The Economics of Bitcoin Price Formation

Introduction

In the past, several studies have identified the factors affecting Bitcoin's price to include market fundamentals (supply and demand), the attractiveness of investors, and global macroeconomic developments. However, according to Ciaian *et al.* (2016), these previous research works only considered the effect of each factor on Bitcoin's price separately. None of them considered the impact of the interaction between the three factors on Bitcoin price. Therefore, Ciaian *et al.* (2016) conducted a study to close this gap.

Conceptual Framework

As stated by Ciaian *et al.* (2016), the equilibrium between Bitcoin demand and Bitcoin supply can be written into an empirically estimable model of Bitcoin price as follows:

$$p_t^B = \beta_0 + \beta_1 p_t + \beta_2 y_t + \beta_3 v_t + \beta_4 b_t + \epsilon_t \quad (1)$$

To integrate the second factor, i.e. Bitcoin's attractiveness for investors, equation (1) is extended to form equation (2) as follows:

$$p_t^B = \beta_0 + \beta_1 p_t + \beta_2 y_t + \beta_3 v_t + \beta_4 b_t + \beta_5 a_t + \epsilon_t \quad (2)$$

Finally, to integrate the third factor, i.e. macroeconomic and financial developments in the Bitcoin price formation, equation (2) is extended to form equation (3) as follows:

$$p_t^B = \beta_0 + \beta_1 p_t + \beta_2 y_t + \beta_3 v_t + \beta_4 b_t + \beta_5 a_t + \beta_6 m_t + \epsilon_t \quad (3)$$

Where y_t is the size of the Bitcoin economy, b_t is the total stock of Bitcoin in circulation, p is the general price level of goods and services, v_t is the velocity of Bitcoin in circulation, m_t captures macroeconomic and financial indicators, and a_t captures Bitcoin's attractiveness for investors.

Data and Econometric Approach

Data: Data extracted from Quandl was used for the supply-demand fundamentals. For Bitcoin's attractiveness for investors, *a*, the researchers used the volume of daily Bitcoin views on Wikipedia as well as the number of new posts and new members extracted from Bitcointalk. For global macroeconomic and financial indicators, *m*, oil price (extracted from US Energy Information Administration) and Dow Jones stock market index (extracted from Federal Research Bank of St. Louis) were used.

Econometric Approach: A vector auto-regressive model (VAR) was built (Equation 4) and this model was thereafter reformulated into a vector error correction model (Equation 5).

$$Z_t = A_1 Z_{t-1} + \ldots + A_k Z_{t-k} + \varepsilon_t \quad (4)$$

$$\Delta Z_t = \sum_{i=1}^{k-1} \Gamma_i \, \Delta Z_{t-i} + \Pi Z_{t-1} + \varepsilon_t \quad (5)$$

where Zt is a vector of non-stationary variables, t is time subscript, A are matrices of different parameters, εt is the error term and k is the number of lags. Equation (5) contains information on both long-run and short-run adjustments to changes in Zt through the estimates of Π and Γ, respectively (Ciaian et. al, 2016).

Results

The models were applied for supply-demand, investor attractiveness, and macroeconomic factors, separately and for an interaction between the three factors. The results show that supply-demand fundamentals have a significant impact on Bitcoin price both when considered separately and when considered in combination with other factors. The same thing goes for investors' attractiveness. However, the results show that global macroeconomic and financial developments only have an effect on Bitcoin price when considered as a lone factor; that is, when considered in combination with other factors, it is of no significance or statistical importance.

According to the results, the long-run relationship between Bitcoin price and different variables considered in the estimated models is stronger than the short-run impact. Also, the demand variables (of supply-demand fundamentals) have a stronger impact on Bitcoin price than the supply variables. For investors' attractiveness to Bitcoin *(new_members, new_posts, and wiki_views)*, the variable *new_members* has a negative impact on Bitcoin price, indicating that attention-driven investment behaviour of new members dominates. Meanwhile, the variable *new_posts* has a positive impact on Bitcoin price, reflecting an increasing acceptance and trust of Bitcoin captured by the intensity of discussion between Bitcoin users. Finally, the variable *wiki-views* has a positive impact; this may be a reflection of changes in the knowledge about Bitcoin or a speculative behaviour of investors.

Conclusion

Having applied the VAR estimation approach and daily data for the period 2009-2014 to identify the relationship between Bitcoin's price and its determinants, the findings are contrary to those of previous studies that opined that macro-financial indicators drives Bitcoin's price. In fact, this research shows that once investor attractiveness to Bitcoin and supply-demand variables are considered, the relevance of macroeconomic and financial indicators in determining Bitcoin's price fades away and becomes insignificant.

Reference

Ciaian, P., Rajcaniova, M., and Kancs, d'. (2016). The Economics of BitCoin Price Formation. Applied Economics. 48. 1799-1815. 10.1080/00036846.2015.1109038.