From Membership to Harvest

A Case Study of European Union's Effect on Swedish Grain Output

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Abstract

Sweden joined the European Union as a member in 1995 resulting in adapting the EUs Common Agricultural Policy and accessing the European common market removing trade barriers for agricultural goods among others. To understand whether an EU membership has had an effect on Swedish production of cereals, specifically wheat and oats, this research applies a Causal-ARIMA model. The model's dependent variable is Production in tonnes and the control variables utilized are Producer Price Index, Temperature, and Precipitation. This results in two models, one for each grain. This is then put in to the context of the Ricardian theory of comparative advantage. Previous studies which have examined the impact of the EU on Sweden have had different focuses: self-sufficiency ratio, productivity, and net benefits. None of these studies have examined production, which is the primary focus of this paper.

The results show that wheat has been positively affected by the membership while production of oats has decreased due to it. According to the Ricardian theory resources will be reallocated from less competitive crops towards more competitive crops. Swedish wheat production can therefore be seen as having a comparative advantage in relation to Swedish oats production.

Keywords: Sweden, Wheat, Oats, European Union, C-ARIMA

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Abbreviations

ARIMA	Autoregressive Integrated Moving Average
C-ARIMA	Causal-ARIMA
CAP	Common Agricultural Policy
EU	European Union
FAO	Food and Agriculture Organization
LRF	Lantmännens Riksförbund
PPI	Producer Price Index
RCM	Rubin Causal Model

1. Introduction

1.1 Background

1.1.1 Grain production in Sweden

Agriculture has always been a cornerstone of Sweden's economy and rural landscape. While global markets and policy frameworks have shifted over time, Swedish grain production has shown remarkable stability. Swedish grain production has been stable over a long period of time, with an average annual production of 5 million tonnes during the years between 1965 to 2012. In Sweden, wheat is, usually, the grain type with the highest harvest levels while oats have the third largest harvest. Within the EU, the largest grain types are wheat, followed by corn and barley. Although cereal acreage in Sweden has decreased over time, the reduction has been compensated by an increase in yield per hectare. The rate of yield per hectare improvement began to slow down during the years leading up to 2014. (The Swedish Board of Agriculture 2014).

1.1.2 National agricultural policy

For many years, Sweden pursued a policy of neutrality based on the country being non-aligned in peacetime and neutral in wartime. This position changed after the end of the cold war when Sweden adopted a more positive view of the European Union (EU) (Nationalencyklopedin n.d. a).

Before joining the EU, Sweden was self-determined in its agricultural policy. In 1946, Sweden decided on an agricultural policy to permanently protect the agricultural sector and agricultural policy goals were established. Price support was the most important instrument of policy but border protection, internal market regulations, and subsidized exports of surplus productions were also tools used to achieve the policy goals. The level of price support fluctuated during the 1960s and 1970s. In the mid-1980s, criticism of the Swedish agricultural policy increased (Nationalencyklopedin n.d. b). In 1990 the Swedish Riksdag decided to reform the agricultural sector and make a transition to a more market-oriented system. The agricultural sector was given various forms of support in order to adjust and adapt production to a free market during the transition period. When the transition was finished, consumer choices were supposed to govern the production via their demands except for goods without a market. Landscape conservation and preparedness was supposed to be funded by society (The Swedish Board of Agriculture 2011a).

After the reformation of the agricultural policy was made, Sweden was left with only border protection. However, the reform process was never completed as Sweden joined the EU and adapted to CAP, which meant that the agricultural sector was re-regulated (Nationalencyklopedin n.d. b).

1.1.3 Sweden and EU

Sweden submitted its application for membership in the EU in 1991, and started negotiations in 1993. Prior to joining the EU, Sweden's participation in the internal market was governed by the 1992 EEA Agreement between EU member states and EFTA countries, including Sweden. However, this agreement did not cover the agricultural sector, which was addressed in Sweden´s EU membership agreement. As a result, significant changes to agricultural policy were introduced through Sweden's EU membership agreement. Sweden became an official EU member state on the 1st of January 1995 (Government Offices of Sweden 2025).

The accession meant that Sweden gained access to the EU's common market for all goods. Therefore, trade barriers, such as tariffs, no longer applied to trade with member states. Countries within the EU were Sweden's most important import and export markets for agricultural goods and food products before its EU accession in 1995 and remained so after Sweden's entry (The Swedish Board of Agriculture 2011b).

1.1.4 CAP

With an EU membership came The Common Agricultural Policy, also known as CAP. CAP is EUs system for agricultural policy which aims to support farmers and ensure food supply for Europe. CAP was introduced in 1962 and a reform took place in 1992, just before Sweden joined the EU, shifting support from market to producer based with a scale down of price support and upshift in direct payments to farmers. In 2003, CAP completely decoupled financial support from production levels and farmers started solely receiving income support. Ten years later CAP was further reformed in order to strengthen competitiveness while promoting sustainability (Directorate-General for Agriculture and Rural Development n.d.).

Before the EU decoupled the financial support in 2003, CAP limited member states' possibility to use its comparative advantages since the form of support discouraged specialization in the agricultural sector within the EU and affected what type of production was profitable in each country. Crop production, for example, did not receive any price support causing a disadvantage (Swedish Institute for Food and Agricultural Economics 2004).

1.1.5 EU accession and the present study

Sweden's EU accession affected the Swedish agricultural policy, thus, presumably also having an effect on production of wheat and oats as market barriers for agricultural goods was removed between Sweden and its most important trade partners. According to research done by Niemi et al. (2005) it is likely that potential net benefits from the Swedish EU membership does not originate from the application of CAP. Another paper provides evidence of a deceleration in the growth of agricultural productivity in Sweden following the country's accession to the EU (Nygårds 2022).

Instead of focusing on net benefits or productivity, this research will use production as its outcome variable. In summary, this study will address the question if Sweden's EU accession has had a causal impact on the production volumes of wheat and oats by utilizing a Causal-ARIMA (C-ARIMA) model. The research controls for exogenous factors such as climate factors, average temperature and precipitation, and economic factors, Producer Price Index (PPI), in order to strengthen the reliability of the results.

1.2 Purpose, Aim and Research question

The purpose of this research is to examine whether a European Union (EU) membership influenced Sweden´s grain production using a causal time series framework, and assess its alignment with theoretical expectations given by Ricardian theory. The aim of this paper is therefore to investigate whether the production of wheat and oats in Sweden has been affected by the 1995 EU accession, in production volumes.

With this as a background the research questions then becomes:

What was the impact of Sweden's EU accession in 1995 on the total production of wheat and oats?

1.3 Scope and Limitations

As mentioned above, the most common grains in Sweden are wheat, oats, barley, and rye with wheat being the most produced cereal, both globally and in Sweden (Från Sverige n.d.). For the purpose of comparative analysis, this study focuses on two grains: wheat and oats. Although barley is the second most produced cereal in

Sweden, it was excluded from the analysis due to the unavailability of consistent historical time series data. Oats were selected as an alternative.

This research is exposed to a few limitations: there is no regional breakdown as the data is only on a national level, the study uses only one single intervention point which may overlook gradual policy effects, and there is the potential of omitted variables such as soil quality and technological change.

1.4 Disposition

The first section of this paper provides an introduction to the subject and suggests why it would be of interest to researchers, together with the paper's aim and research question. In the following section, previous research is presented and an explanation of what gaps this paper aims to address. Relevant theoretical framework for the thesis is presented in section three, containing economic theory in order to give context to the research. Section four then follows up with data and methodology. This section contains the data sources, the model used for the analysis, and a model specification. In section five, results of the research are presented in both tables and figures, together with short explanations. Section six consists of a discussion combining literature review, theory, and results to describe what can be concluded from the research and how it can be interpreted. In the last section the research question will be answered together with advice on future research.

2. Literature review

2.1 Previous research

The area of EU memberships' effect on member states agricultural production has been studied before. There are several studies on Central and Eastern European countries joining the EU and its effect on agricultural production.

According to a report from Food and Agriculture Organization (FAO), CAP on a whole created more incentives for cereal production in the countries who joined in 2004 and 2007 compared to pre-accession and accession had a positive impact on this sector (Csaki & Jambor; FAO Regional Office for Europe and Central Asia 2025). There is also previous research done by Fuller et al. (2003) on how the accession of three Eastern European countries in 2003, will affect agricultural markets by assuming different policy restrictions and applying the FAPRI modelling system. The study concludes that the new member states will, mostly, decrease final consumption of agricultural products while production increases. Another research by Kiss (2011) examined the impact of an EU membership on new member states' agriculture after the enlargements in 2004 and 2007. The research showcased that accession provided incentives to agricultural production. Further research done by Jambor & Gorton (2025), reviews agricultural development of eleven Central and Eastern European countries twenty years after their EU accession through ranking performances. The region, post-accession, experienced increased agricultural output and productivity.

There are some studies done on EU accession of Nordic countries and how it has impacted agricultural production. A study done by Hellgren (2024) utilizes a Difference-in Difference analysis on the impact of EU accession on agricultural self-sufficiency in Sweden and Finland. The research concludes that although overall self-sufficiency did not show any statistically significant change, crops, however, experienced a significant decrease in self-sufficiency ratio. The study points out that this does not mean an automatic drop in domestic production, nevertheless, domestic production has decreased relative to net imports. Another research, done on only Finland, by Tomšík and Rosochatecká (2005) assesses the impact of an EU membership on the competitiveness of Finnish agriculture ten years after accession. Cultivated area has faced a big expansion and acreage for wheat production has almost doubled during the EU membership, the reason for this stems from area payments within CAP.

2.2 Relevance of this research

The enlargement of the EU with the Eastern and Southern countries joining in 2004 has been studied extensively, while only a small amount of research has been done on the EU accession of Sweden. The previous studies lifted in this paper which has examined the impact of the EU on Sweden have different focuses: self-sufficiency ratio, productivity, and net benefits. None of these studies have examined production, which is the primary focus of this paper. Additionally, this study contributes to the literature by employing a novel method, the C-ARIMA model.

The C-ARIMA model has the advantage of not relying on the presence of control units that remain unaffected by treatment such as Difference-in-Difference and synthetic control methods, which is generally used methods for policy evaluation when working with observational time series data (Menchetti et al 2022).

3. Theoretical framework

3.1 Comparative advantage theory

David Ricardo introduced the concept of comparative advantage, emphasizing that relative differences in production efficiency, rather than absolute differences, determine the benefits of international trade. The theory rests on the notion of opportunity cost: even a country that holds an absolute advantage in producing a particular good may benefit from importing it if its resources are more efficiently allocated to producing other goods in which it has a comparative advantage. In accordance with Ricardian theory, countries can boost both their own welfare and global welfare by specializing in the goods they can produce at relatively lower opportunity costs, thereby ensuring more efficient use of resources within and across economies (Montevirgen 2025).

According to a report from Lantmännens riksförbund (LRF) via AgriFood the competitiveness of grain production in Sweden is relatively good, particularly in southern Sweden (Manevska-Tasevska & Rabinowicz 2014).

4. Data and methodology

4.1 Data sources

This paper uses data from The Swedish Board of Agriculture, GeoQuery and U.S. Bureau of Labour Statistics via the Federal Reserve Bank of St. Louis. The study is done on Sweden's production of oats and wheat during a period spanning from 1950 to 2017 with yearly observations.

To assess the effects of Sweden's EU accession on agricultural production comprehensively, this study will utilize production as a dependent variable for wheat and oats.

Production is collected from The Swedish Board of Agriculture as a measure of actual production in tonnes in Sweden which can be used for analysis of food supply and export levels. It gives insights to acreage expansion or reduction and use of land area. For wheat, it is the sum of production of winter wheat and spring wheat. Production for both grains has been transformed into a logarithm. For information regarding the diagnostic tests of production of wheat and oats see appendix 1.

There are three explanatory variables for this study:

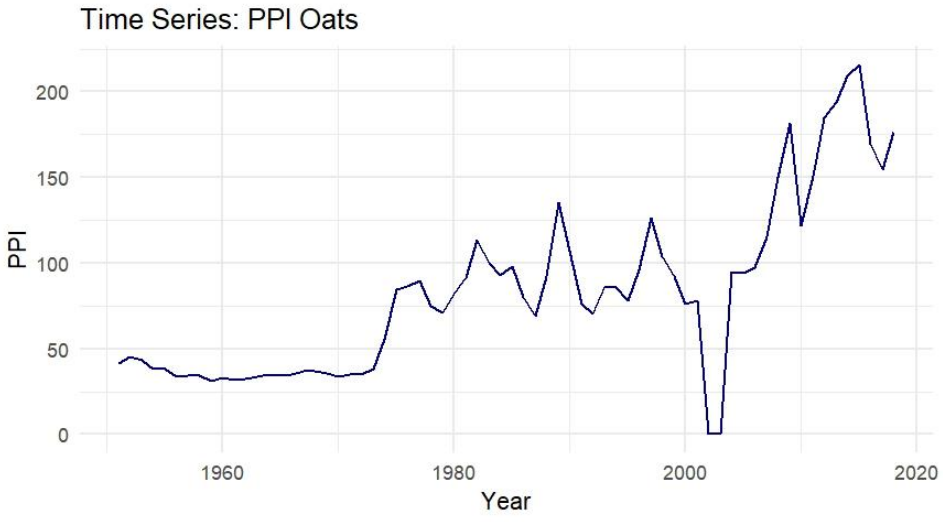

Figure 1. PPI for Oats – Time series

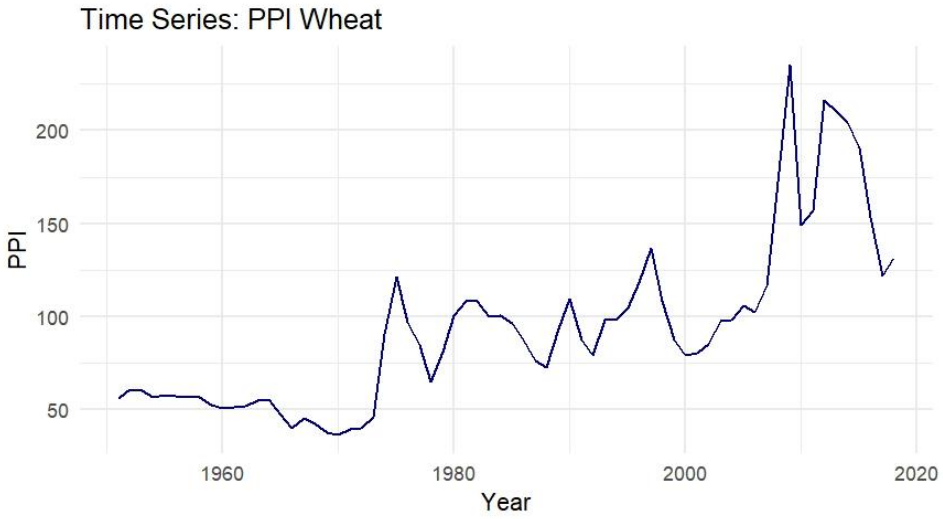

Figure 2. PPI for Wheat – Time series

Producer Price Index (PPI) is a monthly observation of farm products calculated into a yearly mean with 1982=100. The observations are not seasonally adjusted. The data is collected from U.S. Bureau of Labour Statistics via the Federal Reserve Bank of St. Louis.

The line graphs show the trend for PPI for both oats and wheat over the years. The PPI for oats remained stable wheat remained relatively stable in the beginning of the time series before it started to increase after 1970s. After that the curve becomes more volatile. The PPI for wheat also showcases a relatively curve in the beginning. The series showcase several ups and downs afterwards indicating economic volatility in agricultural production.

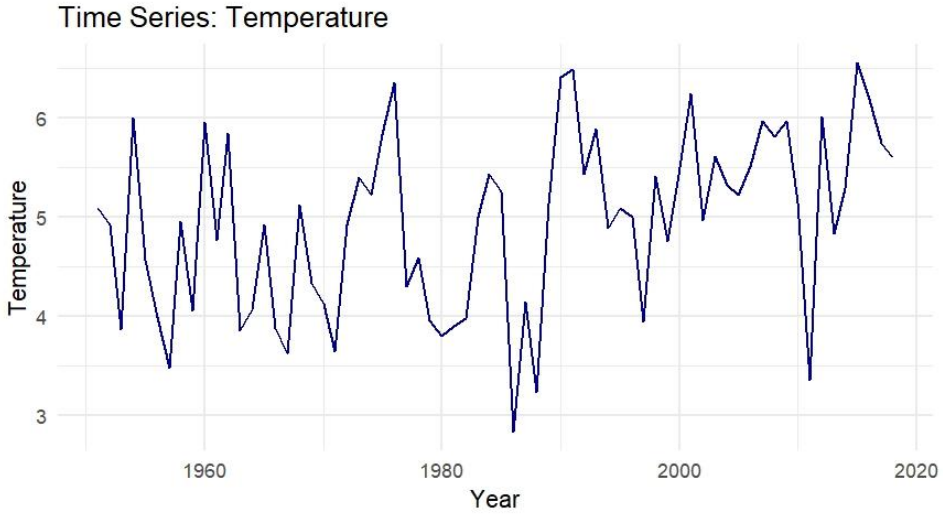

Figure 3. Temperature – Time series

Temperature is observed as a mean for average air temperature per year in degrees Celsius (°C) for Sweden's 21 counties. This data was then reworked to calculate an average for the whole of Sweden. The data is collected from GeoQuery.

The time series graph displays that temperature fluctuate from year to year throughout the entire period, with a gradual upwards trend suggesting warming over time.

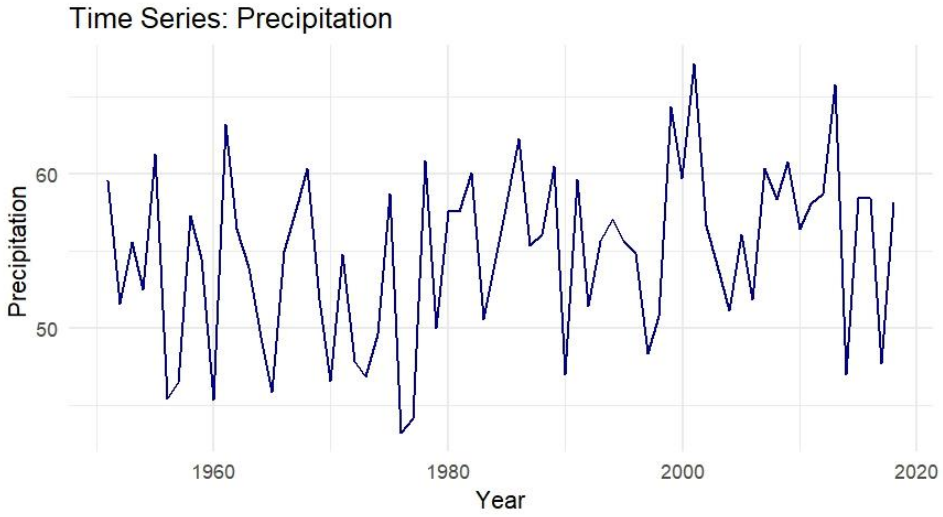

Figure 4. Precipitation – Time series

Precipitation is observed as a mean for average precipitation per year in millimetres for Sweden's 21 counties. This data was reworked to calculate an average for the whole of Sweden per year. The data is collected from GeoQuery.

The line graph showcase variation on a year-to-year basis without any clear long-term trend.

Table 1.Variables - Summary

	Production Oats	Production Wheat	PPI	Temperature	Precipitation
Min	559 000	477 000	36.40	2.831	43.16
1st quartile	842 250	1 012 500	56.69	4.113	50.71
Median	1 130 500	1 268 500	87.72	5.049	55.64
Mean	1 143 059	1 551 676	93.85	4.952	54.81
3rd quartile	1 407 000	2 101 750	108.34	5.609	58.52
Max	1 882 000	3 301 000	235.14	6.556	67.14

Table 1 displays a summary of the main statistical characteristics of the variables used in the analysis. Production for oats shows a wide spread variation in production levels, spanning between 559,000 and 1,882,000 tonnes. However, in comparison, Production for wheat showcases a substantial variation over time ranging between 477,00 and 3,301,000 tonnes. PPI also fluctuates from 36.40 to 235.14. Temperature and precipitation do not vary as much, with min and max values between 2.831 and 6.556 respectively 43.16 and 67.14.

4.2 Model

This paper will utilize a fairly novel approach called C-ARIMA proposed by Menchetti et al. (2022). C-ARIMA integrates the Rubin Causal Model (RCM) framework, which defines the causal effect of an intervention as a contrast of potential outcomes, with Autoregressive Integrated Moving Average (ARIMA) models. The C-ARIMA approach enables the definition and estimation of causal effects of an intervention in an observational time series setting under the RCM where no control unit is available. The C-ARIMA predicts how the outcome variable would have behaved after the intervention, if it had not occurred. By contrasting the observed data with the model-generated counterfactual predictions, it is possible to estimate the causal impact of the intervention (Menchetti et al 2022).

The use of the term causal in Menchetti et al's work differs somewhat from its meaning in the wider econometrics' literature. In the wider literature, causal inference focuses on identifying treatment effects using assumptions such as unconfoundedness, exclusion restrictions, or instrumental variables. In the C-ARIMA framework, however, causality is defined more directly as the difference

between what actually happened to a time series after a policy intervention and what would have happened in the absence of the intervention. The latter is estimated by fitting an ARIMA model to the pre-intervention data and then forecasting the counterfactual series. The gap between the observed and predicted outcomes is interpreted as the causal effect of the policy (Menchetti et al 2022).

The ARIMA model is well suited to this approach, as it captures both persistence and shocks in the data. The autoregressive part means that present values are partly explained by past values, reflecting long-term dynamics such as technological progress or production capacity. The moving average part instead reflects the influence of past shocks, since unexpected events can affect not only the current outcome but also subsequent periods. Together, these elements allow ARIMA to model both stable trends and temporary fluctuations in a time series (Hyndman & Athanasopoulos 2018).

This paper includes two separate models, one for each grain type: Production of wheat, and Production of oats. The model compares predicted levels of production for wheat and oats if Sweden had not joined the EU with the actual levels of production after Sweden joined the EU.

4.3 Model specification

The equation for this model is as follows:

$$Y_t(w) = z_t + \tilde{t}_t(1;0)1_{\{w=1\}}$$

Where $Y_t(w)$ is the potential outcome series at time *t* under treatment *w*. The equation separates the outcome into a baseline component, z_t, independent of treatment, and a treatment effect component called the point causal effect at time *t*, $\tilde{t}_t(1;0) = Y_t(1) - Y_t(0)$. The baseline is modelled using ARIMA, which can capture trends and patterns over time, including autoregressive and moving average effects. While this approach is flexible, the specific ARIMA structure must be specified in advance or estimated from the data. Thus, the model can accommodate many time-series patterns, but it does not automatically allow every possible pattern without prior specification. Further technical details can be gleaned from Menchetti et al. (2022).

5. Results

5.1 Wheat

In this section results for wheat are presented, first a summary table with estimated effects, then a forecast, and lastly point effect and cumulative effect for wheat.

5.1.1 Summary

Table 2. Wheat – Summary.

	Estimated Effect
Point causal effect	**0.334*** **
Standard error	0.119
Left-sided p-value	0.997
Bidirectional p-value	0.005
Right-sided p-value	0.003
Cumulative causal effect	**3.838*** **
Standard error	0.262
Left-sided p-value	1
Bidirectional p-value	0
Right-sided p-value	0
Temporal average causal effect	**0.167*** **
Standard error	0.011
Left-sided p-value	1
Bidirectional p-value	0
Right-sided p-value	0

* p < 0.10, ** p < 0.05, *** p < 0.01

The point effect shows the instant effect at each point in time after the intervention i.e. the point effect measures the causal effect at a specific point in time. The point causal effect is 0.334 meaning the EU accession is estimated to have increased wheat production by 116 percent immediately, given a standard error of 0.119.

The cumulative effect shows the partial sum of the point effects, meaning the sum of point effects up to a predefined time point. This is the amount of wheat produced due to EU accession, from 1995 until 2017 when the time series ends. The cumulative causal effect is 3.838. The standard error for this estimate is 0.262.

The temporal average effect shows the average point effects in a given time period. This indicates total amount of wheat produced, on average, due to the EU accession. The temporal average causal effect is 0.167, meaning that on average the Swedish EU membership is estimated to have increased wheat production by 47 percent per year with a standard error of 0.011.

The bidirectional p-value for the point causal effect, the cumulative causal effect, and the temporal average causal effect are all significant on a 0.01 level.

5.1.2 Forecast

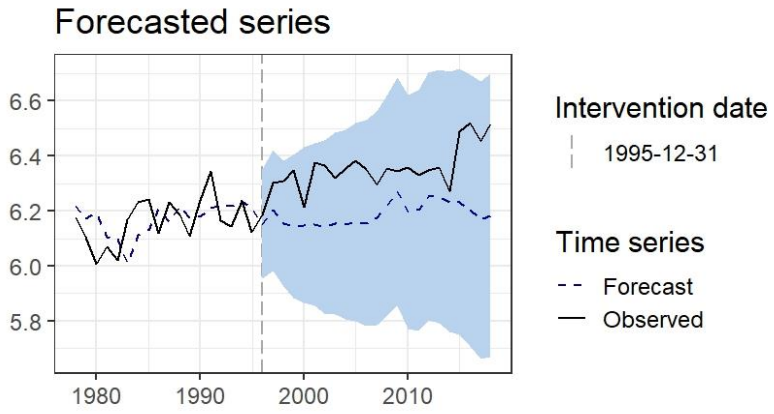

Figure 5. Wheat - Forecast

Figure 5 shows the observed production of wheat over time together with a prognosis from the C-ARIMA model with confidence interval. The predicted values and observed values follow each other relatively good before 1995. After the time of intervention in 1995, the observed series rises above the forecasted counterfactual series. The observed values stay consistently higher throughout.

5.1.3 Point effect and Cumulative effect

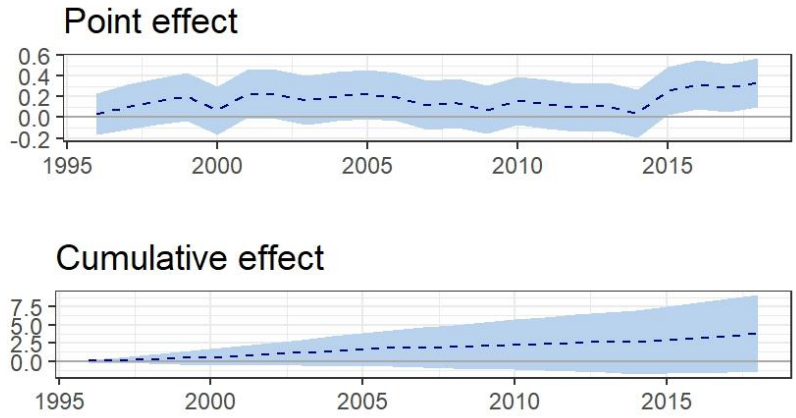

Figure 6. Wheat - Point effect and Cumulative effect

The upper figure in Figure 6 shows the point effect at each point in time after 1995, displaying potential change over time. The lower figure shows the cumulative effect over time after 1995 with the curve summing up the point effects up to any given time point. Both of these figures show a confidence interval which includes zero indicating non-statistical causal effect in contrast to the results in Table 2.

5.2 Oats

In this section, results for oats are presented. First a summary of estimated effects is presented, followed by a forecast, and point effect and cumulative effect.

5.2.1 Summary

Table 3. Oats – Summary.

	Estimated Effect
Point causal effect	**- 0.251****
Standard error	0.104
Left-sided p-value	0.008
Bidirectional p-value	0.016
Right-sided p-value	0.992
Cumulative causal effect	**- 2.967*****
Standard error	0.169
Left-sided p-value	0
Bidirectional p-value	0
Right-sided p-value	1
Temporal average causal effect	**- 0.129*****
Standard error	0.007
Left-sided p-value	0
Bidirectional p-value	0
Right-sided p-value	1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The point effect shows the instant effect at each point in time after the intervention i.e. the point effect measures the causal effect at a specific point in time. The point causal effect is negative 0.251. The standard error is 0.104.

The cumulative effect shows the partial sum of the point effects, meaning the sum of point effects up to a predefined time point. This is the oats production due to EU accession, from 1995 until 2017 when the time series ends. The cumulative causal effect is negative 2.967, given a standard error of 0.169.

The temporal average effect shows the average point effects in a given time period. This indicates the average production of oats due to the EU accession. The temporal average causal effect is negative 0.129 with a standard error of 0.007.

The bidirectional p-value shows that the point causal effect is significant at a 0.05 level, while the cumulative causal effect, and the temporal average causal effect are both significant on a 0.01 level.

5.2.2 Forecast

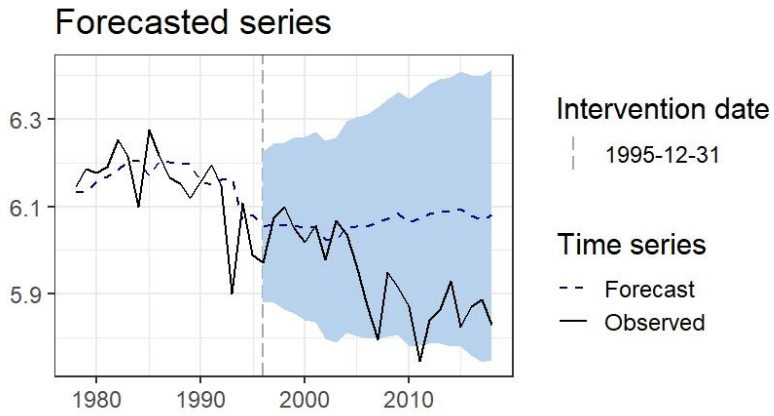

Figure 7. Oats - Forecast

Figure 7 shows the observed production of wheat over time together with a prognosis from the C-ARIMA model, called forecast together with confidence interval. Before the accession the observed values and the forecasted values follows each other relatively good. After 1995, the observed series starts to slowly drop below the forecasted counterfactual and the decline of observed values is sustained.

5.2.3 Point effect and Cumulative effect

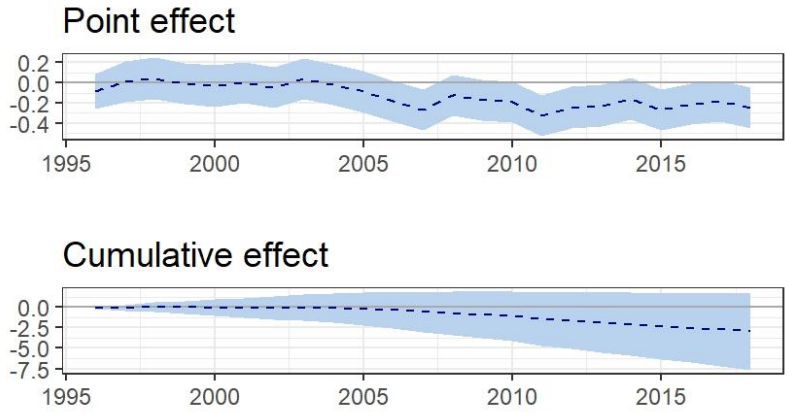

Figure 8. Oats - Point effect and Cumulative effect

In Figure 8, the upper figure displays the point effect at each point in time after 1995, showing potential change over time. The lower figure shows the cumulative effect over time after 1995 with the curve summing up the point effects up to any given time point. Both of these figures show a confidence interval which includes zero indicating non-statistical causal effect in contrast to the results from Table 3.

6. Discussion

6.1 Wheat

The results in Table 2 shows that an EU membership has had a statistically significant positive effect on wheat production, both immediately, point effect, and over time, cumulative and temporal average effect. This means that Swedish wheat production increased because of the EU accession in 1995. This is strengthened by the observed series being consistently above the counterfactual forecast after 1995, in Figure 5. This suggests a sustained positive impact post-accession rather than a temporary effect.

This is in line with Ricardian theory, since Sweden has a relatively good competitiveness in cereal production. The results for wheat support the Ricardian model´s prediction that resources are reallocated to sectors with comparative advantages upon trade liberalization, in this case wheat production increased after accessing the European common market.

There is some uncertainty in the model as the confidence interval for both point and cumulative effect in Figure 6 includes zero. In contrast to this the low p-values from Table 2 indicate that the effect is likely to be statistically robust on a full-year basis. The cumulative or average effect over the entire period could therefore still be significant.

6.2 Oats

The results for oats show that there is a significant negative effect both in point, cumulative and average effect. This means oat production decreased after 1995 due to the Swedish EU membership, both directly and over time. The confidence interval for the point and cumulative effect in Figure 8 both include zero at times, showing non-significance. However, the fact that the cumulative and point effect in Table 3 are both statistically significant at a 1 % level indicates that the effect is actually statistically significant over time.

According to the Ricardian theory this could mean that Sweden do not have a comparative advantage in oat production as production decreased after Sweden accessed the EUs open market, i.e. liberation of trade. It is therefore likely that resources, in this case first and foremost land, has been reallocated to other crops with a comparative advantage.

Unlike wheat, oats show a gradual and long-term decline over the period which suggests a structural change rather than a shock effect. This opens up for the possibility that the decrease in oats production is caused by something other than the EU accession that happened around the same time.

6.3 Comparing Wheat and Oats

When comparing the two crops with each other and the EU accessions effect on the production of wheat and oats there is a clear opposite effect on the two cereals, positive for wheat and negative for oats. This suggests that different crops are affected differently by Sweden's EU membership which could support comparative advantage theory. According to the Ricardian theory resources will be reallocated from less competitive crops towards more competitive crops with a comparative advantage. As wheat production has increased and oats production has decreased after Sweden accessing the EUs open market, growing wheat in Sweden could be seen having a comparative advantage against oats. In this case, it is plausible that acreage which was earlier used to grow oats has probably been redistributed to grow wheat.

The reason why wheat is favourable towards oats could be that access to a bigger market creates opportunities for increased exports for wheat within the EU for Sweden. While for oats it could be because being part of the EU market opens up to more competition from other EU countries and that countries with more efficient production knocks out Swedish oat production. It could also be linked to changes in CAP, where forms of support and production incentives favoured other crops.

The results of this study shows that if production of wheat and oats are valued the same for Sweden then it is important to differentiate agricultural strategies per crop after EU entry, this has to be done in the CAP-framework.

6.4 Comparison with previous research

The results of this study fit into the broader discussion of how EU accession has shaped agricultural production in member states.

In the Swedish case, Niemi et al. (2005) argued that the net benefits of EU membership did not primarily originate from CAP. This aligns with the present finding that wheat production expanded and oat production declined after accession, as these changes could be driven more by comparative advantage and reallocation of resources than by CAP-related support mechanisms. However, Nygårds (2022) shows that agricultural productivity growth in Sweden slowed

after EU entry, which contrasts with the results for wheat, as higher output may not only reflect productivity gains but could also be due to expanded acreage or policy incentives. The slowdown in productivity, showed by Nygårds, is more consistent with the oats results, which indicate a negative effect of EU accession on production.

Looking beyond Sweden, research on Central and Eastern European countries points to a generally positive relationship between EU accession and cereal production (Csaki & Jambor, FAO 2025; Kiss 2011; Jambor & Gorton 2025). In these cases, the increase in cereal production is largely attributed to CAP incentives introduced upon accession, rather than solely to access to the EU market. These findings resonate with the observed wheat expansion in Sweden, but stand in contrast to the decline of oats production, suggesting crop-specific effects that may be masked in broader cross-country analyses. Fuller et al. (2003) similarly emphasize how accession-induced policy frameworks can alter both consumption and production patterns, which is consistent with the reallocation dynamics suggested by the results.

Studies on the Nordic countries provide additional nuance. Hellgren (2024) found that Swedish and Finnish self-sufficiency ratios declined post-accession, indicating a relative drop in domestic production, which aligns with the oats results. In contrast, Tomšík and Rosochatecká (2005) show that Finnish wheat production expanded due to CAP payments, showing that cereal responses varied with market conditions and policy.

Overall, the results of this study are consistent with the literature in showing that EU membership reshaped agricultural production, while highlighting crop-specific differences. Previous research done on Central and Eastern European countries favours CAP implementation as an explanation of change in agricultural production, while in the case of Sweden, market access and comparative advantage appear more influential than CAP.

6.5 Potential limitations

While the results are consistent with Ricardian trade theory and suggest that EU membership had an impact on Swedish wheat and oat production, there are important limitations to keep in mind. A key issue is endogeneity, since EU accession was not an isolated policy change but part of a broader transformation of the Swedish economy in the 1990s. At the same time as joining the EU, Sweden experienced structural reforms, shifts in the CAP, changes in global commodity markets, and technological improvements in farming practices. These

simultaneous developments make it difficult to attribute the observed production changes solely to EU membership.

Moreover, the counterfactual forecasts may not fully capture these overlapping factors. For example, the sustained increase in wheat production could partly reflect technological advances, changing consumer demand, or macroeconomic conditions rather than being exclusively explained by trade liberalization and comparative advantage. Similarly, the long-run decline in oats may be driven by domestic consumption trends or broader structural shifts in agricultural production rather than EU-induced reallocation effects alone.

In other words, while the findings align with Ricardian predictions, they should not be interpreted as conclusive evidence that comparative advantage is the only mechanism at play. The estimated effects may be biased in both directions as other unobserved factors could correlate with EU accession and also influenced crop production. Nevertheless, the contrasting outcomes for wheat and oats still provide indicative support for the idea that resources shifted from less competitive to more competitive crops following EU entry, in line with comparative advantage.

7. Conclusion

The aim of this thesis was to examine whether the production of wheat and oats in Sweden has been affected by the 1995 EU accession, and assess its alignment with theoretical expectations given by Ricardos comparative advantage analysis. The theory states that a country will produce and export a good in which it has comparative advantage i.e. relative productivity decides what is produced. Resources will be reallocated to more competitive crops with a comparative advantage.

Based on the results from the C-ARIMA models created for the two grain types, there is a clear opposite effect post-accession. In the case of wheat, production has increased due to accession while in the case of oats, the production has decreased due to EU membership. Growing wheat in Sweden could therefore be seen as having a comparative advantage against oats. In this case, it is plausible that acreage which was earlier used to grow oats has probably been redistributed to grow wheat.

This paper utilizes annual data meaning no short-term effects or seasonal effects is included and further research with more frequent observations are necessary. Future research could also benefit from including other cereals or looking at other crops as this paper only studies a small part of Swedish crop production affected by the EU accession. This would help with better understanding the effects of the 1995 EU accession on Swedish agricultural production.

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Appendix 1

7.1 Diagnostic test - Wheat

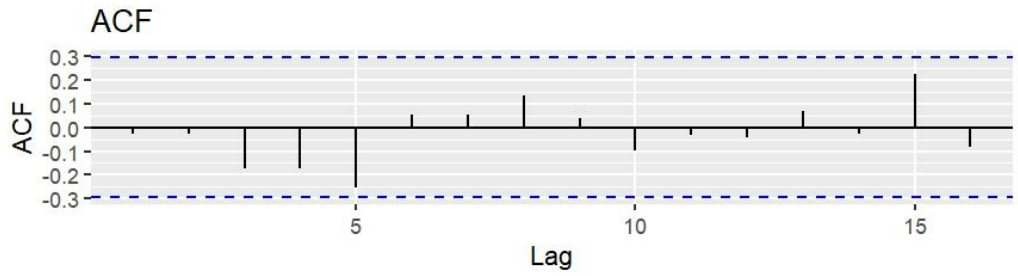

Figure 9. ACF Wheat

The ACF plot shows significant negative autocorrelation at lags 4 and 5, as well as significant positive autocorrelation at lag 15, indicating the time series is likely non-stationary.

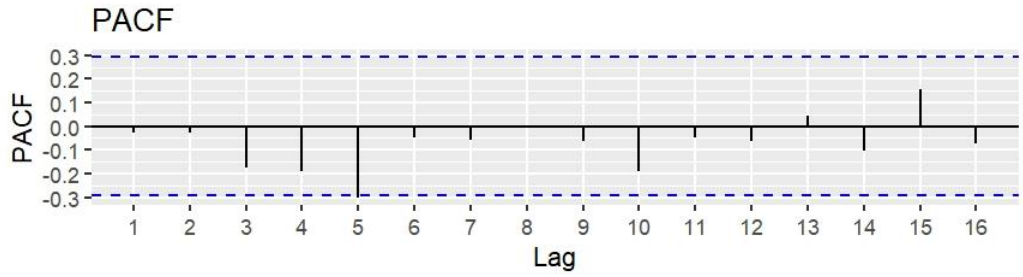

Figure 10. PACF Wheat

The PACF plot shows significant spikes at lags 4 and 5, followed by a sharp drop-off, which suggests an AR (5) process may be a good fit for the differenced data.

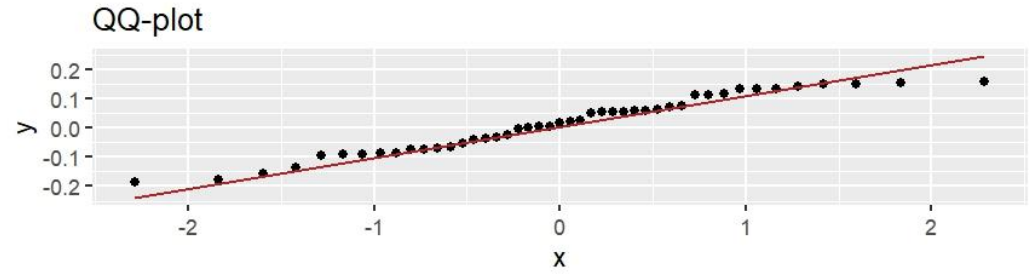

Figure 11. QQ-plot Wheat

The QQ-plot for wheat indicates that the model's residuals are normally distributed.

7.2 Diagnostic test - Oats

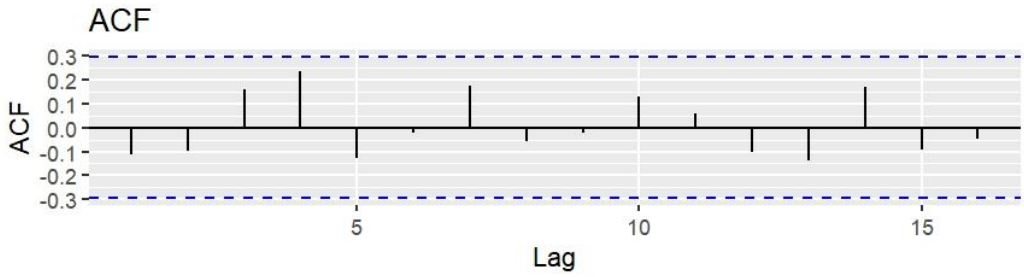

Figure 12. ACF Oats

The ACF plot shows a mix of decaying and significant spikes, indicating an AR component.

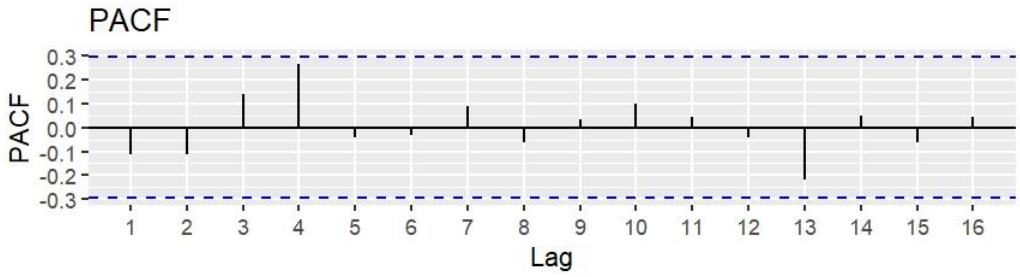

Figure 13. PACF Oats

The PACF plot has a clear and sharp cutoff after lag 4, which is a strong indicator of an AR (4) process.

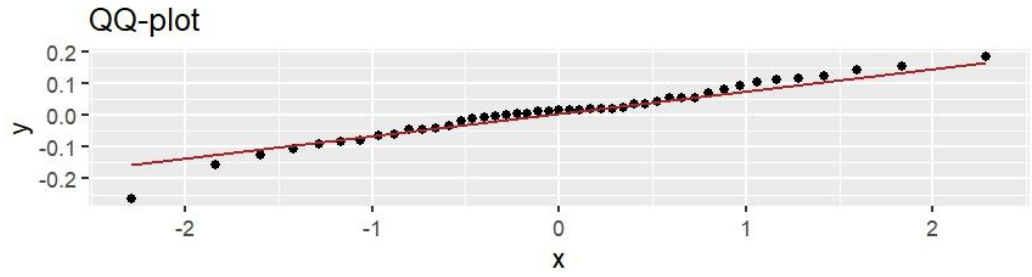

Figure 14. QQ-plot Oats

The QQ-plot shows that the residuals are approximately normally distributed, as the points closely follow the diagonal line.

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