AGRICULTURAL DYNAMICS IN THE EU AND THE RAW MATERIAL SUPER CYCLE

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Abstract

Purpose:

This study aims to explore the impact of the Raw Material Supercycle (RMSC) on agricultural dynamics in the European Union (EU), focusing on key commodity crops such as wheat, maize, barley, sunflower, and the unorthodox but strategic choice of potatoes. The inclusion of potatoes is particularly relevant due to their dietary significance, adaptability to diverse growing conditions, and their potential as a substitute crop during periods of raw material volatility. The research investigates how global raw material trends influence crop production, export values, and market structures within the EU. Moreover, it seeks to identify key domestic and policy-driven factors that moderate the RMSC's effects on the agricultural sector.

Methodology:

Utilizing a multi-method research approach, the study combines regression models with comparative analysis and trend analysis. Regression models are applied to assess the influence of the RMSC on production volumes and export values of wheat, maize, barley, sunflower, and potatoes. The study contrasts the performance of these crops during different phases of the super cycle, identifying key dependencies and divergent trends across the EU. Furthermore, the study tracks changes in the areas under harvest, yields, and production levels for each crop, providing a nuanced understanding of agricultural dynamics in light of global raw material fluctuations.

Key Findings:

The study reveals significant correlation between the RMSC and the performance of EU commodity crops. For instance, while France and Italy continue to dominate the export market for wheat, Bulgaria has emerged as a rising producer, with strong potential for future dominance in this sector. The choice of potatoes, often overlooked in traditional studies, proved insightful, as their unique growing flexibility and substitutive value contributes to mitigating the impact of raw material price volatility. Moreover, the Common Agricultural Policy (CAP) plays important, but limited in effects role in moderating the global super cycle's effects by providing subsidies that buffer internal market dynamics.

Originality/Scientific Novelty:

This research provides an in-depth analysis of how global raw material cycles influence regional agricultural systems, specifically addressing the unorthodox yet strategic role of potatoes. By integrating crop-specific performance during different RMSC phases, it contributes a new understanding of localized agricultural vulnerabilities and resilience.

Practical Value/Implications:

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The findings offer valuable insights for policymakers, particularly in crafting agricultural strategies that can anticipate and mitigate the effects of future super cycle phases. Recommendations include targeted investments in crop diversity and substitutable crops, with implications for strengthening agricultural resilience across the EU.

Introduction

This article explores the complex interplay between agricultural dynamics in the European Union (EU) and the raw material super cycle, with a specific focus on commodity crops. As the global economy experiences fluctuations driven by various factors, including geopolitics, understanding the implications for EU agriculture is essential. Through a comprehensive examination, this study investigates how the raw material super cycle influences the production, export value, and consumption of commodity crops within the EU.

The methodology employs a multi-faceted approach to unravel the intricate connections. Comparative analysis techniques will be utilized to contrast production levels, yields, and areas under harvest of key commodity crops across different phases of the raw material super cycle, enabling the identification of trends and dependencies. Regression models will quantitatively assess the relationships between movements in raw material production volumes. This approach facilitates precise measurement of impacts. Moreover, trend analysis methods will track agricultural indicators over time to pinpoint potential patterns and turning points influenced by the super cycle phases. Recognizing the importance of qualitative factors, the study incorporates conclusions from policy reviews, technological advancements, and other elements shaping EU agriculture. Case studies focusing on specific countries or regions may provide deeper insights into localized dynamics. To anticipate future developments, scenario modelling techniques will be employed, considering projections for raw material super cycles alongside other crucial factors.

Literature Review

The term Raw Material Supercycle (RMSC) refers to long-term trends in the value dynamics of commodities or raw materials that are essential to the production of goods and services. This cycle can last for several years or even decades and is driven by a combination of supply and demand factors (Dreher, A. et al., 2017).

The RMSC can be divided into several phases. During the early phase, there is a period of steady prices due to guaranteed supply from the global value chains, often caused by technological advancements that increase productivity or a period of weak global economic growth (Balié, J., et al., 2019). As demand increases or supply decreases, prices begin to rise, leading to the second phase of the cycle. The second phase of the RMSC is characterized by a period of high prices and volatility

in both supply and demand. This is often caused by a sudden surge in demand from emerging markets, geopolitical tensions, or supply disruptions. The third phase of the RMSC is marked by a period of declining prices as supply outstrips demand. This phase can be quite prolonged with prices falling to levels below the long-term average. During this phase, producers may cut back on investment in new capacity, which eventually leads to a tightening of supply and the start of a new cycle. The term Raw Material Supercycle (RMSC) for agricultural commodities refers to long-term trends in the value dynamics of essential crops and raw materials used in food production and related industries. (FAO, 2015).

In agriculture RMSC can also have apparent stages of development. Low value purchase options phase due to surplus supply. As the demand goes up or the supply decreases, it causes the beginning of the second phase of the cycle, which is marked by high market volatility and uncertainty in a variety of factors, (Lobell and Gourdji's, 2015). Similarly, as Headey, D., & Fan, S. (2018) state, these are usually triggered by a sudden upsurge in demand from emerging markets, geopolitical tensions, or supply disruptions. During this phase, farmers adjust production, leading to oversupply. The third phase is characterized by a prolonged period of contracting price levels as supply exceeds demand, frequently descending below the long-term average. In this phase, farmers may decrease production, ultimately resulting in a supply contraction, and triggering a new cycle.

Further observations define the early phase as a period of steady purchase value options due to mostly guaranteed supply, often caused by technological advancements that increase productivity (Belke, A., et al., 2019) or a period of weak global economic growth. As demand increases or supply decreases, purchase value begins to rise, leading to the second phase of the cycle. The second phase of the RMSC is characterized by a period of high market divarication in both supply and demand. The third phase of the RMSC is marked by a period of declining commodity value as supply outstrips demand.

In recent years, the agriculture RMSC has been relatively muted, with prices remaining stable or declining slightly. In this article, we put forward an additional argument, that currently the EU agriculture is indeed in a state of "false muting" of the RMSC. In the very few scientific reviews on the subject, there is no clear analysis of such operational environment, where farmers are subjected to a multitude of risks (Komarek, A. M., et al.). A "false muting" of the RMSC refers to situations where certain factors may temporarily suppress or mask the impact of the RMSC on certain commodities or regions. In support of our example, an ecosystem of aggressive economy as proven by Hrabynska, I., & Kosarchyn, M., (2022), can create temporary imbalances that could mute the effects of the RMSC.

In the case of the EU, while the entity is a significant producer of certain agricultural commodities, the impact of a Raw Material Supercycle on the agricultural sector

may be influenced by a variety of factors that are very specific. These factors include the union's Agricultural Commodities Market (ACM) infrastructure, geopolitical shakes, trading barriers, trade agreements with third countries, internal policies, and union affiliations among others.

There are several reasons to support the argument that EU's agriculture is currently in a Raw Material Supercycle. The ever-strong demand for agricultural commodities as the global supply chain disruptions, coupled to population growth, and the demand for food and other agricultural products is increasing. The supply of agricultural commodities is limited due to their character and supply chain bottle necks. Still being the main trade currency, as the Euro and US dollar weaken, it becomes cheaper for other countries to import commodities, including agricultural commodities. This can artificially increase demand, but temper supply as traditional supply is dependent on political discretion.

On another hand, we can further find evidence for a so called "false muting" of the Raw Material Supercycle in EU agriculture underlined by structural capacities in the sector. These limit the sector's ability to take advantage of higher prices. EU agriculture has not seen significant targeted investment beyond the green political spectrum, which has limited its ability to modernize and increase productivity as a complete sustainable package. Besides the longtime used subsidies, the Common Agricultural Policy (CAP) fails to address crucial needs on national level. This leads to a situation where prices remain high, but farmers are not able to take advantage of them. Climate change has been the single, more consistent political shout of the EU. It bears a significant impact on EU agriculture, with more frequent droughts and extreme weather events. According to Reardon, T., et al., (2019), this can lead to lower yields and increased production costs, which could offset the ability to scale produce or purchase in poorer and developing countries.

Overall, while there are factors supporting the argument that EU agriculture is experiencing a Raw Material Super Cycle, there are also significant challenges that could limit the sector's ability to benefit from it, therefore experiencing the muted state of the RMSC. The current agriculture RMSC for the EU began in the 90s and it is still ongoing. During this period, demand for commodities such as wheat, corn, and sunflower have increased due to strong emerging markets, especially in China and Africa. Moreover, supply disruptions in key producing regions made a major contribution to these trends. In recent years, the agriculture RMSC has been relatively muted, with actual value of raw materials remaining stable or declining slightly, however throughout our analysis becomes apparent that the low, or non-dynamic prices fail to show the underlying trends in export value formation due to cost of energy sources (Woetzel, J., et al., 2017), global inflation, EU particulars like subsidies and state support, all critical for the existence of union agriculture. In this article, we will put forward an additional argument, that EU agriculture, evident in the case of asset crops, is in a state of "false muting" of the RMSC. In the very

few scientific reviews on the broader subject, there is no clear analysis of such operational environment. A "false muting" of the RMSC could also refer to situations where certain factors may temporarily suppress or mask the impact of the RMSC on certain commodities or regions. In support of our example, factors such as sudden geopolitical tensions, financial liquidity injections, unplanned market release of excess stock-in-store levels of third countries, unintended goods acquisitions, or low demand due to institutional market interventions during economic downturns can create temporary imbalances that could mute the effects of the RMSC.

In essence, the EU is a capable producer and one of the biggest exporters of agricultural commodities in the world, which puts it in a prime position to participate in addressing ever increasing demands. Even within permanent state of market uncertainty and various other pressures, the RMSC presents a unique opportunity for the agricultural sector (Belke et al., 2018). Overall, this is confirmation that there is a decisive influence of global economic environment on the choice of a country's or even a group of countries model of socioeconomic development, (Tolstobrova, N. A., et al. 2015).

Commodity crop production represents a foundational pillar of agricultural activity within the EU, with crops such as wheat, corn, potatoes, sunflower and Barley occupying significant acreage and contributing substantially to both domestic food supply and international trade, (Mathieux, F., et al., 2017). According to Erten, B., & Ocampo, J. A. (2013), the raw material super cycle exerts a direct influence on production dynamics, in essence reflecting itself as a raw material-centric indicator, and even used both in criticality assessments and circular economy monitoring, (Tercero Espinoza, L. A. (2021), determining areas harvested, export value, investment decisions, and agricultural practices. Trade dynamics within the EU could be also compositely linked to the raw material super cycle due to somewhat sustainable intensification (Tilman, D., et al, 2011), with fluctuations in commodity production affecting the competitiveness of EU exports in global markets and influencing trade balances. Understanding how the super cycle influences trade flows, market access, and trade agreements is critical for policymakers seeking to foster robust international trade relationships and enhance the EU's position in global agricultural markets. Moreover, the raw material super cycle exerts a profound influence on commodity crop consumption patterns within the EU and outside of it, as fluctuations in production and availability directly impact consumer choices, food prices, and nutritional outcomes (Pingali, P., 2017). Understanding these dynamics is essential for policymakers and stakeholders involved in food security, public health, and agricultural policy formulation, as it enables them to anticipate and address potential challenges such as food price volatility, supply chain disruptions, and access to nutritious foods (von Braun, J., & Tadesse, G., 2012). Comprehending how the raw material super cycle impacts commodity crop production, trade, and consumption is integral to navigating the complexities of agricultural dynamics within the EU.

The study aims to address several gaps in the existing literature on the interplay between the raw material super cycle and agricultural dynamics in the EU. Apparent is a limited understanding of specific impacts on EU agriculture, including commodity crop production, export value, and areas harvested. Periods of high commodity demand within the RMSC lead to higher production levels, needed to meet market needs, but affecting buying power of large groups in society according to Ivanic, M., & Martin, W. (2016), which further affect the market. Farmers may adjust their planting decisions in response to market signals, leading to shifts in the mix of commodity crops grown in the EU. Ultimately, deriving from the research of Huygens, D., & Saveyn, H. G. M. (2018), as a response to higher demand, the investment in agricultural technologies and sustainable practices aimed at increasing crop yields and efficiency may be incentivized. In recent times a certain lack of comprehensive analysis that examines the interconnectedness between the raw material super cycle and various aspects of EU agriculture without fully capturing the holistic impact of the RMSC on the agricultural sector is more evident. That, coupled with limited empirical research that quantitatively assesses some of the mechanisms through which the RMSC influences agricultural dynamics in the EU brings incomplete understanding of policy implications, and leads to delayed, incomplete or improper reactions to economic signals. In reality, existing literature does not fully explore the policy implications of the RMSC on EU agriculture. In many cases this includes how government policies, trade agreements, regulatory frameworks and possible relationship with the financialization of the commodity markets (Montero Requena, J., 2021) interact with the RMSC dynamics to shape agricultural outcomes, deeming their actions reactive, rather than proactive. More is yet to be desired about unaccounted regional variations on social, cultural, and local macroeconomic level, as evidenced by Motianey, A. (2010). A deeper look into existing research shows us that it considers inadequately for regional variations within the EU, including differences in agricultural practices, climatic conditions, and socioeconomic factors. Presenting a detailed understanding how these particulars interact with the Raw Material Supercycle is essential for this comprehensive analysis. Further, current literature focuses on short-term impacts of the RMSC on EU agriculture, it overlooks the long-term dynamics and structural changes that may occur over extended periods of economic cycling. A better understanding of the long run is necessary for effective policy planning and decision-making.

Purpose (Aim): Using both quantitative analysis and qualitative insights, this article aims to highlight the presence of a RMSC in agricultural commodities, demonstrating its close alignment with the broader economic RMSC. By examining the Raw Material Supercycle in the context of commodity crop production in the EU from 1990 – 2022, the article reveals important mechanisms shaping agricultural dynamics and identifies opportunities and challenges for stakeholders across the agricul-

tural value chain. The findings provide a deeper understanding of the complex relationship between the RMSC and EU agricultural trends, offering valuable insights for policymakers, farmers, traders, and consumers.

Methodology

The article examines the influence of economic and environmental factors on the production of barley, maize, potatoes, sunflower and wheat in four leading agricultural economies of the European Union – France, Germany, Italy and Spain, where we have added Bulgaria due to the fact that it is the fifth largest wheat and sunflower exporter in the union. The selection of these countries is due to their significant role in the EU's agricultural sector, while amongst major cereals like barley, maize, sunflower, and wheat, potatoes have been included because they represent a non-cereal crop with distinct dietary and production patterns, market demand, and climate sensitivity. Further, potatoes' exhibit distinct pricing and export behaviors, often divergent from those of cereals, making them an essential component when analyzing agricultural trends under the Raw Material Supercycle. This broader crop selection allows for a more comprehensive understanding of how different types of agricultural products behave under varying economic and environmental pressures. The data has been sourced from the Food and Agriculture Organization (FAO) in its entirety. The methodology used includes multiple linear regression analysis, where the dependent variable is the production volume in tons. The independent variables include export value, area harvested in hectares and yield as tons per hectare. Applying our methodology in analyzing the RMSC, we have selected a specific research time period of 33 years (1990 – 2022), which corresponds with different phases of the Raw Material Supercycle. For the purpose of this study, we provide a simplified parallel breakdown of potential time periods in the development of EU agriculture. The so called, **Expansion Phase** (1990 – 2008) saw robust economic growth and increasing demand for raw materials, including agricultural commodities, driven by globalization, industrialization, and rapid development in emerging EU economies. Key events during this phase include the establishment of the European Single Market in 1993, EU enlargement in 2004 and 2007, and the accession of several Central and Eastern European countries. Agricultural production in the EU expanded to meet growing domestic and international demand, supported by technological advancements, agricultural subsidies, and somewhat favorable uninterrupted market conditions. The **Peak Phase** (2008 – 2013), coincides with the global financial crisis of 2008 and its aftermath, characterized by economic downturns, market volatility, and reduced consumer spending. One of the factors greatly affected the development of the RMSC into its peak phase is the increased liquidity disbursement, particularly to institutional organizations. The 2008 financial crisis influenced the dynamics of the RMSC in various ways. While a direct impact of

liquidity injections on agricultural commodity prices may have been hidden or delayed, the indirect effects on market sentiment, speculative activity, investment strategies, and financial interconnectedness have significantly influenced the dynamics of the Raw Material Supercycle in the agricultural sector. These complex interactions are crucial for assessing the broader implications of liquidity-driven interventions on agricultural commodity markets and for informing risk management and investment decisions. During this period, agricultural markets experienced fluctuations in prices, trade volumes, and production levels as demand contracted and financial constraints for small and medium farmers affected investment and consumption. EU agricultural policies and subsidies underwent reforms influencing production incentives, market support mechanisms, and trade dynamics.

Following the peak phase, the **Contraction Phase** (2013 – 2016), reflected a period of economic stabilization and gradual recovery, although uncertainty and risk aversion persisted. Agricultural markets faced challenges related to subdued demand, price volatility, and changing consumer preferences, prompting adjustments in production strategies and market positioning. Policy responses from the EU included efforts to enhance market resilience, promote sustainable agriculture, and address environmental concerns through initiatives such as the CAP reforms. During the Contraction Phase (2013 – 2016) of the Raw Material Super Cycle, consumer price volatility remained a significant concern, influenced by various factors beyond commodity market prices. Factors beyond commodity market prices provide a more comprehensive understanding of the drivers for export value volatility during the Contraction Phase of the RMSC. These interconnected factors underscore the complex nature of consumer markets and highlight the various channels through which liquidity injections in financial markets can influence consumer demand dynamics during a RMSC. **The Recovery Phase** (2017 – 2023), presented a mixed picture for EU agriculture, marked by both opportunities and challenges amidst geopolitical turmoil, supply chain disruptions, and unforeseen crises. The COVID-19 pandemic compounded these challenges, disrupting labor availability, transportation networks, and consumer behavior. Lockdown measures and trade restrictions hindered agricultural operations and distribution channels, exacerbating existing vulnerabilities within the sector. As geopolitical tensions escalated, particularly with the special military operation in Ukraine and other global conflicts, EU agriculture faced heightened uncertainty and instability. These events not only affected trade relations and access to key markets but also raised concerns about food security and supply chain resilience. Massive agricultural strikes across the EU in 2023 highlighted growing discontent among farmers over issues such as income inequality, regulatory burdens, and market volatility. These protests underscored the socioeconomic pressures facing agricultural communities and called into question the effectiveness of policy responses. Moreover, EU farmers grappled with intensifying price competition from third countries, where lower production costs and regulatory

standards provided unfair competitive advantage. This influx of cheaper agricultural products threatened the livelihoods of domestic farmers and challenged the EU's commitment to sustainable and ethical practices.

Amidst these challenges, efforts to promote agricultural innovation and sustainability continued, albeit with varying degrees of success. Diversification strategies, investment in value-added products, and quality standards remained priorities, but progress was hindered by resource constraints and shifting market dynamics. The so-called recovery phase is characterized by a fragile equilibrium, with EU agriculture navigating through a complex web of geopolitical, economic, and social factors. The sector's resilience and ability to adapt to these challenges will determine its long-term viability and sustainability in the face of an uncertain future. The complex agricultural landscape within the EU manifests through distinct cultivation patterns across member states, each specializing in key commodity crops. Despite all of their contrasting, they contribute significantly to the EU's agricultural output, each specializing in crops suited to their geographical and climatic conditions. These commodity crops form the backbone of the EU's agricultural sector, closely linked to the ongoing dynamics of the Raw Material Super Cycle.

Materials and Methods

The materials and methods section of this study involves a practical analysis of the current state of the RMSC in EU agriculture and the factors that can enable the sector to unlock its potential. To achieve our objectives, we conducted a literature review on existing studies of the agriculture sector, raw material super cycles, and many related topics. We also analyzed data from various sources. The data sets were made using descriptive statistics and econometric models to identify trends and patterns.

Our study employed a mixed-method approach, combining quantitative and value data sources to provide a broader understanding of the sector's potential in the context of a Raw Material Supercycle.

Results and discussion

The regression analysis provides strong evidence for the factors driving agricultural production within the context of the Raw Material Super Cycle as seen in Table 1. The underlined role of export value in Table 3 and indispensable factors of area harvested, and yield per hectare in Table 1, highlight how demand, agricultural practices, and land use interact to influence production levels. Such understanding helps confirm the RMSC theory, demonstrating that production dynamics are closely tied to cyclical patterns in raw material markets.

Table 1. Results from Comparative Analysis of Agricultural Commodities in EU Countries

| Crop	Country	Multiple R	R Square	Adjusted R Square	Standard Error	Observations	Intercept	Export Value	Area harvested (ha)	Yield t/ha
Barley	Bulgaria	0.98015	0.96069	0.95663	57623.55035	33	-793912.60065	0.73450	3.68571	190541.37685
Barley	France	0.99818	0.99636	0.99599	86652.34676	33	-10394971.71081	0.03170	5.90158	1755269.75834
Barley	Germany	0.99310	0.98625	0.98482	157851.31771	33	-10255392.76627	-0.20919	5.74169	1786753.99260
Barley	Italy	0.99920	0.99839	0.99823	10411.30087	33	-1117985.94615	0.46168	3.80210	292262.78461
Barley	Spain	0.99397	0.98798	0.98674	107910.12929	33	-6011377.11515	-0.04942	2.84539	2104958.69306
Maize	Bulgaria	0.99194	0.98395	0.98229	113337.09292	33	-2000138.83563	0.31267	4.44924	436083.66736
Maize	France	0.99839	0.99678	0.99645	111488.75721	33	-14129933.56024	0.04535	8.67856	1618278.82863
Maize	Germany	0.99746	0.99493	0.99441	72352.99209	33	-3138832.31151	0.89765	7.23619	418846.67582
Maize	Italy	0.99577	0.99155	0.99068	165375.93557	33	-7906043.24412	2.20337	9.54498	810390.27018
Maize	Spain	0.99166	0.98339	0.98168	103949.46385	33	-3316680.29443	-2.07552	8.76741	390126.36789
Potatoes	Bulgaria	0.96726	0.93560	0.92894	42953.34032	33	-321138.85750	-6.73617	12.47346	23153.98760
Potatoes	France	0.99938	0.99875	0.99862	37973.29431	33	-6913684.33178	-0.08452	41.27934	168288.09241
Potatoes	Germany	0.97677	0.95409	0.94934	262718.70897	33	-6330173.04968	-1.85789	26.00486	264856.41763
Potatoes	Italy	0.99920	0.99839	0.99823	10411.30087	33	-1283605.31027	-0.10565	22.56511	56829.42652
Potatoes	Spain	0.99397	0.98798	0.98674	107910.12929	33	-526618.16803	-3.51615	17.47840	63271.68120
Sunflower	Bulgaria	0.99639	0.99279	0.99205	55759.31555	33	-960583.61352	0.14289	1.55082	643467.48320
Sunflower	France	0.99710	0.99420	0.99360	26982.55472	33	-1578197.31093	-0.00607	2.23171	704503.80804
Sunflower	Germany	0.98594	0.97208	0.96919	10132.18058	33	-80029.45457	-0.04611	1.82151	42356.42583
Sunflower	Italy	0.99791	0.99582	0.99539	6819.41200	33	-302627.43608	-0.10164	2.15740	140259.41157
Sunflower	Spain	0.96099	0.92351	0.91559	65479.72759	33	-747869.82807	-0.89609	0.78497	943018.19647
Wheat	Bulgaria	0.99881	0.99763	0.99738	68048.59847	33	-3188611.93799	0.20705	2.92166	1092411.89066
Wheat	France	0.99967	0.99935	0.99928	97373.55925	33	-35039819.10616	0.00486	6.56254	5331721.55758
Wheat	Germany	0.99910	0.99821	0.99802	148432.89355	33	-20282640.86980	0.09785	6.94040	2917992.94154
Wheat	Italy	0.99406	0.98815	0.98692	90652.06734	33	-8015425.63588	0.13669	3.62520	2185710.94918
Wheat	Spain	0.99785	0.99571	0.99526	91700.26051	33	-6011377.11515	-0.04942	2.84539	2104958.69306

The proving concept for a RMSC, characterized in our case, by prolonged periods of rising demand drivers for key commodities, has garnered significant attention. In this analysis, we focus on five crucial raw materials – barley, maize (corn), potatoes, sunflower, and wheat – across five European countries: Bulgaria, France, Germany, Italy, and Spain. Through a combined analysis of regression statistics for each crop and country, we uncovered trends, anomalies, and implications pointing to obvious similarity with the broader raw material market and very much indicative of such a super cycle. Analyzing barley as a key raw material, France and Germany exhibit a significant positive relationship between area harvested and yield, contributing to high production levels. France showcases exceptionally high Adjusted R Square values, indicating a strong correlation between the predictors and the dependent variable. This could suggest robust predictive models or potentially influential factors not captured by the other countries' analyses. Italy's regression shows a significant positive coefficient for yield but a negligible impact of export value, indicating potential domestic-focused production. However, Italy shows the highest Multiple R, indicating a strong linear relationship between the other variables and yield. An anomaly arises in Spain, where the export value has a negative coefficient, suggesting a unique market dynamic possibly influenced by domestic demand or trade policies. Generally, all countries exhibit high R Square values, implying that the chosen variables explain a significant portion of the variability in barley yields.

Table 2. Model Performance by crop and country
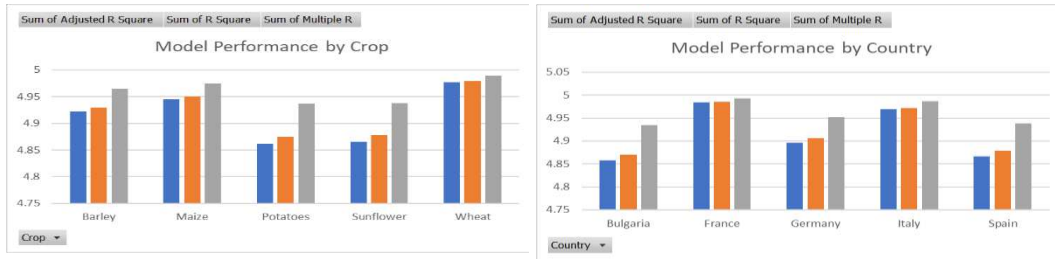
Across all countries variables for Maize area harvested and yield have strong positive effects on production (Table 3). Italy demonstrates remarkably low Standard Error compared to other countries, suggesting relatively precise predictions. Another anomaly in Italy's regression is the significant negative coefficient for export value, indicating a potential domestic demand focus. Bulgaria exhibits high Multiple R and R Square, indicating a strong linear relationship between other variables and maize yield. France and Germany also display strong relationships, while Spain shows slightly lower coefficients but still significant relationships.

Table 3. Export Value variances by crop and country
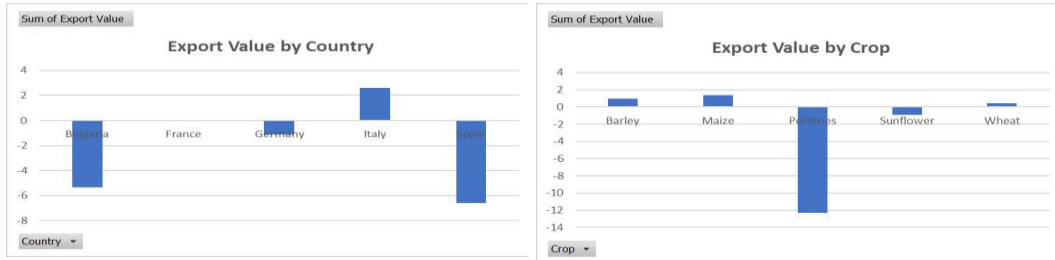
With potatoes, the area harvested significantly impacts production in all countries, with Germany and Bulgaria showing particularly strong coefficients. Spain exhibits a negative coefficient for export value, suggesting a domestic market emphasis. France displays extremely high R Square values, suggesting a tight fit between predictors and yield. Nevertheless, across all countries, the models explain a substantial portion of yield variability, as indicated by high R Square values. Italy shows exceptionally low Standard Error, indicating consistent precise predictions.

Considering the importance of sunflower, the area harvested has a significant positive impact on production across all countries. An anomaly in Italy's regression analysis is the insignificant coefficient for export value, contrasting with other countries this is probably due to the fact that the sunflower is shadowed by substitute export products more common for Italy and unfit for our analysis. Spain

demonstrates notably low R Square and Adjusted R Square values compared to other countries, suggesting the only weaker relationship between predictors and yield in the set. Bulgaria, France, and Germany showcase strong relationships between predictors and yield, as evidenced by high R Square values. Italy exhibits the lowest Standard Error, indicating another consistency with precise predictions.

When we look at wheat, across all countries the area harvested and yield strongly influence production, with Bulgaria showing the highest coefficents. France exhibits extraordinarily high R Square and Adjusted R Square values, indicating a robust fit between predictors and yield. Further, an anomaly in France's regression is the insignificant coefficient for export value, suggesting a potential focus on domestic consumption. Italy displays the highest Multiple R, suggesting a strong linear relationship between predictors and wheat yield. All countries demonstrate high Adjusted R Square values, indicating that the models provide a good fit for the data. In addition, the positive and significant relationship between export value and production suggests that higher global demand and prices (characteristics of an upward phase in the RMSC) drive increased production. Investments in technology and land expansion could be typical responses to sustained higher demands, both locally and internationally, further validating the cyclical pattern of increased production following market booms.

Our findings highlight the importance of domestic factors, such as agricultural policies and internal market dynamics, in shaping production trends for the key crops. Anomalies in export value coefficients suggest varying degrees of reliance on domestic markets versus international trade, which can also be attributed to certain guarantied sales, but structured response to external market demand. This is there on supported by strong positive relationships between area harvested, yield, and production, that are indicative of the potential for increased output to meet rising global demand. Our concise analysis, supported by the above statistical regressions and evidencing the presence of anomalies underscores the need for far more nuanced approach and tailored strategies in navigating the current RMSC.

The combined analysis by regression statistics for five key crops across five European countries reveals both consistent trends and notable anomalies. This analysis accentuates the existence of a RMSC, particularly evident across the different crops and countries. The observed anomalies, such as the lower predictability of sunflower in Spain and the inverse relationship of potatoes in Bulgaria, offer insights into localized market dynamics and areas for further investigation. Overall, the high predictability and strong correlations in most cases affirm the cyclical nature of raw material production, value and export, contributing to the broader understanding of global agricultural trends. While the overall picture suggests a positive outlook for meeting global demand amid a Raw Material Supercycle, the nuances of each country's production dynamics support the importance of tailored strategies and policy

interventions to optimize agricultural productivity and resilience in a currently, and in the years to come very fluid market environment.

The development of a proactive strategy for EU agriculture amidst raw material super cycles necessitates an approach that addresses structural vulnerabilities while capitalizing on emerging opportunities. By implementing a comprehensive set of measures encompassing efficiency, diversification, risk management, sustainability, market access, capacity building, financial resilience, and policy adaptability, the agricultural sector can navigate the challenges posed by Raw Material Supercycles with resilience and adaptability.

Conclusion

This study highlights the importance of understanding agricultural dynamics across different crop types – cereals and non-cereals – during the Raw Material Supercycle. By analyzing the behavior of barley, maize, potatoes, sunflower, and wheat, it captures the diversity of agricultural responses to both market and environmental pressures, offering a comprehensive look at EU agricultural trends under varying phases of the RMSC. There are several avenues for future research and further exploration of the topic of the Raw Material Supercycle and its implications for EU agriculture:

1. *Investigating the historical patterns and long-term trends*: By analyzing historical data and identifying recurring cycles, researchers can gain insights into the drivers and mechanisms underlying the RMSC and its implications for agricultural production, trade, and consumption in the EU.
2. *The effectiveness of existing policy responses and adaptation strategies in mitigating the impacts of the RMSC on EU agriculture*: Iteratively evaluating the role of agricultural policies, trade agreements, financial instruments, and support programs is helping farmers and agribusinesses navigate cyclical fluctuations and economic uncertainties.
3. *The role of technological innovation and sustainable agricultural practices*: Exploring the adoption of precision farming technologies, agroecological approaches, digitalization tools, and climate-smart practices as means to improve productivity, resource efficiency, and environmental sustainability in the face of RMSC.

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