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On the sustainability of the French food system: A macroeconomic assessment

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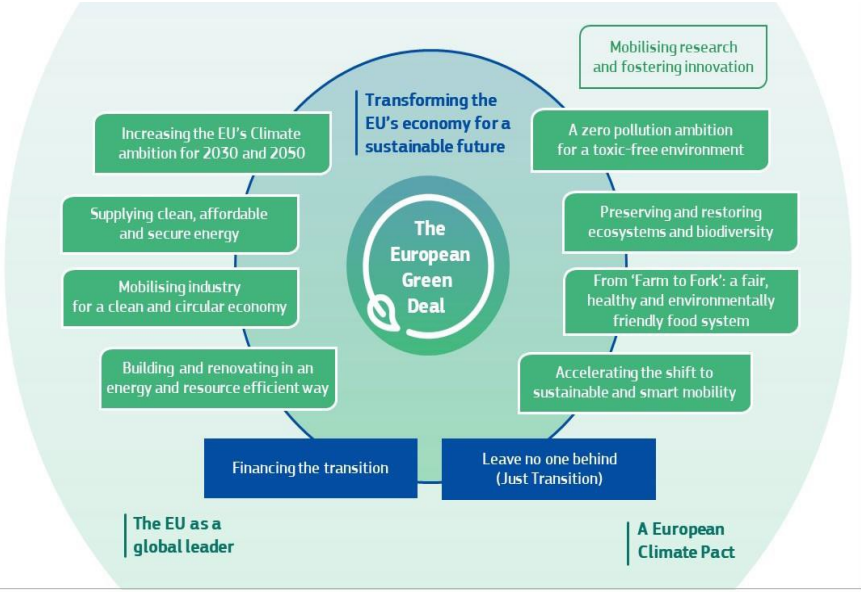
European Green Deal:
"Transforming the EU's economy for a sustainable future"

A consistent set of objectives, among which:

Carbon neutrality by 2050

Goals for all sectors



Various Strategies, including:

Climate Plan and Law

Farm to Fork Strategy

EU Biodiversity Strategy for 2030

Agriculture and Food

Main quantitative targets for agriculture in 2030

- **Greenhouse gas emissions: -35% for non-CO2 gases from a 2015 reference**
- **Pesticides' use and risk: -50%**
- **Nutrients (N & P): -50% for losses ➔ -20% for use**
- **Antimicrobials: -50%**
- **Organic farming: 25% UAA**
- **High-diversity landscape features: 10% of UAA**
- **Losses and waste: -50%**

Literature review

	JRC	USDA	Kiel	Coceral	HFFA	Wageningen
Modèle utilisé	CAPRI *(Modèle d'équilibre partiel)*	EGC *(Modèle d'équilibre général)*	CAPRI *(Modèle d'équilibre partiel)*	Evaluation emprique	MMM *(Modèle d'équilibre partiel)*	AGMEMOD *(Modèle d'équilibre partiel)*
Objectifs considérés						
Réduction de 50% de l'utilisation des pesticides	☑	☑	☑	☑	☑	☑
L'augmentation de +25 % des terres agricoles consacrées à l'agriculture biologique	☑	☐	☑	☑	☑	☑
Réduction des pertes de nutriments d'au moins -50 %	☑	☑	☑	☑	☑	☑
10% des surfaces agricoles converties en éléments de paysage à haute valeur environnementale.	☑	☑	☑	☑	☑	☑
Réduction de 50% de l'utilisation d'antimicrobiens	☐	☑	☐	☐	☐	☐

Source: Farm Europe, 2021

Literature review

Impacts UE		JRC *Scénario PAC 2014*	USDA *Scénario UE seulement*	Kiel *Scénario F2F*
Céréales	Production / Offre	. -15%	. ≈ -27%	. ≈ -21%
	Prix	. +8%	. ≈ +65%	. ≈ +12%
	Revenus	. ≈ - 6000 €	. n/ a	. n/ a
Légumes et cultures permanentes	Production / Offre	. -12%	. ≈ -5%	. ≈ -12%
	Prix	. +15%	. ≈ +15%	. ≈ +15%
	Revenus	. ≈ + 1000 € *	. n/ a	. n/ a
Oléagineux	Production / Offre	. -15%	. ≈ -60%	. ≈ -20%
	Prix	. ≈ +12%	. ≈ +93%	. ≈ +18%
	Revenus	. ≈ - 2000 €	. n/ a	. n/ a
Porc	Production / Offre	. ≈ -15%	. ≈ -7%	. ≈ -16%
	Prix	. +43%	. ≈ +9.5%	. ≈ +48%
	Revenus	. ≈ + 8000 € *	. n/ a	. n/ a

Source: Farm Europe, 2021

Our contributions

❑ Integrating recent statistical evidence on economic behavior

- similar debate on elasticities when assessing the biofuel policies

❑ An original demand scenario

- Local, GM free demand (different from the well analysed veg scenario).

Methods

❑ French CGE model with two main originalities

- Farm supply using Bareille et Gohin, 2020
- Distinguished demand for GM free products

  at the production/processing/retailing stages

Farm supply

Price	Soft wheat	Rapeseed	Sugarbeet	Pig	Pig GM free	Milk	Milk GM free	Fertilizers	Pesticides
Production elasticities									
Soft wheat	0,155	-0,007	-0,004	0,001	0	-0,007	-0,004	-0,03	-0,028
Rapeseed	-0,018	0,425	-0,003	0,001	0	-0,006	-0,003	-0,105	-0,238
Sugarbeet	-0,037	-0,013	0,395	0,002	0	-0,011	-0,005	-0,036	-0,088
Pig	-0,122	0	0	2,491	-0,938	-0,105	-0,149	0,007	0,005
Pig GM free	-0,491	0	0	-10,045	15,806	-0,105	-0,149	0,007	0,005
Milk	0,012	-0,003	-0,001	-0,069	-0,008	1,352	-0,187	-0,041	-0,028
Milk GM free	-0,008	0,004	0,002	-0,242	-0,029	-2,439	3,09	0,094	0,064
Input elasticities	Soft wheat	Rapeseed	Sugarbeet					Total	
Acreage	0,104	0,12	0,275						
Fertilisers	0,238	0,436	0,436					-0,391	0,002
Pesticides	0,337	1,287	1,287					0,005	-0,863
Input initial values									
Fertilisers (€/ha)	150	270	250						
Pesticides (€/ha)	100	230	200						

Consumer demand

	Conv beef	GM free beef	Conv pork	GM free pork	Conv poultry	GM free poultry	Conv dairy	GM free dairy	Ready meals	Income
Conv beef	-0,719	0,075	0,030	0,004	0,021	0,004	0,002	0,002	0,100	0,360
GM free beef	0,208	-1,384	0,055	0,008	0,038	0,008	0,003	0,004	0,183	0,650
Conv pork	0,016	0,011	-0,570	0,033	0,017	0,004	0,001	0,002	0,083	0,300
GM free pork	0,025	0,017	0,372	-1,211	0,027	0,006	0,002	0,003	0,131	0,470
Conv poultry	0,024	0,026	0,037	0,005	-0,882	0,079	0,002	0,002	0,123	0,440
GM free poultry	0,038	0,026	0,060	0,009	0,600	-1,884	0,003	0,004	0,198	0,710
Conv dairy	0,002	0,001	0,002	0,000	0,002	0,000	-0,212	0,020	0,032	0,110
GM free dairy	0,003	0,002	0,004	0,001	0,003	0,001	0,054	-0,406	0,059	0,210
Ready meals	0,010	0,007	0,015	0,002	0,011	0,003	0,003	0,004	-0,897	0,720

Scenarios

- Unproductive biodiversity
  - Taxes on mineral fertilizers and pesticides
  - +8% of unproductive areas
  - Short run / medium run
- Productive biodiversity
  - +2% of unproductive areas
- Sustainable demand
  - From 10% to 20% of GM free demand of pig/poultry/dairy products
  - From 20% to 30% of GM free demand of livestock products
- Farm to Fork
  - = Productive biodiversity and sustainable demand

Price effects

Scenario		Unproductive biodiversity		Unproductive biodiversity		Productive biodiversity		Sustainable demand		Farm to Fork	
Time frame		Short run		Medium run		Short run		Short run		Short run	
€/ton	initial value	Var abs	Var relat	Var abs	Var relat	Var abs	Var relat	Var abs	Var relat	Var abs	Var relat
Soft wheat	183	8,91	4,87%	7,75	4,23%	3,89	2,13%	0,23	0,12%	4,15	2,27%
Corn	269	13,22	4,92%	11,51	4,28%	4,44	1,65%	0,14	0,05%	4,59	1,71%
Rapeseed	438	35,14	8,02%	34,26	7,82%	27,90	6,37%	0,43	0,10%	28,38	6,48%
Sugarbeet	37	8,96	24,22%	8,88	23,99%	5,36	14,48%	-0,02	-0,04%	5,34	14,44%
Fodder (index)	100	17,91	17,91%	14,16	14,16%	9,79	9,79%	-1,54	-1,54%	8,10	8,10%
Pig	1539	-59,84	-3,89%	48,33	3,14%	-15,50	-1,01%	-4,84	-0,31%	-21,06	-1,37%
Pig GM free	1696	-50,58	-2,98%	57,57	3,39%	-9,37	-0,55%	119,97	7,07%	105,11	6,20%
Poultry	1883	-29,13	-1,55%	50,92	2,70%	-5,39	-0,29%	-5,00	-0,27%	-10,88	-0,58%
Poultry GM free	2140	33,84	1,58%	68,18	3,19%	22,63	1,06%	218,32	10,20%	234,75	10,97%
Milk	360	5,03	1,40%	27,36	7,60%	7,34	2,04%	-19,48	-5,41%	-11,93	-3,31%
Milk GM free	364	-30,15	-8,28%	17,73	4,87%	-8,56	-2,35%	25,62	7,04%	15,30	4,20%
Cattle	3388	31,32	0,92%	192,71	5,69%	49,46	1,46%	-104,86	-3,09%	-55,60	-1,64%
Cattle GM free	4136	-372,17	-9,00%	176,70	4,27%	-113,22	-2,74%	-54,79	-1,32%	-175,60	-4,25%

Production effects

Scenario		Unproductive biodiversity		Unproductive biodiversity		Productive biodiversity		Sustainable demand		Farm to Fork	
Time frame		Short run		Medium run		Short run		Short run		Short run	
000 tons	Initial value	Var abs	Var relat	Var abs	Var relat	Var abs	Var relat	Var abs	Var relat	Var abs	Var relat
Soft wheat	36236	-4 226,78	-11,66%	-4 241,27	-11,70%	-2 055,57	-5,67%	16,60	0,05%	-2 035,27	-5,62%
Corn	15514	-1 477,07	-9,52%	-1 480,31	-9,54%	-514,65	-3,32%	8,71	0,06%	-505,15	-3,26%
Rapeseed	4812	-1 187,96	-24,69%	-1 190,21	-24,73%	-977,52	-20,31%	2,65	0,06%	-973,80	-20,24%
Sugarbeet	31838	-2 261,28	-7,10%	-2 230,88	-7,01%	-1 273,62	-4,00%	5,55	0,02%	-1 267,03	-3,98%
Fodder (index)	100	-11,75	-11,75%	-12,43	-12,43%	-7,16	-7,16%	-0,24	-0,24%	-7,57	-7,57%
Pig	1895	40,06	2,11%	-25,17	-1,33%	11,31	0,60%	-92,52	-4,88%	-80,93	-4,27%
Pig GM free	148	0,69	0,46%	-0,35	-0,24%	0,24	0,16%	108,21	73,11%	108,50	73,31%
Poultry	1678	33,94	2,02%	-45,75	-2,73%	8,11	0,48%	-108,97	-6,49%	-100,50	-5,99%
Poultry GM free	186	-1,44	-0,77%	-1,73	-0,93%	-0,73	-0,39%	113,89	61,23%	113,44	60,99%
Milk	19226	-93,97	-0,49%	-753,65	-3,92%	-187,31	-0,97%	-1 410,09	-7,33%	-1 600,17	-8,32%
Milk GM free	5880	49,17	0,84%	-22,51	-0,38%	15,60	0,27%	2 136,17	36,33%	2 153,50	36,62%
Cattle	1204	-14,05	-1,17%	-87,24	-7,25%	-23,44	-1,95%	-48,07	-3,99%	-73,85	-6,13%
Cattle GM free	368	9,24	2,51%	-2,88	-0,78%	3,10	0,84%	84,67	23,01%	87,97	23,90%

Income effects

Scenario		Unproductive biodiversity		Unproductive biodiversity		Productive biodiversity		Sustainable demand		Farm to Fork	
Time frame		Short run		Medium run		Short run		Short run		Short run	
000 000€	Initial value	Var abs	Var relat	Var abs	Var relat	Var abs	Var relat	Var abs	Var relat	Var abs	Var relat
farm value added	38114	-5 653,32	-14,83%	-2 491,22	-6,54%	-3 126,50	-8,20%	320,60	0,84%	-2 875,54	-7,54%
farm wages	6779	-1 728,37	-25,50%	-507,73	-7,49%	-526,08	-7,76%	81,94	1,21%	-455,78	-6,72%
land returns	3022	8 660,63	286,59%	132,54	4,39%	1 625,06	53,77%	-453,20	-15,00%	1 259,89	41,69%
capital returns	28312	-12 588,50	-44,46%	-2 116,08	-7,47%	-4 226,03	-14,93%	692,01	2,44%	-3 680,08	-13,00%
With land regulations											
land returns	3022	-431,98	-14,29%	-202,57	-6,70%	-244,15	-8,08%	25,42	0,84%	-224,65	-7,43%
capital returns	28312	-3 492,98	-12,34%	-1 780,92	-6,29%	-2 356,28	-8,32%	213,24	0,75%	-2 195,12	-7,75%
tax receipts	0	2 418,61		2 403,80		2 512,10		0,00		2 507,35	
food value added	29814	-10,77	-0,04%	-552,04	-1,85%	-135,45	-0,45%	589,41	1,98%	456,04	1,53%
food wages	20780	117,44	0,57%	-215,24	-1,04%	2,39	0,01%	357,22	1,72%	361,28	1,74%
food bill	197930	-366,13	-0,18%	307,64	0,16%	-54,80	-0,03%	423,88	0,21%	304,00	0,15%

Conclusion

- **The GD is a comprehensive roadmap**
- **Existing studies stress the negative impacts on farm markets and income**
- **Our empirical analysis show less negative impacts depending on:**
  - **Biodiversity definition**
  - **Shifts in local demand**
  - **Adaptation of farmers**

- Perspectives
  - Academic: domain of validity of elasticities
  - Policy : Non Tariff Barriers, New Plant Breeding Technology, Green House Gas emissions