The Impact of Consumer Confidence Index on Gold Futures Volatility—Evidence from the GARCH-MIDAS Model

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Abstract. China's gold futures have attracted the attention of many scholars since they were listed and traded on January 9, 2008, but their focus has been on investors in the financial sector, and rarely explored from the perspective of ordinary consumers. From the consumer's point of view, we use the mixed GARCH-MIDAS model to estimate whether there is a certain impact on the volatility of China's gold futures by using the fixed and rolling estimation methods to reflect the consumer confidence index reflecting the strength of consumer confidence. The empirical results show that the consumer confidence index has a significant negative impact on the long-term volatility of gold futures returns, indicating that the consumer confidence index is an important factor affecting the volatility of gold futures returns.

1 Introduction

As one of the largest gold consumers in the world, gold has always been sought after by the Chinese people, so the change of gold price can arouse widespread concern of investors at all times, especially during various financial crises. The emergence of the crisis has greatly affected the confidence of Chinese consumers, because of the need to avoid risks, more financial investors have poured into the gold market. As soon as Shanghai gold futures were launched on January 9, 2008, they were paid more and more attention. As far as academic research is concerned, gold futures have always been the focus of attention of researchers. In recent years, inflation rate, economic policy uncertainty, monetary policy and other macroeconomic variables are often used to estimate and forecast the fluctuation of gold futures rate of return[1] [2] [3]. The results show that each macroeconomic variable has a significant influence on the fluctuation of gold futures return. Compared with the United States and other countries, China's gold futures have a shorter launch time and many uncertainties. However, with the continuous development of China's economy for more than ten years and the continuous improvement of the degree of globalization, China's gold futures have gradually matured in various shocks and challenges, and have been highlighting the essential role of gold futures hedging and playing its role. With the gradual emergence of the function of China's gold futures, more and more researchers focus on China's gold futures market, such as Luo et al. [4] using the Chicago Stock Exchange's gold volatility index and jumps to predict the realized volatility of Shanghai gold futures market. The results show that both of these factors can be important factors for predicting future market volatility, and the prediction performance of gold volatility index is better than jumps. Generally speaking, previous studies on gold futures mainly focused on the macro-economic level, using various macro-economic variables to estimate and predict the volatility of the return of gold futures, while few studies focused on gold futures from the perspective of consumers, and more on the stock and bond markets. For example, Schmeling [5] and Chen [6] use consumer confidence index as decision variables to explore the correlation between consumer confidence index and stock returns. The results show that consumer confidence index can explain stock market returns volatility very well. With the continuous development of China's economy and the improvement of people's income level, consumption demand and investment demand also increase. Gold has become the focus of consumers because of
its commodity and financial attributes. Therefore, from the perspective of consumers, it is of certain economic significance to explore the relationship between consumer confidence index and the volatility of gold futures earnings.

In this paper, considering the availability of data and the superiority of mixing data model, we use GARCH-MIDAS model proposed by Engle et al. [7] to explore the impact of monthly growth rate of Chinese consumer confidence index on daily yield of Chinese gold futures.

The remainder of this article is organized as follows. Section 2 provides the methodology of GARCH-MIDAS models. Section 3 contains the data description. In Section 4 we report the empirical results. The last section is our main conclusions.

2 Methodology

In order to solve the problem of modeling macro variables with different frequencies, many scholars have adopted MIDAS model proposed by Ghysels et al. in a working paper. In the subsequent application, it is found that the prediction effect of MIDAS model is better than that of traditional model, which shows the superiority of mixing model [8]. Subsequently, Engle et al. [7] proposed the GARCH-MIDAS model based on the MIDAS model. The advantage of this model is to divide the return volatility of financial assets into long-term and short-term components and describe them separately. And then, this model has been favored by many scholars and is widely used in stocks, futures and crude oil markets [9] [10] [11] [12]. In this model, the return on day i of month t is written as follows:

$$ r_{i,t} = \mu + \sqrt{\tau_{i,t}} \cdot g_{i,t} \epsilon_{i,t}, \quad \forall i = 1, \ldots, N_t $$

(1)

Where $\epsilon_{i-1,t} \sim N(0,1)$ is the information established for day (i-1) of period $t$, $g_{i,t}$ denoted the short-term daily fluctuation is assumed to be subject to a GARCH (1, 1) process:

$$ g_{i,t} = (1 - \alpha - \beta) + \alpha (r_{i-1,t} - \mu)^2 / \tau_{i,t} + \beta g_{i-1,t} $$

(2)

For long-term components $\tau_t$, they can be characterized by a low-frequency variable, such as the realized volatility $RV_t$ of financial assets or the macroeconomic variable $X_{i,t}$. In this paper, we mainly consider the impact of the growth rate of consumer confidence on the volatility of gold futures returns, so we use macro variables to characterize the long-term components. Given the macro variables, this paper mainly uses the logarithmic GARCH-MIDAS model because the logarithmic form can be better applied to any sign of the variable and the long-term component $\tau_t$ is always positive. Therefore, the logarithmic long-term component $\log \tau_t$ can be written as:

$$ \log \tau_t = m + \theta \sum_{k=1}^{K} \phi_k (w_1, w_2) X_{t-k} $$

(3)

Where $K$ represents the maximum lag order of the low-frequency macro variable $X$ and $\phi(\omega_1, \omega_2)$ is the weight equation based on the Beta function:

$$ \phi_k (w_1, w_2) = \frac{(k/K)^{n-1}(1-k/K)^{n-1}}{\sum_{j=1}^{K} (j/K)^{n-1}(1-j/K)^{n-1}} $$

(4)

Equation (1) - (4) constitutes a GARCH-MIDAS model for estimating the volatility of return on financial assets from low-frequency macroeconomic variables. In addition, in the next estimation process, fixed and rolling estimation windows will be used to ensure the robustness of the model estimation results.

3 Data and descriptive statistics

In this paper, we use monthly Chinese consumer confidence index and daily Shanghai gold futures data. Among them, the consumer confidence index is a representative variable of consumer sentiment, it is a leading indicator comprehensively reflects and quantifies the Chinese consumers’
assessment of the current economic situation and the subjective feelings of economic prospects, income levels, expectations and consumer psychology, and predicts economic trends and consumption trends. Because China's gold futures were listed on January 9, 2008, the selected sample interval began in February 2008, covering 132 months of monthly and daily data, and ended in February 2019. In the empirical process, we use CCIM to represent the consumer confidence index growth rate, while SGPD represents the logarithmic gold futures yield to investigate the impact of consumer confidence fluctuation on the volatility of gold futures return in China. Figure 1 shows the trend of China's consumer confidence index from February 2008 to February 2019. It can be seen that the outbreak of the 2008 financial crisis has greatly affected Chinese consumer confidence. In the following years, consumption confidence has been oscillating, but since 2016, the confidence index has been rising in shocks, indicating that Chinese consumers have high confidence in the current economic situation, economic prospects, income levels and so on. In addition, the descriptive statistics of the variables CCIM and SGPD are given in Table 1. It can be seen from the standard error that the fluctuation of the consumer confidence index is almost twice the fluctuation of the gold futures yield, indicating that the consumer confidence index fluctuates more. In terms of unit root test (ADF) values, both are stationary time series for subsequent empirical analysis, and J-B values indicate that both do not obey the standard normal distribution.

Figure 1. China consumer confidence index (CCI).

|        | CCIM      | SGPD      |
|--------|-----------|-----------|
| Mean   | 1.0013    | 0.0000    |
| Median | 1.0010    | 0.0001    |
| Maximum| 1.0801    | 0.0568    |
| Minimum| 0.9482    | -0.0784   |
| Std.Dev.| 0.0218    | 0.0112    |
| ADF    | -12.861   | -53.1195  |
| J-B    | 4.8139    | 2835.76   |
| Frequency| Monthly | Daily     |
| Obs.   | 132       | 2676      |

4 Results

Since Engle et al. combined GARCH model on the basis of MIDAS, a mixed GARCH-MIDAS model has been proposed, which has been widely used in stock, bond and futures markets. Under different market conditions, different macroeconomic variables are used to estimate and forecast the volatility of return. This paper uses this model to explore the influence of Chinese consumer confidence index on the volatility of Shanghai gold futures return. In the empirical process, economic variables are used to model the long-term components of volatility. That is, using the change of consumer confidence index to establish a model and analyze the long-term components
of Shanghai gold futures volatility. As shown in figure 2, the total volatility of Shanghai gold futures return is basically consistent with its secular volatility ($\tau_{i,t}$) under both fixed window and rolling window, so it is reasonable to use long-term volatility instead of total volatility. In this paper, the results of GARCH-MIDAS model modeling are shown in Table 2. Except for the coefficient $\mu$, the other coefficients are significant, in which the coefficient $\theta$ represents the influence of the growth rate of Chinese consumer confidence index (CCIM) on the long-term volatility of gold futures return. The results show that the coefficients $\theta$ are negative and significant at the level of 1%, both in fixed and rolling windows, indicating that the growth rate of consumer confidence index has a significant negative effect on the long-term volatility of Shanghai gold futures return. In addition, the weight coefficient $\omega$ is also significant. At the same time, the value of $\omega$ is greater than 1 under the two estimation windows, which indicates that the weight of CCIM decreases with the increase of lag order, that is to say, the recent change of consumer confidence index will have a greater impact on the volatility of Shanghai gold futures return.

![Fixed and Rolling Volatility](image)

**Figure 2.** Conditional volatility and its secular component of SGPD returns.

|   | Fixed | Rolling |
|---|-------|---------|
| $\mu$ | 0.0001 | 0.0001 |
| $\alpha$ | 0.0417*** | 0.0408** |
| $\beta$ | 0.9581*** | 0.959*** |
| $\theta$ | -12.522*** | -15.773*** |
| $\omega$ | 3.3449** | 3.7684*** |
| $m$ | 5.3643 | 8.5898** |
| LLF | 8283.05 | 8284.2 |

Note: The bracketed numbers are the standard errors of the estimations. *, **, and ***denote significance at the 10%, 5%, and 1% levels, respectively.

5 Conclusion

In this paper, we use the mixed GARCH-MIDAS model to empirically investigate the impact of Chinese consumer confidence index on the volatility of gold futures return. The empirical results show that the change of consumer confidence has a significant negative impact on gold futures. That is, consumer confidence increases, gold futures price volatility decreases; When consumer confidence is insufficient, gold futures can be more favored by consumers because of its unique safe haven function, which makes the price fluctuation of gold futures increase and affect the futures returns. Therefore, when considering the factors that affect the volatility of the gold market, more attention should also be paid to it from the perspective of consumers.
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