Construction of the Monitoring and Early Warning System of Beijing Pork Market

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Abstract. In view of the sharp fluctuation of pork prices in the market in recent years, this paper integrates the large data from pig production to pork consumption. Based on economic theory, analysis of time series and modern information technology, the monitoring and early warning system of Beijing pork market is designed by using B/S model and SSH framework. It realizes the main functions of pork price trend analysis, cycle identification, forecast and early warning, regulation and reference, and provides information support for better grasping the market pork price change law and ironing pork price fluctuation.

1. Introduction

In recent years, the sharp fluctuation of pork prices on the market has brought a great impact on the supply of “vegetable basket” and pig-breeding industry. Based on The Data Monitoring Pilot Project For Beijing Pig Industry Chain Of Consumption Trend, the monitoring and early warning system of Beijing pork market was designed. The purpose was to build a comprehensive, timely and accurate monitoring and early warning system. It can give full play to the prediction function of large data of pig industry, accurately identify abnormal fluctuations and carry out risk early warning. It has important practical significance to iron the excessive fluctuation of pig supply and demand, and push forward the structural reform of supply side of pig industry.

Since 2007, many domestic scholars have realized the importance of monitoring and early warning of pork market, and have conducted in-depth research on pork market price analysis, prediction and early warning model, information system construction. Jie Lu has analyzed the causes of periodic fluctuation of pork prices [1]. Xuefeng Mao [2], Shaodong Yu [3] and others scholars have used H-P filtering and other time series analysis models to quantitatively identify the fluctuation period of pork prices. Chuangguo Luo has adopted the ARIMA method to build a prediction model of hog prices[4]. Rong Yang has used the structural equation to discuss the construction of hog price early warning model [5]. Tianzhong Wang [6], Quan Liu [7], Liang Qian [8], Anping Zhao [9] and others scholars have explored and studied the framework design and functional design of other agricultural products and pig market monitoring and early warning system. However, the combination of information technology and pig price analysis, market price forecasting and early warning model is still lack of comprehensive and in-depth elaboration. On the basis of the foregoing work, based on the economic theory, time series analysis and modern information technology, this research adopts B/S model and SSH framework to design and complete the monitoring and early warning system of Beijing pork.
market. This system is an organic combination of information technology and pig price analysis, market prediction and early warning model.

2. System overall design
The laws of pig price fluctuation, the forecasting and early warning model are the theoretical and analytical basis of the monitoring and early warning system of Beijing pork market. The main functions of the system are based on electronic database and information technology to realize the price fluctuation of pig market, the operation of forecasting and early warning model and the visualization of the results.

2.1. System structure
The monitoring and early warning system of Beijing pork market draws on the design ideas of Spring, Struts and other open source projects. The system adopts B/S mode and SSH framework. It is developed based on Java language and has integrated the accumulation of business functions for many years. The system is embedded the part functional modules of Eviews 6.0 and Easyfit software through the middleware. Its technical framework is mainly composed of data base layer, system support layer, application service layer and system user layer (Figure 1.). The system design level is clear and easy to maintain and expand.

![Figure 1. Overall framework of the market monitoring and early warning system.](image)

The data base layer includes data management center, self-service platform and virtual application component. It mainly completes data exchange, extraction and management. It can transform and connect with EXCEL, XML, TXT and other data sources. It also develops a standardized open interface for data. Through the data exchange and sharing platform of Beijing Agricultural Bureau, data exchange and sharing can be realized with the “Business Report System of Agricultural Bureau”, “Monitoring System of Agricultural Products Origin”, “Agricultural Products Market System”, “Electronic Certification System of Livestock and Poultry Products”.
The system support layer which is the core of the system includes two parts: technical support and analysis model. The technology support part provides rapid development components with good expansibility and maintainability. It builds and implements the technology support of system business application through various service functions it provides. In the analysis model part, the basic algorithms such as formula, model and probability distribution function are provided for business function modules such as forecasting, early warning and market analysis.

The application service layer mainly realizes the management of the business data and the system. The User level of the system is to provide unified data display, query, analysis and reporting services such as government management departments, pig breeding, slaughtering, sales and other enterprises, as well as departments or individuals concerned about pig industry data.

2.2. Database construction
The business data of the system include key indicators from the whole chain of pig breeding to terminal consumption. Datas from different links come from different business systems. Through the information resources catalogue and exchange system of Beijing Agricultural Bureau, the data exchange and sharing with various business systems are completed. At the same time, the transformation, docking and import of EXCEL, XML, TXT and other data sources are supported.

2.3. Man-machine interface
The human-machine interaction interface consists of 4 parts: main window, sub window, dialog box and form control. The main window is responsible for guiding users to select function menu. Sub windows are used to receive user information and display simulated running results. Dialog box mainly provides users with error information in system operation. Drop-down menus, toolbars, tables and graphs provided by form controls can interact with users.

3. Main functions and technical principles of the system

3.1. Statistical analysis module
This module mainly realizes the basic statistical functions such as classification, aggregation, comparison, average value, standard deviation, coefficient of variation, index generation, and fast calculation of technical indicators. JSP is used to develop the front page and open source Eclipse BIRT technology is used to improve the expansibility and renewal of the system.

3.2. Cycle identification module
The data used in the price cycle identification module are the monthly price fixed base index series. In the process of implementation, the time span of pork price from one peak (trough) to one adjacent trough (peak) is automatically arranged by system program positioning. The period (monthly number) is calculated.

3.3. Price prediction module
The main techniques used in price forecasting are exponential smoothing model and differential autoregressive moving average (ARIMA) model in time series to realize pork price forecasting. In the process of implementation, Eviews is embedded in middleware to determine the time dimension, and the system will automatically display data processing mode and model equation.

3.4. Price warning module
This module realizes early warning of pork price exceeding threshold. The purpose of pork price alarm is to determine the threshold of price fluctuation, which is regarded as normal price fluctuation within the threshold range and abnormal fluctuation beyond the threshold. To determine the threshold, we need to simulate the statistical distribution characteristics of time series data (such as normal distribution) and delimit the threshold interval at a certain confidence level. For pork, two kinds of
time series data are usually used: the sequence of pork price itself, and the sequence of pig grain ration (pork price to corn price ratio).

3.5. Control reference module
This module uses data visualization technology to visualize the period of abnormal fluctuation of pig price in history (since 2000), major natural and social events affecting the supply and demand of pig market, key data indicators of pig production and market in special period, and regulatory measures of pig market introduced by the government.

4. Development and implementation of the system

4.1. System operation and development environment
The system runs in the network environment and consists of database server, application server and corresponding network equipment. The system is using Oracle 10g as database platform, Tomcat 5.0 as Web server and JSP engine, Windows 2003 Sever as server operating system. Java5.0 is the development platform, J2EE is the development framework, and Ellipse4.0 is the foreground development tool. Call Eviews6.0's time series analysis component to realize friendly and easy operation of human-machine interface.

4.2. System function example

4.2.1. Market analysis interface. This functional module completes the calculation of key statistical indicators of market data for different segments of live pigs. It mainly includes discrete analysis (average value, standard deviation, coefficient of variation, etc.), contribution rate analysis (feed price, piglet price, number of piglets and so on) and decomposition analysis (decomposition of time series data of price by H-P filter).

4.2.2. Price prediction interface. This module can complete time series prediction, multi factor prediction and other prediction. Taking the operation of combined forecasting model in time series forecasting as an example, the system automatically displays the monthly forecasting values in the form of data tables (Figure 2.).

Figure 2. Time series prediction price function display interface.
4.2.3. **Price warning function module.** This module completes the alarm analysis of abnormal fluctuation of hog prices. Taking the operation of Value-at-Risk method as an example, click the “Price Warning-VAR” button on the left toolbar and select the time period in the right dialog box. The system shows the results in the form of data tables and data probability distribution maps (Figure 3.).

![Price warning function display interface](image)

**Figure 3.** Price warning function display interface.

5. **Conclusion and discussion**

The monitoring and early warning system of Beijing pig market uses modern information technology to realize the integration and integration of multiple and decentralized data, forming a basic database including pig breeding, slaughtering, market circulation, terminal consumption, etc. The system grasps the core of market price fluctuation analysis and embeds economic analysis model to realize the decomposition, prediction and early warning of pork price fluctuation. The research and development of the system and its application are useful explorations for the analysis and research of pig industry based on big data. It has positive significance for improving the scientific, pertinence and effectiveness of macro-control of pig market and promoting the sustained, stable and healthy development and transformation and upgrading of pig industry.

There are still some problems to be solved in the process of system development and application, for example, data collection standards and standards for pig industry chain need to be improved. Data is the core of system operation. It is necessary to gather important data indicators which have great impact on production and consumption, strong representativeness, high update frequency and high accuracy around the key links of pig industry chain. At the same time, the data acquisition standards and norms of various indicators are formulated, and the data verification mechanism is established to improve the accuracy of data.

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