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**Evaluation cover page**

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I further confirm that this work has not previously been submitted for evaluation by me or anyone else at CCT College Dublin or any other higher education institution.

Impact of Drought Events on Grains Pricing.

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**Title:** Impact of Drought Events on Grains Pricing.

# Introduction

Agriculture is a complex sector that involves different driving parameters (environmental, economic, and social). Agricultural production is now known to be highly sensitive to climate change (Easterling et al., 2007).

Climate change affects all agricultural sectors in a multitude of ways that vary from region to region, reducing the predictability of seasonal weather patterns and increasing the frequency and intensity of extreme weather events, such as floods, cyclones, and heatwaves (Food and Agriculture Organization, FAO, 2011).

Climatic factors directly impact the supply and demand of grains in the market, consequently influencing prices in accordance with the principles of the Law of Supply and Demand.

Of all the categories of commodities, grain commodities prices play a critical role in everyone's daily life. Fluctuations in grain commodities prices pose a threat to consumers and lead to instability in the incomes and operations of farmers' households (Ayankoya et al., 2016).

To cope with anticipated changes in climatic conditions, can resort to – among others – the following measures: modify your crop rotation to optimize the use of available water, readjust planting dates based on temperature patterns and rainfall, use crop varieties better adapted to new weather conditions (for example, more resistant to heat and drought) and plant in tilled lands or small areas trees that reduce runoff and serve as windbreaks. Among the key measures that the EU and its States can provide to the agricultural community with more precise information on climate risks and adaptation options and providing support for advisory services as well as activities deformation (Climate change and European agriculture, The challenges ahead, available from <https://publications.europa.eu/resource/cellar/14d3648c-4078-46eb-90dd-c4e787a32fca.0011.02/DOC_1>)

That said, this project seeks to offer for management the option to compare how prices developed during these events for decisions making.

# Objectives

1. Understand the relationship between grain price movements and weather events.
2. Predict future grain prices, assisting traders and stakeholders in decision-making.
3. Minimize risk in trading by predicting futures values.
4. Offer alternative solutions to producers developing price forecast.

# Defining the Problem

Agricultural production is affected by different market factors, which affect supply and demand and in consequence pricing.

Climatic factors in agriculture are difficult for producers to handle because they cannot be controlled by them.

However, approximately 90% of natural disasters registered in Europe since 1980 can be attributed directly or indirectly to meteorological causes and climatic, and represent around 95% of the losses economic, it caused by natural disasters. The global losses derived from climatic phenomena and meteorological events have experienced a notable increase for the last 25 years. Although social changes and economic development are the factors that have most influenced, however, still It is too early to determine by what percentage the increase in losses can be attributed to the climate change of anthropogenic origin (The impacts of climate change in Europe: indicator-based on evaluation, 2011, available from <https://www.miteco.gob.es/content/dam/miteco/es/calidad-y-evaluacion-ambiental/publicaciones/impactos%20cambio%20climatico_tcm30-185070.pdf>)

By acknowledging the diverse influences of climate factors on both production and prices, we can strive to formulate sustainable solutions and strategies aimed at lessening the impact on the agricultural sector.

# Scope

Defining the project scope is identifying all the work that the project will accomplish to achieve its final goal. It is used to develop and confirm a common understanding of the project scope among key project stakeholders The project team has identified the activities that will be necessarily to support the project. (Project Scope Management, 2016, available from <https://www.pm4dev.com/resources/free-e-books/7-project-scope-management/file.html>)

It is imperative for both farmers and consumers to grasp the correlation between weather patterns and grains prices. Awareness of factors such as temperature variations, precipitation levels, occurrences of natural disasters, and the timing of seasons allows stakeholders within the agricultural sector to forecast and adjust to price fluctuations resulting from diverse weather conditions more effectively.

Compare how prices developed during climate event (drought) using prices and weather data between 2000 and 2024 and implementing machine learning techniques.

Including corn, oat, wheat, rice, soybean and soybean oil as a grain, prices as a dependent column and drought as a climatic factor and independent column.

**Timeline:**

As this project spans two semesters where we must develop the following steps regarding complete it:

* Develop the project proposal.
* Find the necessary data.
* Work in cleaning data set it is necessary.
* Implement machine learning techniques.
* Develop conclusions and advice post results.

# Data Sources

A practical approach to defining data is that data are numbers, characters, images, or other method of recording, in a form which can be assessed to make a determination or decision about a specific action. Many believe that data on its own has no meaning, only when interpreted does it take on meaning and become information. By closely examining data we can find patterns to perceive information, and then information can be used to enhance knowledge (Denis Howe, 1993-2005).

To create the data set, data was collected from various sources. The main data set <https://www.kaggle.com/datasets/guillemservera/grains-and-cereals-futures?select=individual_data> (obtained from Kaggle ), which has the follow license to use it <https://creativecommons.org/licenses/by-nc/4.0/> contains data on cereal prices from the years 2000 to 2024. This data set was enriched with data referring to the climate <https://www.kaggle.com/datasets/pavansanagapati/usdroughtdata>, (obtained from Kaggle), which has the follow license to use it <https://creativecommons.org/publicdomain/zero/1.0/>.

# Ethical Considerations

Ethics concerns questions about how people should act and what constitutes truthful behaviour (Lewis,1985).

Wherever data is used to predict and support decision-making processes, those decisions can affect people in many ways (Barocas & Selbst, 2016). Although the growing field of data science has brought many new possibilities for problem solving and developing new insights based on data analysis (Saltz & Dewar, 2019), the topic of ethical challenges and the “appropriate” way of using data has only recently been starting to receive the attention it deserves. Since an overall compliance regarding to what is considered ethical vs. unethical seems to be lacking (Asadi-Someh et al., 2016), the field of data science requires a more thorough investigation.

The idea of ethics involves not only human rights but also the rights of data derived from people as well as how to best handle this abundance of information for the greater good.

# GitHub link

<https://github.com/CCT-Dublin/strategic-thinking-capstone-project-feb-2024-ft-Rosma28>

# Develop Data Set

According we were describing in the c

# **Characterization of data and pre-processing**

Exploratory Data Analysis or (EDA) is understanding the data set by summarizing its main characteristics and often plotting them visually. This step is very important especially when we arrive at modelling the data to apply Machine learning. Plotting in EDA consists of Histograms, Box plot, Scatter plots and many more. Through the process of EDA, we can also refine the problem statement or definition of our problem.(McQuaid, D. (2024b). file:///C:/Users/Dell/Downloads/Feature%20Scaling%20or%20Normalization%20(3).pdf.).

Also, define the characteristics of our data (number of columns, rows, null values, etc). In the following part we will explain about it.

These data is a csv document which we display as the name of “df1”(corn data set) and “df2”(weather data set) in our Jupyter Notebook.

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**Fig1: Display library to import data set and also other libraries which we will use in the future processing data.**

Regarding to combine two data set df1 and df2 we use the next function:

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**Fig.2: Join “df1” and “df2”in just one data set called df.**

In order to know how many columns, rows and which data types we have we display the function .info

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**Fig.3: Display rows, columns and data types.**

In this case our data have 5956 rows (observations) and 13 columns (features) with object as a data type which means string values.

In regards to know if we have null values in our data set, we use the function .isnull().sum()

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**Fig. 4: Display null values.**

To visualize distribution of all variables in the data we use histograms

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**Fig.5: Display Histograms.**

To identify outliers in the features, we use boxplot

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**Fig. 6: Display boxplot.**

To visualise the relationship between the features and the response we can use scatterplots, here some examples:

A graph with blue dots

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A graph with blue dots

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**Fig.7: Display scatterplots, features vs target.**

When we want to apply our modals, we need to replace categorical values for numerical values, as we see before in function .info the feature “Weather” has that condition.



**Fig. 8: Transform categorical to numerical.**

For this case we use a Nominal encoder because it doesn’t have any range of importance between each category.

Also, we need to define our dependant(Y) and independent(X) values.

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**Fig.9: Define X and Y to split data.**

# **Scaling and Normalization**

Some features, such as latitude or longitude, are bounded in value. Other numeric features, such as counts, may increase without bound. Models that are smooth functions of the input, such as linear regression, logistic regression, or anything that involves a matrix, are affected by the scale of the input. Tree-based models, on the other hand, couldn’t care less. If your model is sensitive to the scale of input features, feature scaling could help. As the name suggests, feature scaling changes the scale of the feature. Sometimes people also call it feature normalization. Feature scaling is usually done individually to each feature. Next, we will discuss several types of common scaling operations, each resulting in a different distribution of feature values.( McQuaid, D.(2024a)file:///C:/Users/Dell/Downloads/Feature%20Scaling%20or%20Normalization%20(3).pdf.)

So, before to apply our models, normalization is necessary to perform our points of data and have the same measure on it. In this case we use RobustScaler because as our boxplot show we could identify outliers in the data set

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**Fig.10: Scaling data.**

# **Training and Testing our Data Set**

Regarding apply the model we need to split the data for train and test. In this first case we use for test size 30% .

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**Fig 11: Splitting data.**

For test size of 30% we will use 931 observations and 11 features.

# **Applying Modals**

Machine learning algorithms that learn from input/output pairs are called supervised learning algorithms because a “teacher” provides supervision to the algorithms in the form of the desired outputs for each example that they learn from.( Müller, A.C. and Guido, S. (2016). https://www.nrigroupindia.com/ebook/Introduction%20to%20Machine%20Learning%20with%20Python%20(%20PDFDrive.com%20)-min.pdf. Available at: <http://safaribooksonline.com/>.)

For this data the better modal is Linear Regression

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Cross validation

A screenshot of a computer program

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Predictions and True Values

**A graph of a graph

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**A graph showing the difference between a graph and a graph

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**A graph with blue and yellow dots

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**Error**

**A screenshot of a computer

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**A blue graph with text

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**A computer error message

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**A graph and chart with numbers

Description automatically generated with medium confidence**