Using Data Mining Methodology to Build the Predictive Model of Gold Passbook Price

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Abstract—Gold passbook is an investing tool that is especially suitable for investors to do small investment in the solid gold. The gold passbook has the lower risk than other ways investing in gold, but its price is still affected by gold price. However, there are many factors can cause influences on gold price. Therefore, building a model to predict the price of gold passbook can both reduce the risk of investment and increase the benefits. This study investigates the important factors that influence the gold passbook price, and utilize the Group Method of Data Handling (GMDH) to build the predictive model. This method can not only obtain the significant variables but also perform well in prediction. Finally, the significant variables of gold passbook price, which can be predicted by GMDH, are US dollar exchange rate, international petroleum price, unemployment rate, whole sale price index, rediscount rate, foreign exchange reserves, misery index, prosperity coincident index and industrial index.

Keywords—Gold price, Gold passbook price, Group Method of Data Handling (GMDH), Regression.

I. INTRODUCTION

SINCE gold can keep the value, people invest gold to reduce the risk of inflation. Gold can maintain its purchasing power no matter in the time of inflation or deflation, so investing gold is the effective way to save the wealth. Moreover gold's quality of keeping value is more powerful when the economy is more confusion. From investor's viewpoint, most of people buy gold because of its quality of keeping the value. In Taiwan, many financial organizations feel optimistic with the trend of investing gold and produce the product of investing gold from low risk to high, for example, gold passbook, gold mutual funds, gold ETF, gold options, gold futures and so on. Among these products, gold passbook is the lowest risk one. Gold passbook is the tool for normal investor buying the solid gold, and it use one gram of gold to be the basic unit listing. The investors can commission the bank to buy gold and save into the passbook anytime or in time. They also can resale gold in the passbook to the bank. After establishing the account, banks will give the gold passbook to list the trading gold's balance.

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Bank of Taiwan as an example, the increase of gold passbook accounts timed five in 2008, and the total accounts almost reached 160000. Daily average has 243 people to establish an account. The hedging preferences of gold to investors let the gold price increased 12% in 2009. In the literatures, many methods can be applied to predict the gold price, and most results demonstrate that the gold price predictive model which is built by artificial neural network has the higher correctness. But, artificial neural network can not obtain the significant variables. Though Group method of Data Handling (GMDH) is also one of the artificial neural network methods, it can not only obtain the significant variables but also do well in prediction. Therefore, this study applies GMDH to investigate the significant factors of the influence on gold passbook price and develops a predictive model which has a high discrimination to let all of the companies or investors to make the investment decisions which can have the lowest risk.

Gold passbook business use the passbook to note the trading record when sell gold. Investors can entrust the banks to buy gold and deposit in the passbook, resale gold to the bank or withdraw the solid gold base on the bank rule anytime. The gold passbook uses one gram to be the basic trading unit sale, it has the advantages of small investment and lower risk compared to other gold investing products. Since it has the less features of low invested threshold, the little dealing spread and convenient trade, gold passbook becomes the best elementary tool for investors. The gold passbook is one of gold investing products so that its price is certainly affected by gold price. Capie, Mills, and Wood [2] indicated that gold has served as a hedge against fluctuation in the foreign exchange value of the dollar. A negative relationship is found between gold price and sterling–dollar exchange rates, and gold price and yen–dollar exchange rates, respectively. But its reflection degree seems highly dependent on unpredictable political attitudes and events. Narayan, Narayan, and Zheng [8] examined that the long-run relationship between gold and oil spot and futures markets. Their findings indicated that a rise in the oil price leads to a rise in the inflation rate, which translates into higher gold prices. Hence, the oil market can be used to predict the gold market prices. Lawrence [5] demonstrated that there is no statistically significant correlation between returns on gold and changes in macroeconomic variables such as GDP, inflation and interest rates. McDonald and Solnick [7] found investing gold can fight against inflation and the unsure political in the research of gold price and gold stocks. Therefore, gold provide a good hedge access. In addition, the study also found out that

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the variation of gold price is a crucial factor to explain the tendency of gold stocks. Blose and Shieh [1] also got similar results. Levin and Wright [6] showed that a long-term positive relationship exists between the price of gold and the US price level. This evidence demonstrates that gold is a long-term hedge against inflation. In the short-run, there was a positive relationship between gold price movements and changes in US inflation, US inflation volatility and credit risk. They also found that the relationship between the gold price and the US dollar trade-weighted exchange rate and the gold lease rate is negative and statistically significant. Sim and Jeffrey [9] found that the gold price can explain the Australian mining company stock's returns. Clinch, Whittred and Wood [3] used multifactor model to investigate whether the gold price can explain gold stock's return or not. The empirical result showed the significant effect. Faff and Chan [4] used multifactor model to test gold industry stock returns with Australian stock market as the research subject to discuss other variables, except for the factor of the market, that could also explain the stock returns. Therefore, three variables, gold price, interest rate, and exchange rate, were taken into consideration in the study from 1972 to 1992. The results of the study found out that the variables capable of explaining stock price were the market and gold price. Smith [10] found that correlation between returns on gold and returns on US stock price indices is negative but correlation is small.

II. METHODOLOGY

The steps of constructing gold passbook price prediction model by using GMDH are as following:

Step 1: Collection of the gold passbook price

The study selects samples for constructing models by using gold passbook list price provided by Taiwan Bank, from January 2nd, 2007 to August 11th, 2009.

Step 2: The explanatory variables

This study constructs gold passbook price prediction model by using explanatory variables in Table 1.

TABLE I THE EXPLANATORY VARIABLES USED TO CONSTRUCTS GOLD PASSBOOK PRICE PREDICTION MODEL

1. US dollar exchange rate	9. Leading index
2. Petroleum price	10. Coincident index
3. Unemployment rate	11. Prosperity countermeasure signal
4. Wholesale price index	12. Gross domestic product
5. Consumer price index	13. Taiwan stock exchange capitalization weighted stock index (TAIEX)
6. Rediscount rate	14. Industrial index
7. Foreign exchange reserves	15. Gold seasonal variation
8. Misery index	

Step 3: Construct model by using GMDH

The steps of using GMDH to construct gold passbook price prediction model are as follows.

1. Set up superior criteria of each level and the number of output variables.

2. Select input and output variables.

3. Use training data to develop gold passbook price prediction model.

4. Use test data to test gold passbook price prediction model.

5. Choose the best model.

In this study, prediction model with the smallest average value of RMSE will be the best.

III. EMPIRICAL RESULTS

The sample of this study includes gold passbook list prices of Taiwan Bank and the data of the explanatory variables in Table 1, from January 2nd, 2007 to August 11th, 2009. This data is analyzed by two methods, Group Method of Data Handling (GMDH) and Regression Analysis, and the models are evaluated by using the values of RMSE. The results show in Table 2 below. From Table 2, the values of RMSE of the models conducted by using Group Method of Data Handling (GMDH) and regression are 23.2303 and 33.0774, respectively. Since the model built by GMDH has smaller RMSE, GMDH outperform regression in prediction of gold passbook price. Moreover, according to this study, the significant explanatory variables on the influences of gold passbook price include US dollar exchange rate, petroleum price, unemployment rate, wholesale price index, rediscount rate, foreign exchange reserves, misery index, coincident index and industrial index.

TABLE II THE RESULTS OF GOLD PRICE PREDICTION MODELS CONSTRUCTED BY GMDH AND REGRESSION ANALYSIS

	GMDH	Regression Analysis
RMSE	23.2303	33.0774
Significant explanatory variables	US dollar exchange rate Petroleum price Unemployment rate Wholesale price index Rediscount rate Foreign exchange reserves Misery index Coincident index Industrial index	US dollar exchange rate Petroleum price Unemployment rate Consumer price index Wholesale price index Rediscount rate Foreign exchange reserves Misery index Leading index Coincident index Gross Domestic Product TAIEX Industrial index Gold seasonal variation

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IV. CONCLUSION

This study uses gold passbook list price of Taiwan Bank as the data, and the research period is from January 2nd, 2007 to August 11th, 2009. Then, we apply Group Method of Data Handling (GMDH) and Regression Analysis to construct models in order to predict gold passbook price. The results show that the model using GMDH has lower RMSE than that of the model obtained by regression. It indicates that the prediction model of gold passbook price constructed by GMDH, which is suggested by the study, provides higher rate of accuracy. The significant explanatory variables of gold passbook price are US dollar exchange rate, petroleum price, unemployment rate, wholesale price index, rediscount rate, foreign exchange reserves, misery index, coincident index and industrial index. Moreover, one can consider other explanatory variables, for example, producer price index, purchasing manager index, and American ECRI leading index, in further study.

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