Based on the time series model and decision tree model, whether wildlife trade should be banned for a long time summary

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Abstract. This article aims to study the main objects, objectives and trade trends of wildlife trade in recent years, as wildlife markets have been identified as the initiators of the outbreak and spread of the new coronavirus in 2020, and to collect and analyze the long-standing ban on wildlife trade. The data is graphed for visual analysis, and the Pearson correlation analysis method is used to analyze the relationship between wildlife trade and major infectious disease outbreak, social and economic impact indicators, and summarize the econom ic and social impact of this long-term ban. Then, the mathematical model we fit, combined with the current situation of the new crown epidemic, to provide effective, forward-looking, sustainable views and policy recommendations.

Keywords: wildlife trade, infectious diseases, time series model, random forest, decision tree model.

1. Introduction

Numerous surveillance data and studies in related fields have shown that wildlife markets are also suspected to be the source of the SARS virus in 2002. In addition, Ebola virus, Nipah virus, Middle East respiratory syndrome virus, etc. have also been confirmed to originate in wild animals. The entire industrial chain of wildlife trade has had a bad impact on biosecurity, human public health security, and human production and life. This paper aims to study the main objects and objectives of wildlife trade and the trade trends in recent years, and to collect and analyze the corresponding data on the long-term ban on wildlife trade. The data is graphed for visual analysis, and the Pearson correlation analysis method is used to analyze the relationship between wildlife trade and major infectious disease outbreak, social and economic impact indicators, and summarize the economic and social impact of this long-term ban. Then, the mathematical model we fit, combined with the current situation of the new crown epidemic, to provide effective, forward-looking, sustainable views and policy recommendations.

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2. Model Creation and Solving

2.1. Selection of indicators

By collecting data, we analyze the changes in trade in 2003~2022, and then the data given does not have data for 2022, which requires us to combine the trade data for 1990~2021 and forecast the data in 2022. The data from 1990~2021 are filtered out as follows.

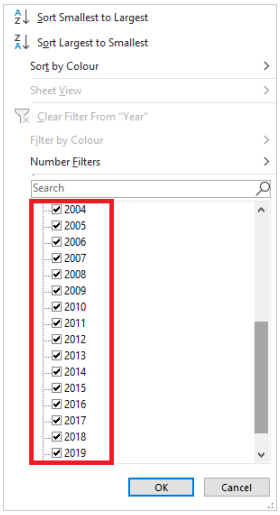


Fig 1. Screening of trade data from 1990 to 2021

After screening the data from 1990 to 2021, the following table shows the total number of exporters in each year.

Table 1. Annual Trade Data From 1990 To 2021

Year	Importer reported quantity	Exporter reported quantity
1990	22159	21956
1991	23579	31239
1992	15668	22681
1993	14084	20009
1994	13356	13999
1995	10071	9529
1996	7432	10757
1997	10392	19752
1998	8472	12670
1999	9752	13660
2000	7469	12034
2001	6196	11631
2002	6481	8022
2003	8537	11885
2004	11519	6987
2005	8819	9600
2006	5919	5849
2007	3221	3216
2008	3113	4088
2009	3671	3507
2010	5002	5233
2011	2196	4200
2012	2791	3665
2013	2600	3575
2014	3488	4054
2015	2804	2483
2016	2723	2916
2017	4277	3793
2018	6408	4174
2019	1434	8018
2020	598	6802
2021	428	1333

For this question, we establish a time series model to fit and forecast the trade data from 1990 to 2022. See Appendix B for the specific code.

In the time series model, we use the moving average method to forecast the trade situation in 2022. The algorithm steps are as follows.

Step1 Set the observation sequence as a time series, and take the number of moving average items. The calculation formula of the average value of one movement is as follows.[4]

$$\begin{aligned} M_t^{(1)} &= \frac{1}{N}\left(y_t + y_{t-1} + \cdots + y_{t-N+1}\right) \\ &= \frac{1}{N}\left(y_{t-1} + \cdots + y_{t-N+1}\right) + \frac{1}{N}\left(y_t - y_{t-N}\right) \\ &= M_{t-1}^{(1)} + \frac{1}{N}\left(M_t^{(1)} + \cdots + M_{t-N}^{(1)}\right) \end{aligned} \tag{1}$$

Step2 The calculation formula of the second moving average is as follows.

$$\begin{aligned} M_t^{(2)} &= \frac{1}{N}\left(M_t^{(1)} + \cdots + M_{t-N+1}^{(1)}\right) \\ &= M_{t-1}^{(2)} + \frac{1}{N}\left(M_t^{(1)} + \cdots + M_{t-N}^{(1)}\right) \end{aligned} \tag{2}$$

Step3 When the basic trend of the prediction target is fluctuating up and down at a certain level, we can use the one-time moving average method to establish a model for prediction analysis.

$$\begin{aligned} &\hat{y}_{t+1} = M_t^{(1)} = \tfrac{1}{N}\left(y_t + y_{t-1} + \cdots + y_{t-N+1}\right), \\ &t = N,\ N+1,\ \ldots,\ T \end{aligned} \tag{3}$$

$$S = \sqrt{\frac{\sum_{t=N+1}^{T}(\hat{y}_t - y_t)^2}{T-N}} \tag{4}$$

3. Changes in Trade

It is not difficult to find from the above chart that during 2003-2022:

(1) In terms of import quantity, wildlife trade basically shows a decreasing trend, with the peak values in 2003, 2004, 2005 and 2006;

(2) In terms of export quantity, the wildlife trade basically shows a trend of shrinking and then gradually warming up, with the peak appearing in 2003, 2004, 2005, 2006 and 2018 respectively;

(3) In general, the import and export trade of wildlife was relatively active from 2003 to 2006, the import was relatively stable from 2007 to 2021, the export was relatively stable from 2007 to 2019, and the export was relatively active in 2020.

In conclusion, we do not agree with a long ban on wildlife trade, which can have a significant economic and social impact. Legal wildlife trade can also be divided into various forms by purpose, not just because of the current dangers of eating wildlife. Moreover, the wildlife market is large. If hastily banned, the volatility of the meat market may be very large, affecting people's livelihood. And many traditional Chinese medicines will use wild animals as medicinal herbs. If the wildlife trade is directly prohibited, it is not conducive to the development of traditional Chinese medicine in China. Illegal wildlife trade should be banned. According to statistics, the illegal wildlife trade has become the third largest illegal trade in the world after drugs and weapons. If no measures are taken, it will even disrupt the international trade market and further worsen the already turbulent international situation. Under the wanton development of wildlife trade, the species of animals protected by the state began to increase, but the number decreased sharply. The animals were either buried on dining tables, processed into crafts and displayed in window windows, or imprisoned in a small space for life. Moreover, species are declining, and biodiversity is a serious threat. In today's special period,

banning illegal wildlife trade can also reduce the contact between people and wildlife from the source, and prevent the pathogens carried by wildlife from entering people's lives, thus reducing the risk of wildlife infection.[8]

4. Model evaluation and improvement

In this paper, the corresponding data is analyzed visually, and the Pearson correlation analysis is used to analyze the relationship between wildlife trade and major infectious disease outbreaks, social and economic impact indicators, and to find and judge the impact of this long-term ban on the economy and society. Then the mathematical model fitted by us is a topic of data analysis and related analysis, which requires us to study the correlation between wildlife trade and the outbreak of major infectious disease, and evaluate the significant economic and social impact.

First, we preprocessed the data, supplemented the missing values, and screened the required values. At the same time, we aggregated and analyzed Class, Order, Family, Genus, Term, etc., to naturally obtain the species with the largest transaction frequency. Then, the target category data of each animal trade was sorted out, and the time series model was fit and predicted for the data in the data table, and analyzed the change trend of trade.

Analysis of whether wildlife trade problems related to major infectious disease outbreak, we collected some major infectious disease outbreak event data, at the same time took the mad cow disease, foot and mouth disease, bird flu, brucellosis since ten years before infection to infection years after data as a basis, analysis of the relationship between different animals and epidemic infectious diseases.

We collected the indicators of the impact of wildlife trade on the economy and society, constructed a set of index system and made relevant data analysis. In addition, the random forest and XGBoost decision tree model. After examination, all the models have high accuracy.

In conclusion, the time series model analysis of historical data fluctuations, at the same time auxiliary to predict, spiarman correlation analysis directly get the relationship between animal trade and disease, establish multifactor evaluation system, quantitative analysis should ban animal trade for a long time, comprehensive consideration ban trade for the economic and social influence, has important practical significance.

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