Impact of ECFA on trend of exchange rate between NTD and RMB based on Grey Prediction Model

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Abstract: - Beginning from 2001 in which both Taiwan and China joined World Trade Organization (WTO), a large number of Taiwanese manufacturers have moved their plants across Taiwan Straight to China in search for cheaper labor force regardless of the political tensions between two countries. With the gradual easing of cross-strait political tension after the inauguration of pro-China president of Taiwan, the Taiwan Government starting from 2009 has been promoting the "Economic Cooperation Framework Agreement" (ECFA) through which the government claims the cross-strait economic and trade relations could be further enhanced and Taiwan could avoid being "marginalized" from the regional economic system. Additionally, as the two countries gradually lift restrictions on the investment and remove tariff barriers the cross-strait economic is bound to be more closely and the trade exchanges are set to skyrocket. However, since the bilateral trade or investment is generally through the U.S. dollar the fluctuation in currency exchange rate may serve as one of the important factors when the business makes the investment decision. Therefore, this paper applies Grey prediction method of Grey theory to the forecast of the exchange rate between NT dollar and RMB on which Taiwan enterprises could depend when formulating their investment strategies of investing more in China or Taiwan.

Key-Words: - Grey System, Grey Prediction, Exchange Rate, ECFA

1.Introduction
According to the statistics from minister of economic affair (MOEA), the number of applications for Taiwan-based enterprises to invest in China from 1991 to April 2010 stands at 38,704 with the total amount of the investment reaching 86.804 billions U.S. dollars, accounting for 57.58% of foreign investments for Taiwan-based companies. Regardless of whether Taiwan companies over-rely on the China market, China has been the most important business partners from the viewpoints of the Taiwan-based companies. In terms of trade volumes, China also tops the list with 26.7% of foreign trade during 2009, far exceeding the same with Japan (12.9%), U.S. (11.5%), and Europe (11.0%). Thus, the number indicated in the trade volumes also suggests that China has been the biggest trading partners for Taiwan-based companies.

Figure 1. Investment of Taiwan-based companies in China
Figure 1 shows that the investment of Taiwan-based companies in China gradually climb on a yearly basis despite the decline in 2009 as the result of the

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Financial crisis spread across the globe. With the bounce back in 2010 and the harmonious relationship between the two countries, the investment in China during the first four months of 2010 increases twice as much during the same period in 2009. With the signing of ECFA, the investment and trade volumes between Taiwan and China are supposed to be continuing to increase.

Table 1. Jan-Apr, 2009 and Jan-Apr, 2010 The number of investments and investment

<table>
<thead>
<tr>
<th>(unit: US$1,000)</th>
<th>Number of investment</th>
<th>Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-Apr, 2009</td>
<td>99</td>
<td>1,204,507</td>
</tr>
<tr>
<td>Jan-Apr, 2010</td>
<td>303</td>
<td>4,100,906</td>
</tr>
<tr>
<td>Increase or decrease over the same period</td>
<td>204</td>
<td>2,896,399</td>
</tr>
<tr>
<td>Percentage increase or decrease over the same period</td>
<td>206.06</td>
<td>240.46</td>
</tr>
<tr>
<td>Accumulated from 1991 to 2010.04</td>
<td>38,074</td>
<td>86,803,955</td>
</tr>
</tbody>
</table>

2. LITERATURE REVIEW

2.1 ECFA (Economic Cooperation Framework Agreement)

ECFA (Economic Cooperation Framework Agreement) is the specification of cross-strait economic cooperation activities between China and Taiwan. The contents of the agreement will be determined in reference to the agreements between ASEAN countries and China while further having the unique needs associated with Taiwan into account. ECFA could encompass merchandise trade, early harvest, services, investment protection, economic cooperation and dispute resolution mechanisms. The purpose of ECFA is to promote cross-strait economic and trade relations.

Advantages may include:
1. Keep Taiwan ahead of the competitors at the time of attempting to enter into the China market
2. Attract foreigners to invest in Taiwan for reshaping Taiwan's economic structure
3. Facilitate Taiwan as a portal for foreign business
4. Help supply chain to stay in Taiwan
5. Help the Taiwan business at China increase its procurement
6. Expedite the development of an industrial logistics center in Taiwan

2.2 Grey Theory

Grey system is used in a variety of fields. For example, Grey system is used in monitoring changes of groundwater flow caused by any construction work in fractured rock mass. Grey model may be used in improving conventional image edge algorithms through which the information and problems may be generated and undetected. Grey system could be applicable to predicting the stock market influenced by multiple factors. Another application of Grey model in financial-related field is for predicting financial time series with characteristics of poor information, small sample size, high noise, non-stationary, non-linearity, and varying associated risk. Also in, the Grey model has been used to predict that another financial crisis is less likely to occur. Grey system is also utilized when analyzing the stock data before predicting the stock price at any specific time. In short, Grey system could effectively deal with incomplete and uncertain information where a Grey Model (GM) is the core of the Grey system collecting available data to obtain the internal regularity without using any assumptions.

3. Methodology

The Grey forecasting model GM (1,1) (Deng Poly Dragon, 1988) is used in the present research. GM (1,1) model of order differential equation is:

\[
\frac{dx^{(i)}}{dt} + ax^{(i)} = b
\]

Where \( t \) is the independent variable, \( x \) stands for the Grey control variables, and \( a \) along with \( b \) are the model parameters to be determined. Suppose the original data series are as follows,

\[
x^{(0)} = (x^{(0)}(1), x^{(0)}(2), \ldots, x^{(0)}(n))
\]

(2)

In Grey systems modeling, one must make one of the original data series generated by cumulatively adding (accumulated generating operation; AGO), for the provision of information among modeling, and weakening the randomness of the original series. We define \( x \) (1) as an AGO data series of \( x(0) \), which could be written as:

\[
x^{(1)} = (x^{(1)}(1), x^{(1)}(2), \ldots, x^{(1)}(n)) = \sum_{i=1}^{1} x^{(0)}(k), \sum_{i=1}^{2} x^{(0)}(k), \ldots, \sum_{i=1}^{n} x^{(0)}(k)
\]

(3)

Using the least squares method on basis of (1) and (3) in order to obtain the coefficient

\[
\hat{a} = \begin{bmatrix} a \\ b \end{bmatrix} = (B^TB)^{-1}B^Ty
\]

(4)
One accumulative matrix \( B \) as:

\[
B = \begin{bmatrix}
-\frac{1}{2}[\chi^{(1)}(1) + \chi^{(1)}(2)] & 1 \\
-\frac{1}{2}[\chi^{(1)}(2) + \chi^{(1)}(3)] & 1 \\
\vdots & \vdots \\
-\frac{1}{2}[\chi^{(1)}(n-1) + \chi^{(1)}(n)] & 1
\end{bmatrix}
\]

Constant vector \( y \) as:

\[
y = \begin{bmatrix}
\chi^{(0)}(2) \\
\chi^{(0)}(3) \\
\vdots \\
\chi^{(0)}(n)
\end{bmatrix}
\]

With the result of (4) substituted into (1), (1) could be as follows:

\[
x^{(1)}(k + 1) = x^{(0)}(1) - \frac{b}{a} e^{-ak} + \frac{b}{a}
\]

Where \( x^{(1)}(1) = x^{(0)}(1) \)

The result in (5) may lead to a restored data series when subjecting (5) to an inversed-accumulated generating operation \( (IAGO) \), and the restored data series could be as:

\[
x^{*0}(k) = x^{(0)}(1) - \frac{b}{a} e^{-a(k-1)(1-e^a)}
\]

Set \( k \) as 1-n, and the restored data series becomes:

\( x^{*0} = (x^{*0}(1), x^{*0}(2),..., x^{*0}(n)) \)

Thereafter, further examination is required for determining precise degree in terms of a discrepancy between predicted and practical value denoted as \( e(k) \). The present paper utilizes residual test method from the actual values and predicted values as follows (Deng Poly Dragon, 1988):

\[
e(k) = \frac{x^{*(k)} - x^{*(k)}}{x^{*(k)}} \times 100\% \quad , \quad k = 1, 2, ..., n
\]

Precision level is \( 1 - e(k) \), and if the average degree is greater than 90% accurate, this model prediction performance would be deemed good.

4. Experiment

The present research is devoted to a prediction of the exchange rate fluctuation between NT dollar and RMB through the methodology of Grey prediction model. The present research utilizes the data source from January 2005 to May 2010. Figure 2 shows that the exchange rate between NT dollar and RMB is trending down. Table 2 indicates the difference between the prediction and the actual values of the exchange rate.
Table 2. Predictive value of NTD against the RMB and error

<table>
<thead>
<tr>
<th>Date</th>
<th>Predictive value of NTD against the RMB and error</th>
<th>Date</th>
<th>Predictive value of NTD against the RMB and error</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/13</td>
<td>0.2321945  0.2259140</td>
<td>0.00039  0.00039</td>
<td>1.6617471  1.6617471</td>
</tr>
<tr>
<td>10/15</td>
<td>0.2321945  0.2259140</td>
<td>0.00039  0.00039</td>
<td>1.6617471  1.6617471</td>
</tr>
<tr>
<td>10/17</td>
<td>0.2321945  0.2259140</td>
<td>0.00039  0.00039</td>
<td>1.6617471  1.6617471</td>
</tr>
<tr>
<td>10/19</td>
<td>0.2321945  0.2259140</td>
<td>0.00039  0.00039</td>
<td>1.6617471  1.6617471</td>
</tr>
<tr>
<td>10/21</td>
<td>0.2321945  0.2259140</td>
<td>0.00039  0.00039</td>
<td>1.6617471  1.6617471</td>
</tr>
</tbody>
</table>

5. Conclusion

With the signing of ECFA between Taiwan and China, the investment amount and the trade volumes between the two countries are set to increase in a continuous manner. Thus, the exchange rate between NT dollar and RMB may be critical to any investment originating from either Taiwan or China. And how to precisely predict the trend of the exchange rate proposed by the present research may provide the guidance with both the investing public and the business and serve as an effective aid to the investment decisions.

6. Reference