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Environmental Change Impact on Agriculture Economic Products

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Abstract: There are significant environmental changes in the northwest region of China. These changes are raising concerns about their effects on agricultural products. In addition, this paper synthesizes findings from various studies to find the relationship between environmental changes and agricultural products. Expect for historical challenges, like barren land and sandstorms, governance build many policies to make ecological and agricultural improvements. These policies target to solve the environmental problems. Furthermore, the study processes many influential factors like changing precipitation patterns, ecological improvements, creative farming practices, and governmental policy impacts. By using the ARIMA model to forecast the data from the China Agricultural Information Network, results evaluate how environmental changes affect prices of key agricultural products, especially for peaches and watermelons. In the rest of studies also highlights the roles of technology and policies and providing insights into their economic and ecological significance. In conclusion, this study reveals the understanding of relationship between environmental changes and agricultural products, and it offer insights for sustainable development in the northwest region of China.

Keywords: agriculture, environment, China agricultural economic product

1. Introduction

The northwest region of China, historically characterized by arid landscapes, yellow sandstorms, and economic challenges, has suffering remarkable environmental changes over the past few decades. These transformations also have inspired interest and concern about their impact on the region’s agricultural economic products. Before conducting the comprehensive environmental policies from local government, the region is struggled to overcome the harsh natural conditions. However, efforts for restoring ecological balance and promoting sustainable practices have many substantial improvements, both in environmental health and agricultural output.

In addition, expect for existing literature in this paper, this study employs the Autoregressive Integrated Moving Average (ARIMA) model, which is a powerful time-series analysis technique, to delve deeper into the influence of environmental changes on agricultural economic products. In addition, this model is utilizing data sourced from the China Agricultural Information Network. Furthermore, the research focuses on two key agricultural products: peaches and watermelons. Through the application of the ARIMA model, the study targets to provide valuable insights into the

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price trends of these products, and indicates the complex interaction between environmental factors, technological advancements, policy interventions with agricultural outcomes.

Furthermore, this paper is not only showing a mere examination of price trends but is also aims to uncover the multifaceted forces that contribute to the observed trends, particularly the influence of technological advancements and governmental policies. By exploring how these external dynamics change agricultural production price trends, this study also aims to contribute to a more comprehensive understanding of the factors driving the evolution of the northwest region's agricultural landscape.

Ultimately, this paper offers a holistic perspective on the relationship between environmental changes and agricultural products in China's northwest region. The result or conclusion gained from this study can help policymakers, agricultural stakeholders, and researchers to get useful information and use them to develop sustainable strategies for fostering economic growth, environmental health, and resilience in the face of recurring challenges.

The rest of paper is divided into literature review, methodology, result, discussion, and conclusion. In the literature review, it aims to synthesize and analyze multiple research articles. The methodology aims to how to use the ARIMA model to forecast the impact of environmental changes on agricultural economic products in Northwest region of China and points out that the limitation of this model for forecasting this research target. Then, the result part indicates that the result by using ARIMA model to forecast future two products' price. Next section indicates that the reason of conflicting between the forecast result and accuracy data.

2. Literature Review

In these decades, northwest region of China has been undergoing huge environmental changes, which have raised concerned about their agricultural economic products. In the historical ecological fragility of this region, the poor weather conditions compounded by government policies favoring unsustainable agricultural practices, have led to soil erosion and desertification [1]. In "The Relationship between Ecological Environment Construction and Economic Development in the Northwest Territories", the author indicates the relationship between ecological environment and economic development, as discussed in multiple sources, underscores the complexity of the challenges faced by the northwest region. Natural factors such as drying, erosion, and evaporation interact with economic growth, leading to a complex web of influences [2]. Before the government environmental policy, the northwest region is famous as barren land, yellow sandstorms, and poverty. After the government controlling, the annual precipitation has a significant increasing trend, it's expected that there could be potential benefits for crop growth and yield, assuming other factors remain conducive [3]. In addition, through these decades of environmental management, the entire Northwest ecology has been a great success both environmentally and agriculturally. The decreasing trend in precipitation has historically posed challenges to the province's ecological health and economic stability, emphasizing the need for adaptive strategies [4]. The China government do many efforts on Ecological Improvement. The first is Military involvement, along with large-scale trees, like 300,000 trees were planted, and grassland restoration, suggests a proactive approach to enhancing the environment. These efforts have the potential to positively impact the agriculture sector by creating more favorable conditions for crop cultivation [5]. Furthermore, government research and development investments, coupled with rural infrastructure improvements, contribute to technological advancements in agriculture. This suggests also that a sustainable environment can foster innovation within the agricultural sector [6]. Especially for the region of Northwest, government set up many programs. These programs resulting improvement of ecological conditions, indicating that changes in land use practices can lead to positive economic and environmental products [7]. Last but not least, government support and innovative practices reshape the agricultural landscape. In addition, the success of the watermelon industry, supported by financial incentives and farmer engagement, shows we can adapt to changing environmental conditions to cultivate economically viable crops [8]. However, there are two key aspects of environmental changes impact on plant and ecosystem dynamics. The first is climate changes can alter key factors, PCFs, influencing plant growth, such as photosynthesis and nutrient availability, ultimately affecting the yield and quality of agricultural products [9]. The second is climate change can affect on ecosystems Changes in plant-oil interactions have far-reaching consequences, influencing not only agricultural products but also the overall biodiversity and functioning of terrestrial ecosystems [10].

3. Methodology

3.1. Research Design

The Primary purpose of this study is to forecast the impact of environmental changes on agricultural economic products' price in Northwest China by using time-series analysis techniques. To achieve this goal, the study employs the ARIMA (Autoregressive Integrated Moving Average) model, a widely used method for forecasting and analyzing time-dependent data patterns. The reason of ARIMA model is chosen due to its effectiveness in capturing and modeling complex temporal relations within data.

3.2. Data Collection

The data are abstracted from "China Agricultural Information Network and Choice", including agricultural products' price, like peaches and watermelons. The time frame considered in this study spans decades, allowing for a comprehensive evaluation of the impact of environmental changes on agricultural economic products in Northwest China.

3.3. ARIMA Model

The ARIMA model is composed of three main components: autoregressive (AR) terms, differencing (I) terms, and moving average (MA) terms.

Autoregressive (AR) Component: The AR component captures the linear relationship between the current value of the variable and its past values. It is represented as AR(p), where "p" indicates the number of lagged observations used in the model.

Integrated (I) Component: The "I" component involves differencing the time series to make it stationary, which helps in stabilizing the variance of the data. The "I" in ARIMA represents the number of differencing operations needed to achieve stationary.

Moving Average (MA) component: The MA component considers the relationship between the current value of the variable and its past forecast errors (residuals). It is represented as MA(q).

3.4. Model Selection

The selection of appropriate parameters (p, d, q) for the ARIMA model is crucial for accurate forecasting and analysis. To determine the optimal values for these parameters, the study employs techniques such as autocorrelation function (ACF) and partial autocorrelation function (PACF) plots. These plots help identify the order of differencing (d) and the lag orders for the AR (p) and MA (q) components.

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3.5. Model Fitting and Validation

Once the parameters are determined, the ARIMA model is fitted to the dataset. The fitting process involves estimating the model's coefficients using methods like maximum likelihood estimation. The model's performance is assessed through various diagnostics, like residuals analysis, Ljung-Box test for white noise, and AIC (Akaike Information Criterion) values. A well-fitting model should have residuals that resemble white noise and a lower AIC value.

3.6. Limitations

It's important to note that the ARIMA model assumes that the underlying data follows a specific pattern, and its effectiveness is influenced by the quality and completeness of the data. Additionally, while ARIMA captures linear relationships, it may not fully account for complex non-linear interactions that could be present in the data. In the future, this article will improve its research results based on multidimensional data and more complex and effective mathematical models.

4. Result

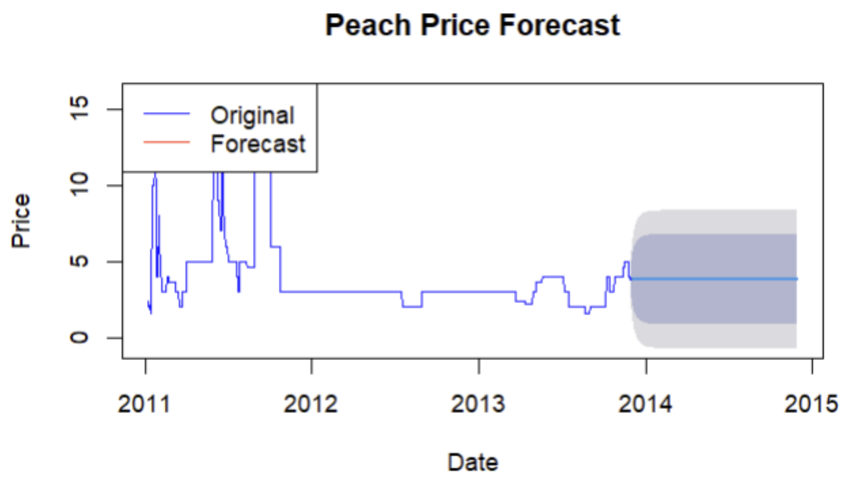

Figure 1: Peach Price Forecast Result.

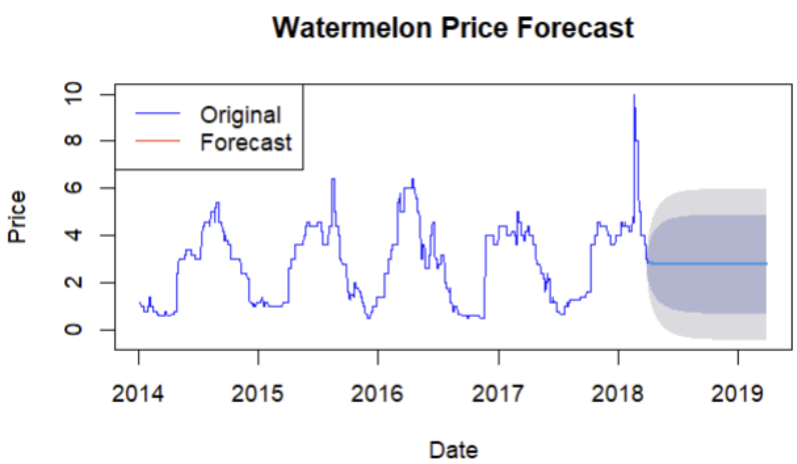

Figure 2: Watermelon Price Forecast Result.

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4.1. ARIMA Model for Peach Production

As for Figure1, the ARIMA model for peach production yielded best pdq values of 2, 0, 2. This configuration ensures a stable and reliable forecasting model. Importantly, the absence of an increasing trend indicates that peach production is inclined to remain relatively constant over the forecasted period.

4.2. ARIMA Model for Watermelon Production

In Figure2, in the case of watermelon product, the ARIMA model indicated the most suitable pdq values to be 2, 0, 3. Like the peach model, this configuration guarantees a good forecasting mechanism. the absence of an increasing trend observed in the data, particularly in the year 2019, shows the watermelon industry’s preference is maintaining consistent production levels, thereby responding to market demands without severe fluctuations.

5. Discussion

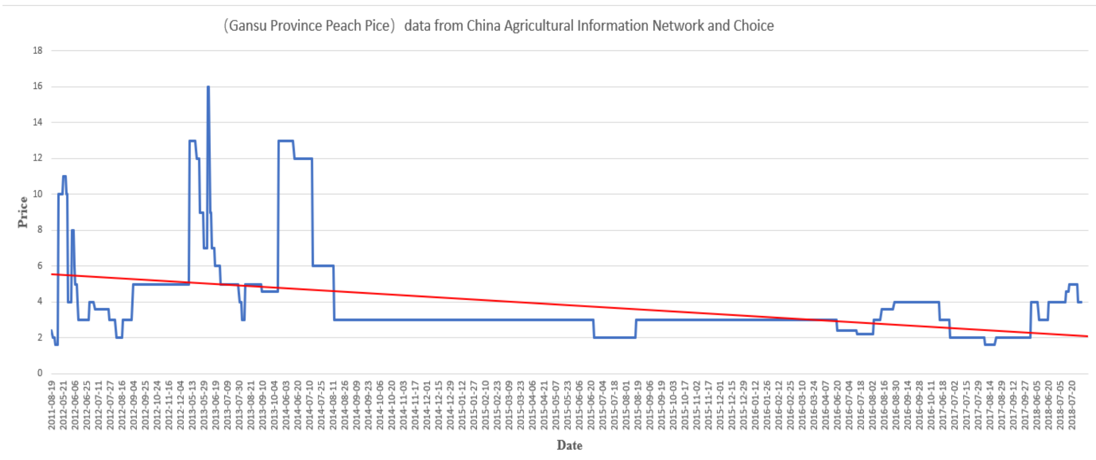

Figure 3: Actual Peach Price Trends.

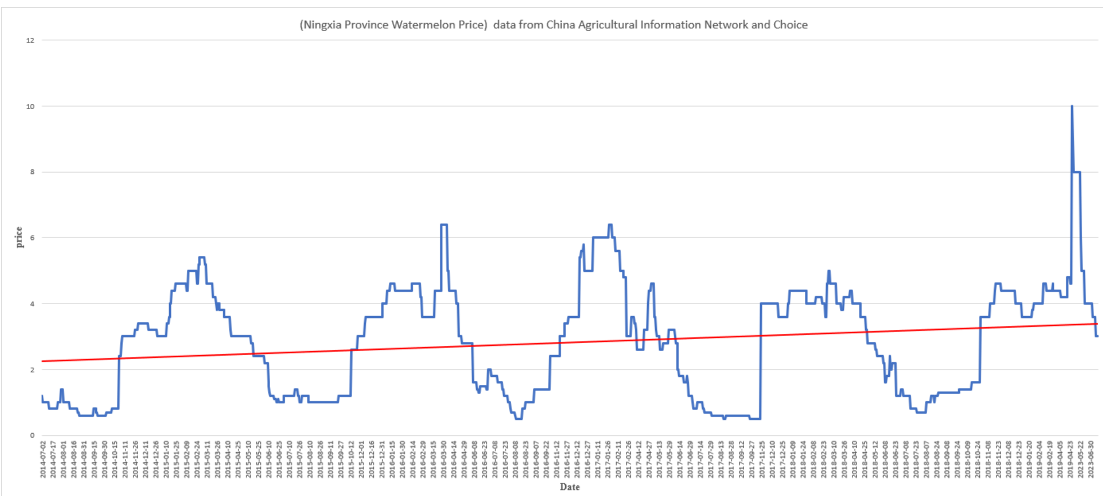

Figure 4: Actual Watermelon Price Trends.

As for Figure3, the utilization of ARIMA models to forecast the price trends of significant agricultural products, especially for peaches and watermelons, has yielded results that different from both initial

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projections and established scholarly literature, as conspicuously demonstrated by Figure4 The absence of obviously upward or downward trends in the projected prices of these products, so we need to reconsider reevaluation of the accuracy and comprehensiveness of the model in capturing the complete spectrum of influential variables. This discussion target to delve into these differences and show the essential roles played by external dynamics, particularly technological advancements, and governmental policies, in shaping the authentic observed trends in prices.

5.1. Impact of Technological Advancement on Agricultural Trends

While ARIMA models excel at capturing patterns in time series data, they might inherently overlook the transformative effects of technological progress within the agricultural domain. The rapid evolution in farming techniques, crop genetics, and after harvest processes can recalibrate the balance between supply and demand, and it led observable effects on market prices. However, the conventional ARIMA framework might struggle to accommodate non-seasonal shifts arising from technological advancements.

Due to decreasing trend in precipitation in history, the need of adaptive strategies is the target goal to problem of province's ecological health [4]. The technological revolution in agriculture has fundamentally altered traditional farming practices in the northwest region of China. Advancements such as precision agriculture, biotechnology, and mechanization have revolutionized the way crops are cultivated, managed, and harvested. These innovations enable farmers to monitor soil conditions, optimize irrigation, and tailor fertilization, resulting in improved crop yields and quality. As "Change Precipitation Trends and Agricultural Productivity" suggests, these advancements can synergize with increasing annual precipitation to create an environment conducive to even greater yield improvements [3]. Therefore, it is plausible that the ARIMA models, despite their effectiveness, might struggle to capture the intricate interplay between technological progress and agricultural trends.

5.2. Government Policies and Environmental Governance

The case of peaches serves as a compelling testament to the influence of governmental policies on agricultural trends. Government-led initiatives focused on environmental preservation and prudent resource management, as exemplified by "In the Improving the Ecological Environment for the Benefit of the People of Northwest China." hold the potential to bring about substantial transformations within the agricultural sector [5]. Furthermore, the study "Influence of Environment Governance on Agriculture Green Technology Innovation" underscores the interconnectedness between effective environmental governance and agricultural innovation [6]. This highlights the capacity of policy interventions to act as catalysts for driving changes in agricultural practices, subsequently resonating throughout market dynamics and price trends.

The northwest region of China's remarkable agricultural transformation owes much to visionary government policies and proactive environmental governance. The strategic planting of hundreds of thousands of trees, grassland restoration efforts, and investments in rural infrastructure, as discussed in " In the Improving the Ecological Environment for the Benefit of the People of Northwest China." have not only improved the ecological landscape but have also created a more conducive environment for agricultural product [5]. These initiatives, coupled with the correlation established in "Influence of Environment Governance on Agriculture Green Technology Innovation" reveal the integral connection between sustainable policies and technological innovation [6]. Furthermore, the improvement of ecological conditions can lead to positive effect on economic agricultural products [7]. All these improvements are shown in good way on two key aspects of plant growth and ecosystem

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stable, PCF'S [9] and soil quality [10]. As such, the evolving policies of the northwest region underscore the potential of government initiatives to shape the trajectory of agricultural trends.

5.3. Economic and Ecological Implications of Policy Initiatives

The convergence of data and empirical evidence strengthens the positive outcomes of environmental policies on agricultural economic commodities. Governments are increasingly investing dedicated efforts in bolstering sustainability, driven by the overarching objective of leaving behind vibrant landscapes, untainted water bodies, and a nurturing environment for future generations. This commitment seamlessly aligns with the aspirations for sustainable development as championed by institutions such as China's environmental sector and economic development sector.

Given these intricate influences, it is imperative to adopt a comprehensive approach that amalgamates technological, environmental, and policy considerations when analyzing agricultural price trends. By embracing this holistic perspective, a more nuanced comprehension of the multifaceted forces molding the agricultural landscape can be achieved. As the northwest region of China embarks on a journey of environmental and agricultural transformation, the insights gleaned from this analysis offer valuable guidance for formulating resilient and sustainable farming practices.

5.4. Embracing Holistic Approach to Predict Agricultural Trends

In conclusion, the divergence of observed trends in agricultural product prices from the predictions of ARIMA models underscores the need to consider broader external factors in shaping these trends. Technological advancements and government policies are revealed as significant drivers that interact with environmental changes to influence the agricultural landscape. The northwest region of China's journey from barren land to agricultural prosperity showcases the potential of integrating sustainable policies and innovative technologies. This serves as a valuable lesson not only for China but also for regions globally facing similar challenges. Embracing a holistic approach that accounts for these multifaceted influences will undoubtedly lead to more accurate and comprehensive models for predicting and understanding agricultural trends, ultimately fostering sustainable growth and prosperity.

6. Conclusion

Overall, the evidence presented can support following the ideas. The first is ARIMA model cannot accurately and comprehensively forecast these agricultural trends, because accurately predict them require us to consider multifaceted influences, like government policy, environmental change, and technological advancements. In addition, Protecting the environment can create some conflict with the development of economic agricultural products. In addition, following the historical ecological fragility the poor weather always appears in the northwest region [1], and the relationship between natural factors such as drying, erosion, and evaporation with economic growth build a complex web which is hard for us solve and balance it [2]. Hence, we need to find the balance of them. Thus, we can achieve sustainable development of economic agricultural products, so that these agricultural products have well developed and make them can also be used to protect the environment.

Based on these conclusions we can find that If scholars want to get comprehensive predictions during research, they must consider all these external factors. In addition, to achieve goal of sustainable development in agricultural production, government can introduce or develop new agricultural technology. With this new technology, cropland can achieve the of one acre of productive land, and this result can compensate of the impact of returning farmland to forest on decreasing agricultural production. In addition, Agricultural products can achieve joint development through new technology and environmental governance. Take selenium watermelon as an example.

Developing new species of this watermelon which do not cause bad effect with earth, it also has lower risk and price than old one [10]. Furthermore, government can publish new policy that decreasing tax and providing subsidy. With these policies can promote the willing of farmers to plant these new agricultural products. Government also can conduct North-South Economic Cooperation City which make North agricultural production has wider sales channel. Government can help local famer or agricultural production to build own product brand. This way can help local agricultural production to go out of northwest region.

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