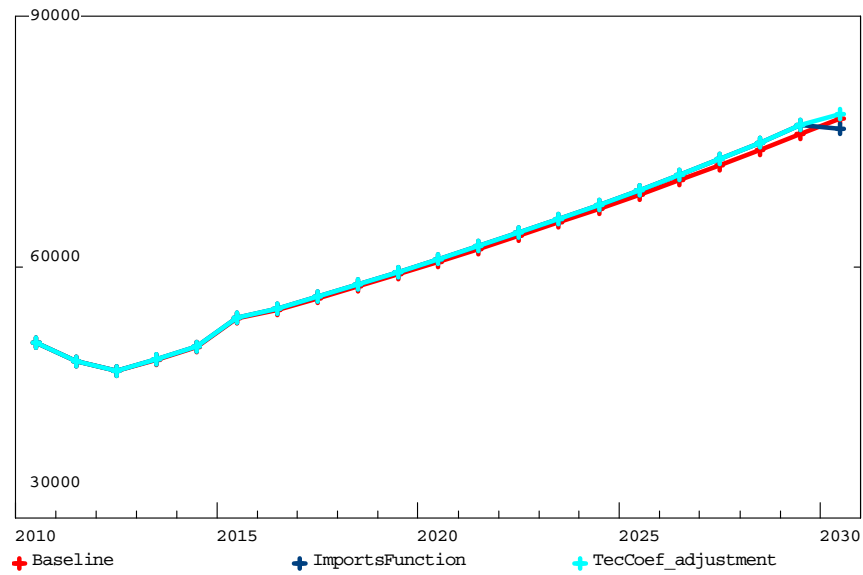
Land transport services
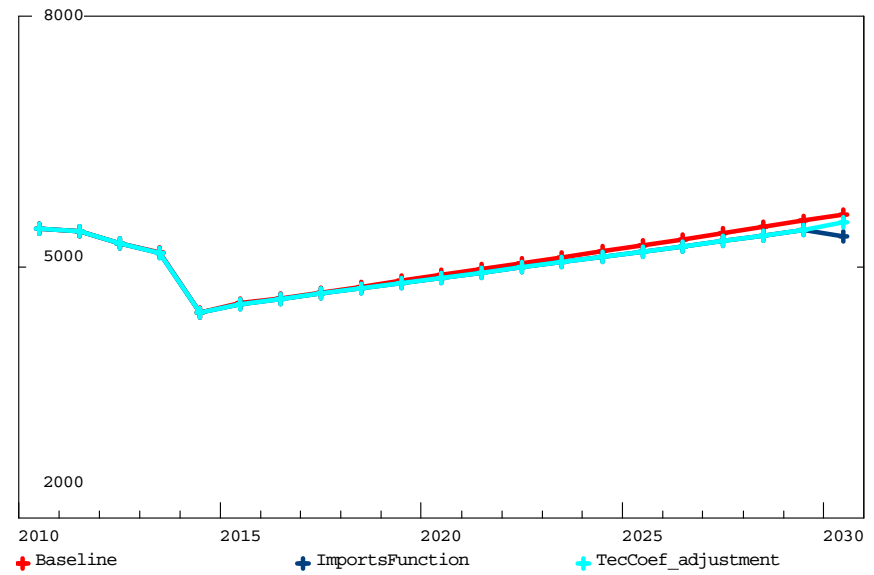
output
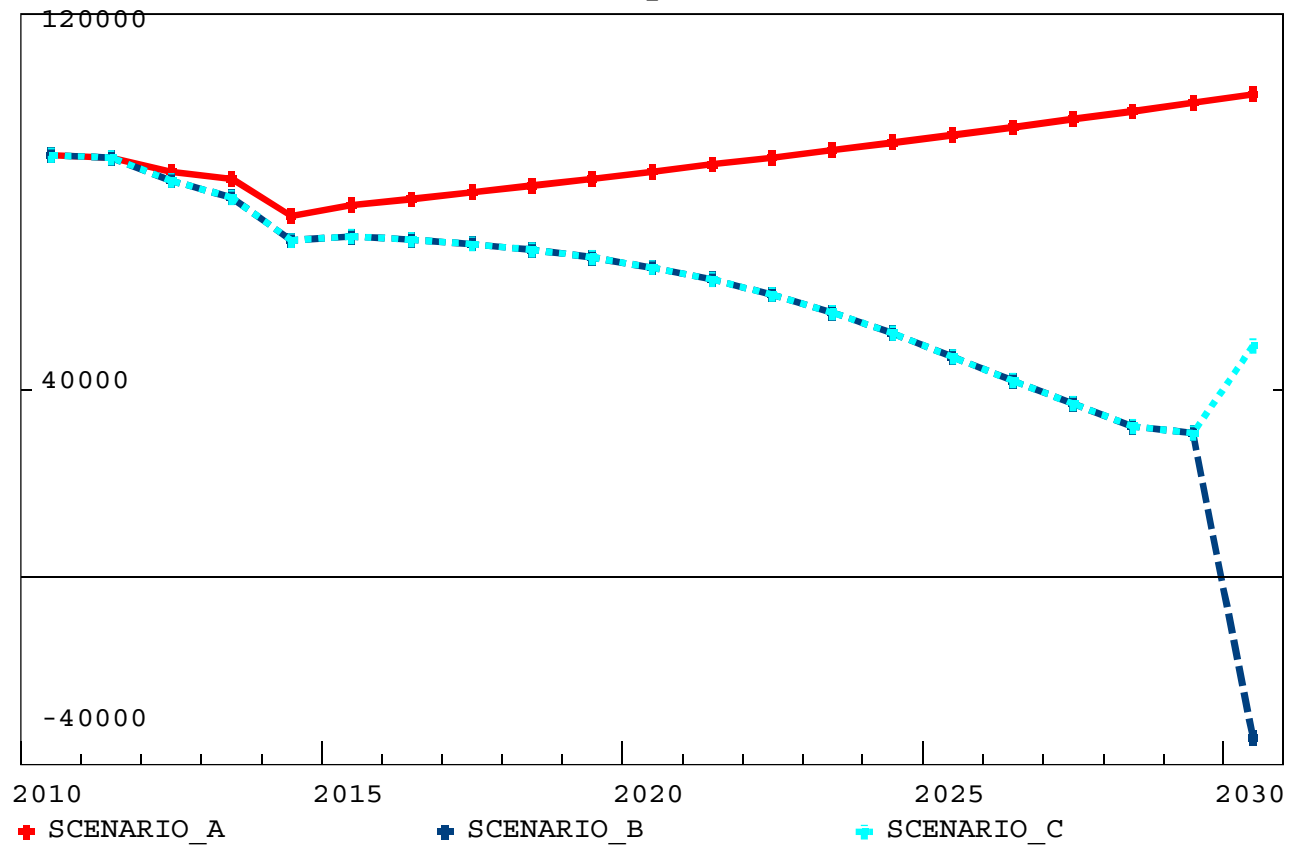
Support services for transportation
output

Coke and refined petroleum products
output

Baseline	ImportsFunction	TecCoef_adjustment

Chemicals and chemical products
output

Postal and courier services
output

Baseline   ImportsFunction   TecCoef_adjustment

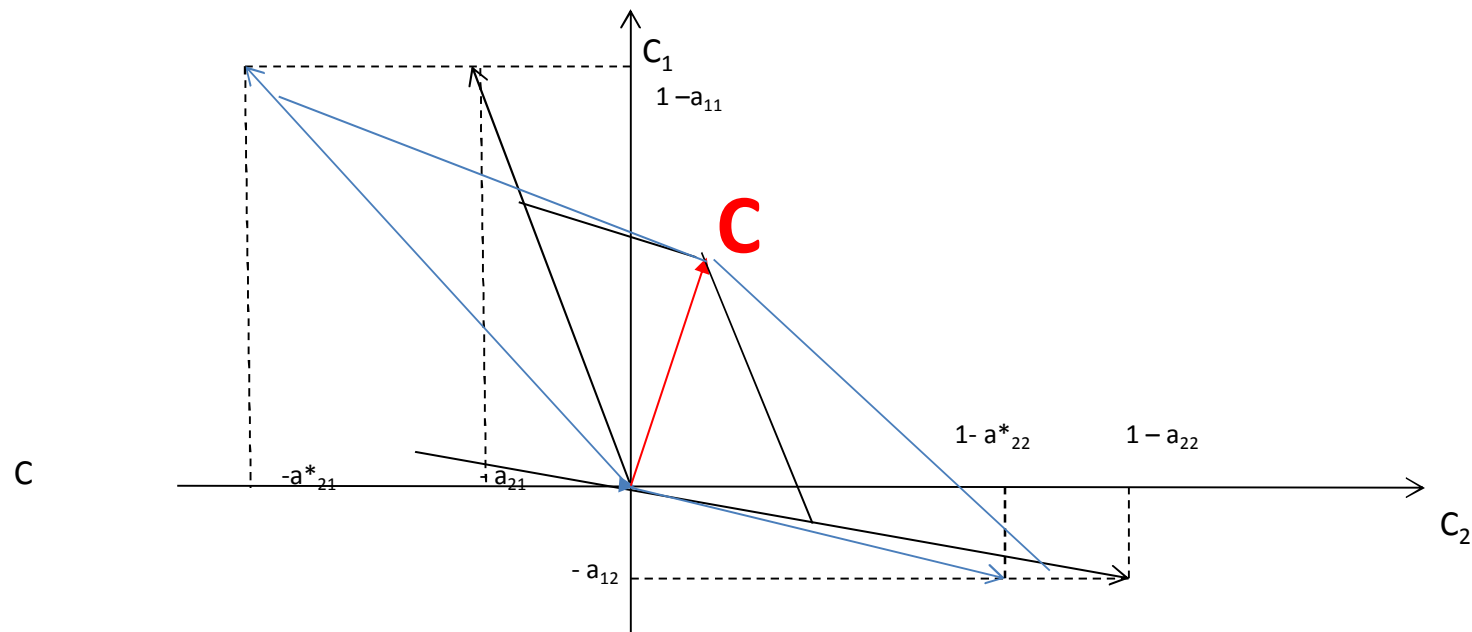Baseline   ImportsFunction   TecCoef_adjustment

A Scenario number 4

An experiment Adjusting the A matrix every year
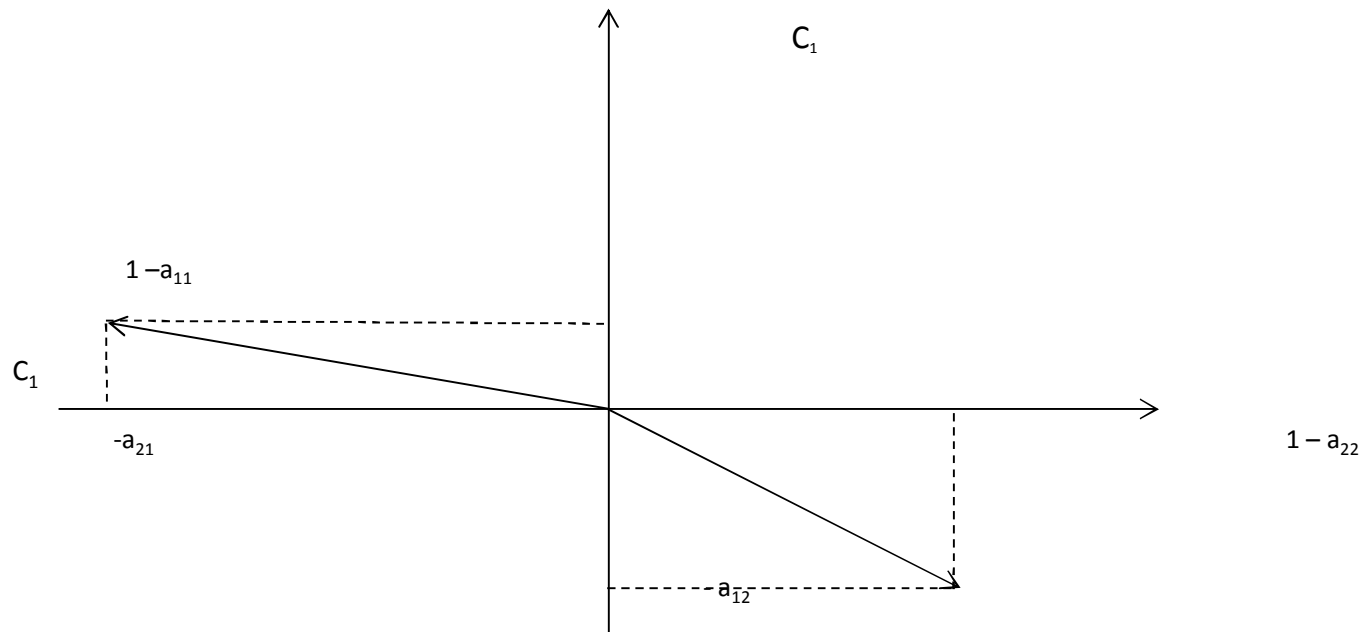
Seidel2 implementation

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        sumNet = sum - f[i];
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//         if (i == 31 && iter == 0) {
        if (sum < 0.0) {
                ratio =(q[i]-f[i])/sumNet;
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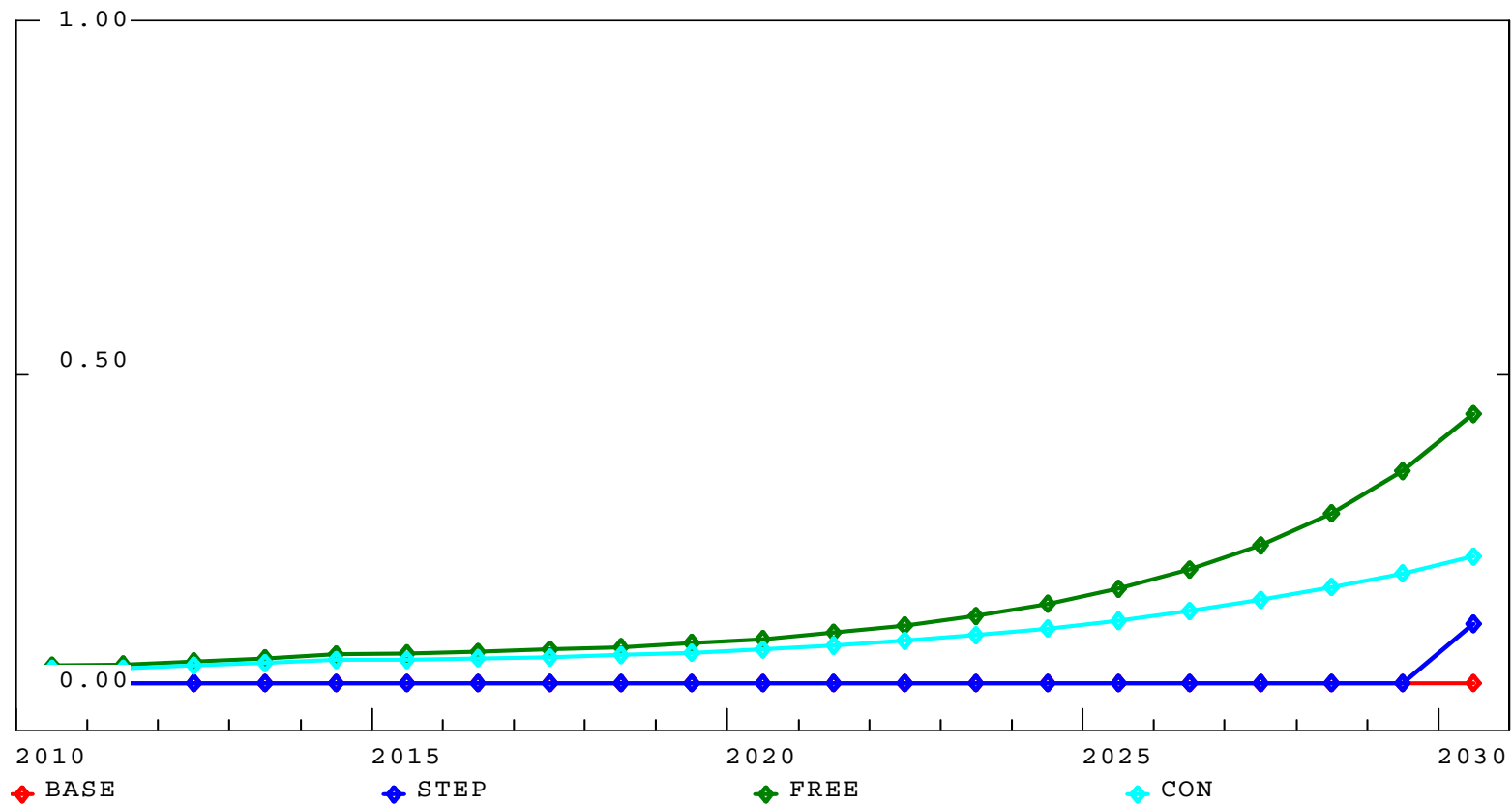
Impact of the Vector bases on output
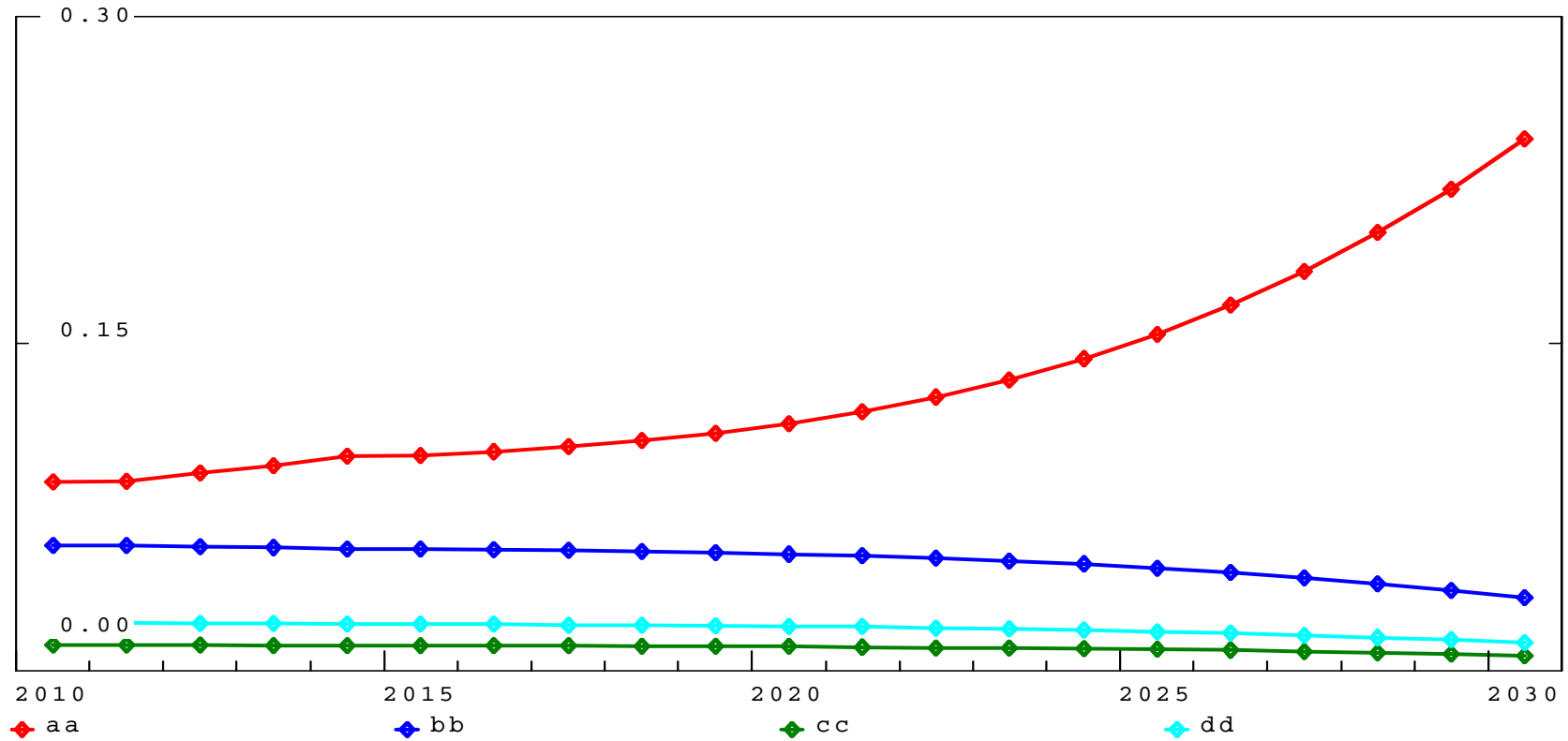
When a vector basis
cannot produce positive outputs

Technical coefficient A31.31
Land transport services

◆ BASE	◆ STEP	◆ FREE	◆ CON

Some Technical coefficients
Land transport services

Continue………