Forecasting China's foreign exchange reserves using dynamic model averaging: The roles of macroeconomic fundamentals, financial stress and economic uncertainty

Rangan Gupta [a], Shawkat Hammoudeh [b], Won Joong Kim [c],[*], Beatrice D. Simo-Kengne [a]

[a] *Department of Economics, University of Pretoria, Pretoria, South Africa*
[b] *Lebow College of Business, Drexel University, Philadelphia, USA*
[c] *Department of Economics, Konkuk University, Seoul, Republic of Korea*

A R T I C L E   I N F O

A B S T R A C T

We develop models for examining possible predictors of growth of China's foreign exchange reserves that embrace Chinese and global trade, financial and risk (uncertainty) factors. Specifically, by comparing with other alternative models, we show that the dynamic model averaging (DMA) and dynamic model selection (DMS) models outperform not only linear models (such as random walk, recursive OLS-AR(1) models, recursive OLS with all predictive variables models) but also the Bayesian model averaging (BMA) model for examining possible predictors of growth of those reserves. The DMS is the best overall across all forecast horizons. While some predictors matter more than others over the forecast horizons, there are few that stand the test of time. The US–China interest rate differential has a superior predictive power among the 13 predictors considered, followed by the nominal effective exchange rate and the interest rate spread for most of the forecast horizons. The relative predictive prowess of the oil and copper prices alternates, depending on the commodity cycles. Policy implications are also provided.

© 2014 Elsevier Inc. All rights reserved.

* Corresponding author. Tel.: +82 2 450 0530; fax: +82 2 446 3615.
E-mail addresses: rangan.gupta@up.ac.za (R. Gupta), hammousm@drexel.edu (S. Hammoudeh), wjkim72@konkuk.ac.kr (W.J. Kim), beatrice.simo_kengne@up.ac.za (B.D. Simo-Kengne).

1. Introduction

The world's economic system has been characterized by significant external imbalances in the last two decades or so. This global phenomenon has manifested itself clearly by the accumulation of international exchange reserves and external assets, particularly in developing countries. The international reserves have mounted to more than 30% of developing countries' GDP and 8 months' worth of their imports (Rodrik, 2006). These reserves are used as insurance against financial crisis and default risk. It's well known that countries with large scale foreign reserves like Singapore and Taiwan were the least affected by speculation during the 1997 Asian crisis (Lane & Burke, 2001). Foreign reserves can also serve as an additional source of national income in the form of interest-yielding time deposits or interest-earning bonds and bills denominated in foreign currencies. This is the case of oil-exporting countries. Other countries such as emerging market economies use the accumulation of large scale foreign reserves as a tool of foreign exchange intervention to resist currency appreciation in the face of accommodative monetary policy (Mahanty & Turner, 2006). Countries that follow an export-oriented growth strategy may end up with competitive hoarding similar to competitive devaluation, depicting a return to mercantilist strategies. Foreign reserves may also mitigate the real exchange rate effects of terms of trade shocks and export promotion. Moreover, countries with less flexible exchange rate regimes should require higher levels of international reserves to sustain exchange rate stability.

There is also the question of the adequacy of foreign reserves in terms of some criterion expressing the need for reserves. There is an opportunity cost of holding international reserves which can be represented as an income loss for those countries that do not hold the optimal reserves holdings. The difference between the return on liquid international reserve assets and the cost of foreign borrowing, or the return on domestic assets and investment, makes up the opportunity cost of holding international reserves.

Most of the BRICS countries – Brazil, Russia, India, China and South Africa – are developing countries known for holding large international reserves. These countries have experienced strong economic growth fueled by strong exports, which has led to accumulation of large reserves. China's foreign reserves are mainly composed of US dollars in the forms of US government bonds and institutional bonds. Growing from $600 billion ten years ago, those reserves stood at $3.5 trillion in June 2013, making them the highest foreign exchange reserves in the world with the US dollar and yen holdings taking up 60% and 10% of the total, respectively.

The literature has shown that reserve holdings by similar countries seem to be a predictable outcome of a few key factors including the size of international transactions, their volatility, the exchange-rate arrangement, financial risks and political considerations (Aizenman & Marion, 2004). The objective of this study is to examine possible predictors of the growth of China's international reserves and to generally shed new light on the 'puzzling' pattern of international reserves, using fairly recent prediction models. It will be interesting to discern the prowess of real economic and financial variables in predicting changes in China's international reserves. In particular, we are keen to understand the predictability power of industrial production, trade openness, interest rate spreads, financial stress and economic policy uncertainty, among other variables of China's accumulation of international reserves. While interest rate spreads are associated with opportunity cost of holding reserves (e.g., Aizenman & Lee, 2007; Aizenman & Marion, 2004; Edison, 2003), the stress and uncertainty variables represent volatility of external disturbances which influences the need for international reserves.

The prediction results of China's international reserves are of interest to both capital markets and policy-makers due to their huge size and their relation with the management of China's exchange rate and the intention to putting them to innovative uses in the future. They would also help send signals to the Chinese policy-makers regarding the adequacy and optimality of these reserves. They can signal to the Chinese central bank of how the amount of foreign currencies it holds relates to the three months of imports rule. They also have implications for exchange rate policy arrangements and currency controls in China and levels of interest rates in major foreign countries like the United States. Currently, the Chinese State Council is calling for innovative uses of those reserves instead of placing the majority in low yielding US securities. The IMF also urges China to make systematic