

Two Are Better than One?

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Abstract

This paper uses Markov-switching specifications to create a hybrid model with time-varying loading on each of chartist and fundamentalist approaches. The empirical data include the U.S. dollar exchange rates of four Asian tiger countries' currencies including NTD, SGD, HKD and KOW from 1980 to 2000. Our empirical findings are consistent with the following notions. First, the forecasting performances of the hybrid model with time-varying weight outperform each technique and the random walk model in all cases. Moreover, the state of chartist (fundamentalist) is associated with the low (high) volatility measure.

Keywords: Chartist, Fundamentalist, Exchange rate

1. Introduction

This paper establishes a hybrid model from chartist and fundamentalist approaches. Specifically, we adopt the Markov-switching specifications to capture the unobservable and time-varying weight on each of these two approaches. Moreover, we use the exchange rate returns of four Asian tiger countries' currencies as the sample to analyze and compare the forecasting performances of alternatives.

Economists have developed various economic models to explain the exchange rate movements. Unfortunately, the explanatory powers of fundamental factors from these economic models on exchange rates have been unsatisfactory (please refer to Meese and Rogoff (1983) and Mark (1995)).

Because of trivial performance by fundamentalists, some econometrists proposed the chartist approaches to analyze the exchange rates. The ideas of chartist approaches are based their expectations of future changes of exchange rates solely on the past behaviors of exchange rates, under the assumption that the lagged values of the change of the exchange rates could be used to predict the future values (please refer to Hsieh (1989) and Allen and Taylor (1990)).

Frank and Froot (1986) developed an exchange rate forecasting model that incorporated both of fundamentalist and chartist techniques. One of the characteristics of Frank and Froot's (1986) model is

the weight on each of two forecasting alternatives. Specifically, they suggested the weight is a function of investors' preferences and these preferences cannot be observed directly.

Even prior studies have suggested a hybrid model from chartist and fundamentalist, the empirical testing of the hybrid model has been absent. One of the main obstacles is the decision of weight on each of these two different forecasting techniques. Specifically, the relative importance of each technique varies over time and is unobservable and time-varying. In this paper, we adopt the Markov-switching specification to picture the time-varying and unobservable characters of weights.

2. Model Specifications

Chartists-ARMA (1, 1)

There are plenty of model specifications in the chartist approach. However, the target of this paper is not to find the best chartist specification. Therefore, for convenience, we adopt the ARMA (1, 1) model to sever as a representative chartist model. The ARMA (1, 1) setting is presented as follows:

$$R_t = cont + \alpha \cdot R_{t-1} + \beta \cdot u_{t-1} + u_t, u_t \sim N(0, \sigma)$$

In the above setting, R_t and R_{t-1} are the exchange rate returns of home currencies in time t and time $t-1$, respectively. u_t and u_{t-1} are the residual term in time t and time $t-1$, respectively and follow the Gaussian distribution with standard error, σ .

Fundamentalists

In this paper, we use two fundamental variables including inflation rates from the theory of Purchasing Power Parity and interest rates from the theory of Interest Rate Parity to establish the following regression:

$$R_t = cont + \Psi \cdot (\pi_{t-1} - \pi_{t-1}^*) + \Gamma \cdot (r_{t-1} - r_{t-1}^*) + u_t, u_t \sim N(0, \sigma)$$

In the above setting, π_{t-1} and π_{t-1}^* present the inflation rates of home and foreign countries in time $t-1$, respectively. r_t and r_t^* present the interest rates of home and foreign countries in time $t-1$, respectively.

Hybrid model with no-switching

$$R_t = cont + \Psi \cdot (\pi_{t-1} - \pi_{t-1}^*) + \Gamma \cdot (r_{t-1} - r_{t-1}^*) \\ + \alpha \cdot R_{t-1} + \beta \cdot u_{t-1} + u_t, u_t \sim N(0, \sigma)$$

The character of the above regression is to consider both of the two fundamental variables including $(\pi_{t-1} - \pi_{t-1}^*)$ and $(r_{t-1} - r_{t-1}^*)$ as well as two time series components including R_{t-1} and u_{t-1} as the explanation variables of the exchange rate return, y_t . However, the weight on each of two forecasting techniques is equal and constant over time:

$$y_t = cont + 1 \cdot [\Psi \cdot (\pi_{t-1} - \pi_{t-1}^*) + \Gamma \cdot (r_{t-1} - r_{t-1}^*)] \\ + 1 \cdot [\alpha \cdot y_{t-1} + \beta \cdot u_{t-1}]$$

Hybrid model with Markov-switching

$$R_t = cont_1 + \alpha \cdot R_{t-1} + \beta \cdot u_{t-1} + u_{t,1}, u_{t,1} \sim N(0, \sigma_1) \quad \text{for } s_t = 1 \\ R_t = cont_2 + \Psi \cdot (\pi_{t-1} - \pi_{t-1}^*) \\ + \Gamma \cdot (r_{t-1} - r_{t-1}^*) + u_{t,2}, u_{t,2} \sim N(0, \sigma_2) \quad \text{for } s_t = 2$$

, where s_t is an unobservable state variable and follows a Markov chain with one order:

$$p(s_t = 1 | s_{t-1} = 1) = p_{11}, \quad p(s_t = 2 | s_{t-1} = 1) = p_{12} \\ p(s_t = 2 | s_{t-1} = 2) = p_{22}, \quad p(s_t = 1 | s_{t-1} = 2) = p_{21}$$

The characteristic of the above setting is to adopt both of the factors from chartist and fundamentalist approaches to predict the exchange rate returns. Moreover, we use $s_t=1$ ($=2$) to present the state of chartist (fundamentalist). Although the regime variable s_t is unobservable, one can still use the data itself to estimate the specific regime probability at any time point. In this paper, we use the smoothing probability to serve as the weight of each forecasting technique:

$$R_t^e = p(s_t = 1 | I_T) \cdot [cont_1 + \alpha \cdot R_{t-1} + \beta \cdot u_{t-1}] \\ + p(s_t = 2 | I_T) \cdot [cont_2 + \Psi \cdot (\pi_{t-1} - \pi_{t-1}^*) + \Gamma \cdot (r_{t-1} - r_{t-1}^*)]$$

3. Empirical Results

In this paper, we adopt the US dollar exchange rate of four Asian tiger countries' currencies including the New Taiwan Dollar (NTD), Singapore Dollar (SGD), Hong Kong Dollar (HKD) and Korea Won (KOW). Three types of data frequencies in this paper are weekly, monthly and quarterly. The data period is from 1980 to 2000. The proxies of interest rates and inflation rates are three-month treasury rates and change rates of CPI index, respectively. Data source is AREMOS database.

Table 1 presents the forecasting performances of alternatives relative to the random walk model for various data frequencies. Remarkably, the hybrid model with time-varying weight appears better

forecasting performances. Besides, the greatest (smaller) forecasting error reduction of the model occurs in the quarterly (weekly) data. The model performs middle forecasting performance in the monthly data. These results conclude the higher data frequencies are the forecasting performances decay more.

Table 2 presents the estimates of the parameters of the hybrid model with Markov-switching established in this paper for the monthly exchange rate returns. One of characters of the model is the assumptions of two different measures of standard errors. Quite interestingly, the standard error estimates of state 2 (σ_2) are significantly greater than the ones of chartist state (σ_1) in all cases. Moreover, the characteristics are consistent for various data frequencies (not reported here). These findings are consistent with the following notions that the state of fundamentalist (chartist) is associated with the high (low) volatility market state.

The above empirical results correspond to the announcements of Sethi (1996). Specifically, Sethi (1996) proposed the appearances of the moderate power from the fundamental elements during the period of the market price deviating from the equilibrium level. The occurrence of the influences from fundamental factors in Sethi (1996) is consistent with the state of fundamentalist in the hybrid model with non-constant loading established in this paper. Moreover, the deviation from the equilibrium level in Sethi (1996) is consistent with the high volatility state in the model. On the other hand, another empirical finding of the chartist with the low volatility state in the model is consistent with the notion that investors can adopt the chartist approaches to earn a better profit during the stable market period.

4. Conclusion

In this paper we adopt the Markov-switching specification to establish the hybrid model with time-varying loading on each of chartist and fundamentalist techniques. The US dollar exchange rates of four Asian tiger countries' currencies serve as the representative examples in this paper. Our empirical results demonstrate that the statistic significances and better forecasting appearances of the hybrid model with non-constant weight relative to single technique and the random walk model. In contrast, the performances of the hybrid model with constant weight are trivial. Moreover, the state of chartist (fundamentalist) is associated with the smaller (bigger) volatility measure.

5. References

- [1] Meese, R. and Rogoff, K. 1983. Empirical Exchange Rate Models of Seventies: Do they Fit Out of Sample? *Journal of International Economics* 14: 3-24.
- [2] Mark, N. C. 1995. Exchange Rates and Fundamentals: Evidence on Long-Horizon Predictability. *The American Economic Review* 85: 201-218.
- [3] Hsieh, D. A. 1989. Testing for Nonlinear Dependence in Daily Foreign Exchange Rates. *The Journal of Business* 62: 339-368.
- [4] Allen, H. and Taylor, M. P. 1990. Charts, Noise and Fundamentals in the London Foreign Exchange Market. *The Economic Journal* 100: 49-59.
- [5] Frankel, J. A. and Froot, K. A. 1986. Understanding the US dollar in the eighties: The Expectations of Chartists and Fundamentalists. *Economic Record, Special Issue on Exchange Rates and the Economy*: 24-38.
- [6] Sethi, R. 1996. Endogenous Regime Switching in Speculative Markets. *Structural Change and Economic Dynamics*: 99-118.

Table 1 Percentage of Forecast Error Reductions Relative to the Random Walk Model for Various Data Frequencies

(a) Mean Square Error (MSE)

	Chartist	Fundamental	Hybrid	
			No-switching	Markov-switching
<i>Quarterly</i>	2.702%	-0.839%	-1.935%	30.963%
<i>Monthly</i>	1.731%	0.027%	0.508%	20.749%
<i>Weekly</i>	0.602%	-0.437%	-3.117%	0.196%

(b) Mean absolute Error (MAE)

	Chartist	Fundamental	Hybrid	
			No-switching	Markov-switching
<i>Quarterly</i>	-4.568%	-7.081%	-8.294%	16.480%
<i>Monthly</i>	-2.210%	-5.428%	-4.600%	4.697%
<i>Weekly</i>	-0.218%	-0.330%	-4.620%	0.71%

Note: In this table, we present the average value of forecast error reduction percentage relative random walk model of all cases for various data frequencies.

Table 2 Parameter Estimates of the Hybrid Model with Markov-switching

	NTD	SGD	HKD	KOW
$cont_1$	-0.013 (0.017)	-0.149 (0.091)	0.001 (0.005)	0.017 (0.024)
α	0.793*** (0.097)	-0.022*** (0.001)	0.239*** (0.087)	0.879*** (0.084)
β	-0.700 *** (0.111)	0.403*** (0.001)	-0.453*** (0.053)	-0.573*** (0.213)
σ_1	0.651*** (0.064)	0.886*** (0.057)	0.137*** (0.007)	0.638*** (0.075)
$cont_2$	-0.027 (0.298)	0.579 (0.593)	0.858** (0.386)	1.669 (2.929)
Ψ	0.255 (0.480)	1.530* (0.877)	0.173* (0.120)	-0.992 (2.074)
Γ	4.637* (2.692)*	1.410 (2.851)	-0.440 (2.770)	-1.343 (5.487)
σ_2	2.710*** (0.370)	2.496*** (0.251)	2.541*** (0.260)	8.613*** (1.351)
p_{11}	0.881*** (0.092)	0.964*** (0.018)	0.986*** (0.008)	0.982*** (0.013)
p_{22}	0.554*** (0.175)	0.904*** (0.048)	0.951*** (0.031)	0.883*** (0.068)
<i>Log-Lik.</i>	-367.133	-410.719	-307.070	-507.236

Note:

- In the parenthesis, we present the standard error estimate of the parameter estimate.
- The***, ** and * denote the significance in 1%, 5% and 10%.