The impact of subsidies on the agricultural sector: A linear programming approach to Portuguese farming

Author:

Vítor João Pereira Domingues Martinho (vdmartinho@esav.ipv.pt)

Agricultural School, Polytechnic Institute of Viseu, 3500 Viseu, Portugal

Abstract

Since the adhesion to the European Economic Community (EEC), in 1986, Portugal has benefited from several forms of financial support, in the context of Common Agricultural Policy (CAP), towards the farmers' income and the farms' structure. The framework for these income subsidies has changed from that time until now, namely, because of the CAP reforms in 1992, 2000, 2003 (with its application since 2005), 2007 (less importantly) and 2013, and the structural subsidies experienced transformations in 1994, 2000, 2007 and 2014. In this context, the principal objective of this study is to analyze the implications of the various subsidies, within the Portuguese agricultural sector, that came as a consequence of the adhesion to the ECC and of several farming policy reforms after that date, with data obtained from the FADN (2014) and through a model of linear programming solved with the LINGO (2015) optimization software. This study is an interesting contribution to scientific literature and for the agricultural policy makers and designers. There are no existing studies, considering the literature consulted, covering these subjects for Portugal and using the linear programming with this statistical information. The linear programming has some advantages, because it allows for optimal analysis and obtains exact results. This is a first approach with these methodologies and data.

Keywords: Portuguese agricultural sector; Agricultural policies; Subsidies; Linear programming.

Jel codes: O13; Q18; C61.

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1. Introduction

In the mid-eighties (1986) Portugal adhered to the European Economic Community with great implications upon the Portuguese across several economic sectors.

The agricultural sector benefited, more or less, from a transitional period for adaptation to the EEC rules and dynamics, considering the assumptions of this adherence, namely those related with the free trade among the Member States. In this context, Portugal did not benefit from some Common Agricultural Policy instruments applied to the European farming sectors, namely those related to the markets and prices, until the first great CAP reform of 1992.

With the first reform of 1992 there were significant changes, namely, with the de-coupling of the CAP income subsidies from production (Martinho, 2015a). The reform of 1999 reinforced the

tendencies of the first reform and the reform of 2003 to bring new significant changes with the total de-coupling of the CAP income subsidies from production and from farming activities. In 2007 the unique Common Market Organization for agricultural products was created.

The structural policies for agriculture changed, after the adherence of Portugal, in 1994 (first Common Support Framework), in 2000 (second Common Support Framework), in 2007 (National Strategic Reference Framework) and in 2014 (Portugal 2020).

In this context it seems interesting to analyze the implications of these several transformations in the Portuguese farming sector, not only as an important contribution to scientific literature, considering the adequacy of the study, as well for the Portuguese and European Union policy makers and designers. The agriculture is an important economic sector with significant direct and indirect impacts on the socioeconomic framework (Martinho, 2015b).

This study is, also, an interesting contribution, due to the consideration of the linear programming as a method of analysis. The linear programming models have the advantage of allowing for optimal and exact results.

In this way, the objective of this study is to analyze, through models of linear programming, the consequences in agriculture of the income and structural subsidies which came to Portugal after the adherence to, what was once referred to as, , the EEC and after the several changes in the income and structural agricultural policies, with statistical information available from 1989 until 2009 (the largest time series accessible), in the FADN (2014) and using the optimization software LINGO (2015).

2. Background literature

Sometimes the agricultural subsidies, namely those related with international trade practiced in the United States and in the European Union can cause economic distortions in international relationships (Bruno et al., 2012). In fact, these two economies are those which suffer more pressures in the context of the World Trade Organization, from subsidies on agriculture (Bruno et al., 2014).

The agricultural subsidies, indeed, aim to stabilize the relationships between the demand and the supply in food markets, ensuring prices are accessible to consumers and incomes are reasonable for farmers whilst aiming to improve the structure of farms. However, these financial supports have various adverse consequences, depending on the contexts, such as health, environment and food security, which happened in China after 1997 with the agricultural subsidies being introduced to reduce the problems related with the lack of food in the agricultural markets (Zhao et al., 2014).

In a different context, farming subsidies have also had negative consequences upon the health of the United States' population, increasing the problems of obesity (Franck et al., 2013). The adverse impacts of subsidies on local biodiversity, in some regions, is real and significant, claiming for more adjusted policies, oriented towards the local realities, rather than for the national or regional conditions (Gottschalk et al., 2007).

On the other hand, in certain circumstances, the subsidies can be economically inefficient, because they induce the farmers to opt for production which may be less profitable, stimulating productions which were previously not considered (Střeleček et al., 2009). In the South of Portugal, among the crop prices, availability of water, farmers' vocational training and the market structures, the subsidies influence the farms performance (Silva et al., 2001). In other cases, they promote structural changes, such as those verified in Slovenia, where the number

of medium-size farms has been decreasing because they are too big to receive sufficient subsidies and too small to be economically efficient (Bojnec and Latruffe, 2013). In Northeast Portugal, over the last three decades, the annual crop productions decreased, as a consequence of various factors, but also because of the farming policies designed into the framework of the Common Agricultural Policy (Pôças et al, 2011). Structural changes were also observed, in the last decade, for the Southern region of Portugal, with several structural changes, where the decoupled subsidies held some responsibilities (Ribeiro et al., 2014). Similar structural transformations were verified for the Central and Alentejo regions of Portugal, over the last 20 years, where there was some transition to livestock production (Jones et al., 2014).

Another important question is relation of subsidies with employment. The impact on the labor market, considering the existing literature, are not consensual (Pandit et al, 2013). The subsidies for agriculture may be, also, socially unjust, because they favor the larger farmers in detriment to smaller ones, in this way some efficient redistribution is needed (Cong and Brady, 2012). The farming policies, in some contexts, have significant implications toward farmers' debts, for example, Ciaian et al. (2012) found that the subsidies increase the long-term credits in the larger farms and the short-term credits in smaller farms.

However, the farming sector has many particularities and requires for planned interventions at the structural and farmers' income level. For example, the prices in the farming sector are often subject to some volatility during the year and among different years, which can bring about some undesirable implications to the consumers and to the farmers, but frequently the main negative consequences are for the agricultural producers. In this way, there are several farming strategies, in different countries, to deal with these situations, such as price subsidies and product purchases (Severová et al., 2012; Chen et al., 2014).

The need for planned interventions, by public institutions, and the implementation of adjusted policies are higher in disadvantaged or mountain zones, where problems with the food markets' supply are far greater and the complications for the local population without the convenient attention can be serious (Dame and Nüsser, 2011). The importance of the agricultural subsidies are, too, referred to by Czech farmers which indicates positive improvements after the adherence of this country to the European Union in 2004, with the adoption of the Common Agricultural Policy (Špička et al., 2009; Lapka et al., 2011). In a similar way, the strategies and the subsidies associated with crop insurance help the farmers in their decisions and can improve agricultural output growth and the profitability of the farmers (Jing-feng and Pu, 2014). Nowadays, a growing problem is the asymmetry between the rural and the urban, between the peripheral and the core zones and between the coastal and the interior regions. A big challenge has been to counteract this tendency, namely for public policies. Some studies show that, indeed, the recent subsidies for agriculture reduced the agglomeration of economic activity in the more populated cities (Daniel and Kilkenny, 2009). The majority of olive-growing farms in the south of Spain are not viable without the national and European subsidies, which clearly explains the importance of agricultural subsidies for the continuation of farms in some countries and in certain regions (Amores and Contreras, 2009). The olive production was also studied by Graaff et al. (2008) and Stroosnijder et al. (2008), in the context of the European Union, which highlights some scenarios for the future of these activities in Mediterranean countries and by Fleskens and Graaff (2010), in the Portuguese context. Gomez et al. (2008) found that organic olive production, namely in mountain zones, has low profitability in Mediterranean countries and its sustainability depends on substantial levels of financial support.

The farming policies implementation and subsidies management are not easy tasks for the different governments and public institutions. To diminish these difficulties several software tools have been developed, some based on the recent evolution within the framework of the information communication technologies (Zadravec and Zalik, 2009).

The perception of the farmers about the level of subsidies that they receive is not always real, namely concerned with indirect financial support (Daugbjerg et al., 2005), which can bias the decisions and options of farmers. Indeed, these questions related to the agricultural sector are complex and need resilient approaches.

Legg (2003) presented in these fields an interesting address and some ideas for the international debate about the farming policies and concerning the interrelated and derived subsidies for agriculture.

3. Data used

In the following tables the statistical information obtained from the FADN (2014) for the Portuguese context is presented, for the period 1989-2009 (the largest period available in the database considered).

Table 1. Economic size and labour (AWU and hours)

Year	Economic size (ESU)	Total labour input (AWU)	Labour input (hours)	Unpaid labour input (AWU)	Paid labour input (AWU)	Paid labour Input (hours)	Unpaid labour input (hours)
1989-1993	6,0	1,6	3866,2	1,3	0,3	679,0	3187,3
1994-1999	7,2	1,4	3393,9	1,2	0,2	501,6	2892,3
2000-2007	11,0	1,5	3302,4	1,2	0,2	543,2	2759,3
2007-2009	12,7	1,6	2992,4	1,3	0,3	478,7	2513,7

The period considered was divided into four sub-periods, considering the dates related with the most determinant CAP reforms and with the structural subsidy changes, and averages for each sub-period were calculated. Indeed, in 1992 the first CAP reform occurred and in 1994 an important change to the structural funds after the adhesion of Portugal to the European Economic Community/European Union also occurred. In 2000 another transformation was verified, as well as in 2007.

Table 1 shows that the economic size of farms in Portugal increased along the sub-periods considered, from 6.0 ESU (European Size Units) in the first sub-period to 12,7 in 2007-2009. Bothpaid and unpaid labour, expressed in hours, decreased significantly across the period, which is not verified by the labour expressed in AWU, because of the changes verified in the form of calculation for this unit from 1989 until 2009. The paid is around 20% of the total labour, which is demonstrative of the unpaid, or family, labour in farms.

Table 2 proves the farms' specialization in livestock production, namely after the year 2000, changing from 5,6 LU in the first sub-period to 12,9 in the last set of years. This specialization is evidenced by the number of LU, that indeed increased, but also by the stocking density, that is unchangeable over the period, which means that some farms changed their structure from crop to livestock production. The other livestock production that increased the most was that for cows, from 1,8 in 1989-1993 to 5,3 in 2007-2009.

Table 2. Livestock production (LU)

Year	Total livestock units	Dairy cows	Other cattle	Sheep and goats	Pigs	Poultry	Stocking density (LU/ha)	Milk yield (Kg/cow)
1989-1993	5,6	1,0	1,8	1,1	1,0	0,4	0,6	4086,8
1994-1999	5,7	1,0	2,0	1,1	1,1	0,4	0,6	4979,9
2000-2007	9,8	1,6	3,7	2,0	1,9	0,3	0,7	6007,1
2007-2009	12,9	2,0	5,3	2,6	1,9	0,8	0,6	6761,5

Some agricultural economic results have increased significantly from 1989 until 2009, as the gross farm income (increased about 3,1 times), the farm net value added (augmented around 3,3 times) and the farm net income (about 3.6 times more). Work productivity increased, too, expressively (table 3).

The average capital increase, from the eighties until 2009, was around 100%, the gross investment augmented about 50% and the cash flows improved significantly. However, the net investment decreased drastically, signaling that the investment was made with capital subject to a rapid and vast depreciation (table 4).

Table 3. Farm economic results (euro)

Year	Gross Farm Income	Farm Net Value Added	Farm Net Income	Farm Net Value Added / AWU	Farm Net Income / FWU
1989-1993	5043,4	3674,8	2773,4	2262,8	2071,6
1994-1999	6154,5	4262,2	3174,7	3034,0	2650,8
2000-2007	11384,9	8276,7	6463,6	5577,1	5230,0
2007-2009	15751,0	12269,0	9914,3	7883,0	7582,0

Table 4. Investments and cash flows (euro)

Year	Average farm capital	Gross Investment	Net Investment	Cash Flow *	Cash Flow **
1989-1993	25745,6	2250,0	881,4	3115,6	859,2
1994-1999	25947,5	2180,0	287,3	4095,2	2063,5
2000-2007	40775,1	2719,4	-388,6	8897,7	6235,9
2007-2009	50433,7	3492,7	10,7	12970,7	9052,0

*Not taking into account operations on capital; ** Taking into account all operations in farms.

The total utilized agricultural area (table 5) increased significantly from 11,9 to 26,1 ha, as well the rented area (from 4,1 to 8,2 ha, double), namely because the increase in the area used for forage crops (from 3,3 to 11,8 ha). This confirms the conversion of farms from crop production to livestock activities.

Table 6 confirms this tendency (forage crops production increased from 480,6 euro in the first sub-period to 1618,7 in the last sub-period). However, this table also shows other tendencies, such as the increase in production, in euros, of industrial crops, vegetables and flowers and fruits. Maybe the total de-coupling of the subsidies implemented after the CAP reform of 2003 has had some influence here, correcting some problems related with some CAP technical inefficiency.

Indeed, the total livestock output changed to the double from the second for the third sub-period, with increases in almost all livestock production (table 7). However, the livestock value changed negatively over the last two sub-periods, maybe due to some rises verified in supply.

Table 8 shows that the costs for the inputs increased significantly, namely after the year 2000, representing 7633,2 euro in 1989-1993, 15293,1 in 2000-2006 and 19675,3 in 2007-2009. The large part of these costs is represented by intermediate consumption and about half are relative to specific costs. In stressing the increases in the costs for fertilizers (481,4 in the first sub-period to 1285,7 euro in the last period) and crop protection (from 242,4 to 816,3 euro), the specific costs for forestry augmented expressively in the last period.

Table 9 corroborates the tendency verified in table 8, referring to, therefore, the significant rises, over the whole period, in energy consumption and in depreciation (increased about 2,5 times and the gross investment around 1,6 times-table 4). On the other hand, the interest paid decreases.

Portuguese farms have invested over the last two decades in land, permanent crops, buildings, machinery and breeding livestock, but namely in the first two fixed assets (table 10). Farms increased their liabilities, namely through greater increases in short-term loans, but the net worth also augmented, which means that the increase in total assets exceeded the rise in liabilities.

The total subsidies, excluding investment, rise expressively after the third sub-period, from 415,4 euro in 1989-1993 to 3871,1 in the third sub-period and 5659,7 euro in 2007-2009 (table 11), namely because of the significant rise in the total of subsidies for livestock (cattle), environmental subsidies, LFA subsidies, total support for rural development and decoupled subsidies (table 11 and 12).

The subsidies on investments changed from 574,8 euro in the first sub-period, to 391,7 in 1994-1999, to 501,1 in 2000-2006 and to 295,7 in the last sub-period. In fact, the changes in the subsidies are significant, but follow some tendency of decline (table 12).

The total de-coupling of subsidies introduced with the CAP reform of 2003, seems to bring significant structural changes in Portuguese farms, specifically with transitions from crop productions to livestock activities and to Mediterranean crop productions that traditionally were not chosen, because they did not receive subsidies (namely after the CAP reform of 1992), such as fruit, vegetables and flowers.

Another important finding is that the agricultural output appears to increase in Portugal, with relevant rises in the utilization of fertilizers and crop protection products, which may be an unexpected practice with less desirable implications on the environment and in farming sustainability.

Table 5. Crop productions (ha)

Year	Total Utilised Agricultural Area	Rented U.A.A.	Cereals	Other field crops	Energy crops	Vegetables and flowers	Vineyards	Permanent crops	Olive groves	Orchards	Other permanent crops	Forage crops	Agricultural fallows	Set aside	Total agricultural area out of production	Woodland area
1989-1993	11,9	4,1	2,1	0,4	0,0	0,1	0,7	1,4	0,9	0,5	0,0	3,3	4,0	0,0	4,0	4,1
1994-1999	12,3	3,8	1,8	0,5	0,0	0,1	1,0	1,3	0,8	0,5	0,0	4,0	3,5	0,1	3,6	4,0
2000-2007	19,4	6,3	2,3	0,5	0,0	0,3	1,1	2,1	1,4	0,7	0,0	7,2	5,8	0,2	6,0	4,1
2007-2009	26,1	8,2	2,3	0,5	0,0	0,4	1,2	2,9	2,0	0,9	0,0	11,8	6,8	0,0	7,0	3,3

Table 6. Crop productions (euro)

Year	Total output	Total output crops & crop production	Total crops output / ha	Cereals	Protein crops	Energy crops	Potatoes	Sugar beet	Oil-seed crops	Industrial crops	Vegetables & flowers	Fruit	Citrus fruit	Wine and grapes	Olives & olive oil	Forage crops	Other crop output
1989-1993	9572,4	5490,0	692,8	1254,2	31,6	0,0	363,4	0,0	37,6	64,0	599,0	487,0	118,4	1371,0	300,6	480,6	381,0
1994-1999	10226,3	6124,8	708,0	875,7	30,5	0,0	491,2	18,7	22,5	30,5	959,5	498,0	107,8	1868,0	322,8	597,5	302,7
2000-2007	17643,0	9725,9	732,6	878,4	24,0	0,0	624,0	133,3	12,6	87,3	1966,1	814,7	269,3	2966,6	576,0	1018,1	355,0
2007-2009	23951,0	13203,0	692,3	1218,3	20,7	9,0	727,7	38,7	38,0	210,3	3357,7	1539,0	392,7	2841,7	996,3	1618,7	204,0

Table 7. Livestock productions (euro)

Year	Total output livestock & livestock products	Total livestock output / LU	Change in value of livestock	Cows' milk & milk products	Beef and veal	Pigmeat	Sheep and goats	Poultrymeat	Eggs	Ewes' and goats' milk	Other livestock & products
1989-1993	3769,0	668,8	76,4	1220,6	912,2	793,6	261,4	280,2	89,0	118,8	93,4
1994-1999	3450,5	600,7	82,3	1327,2	761,2	661,3	240,2	143,2	58,0	139,7	120,5
2000-2007	6961,4	702,3	-85,1	2834,0	1369,7	1639,7	516,3	157,3	5,0	338,7	100,7
2007-2009	9606,0	741,3	-162,7	4304,0	1841,0	1651,7	682,7	162,3	256,7	491,0	217,3

Table 8. Crop, livestock and forestry productions inputs (euro)

Year	Total Inputs	Total intermediate consumption	Total specific costs	Specific crop costs / ha	Seeds and plants	Seeds and plants home-grown	Fertilisers	Crop protection	Other crop specific costs	Specific livestock costs / LU	Feed for grazing livestock	Feed for grazing livestock home-grown	Feed for pigs & poultry	Feed for pigs & poultry home-grown	Other livestock specific costs	Forestry specific costs
1989 - 1993	7633,2	4854,0	3440,8	100,4	376,0	93,6	481,4	242,4	101,4	400,6	1310,6	547,4	803,2	27,8	122,4	3,4
1994 - 1999	9001,8	5656,0	3741,2	119,2	412,3	88,8	509,3	359,2	185,8	394,5	1413,8	604,0	628,2	19,2	211,8	20,2
2000 - 2007	15293,1	9912,6	6699,6	129,3	656,1	105,4	833,0	576,9	453,3	420,9	2566,7	1009,3	1052,9	26,3	536,0	25,6
2007 - 2009	19675,3	13582,3	9615,3	147,0	984,0	185,3	1285,7	816,3	743,3	440,7	3649,0	1267,0	1313,7	16,0	729,7	93,7

Table 9. Other inputs (euro)

Year	Total farming overheads	Machinery & building current costs	Energy	Contract work	Other direct inputs	Depreciation	Total external factors	Wages paid	Rent paid	Interest paid	Taxes
1989-1993	1413,2	346,4	560,4	244,4	262,2	1368,6	1410,8	989,6	214,8	206,6	19,0
1994-1999	1915,0	496,0	700,5	262,2	456,3	1892,5	1453,3	1085,5	223,0	144,8	23,2
2000-2007	3213,0	857,9	1132,9	470,3	752,0	3108,0	2272,6	1775,1	369,9	127,7	71,0
2007-2009	3967,3	972,3	1711,0	542,7	742,0	3481,7	2611,0	1894,3	540,7	176,0	109,3

Table 10. Some accounting indicators (euro)

Year	Total assets	Total fixed assets	Land, permanent crops & quotas	Buildings	Machinery	Breeding livestock	Total current assets	Non-breeding livestock	Stock of agricultural products	Other circulating capital	Total liabilities	Long & medium-term loans	Short-term loans	Net worth
1989-1993	52154,2	46730,4	30672,4	6577,6	7115,8	2364,4	5424,0	1629,8	1350,6	2443,6	1479,4	1091,0	388,2	50674,8
1994-1999	49146,8	43364,3	27524,8	6214,7	7414,3	2210,3	5782,7	1406,5	1642,3	2733,5	1543,7	958,3	585,0	47603,2
2000-2007	68011,9	58089,6	34765,9	8348,0	11074,1	3902,0	9922,1	2137,6	1985,7	5799,0	2469,0	1301,0	1168,1	65542,9
2007-2009	87975,3	75045,0	46601,7	10738,7	12012,7	5691,3	12930,3	2820,0	2695,3	7415,7	3075,3	1752,7	1323,0	84900,3

Table 11. Crop and livestock productions subsidies (euro)

Year	Total subsidies - excluding on investments	Total subsidies on crops	Compensatory payments/area payments	Set aside premiums	Other crops subsidies	Total subsidies on livestock	Subsidies dairying	Subsidies other cattle	Subsidies sheep & goats	Other livestock subsidies	Environmental subsidies	LFA subsidies	Total support for rural development	Other rural development payments
1989-1993	415,4	121,4	0,0	0,0	121,4	183,6	9,8	58,4	110,8	4,2	0,0	0,0	0,0	0,0
1994-1999	1694,2	742,0	385,8	28,8	327,0	473,3	73,3	201,0	148,8	49,8	208,3	0,0	208,3	0,0
2000-2007	3871,1	1185,6	497,7	27,4	660,4	1064,3	160,0	656,4	246,9	0,6	505,0	499,4	1024,6	19,7
2007-2009	5659,7	513,7	15,3	0,0	498,3	1186,0	210,3	758,7	215,7	1,3	487,7	785,7	1405,3	132,3

Table 12. Other subsidies (euro)

Year	Subsidies on intermediate consumption	Subsidies on external factors	Decoupled payments	Single Farm payment	Additional aid	Balance subsidies & taxes on investments	Subsidies on investments	Payments to dairy outgoers
1989-1993	110,2	0,2	0,0	0,0	0,0	509,6	574,8	0,0
1994-1999	10,8	2,3	0,0	0,0	0,0	365,8	391,7	8,0
2000-2007	33,7	3,0	525,1	510,6	14,6	459,6	501,1	11,6
2007-2009	1,0	0,0	2544,7	2490,3	54,0	255,7	295,7	0,0

4. The model considered

The results presented in the following table (section 5) were obtained for each one sub-period considered, over the period 1989-2009, through the optimization software LINGO (2015), considering a model of linear programming. This methodology was used in some recent analysis such as those presented in Dantzig (2002). These models of linear programming have two parts, the objective function that aims to be optimized (maximized in this study) and a set of constraints to adjust the models to each context. The model used may be described as following:

Max Z=o1x1-c1x1+o2x2-c2x2 (Objective function)

Subject to

a11x1<=b1 (Constraint to crop subsidies)

a21x2<=b2 (Constraint to livestock subsidies)

a31x1+a32x2<=b3 (Constraint to total subsidies excluding investments)

a41x1+a42x2<=b4 (Constraint to total subsidies on investments)

x1<=b5 (Constraint to the area)

x2<=b6 (Constraint for the livestock units)

Where the x1 represents crop production in ha, the x2 the livestock activities in LU, the o1 crop output per ha, o2 livestock output per ha, c1 crop specific costs per ha and c2 livestock specific costs per LU. The letters a represent the needs, per respective unit, in each constraint for the crop and livestock activities and the letters b are the availabilities.

5. The results obtained

Table 13 demonstrates that the gross margin increased from the first sub-period (7055,1 euro) to the last sub-period (14215,7 euro) and that the crop productions are more profitable than livestock activities. Only in the third sub-period (2000-2006) were the livestock productions considered with some dimension (3,7 LU).

Table 13. Results obtained with the linear programming models

	Sub-period 1989-1993	
Variable	Value	Reduced Cost
X1	11,9	0,0
X2	0,0	0,0
Row	Slack or Surplus	Dual Price
1	7055,1	1,0
2	0,0	45,8
3	183,1	0,0
4	0,0	3,6
5	0,6	0,0
6	0,1	0,0
7	5,6	0,0
	Sub-period 1994-1999	
Variable	Value	Reduced Cost
X1	12,3	0,0
X2	0,0	0,0
Row	Slack or Surplus	Dual Price
1	7243,9	1,0
2	1,5	0,0
3	472,6	0,0
4	0,5	0,0
5	0,0	3,0
6	0,0	493,5
7	5,7	0,0
	Sub-period 2000-2006	
Variable	Value	Reduced Cost
X1	12,2	0,0
X2	3,7	0,0
Row	Slack or Surplus	Dual Price
1	8365,8	1,0
2	0,0	7,6
3	788,1	0,0
4	2,1	0,0
5	0,0	5,5
6	7,2	0,0
7	6,1	0,0
	Sub-period 2007-2009	
Variable	Value	Reduced Cost
X1	26,1	0,0
X2	0,0	800,5
Row	Slack or Surplus	Dual Price
1	14215,7	1,0
2	0,1	0,0
3	1186,0	0,0
4	0,0	2,5
5	1,1	0,0
6	0,0	0,0
7	12,9	0,0

From 2007 to 2009 the marginal costs for livestock production were about 800,5 euro, the worst period in terms of reduced costs for animal activities.

In the first sub-period (1989-1993) the Portuguese farms could have increased the gross margin in 45,8 euro per each additional euro in crop subsidies and 3,6 euro in any extra euro in the total subsidies excluding investments.

In the years of 1994-1999 the increases in the gross margin for any additional euro could have been of 3,0 euro for the subsidies on investments and 493,5 euro for any extra ha.

Any extra euro in crop production subsidies and subsidies on investments could have improved the Portuguese farms gross margins by 7,6 and 5,5 euro, respectively, in the third sub-period. In the last period, the total subsidies were excluding the investments that could have provided some improvements in the gross margin per additional euro (2,5 euro).

This is an approach for these issues, considering the data available in the FADN (2014), that could be improved in the future with more disaggregation in the statistical information.

6. Conclusion

The study presented here, for the period 1989-2009, is intended to be an interesting contribution to the international scientific community and more of a base or study to support the policymakers in designing adjusted agricultural policies for the objectives of each country and region.

The literature review reveals that the several concerns related to farming policies are not unanimous and generate some controversy. Considering the particularities of agriculture, the various public interventions in the sector, in terms of market and price and in terms of structures are needed, but sometimes there are undesirable implications (in the environment, sustainability, markets and structures, for example), namely when the policies are implemented in a similar way across all realities, as happened with the Common Agricultural Policy that is applied with similar rules for all countries in the European Union.

With the data analysis it was possible to observe that there were significant structural transformations in Portuguese farms, namely after the years 2000-2006, with some transitions to livestock production and Mediterranean crop production, such as vegetables, flowers and fruit. These evolutions from 1989 until 2009 were accompanied with improvements in the farming economic results, in total assets and in the net worth. However, there are other consequences, such as the increase in the use of fertilizers and crop protection products, as a reduction in the net investment.

The results confirm, in an optimized way, improvements in farming economic results from 1989 until 2009, but show that crop production continues to be the more profitable agricultural activity in the Portuguese context, where the farms have, on average, small dimensions. On the other hand, all the subsidies are an important complement to the income of Portuguese farmers.

The recent agricultural policies in Portugal, namely those related to the total de-coupling of subsidies (single farm payment) that come from the Common Agricultural Policy and which have been implemented since 2005, after the CAP reform of 2003, seem to promote increases in agricultural output (in line with the findings of Martinho, 2015a), specifically through livestock activities and Mediterranean crop production, increasing the use of fertilizers and crop protection. However, crop production, in Portugal, continues to be the most profitable activity.

In future research it will be important to analyze the implications of these subsidies on the environment and on Portuguese agricultural sustainability. It will be important to analyze the questions related to the reduction in net investment.

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