ARTICLE IN PRESS

Economic Modelling xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/econmod

How efficient are China's macroeconomic forecasts? Evidences from a new forecasting evaluation approach☆

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ARTICLE INFO

Keywords:
Forecast revisions
Macroeconomic forecast
Unbalanced three-dimensional panel data
Surveys
LINEX asymmetric loss function

ABSTRACT

Surveys, which are designed to collect data and include professional forecasts of macroeconomic variables, are of great interest to central banks and various institutions. The formal evaluation of such forecasts has attracted considerable attention in literature. However, empirical studies focusing on China are limited. This paper firstly proposes a new approach to test forecasts' accuracy and efficiency under asymmetric loss function by using a unique dataset from surveys conducted by the State Administration of Foreign Exchange in China. It is found that forecasters of the four macroeconomic variables (i.e., GDP growth rate, CPI, exports and imports) partially utilize new information and publicly available information under LINEX loss function when they update the forecasts, which are similar to those under quadratic loss function. Besides, a new finding in this paper is that over-smoothing hardly exists in the forecasts of GDP growth rate and CPI in China, which is different from the results in developed countries. Our findings suggest clear areas of opportunity to improve the accuracy of the forecasts, such as considering the negative autocorrelation found in forecast revisions of CPI.

1. Introduction

In 2007, the State Administration of Foreign Exchange (SAFE) in China designed authoritative surveys of individual respondents for collecting data. Since then, the SAFE monthly asks a group of professional forecasters to provide their views on several key macroeconomic indicators of China, including Gross Domestic Production (GDP) growth rate, Consumer Price Index (CPI), exports and imports, because accurate forecasts are important for policy making. These authoritative surveys not only collect information on market expectations but also on individual variations, which is a real treasure for economic study in China. However, to the best of our knowledge, no literature has evaluated performance of these forecasts. And whether all available information are incorporated efficiently into these professional forecasts is still an unsolved fundamental economic problem in China.

Recently, there has been an increasing interest on evaluating the forecasts by examining forecast errors or revisions, since Mincer and Zarnowitz (1969) propose a classical joint-test for single horizon forecasting, which is further studied by Zarnowitz (1985), Holden et al. (1990). In addition, Nordhaus (1987) provides two propositions and more powerful tests about the behaviour of forecast revisions whether the forecasts are efficient, which are applied to examine the revisions of Greenbook forecasts by Clements et al. (2007) and Patton and Timmermann (2012). Subsequently, Capistrán and López-Moctezuma (2014) find that fixed-event forecasts of Mexican inflation and GDP growth are inefficiency under quadratic loss function.

However, a potential problem with the aforementioned approaches, which are based on the assumption of symmetry for the loss function, is that the tests may not be as efficient or powerful as expected. This assumption has been challenged by Granger and Newbold (1986), who suggest that "an assumption of symmetry for the cost function is much less acceptable". Specifically, it is reasonable to give various weights for under-prediction and over-predication (see Wang and Lee (2014)). For example, some studies have argued that central banks (e.g., in Europe, Canada, and Sweden) may have asymmetric preferences, and may attach different weights to positive and negative deviations from targets (e.g., Nobay and Peel, 2003; Ruge-Murcia, 2000, 2003). Capistrán (2008) indicates that the cost of under-predicted CPI by the Federal Reserve is smaller than that of over-prediction in the pre-Volcker era, while it also indicates that the opposite is true for the period since Volcker. In addition, some standard conditions associated with optimal forecasts under a quadratic loss, including unbiasedness and a lack of correlation among all variables in the forecasters' information set

☆ We are grateful to the State Administration of Foreign Exchange in China for providing data. Zhang acknowledges financial support from the Natural Science Foundation of China (71422015), and Center of National Mathematics and Interdisciplinary Sciences (Research Project of Global Macroeconomic Monitoring, Forecasting and Policy Simulation Platform).

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http://dx.doi.org/10.1016/j.econmod.2017.08.028
Received 21 December 2016; Received in revised form 21 June 2017; Accepted 25 August 2017
0264-9993/

(Diebold and Lopez (1996)), often do not hold with asymmetric loss, as suggested by Patton and Timmermann (2007).

To analyze forecasts' efficiency and accuracy from various perspectives, this paper proposes a novel approach to investigate whether new information is immediately and fully reflected in the latest forecasts under asymmetric loss functions (i.e., different weights to the costs of over- and under-predicting the target variables). This approach is different from the prior approaches (e.g., Clements, 1997; Elliott et al., 2005; Wang and Lee, 2014) which examine forecasters' rationality instead of forecasts' efficiency. This paper analyzes the fixed-event forecasts of GDP growth rate, CPI, exports and imports in China during 2011–2015, which are supplied by the SAFE. These forecasts are revised in response to new information, and eventually form a sequence of 12 forecasts before the target outcome is known. Similar to Davies and Lahiri (1995), these monthly forecasts comprise a three-dimensional unbalanced panel with individual forecasts, target years, and forecast horizons.

In this paper, some interesting results are listed. Firstly, we find forecasters of four macroeconomic variables partially and inefficiently utilize information when they update forecasts. One possible explanation is that for GDP and CPI, the forecasts move towards an equilibrium state driven by the variations of the forecasts process in last period, while for exports and imports, the forecasters prefer to follow their potential trend in the previous years. Another possibility is that turning points are difficult to examine, because the original relationship between variables and other exogenous factors may change over time, especially during economic crisis. Secondly, the negative autocorrelation exists in the series of forecast revisions, which suggests that the forecasters prefer to over-adjust to new information and change their original forecasts. It is possible that the forecasters are not so confident about growth prospects. Compared with developed economies, China's economy has developed rapidly yet with greater uncertainties and challenges, making forecast revisions very volatile. Finally, the second-order autocorrelation coefficients are nearly zero, which is the evidence of an absence of “over-smooth” during this period.

Compared to the prior approaches in related literatures, this study has a number of appealing features. First, few literatures focus on evaluating macroeconomic forecasts in China, even though forecasts' evaluation is necessarily studied in most western countries. This paper firstly analyzes professional forecasts in China from the perspective of forecasts' errors and revisions to fill this gap. Second, a unique dataset with authoritative surveys from the SAFE is used. Specifically, specialists participating in the surveys come from well-known commercial banks, financial institutions and academic institutions. Third, a novel approach is proposed to examine forecasts' efficiency under LINEX loss function, and further analyze the non-zero correlations among forecast revisions in a straightforward manner. Our idea can be extended to other loss functions and used to determine whether the forecasters can be labeled efficient or not with different properties, which avoid the crucial assumption of symmetric loss function in the prior literatures.

The remainder of this paper is organized as follows. Section 2 proposes an novel econometric approach to investigate whether new information is utilized efficiently under asymmetric loss function. Section 3 discusses results of unbiasedness and efficient tests in an empirical application. Section 4 discusses possible areas of future work. Finally, Section 5 concludes.

2. Methodology for testing for forecast efficiency

2.1. Optimal forecasts under LINEX loss function

In terms of outcome of a given event (say, y_t at $t = \tau$) with forecast horizons h, the forecasts are denoted by $f_{\tau,h}$, where $h = 1, \ldots, 12$, which gives one-step to $h-$ step forecasts of the value of the process in period τ. The optimal forecast computed at period $\tau - h$, conditional on the past information set $I_{\tau-h}$, is defined as

$$f^*_{\tau,h} = argmin_{f_{\tau,h}} E[L(y_\tau - f_{\tau,h})|I_{\tau-h}],$$

where $L(\cdot)$ is a general loss function, $f^*_{\tau,h}$ is the optimal forecast at $\tau - h$ and $y_\tau - f_{\tau,h}$ denotes the forecast error at period $\tau - h$. The first-order condition, defined as the generalized error in Patton and Timmermann (2007), is obtained from

$$E[L'(y_\tau - f^*_{\tau,h})|I_{\tau-h}] = 0, \tag{2.1}$$

where $L'(\cdot)$ is the first derivative of the loss function with the forecast $f_{\tau,h}$. First-order condition gives the marginal changes in the loss function with a one-unit change in the forecast. Here, the LINEX loss function, which is a frequently-used asymmetric loss function, is considered. The simple form is as follows

$$L(e_{\tau,h}) = \frac{2}{\alpha^2}[exp(\alpha e_{\tau,h}) - \alpha e_{\tau,h} - 1],$$

where $e_{\tau,h} = Y_\tau - f_{\tau,h}$ is the forecast error. This loss function is approximately cubic by Taylor expansion

$$\begin{aligned} L(e_{\tau,h}) &\simeq \frac{2}{\alpha^2}\left(1 + \alpha e_{\tau,h} + \frac{1}{2}(\alpha e_{\tau,h})^2 + \frac{1}{6}(\alpha e_{\tau,h})^3 - \alpha e_{\tau,h} - 1\right) \\ &= e^2_{\tau,h} + \frac{1}{3}\alpha e^3_{\tau,h} = e^2_{\tau,h}\left(1 + \frac{1}{3}\alpha e_{\tau,h}\right). \end{aligned}$$

For a small given α, the loss function is approximately quadratic by Taylor expansion, i.e., $L(e_{\tau,h}) \simeq e^2_{\tau,h}$. If α is significantly different from zero, it is clear that $\frac{1}{3}\alpha e_{\tau,h}$ is considered as a measure of deviations from symmetric least squared errors. This loss function is a function of the realization of Y_τ and the forecast $f_{\tau,h}$, as well as the shape parameters α. When $\alpha > 0$, under-predicting is most costly than over-predicting, and vice versa. This is reflected in the optimal forecasts $f^*_{\tau,h}$, which exceeds $E(f_{\tau,h}|I_{\tau-h})$ when $\alpha < 0$ and falls below it when $\alpha > 0$. Here, we focus on estimating α based on the following first-order condition

$$L'(e_{\tau,h}) = \frac{2}{\alpha^2}[\alpha exp(\alpha e_{\tau,h}) - \alpha] = \frac{2}{\alpha}\left[\left(1 + \alpha e_{\tau,h} + \frac{\alpha^2 e^2_{\tau,h}}{2} + \frac{\alpha^3 e^3_{\tau,h}}{6} + o_p(e^3_{\tau,h})\right) - 1\right].$$

If we observe the sequence $\{f^*_{\tau,h}\}$ of the optimal one-step-ahead point forecasts provided by the forecaster, α can be estimated directly from

$$\hat{\alpha}_h = \frac{2\sum_\tau E(Y_\tau - f^*_{\tau,h})}{\sum_\tau E(Y_\tau - f^*_{\tau,h})^2}, \tag{2.2}$$

using $E(L'(e_{\tau,h})|I_{\tau-h}) = 0$. However, in practice, we only observe the sequence $\{f_{\tau,h}\}$, where $f_{\tau,h}$ is obtained with the information up to time $\tau - h$. The estimator $\hat{\alpha}_h$ depends on the information $I_{\tau-h}$. To simplify, α_h is substituted with the same optimal α_0 to minimize $\sum_{h=1}^{12} E(L'(e_{\tau,h})|I_{\tau-h}) = 0$.

2.2. Efficiency tests under LINEX loss function

Here, several progressive tests are considered. First, we test whether the forecast errors are uncorrelated with the past forecast revisions. Considering that the optimal first-order condition made at $\tau - (h+1)$ is equal to zero, i.e, $E[L'(e_{\tau,h+1})|I_{\tau-h-1}] = 0$, a weak efficiency test involving forecast errors and revisions is developed as follows

$$exp(\alpha e_{\tau,h}) - 1 = \beta_0 + \beta_1(f_{\tau,h} - f_{\tau,h+1}) + \xi_{\tau,h},$$

$$H_0\colon \beta_0 = \beta_1 = 0. \tag{2.3}$$

Second, the necessary condition for the first-order condition is given by the first difference of generalized errors as follows

$$E[L'(e_{\tau,h+1}) - L'(e_{\tau,h})|I_{\tau-h-1}] = 0.$$

That is,