A Work Project, presented as part of the requirements for the Award of a Master Degree in Finance from the NOVA – School of Business and Economics.

Risk management Tools in the context of Common Agriculture Policy- Dairy Market

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4th January 2018

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Abbreviation List

CAP - Common Agriculture Policy

CBT -Chicago Board of Trade

CMO - Common organisation of the markets

EAFRD - European Agricultural Fund for Rural Development

ECSC - European Coal and Steel Community

EU - European Union

GATT - General Agreement on Tariffs and Trade

GHG - Greenhouse gas emissions

LAG - Local Action Group

LEADER - *Liaison Entre Actions de Développement de l'Économique Rurale*

MGQs - Maximum Guaranteed Quantities

MS - Member State

OECD - Organisation for Economic Co-operation and Development

RDPs - Rural Development Programmes

SAP - Single Area Payment

SFP - Single Farm Payment

SMP - Skim Milk Powder

UNEP - United Nations Environment Program

WHO - Word Health Organization

WMO - World Meteorological Organization

WWF - World Wildlife Fund

Abstract

This essay provides an introductory approach concerning environmental and consequently the agricultural risks faced currently, it also discusses the main causes, present consequences and also the tendencies for the future risks. It addresses the Common Agriculture Policy (CAP) history and its instruments. It also describes the current risk management tools under CAP to deal with risks possessed and its past implementation in dairy market (2014-2016). Lastly, it studies the potential effectiveness of such policies, a regression analysis was conducted wherein the dairy market prices were regressed by various variables (risk management tools) to determine if risk management tools had any influence on the prices.

Introduction

Having done a Research Internship at European Court of Auditors, I had the opportunity to work with Risk Management tools of the Common Agriculture Policy.

In this essay, I will approach the current environmental challenges triggered by climate change that have drastic consequences. I have focused specifically on agriculture.

After which I have put forth the discussions on risk, its origins and how they affect agriculture in general and the current strategies taken up by the European Union to mitigate the risks at either farmer level or at the level of the Member States.

I go on to briefly analyse the history of CAP, its most remarkable reforms and its current instruments under Pillar I and Pillar II. It carries a lot of importance at the EU since it takes up 45% of EU budget.

Subsequently I have analysed the Dairy market, the history of milk quotas and on the milk quotas abolition that happened in 2015. I have also discussed as to how the

Russian ban on the EU products that affected the prices and also how China's decrease of demand in 2014 affects the prices of the Whole Milk Powder.

Regarding the methodology of the study I studied the effect of risk management tools of the CAP in order to mitigate market disruptions caused by various factors in the dairy sector. The Dairy market risks are mitigated at the farmer level with the usual EU subsidies, direct payments under Pillar I and at EU level with had hoc measures, the exceptional measures of 2014 to 2016, as demonstrated on **Table 2** appendix.

In order to study these two risk management instrument' effects, a regression analysis was utilized with milk subsidies and exceptional measures as independent variables. First regression gives emphasis on the milk subsidies. While second studies the effect of exceptional measures. Thus, the effects of these instruments on the milk prices was studied, the milk price variable here is used as a proxy to the dairy market. The regression analysis also included fuel and fertilizer prices as these variables act as costs. The fuel prices specifically had a huge impact on the farming sector as a result of the financial crisis of 2007. The other market variables were EU milk production and historical exportations to Russia and China. And a reinforcing regression was conducted to further the impact of the above two variables by measuring their effects simultaneously.

Risks faced Nowadays

Climate change Impacts

Climate Change consists in a deep change of the normal state of climate and it could be due to natural and human actions. By natural action we intend for example Earth's Orbit, Solar Radiation and atmosphere composition, whereas human action mainly refers to Greenhouse gas emissions (GHG), urbanization and deforestation

(WMO, 2010). Concerning GHG emissions. GHG englobe three most environmental damaging corresponding to 98% of the total emissions: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). CO_2 emissions, caused by fossil fuel's combustion for energy production (equal to 2/3 of total energy production) represent around 75% of the total GHG emissions. The second largest group of GHG emissions are CH_4 emissions, which are more harmful than CO_2, around 25 times more potent in a century period (OCDE, 2012; WMO, 2010). CH_4 emissions come from fossil fuel production, current practices of farming, waste management, biomass burning, oceans, and many others as wildfires (OECD, 2018). Lastly, N_2O emissions, even though representing the lowest percentage in GHG composition, are the ones from this sample that last longer in the planet (around 120 years) and are considered more than 310 times warming potent than CO_2 in a century. Nowadays, GHG emissions are increasing and in response to that, the average annual climate catastrophes worldwide have been growing significantly (WMO, 2010). For instance the average catastrophic events from 1980-1989 were 335, and this number more than doubled in the period 2002-2011, reaching the average of 716 events per year (EASAC, 2013).

Regarding deforestation, one of most worrying examples is the case concerning the Amazon which caused the destruction of 20% of Amazon biome. The World Wildlife Fund (WWF) estimates that more than a quarter of the current fauna and flora will disappear within 12 years if this rate of deforestation is maintained and no preventions are taken(WWF, 2018).

The natural catastrophes due to human actions affect us in an extremely evident way. An alarming study of Hawkins *et al.*, (2017) shows that the increase of global temperature from preindustrial period (1850-1900) when the temperature was 0.65 ºC

until nowadays was more than 0.7ºC It has been a worrying subject since already in 2015 Paris agreement temperature achieved 1.5ºC. Last summer's August (2018), which was the warmest in Europe, is the result of greenhouse gases emissions increase. This heat caused damaging fires all around the world, from Greece (Athens) to Iberian Peninsula, to USA and Canada (WMO, 2018). And winters are getting more rigid , we can recount 2009's and 2010's winters in Europe which have been incomparable colder than the previous ones. Furthermore, the first decade of this century has been the one with more precipitation since 1901. These natural disasters are having massive impacts in human life, for instance, from 2005 to 2014 they have caused around 840 thousand deaths (IFRC, 2015).

According to the United Nations Environment Program (UNEP) environment degradation was the cause of 12.6 million deaths in 2012, which means 23% of total number of deaths around world (UNEP, 2016; WHO, 2016). The majority of deaths are caused by diseases linked to environment degradation, amongst the most communes: Diarrhea that accounted for roughly 530,000 deaths a year; Malaria that caused around 438,000 deaths on 2015 and still accounts 3.2 billion people worldwide on risk of it (Unicef, 2018a) ; exposure to indoor air pollution (e.g. pneumonia, pulmonary disease) that every year cause around 2million deaths (Unicef, 2018b). These diseases are mainly associated with the lack of potable water and hygiene, air pollution and the use of solid fuels for cooking, and the deficiencies concerning water waste and land's management (OCDE, 2012).

Air pollution represents the highest cause of death; the United Nations Environment Programme estimates that every year 7 million people worldwide die because of exposition to poor quality air (garbage, industries, transportation, wildfires) (OCDE,

2012). The second cause of deaths is the lack of potable water, since around world every year it causes 3.5 million deaths. This data is even more astonishing if we consider that in the era of water shortage just 20% of produced wastewater worldwide is treated (UNEP, 2016).

Climate change has an armful impact on human life also because it is accelerating land destruction, every year 12 million hectares of productive farm land gets either degraded or deserted in a world with more than 7 billion people and with an expected population of 11 billion by 2100 (UN, 2015; WMO, 2010).

Future tendencies in Climate Change

If climate changes maintain the current path it is expected to decrease water availability which will lead to millions of people facing water stress. With less water it will increase drought in mid and semi-arid low latitudes. Increase of wildfires, more accentuated species migrations and increase of risk of extinctions and some resultant extinctions. In agriculture it is expected to present a decrease of productivity in cereals.. We, as human beings will face increase of morbidity and mortality as result of mainly heat waves, floods, droughts and diseases as well (OCDE, 2012).

Achieving environmental goals

Governments are well aware of the importance and the impacts of climate change and in 2015's Paris Agreement countries agreed to change the path of climate change, keeping the increase in global average surface temperature of Earth below 2 °C above pre-industrial levels (OCDE, 2017). However, according to 2015 OCDE report *Investing*

in Climate, Investing in Growth the national commitments of countries participating to the Paris Agreement even fully implemented, will not be enough leading to an increase of the global average temperatures of 3 degrees Celsius. If countries will not change their rate of emissions cause by fossil energy in the next 15 to 30 years, it will be impossible to achieve the goal of Paris Agreement (OCDE, 2017).

A solution proposed by the OECD, Organisation for Economic Co-operation and Development, is that could take advantage of the currently low real interest rates , and allocate their investments to low carbon infrastructures with low impact on GHG emissions. In fact, it is important that leading economies start adopting low-carbon practices since just G20 are responsible for 80% of the world's emissions.

Risk Management tools

Origins of Risks

Kaplan and Garrick (1981) gave examples of different kinds of risk as business risk, social risk, economic risk and military risk. According to the authors risk englobes the uncertainty and the damage that can be faced. A risk is associated with an uncertainty in the outcome that negatively affects the output. A risk can be independent or correlated to other risks. If the risk is linked to other risks, it is defined as a systemic risk an example could be the price of product and concerning production. On the opposite, if the risk is not correlated and independent from others risks it is called idiosyncratic risk and an example could be an injury of a farmer or employee (OCDE, 2009).

Risks can be classified by their probability of occurrence and magnitude of their loss. Concerning the probability of occurrence, risks can be classified as systematic if

they occur more than once. In this way it can be estimated their probability of occurrence and if they affect overall market of the farmers subjected to the same conditions. An example could be the variance in productivity according to weather events as drought and floods. On opposite non-systematic risks are irregular and for these risks it is not possible to estimate a probability., Moreover they are tied to specific regions and thus, do not affect overall market of farmers. However, this risk can be reduced when the farmer diversify his portfolio (Daniel and Featherstone, 2001; OCDE, 2009).

Risks faced in Agriculture

According with Musser and Patrick (2001) there are five more important sources of risk, the first one is production risk and it englobes the variation in production in crops and livestock caused by weather diseases and pests, thus exact quantity and quality of output is not known in the beginning of process. The second is the market risk, that englobes variation of prices commodities and this way interferes with hedging strategies. The third one is the financial risk which englobes the ability to pay bills and maintain production until receive the income, thus survive bankruptcy. The fourth one is the legal and environmental risk that considers the possibility of lawsuits started by a range of individuals or other businesses and also the changes in laws by responsible entities that will imply changes in agricultural practices. The fifth one is related with the resources risk due to the uncertainty in the event of employee's or his family's illness, divorce, death or others. Additionally, Moschini and Henessy (2001) talks about sources of uncertainty instead of risk and also refers technological uncertainty when evolution in production could make past investments outdated.

Between the above risks mentioned, common literature suggests that the most important risks in agriculture are production and market risks. Price risk is most of the times systematic because it alters the price change for all farmers in market. On the opposite production risk is most the times idiosyncratic in situations of hail, rain, floods, drought and others. However it can become systemic when catastrophic events affect all region (OECD, 2009).

Strategies to reduce risks

Managing risk in agriculture is complex and englobes three main phases. The first one deals with the quantification of the impact of the risk and its variability either from year to year or within different farmers. The second phase is to study the best risk management tool to deal with risk faced. It is important as well to study the relation towards risk faced by farmer, since not all farmers have the same behavior against risk, or at least they have different degrees of it. The last phase is to elect the best strategy to improve the risk management.

Concerning the quantification of risk and its variation, the most important risks are production and market (price). Price is more known throughout the markets and thus there are less information asymmetry and can be reduced with futures, forwards or options. However, production risk is more difficult to measure and it leads to existence of asymmetry information and adverse selection due to the existence of high and low risk agents which is private information and is difficult for agencies to get that type of information (Prescott and Townsend, 1984; OECD, 2009). Depending on their degrees of damage, risks can be classified as normal, market and catastrophic risk. A normal risk implies low costs, but it is frequent and can be diversified by farmer with different

allocation of land, diversification of crops or activities and preventions measures as irrigation. A market risk implies higher costs, middle frequent and require use of market instruments which englobe insurance and futures markets, however not all risks can be insurable because of lack of information and information asymmetry. Catastrophic risks are the ones less frequent but cause higher damage and government may interfere with ex ante or ex post measures. Regarding the study the best risk management tools for normal risk have already been stated above. In case of market and catastrophic risk as the costs are significantly higher it involves additional strategies which are beyond the control of the farmers (OECD, 2009).

Common strategies to reduce risk at farmer level are allocation of land, production diversification, change of techniques and inputs (OECD, 2009).

Concerning market instruments to reduce risk, the two most common are insurance, futures and forward contracts. Forward contract consist in an agreement about price and quantity between farmer and buyer. In this case, the farmer is protected against the quantity and price he hedged and if he hedges all the quantity he knows he will sell all the quantity for that price. A future contract is a standardized forward traded not just between a farmer and a seller but in an organized exchange such as the Chicago Board of Trade (CBT). Buyers will assume long position while the seller will assume short position. The delivery of the commodity do not have to be realized (Bodie et al., 2014).

An insurance contract can transfer risk of extreme weather events on crops and usually these contracts depend on government support through subsidies since it has high transaction costs (Barnett and Mahul, 2007). With insurance farmers pay every year a premium and it gives the right to receive protection in case of losses associated with risk

farmer took, for example if he subscribed insurance against hail in case of occurrence and cause high costs farmer will receive indemnity (OECD, 2009).

In case of occurrence of catastrophic events, that usually are systemic, affecting a huge number of individuals. From an economic outlook it happens when government aid is needed and activated. This aid is divided in *ex ante* and *ex post* measures (OECD, 2009). As *ex post* measures, governments in OECD countries, implement a tax system smoothing that states that the poorest farmers pay at a lower rate and it permits that all farmers pay according to the income of that year, which means that for example if one year a climate disaster affected production of farmers this year they do not pay taxes and they would pay in the next year. It can as well permit that farmers pay a rate every year of the average income. In this case they do the average income for years and then it is settled the tax rate (OECD, 2009, 2010). Governments also offer countercyclical programs which are based on usually prices indicators, so in years with high prices these programs offer lower support and vice versa, however sometimes despite government effort it does not target farmers with low income (OECD, 2011). Following years 2005 some countries provided *ad hoc* measures, preferential credits and debt restructuring. European union have taken programmes to compensate farmers for high input costs that were faced during and after financial crisis of 2008, mainly fuel costs (OECD, 2011). As *ex ante,* in New Zealand and other OECD countries there are fund stipulated to research and control in pests, diseases and border control, this means that in case of significant losses to farmers in these situations they are refunded as well (OECD, 2007).

Lastly, in EU, in order to manage agricultural risks, Measure 17 of the Rural Development Programmes (RDPs) was created in the year 2013 under the following legislation, Articles 36 – 39 of Regulation (EU) No 1305/2013 (FEGA, 2018). Consulting

Article 37 of Regulation (EU) No 1305/2013, it is a stipulated financial aid for crops, animals and plant insurance premiums as a support to farmers in case of economic losses caused by crops, animal and plant diseases, infestation and environmental incident. Eligible farmers just receive support in case previous causes destroy more than 30% of average annual production in the past 3 years or in the 5 years after excluding higher and lower year. Farmers support represents 65% of insurance premium cost. Article 38 of the same regulation, provides financial support for mutual funds support in case of economic losses suffered by the farmers with same causes of the previous article. Finally, Article 39 refers to Income Stabilization tool and supports farmer, again, in same conditions of previous articles.

Common Agricultural Policy

Brief History of CAP creation

In 1957 six countries (Belgium, France, Germany, Italy, Luxembourg, Netherlands) with Treaty of Rome created European Economic Community- EEC, that in future would become the European Union (EU). These countries wanted to avoid and prevent permanently situations of hunger and starvation in future similar as faced in post war period. Despite the recognition of the importance of creating an agriculture policy at an EU level that would provide food at affordable prices and fair income to farmers, CAP was created later in 1962. By affordable prices it now represents around 15% of an average family income what 50 years ago was double (European Commission, 2012).

In the beginning CAP was working as market support, it was decided to determine common prices to EU products and that would start effectively in 1967. The establishment of the prices of the dairy and livestock within the EU involved settling the price at a level

above “price fork”- it is the range between upper and lower value. In case of cereals they were between price fork levels, yet closer with upper level This had a consequences on the EU exportation and importation level since, in general, European products were more expensive than world average (Ackrill, 2000). This resulted in Member State measures such as high taxes in importations from countries outside CAP and granting of subsidies to EU exportations in order to avoid wastage of products produced (Ackrill, 2000).

CAP Reforms

According to Hill (2012) the CAP had mainly 4 reformers until now. During the 70s decade, in response to the minimums prices required in market, it was observed that there was a surplus in the supply side of the market because Europeans farmers were producing more than what was needed (European Commission, 2012). All this ended up in causing the EU budgetary crisis of 1982 and originated the first CAP reform 1982-1988. The first CAP reform decreased support prices created quota limits on dairy products in 1984 (European Commission, 2012). On other side, an increased support on sectors with higher demand as cereals was implemented. (Hill, 2012).

The second CAP reform took place between 1988 and 1991, because of the inefficiency of the first reform in surplus control, second reform focused in extension to all CMOs, Common organisation of the markets of Maximum Guaranteed Quantities (MGQs), thus excess of production would face a decrease in price support price in order to reduce budgetary costs. At same time during this period, a structural reform was created in order to increase support to rural areas to create jobs in that area and permit environment protection.

The third CAP reform was conducted during 1991 to 1997 and in the background a continuous increase in surplus of beef, milk powder, tobacco, wine and cereals took place. Also, there was that time concern with impact of agriculture on environment what lead to Rio Earth Summit, in 1992 focused an importance on sustainable development, CAP did as well a reform to farmers aware about the climate change and its consequences in future. The message was clear that it was required to produce more but in a more sustainable way, as well. And in 1992 under *MacSharry* Reform, direct payments to farmer increased it was announced the new payments to farmers by hectare, in case of crops production, and per head of animals, in case of animal production, to change the mechanisms that depend on increasing market prices. In 1994 it was established the General Agreement on Tariffs and Trade (GATT) agreement which would limit subsidized agricultural EU exports, 'tariffication' of non-European commodities and restriction of quantities of each commodity that would be imported, which means that the tools to make price of EU commodities high were limited now. Price support tool of CAP was reaching its end. (European Commission, 2012).

The fourth CAP reform took place between 1997 and 2012 according with Hill (2012) however European Parliament (2018a) considers three reforms in the same period. The main changes included the enlargement of countries mainly in central and Eastern Europe and the changing the majority of premiums to single farm payment in 2003. It was faced as well additional lowering in the prices of surplus products, mainly beef and cereals. Quotas were retained in dairy products even though it was faced by further lowering of prices, compensated with direct payments.

Under the Agenda 2000 reform the socio-structural measures was reinforced with a creation of a new development policy known as 'second pillar', that brought a voluntary

modulation whereby MS could swift up to 20% of CAP direct payments to the new pillar that intend to support rural development (Hill, 2012; European Parliament, 2018a).

Under the June 2003 reforms, EU focused to ensure a more equitable support because a reduction in CAP fist pillar was made in order to allocate more funds to rural development policy from 2007 to 2013, period in which budget froze. The most important change was, however, the introduction of Single Payments Scheme (SPS) that englobes Single Farm Payment (SFP) and Single Area Payment (SAP) and the annual payments to farmers directed by country-responsible authorities, yet fully funded by EU, it is based on their entitlement in the period of 2000 to 2002. These payments could be based in income they received in past 'historic model' (the one most EU-15 elected) or at an average rate per hectare calculated to the region 'regional model' or even a mixture of both models 'hybrids'. Additionally these models could change from 'historic' to 'regional' and thus were 'dynamic' and some continued to be being 'static'. In case of farmers from MS which joined EU after this reform receive sum specified in Accession Agreements that details amounts to per agricultural hectare. This reform had as consequence in the 21 Common Market Organization (CMO) with different regulations and separated by groups of agricultural commodities which were responsible for certifying that farmers received the highest price for their products that in other situation they wouldn't. This reform made that these 21 CMO merged into 1 in 2007 (Hill, 2012; European Parliament, 2018a).

The 2009 'Health Check' was mainly, the consolidation of the 2003 reform, reinforcing of the rural development measures with funds from Pillar I and elimination of some existent payments linked with production (European Parliament, 2018a).

Under the 2013 reform direct payments were substituted with 7 components: 1) Basic direct payment; 2) a greening payment to conservation of public goods; 3) creation of support to young farmers 4) Farmers may receive additional support for the first hectares of land, as a redistributive component; 5) Additional support in case of areas with natural limitations; 6) Additional support linked with production; 7) In case of small farmers, a simplified system for them. In this new CAP Pillar I funds direct payments and market measures with European Agricultural Guidance and Guarantee Fund (EAGGF). Inter Pillar flexibility was improved and from 2015 until now its possible funds transfer between pillars, from first to second up to 15% and from second to first up to 25%. Additionally in CMO, as a preventive measures, reserves were created and the consolidation of single CMO tools to be used in situation of sector crises or market disruption were also introduced (European Parliament, 2018a).

Present CAP instruments

CAP is nowadays implemented through the use of Pilar I and Pillar II. Pilar I englobes direct payments to farmers and markets support, as stated above.

Pillar II englobes support of agriculture and rural development and environment sustainability. Contrary to Pillar I, Pillar II is co-financed by EU funds and either national, regional or local funds. In order to address rural development it is important to define what is rural. According with OECD method to classify rural areas population density is the key definitor. Thus, geographical areas are classified in three different types: Predominantly rural (PR) if more than 50% live in rural communes with less than 150 residents per km2 ; Intermediate Regions (IR) if 15%-50% of residents live in rural region and Predominant Urban (PU) if less than 15% residents live in rural region. Rural areas PR represent more than half of area of EU, however these areas have a small share of

economic activity, around 12% of gross value added. These areas are mostly isolated from city centers and badly connected to the last ones. And this low connection to major center of population make economic obstacles to local business and agriculture industry because main market is distant and transport is costly. Then rural areas can be very different, as there are three main types: 1) the ones with pressure of modern life in rural society, the main tradeoff here is how to better keep these areas intact in an environmental point of view but provide as well recreation and leisure to residents; 2) Areas in rural decline that are facing declining in population, getting more isolated, reduction of rural services. In these areas it becomes fundamental to invest for the encouragement of farmers and local economy, facilities and infrastructures; 3) Very disadvantaged areas, usually located in mountains, hills or isolated. There are areas extremely dependent in agriculture and defectively populated. In these cases it is permanently required funding to local farmers, services and the remaining businesses. (Hill, 2012).

In order to support these areas previously mentioned, the rural public expenditures are divided in main three categories: Support to agriculture adjustment; Development of more activities in rural areas and Agri-environmental schemes. In case of support to agriculture adjustment these expenditures include grants to farmers to improve their equipment to better deal with technical circumstances presented. In case of expenditures for the development of more activities and non-agricultural, in rural areas it englobes outflows in non-agricultural activities as tourism, manufacture, services that create job and income to residents. Lastly in Agri-environmental schemes that usually are payments to farmers and creation of jobs. Farmers receive to not cultivate all lands and leave some marginal to promote local wildlife existence as maintenance of the species' existence. In these cases rural jobs are created to keep fields in that biological conditions (Hill, 2012).

The importance of CAP

To understand the importance of CAP it permits that 500 million people have access to safety and good quality food and assures animal welfare, represents the highest percentage of EU budget-45% that is divided in agricultural and rural development and converted to euros it is around 55 billion (European Commission, 2012).

As far as direct payments are concerned, it is known that they are very important to small farmers. But to study its importance to overall farmers in EU it was collected data from Farm Accountancy Data Network (FADN) in year of 2016 and results are in appendix **Table I.** In the first column there are a sample of farmers to each 28-EU MS, in second column family farm income expressed per family labor unit, in third column subsidies and taxes from current productive activity in the accounting year, in last column there are the result of subtraction of subsidies and taxes to family farm income. To the majority (13 countries it is possible observe that the result is negative, so there a high dependence do that sample of farmers in that country. Then from 15 MS not all have family farm income net of subsidies and taxes above its minimum wage.

EU Dairy Market

Dairy sector represents 15% by value of EU agricultural output, which is a major player in the world dairy market and leads the exportation of many dairy products. As a part of the geographically analysis, most MS producers that account up to 70% of production are Germany, France, United Kingdom, Poland, Netherlands and Italy (European Commission, 2018a). In this range of countries, the percentage of products

obtained (1 000 t) from cows in all milks is above 90% in all countries except Italy where it is around 86% (Eurostat, 2018).

In EU there was a long period of steady fall in prices of dairy products until 2010. However, between 2010 and 2014 the market price of dairy products rose substantially. This was a period of increase in demand and in order to satisfy the demand, production was increased as well, this stimulated the increase in milk price in that period (European Commission, 2018b). Moreover , the EU dairy products demand decreased which lead to a sharp fall in prices in 2016, as demonstrated in **Figure 1** in appendix.

As an important commodity, milk is englobed in CMO in accordance with the Regulation (EU) No 1308/2013. In order to establish stability in this market there are numerous market tools managing it, such as public intervention, private storage, exceptional measures, milk quotas, Aid schemes and Direct payments and rural development programmes (European Commission, 2018c).

In case of public intervention instrument, butter and skimmed milk powder (SMP) are bought into public storage, usually this action takes place between 1st March and 30th September. If market conditions allow, the butter and SMP are sold back to market. This measure was created on November 2016 as an incentive in order to make a price recovery (European Commission, 2018c).

Private storage is granted by the commission to supports the private storage of some dairy products: Butter, Skim Milk Powder (SMP) and Cheeses with Protected Designation of Origin. It permits to take out some products from the market, however this way goods are retained with private owner. This measure exists since 2014 and permits private operators to keep the store until end of the contract period, meanwhile they can

receive grants for the storage costs for between 90 to 210 days (European Commission, 2018c).

Regarding Exceptional measures, *ad hoc* measures were created englobing a package of 948 Million of EUR between 2014 and 2016, as represented in **Table 2** on appendix. According to Regulation (EU) No 1308/2013 measures were introduced against: market disturbance (Article 219); animal diseases and lack of consumer confidence (Article 220); specific problems (Article 221) and severe imbalance in market (Article 222). The measures introduced with Regulation (EU) No 1308/2013 incentivized creation of packages of aid for milk production reduction. This measures arose in response to the Russian Ban, since 2013 Russia decreased the EU agri-food importations significantly from 11.8 billion EUR to 6 billion EUR in 2017 (European Commission, 2018d).

In case of Milk quotas, they were introduced in 1984 but in 2015 they were abolished after a period of 31 years under the quotas. The main reason for its abolishment were the considerable increase in consumption of dairy market. For example in last 5 years of quotas EU dairy exports increased 45% in volume and 95% in value. In the future it is aimed to resolve problems of surplus production, since now this sector is following a market-oriented policy (European Commission, 2018f).

Concerning Aid scheme that intends to support the supply of milk products under School Milk Scheme that englobes a EU aid of 18.15€ aid per 100kg and can additionally be supplemented at national level (European Commission, 2018c).

Lastly, in what concerns to Direct payments are direct grants that farmers receive to safeguard a safety income. They act as a basic income support and are decoupled from

the production, thus stabilizes the farmers income that is subject to volatility of sales of the products in market (European Commission, 2018g).

Methodology

The methodology of this work project will be to study whether the risk management tools at farmer level and additionally the exceptional measures introduced by the Commission in response to falling prices in dairy sector accomplished their objectives in efficient way. Thus, I tried to study the if the following variables have or have not any impact on milk price and its contribution to price variability:

Regression used was the following:

$$MilkP_t = \alpha + \beta_1 MilkP_{t-1} + \beta_2 FuelP_t + \beta_3 Fertilizer_t + \beta_4 Russia_t + \beta_5 ChinaWMP_t + \beta_6 EUproduc_t + \beta_7 WGDP_t + \beta_8 MilkS_t + \beta_9 EM_t + e_t$$

The following variables were used, whose source is attached **Table 3** on appendix:

- $MilkP_{t-1}$ that represents the cows raw milk of EU in past month in EUR, I decided to use this variable as a proxy of dairy products price since milk cows raw price are the major component of EU dairy market, as presented at EU Historical Production;
- $MilkS_t$ represents milk subsidies on milk products in EU in million EUR, this are direct payments to farmers under Pillar I of CAP and it should contribute to a decrease in prices;
- $Russia_t$ represents Russia demand for EU dairy products in million tons.
- $ChinaWMP_t$ represents China demand for Whole Milk Powder in million tons.
- $EUproduc_t$ represents EU production of milk in million tons. Before 2014 it was used a proxy with Germany production;

- $WGDP_t$ represents World GDP in million US$.
- $FuelP_t$ represents Eurozone weighted average agriculture Fuel prices, in EUR.
- $MilkS_t$ represents milk subsidies on milk products in EU in million EUR, this are direct payments to farmers under Pillar I of CP;
- $Fertilizer_t$ represents Urea fertilizer prices available in world bank. It was choose urea since it is the most important straight nitrogen global fertilizer and it use has been increasing in Europe. Moreover, most of nitrogen consumption increase in last 30 years was made with Urea (Fertilizers Europe, 2009).
- EM_t that represents exceptional measures triggered by Commission in 2014, 2015 and 2016 and values are in million EUR and this variable should contribute to a decrease in prices.

Methodology Shortcomings

The first shortcoming is the fact that variables of regression have different available data. $FMilkP_t$ and $Fertilizer_t$ are variables with monthly data while the remaining ones,$MilkS_t, Russia_t$, $ChinaWMP_t$, $\beta_6 EUPRODUC_t$,$WGDP$ and EM_t, are variables with only annual data. And $FUELP_t$ has weekly data. In order to have a longer time series these were converted from annual and weekly ranges into monthly by interpolating these data with EVIEWS Software. The second shortcoming is the seasonality effect that some variables might have and EVIEWS does not demonstrate it since it was done by data interpolation. For example, Annual exportations to China and Russia could be higher in some specific months and similarly EU production milk theoretically have higher or lower production depending upon the weather, for example if winter is colder, it delays grass development of cows and consequently decreases the

milk collection (European Commission, 2018h). The last and third limitation appears with fact that the production subsidies and Exceptional market measures take longer than intended period, due to EU bureaucracy, since EU support will take time to reach respective pay agencies of each MS and finally the intended farmers (European Commission, 2017).

Results

Results of the variation in regression above are shown in **Table 4, Table 5** and **Table 6** on appendix.

As regards to regression without EM_t it is a 10 year monthly regression that starts in December 2007 and ends on December 2017. The main observations are that fuel costs, EU subsidies and even china demand contributed to increase in milk price and thus dairy market. On other side, Eurozone production and fertilizer prices contributed to lowering the prices. Russia demand and World GDP were not statistically significant.

The main justification for the increase in the prices due to subsidies and the risk management tools at farmer level, were the fact that production incentive (the part of milk subsidies decoupled with production) made farmers produce even more while demand was increasing, this is seen from the data that the demand has been rising over the years that reinforces our belief that the price will followed the increase in demand. Considering fuel prices as a cost, it contributed to increase in prices, as it acts as an input and with emerging of 2007 financial crises it was observed that a very significant increase in prices took place and affected the EU farmers, even though farmer fuel is less expensive than other fuel for the cars and other means of transportation, as it can be observed at weekly Oil Bulletin of European Commission website (2018i). In case of China demand, more

precisely for the Whole Powder Milk, it unexpectedly contributed to increase in the prices. One possible reason is if we observe EU exportations during this 10y period it has increased during most of the years, except from 2010 until 2011 and 2013 to 2014 as it can be demonstrated in below:

Figure 2: EU Exportations of Whole Milk Powder to China

Source: Agriculture and rural development, *EU Milk Market Observatory*.

The main explanation for the decrease of dairy prices due to EU productions is linked with significant increase of milk production since milk quotas were abolished in the end of 2015, and significant production increase has been observed since 2010 already. More production in this case, when the demand curve does not follow this increase leads to the decrease in the prices. As regards to fertilizer prices it contributed to a decrease in price because fertilizer is a cost for farmers and through past years it has been decreasing, as demonstrated in **Figure 3**, appendix.

Considering regression without $MilkS_t$, it is a 3y monthly regression starting on January 2014 and ending in December 2016. In this regression neither fuel nor the fertilizer prices were incorporated as in previous regression these variables were incorporated and clearly had impact on milk prices decrease and my aim with second

regression is to study if EM_t counterbalanced the Russia Ban in some way. China demand and European production were not significant. However Exceptional Measures, Russia ban and World GDP all contributed to price decrease. The Russian ban contributed to a decrease in the prices because as regards to it, it affected the milk prices because a very significant decrease in overall dairy market demand was observed as demonstrated bellow: **Figure 4:** EU Exportations of Dairy products to Russia.

Source: Agriculture and rural development, *EU Milk Market Observatory.*

With regards to Exceptional measures it was expected that it contributed to an increase in milk price, however according to the results in table IV it contributed to a decrease. One possible explanation is the fact that farmers did not decrease milk production as was accorded and also even if they did, the amount of Exceptional measures did not cover the market downward trend in prices.

In what concerns to results of regression with $MilkS_t$ *and* EM_t, are demonstrated in **Table 6** on appendix. Both measures had the same impact in milk prices as above discussed. In case of exceptional measures it had a negative impact, thus contributed to a decrease in milk prices. On opposite, and similarly as regression subsidies had a positive impact in milk price, thus contributed to a increase in milk price.

Conclusion

We are living in period with erratic climate change events with the most drastic consequences. Millions of people are dying, and many are in risk of it because of this global climatic change. However the objectives and its solutions that have arisen in conventions like the Paris Agreement 2015 do not seem efficient since OECD reports state that in next 15 to 30 years the objectives won't be achieved. Future consequences of climate change would be even more drastic, resulting either in deforestation or air pollution. The most developed countries are responsible for 80% air pollution. Moreover, some of them even left Paris Agreement showcasing their concerns about climate change, e.g.- USA case (Climate Analytics, 2018).

Risk is associated with an uncertainty in the outcome that negatively affects the output and in case of a sector like Agriculture due to climate change, those changes are even more evident. In order to mitigate that, the EU has been developing risk management tools and created Measure17, exceptional measures were adopted as well in some segment of the markets and the EU subsidies contribute as well towards the mitigation of those risks since savings from the most productive years can play an important role.

CAP has its history rooted in 1962 when it was created, it has already gone through several reforms in order to better adapt to either market or EU citizens needs. It played an important role during the crisis of dairy market since both subsidies to milk producers and exceptional measures as risk management tools were statistically significant in the regression analysis that was conducted, subsidies contributed to an increase in price, however because exceptional measures were implemented in a critical period, and response to Russian ban, and when prices were with a decreasing tendency, it contributed to a decrease in the prices.

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Appendix

Table 1. Farm Net Income and Current subsidies and taxes

Year	Country (3 digits FADN acronym)	Farm Net Income (SE420)	Balance current subsidies & taxes (SE600)	Output without subsidies
2016	(BEL) Belgium	57838	21340	36498
2016	(BGR) Bulgaria	6844	9954	-3110
2016	(CYP) Cyprus	7557	3951	3606
2016	(CZE) Czech Republic	37162	89078	-51916
2016	(DAN) Denmark	9480	32410	-22930
2016	(DEU) Germany	40462	36190	4272
2016	(ELL) Greece	10796	6124	4672
2016	(ESP) Spain	35160	12308	22852
2016	(EST) Estonia	-1889	21299	-23188
2016	(FRA) France	25641	26354	-713
2016	(HRV) Croatia	7681	5233	2448
2016	(HUN) Hungary	20878	15981	4897
2016	(IRE) Ireland	24708	16748	7960
2016	(ITA) Italy	32940	7263	25677
2016	(LTU) Lithuania	10553	11222	-669
2016	(LUX) Luxembourg	36794	54572	-17778
2016	(LVA) Latvia	13761	16124	-2363
2016	(MLT) Malta	11083	2650	8433
2016	(NED) Netherlands	70703	14595	56108
2016	(OST) Austria	23933	19791	4142
2016	(POL) Poland	7723	5185	2538
2016	(POR) Portugal	15999	7726	8273
2016	(ROU) Romania	5102	2107	2995
2016	(SUO) Finland	12802	48387	-35585
2016	(SVE) Sweden	24646	40591	-15945
2016	(SVK) Slovakia	85528	155418	-69890
2016	(SVN) Slovenia	4814	6593	-1779
2016	(UKI) United Kingdom	32082	38988	-6906

Table 2. Measures to support dairy sector.

Safety Net	Exceptional market measures	Other measures
• Prolongation of the intervention period and increase up to 350 000 tonnes of the SMP ceiling determining the quantities that can be bought at fixed price (169.8 EUR/100 kg) • Private storage aided scheme for SMP and butter • Enhanced private storage aided scheme for SMP (higher support rate with longer storage period - 365 days)	• Private storage aid scheme for cheese • 38 million EUR of exceptional aid to Baltic countries and Finland, particularly affected by the Russian import ban, also with possibility of national top-up (2014) • 420 million EUR of targeted aid for the livestock sector, with the option of a 100% top-up using national funds (2015) • Possibility of voluntary agreements between farmers to limit milk supply for a 6 months period, starting from 13 April 2016 and extended until 13 April 2017 (based on Article 222 of the Common Market Organisation) • 150 million EUR aid for milk production reduction (2016) • 350 million EUR support package to the livestock sector targeted to activities of market stabilisation and economic sustainability, with the option of a 100% top-up using national funds (2016)	• Establishment of a task force on agricultural markets • Temporary increase in state aids • Increased rates of advanced payments under the direct payment scheme • Increased funds for food promotion programmes • Advancing of the Milk Package report from year 2018 to year 2016 • Milk for Syrian school children

Source: (European Commission, 2017) p.17

Figure 1: Evolution of milk prices in EU

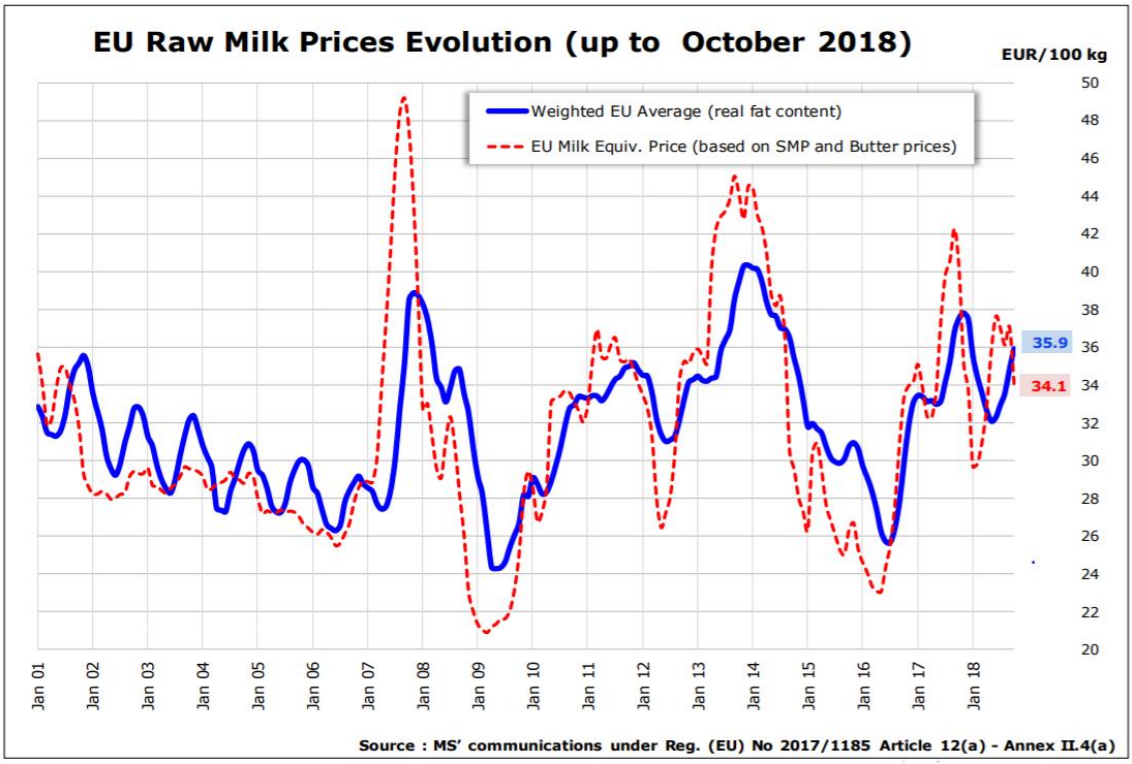
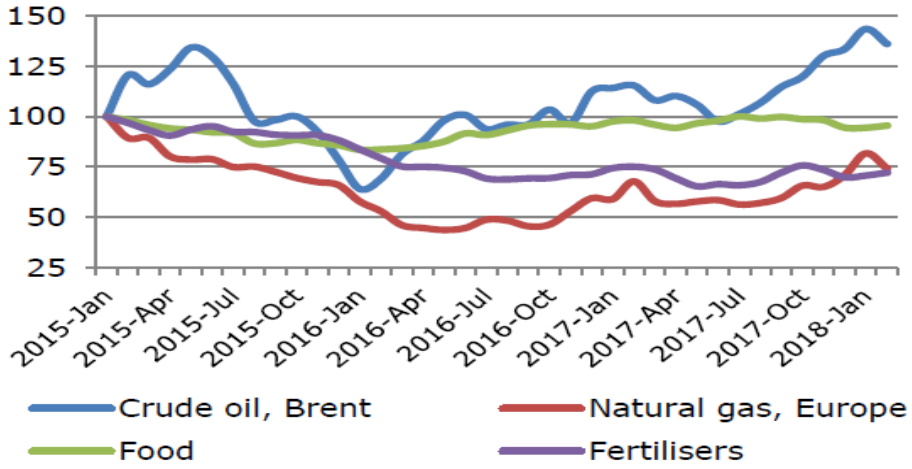


Figure 3: Commodities prices in EU



Source: (European Commission, 2018h), page 3.

Table 3. Variables description and source information.

Variable	Sample	Description	Source
MilkP	2008.01-2017.12	*Cows row milk price*	Regulation (EU) No 2017/1185 Article 12(a) - Annex II.4(a)
MilkS	2008.01-2017.12	EU subsidies in milk products	EUROSTAT
EUPRODUC	2008.01-2017.12	EU production of milk in million tons.	EUROSTAT
FUELP	2008.01-2017.12	Eurozone weighted average agriculture Fuel prices	Oil Bulletin Prices History
Fertilizer (Urea)	2008.01-2017.12	Urea fertilizer	World Bank
Russia	2008.01-2017.12	Exportations to Russia of dairy products.	EU Commission
ChinaWMP	2008.01-2017.12	Exportations to China of Whole Milk Powder.	EU Commission
WGDP	2008.01-2017.12	World GDP in million US$	World Bank
EM	2014.01-2016.12	*Exceptional Measures in dairy market*	BCE

Table 4. Regression Results (1)

	(1)	(2)	(3)
$Milkp_{t-1}$	0.929542*** (0.037122)	0.930308*** (0.036333)	0.923036*** (0.034125)
$logFuelP_t$	0.1555649** (0.046978)	0.154147** (0.047187)	0.156761** (0.046813)
$logFertilizer_t$	-0.025670 (0.019114)	-0.028972 (0.019606)	-0.034876* (0.014912)
$logSubsidies_t$	0.029350** (0.013672)	0.034969** (0.015019)	0.034876** (0.014912)
$D(EUproduc)_t$	-3.23E-06** (1.15E-06)	-3.06E-06** (1.04E-06)	-2.85E-06** (1.10E-06)
$D(ChinaWMP)_t$	0.001127** (0.000444)	0.001078** (0.000419)	0.001087** (0.000414)
$WGDP_t$	-0.239515 (0.182108)	-0.208539 (0.196875)	
$Russia_t$	-4.13E-06 (7.88E-06)		
n	120	75	120
R^2	0.963893	0.963713	0.963108
Adjusted R^2	0.961290	0.961445	0.961149
F-statistic	370.3970	424.9286	491.6619

Note: The number of columns represents number of regressions. It was used *LS-Least Squares* method. And regarding coefficient covariance method was used Newey-West. Asterisks *** ** * represent significance level at 1%, 5% and 10%.

Table 5. Regression Results (2)

	(1)	**(2)**	**(3)**
$Milkp_{t-1}$	1.006190*** (0.084069)	0.991244*** (0.089813)	0.911646*** (0.091688)
$D(logEM)_t$	-5.539838*** (1.765107)	-5.176755*** (1.866404)	-3.629290* (2.016229)
$D(logRussia)_t$	-0.858613*** (0.278602)	-0.802519** (0.293852)	-0.564631* (0.314949)
$WGDP_t$			-7.641756** (3.739088)
$logEUproduc_t$	0.608607 (0.524454)		
$logFuelP_t$	0.060171 (0.094139)	0.001294 (0.001294)	
n	35	35	35
R^2	0.928388	0.929067	0.930714
Adjusted R^2	0.918839	0.919609	0.921476
F-statistic	97.23046	98.23338	100.7465

Note: The number of columns represents number of regressions. It was used *LS-Least Squares* method. And regarding coefficient covariance method was used Newey-West. Asterisks *** ** * represent significance level at 1%, 5% and 10%.

Table 6. Regression Results (3)

	(1)	**(2)**	**(3)**
$Milkp_{t-1}$	0.885632*** (0.103349)	0.911670*** (0.091692)	1.009309*** (0.086287)
$D(logSubsidies)_t$	0.103076 (0.073657)	0.116646* (0.065057)	0.209041*** (0.040247)
$D(logEM)_t$	-0.097436 (0.072720)	-0.116889** (0.059048)	-0.219390*** (0.022127)
$WGDP_t$	-8.227295* (4.270943)	-0.204559** (0.100084)	
$logFuelP_t$	0.060171 (0.094139)		
n	35	35	35
R^2	0.931611	0.930714	0.923658
Adjusted R^2	0.919820	0.921476	0.916270
F-statistic	78.49468	78.26662	76.56957

Note: The number of columns represents number of regressions. It was used *LS-Least Squares* method. And regarding coefficient covariance method was used Newey-West. Asterisks *** ** * represent significance level at 1%, 5% and 10%.