



2.6. Exercise: yield shock with and without market model

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Background: Yield shocks - why they matter

Yields changes can also be applied exogenously in CAPRI

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Severity of drought and heatwave crop losses tripled over the last five decades in Europe

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[Environmental Research Letters, Volume 16, Number 6](#)

[Focus on Sustainable Food Systems](#)

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Article

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Ermir Shahini, Eugen Skura, Fatbardh Sallaku, Shpend Shahini

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Abstract

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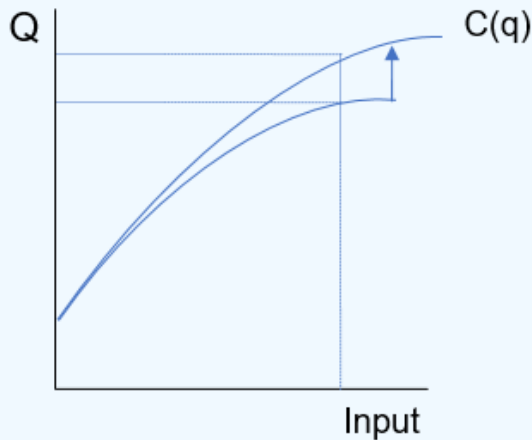
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With and without market model

- In CAPRI, Yields changes can be applied for the tasks:
 - Run CAPRI **with market** model
 - Run CAPRI **without market** model
 - In CAPRI, yields are partly endogenous
 - Farmers might adjust input use (like fertilizer or feed) → which slightly changes yields
 - The model decides these changes by optimizing farm profits and balancing inputs and outputs
 - If market feedback is on, changes in production can influence prices → adjust inputs → adjust yields
- ✓ But you can force yield changes exogenously for scenario analysis

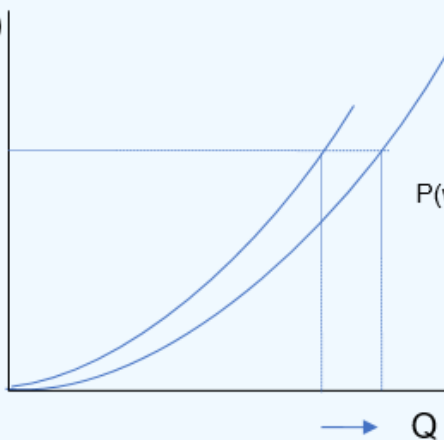
With and without market model

production function

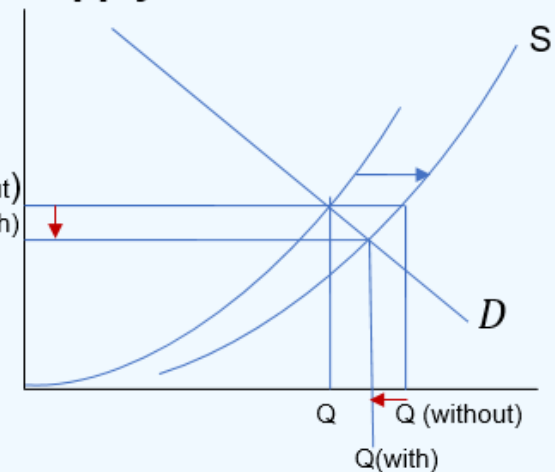


Input * price input = C(q)

cost function



supply function = MC



$$\mathbf{Profit} = P * Q - C(q)$$

$$\frac{dProfit}{dQ} = P - \frac{dCost}{dQ} = 0$$

$$\frac{dCost}{dQ} = P = MC$$

Important code parts

```
$setglobal SCENDES yield shock
*
*   Baseline scenario
*
$include ../gams/scen/base_scenarios\CAP_2014_2020.gms
*
*   Category : yield shocks
*
DATA(RS,"SWHE","Yild","ChangeFactor") = 1.30;
```

Create a new file under gams/pol_input

Equal to using the Policy Editor

../gams/capmod/shift_yields.gms

```
*
* ----- take over yield shifts from scenario definition
*          (input demand per ha / head will be adjusted to the change in main output coefficients)
*
DATA(RU,MPACT,O,"Y") $ ( SUM(PACT_TO_Y(MPACT,O1), DATA(RU,MPACT,O1,"Y")) $ PACT_TO_O(MPACT,O) $ DATA(RU,MPACT,"Yild","AbsoluteLevel"))
= DATA(RU,MPACT,"Yild","AbsoluteLevel") * DATA(RU,MPACT,O,"Y")
  /SUM(PACT_TO_Y(MPACT,O1), DATA(RU,MPACT,O1,"Y"));
*
DATA(RU,MPACT,O,"Y") $ ( PACT_TO_O(MPACT,O) $ DATA(RU,MPACT,"Yild","AbsoluteChange"))
= DATA(RU,MPACT,O,"Y") + DATA(RU,MPACT,"Yild","AbsoluteChange");
*
DATA(RU,MPACT,O,"Y") $ ( PACT_TO_O(MPACT,O) $ DATA(RU,MPACT,"Yild","ChangeFactor"))
= DATA(RU,MPACT,O,"Y") * DATA(RU,MPACT,"Yild","ChangeFactor");
*
DATA(RU,MPACT,O,"Y") $ ( PACT_TO_O(MPACT,O) $ DATA(RU,MPACT,"Yild","PercentageChange"))
= DATA(RU,MPACT,O,"Y") * (1. + DATA(RU,MPACT,"Yild","PercentageChange")/100.);
*

p_pmpCnst(RU,MPACT,A) $ data(RU,MPACT,"D_PMPL","AbsoluteChange")
= p_pmpCnst(RU,MPACT,A) + data(RU,MPACT,"D_PMPL","AbsoluteChange");
```

The objective function

```
"..\gams\supply\Supply_model.gms"
```

```
-----  
OBJEQF_.. v_obje =E= SUM(RUNR,  
* --- revenues - variable costs  
* v_linObjPart(RUNR) - v_sumOfPmpTermsLevls(RUNR  
* --- contribution of PMP terms for feeding  
*  
* ) ;  
-----  
LINEAR (RUNR)..  
v_linObjPart(RUNR) =E=  
* --- sales/purchases valued by "unit value" price  
* from gross Economic Accounts for Agriculture  
*  
* SUM(RUNR_OMOBJE(RUNR,OM_OBJE) ,  
* v_netPutQuant(RUNR,OM_OBJE) * ( SUM(R_RAGG(RUNR,MSACT) ,  
* (%data%(MSACT,"UVAG",OM_OBJE,"Y"))  
*  
* ;  
-----  
SUPBAL_ (RUNR_OMS IN SUPBAL(RUNR,OMS)) ..  
* --- sales or purchases  
* (exemption: fodder which is not tradeable)  
* v_netPutQuant(RUNR,OMS) $ ( (NOT FODDO(OMS)) or ((p_PMPStep1 eq 1) $ (NOT SAMEAS(OMS,"STRA"))  
* or (p_exoDemand(RUNR,"UVAG",OMS) $ (p_PMPStep1 eq 1)))  
* --- young animals needed in regions  
* (defined in equation INPANIE_)  
* + v_youngAnimUse(RUNR,OMS) $ OMYANI(OMS)  
* --- non-tradable feed use (FGRA,FOFA ...)  
* (defined in equation FEDUSE_)  
* + SUM(FEED_TO_O(FODDI,OMS) , v_feedQuantReg(RUNR,FODDI))  
* --- feed use of trade able bulks (FCER,FPRO ...)  
* (defined in equation FEDUSE_)  
* + v_feedQuantReg(RUNR,OMS) $ I(OMS)  
* + p_exoDemand(RUNR,"DEMD",OMS)  
* ---E=---  
* --- total output: activity level * output coefficient  
* --- * technology factor for alternative  
* SUM( (MPACT,A) $ (PACT_TO_O(MPACT,OMS) $ p_techFact(RUNR,MPACT,"LEVL",A)) ,  
* v_actLevl(RUNR,MPACT,A) * (%data%(RUNR,MPACT,OMS,"Y")) * (p_techFact(RUNR,MPACT,OMS,A)+1.) * 0.001  
* ) ;
```

Expectations

- Yield
- Supply
- Price
- Mineral fertilizer use
- Pesticides use
- Global warming potential
- Income
- Trade

Example of exogenous yield change

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	A	B	C	D	E	F	G	H
1		SWHE	DWHE	BARL	RYEM	OATS	MAIZ	OCER
2	AL000000	0.635886	0.635886	0.688197	0.628904	0.729235	0.721752	0.6435
3	AT110000	0.684503	0.684503	0.748764	0.674261	0.804356	0.794653	0.69326
4	AT120000	0.684503	0.684503	0.748764	0.674261	0.804356	0.794653	0.69326
5	AT130000	0.684503	0.684503	0.748764	0.674261	0.804356	0.794653	0.69326
6	AT210000	0.684503	0.684503	0.748764	0.674261	0.804356	0.794653	0.69326
7	AT220000	0.684503	0.684503	0.748764	0.674261	0.804356	0.794653	0.69326
8	AT310000	0.684503	0.684503	0.748764	0.674261	0.804356	0.794653	0.69326
9	AT320000	0.684503	0.684503	0.748764	0.674261	0.804356	0.794653	0.69326
10	AT330000	0.684503	0.684503	0.748764	0.674261	0.804356	0.794653	0.69326
11	AT340000	0.684503	0.684503	0.748764	0.674261	0.804356	0.794653	0.69326
12	BA000000	0.673601	0.673601	0.735183	0.66409	0.787511	0.778306	0.68211
13	BG010000	0.645315	0.645315	0.699944	0.637701	0.743804	0.73589	0.65319
14	BG020000	0.654743	0.654743	0.71169	0.646497	0.758373	0.750029	0.66283
15	BG030000	0.645315	0.645315	0.699944	0.637701	0.743804	0.73589	0.65319
16	BG040000	0.688923	0.688923	0.75427	0.678384	0.811186	0.801281	0.69778
17	BG050000	0.654743	0.654743	0.71169	0.646497	0.758373	0.750029	0.66283
18	BG060000	0.635886	0.635886	0.688197	0.628904	0.729235	0.721752	0.6435

```

1 *****
2 $ontext
3
4     CAPRI project
5
6     GAMS file : yield_shock_npc.GMS
7     @purpose  : yield shock as introduced by NPC (see NPC project)
8
9     @author   : Jordan, Ana and Caetano
10    @date     : October 2022
11    @refDoc   :
12    @seeAlso  :
13    @calledBy :
14
15 $offtext
16 *****
17 $INCLUDE "pol_input\cap_after_2014\ref.gms"
18
19 * to activate the NPC yield shock (see capmod\DEFINE_INPUS.GMS)
20 $setglobal npc ON
21
22 * --- define as change factor (ex. 0.2)
23 $setglobal plapReduction 1
24
25 parameter p_npc_yield(*,*) "yield shock by NUTS2 region and crop"
26 ;
27
28 * --- load the estimated yield gaps considering natural pest control effect in organic farms
29
30 $call "GDXXRW.exe pol_input\npc\predictions_mapping.xlsx o=pol_input\npc\data.gdx par=p_npc_yield rng=Sheet2!A1:AJ239";
31
32 $GDXIN pol_input\npc\data.gdx
33 $LOAD p_npc_yield
34 $GDXIN
35
36 * --- define scenario specific adoption rate
37
38 display p_npc_yield;
39
40 * --- load the yield gaps
41
42 DATA(RU,MPACT,"Yield","ChangeFactor") = p_npc_yield(RU,MPACT);
43

```

Breakout session

- Same groups as previous session
- Hand on exercise
 - run the scenarios (or download the results)

```
res_2_1730cap_after_2014_refdefaultA  
res_2_1730userScens_Yield_shock_2_6_DEdefaultA  
res_2_1730userScens_Yield_shock_2_6_MMOdefaultA
```

- fill out the quiz at the end of the ppt
- provide 1-2 slide additional results in the area of
 - income, production, environmental indicators, trade
- Please indicate one member of the group to present the group work at the end in about 2-5 min

Exercise 2.5. Scenario assumption

- Introduce a yield change of +30% for soft wheat in Germany
 - Find, create or upload the correct gms file from `pol_input/user_scen` (upload the results in `...results\capmod`)
 - Run the scenario for Germany. Proof that the yield shock was correctly translated into the model (no table view or “exog. yield changes”)
 - Run it also with the market model (upload the results...)
 - *optional: apply the shock only to Germany instead of all regions*
 - hint: use the set `MAP_RR` (`sets.gms`)
- Fill the cloze at the end of the presentation

Cloze for Exercise 2.6

- What is the supply of soft wheat in Germany with and without the use of the market model?
- The supply in Germany increases by ___% without the market model switched on and by ___% with market model.
- The price changed for soft wheat in Germany without the market model changes by ___% and ___% with market model.
- The hectare changes for soft wheat in Germany by ___% with and by ___% without the market model?

Relevant tables in the exploiter

- For supply, hectare and heard size, income and yield by activity (GUI table **farm->supply details**)
- For producer price changes (GUI table **prices**)
- If of interest check product balances (trade, feed use, consumption) (GUI table **market->product balances, detailed**)