Is a Markov Switching Model using Genetic Algorithm probabilities appropriate in determining Bitcoin price regimes?

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Research Proposal

In this paper we propose Bitcoin's exchange rate follows a regime changing structure. Engel and Hamilton (1989, 1990, 1994), among others have suggested exchange rates can be forecasted using a Markov Switching Model. Following their work we construct a [or an ?] MSM assuming two price regimes, a high period - typified by an exponential rise in value, and a low period - typified by low value, both with high volatility. In our paper we shall consider 3 markov models, each in which the two price regimes are normally distributed. The models differ in only how the probabilities enter in the transition matrix. In the first case, our base case of comparison, we consider constant probabilities, found using maximum likelihood, as in Hamilton (1990). In the second case we consider time-varying probabilities as in Diebold, Lee and Weinbach (1994). In the third case we propose time varying probabilities evolving by genetic algorithm. To elaborate our Genetic Algorithm, we begin by constructing a a binary string (gene) of chromosomes equaling 0 if this predicting variable (chromosome) suggests state will be in the same next period, and 1 if it suggests a change in regime. Taking the average of the gene returns our probabilities. Composing our $x_k, k = 1, 2, \ldots, K$ predicting variables are: exogenous variables unique to predicting bitcoin price that others have used such as market sentiment, hash rate, gold, and a stock market index; exogenous variables that are used in predicting exchange rates of fiat currencies such as differentials in inflation and interest rates, current account deficits, public debt, terms of trade, political stability and economic performance; finally we include the class of endogenous variables constructed from patterns such as the triangle pattern, and head-and-shoulder pattern as suggested by Shah and Zhang (2014).

References

Engel, Charles. "Can the Markov switching model forecast exchange rates?". https://www.ssc.wisc.edu/~cengel/PublishedPapers/JIEMarkov.pdf

Diebold, Francis X., Lee, Joon-Haeng, and Weinbach, Gretchen C. "Regime switching with time-varying transition probabilities" in C. Hargreaves (ed.), Nonstationary Time Series Analysis and Cointegration. (Advanced Texts in Econometrics, C.W.J. Granger and G. Mizon, eds.), 283-302. Oxford: Oxford University Press

Shah, Devavrat, Zhang, Kang. "Bayesian regression and Bitcoin" https://arxiv.org/pdf/1410.1231v1.pdf