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AN ALTERNATIVE SCHEME TO COMPUTE THE COMMON AGRICULTURAL POLICY DIRECT PAYMENTS TO FARMERS

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An alternative scheme to compute the Common Agricultural Policy direct payments to farmers

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Abstract.

An alternative to the direct payments modulation under CAP Regulation n. 2237/2003 is presented, using a logistic function model where payments to farmers are related to economic efficiency, environmental impact of agricultural production, and farmer's income.

The approach used develops into two phases: in phase one the focus is on modulation among countries; then in phase two redistribution among farmers within a Member State is contemplated.

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1. Introduction

The most recent reform of the Common Agricultural Policy (CAP) of the European Union (EU), known as the Mid Term Review (MTR) of Agenda 2000, was approved by the Council of Ministers of Agriculture in June 2003 and started to be adopted by member states in January 2005. It is thus too soon to even try an evaluation of its results. However some prospective effects of its effects of its implementation are possible and were performed.[1]

The MTR is the last step of a long process, beginning with the MacSharry reform in 1992, along which the concepts of decoupling farmer's income support via direct payments, and agro-environmental and social accompanying measures were progressively introduced and implemented. In the entire process there was a clear willingness to shift resources from the so called "first pillar" to the "second pillar" of CAP, e.g. reinforcing rural development and environmental friendly practices at the expense of traditional market support measures.

One of the key instruments to achieve such goals was the introduction of modulation of direct payments (DP) to farmers.

Initially introduced as a voluntary scheme by Regulation n. 1259/1999, also known as "Horizontal Regulation", modulation became compulsory after a long series of proposals and negotiations that ended up with the approval of Regulation n. 2237/2003, in the framework of the MTR. In its final version modulation was designed as a very simple, even simplistic, scheme were farmers get as direct payments the amount of support they received historically, where historically means the 2000-2002 average of the amounts received. Additionally farmers whose historic support exceeds 5,000 euros will suffer cuts in their payments from 3% in 2005 up to 5% in 2007, and remaining at this last level thereafter. According to the Regulation the amount of resources equal to 1 percent point of modulation rate will be kept by the Member State while the remaining will be redistributed to Member States following "objective criteria" defined by the Commission.[2]

[1]See for instance Henke, R. and R. Sardone (2003).

[2] The criteria are: the share of agricultural employment (35%), the share of Utilised Agricultural Area (65%) and the per capita GDP (as a correction factor).

The aim of this paper is to point out what we consider the main limitations of this kind of modulation and to propose an alternative scheme.

In the next section those limitations are put forward and the desirable features of an alternative scheme are analysed. In section 3. the analytical model is presented, section 4. shows model results from several simulations and in section 5. a few concluding remarks are put forward.

2. Another way to look at modulation

As it was designed modulation suffers from several limitations, namely:

- it favours the freezing of the “historic” allocation of resources;
- does not induce specific incentives for either improving that allocation and/or adopt environmental friendly practices;
- does not take into account the sound differences that exist among Member States in what concerns the negative impact of agricultural production on the environment, nor the marked divergences in farmer’s income.

In fact, when farmers receive as direct payments exactly the same amount they got in the past, they do not feel any urgent motivation to change their product mix and technologies.

In what concerns environment, it is true that Regulation n. 1259/1999, article n. 3, establishes that each Member State may link direct payments to the adoption of environmental measures retained appropriate to its specific situation. Furthermore Regulation n. 2237/2003 states that a farmer receiving DP can choose not to farm his land, in which case he is bound to respect the “good agricultural and environmental conditions” defined by the member State. None of these possibilities does however define a functional link between DP and environmental friendly practices such as, for instance, “better performance means higher payments”.

As to the third type of limitations stated above it is well known that the level of the negative impact of agricultural production on environment in terms of, for example, green house gas emissions is quite different among member states due to the diversity in fertilizers and pesticides use. As it is also well known and documented that there are very sound divergences in farmer’s income among EU Member States.[3]

It looks then desirable to define a mechanism that makes DP work as an instrument of income support, but with compliance of environment standards and economic principles.

For that purpose a few simple guidelines seem appropriate.

First of all, the recognition of diversity in environmental impacts and income levels leads to shifting the focus of the analysis from modulation within countries (as it is

[3] Buckwell, A. (1997)

designed now) to modulation among countries. Why should a country with highly intensive agricultural production, generating high levels of green house emissions and causing important damages in underground waters, be treated equally to another one where agricultural production has much lesser negative impacts on the environment?

If income support derives its legitimacy from society being willing to pay for the positive externalities farmers produce and cannot be accounted for by the market, and from a socially recognized need for income redistribution, why should countries where the average farmer's income is double the national average be awarded the same rate of support received by farmers in countries where their average income is half of the national average? The redistribution effects imbedded in the present design of DP may rightly be questioned.[4]

Last, but not the least, it seems difficult to accept DP to farmers independently of their economic performance. If no economic efficiency criteria are taken into account, then the allocation of resources has no support whatsoever on economic rationality.

Although debatable all these questions are worth consider in an alternative scheme for DP.

It looks then appropriate to make DP to farmers dependent on the following items:

- economic efficiency;
- level of environment damages;
- farmer's income.

The choice of quantitative variables that can best represent these items is of course highly dependent on data availability. But the desired behaviour of those variables can be anticipated.

It is not difficult to accept that the rate of support awarded must be growing with economic efficiency; declining with environment damages; and also declining with farmer's income, if redistributive effects are to be achieved. The rate of increasing or decreasing support can be assumed as constant, show either increasing or decreasing returns, or even both types of returns.

The last of these alternatives seems better suited to model the relationship between DP and the chosen variables. Simply decreasing or increasing rates of support would lead to extremely high benefits or costs to the extreme cases. For instance very high levels

[4] See again Henke, R. and R. Sardone (2003).

of income would be abnormally penalised with a constant decreasing rate of support. By the same token, with constant increasing support, low economic efficiency would determine drastic cuts for less efficient farmers which could prevent any kind of potential improvement.

Thus being a relationship that starts by increasing at an increasing rate and then becomes increasing at a decreasing rate seems appropriate to link economic efficiency and the rate of DP. On the other hand a relationship starting by decreasing at an increasing rate and then shifting to decreasing at a decreasing rate, can better link DP and environment damage. This type of relationship can be described by a well known functional form: the logistic function

$$y = \frac{\gamma}{1 + \beta e^{-\alpha x}}$$

As can be seen in Section A of the Appendix, the logistic curve fulfils the above mentioned requirements. In addition one can build a combination of two or more logistic curves, as it is also shown in Section A of the Appendix, and make the rate of DP dependent on more than one variable.

The logistic has yet other interesting properties. The parameter γ is the upper asymptote of the function, while the horizontal axe is the lower asymptote. This means that γ is the maximum value the function can reach. It is also easy to see that the intercept is equal to $\frac{\gamma}{1 + \beta}$.

How can we then use the logistic function to model the relationship between DP and economic and environmental variables?

First of all let us define the variables not in absolute terms but in terms of deviations from a given *norm* value. The *norm* can be any simple statistical indicator like the mean or the median values of the variables, or can be set by the policy decision makers as the *normal* value. This means that, for example, the income variable is measured as the deviation of the (average) farmer's income in each Member State from the average of the EU-15 Member States.

Secondly, direct payments are taken as percentages of the *fixed* DP. The *fixed* DP being defined by policy makers, as it was the case when Regulation n. 2237/2003 adopted the historic values of support received by each Member State as the basis for modulation. This means that the dependent variable of the model is the percentage of the *fixed* DP that each country should receive.[5]

Since variables are defined as deviations from the *norm*, and given the fact that the intercept of the logistic is equal to $\frac{\gamma}{1 + \beta}$, this intercept is the value of the dependent variable at the *norm* values of the explaining variable(s). Then, making the intercept equal to 1 (or 100%) means that, at the *norm* value(s) of the independent variable(s) the DP to be paid equals the *fixed* direct payment. From this it follows that

$$\frac{\gamma}{1 + \beta} = 1 \qquad \Rightarrow \qquad \gamma = 1 + \beta$$

This is the main constraint of the model that will be presented in the next section.

And what about other guidelines for defining the values of the parameters, γ, β and α.

Recalling that γ is the upper asymptote of the function, it follows that γ is the maximum percentage value the decision makers are willing to accept for DP. In other words, making γ = 1.25 means that direct payments can never exceed 125 percent of the *fixed* value. And the value of γ automatically determines β.

The parameter α determines the rate at which the function increases or decreases. Higher values of $|\alpha|$ correspond to faster rates (steeper curves) and lower values to slower ones. The parameter can then be changed to accommodate the rate decision makers see as more appropriate, or seen in another perspective, how sensitive DP should be to variations in the explaining variables.

[5] Section B of the Appendix illustrates this reasoning.

3. The model

The model is formulated as

$$DPR = \frac{\gamma_1}{1+\beta e^{-\alpha_1 s_x}} + \frac{\gamma_2}{1+\beta e^{-\alpha_2 s_y}} + \frac{\gamma_3}{1+\beta e^{-\alpha_3 s_z}}$$

with $\gamma_1, \gamma_2, \gamma_3, \beta, \alpha_1 > 0$ and $\alpha_2, \alpha_3 < 0$

$$\gamma_1 + \gamma_2 + \gamma_3 = 1 + \beta$$

and where

DPR = direct payment rate as percentage of the *fixed* DP

s_x = economic efficiency indicator deviations, defined as

$$s_x = \frac{x - x^*}{x^*}$$

x^* being the *norm* value of the economic efficiency indicator

s_y = green house gas emissions indicator deviations, defined as

$$s_y = \frac{y - y^*}{y^*}$$

y^* being the *norm* value of the green house gas emissions indicator

s_z = farmer's income indicator deviations defined as

$$s_z = \frac{z - z^*}{z^*}$$

z^* being the *norm* value of the farmer's income indicator

Within this framework we can get the amount of DP that should be assigned to each country as a function of its positioning relatively to the *norm* values. Some will get more than the *fixed* value and some will get less. Once these values are obtained a similar model can be used, to assign the DP within each country as a function of farmer's economic dimension if the Member State considers that an important element of the redistribution policy.

To implement the model it is then necessary to:

(i) choose the parameters values;

(ii) define the *norm* values for the variables;

(iii) establish the *fixed* DP.

For the tentative application whose results are presented in the next section we assumed that it would not be realistic to think that CAP decision makers would accept that either a member State or a farmer could ever receive more than 133 percent of the *fixed* DP. The values of γ_1 , γ_2 and γ_3 have then to add up to 4/3 and β results equal to 1/3. As to α, several values were tried when performing different simulations. Two alternative *norm* values were used in the experiment: the arithmetic mean and the median of the values observed for each country and indictor.

The direct payment was *fixed* for each country at the historical level according to Regulation n. 2237/2003.

4. Model results

Two sets of simulations were performed. In one the three variables model was used and in the other only two variables was used: economic efficiency and economic dimension; economic efficiency and GHG emissions; economic efficiency and farmer's income.

Two alternative measures were computed for the economic efficiency indicator: Total Standard Gross Margin/ Agricultural Area and Total Standard Gross Margin/ Agricultural Work Unit.

The GHG emissions were measured in tonnes of CO_2 per Economic Size Unit (ESU), for each country. The CO_2 level of emissions was the 1995-97 average as reported by the OECD.[6]

Farmer's income was taken from the Eurostat Database NewCronos and for each country the farmer's income indicator was computed as the ratio Total Farmer's Income/ Number of Farms.

Table 4.1 shows the complete description of the simulations performed. Simulations number 7 and 8 were performed with an alternative measure of farmer's income (entrepreneurial income) and since they gave very similar results to those of simulations 5 and 6 they are not presented here.[7]

As stated above different values of α were tried to get simulation results that could be compared with the direct payments scheme resulting from Regulation n. 2237/2003. In this context, by comparable we mean not radically different in terms of total volume of funds involved, otherwise they would not be at least potentially acceptable for decision makers. For the two variables version of the model we finally adopted $\alpha_1 = 0.3$ and $\alpha_2 = -0.6$. For the three variables version $\alpha_1 = 0.3$, $\alpha_2 = -0.3$ and $\alpha_3 = -0.55$.

The results of the exercise performed are showing in Tables 4.2.

The first impression one gets at looking at table is that results represent a fairly wide range of possibilities that look quite acceptable. The highest cut in DP takes place for Netherlands under simulation 2.2 and equals 20 percent of the *fixed* DP. On the other extreme the highest increase in DP refers also to the Netherlands under simulation 4.1 and points towards a 6 percent increase in DP. The 20 percent cut is a consequence of

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[6] OECD (2001)

[7] The complete set of results is available from the author upon request at fbsoares@fe.unl.pt

the very large economic dimension of Dutch farms, while the 6 percent cut derives from the high green gas emissions originated by Dutch agricultural production.

Going into a more careful analysis of Table 4.2 it becomes apparent that countries with highly intensive agricultural production, higher economic dimension of farms and higher farm incomes tend to be penalised, as it is the case of Belgium, Denmark, France, Luxembourg, Netherlands, and the United Kingdom. On the other hand countries with lower farming intensity, small farm size and income, like Greece, Ireland, Italy, Austria and Portugal and tend to be beneficiaries. Germany, Spain, Finland and Sweden remain more or less unaffected by this alternative scheme of computing direct payments to farmers.

Table 4.1 – Variables included in the simulations

Simulation number	*Norm* value of the indicator set as the:	
	Arithmetic mean	Median
1.1	EEA ; ED	
1.2		EEA ; ED
2.1	EEW ; ED	
2.2		EEW ; ED
3.1	EEA ; GHG	
3.2		EEA ; GHG
4.1	EEW ; GHG	
4.2		EEW ; GHG
5.1	EEA ; FI	
5.2		EEA ; FI
6.1	EEW ; FI	
6.2		EEW ; FI
9.1	EEA ; GHG ; FI	
9.2		EEA ; GHG ; FI
10.1	EEW ; GHG ; FI	
10.2		EEW ; GHG ; FI

Legend:

EEA = Economic Efficiency measured as

Total Standard Gross Margin / Agricultural Area

ED = Economic Dimension

EEW = Economic Efficiency measured as

Total Standard Gross Margin / Agricultural Work Unit

GHG = Green House Gas Emissions

FI = Farmer's Income

If we look further at the last four columns of the table, corresponding to simulations where the three variables – economic efficiency, green gas emissions and farmer's income – were present, the picture remains basically the same.

Table 4.2 – Values of Direct Payments Rates (DPR)

Country	Simulation number															
	1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	6.1	6.2	9.1	9.2	10.1	10.2
Belgium	0.98	0.97	0.98	0.95	1.02	1.03	1.02	1.01	0.93	0.99	0.93	0.96	0.93	0.96	0.93	0.95
Denmark	0.93	0.89	0.95	0.90	0.99	1.00	1.01	1.00	0.90	0.95	0.92	0.95	0.90	0.94	0.91	0.94
Germany	0.99	0.98	1.00	0.98	1.00	1.01	1.02	1.01	0.98	1.01	1.00	1.01	0.99	1.00	1.00	1.01
Greece	1.06	1.07	1.03	1.03	1.03	1.04	1.00	0.99	1.03	1.05	1.00	1.00	1.03	1.04	1.01	1.02
Spain	1.02	1.02	1.03	1.02	0.99	0.99	1.00	0.99	0.96	0.98	0.97	0.98	0.98	0.99	0.98	0.99
France	0.97	0.96	0.99	0.97	0.99	1.00	1.01	1.00	0.88	0.92	0.90	0.93	0.90	0.93	0.91	0.93
Ireland	1.01	1.01	1.01	1.00	0.92	0.91	0.93	0.91	0.96	0.99	0.97	0.98	0.96	0.97	0.96	0.97
Italy	1.05	1.06	1.03	1.02	1.03	1.04	1.00	1.00	1.03	1.05	1.01	1.02	1.04	1.05	1.03	1.03
Luxembourg	0.97	0.96	0.98	0.96	0.88	0.86	0.89	0.86	0.85	0.90	0.86	0.90	0.85	0.88	0.85	0.88
Netherlands	0.92	0.87	0.87	0.80	1.10	1.13	1.06	1.05	0.87	0.95	0.83	0.87	0.86	0.91	0.83	0.87
Austria	1.03	1.03	1.03	1.02	1.02	1.03	1.02	1.02	1.01	1.02	1.01	1.02	1.02	1.03	1.02	1.03
Portugal	1.04	1.04	1.02	1.02	1.01	1.01	0.99	0.99	1.03	1.04	1.01	1.02	1.04	1.04	1.03	1.03
Finland	1.01	1.01	1.01	0.99	1.02	1.02	1.02	1.01	0.99	1.01	0.99	1.00	1.00	1.01	1.00	1.01
Sweden	1.00	0.99	1.02	1.01	0.97	0.97	0.99	0.98	0.98	1.00	1.01	1.02	0.99	1.00	1.00	1.01
United Kingdom	0.93	0.90	0.96	0.92	0.97	0.97	1.00	0.99	0.93	0.96	0.95	0.98	0.94	0.96	0.95	0.97

Source: Model results

A clearer cut view of the results is obtained if we compare the *fixed* DPs with the values resulting from the model. For that purpose Table 4.3 was constructed.

Looking at the last row of the table it can be seen that simulations results vary from a decrease of 7.4 percent in total direct payments (simulation 10.1) to a situation in where total direct payments equal the historic level (simulation 2.1). There is thus a lot of room for decision makers choice.

For eleven of the fifteen countries we can find results corresponding to both increasing and decreasing DP. The most extreme case is Netherlands that in simulation 2.2 suffers a reduction of 20.2 percent in its historic DP, while in simulation 3.2 it experiences an increase of 12.6 percent. The explanation for such a high variance in results is rather simple. The Netherlands is an outlier in the distributions of the variables used. Thus Dutch deviations from the *norm* tend to be high and consequently DPR deviate more from the *status quo* value of one.

Italy and Austria end up by being always beneficiaries of higher DP, while Luxembourg and the United Kingdom are always confronted with smaller benefits. This does not mean however that Luxembourg would always receive less than they are allocated with Regulation n. 2237/2003. For example in simulation 1.1 Luxembourg would get less 2.7 percent in DP while under the Regulation it would see DP decline 3.7 percent. The same with the United Kingdom. Under simulation 3.2 the cut would be 3.0 percent while it reaches 4.2 percent under the Regulation.

As pointed out at the end of section 3, after the distribution of DP among countries is obtained each Member State can choose to perform further modulation or adopt a proportional distribution of costs or benefits among its farmers. If the country is receiving more than foreseen by the Regulation a proportional distribution seems fair inasmuch as there are no costs to be supported, only benefits. But if the country receives less, than it may make sense to apply modulation.

The rationale for this modulation is exactly the same as that adopted in Regulation n. 2237/2003: the burden should be bared by larger farmers. But in this case there is a small (big) difference. The scope of the exercise is not to further cut total farmer's payments but to redistribute the volume of funds allocated to the country. The appropriate variable to use for this purpose is economic dimension of farms whose distribution by size classes of dimension can be found in the NewCronos database.

Table 4.3 – Direct payments under Regulation n.2237/2003 and model simulations (Mio EUR)

Country	Regulation n. 2237/2003			Model simulations															
	Historic value	Value with modulation	Δ%	1.1		1.2		2.1		2.2		3.1		3.2		4.1		4.2	
				Value	Δ%	Value	Δ%	Value	Δ%	Value	Δ%	Value	Δ%	Value	Δ%	Value	Δ%	Value	Δ%
be	**503.8**	485.8	-3.6	495.6	-1.6	488.8	-3.0	495.2	-1.7	477.0	-5.3	514.6	2.1	521.3	3.5	514.3	2.1	509.5	1.1
dk	**996.9**	960.0	-3.7	923.5	-7.4	891.4	-10.6	944.8	-5.2	897.5	-10.0	987.5	-0.9	992.4	-0.5	1,008.9	1.2	998.6	0.2
de	**5,380.9**	5,178.5	-3.8	5,312.2	-1.3	5,260.6	-2.2	5,391.7	0.2	5,275.3	-2.0	5,391.3	0.2	5,418.5	0.7	5,470.9	1.7	5,433.2	1.0
gr	**1,936.8**	1,908.0	-1.5	2,047.4	5.7	2,075.4	7.2	1,991.5	2.8	1,986.8	2.6	1,987.0	2.6	2,008.4	3.7	1,931.0	-0.3	1,919.8	-0.9
es	**4,809.1**	4,662.1	-3.1	4,907.1	2.0	4,913.8	2.2	4,932.6	2.6	4,908.0	2.1	4,772.2	-0.8	4,771.6	-0.8	4,797.7	-0.2	4,765.8	-0.9
fr	**8,354.4**	8,024.6	-3.9	8,139.0	-2.6	8,018.4	-4.0	8,286.8	-0.8	8,080.8	-3.3	8,298.9	-0.7	8,320.3	-0.4	8,446.7	1.1	8,382.7	0.3
ie	**1,255.7**	1,218.1	-3.0	1,265.6	0.8	1,262.6	0.5	1,271.2	1.2	1,257.9	0.2	1,159.5	-7.7	1,145.2	-8.8	1,165.1	-7.2	1,140.5	-9.2
it	**3,910.5**	3,816.9	-2.4	4,103.9	4.9	4,150.9	6.1	4,020.9	2.8	4,006.8	2.5	4,012.0	2.6	4,053.2	3.6	3,929.0	0.5	3,909.1	0.0
lu	**29.5**	28.4	-3.7	28.7	-2.7	28.3	-4.2	29.0	-1.6	28.3	-4.1	25.9	-12.0	25.4	-13.8	26.3	-10.9	25.5	-13.7
nl	**705.5**	681.6	-3.4	645.7	-8.5	614.7	-12.9	613.7	-13.0	562.7	-20.2	777.5	10.2	794.6	12.6	745.5	5.7	742.6	5.3
at	**696.5**	681.6	-2.1	714.3	2.5	716.8	2.9	715.7	2.8	711.8	2.2	710.1	2.0	714.3	2.6	711.5	2.2	709.3	1.8
pt	**582.0**	571.0	-1.9	602.6	3.5	606.5	4.2	594.6	2.2	592.8	1.9	585.3	0.6	587.4	0.9	577.2	-0.8	573.7	-1.4
fi	**528.4**	515.4	-2.5	532.7	0.8	531.7	0.6	532.4	0.8	524.8	-0.7	537.6	1.7	541.6	2.5	537.2	1.7	534.7	1.2
se	**718.0**	693.1	-3.5	716.8	-0.2	712.6	-0.7	733.8	2.2	724.1	0.8	696.8	-3.0	694.7	-3.2	713.8	-0.6	706.2	-1.6
uk	**3,755.6**	3,596.8	-4.2	3,500.4	-6.8	3,386.7	-9.8	3,596.9	-4.2	3,452.6	-8.1	3,651.7	-2.8	3,643.2	-3.0	3,748.2	-0.2	3,709.2	-1.2
EU-15	**34,163.6**	33,021.9	-3.3	33,935.4	-0.7	33,659.0	-1.5	34,150.9	0.0	33,487.1	-2.0	34,107.8	-0.2	34,232.1	0.2	34,323.2	0.5	34,060.1	-0.3

Source: European Commission - Council Working Party, 2003 and model results

Table 4.3 (continued) – Direct payments under Regulation n.2237/2003 and model simulations (Mio EUR)

Country	Regulation n. 2237/2003			Model simulations															
	Historic value	Value with modulation	Δ%	5.1		5.2		6.1		6.2		9.1		9.2		10.1		10.2	
				Value	Δ%	Value	Δ%	Value	Δ%	Value	Δ%	Value	Δ%	Value	Δ%	Value	Δ%	Value	Δ%
be	**503.8**	485.8	-3.6	470.9	-6.5	497.1	-1.3	470.5	-6.6	485.3	-3.7	466.5	-7.4	483.7	-4.0	466.4	-7.4	477.8	-5.2
dk	**996.9**	960.0	-3.7	896.5	-10.1	942.2	-5.5	917.8	-7.9	948.4	-4.9	901.0	-9.6	932.3	-6.5	911.6	-8.6	935.4	-6.2
de	**5,380.9**	5,178.5	-3.8	5,285.1	-1.8	5,423.2	0.8	5,364.7	-0.3	5,437.9	1.1	5,319.8	-1.1	5,404.0	0.4	5,359.6	-0.4	5,411.4	0.6
gr	**1,936.8**	1,908.0	-1.5	1,987.3	2.6	2,033.3	5.0	1,931.3	-0.3	1,944.7	0.4	1,990.8	2.8	2,015.8	4.1	1,962.8	1.3	1,971.5	1.8
es	**4,809.1**	4,662.1	-3.1	4,639.5	-3.5	4,733.2	-1.6	4,665.0	-3.0	4,727.3	-1.7	4,718.9	-1.9	4,780.8	-0.6	4,731.6	-1.6	4,777.9	-0.6
fr	**8,354.4**	8,024.6	-3.9	7,371.3	-11.8	7,710.1	-7.7	7,519.1	-10.0	7,772.4	-7.0	7,512.6	-10.1	7,760.2	-7.1	7,586.5	-9.2	7,791.4	-6.7
ie	**1,255.7**	1,218.1	-3.0	1,210.9	-3.6	1,238.7	-1.4	1,216.5	-3.1	1,234.0	-1.7	1,207.0	-3.9	1,221.8	-2.7	1,209.8	-3.7	1,219.4	-2.9
it	**3,910.5**	3,816.9	-2.4	4,042.2	3.4	4,124.0	5.5	3,959.2	1.2	3,979.9	1.8	4,055.7	3.7	4,098.4	4.8	4,014.2	2.7	4,026.3	3.0
lu	**29.5**	28.4	-3.7	25.1	-14.8	26.5	-10.3	25.5	-13.7	26.5	-10.2	24.9	-15.5	25.8	-12.5	25.1	-14.9	25.8	-12.4
nl	**705.5**	681.6	-3.4	615.7	-12.7	668.5	-5.2	583.7	-17.3	616.5	-12.6	604.2	-14.4	642.6	-8.9	588.2	-16.6	616.6	-12.6
at	**696.5**	681.6	-2.1	701.0	0.7	712.4	2.3	702.4	0.9	707.4	1.6	711.9	2.2	718.6	3.2	712.6	2.3	716.1	2.8
pt	**582.0**	571.0	-1.9	598.6	2.9	606.0	4.1	590.6	1.5	592.4	1.8	604.7	3.9	608.1	4.5	600.6	3.2	601.3	3.3
fi	**528.4**	515.4	-2.5	520.9	-1.4	534.0	1.1	520.5	-1.5	527.0	-0.3	526.4	-0.4	534.6	1.2	526.2	-0.4	531.2	0.5
se	**718.0**	693.1	-3.5	706.7	-1.6	720.4	0.3	723.7	0.8	731.8	1.9	710.9	-1.0	718.6	0.1	719.4	0.2	724.3	0.9
uk	**3,755.6**	3,596.8	-4.2	3,488.0	-7.1	3,598.7	-4.2	3,584.6	-4.6	3,664.6	-2.4	3,528.0	-6.1	3,602.5	-4.1	3,576.3	-4.8	3,635.5	-3.2
EU-15	**34,163.6**	33,021.9	-3.3	32,559.7	-4.7	33,568.0	-1.7	32,775.1	-4.1	33,396.1	-2.2	32,883.3	-3.7	33,547.8	-1.8	32,991.1	-7.4	33,461.8	-2.1

Source: European Commission - Council Working Party, 2003 and model results

In this new context the model has to be applied in a way that the sum of the payments made to all size classes of economic dimension must add up to the total amount of funds allocated to the country.

In analytical terms this requirement may be written, for each country receiving less than the historic level, as

$$TDP = \sum_{i=1}^{n} \frac{\gamma}{1+\beta e^{-\alpha s_{di}}} \times ESU_i \times DPESU$$

where

TDP = Total Direct Payments to the country

i = class size of economic dimension

s_{di} = deviation of average dimension in class i from average dimension of all classes

ESU_i = economic dimension of class i

$DPESU$ = average DP (Total Direct Payment under Regulation n. 2237/2003 / Total Economic Dimension)

With given values for γ and β the equation can be solved for α and then the logistic function applied to compute *DPR* values for each of the n classes.

This computation was performed and, just for exemplification, selected results for Belgium are shown in Table 4.4.

According to Regulation n. 2237/2003 Belgium should receive 503.8 million euros as DP. This means that by each economic size unit Belgian farmers would receive on average 503,800,000 / 3,155,270 ESU = 159.67 euros/ESU. Then the 5,000 euros upper limit of exemption would correspond to 5,000 / 159.67 = 31.315 ESU of dimension. If we look at Table 4.4 we see that in our exercise cuts in direct payments take place only at the 40 - < 100 class and over. Thus the intention of exempting from cuts the smaller farmers, imbedded in the Regulation, is respected.[8] But the redistribution is made under assumptions of much more sound economic reasoning.

[8] This is also true for the other simulations performed.

Table 4.4 – Modulation within countries: Belgium with $\gamma = 4/3$ and $\beta = 1/3$

		Direct payments per size class of economic dimension (Mio EUR)							
		0 - < 2	2 - < 4	4 - < 8	8 - < 16	16 - < 40	40 - < 100	≥ 100	All classes
Average (00-02)	**Value**	**1.108**	**2.365**	**6.130**	**13.090**	**56.815**	**212.793**	**211.500**	**503.800**
Simulation 2.1	Value	1.120	2.388	6.186	13.189	56.999	211.186	204.198	495.266
α = -0.043707	Δ%	1.05	1.00	0.92	0.76	0.32	-0.76	-3.45	-1.69
Simulation 5.2	Value	1.117	2.384	6.175	13.169	56.961	211.520	205.743	497.068
α = -0.034684	Δ%	0.84	0.80	0.73	0.60	0.26	-0.60	-2.72	-1.34
Simulation 6.1	Value	1.149	2.448	6.330	13.443	57.477	206.842	182.904	470.593
α = -0.15881	Δ%	3.71	3.53	3.26	2.70	1.16	-2.80	-13.52	-6.59
Simulation 6.2	Value	1.132	2.414	6.247	13.297	57.200	209.385	195.616	485.292
α = -0.091955	Δ%	2.19	2.08	1.92	1.58	0.68	-1.60	-7.51	-3.67
Simulation 9.1	Value	1.154	2.457	6.351	13.481	57.549	206.165	179.423	466.579
α = -0.17638	Δ%	4.1	3.9	3.6	3.0	1.3	-3.1	-15.2	-7.4
Simulation 10.2	Value	1.141	2.432	6.290	13.373	57.343	208.081	189.176	477.836
α = -0.12641	Δ%	3.0	2.8	2.6	2.2	0.9	-2.2	-10.6	-5.2

Source: Model results

5. Concluding remarks

The alternative scheme that was presented is preferable to the simplistic view of Regulation n. 2237/2003 insofar as it takes into consideration factors like economic efficiency, environment impacts and farmer's income levels. But from an applicability point of view it involves some difficulties.

The variety of alternatives that can be presented to decision makers is simultaneously positive and negative. Positive because the room for choice is enlarged. But negative in the sense that the negotiation process may be more difficult. For politicians it is always easier to accept solutions where all countries loose or gain, than the ones that contemplate losers and gainers.

From a technical perspective the proposed scheme may also present additional problems. While for applying the Regulation it is enough to know how much a farmer got in the past, to apply within country modulation it is necessary to know the economic dimension of each farm in terms of ESU. It is not an insurmountable job but it requires some computation work.

In this proposal we did not contemplate the partial devolution of funds raised by modulation to the member states. This is one of the reasons why this is not a finished exercise. Moreover, if it was to be adopted, the scheme would require additional simulation work involving at least different values for the parameters of the model, to get a more comprehensive set of alternatives.

References.

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Henke, R. and R. Sardone (2003), The reorientation process of the CAP support: modulation of direct payments, *Working Paper n. 21, Roma, INEA*

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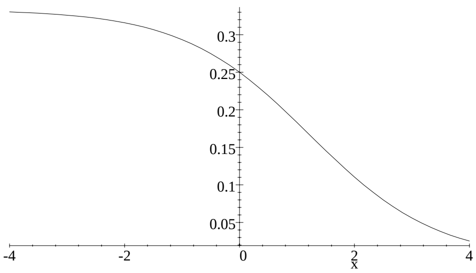
APPENDIX

A - Logistic function shapes

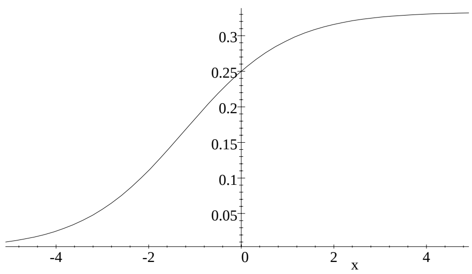
The logistic function can be written as

$$y \qquad \frac{}{1 \quad e^{-\quad x}}$$

where pararameters and are 0 and the parameter can be 0 or 0
If 0 , and for instance with $\frac{1}{3}$, $\frac{1}{3}$ and -0.9 the function assumes the shape



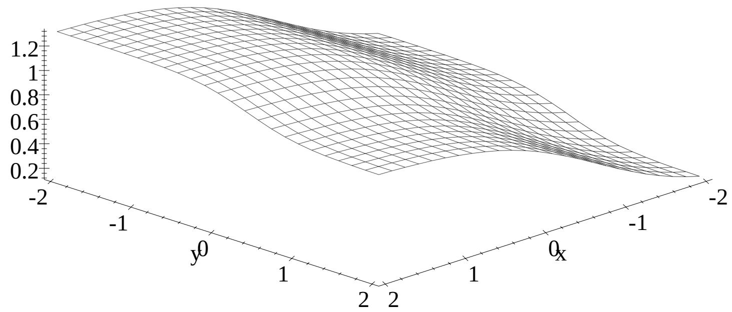
With the same values for and , and 0.9 the shape of the function is



One can combine two or more logistic functions and get for example

$$z \qquad \frac{1}{1 \quad e^{-\quad 1x}} \qquad \frac{2}{1 \quad e^{-\quad 2y}}$$

with $_1$ 1, $_2$ $\frac{1}{3}$, $\frac{1}{3}$, $_1$ 1.5 and $_2$ -3 the function assumes the shape



B - Model exemplification

Taking the variables in terms of their deviations to the *norm* the model can be written as (taking the same values for the parameters and two explaining variables)

$$DPR \quad \frac{1}{1 \quad e^{- \quad 1 s_x}} \quad \frac{2}{1 \quad e^{- \quad s_y}}$$

[B.1] For $s_x \quad 0$ and $s_y \quad 0$ (x and y at *norm* values)

$$DPR \quad \frac{1}{1 \quad \frac{1}{3} e^{-1.5 \quad 0}} \quad \frac{\frac{1}{3}}{1 \quad \frac{1}{3} e^{- \ -3 \quad 0}} \quad 1.0$$ DPR equals to the *fixed* value

[B.2] For $s_x \quad 0.25$ and $s_y \quad 0.25$ (x and y 25% above the *norm*)

$$DPR \quad \frac{1}{1 \quad \frac{1}{3} e^{-1.5 \quad 0.25}} \quad \frac{\frac{1}{3}}{1 \quad \frac{1}{3} e^{- \ -3 \quad 0.25}} \quad 1.009$$ DP ≈ 101% of the *fixed* value

[B.3] For $s_x \quad 0.5$ and $s_y \quad 0.5$ (x and y 50% above the *norm*)

$$DPR \quad \frac{1}{1 \quad \frac{1}{3} e^{-1.5 \quad 0.5}} \quad \frac{\frac{1}{3}}{1 \quad \frac{1}{3} e^{- \ -3 \quad 0.5}} \quad .99762$$ DP ≈ 98% of the *fixed* value

[B.4] For $s_x \quad -0.25$ and $s_y \quad -0.25$ (x and y 25% below the *norm*)

$$DPR \quad \frac{1}{1 \quad \frac{1}{3} e^{-1.5 \quad -0.25}} \quad \frac{\frac{1}{3}}{1 \quad \frac{1}{3} e^{- \ -3 \quad -0.25}} \quad .961$$ DP ≈ 96% of the *fixed* value

[B.5] For $s_x \quad -0.5$ and $s_y \quad -0.5$ (x and y 50% below the *norm*)

$$DPR \quad \frac{1}{1 \quad \frac{1}{3} e^{-1.5 \quad -0.5}} \quad \frac{\frac{1}{3}}{1 \quad \frac{1}{3} e^{- \ -3 \quad -0.5}} \quad .8965$$ DP ≈ 90% of the *fixed* value

[B.6] For $s_x \quad 0.5$ and $s_y \quad -0.5$ (x 50% above and y 50% below the *norm*

$$DPR \quad \frac{1}{1 \quad \frac{1}{3}e^{-1.5 \quad 0.5}} \quad \frac{\frac{1}{3}}{1 \quad \frac{1}{3}e^{- \; -3 \quad -0.5}} \quad 1.1742$$ DP ≈ 117% of the *fixed* value

[B.7] For s_x -0.5 and s_y 0.5 (x 50% below and y 50% above the *norm*

$$DPR \quad \frac{1}{1 \quad \frac{1}{3}e^{-1.5 \quad -0.5}} \quad \frac{\frac{1}{3}}{1 \quad \frac{1}{3}e^{- \; -3 \quad 0.5}} \quad .71994$$ DP ≈ 72% of the *fixed* value