

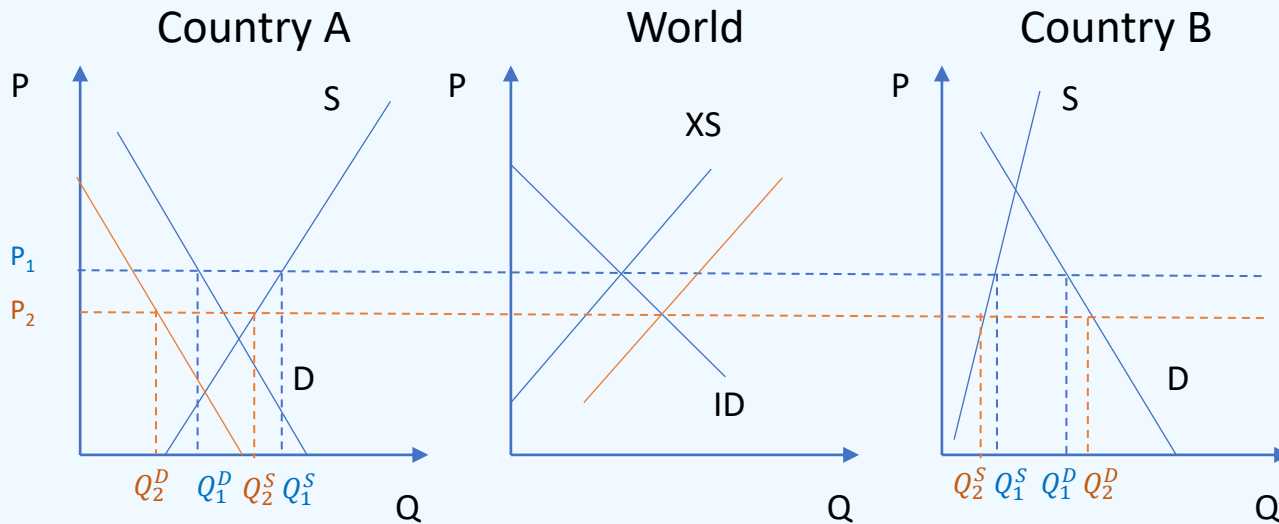


# GDP Changes

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# Economic Background



# Expectations

If the income decreases, what happens in:

Importer. Price Setter	Importer. Price Taker	Exporter. Price Setter	Exporter. Price Taker
<ul style="list-style-type: none"><li>• Demand</li><li>• Price<sup>w</sup></li><li>• Supply</li><li>• Imports</li><li>• ...</li></ul>	<ul style="list-style-type: none"><li>• Demand</li><li>• Price<sup>w</sup></li><li>• Supply</li><li>• Imports</li><li>• ...</li></ul>	<ul style="list-style-type: none"><li>• Demand</li><li>• Price<sup>w</sup></li><li>• Supply</li><li>• Exports</li><li>• ....</li></ul>	<ul style="list-style-type: none"><li>• Demand</li><li>• Price<sup>w</sup></li><li>• Supply</li><li>• Exports</li><li>• ...</li></ul>

# Final Demand in CAPRI

- Indirect utility function

F and G functions, homog. of deg. one in prices P,  
Y = Income

$$v(p, y) = \frac{-G}{y - F}$$

- Derive per capita Marshallian demands using Roy's identity:

$$PerCap_i = F_i + \frac{G_i}{G} (y - F)$$

Where  $F_i$  and  $G_i$  are the first derivatives of F and G with respect to own prices

Sidenote

$$x_i^m = - \frac{\partial v(p, y)}{\partial p_i} \div \frac{\partial v(p, y)}{\partial y},$$

Where  $x_i^m$ : Marshallian demand for good  $i$

$p_i$ : price of good  $i$

$y$ : income

# Final Demand in CAPRI

$$F = \sum_i d_i c_{pri_i}$$

Where  $d_i$ : minimum commitment level of good  $i$  independent of prices and income

$c_{pri_i}$ : consumer price of good  $i$

$G$  is based on generalized Leontief formulation:

$$G = \sum_i \sum_j b_{ij} \sqrt{c_{pri_i} c_{pri_j}}$$

## Sidenote

Leontief cost function:

$$C = Y \left[ \sum_i \sum_j \beta_{ij} \sqrt{p_i p_j} \right]$$

$\beta_{ij} = \beta_{ji}$  (Young's theorem): budget shares

# Final Demand in CAPRI

$$PerCap_i = F_i + \frac{G_i}{G} (y - F)$$

Minimum commitment (d)  $\rightarrow$   $F_i$

$\underbrace{\hspace{10em}}$  "non-committed income"

Value of minimum commitments  $\rightarrow$   $F$

Human consumption:

$$hcon_{i,r} = pop_r PerCap_{i,r}$$

# Transmission of the Shock in CAPRI

```
* ----- Behavioural functions
*$onlisting
*
* --- definition of F as sum of Di multiplied with prices for the Generalised Leontief expenditure funtion
*      PD: commitments / linear terms in the individual demand functions
*      (in kg per capita, therefore prices are expressed in Euro/kg <=> CPRI [Euro/ton] * 0.001)
*
```

```
GLDemandFS_(RMS) $ sum(XXX $ v_consQuant.range(RMS,XXX),1) ..
*
*      v_GLDemandFS(RMS) /
*
*      --- the following term (also found o the RHS) is only for scaling purposes
*      to bring the equation around unity
*
*      (SUM(XX1 $ p_pdGL(RMS,XX1,"CUR"),
*          DATA(RMS,"CPRI",XX1,"CUR") * p_pdGL(RMS,XX1,"CUR")*1.E-3) + 0.1)
*
*      =E= SUM(XX1 $ p_pdGl(RMS,XX1,"CUR"),
*          v_consPrice(RMS,XX1) * p_pdGL(RMS,XX1,"CUR")*1.E-3)
*      / (SUM(XX1 $ p_pdGL(RMS,XX1,"CUR"),
*          DATA(RMS,"CPRI",XX1,"CUR") * p_pdGL(RMS,XX1,"CUR")*1.E-3) + 0.1);
*
```

$$F = \sum_i d_i cpri_i$$

```
* --- definition of function G for the Generalised Leontief expenditure funtion
*      (per capita)
*
```

```
GLDemandGS_(RMS) $ sum(XXX $ v_consQuant.range(RMS,XXX),1) ..
*
*      --- due to DF in the calibration of the parameter set, it is possible
*      to fix v_GLDemandGS durign a value. That value is 10000. and
*      use in the equation for scaling to bring the equation to unity in the
*      calibration point
*
*      v_GLDemandGS(RMS)/10000. =E= SUM( (XX1,YY1) $ p_pbGL(RMS,XX1,YY1,"CUR"),
*          p_pbGL(RMS,XX1,YY1,"CUR")
*          * SQRT(v_consPrice(RMS,XX1)*v_consPrice(RMS,YY1)*1.E-6) )/10000.;
```

$$G = \sum_i \sum_j bd_{ij} \sqrt{cpri_i cpri_j}$$

# Transmission of the Shock in CAPRI

```

* --- definition of first derivatives of G called Gi for the Generalised Leontief expenditure funtion
*   (per capita)
*
GLDemandGiS_(RMS,XXX) $( (v_consQuant.LO(RMS,XXX) ne v_consQuant.UP(RMS,XXX))
                        $ DATA(RMS,"HCon",XXX,"CUR")) ..

v_GLDemandGiS(RMS,XXX)

*
*   --- the following is only a scaling term to bring the equation around unity
*   in calibration point. It is also found on the RHS
*
/ (SUM( YY1 $ p_pbGL(RMS,XXX,YY1,"CUR"),
      p_pbGL(RMS,XXX,YY1,"CUR")
      * SQRT(DATA(RMS,"CPRI",YY1,"CUR")/DATA(RMS,"CPRI",XXX,"CUR"))) + 0.1)

=E= [SUM( YY1 $ p_pbGL(RMS,XXX,YY1,"CUR"),
      p_pbGL(RMS,XXX,YY1,"CUR")

*
*   ---- the division / multiplication by DATA(RMS,"CPRI",XXX,"CUR")
*   cancel out and are only introduced to stabilize
*   the numerical solution
*
*   * SQRT(v_consPrice(RMS,YY1)/DATA(RMS,"CPRI",XXX,"CUR"))
*   * SQRT(DATA(RMS,"CPRI",XXX,"CUR")/v_consPrice(RMS,XXX))
]

/ (SUM( YY1 $ p_pbGL(RMS,XXX,YY1,"CUR"),
      p_pbGL(RMS,XXX,YY1,"CUR")
      * SQRT(DATA(RMS,"CPRI",YY1,"CUR")/DATA(RMS,"CPRI",XXX,"CUR"))) + 0.1);

```

$$x_i = -\frac{\partial V/\partial p}{\partial V/\partial(Y-F)} = \frac{G_i}{G}(Y-F) + F_i$$

```

*
* ----- definition of human consumption for the Generalised Leontief expenditure funtion
*
Xis_(RMS,XXX) $( (v_consQuant.LO(RMS,XXX) ne v_consQuant.UP(RMS,XXX))
                $ DATA(RMS,"HCon",XXX,"CUR")) ..

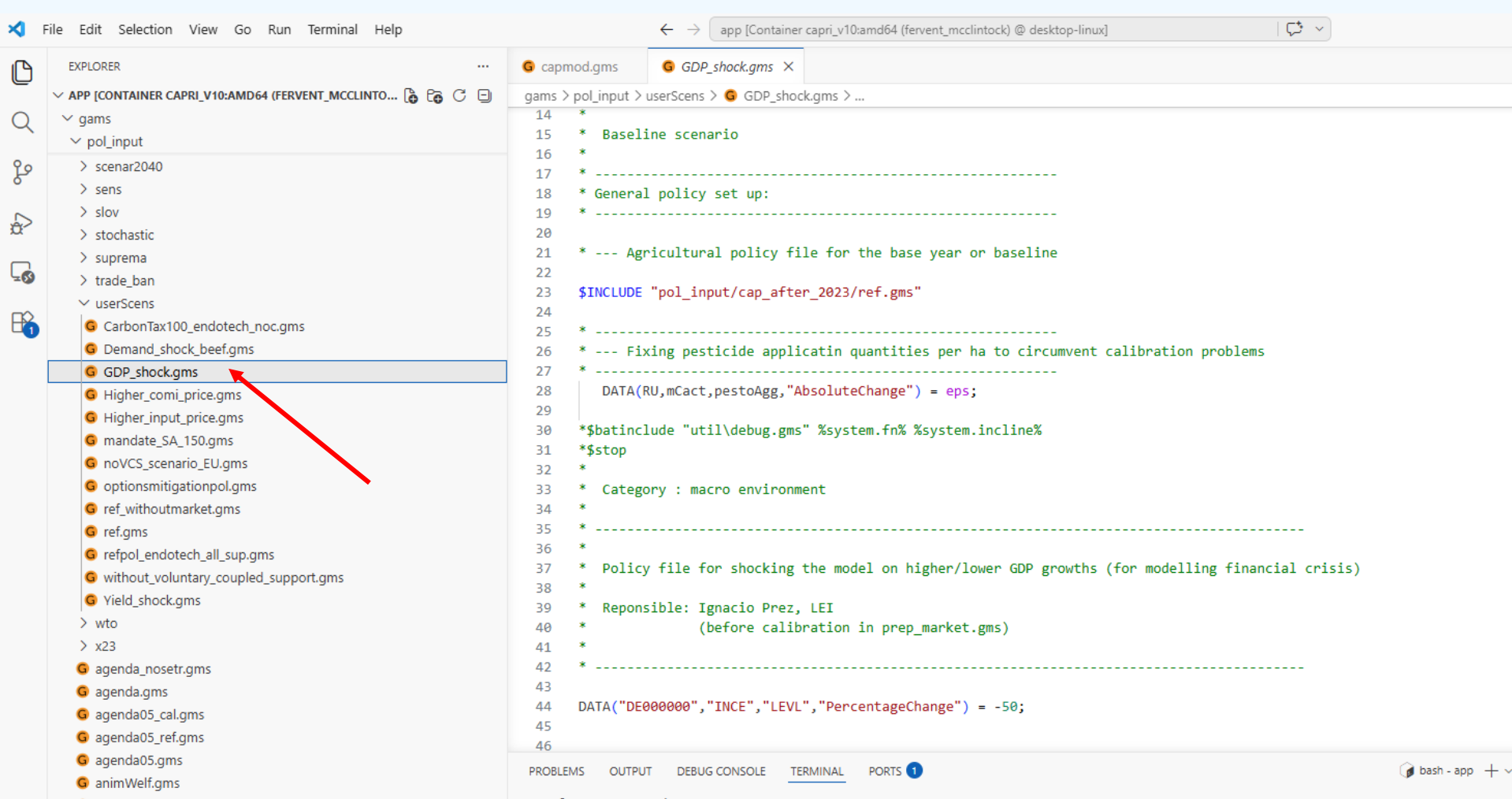
( v_consQuant(RMS,XXX) $ ( v_consQuant.LO(RMS,XXX) GT 0)
+ v_consQuantNeg(RMS,XXX) $ ( v_consQuant.LO(RMS,XXX) LE 0)
)
/ (DATA(RMS,"HCon",XXX,"CUR")+0.1) =E=

((v_GLDemandGiS(RMS,XXX)/v_GLDemandGS(RMS)
 * ( DATA(RMS,"Ince","Levl","CUR")/DATA(RMS,"INHA","LEVL","CUR") - v_GLDemandFS(RMS)
 + p_pdGL(RMS,XXX,"CUR")) * DATA(RMS,"INHA","LEVL","CUR")/1000.)/(DATA(RMS,"HCon",XXX,"CUR")+0.1);

```

**hcon**

# Scenario Definition



The image shows a code editor interface with a file explorer on the left and a code editor on the right. The file explorer shows a directory structure with the following files and folders:

- APP [CONTAINER CAPRI\_V10:AMD64 (FERVENT\_MCCLINTO...)]
  - gams
    - pol\_input
      - scenar2040
      - sens
      - slov
      - stochastic
      - suprema
      - trade\_ban
      - userScens
        - CarbonTax100\_endotech\_noc.gms
        - Demand\_shock\_beef.gms
        - GDP\_shock.gms**
        - Higher\_comi\_price.gms
        - Higher\_input\_price.gms
        - mandate\_SA\_150.gms
        - noVCS\_scenario\_EU.gms
        - optionsmitigationpol.gms
        - ref\_withoutmarket.gms
        - ref.gms
        - refpol\_endotech\_all\_sup.gms
        - without\_voluntary\_coupled\_support.gms
        - Yield\_shock.gms
      - wto
      - x23
    - agenda\_nosetr.gms
    - agenda.gms
    - agenda05\_cal.gms
    - agenda05\_ref.gms
    - agenda05.gms
    - animWelf.gms

The code editor shows the content of 'GDP\_shock.gms' with the following code:

```
14 *
15 * Baseline scenario
16 *
17 * -----
18 * General policy set up:
19 * -----
20
21 * --- Agricultural policy file for the base year or baseline
22
23 $INCLUDE "pol_input/cap_after_2023/ref.gms"
24
25 * -----
26 * --- Fixing pesticide applicatin quantities per ha to circumvent calibration problems
27 * -----
28 DATA(RU,mCact,pestoAgg,"AbsoluteChange") = eps;
29
30 *$batinclude "util\debug.gms" %system.fn% %system.incline%
31 *$stop
32 *
33 * Category : macro environment
34 *
35 * -----
36 *
37 * Policy file for shocking the model on higher/lower GDP growths (for modelling financial crisis)
38 *
39 * Responsible: Ignacio Prez, LEI
40 * (before calibration in prep_market.gms)
41 *
42 * -----
43
44 DATA("DE000000","INCE","LEVL","PercentageChange") = -50;
45
46
```

# Exercise

- Run a scenario that considers a 50 % decrease of GDP in Germany
- Open `..\gams\arm\market_model.gms` and find the equation for GDP
- Answer the questions on the following slide
- Compare the answers with your expectations

# Exercise

1. The human consumption (1000 t) of all primary agricultural output in Germany changes by \_\_\_%.
2. The largest change in human consumption (1000 t) of agricultural products in Germany occurs for \_\_\_\_\_ products and amounts to \_\_\_%.
3. The domestic market use of biodiesel and bioethanol in Germany decreases/increases by \_\_\_% and \_\_\_% yielding producer prices to decrease/increase by \_\_\_% and \_\_\_%, respectively.
4. The exports of fresh milk products from Germany decreases/increases by \_\_\_%. Explain the driving forces of this change.
5. The agricultural activity showing the largest change in Germany is \_\_\_\_\_, with a +/- \_\_\_%.  
The total agricultural income (Mio €) in Germany increases/decreases by \_\_\_\_\_.(absolute value)

Now let's have a look at welfare indicators. In CAPRI the consumer's welfare is measured in Money metrics, which can be broadly understood as a measurement for changes in the purchasing power of the consumer.

6. The Money metric (Mio €) in Germany in absolute values decreases/increases by \_\_\_\_\_. Overall the total welfare (Mio €) increases/decreases by \_\_\_\_\_. Explain the reasons.
7. Now look at the same indicators in France (in absolute values; Mio €): Agricultural income +/- \_\_\_\_\_, money metric +/- \_\_\_\_\_ and total welfare +/- \_\_\_\_\_. Compare them with Germany.

# Exercise – some hints

1. The human consumption (1000 t) of all primary agricultural output in Germany changes by \_\_\_\_%. (**Markets > Product balances, detailed**)
2. The largest percentage change in human consumption (1000 t) of agricultural products in Germany occurs for \_\_\_\_\_ products and amounts to \_\_\_\_%. (**Markets > Product balances, detailed**)
3. The domestic market use of biodiesel and bioethanol in Germany decreases/increases by \_\_\_\_% and \_\_\_\_% yielding producer prices to decrease/increase by \_\_\_\_% and \_\_\_\_%, respectively. (**Markets > Product balances, detailed**); (**Prices > Prices**)
4. The exports of fresh milk products from Germany decreases/increases by \_\_\_\_%. Explain the driving forces of this change. (**Markets > Product balances, detailed**)
5. The agricultural activity showing the largest percentage change in income in Germany is \_\_\_\_\_, with a +/- \_\_\_\_%. (**Farm > Supply details**)  
The total agricultural income (Mio €) in Germany increases/decreases by \_\_\_\_\_ (absolute value). (**Welfare > Welfare overview**)

Now let's have a look at welfare indicators. In CAPRI the consumer's welfare is measured in Money metrics, which can be broadly understood as a measurement for changes in the purchasing power of the consumer.

6. The Money metric (Mio €) in Germany in absolute values decreases/increases by \_\_\_\_\_. Overall the total welfare (Mio €) increases/decreases by \_\_\_\_\_. Explain the reasons. (**Welfare > Welfare overview**)
7. Now look at the same indicators in France (in absolute values; Mio €): Agricultural income +/- \_\_\_\_\_, money metric +/- \_\_\_\_\_ and total welfare +/- \_\_\_\_\_. Compare them with Germany. (**Welfare > Welfare overview**)