Nijmegen School of Management
Department of Economics and Business Economics
Master's Thesis Economics (MAN-MTHEC)

The effect of crop variety on political stability in England

By Rob van Mourik (S1044661)

Nijmegen, 29 June 2024

Program: Master's Program in Economics
Specialisation: International Political Economy
Supervisor: Vincent Delabastita

Radboud Universiteit

1 Abstract

The British agricultural revolution is an example of how developments in agriculture are influenced by, and in turn causing technological development, political changes and demographic shifts. The changes in the agricultural sector during this time included changes in crop output and variety. This research covered the effect crop variety has on the political stability of English counties during the agricultural revolution. The relationship was theorised to function through the different inherent qualities and drawbacks of crops making some crops more stable in price than others, this price difference would in turn affect political unrest. The relationship was tested through 5 OLS regressions each using the percentage of a crop grown compared to total output for a county. The paper found no relationship for three of the five crops with oats showing an insufficient correlation to be viable. Barley showed a positive relationship with political instability. Due to insufficient correlation between most of the crops and political instability the paper found insufficient evidence for a relationship between crop variety and political instability.

Table of Contents

2 Introduction

The farmers protests of the last years throughout Europe have called for a change in attitude towards farmers from policymakers. Various news articles have been written about the causes of these protests. Outrage over EU environmental regulations and cheap outside grain imports have made it more difficult for European farmers to sustain their agricultural output. The use of slogans like “no farmers no food” were used during these protests to underline the importance of farmers to the economy and society of their nations (van der Ploeg, 2020). The protestors wanted to highlight how even in the twenty-first century, farmers are indispensable.

Farms were not as efficient historically as they are today. The high labour intensity of agricultural work and relatively low output meant a lot of work had to be put into supplying the basic sustenance needs of the populace. The amount of crops harvested per farmer would not exceed the requirements of the farmer and his family by much, thus a large portion of the population of a country had to be farmers in order to stave of starvation (Verma, 2006). Subsequently, the large population of farmers and labourers played a large role in the development of the economic and political situation throughout the world (Mcmichael, 2008).

Domesticates and agricultural economies based on farming and herding are associated with radical restructuring in human societies. The development of the first cities and sedentary civilisations was only made possible through the use of domesticated crops and animals. The growth of a population often depended on the availability of food supplies. Increases in the supply of food through agricultural innovation and adaption made populations boom (Zeder, 2008).

Increases in agricultural production were made possible by innovations in equipment and method. The usage of plows, scythes and machinery allowed for faster and less labour intensive harvesting of crops (Chavas, 2008). Meanwhile the use of different crop types and harvesting methods allowed farmers to harvest more nutritional produce multiple times per year (Perkins & Jamison, 2008). One period in which large amounts of agricultural innovation occurred was during the British agricultural revolution.

The period of time between the 17th and 19th centuries saw large increases in agricultural production due to the adoption of new agricultural innovations. Improved fertilizers, the increased use of crop rotation and the use of new farming implements among other things allowed farmers to diversify and even export their crops on some occasions without facing the danger of starvation (Aposolides et al., 2008). This rapid growth in agricultural production has its effects on the economic conditions in the nation. The population of Britain increased rapidly as increased amounts of food allowed more people to live on smaller plots of land. Farmers could start growing more different types of crops for export or domestic consumption. The large changes in imports and exports as well as the price of crops likely affected the political situation in Britain during this time. (Caprettini & Voth, 2020)

Yet while agricultural production rose, national and regional tensions still often caused political unrest in Great Britain. The swing riots of the 1830s caused by a variety of factors like the adoption of labour saving technologies such as the new threshing machines show that the adoption of these technologies carry significant political risks as well (Caprettini & Voth, 2020). Furthermore although production rose throughout Great Britain during this time, the nation was no stranger to famine due to failed harvests or mismanagement. The 1855-1860 potato famine in Ireland is one of the examples of political unrest caused by crop failure (Engler et al., 2013). The change in regional political tension could vary due to crop failure, this however may be dependent on the type of crops and the size of the harvest.

Previous literature has tried to find the economic factors which explain increases and decreases in political unrest. The development status of a country, opportunity costs and greed have been linked to some extent to civil unrest (Moubarak, 2014). Regional exposure to shocks and uncertainty due to climate related concerns are also mentioned as factors which contribute to political unrest (Nurmanova, 2019). Industrial stability also seems to be a contributing factor to riots as all of these factors. The development factors, climatic factors, and industrial factors affecting the political situation in various countries often work through price shocks which negatively impact the general population’s physical and mental health (Loud, 1920). Agricultural shocks similarly impact these prices on a local and country wide level. The exact roles these various factors play and the circumstances surrounding these political incidents are still difficult to research and test. Hence some research states that the development factors only play a partial role in determining the political stability of a nation (Caruso & Schneider, 2011). Local and structural effects tend to impact political stability differently as the diffusion effects of economic shocks are much more potent in effect than direct local factor changes (Aidt & Leon-Ablan, 2022). Similarly local impacts of the previously discussed changes for the agricultural sector may show varying effects based on factors like crop variety and export potential. Finding out what role the agricultural production factors play on a local and national level may help uncover more about these determinants of political unrest.

2.1 Academic Contribution

This research plans to examine the relationship between the changes in regional crop cultivation and the political stability in those regions of England. Previous research has covered regional crop variation and its effect on prices and exports in countries like France (Liapis, 1988). Furthermore, the political and economic consequences of the agricultural revolution have also been discussed in previous papers (Newell, 1973; Overton, 1996). The link between the regional crop variation and the political stability of these regions during this period has however so far been mostly unexplored. As such in order to shed some light on the effect of crop variety on the political situation, this paper will be covering How regional crop variety affected the political stability in England during the agricultural revolution.

The usage of different historical datasets to construct a county specific cross-sectional database will contribute new insights in the historical usage of crops and their effect on internal political stability. Shedding light on the effects of this crop variation and exploitation may give additional insights into the historical economic indicators behind political stability. Furthermore, this paper could help further the discussion on the causes of political unrest by analysing the effect different crop yields have on this variable.

Examining crop types and political unrest from this historical angle can provide some beneficial information into currently ongoing debates and issues. Crops have historically been selected based on their profitability or resistances to weather or pesticides (Deepa & Ganesan, 2019). Finding out which crops have historically been correlated with higher or lower political unrest may cause some reconsideration of modern crop usage. Modern crop usage has also been occupied with the onset of climate change, which has increased a demand for more reliable crops, this paper may help in this selection by providing a historical perspective. Additionally, this paper may help us to understand the preconditions for riots among the population today, this may help policymakers adapt to the recent farmers protests. Examining the impact of different crop types and outputs on this unrest might help policymakers come up with a solution that would both satisfy environmental as well as agricultural concerns.

2.2 Research explanation

This research question will be tested using quantitative methods. These include regional crop variety statistics from (Turner, 2005). These crop statistics will be used in combination with data representing political stability for each county. The regional political stability will be represented by taking the data from the (Chambru & Maneuvrier-Hervieu, 2022) Historical social conflict Database. The comparative amount of riots per English region over the period between the 1680's and 1830's will be compared to the crop variation during this time to establish a possible link between the cultivation of different crop varieties and the political unrest in these regions. The data by Chambru & Maneuvrier-Hervieu (2022) used data from multiple sources such as regional studies and archival sources including Holland (2005) and Bohstedt (2010) to create a dataset of conflict and riots in multiple countries separated by region.

3 Literature review

3.1 Previous Research

3.1.1 History, Geography and Economy

The variables and aspects of this research have been studied previously in different literature. The individual impacts and causes of political unrest, crop variety, English historical development and the agricultural revolution as a whole provide us with preliminary expectations of this research. Firstly a piece of historical background on both the agricultural revolution in England as well as the general geographical, demographic, economic and political situation in England during this time should be provided. The historical context may already highlight historical factors which influence the variables used.

The economy of England during the time period covered in this research was largely dependent on the harvest. Each year would yield different harvests as weather and seasonal conditions affected the crops sown (van der Paauw, 1972). Yield ratios determined the size of the harvest, this statistic showed a large increase in yield ratio's from the late medieval period until the seventeenth century (Overton & Campbell, 1991). Roughly 4-5 bushels per acre would be harvested before the sixteenth century, comparatively in the middle of the seventeenth century this ratio would rarely fall below 8-10 bushels per acre. The large increase in the yields of wheat, rye, barley, oats, peas and beans showed an increase in agricultural production even before the agricultural revolution took place (Hoskins, 1964). Interestingly, regional differences in the economy of England were apparent from the wage differences between counties. The north of England and the southeast would generally see much higher average wages then the midlands and especially Cornwall. Part of the difference in relative wages between counties can be explained by industrialization. Counties with higher wages saw increased consumption of meat and luxury products. Wages and wage inequality might explain regional differences in political unrest (Hunt, 1986).

Geography has a large influence on the lifestyles of people. Countries have often specialized in various industries according to their geographical strengths and weaknesses. The societies in Scandinavia famously developed around fishing and raiding due to their coastal position and poor climatic conditions to grow crops (Ling et al., 2018). England is similarly divided among geographical boundaries. The fertile clay rich soil of eastern England are prime areas for agricultural production. This is opposed to the more mountainous and unsaturated landscape of Northern England which is less fertile. The fertile areas often became more densely populated through an abundance of sustenance. A link to political differences between these more or less fertile areas has been proposed. Fielding (2021) suggested a possible link between low social conservatism in densely populated areas due to acclimatization to innovation. The differences in soil are likely to be reflected in the harvest and crop data used in this paper, similarly, the political differences between these areas could influence the political instability factor.

Demographically, England would also see a large change in both population size and urbanization. The population of England increased from 8.3 million in 1801 to 16.8 million in 1851 (Gapminder et al., 2022). The increasing population and reduced labor intensity of agriculture led to a large amount of internal migration during this period. The population would move to the cities where new industries provided employment opportunities. Some cities and towns were however more successful in this industrialization effort than others. The large cotton industries in Manchester and Nottingham provided these cities in the north and midlands a good starting position for industrialization. The steel and power industries caused a growing demand in iron and coal which caused some areas with rich deposits of these resources to see an influx in population as well (Chapman, 1965). The urbanizing and densely packed population saw increases in mortality through the poor sanitary conditions (Kearns, 1988). It is these demographic changes and their consequences that are at the base of the political stability of these regions. Perhaps these industrialized regions saw larger amounts of political unrest because their large populations were subjected to the poor living conditions of the cities. The fewer plots of land that were available for agricultural production may also have caused increased price volatility (Bellemare, 2011).

3.1.2 Political context

The agricultural revolution in England coincided with a changing political landscape in the British isles. England had faced a large amount of civil strife during the 17th century. The civil war between the royalists and parliamentarians had wreaked havoc on the population of England. Trade and harvests had been negatively affected by the war. A higher percentage of England would die during this conflict than during the first world war (Peters, 2016); (Mortlock, 2017). During the latter part of the century, further political changes during the glorious revolution were followed by revolutionary legislation. The bill of rights gave the parliament more power to legislate and levy taxes while also benefitting the general population through a reform of the justice system and by giving the common man the freedom to petition the king (Lock, 1989). In

1707 England and Scotland were united under a single kingdom, this union facilitated agricultural improvements in Scotland although these would lag behind English agricultural development (Douglas, 2009). Because of the differences between these countries examining their agricultural revolutions separately ought to produce more reliable results. The English parliament would facilitate the enclosure of property through various acts. These acts would facilitate a change in land ownership. Farmers went from working multiple narrow distant strips of land to working a single large field over which they often had legally enforceable rights. The increase in agricultural productivity that was facilitated by the enclosures also required fewer tenants to work the same amount of land, this caused many former farmers to leave the countryside to look for work in the industrializing towns and cities (Gay, 1905). The industrial revolution of the late 18th and 19th centuries would see various political movements as well. The increased production of both consumer and agricultural goods through the use of steam engines and other machines did not benefit the entire population. Farmers displaced by the aforementioned land reforms would cause overcrowding in cities. Poor wages, large working hours and almost non-existent social safety nets caused the standard of living for many people to stagnate. The bad living conditions caused protests against industrialization in both urbanized and rural areas of the country (Holland, 2004). Regional differences in wages would thus suggest differences in political unrest as well. To stop the riots and unrest that resulted from the increased use of machinery, parliament enacted various poor laws. The effectiveness of these poor laws in decreasing unrest is however difficult to assess (Boyer, 1985).

Previous research has examined the political situation in England during our specified time period (Clark, 1996). The paper noted "The evidence suggests that England in the period prior to the Industrial Revolution cannot be cited as an example of the importance of political stability to economic development"(Clark, 1996, p.26). The paper thus suggests that a positive causal relationship between political stability and economic development cannot be established prior to the industrial revolution. The decoupling of political stability from economic development is of particular interest here as these aspects are related to agricultural production and the agricultural revolution. The economic impacts of the agricultural revolution are observable through the increase in food production. The question remains whether this agricultural development affected the political situation in turn.

3.1.3 Crop differences

Broadberry et al. (2015) have previously examined British agricultural production. They have compiled significant amounts of data on the regional crop and livestock variety as well as price increases and decreases over time. The Book noted an increase in agricultural production over the time period it covers, going on to state that livestock productivity increased more substantially. The usage of the different crops are also covered to some extent as well as the price fluctuations of the various agricultural products. The differences in crop types and their usage are also mentioned in the book, this is of particular interest to this research as it may provide some insights into the different regional cultivation of crops. Barley and oats yields are higher in the south for instance, while pulses do better in the east of England. Furthermore grain was changed from an export to an import good due to population growth requiring more grain over time. However its elasticity also increased as the abundance of grain allowed more of it to be used for uses beyond basic sustenance. Bakeries could make different pastries while breweries would make different drinks. These more luxurious goods were not necessary to survival and thus subject to larger changes in demand compared to the more basic bread and beer. Ultimately the book connects these varying agricultural outputs with the economic growth of Britain between 1270 and 1870.

The differences between the crops grown during the agricultural revolution are also important aspects to determining the relationship between the variety in these crops and political stability. The labour requirements, energy output and perfect growing conditions for wheat, rye, barley, oats and pulses are all different to some extent. Barley has a high resistance to salinity and drought which ultimately means that the crop can be planted more extensively in regions which experience these droughts and salty soils more frequently (Ziaei et al., 2015). Wheat is currently grown on more land than any other crop, its advantage is both its versatility and its relatively high protein content. The harvesting of wheat was made more efficient through the use of harvesters during the agricultural revolution making it one of the most efficient crops to plant during this time. The relatively efficient means of storage and the earlier mentioned high protein content of wheat helped it achieve its place as one of the most popular crops, the price of wheat relative to the other crops covered in this paper was also lowered due to the increased harvest yields (Clark, 2004). However the biggest advantage of wheat is the versatility of the crop. Bread, porridge, biscuits, beer and cereals are all made using wheat. The large amount of different uses for wheat created a demand that fit the easy supply of the crop (Shewry, 2009). Oat is often used as animal feed but can also be used to make bedding or oatmeal. The oat can be grown in different climate types during different periods of time depending on the seasonal conditions. The crop requires a large amount of water but is very resistant to incredibly heavy rains and cold conditions (Stevens et al., 2004). Pulses are even higher in protein levels than wheat which makes them an excellent source of nutrition. Pulses can face problems with regards to storage and digestibility. Long storage times in humid conditions will decrease the quality of the seeds (Singh, 2017). Finally, rye is also popular as a crop. It has been used widely in animal feeds and in the production of bread. Rye is extremely resistant to cold conditions and can grow in soil with low fertility. In highly fertile soils rye has however often been replaced by other grains like wheat (Bushuk, 2001). The less fertile north of England may be better suited to the more resistant crops like rye, barley and oats. Whether the use of these crops has also led to changes in the political situation of these areas remains to be seen.

3.1.4 Agriculture and political unrest

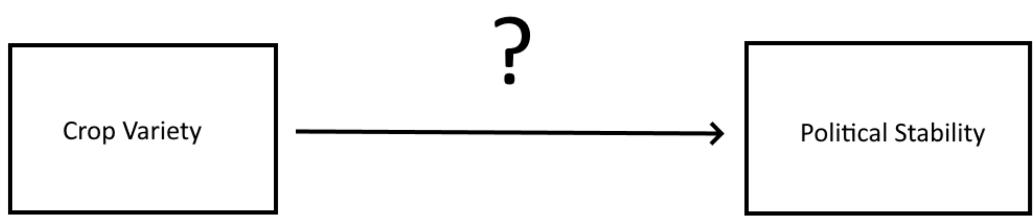
A paper by Pretty (1991) covered the British Agricultural Revolution and the innovations associated with it. The paper argues that the innovations of the agricultural revolution allowed the population to grow. The maximised use of resources through the development of new technologies caused crop and livestock production to triple. The paper addresses technologies like the seed drill and Four Course rotation which allowed for more effective land usage. The use of surveyors allowed for easier adoption while newspapers and Books allowed these advancements to be spread more quickly among farmers. The adoption of technologies would nevertheless often be delayed by 100 to 200 years as the diversity of Britain would cause some technologies to only be commonplace in small localities. This might cause some regional variation in crop usage and cultivation which ultimately has an effect on this paper.

Having now established the historical background and having obtained information on crop production, the next step is to find a link between political unrest and crop production. (Bellemare, 2011) addresses the effect food prices and price volatility had on political unrest. The paper noted that increases in food prices were associated with higher levels of political unrest. However, a positive relationship between food price volatility and political unrest was not found. This indicates that although there may be a link between food prices and unrest this does not directly translate to a link between large price shocks and political instability.

Last of all, the link between political unrest and agriculture was discussed by Hendrix & Haggard (2015). The paper compared the effect of both regime types and agricultural factors like food prices and agricultural policy on the political unrest in developing countries. The paper found that global food prices are positively associated with increases in rioting, yet this relationship was dependent on the regime type of the country. Global food prices are correlated with agricultural production, hence this paper might find a relationship between agricultural production and increased riots. Similarly, Paveliuc Olariu (2013) mentioned a similar relationship between civil unrest and food shortages throughout the world. It should however be noted that these papers cover a relatively recent time period compared to our research. Furthermore the role of regime types might cause an analysis of English unrest to yield different results than Hendrix & Haggard, (2015).

3.2 Modelling

FIGURE 1: BASIC CONCEPTUAL MODEL



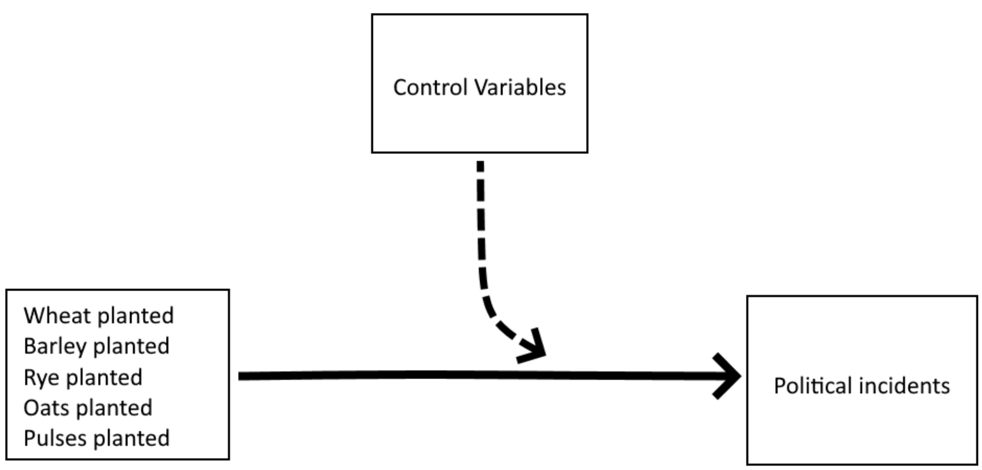
The basic variables and context given by the papers provide a context from which to establish the main hypothesis. As outlined in the previous sections, regional crop variety and political stability will be the main dependent and independent variables. Establishing a positive or negative relationship between the two will however be difficult without both proper definitions of these variables and additional independent variables. Starting with the first point, both crop variety and Political stability are quite nebulous concepts which can be measured in different ways. Figure 1 shows the basic conceptual model which includes the main dependent and independent variables. Crop variety and political stability are not yet clearly defined in this model, to avoid further complications both of these terms should be defined as clearly measurable variables. The regional differences in crop variety and cultivation should be measured with the other regional differences in mind. Taking the amount of different crops sown or any other absolute number runs the risk of measuring the amount of arable land or population instead of crop variety. Taking the percentages of specific crops grown in the region compared to the total in England would somewhat mitigate this problem. Crop variety will be measured by taking the percentages of each crop grown compared to the total county crop output of all of the assessed crops. The effect crop variety has can then be determined by an analysis of each crops significance in affecting political unrest. Political stability is not necessarily an objective measure either, the amount of coups or the number of protests can all be used to measure political stability yet yield varying outcomes. Political movements tend to depend on different factors in different countries under different conditions. High Oil prices could spark protest in one country while making other countries less susceptible to protests (Vadlamannati & de Soysa, 2020). The amount of protests in an authoritarian society could be lower due to the repression and crackdowns, yet this does not necessarily translate to a more stable society. However, these issues mostly arise when comparing political stability between countries. A comparison between countries is not made in this research, hence a single definition may be taken to represent political unrest. Taking the amount of riots is likely to be representative of the political stability statistic. Riots/conflicts will thus be used to represent political stability.

3.2.1 Hypothesis

With regards to establishing a hypothesis, the previously covered papers may be of assistance. Hendrix and Haggard (2015) and Paveliuc Olariu (2013) mentioned the effects of food prices on political stability. Higher food prices led to food shortages which led to food riots. Food prices during the agricultural revolution were largely dependent on the size of the year's harvest. Harsh winters or blights could cause the harvest to fail and prices to rise (Hoskins, 1964). Counties and regions cultivating a larger variety of crops are likely less vulnerable to these blights or harsh conditions as different crops have different needs (Fischer, 2015). It would therefore be likely that a larger crop variety means a lower amount of political unrest. The hypothesis can thus be stated as the following:

Crop variety has a negative relationship with political instability.

FIGURE 2: EXPANDED CONCEPTUAL MODEL



3.2.2 Expanded conceptual model

There are multiple variables which may have had an effect on the political stability of England and its regions during the agricultural revolution. The economic, demographic and historical factors will be assembled into a more detailed theoretical model to better understand the factors influencing this political unrest. Figure 2 shows the expanded conceptual model which includes both the independent and dependent variable as the terms they were measured as. The control variables are added to the model to improve the predictive power and strength of the model. The model will be using the crop variety per county which is split into five large crop types. The crop types will be used as the independent variable to determine the crop variety. The previously covered economic situation and the developing agricultural situation causes the crop variety to be of particular interest. The different uses of crops and their prevalence may explain regional differences in other variables. The effect of crop variation on regional differences in political instability will hence form the first avenue of research. Crop variety will be calculated by calculating the percentage yield of certain crops of the total county wide yield. Different crop types have different advantages which may in turn impact the dependent variable. With regards to the differences in crops it may be worthwhile to create a sub-hypothesis based on expected influences of each crop type. Previous research has established that the crops rye, barley and oats are more resistant to different weather types and conditions than wheat. When a period of drought or heavy rainfall occurs it is likely that counties with more rye, barley and oats will be able to harvest a larger portion of their crops. The counties with a higher portion of successfully harvested crops will likely see fewer riots. I therefore pose that Rye, barley and oats are more negatively correlated with political instability then wheat.

Further factors of particular interest have also come up during the analysis of previous literature. These additional factors should be included into the analysis as a means to explain political unrest fully. Geographical and demographic factors will be taken into account through the inclusion of acreage size per county as well as the total crop output per county as these factors can influence political unrest themselves. The acreage size per country is of importance as this determines how much food can be produced in each county. Counties see varying total crop output levels based on acreage size which in turn has an effect on what crop is grown, prices and political stability. Population size and density will also be taken into account as a variable as a possible link between these factors and social conservatism was proposed by fielding (2021). As seen previously the changing needs of agriculture and the movement towards industrialising cities makes population a historically important variable for this analysis. Economic factors generally cause a change in the political sphere. The economic circumstances during the agricultural and industrial revolution were the cause for protests and riots during this time. The poor working conditions and low wages thus influenced the political situation. Hence average wages per county will be taken into account as a factor because it might help explain the differences between counties. Price differences are important to discuss with regards to the wage data as these tend to influence the actual purchasing power of the wages. One dollar in Russia buys more than a dollar in the US. However, the extent of the problem in a county-by-county comparison is not as large. The real wages per county in England during the agricultural revolution are difficult to measure due to the amount of county-based price data required. The paper will be taking nominal wages into account with the caveat that these do not fully reflect the differences in cost of living between counties.

4 Methodology

As insufficient time based data was available, the paper will be using a simple OLS regression based on linear cross-sectional data. The regression will consist of multiple factors which attempt to explain the political unrest variable. The Political unrest variable will be measured as the amount of riots that occurred during the agricultural revolution, these riots vary with regards to causes and size but should nevertheless provide a decent indicator of political unrest. The amount of political incidents in each county during the timeframe will thereby be used to measure poltical unrest. Figure 3 gives the histogram of the dependent variable, showing the amount of incidents and how often these occur in the dataset. Data from the 1680's up to the 1880's will be taken into account. As mentioned previously the data on political incidents was taken from (Chambru & Maneuvrier-Hervieu, 2022). Furthermore the explanatory variable crop variation will be measured by taking the percentages of each crop per region as to create a representative sample of the crop types compared to other counties. The crops taken into account are Wheat, Rye, Barley, Oats and pulses as these were grown broadly and each have different uses and strengths which could lead to regional differences. The data on these crops were compiled by parish which was totalled per county in this paper. Each crops percentages and their frequency of occurring in the dataset are shown in Figure 4. The original data comes from (Turner, 2005). The regions in this paper are given in Table 3, these are all the counties which were part of England during the time period covered. Population per county will be used as a variable as this is likely to affect all other variables. The amount of 20 year olds engaged in agriculture will also be taken into account even though it is mostly related to population as this may account for some of the demographic differences. The population statistics are taken from 1771 as this date is relatively representative of the populations during the entire period. These scores are taken from Wrigley (2007). The total acreage per county in acres as well as the percentage of total land that is arable are taken into account as well as this is likely to affect crop output. This data is taken from 1836 as this is the earliest date at which reliable statistics for this factor exists. This data is taken from Broadberry et al. (2015). Finally, the differences in wages are likely to cause some differences in riots between counties. Hence the wages of agricultural labourers per county are taken into account. Although wages were calculated in shillings and pence's, these have been converted to pounds in the analysis. The wages are nominal wages per county for the timespan of the data, although county-by-county price differences may cause some differences in purchasing power, the wage data is generally representative of the wealth earned compared to the rest of the country. The wage data spans 1794-1795 as this span accounts for single large pay rises or falls and is representative of the total time span. The wage data was taken from Hunt (1986).

For the analysis the data was given a variable describing the data it uses. The following variables correspond to the following data:

- Instability incidents = Amount of riots per county
- Wages 1795 = Wages in pounds from 1794-1795
- Acreage = The amount of arable acres per county in 1836
- Arable percentage = Amount of arable land as a percentage of all land per county in 1836
- Twenty year olds in agriculture = Amount of twenty year olds employed in agriculture in 1771
- Agricultural occupiers = Amount of agricultural employers employing labour in 1771
- Population = Population per county in 1795
- Population per acre = Population in 1795 divided by the amount of arable acres per county

Five models will be used to measure the effect of each crop on political instability individually. Oats, Wheat, Rye, barley and Pulses will each receive their own regression. The crops will not be included in the regressions of each other to avoid them affecting the results. Below in Table 1 the descriptive statistics of the variables included in the model as well as their sources are given Before using the OLS regression on the data a number of tests have to be performed in order to make sure the data satisfies the assumptions for an OLS regression. The residuals were checked to identify if they are normally distributed, independent and had a mean of zero. Heteroscedasticity was checked as well as the possibility of autocorrelation showing up.
A multi collinearity test was performed on the data in order to determine whether the data was usable in this form. The VIF values remained close to one on all but the most obvious variables. The two variables "population" and "twenty year olds in agriculture" both showed some multi collinearity at values above 5. The multi collinearity of these two variables is likely a result of the influence of population on both values. The dataset can still be used as the high VIF values are only present for the control variables. The only other test that gave a significant p-value was the heteroscedasticity test. The Non-constant variance test showed a significant outcome meaning that the error variance likely changed with the level of our fitted response value. The heteroscedasticity was likely caused by significant outliers in the data which caused the error variance changes. The data was "winsorized" for these extreme values to mitigate the problem while keeping the observations mostly intact. This "winsorize" command replaces the quantum of some of the smallest and largest values with other boundary values thus reducing the effect of outliers. The adjusted data showed no significant heteroscedasticity meaning it could be used without causing as many problems.

The new adjusted variables are compliant with the standard OLS assumptions, the results can therefore be reliably interpreted according to these assumptions. One more look at the variables and their general characteristics may be useful before applying the data. Table 1's descriptive statistics firstly show a fairly meagre number of observations, the amount of counties in England limit the amount of observations. Each observation has a fairly high impact on the dataset and the regressions which makes the dataset fairly vulnerable to single outliers. The previously mentioned adjustments help limit the effects of the outliers, yet unrepresentative or erroneous data may still impact the regressions. The large means of acreage and population based data are logical due to the measurements in people and acres. These large numbers will likely lead to a regression coefficient output close to zero. Each change of one in acreage or population is unlikely to change the instability significantly. The different measurements should also be noted with regards to the crop type variables. The measurement of the five crops in percentages should be kept in mind in future analysis as these relative numbers are compared with the absolute numbers of the dependent and control variables. The significance of the data should however still be unchanged and representative of the impacts of these variables. Lastly, the large standard deviations for some variables may be caused by the differences in the size of counties. Some English counties include much more land or people than others, these large differences should not be problematic for the analysis.

TABLE 1 : DESCRIPTIVE STATISTICS AND SOURCE OF VARIABLES

Statistic	N	Mean	St. Dev.	Min	Max	Source
Average wages	41	1.034	0.141	0.800	1.320	(Hunt, 1986)
Instability incidents	41	71.415	47.640	16	161	(Chambru & Maneuvrier-Hervieu, 2022)
Acreage	41	800,624.400	428,440.500	96,640	1,815,040	(Broadberry et al., 2015)
County arable percentage	41	44.300	14.646	21.500	72.400	(Broadberry et al., 2015)
Twenty year olds in agriculture	41	77,391.460	70,988.120	4,940	358,521	(Wrigley, 2007)
Agricultural occupiers	41	3,410.049	1,871.000	429	9,328	(Wrigley, 2007)
Wheat percentage	41	35.061	6.463	15.276	47.003	(Turner, 2005)
Rye percentage	41	0.798	0.918	0.000	4.624	(Turner, 2005)
Barley percentage	41	24.925	8.380	4.837	42.683	(Turner, 2005)
Oats percentage	41	28.261	12.832	7.338	65.834	(Turner, 2005)
Pulses percentage	41	10.955	8.361	0.073	28.411	(Turner, 2005)
Population per acre	41	0.277	0.454	0.018	2.951	(Broadberry et al., 2015), (Wrigley, 2007)
Population	41	161,545.300	109,754.200	15,102	637,458	(Wrigley, 2007)

5 Results

TABLE 2 : REGRESSION OUTPUT

	Dependent variable:				
	Instability incidents				
	Oats regression	Wheat regression	Rye regression	Barley regression	Pulses regression
	(1)	(2)	(3)	(4)	(5)
Oats percentage	-1.1*				
	(0.6)				
Wheat percentage		-0.3			
		(1.2)			
Rye percentage			-8.6		
			(7.8)		
Barley percentage				2.4***	
				(0.8)	
Pulses percentage					-0.1
					(0.9)
Average wages	61.1	38.9	51.2	79.1	42.6
	(53.0)	(55.7)	(54.0)	(49.5)	(54.7)
Population per acre	-57.9	-57.3	-54.1	-45.4	-54.2
	(37.9)	(40.5)	(39.0)	(35.2)	(41.3)
Acreage	-0.000**	-0.000**	-0.000**	-0.000***	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
County arable percentage	0.6	0.7	0.8	0.7	0.8
	(0.5)	(0.5)	(0.5)	(0.5)	(0.6)
Twenty year olds in agriculture	0.000	-0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Agricultural occupiers	0.02**	0.01*	0.01	0.02**	0.01*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Population	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-6.1	-11.5	-30.3	-124.6*	-26.2

	(69.3)	(93.1)	(70.5)	(71.2)	(71.8)
Observations	41	41	41	41	41
R^2	0.4	0.4	0.4	0.5	0.4
Adjusted R^2	0.3	0.2	0.2	0.4	0.2
Residual Std. Error (df = 32)	40.3	42.1	41.4	37.2	42.2
F Statistic (df = 8; 32)	3.0^{**}	2.4^{**}	2.6^{**}	4.2^{***}	2.4^{**}
Note:	*p<0.10**p<0.05***p<0.01				

Table 2 above shows the effects of the aforementioned variables on the political instability factor discussed before. Firstly, the adjusted R-squared variables between 0.2 and 0.4 show that although the variables included in the analysis give a partial explanation of the development of political instability over time, the analysis can be expanded through the addition of more factors. The amount of observations concern the number of counties included in the analysis. The main explanatory variables seem to mostly have no effect on the instability incidents factor. Oats and wheat share a negative multiplier while the other three crops show a possible positive relationship, yet for all crops except oats and barley, the results are not at all significant and must therefore be taken as inconclusive. The negative correlation between oats and instability incidents show a possible link between a high amount of oats sown and lower political instability yet this correlation should be taken with a large grain of salt as there is a chance between 5% and 10% that this correlation was falsely identified. The correlation between Barley and political stability is a positive one. The positive correlation means that an increase in the percentage of Barley planted in a county is correlated with more instability incidents. The correlation established by the table is relatively trustworthy as the chance of this correlation being falsely identified is below 1% based on this data. The correlation between barley and instability incidents means that a higher percentage of barley grown compared to other regions leads to a larger amount of riots.

The control variables with regards to, acreage and agricultural occupiers are significantly correlated with instability incidents. These two factors seem to influence political instability in opposing ways. Larger amounts of acreage in a county leads to lower political instability while increased amounts of agricultural occupiers led to more political instability, though this relationship is not present for all regressions. Oddly enough the wages and population per acre are not at all significant in any way. Another interesting part of the results is that of the other variables which might indicate an abundance of food like the county arable percentage, none are correlated in any way with political instability. No correlations between the amount of twenty year olds employed in agriculture and the general population with instability could be found. Currently these factors seem to influence political stability insufficiently to cause a notable increase or decrease in the amount of riots.

The regression output is as previously mentioned influenced by the different measurements of the variables. The population based and acreage variables did as mentioned cause the regression to output many coefficient scores close to zero. Although the coefficients give little indication of the effect of each acre or person, the significance and positive or negative modifier still make these scores useful to take into account when explaining the instability incidents variable.

6 Conclusion & Reflection

Analysis of the data showed that only two of the crops had a significant effect on the political stability factor. The percentage of barley planted compared to the other crops in the region showed that higher amounts of planted barley had a positive significant relationship with instability incidents. The higher the amount of barley planted compared to other crops the higher the political instability in these counties. Higher amounts of oats planted in the county were correlated to some extend with lower political instability. The relationship between oats and political stability is however not decisive enough to be taken for granted as this relationship still had a significant chance to be a false positive.

The results somewhat oppose the hypothesis previously posed. Barley is as stated in the literature review seen as a crop that is relatively resistant to salinity and dry weather conditions. The resistances of barley to adverse weather conditions would suggest that a county growing a lot of this crop would see more stable harvests. More stable harvests would in turn lead to lower food prices and a smaller amount of political incidents. However, the results point towards barley having the exact opposite impact compared to the previously stated expectations. A possible explanation for this phenomenon could be the conditions under which counties have to plant barley. Barley may primarily be planted in counties whose soils have high salt contents and face more droughts than other counties. Although the output of barley may be high under these conditions, other crops face more difficulty growing in these lands thus decreasing overall output, increasing food prices and causing political instability. The possible explanation of the relationship between barley and political stability is further complicated by the results obtained from the Oats regression. Oats are a crop which is resistant to heavy weather like rainfall while requiring a lot of water, this resistance to extreme weather which is also present in barley might suggest similar outcomes. The different resistances and planting conditions might be a cause of the opposite relationship both crops seem to have with political stability. Taking the current results into account we have to reject the sub-hypothesis posed in the methodology section. Rye and barley are not more negatively correlated with political instability than wheat. The relationship between oats and political stability is also not significant enough to make a definitive statement about the political effects of this crop compared to the others. Insufficient information on the effect of wheat on political stability also makes it impossible to confirm the sub-hypothesis at this time. With the current results we can make no statements regarding the political impacts of wheat, rye and pulses. The significant positive relationship between political unrest and barley would suggest the opposite of the relationship posed in the sub-hypothesis. The opposite relationship cannot be stated with certainty either as the relationships between political unrest and wheat, rye and oats are unclear. The main hypothesis also has to be rejected as the effect of different crops on political unrest is not decisive. The data indicated no relationship between most of the crops and political instability could be established, hence it is impossible to say whether more variety between these crops causes fewer or more political incidents. While Oats and Barley have planted at different rates likely have some impact on political stability, a decisive correlation between all crops and political stability would be necessary to establish a definitive correlation between crop variety and political stability. Although the research question cannot currently be definitively answered, the positive and negative correlations found between some of the crops and political instability does shows that there may be more to this relationship than meets the eye. More research into the benefits of both past and present use of barley, oats and the other crops can provide more information regarding their strengths and weaknesses. Lowering the production of barley and perhaps increasing the cultivation of oats in accordance with current research may yield positive results with regards to political stability. More research is still necessary to solidify the effect of crop types and variety on political stability before significant policy changes can be made.

6.1.1 Discussion

Future research on similar topics could expand the current analysis and add to the research by expanding and changing the variables and analysis involved. The cross-sectional data used currently was used due to the unavailability of sufficient yearly data for all independent and dependent variables. If more data on this topic is available for more years a panel data analysis may become possible. A panel data analysis will help reduce the effect of outliers in both crop production and yearly output. The cross-sectional data used currently does not have this same advantage. More variables could also be added to create a model with a higher R-squared. The variance in the independent variable explained by the dependent variables remains quite low currently. Adding additional factors based on trade between countries, temperatures and prices could help expand the model and more adequately explain the variance of political stability. Other crop types and agricultural products like livestock could also be added to assess the impact of these factors on political stability. Finally, future research could decide to measure variables used in this piece differently than this research does. The measurements taken could be further reduced to production of crops per farmstead or instead compared on a country-wide or regional basis. The dependent variable may also be measured through other methods like government stability or political violence. The different measurements of these variables may cause the analysis to yield more meaningful results.

This research was limited by a number of factors. As previously stated, the analysis was performed on cross-sectional data from the same time-period but different times, this discrepancy between the data used was caused by differences of availability in data. Although the data is likely mostly representative of the time, the different measurement years may have caused some issues in the data as population for a single year may not be completely representative for the other years used. This problem is the largest for the instability incidents factor as these were taken from a larger timeframe than the other variables.

Due to the large use of historical documents and measurements in this research the accuracy of the data studied may also vary. Historical documents and reports are often not as reliable as modern day sources. The accuracy of crop and population measurements during this time may vary with the author and their own measurement strategy (Gill, 2018). The crop measurements taken from the 1801 crop returns contained a large amount of notes regarding the unavailability or inaccuracy of the crop returns for some parishes. The notes were taken into account as much as possible when calculating the county-wide crop harvests. The notes regarding unavailable data for some parishes could however not be accounted for accurately, as such this research may have undercounted the crop harvest for some counties. Last of all, the amount of observations in the paper was limited by the total number of counties in England. This problem was unavoidable as the analysis was built upon comparisons between counties. The relatively small number of observations may still cause the analysis to be less representative and trustworthy than an analysis with more included observations.

To summarise, this paper represents an examination of the relationship between various crop outputs and the political instability in England during the agricultural revolution. The hypothesis of the paper expected a negative relationship between crop variety and political instability. The paper found insufficient evidence to establish a relationship between the crop outputs and the political instability factor. Due to the inconclusive relationship found by the OLS-regressions used the hypothesis is rejected.

7 Bibliography

Aidt, T., & Leon-Ablan, G. (2022). The Interaction of Structural Factors and Diffusion in Social Unrest: Evidence from the Swing Riots. *British Journal of Political Science*, *52*(2), 869–885. https://doi.org/10.1017/S0007123420000873

Aposolides, A., Broadberry, S., Campbell, B., Overton, M., & van Leeuwen, B. (2008). *English Agricultural Output and Labour Productivity, 1250- 1850: Some preliminary estimates*. https://ore.exeter.ac.uk/repository/handle/10871/13985

Bellemare, M. F. (2011). Rising Food Prices, Food Price Volatility, and Political Unrest. *SSRN Electronic Journal*, 1–42. https://doi.org/10.2139/ssrn.1874101

Bohstedt, J. (2010). *The Politics of Provisions: Food Riots, Moral Economy, and Market Transition in England, c. 1550–1850*. Routledge. https://doi.org/10.4324/9781315554297

Boyer, G. R. (1985). The Economic Role of the English Poor Law, 1780–1834. *The Journal of Economic History*, *45*(2), 452–454. https://doi.org/10.1017/S0022050700034185

Broadberry, S., Campbell, B. M. S., Klein, A., Overton, M., & van Leeuwen, B. (2015). *British Economic Growth, 1270–1870*. Cambridge University Press. https://doi.org/10.1017/CBO9781107707603

Bushuk, W. (2001). Rye production and uses worldwide. *Cereal Foods World*, *46*(2), 70–73.

Caprettini, B., & Voth, H.-J. (2020). Rage against the Machines: Labor-Saving Technology and Unrest in Industrializing England. *American Economic Review: Insights*, *2*(3), 305–320. https://doi.org/10.1257/aeri.20190385

Caruso, R., & Schneider, F. (2011). The socio-economic determinants of terrorism and political violence in Western Europe (1994–2007). *European Journal of Political Economy*, *27*, 37–49.

https://doi.org/10.1016/j.ejpoleco.2011.02.003

Chambru, C., & Maneuvrier-Hervieu, P. (2022). Introducing HiSCoD: A new gateway for the study of historical social conflict. *Working Paper Series / Department of Economics*, *407*, Article 407. https://doi.org/10.5167/uzh-217109

Chapman, S. D. (1965). The Transition to the Factory System in the Midlands Cotton-Spinning Industry. *The Economic History Review*, *18*(3), 526–543. https://doi.org/10.2307/2592563

Chavas, J.-P. (2008). On the economics of agricultural production*. *Australian Journal of Agricultural and Resource Economics*, *52*(4), 365–380. https://doi.org/10.1111/j.1467-8489.2008.00442.x

Clark, G. (1996). The Political Foundations of Modern Economic Growth: England, 1540-1800. *The Journal of Interdisciplinary History*, *26*(4), 563–588. https://doi.org/10.2307/205042

Clark, G. (2004). THE PRICE HISTORY OF ENGLISH AGRICULTURE, 1209–1914. In *Research in Economic History* (Vol. 22, pp. 41–123). Emerald Group Publishing Limited. https://doi.org/10.1016/S0363-3268(04)22002-X

Deepa, N., & Ganesan, K. (2019). Decision-making tool for crop selection for agriculture development. *Neural Computing and Applications*, *31*(4), 1215–1225. https://doi.org/10.1007/s00521-017-3154-x

Douglas, C. (2009). Enclosure and agricultural devolopment in Scotland. *University of Oxford*, 1–648.

Engler, S., Luterbacher, J., Mauelshagen, F., & Werner, J. (2013). *The Irish famine of 1740–1741: Causes and effects*. https://doi.org/10.5194/cpd-9-1013-2013

Fielding, D. (2021). By the soil divided: The roots of geographical variation in English social conservatism. *Political Geography*, *84*, 102303. https://doi.org/10.1016/j.polgeo.2020.102303

Fischer, R. A. (2015). Definitions and determination of crop yield, yield gaps, and of rates of change. *Field Crops Research*, *182*, 9–18. https://doi.org/10.1016/j.fcr.2014.12.006

Gapminder, HYDE, Systema Globalis, & United Nations World Population Prospects. (2022). *Population by country, available from 10,000 BCE to 2100, based on data and estimates from different sources.* (Version 7) [dataset]. Our world in data. https://ourworldindata.org/grapher/population?tab=map

Gay, E. F. (1905). The Inclosure Movement in England. *Publications of the American Economic Association*, *6*(2), 146–159.

Gill, J., David. (2018). Constructing Trustworthy Historical Narratives: Criteria, Principles and Techniques. *British Journal of Management*, *29*(1), 191–205.

Hendrix, C. S., & Haggard, S. (2015). Global food prices, regime type, and urban unrest in the developing world. *Journal of Peace Research*, *52*(2), 143–157. https://doi.org/10.1177/0022343314561599

Holland, M. (2004). *Swing unmasked: The agricultural riots of 1830 to 1832 and their wider implications*. FACHRS Publishing.

Hoskins, W. G. (1964). Harvest Fluctuations and English Economic History, 1620-1759. *The Agricultural History Review*, *16*(1), 15–31.

Hunt, E. H. (1986). Industrialization and Regional Inequality: Wages in Britain, 1760-1914. *The Journal of Economic History*, *46*(4), 935–966.

Kearns, G. (1988). The urban penalty and the population history of England. In *Society, Health and Population during the Demographic Transition* (pp. 213–236).

Liapis, P. S. (Ed.). (1988). *Economic analysis of grain production in france*. United States Department of Agriculture, Economic Research Service. https://doi.org/10.22004/ag.econ.278016

Ling, J., Earle, T., & Kristiansen, K. (2018). Maritime Mode of Production: Raiding and Trading in Seafaring Chiefdoms. *Current Anthropology*, *59*(5), 488–524. https://doi.org/10.1086/699613

Lock, G. (1989). The 1689 Bill of Rights. *Political Studies*, *37*(4), 540–561. https://doi.org/10.1111/j.1467-9248.1989.tb00288.x

Loud, H. K. (1920). Industrial Unrest Caused by the Changing Measure of Value. *The ANNALS of the American Academy of Political and Social Science*, *90*(1), 143–150. https://doi.org/10.1177/000271622009000131

Mcmichael, P. (2008). Peasants Make Their Own History, But Not Just as They Please. . . *Journal of Agrarian Change*, *8*(2–3), 205–228. https://doi.org/10.1111/j.1471-0366.2008.00168.x

Mortlock, S. (2017). *Death and disease in the English Civil War* [Text]. The Biomedical Scientist. https://thebiomedicalscientist.net/science/death-and-disease-english-civil-war

Moubarak, R. (2014). The Economic Determinants of Civil Unrest: A Cross-National Study. *University of Ottawa*, *1*(1), 1–39.

Newell, W. H. (1973). The Agricultural Revolution in Nineteenth-Century France. *The Journal of Economic History*, *33*(4), 697–731.

Nurmanova, D. (2019). Exogenous Shocks and Political Unrest. *Electronic Theses and Dissertations 6355*, 1–170.

Overton, M. (1996). *Agricultural revolution in England: The transformation of the agrarian economy 1500-1850*. Cambridge, England ; New York : Cambridge University Press. http://archive.org/details/isbn_9780521568593

Overton, M., & Campbell, B. (1991). *Productivity change in European agricultural development* (pp. 1–50).

Paveliuc Olariu, C. (2013). Food scarcity as a trigger for civil unrest. *Advances in Agriculture and Botanics*, *5*(3). https://orbi.uliege.be/handle/2268/159393

Perkins, J. H., & Jamison, R. (2008). History, Ethics, and Intensification in Agriculture. In P. B. Thompson (Ed.), *The Ethics of Intensification: Agricultural Development and Cultural Change* (1st ed., pp. 59–83). Springer Netherlands. https://doi.org/10.1007/978-1-4020-8722-6_3

Peters, E. (2016). Trauma Narratives of the English Civil War. *Journal for Early Modern Cultural Studies*, *16*(1), 78–94.

Pretty, J. N. (1991). Farmers' extension practice and technology adaptation: Agricultural revolution in 17–19th century Britain. *Agriculture and Human Values*, *8*(1), 132–148. https://doi.org/10.1007/BF01579666

Shewry, P. R. (2009). Wheat. *Journal of Experimental Botany*, *60*(6), 1537–1553. https://doi.org/10.1093/jxb/erp058

Singh, N. (2017). Pulses: An overview. *Journal of Food Science and Technology*, *54*(4), 853–857. https://doi.org/10.1007/s13197-017-2537-4

Stevens, E., Armstrong, K., Bezar, H., Griffin, W., & Hampton, J. (2004). Fodder oats: A world overview. In *Fodder Oats: A World Overview* (pp. 1–10). Food and Agriculture Organization of the United Nations.

Turner, M. (2005). *Crop Returns for England, 1801* [CESSDA Data Catalogue]. UK Data Service.

https://doi.org/10.5255/UKDA-SN-5156-1

Vadlamannati, K. C., & de Soysa, I. (2020). Oil price volatility and political unrest: Prudence and protest in producer and consumer societies, 1980–2013. *Energy Policy*, *145*(1), 111–719. https://doi.org/10.1016/j.enpol.2020.111719

van der Paauw, F. (1972). Quantification of the effects of weather conditions prior to the growing season on crop yields. *Plant and Soil*, *37*(2), 375–388. https://doi.org/10.1007/BF02139980

van der Ploeg, J. D. (2020). Farmers' upheaval, climate crisis and populism. *The Journal of Peasant Studies*, *47*(3), 589–605. https://doi.org/10.1080/03066150.2020.1725490

Verma, S. R. (2006). Impact of Agricultural Mechanization on Production, Productivity, Cropping Intensity Income Generation and Employment of Labour. *Punjab Agricultural University, Ludhiana*, 133–153.

Wrigley, E. A. (2007). English county populations in the later eighteenth century1. *The Economic History Review*, *60*(1), 35–69. https://doi.org/10.1111/j.1468-0289.2006.00355.x

Zeder, M. (2008). *Domestication and early agriculture in the Mediterranean Basin: Origins, diffusion, and impact*. *105*(33), 11597–11604. https://doi.org/www.pnas.orgcgidoi10.1073pnas.0801317105

Ziaei, S. M., Mazloumzadeh, S. M., & Jabbary, M. (2015). A comparison of energy use and productivity of wheat and barley (case study). *Journal of the Saudi Society of Agricultural Sciences*, *14*(1), 19–25. https://doi.org/10.1016/j.jssas.2013.04.002

8 Appendix

FIGURE 3: HISTOGRAM OF INSTABILITY INCIDENTS

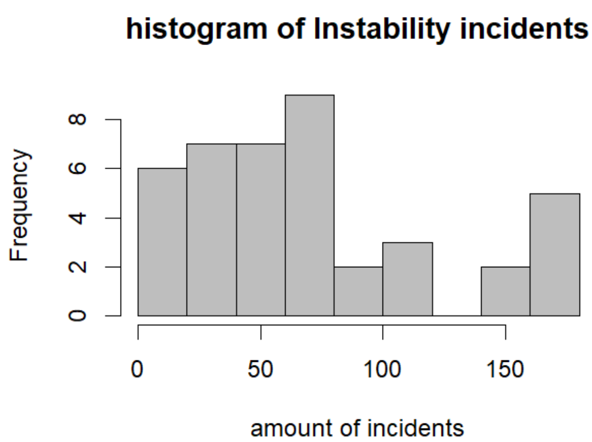
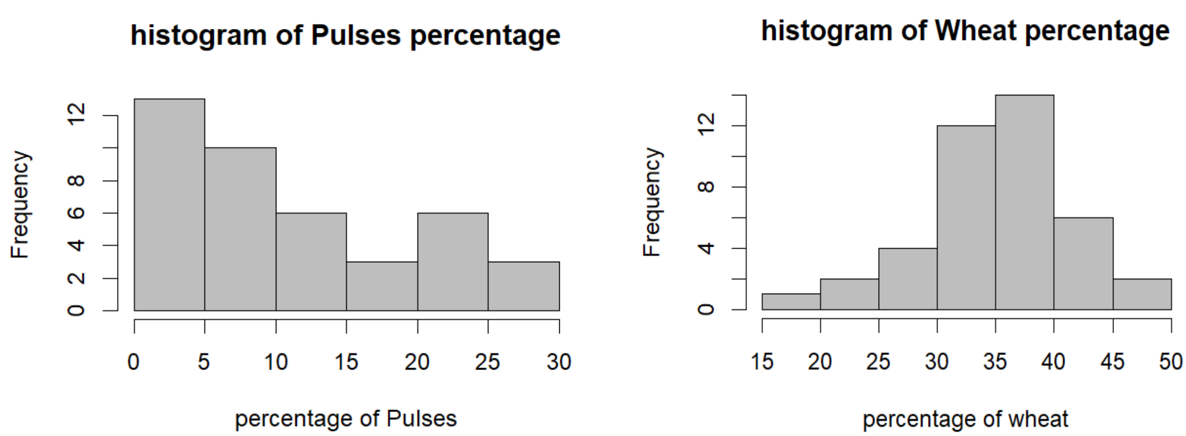
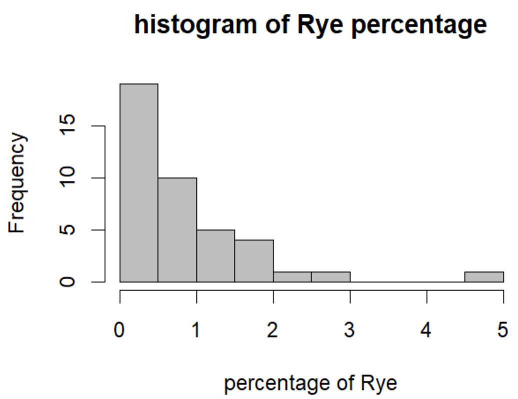
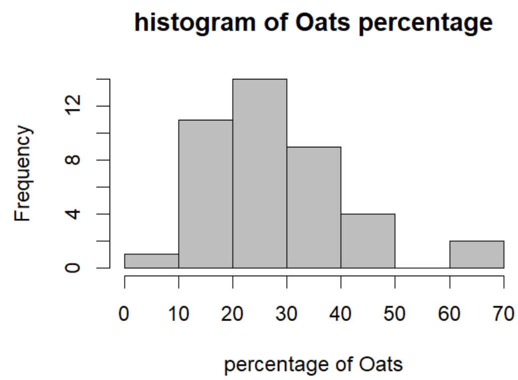


FIGURE 4: HISTOGRAMS OF CROP PERCENTAGES







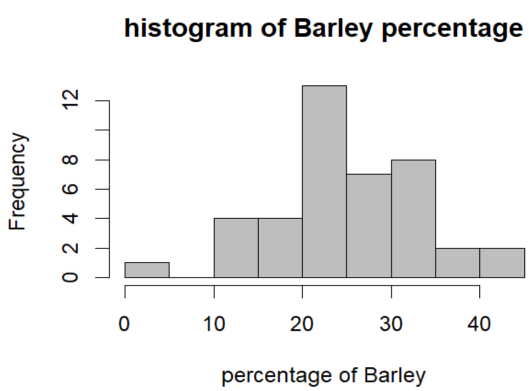


TABLE 3: COUNTIES INCLUDED IN DATASET

Bedfordshire	Middlesex
Berkshire	Norfolk
Buckinghamshire	Northamptonshire
Cambridgeshire	Northumberland
Cheshire	Nottinghamshire
Cornwall	Oxfordshire
Cumberland	Rutland
Derbyshire	Shropshire
Devon	Somerset
Dorset	Staffordshire
Durham	Suffolk
Essex	Surrey
Gloucestershire	Sussex
Hampshire	Warwickshire
Herefordshire	Westmorland
Hertfordshire	Wiltshire

Huntingdonshire	Worcestershire
Kent	Yorks East Riding
Lancashire	Yorks North Riding
Leicestershire	Yorks West Riding
Lincolnshire	