Fintech Final Project Report

Introduction of Bitcoin:

Cryptocurrency is one of the most viral finance products. It is a digital asset designed to work as a media of exchange. For this feature, many people compare it to fiat, but however, its price is often in a flux. So instead of availing of crypto as money, more people use it as an investment or hedge. But where does this “cryptocurrency” come from? Let me tell you the story and the history of its development.

Back in the 1974, Economics Nobel Memorial Prize winner *Friedrich von Hayek* first propose a concept of decentralized digital currency in his masterpiece Denationalization of Money. He portrays a future of utopian where a group of hackers create an internet nation without the interference of government. They issue their own “fiat” and escape the fate of being controlled by the authority. After *Friedrich von Hayek* publish his book, a bunch of cryptographers start to design their system, but however, the spark eventually died out.

Back in 2008/ 2009, the world is suffering a finance crisis and the market was in a chaos. 45% of world’s wealth was destroyed in the financial crisis and the excessive QE wreaked havoc to the health of market and the confidence of investor. Global production of 2009 decreased by 2.9% and is the first time after WW2. (Let’s not discuss the misery 2020)

In 2009 January 3rd, several weeks after Lehman Brother went bankruptcy, Satoshi Nakamoto issue the white paper of Bitcoin. Bitcoin is a decentralized cryptocurrency, require user to maintain the accuracy and credibility of it (POW prove-of-work). Its most attractive features are its confidential and speed. Bitcoin avail a new technique called Blockchain, require miners(users) to encrypt the information of transaction and check the correctness of the data. To encourage miners to help maintain the stability of the Blockchain, the one of successfully encrypt a block will receive some bitcoin as an acknowledgement.

In 2009 ~ 2011, bitcoin was below $1 and grow extremely slow. However, in 2011 it rose from $0.3 to $5.7 and $5.7 to 13.3 for 2012. In 2013 ~ 2017, it grows rapidly to around $1000 per bitcoin. On December 17th 2017, bitcoin reach its all-time-high $19783.06, which is quite unbelievable; but on January 1st 2018, bitcoin fell back to $13412.33. Though out the first half of 2018, it fell to $6000 and fluctuated between $12000 and $6000 for the second half of 2018 till nowadays. It is around $9000 for this moment (7/1).

Bitcoin price from 2009 ~ 2019

Reference: https://en.bitcoinwiki.org/wiki/Bitcoin_history

Bitcoin Trading Strategy:

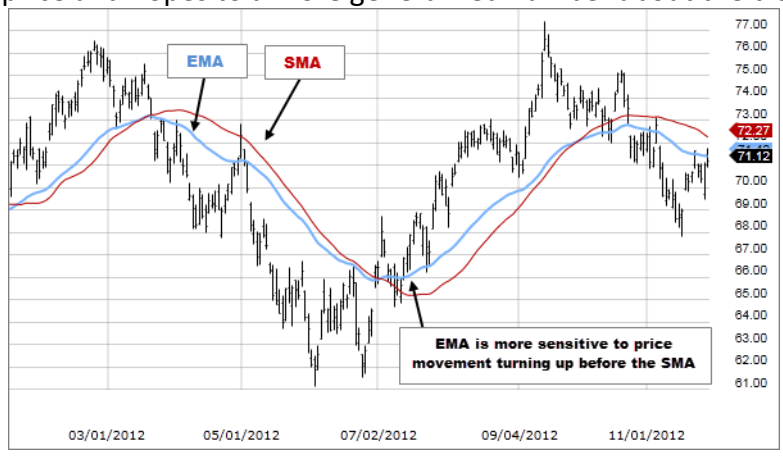
From the appearance of bitcoin, many companies arise and start provide service about bitcoin. Many brokers, investment companies and bank start perceive Bitcoin as a financial product and hedge. Also, since Bitcoin might fluctuate a lot in one single day, it is one of the most attractive financial products to day trader and quant trading company. Lots of investor are trying to arbitrage from Bitcoin market and dream to make money from this extremely unstable market. Some success and some fail as all market does, but unlike ordinary stock market or future market, Bitcoin is too rapid and too technique-oriented, to invest in bitcoin somehow rely on some program technique. (Otherwise you need to become the major player and influence the market yourself)

There are lots of different trading strategies used on Bitcoin market. Scalping, Fading, MA, Arbitrage and etc. They require speed, investigation and maybe some luck to win some money. There are also long trade and short trade, and their strategy may be really different. For long term trader, value investment might be a smart move; even Buffett is one of the proponents of value investment. However, for short term trading, people tend to do technique analysis such as the one I was using in my final project – MA (Golden/ Death Cross). There are also numerous trading strategies, some might work for some days and the other for the other days. All in all, the market varies seconds from seconds, one wrong step and you might end up losing everything.

Moving Average:

However, for lacking of time and documentation, I decide to use the golden and death cross given. But I still try to test different MAs to acquire largest profit, and I have some ideas to balance between loss due to transaction fee and gain due to the earning (It still depends on how the market is eventually). But let's talk about MA beforehand, and we can trail different pairs of MAs.

There are two main type of MA; one is call SMA and another EMA. SMA stands for Simple Moving Average, and it simply average the price through a period. For example, SMAß means taking the past ß price data (include the newest price data) and calculate the means *(∑price(i) / ß)*. And for EMAß, we pay more attention on current price so we use a harder formula: *(EMA_n = price(current) * W + EMA_{n-1} * (1 - W))*, where *(W = S / (1 + days))* and S stands for smoothing and is an arbitrary constant. So ordinary speaking, EMA give more weight to current price and can respond to more quickly while SMA tends to normalize rapid change of price and hopes to a more generalized number about the trend.



Also, choosing different period for MA will lead to different sensibility. A short-term MAß takes a smaller ß, while long-term MAß has a larger ß. A short-term MA will be more sensitive to the fluctuation of the price and a long-term reflex the long-term trend of specific financial product. So, in the realm of statistical analysis, we often use multiple MAs to show how the market react and try to predict the future market.

MA7 short-term (more sensitive)

MA25 long-term (less sensitive)

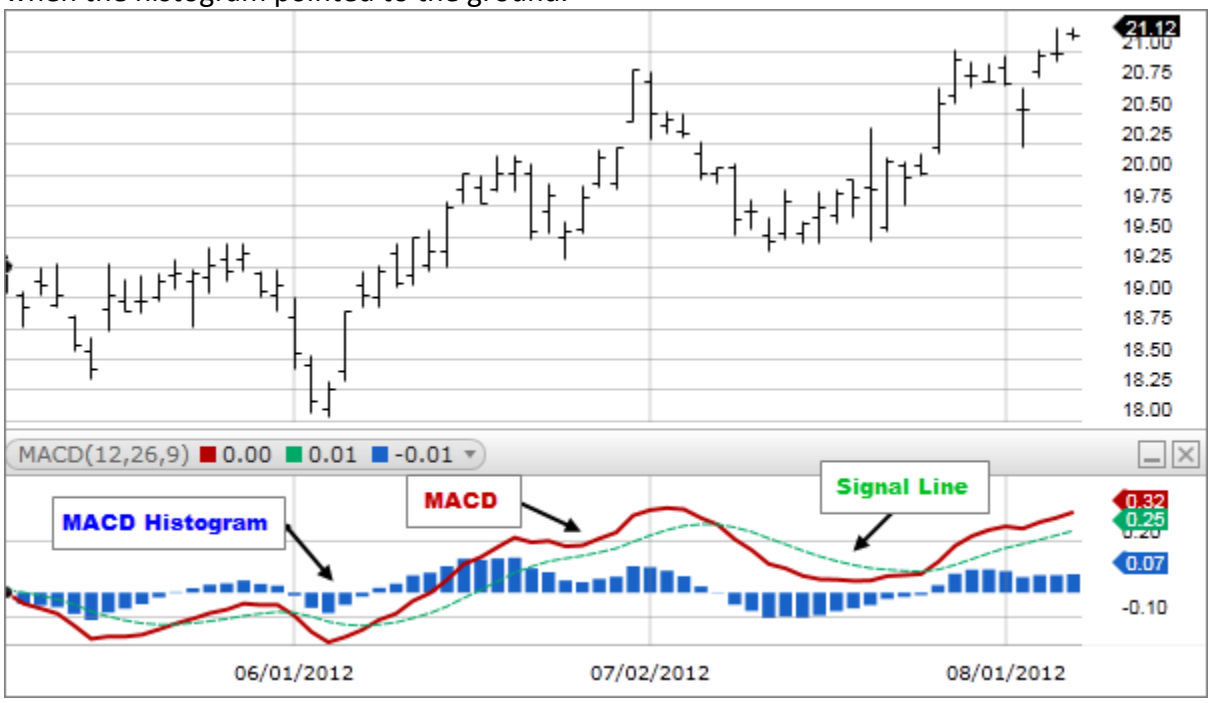
MACD:

MACD stands for Moving Average Convergence Divergence and is a trend-following trading strategy momentum indicator that avail the property of different MAs and trade. So, you can simply choose 2 MAs and draw a curve by subtracting one MA from the other.

There are many different methods to deal with MACD, but I will only introduce some of them in the following. Someone compares the line with zero point, and buy when MACD moves above zero and sell when it dives beneath zero. This algorithm is logically equal to comparing whether the 2 MA crosses or not, which is Golden Cross and Death Cross I would introduce beneath.

Another common practice is to draw another EMA to calculate MACD again with the previous MACD line; then compare it with zero line (Signal Line Crossover). To be more explicit, you will use 3 MA lines. You could acquire a MACD by the first two MA, then you could do zero-line indicator by comparing the MACD you acquire with your 3rd MA line. The advantage of doing so is that you can be more sensitive to price fluctuation while you can dilute fluctuation.

So, the 3rd line will be named as Signal Line. The difference you acquire by subtracting Signal Line and MACD is MACD Histogram. You can buy when the histogram grows upward and sell when the histogram pointed to the ground.



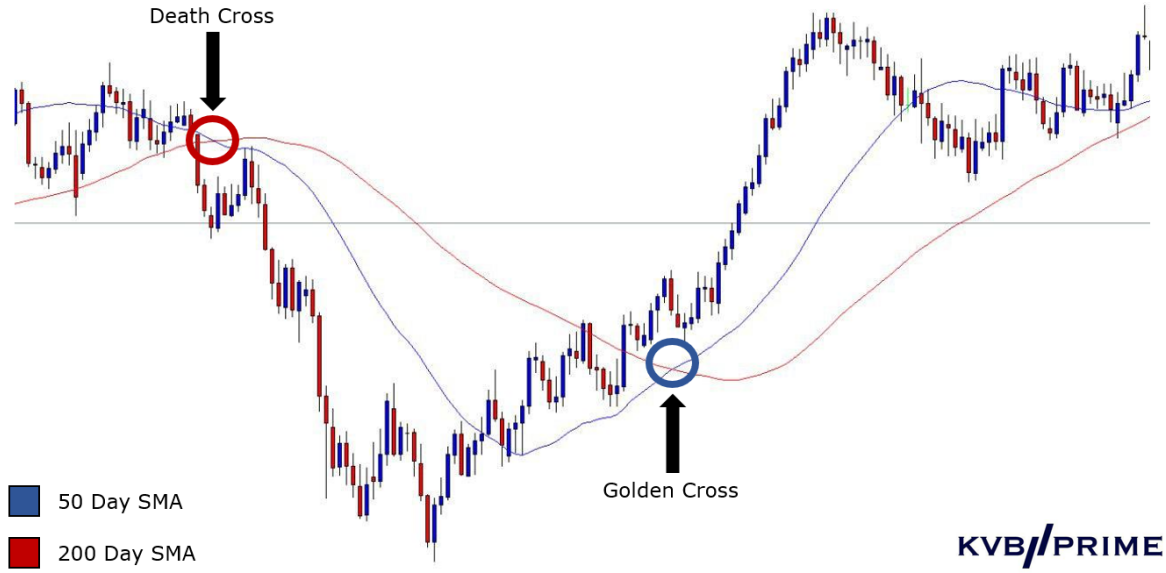
Of course, there are still a bunch of other ways to exploit MACD, there are more to be discover. But I think these two methods are enough for today so let's carry on and focus on the zero-line method --- Golden Cross and Death Cross.

Golden Cross:

A common usage of MAs pair is by choosing a long-term MA and a short-term MA, and observe their relation. So, a golden cross occurs when short-term MA cross **above** long-term MA, and this indicate that the market is uprising compare to history trend since short-term MA is more sensitive. So, investor hope that the market will keep rising when a golden cross appears (short-term MA keep rising).

Death Cross:

As for death cross; it appears when short-term MA cross **below** long-term MA, and this indicate that the market is shrinking and the price is dropping. So, whenever death cross occurs, trader indicate that the price might continue to drop, so it is wiser to stop buying and sell the shareholding.



MA Cross Trading Strategy:

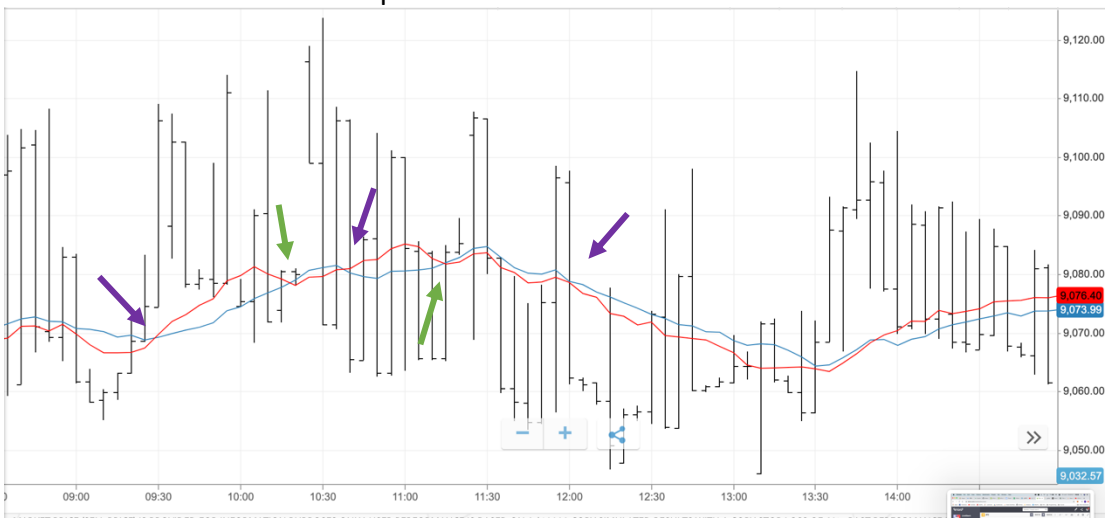
MA cross trading strategy avail of both golden cross and death cross. So, the algorithm is simple and straight forward.

1. Get new data and calculate short-term MA and long-term MA
2. If Golden Cross occurs → buy BTC
   Elif Death Cross occurs → sell BTC
   Else → repeat step 1 and step 2

However, the most important part is choosing the appropriate MAs pairs to avoid buying and selling when the price is fluctuating in a bounded region as well as maximize the profit between a golden cross and a death cross. (Profit = Price(golden) – Price(death))

So, let's dwell into some scenario when using inappropriate MAs pairs that would cause you a lot of money or make you earn way less then expected.

1. Fluctuate between bounded price



Since the price is bounded between $9070 and $9080, we trade 5 time which will cost us 5 * 0.05% of transaction fee. So, if the timeline elongate, trader will excessive transactions and lead to a significant loss due to transaction fee.

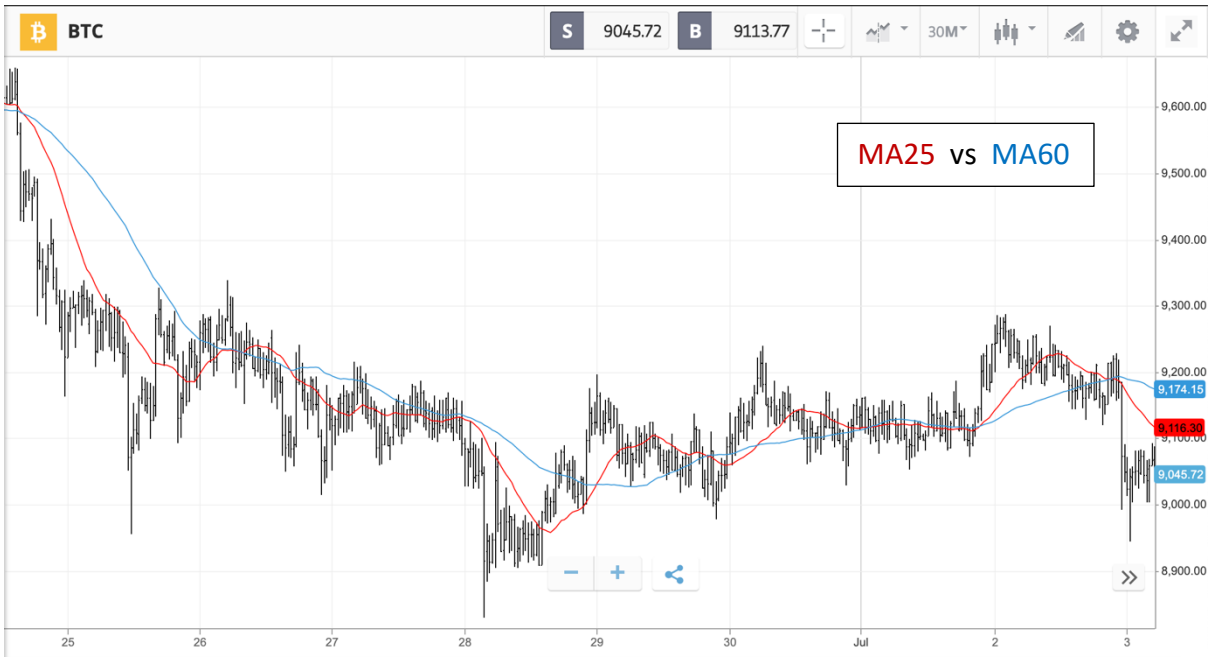
2. Earn less due to inappropriate MAs pairs

As the charts show, large MA pairs didn't success to arbitrage the sudden drop for about $200 while smaller MA pairs receive about $150.

So, traders have to try to strike a balance and choose a good MAs pairs to achieve maximize profit and minimize the loss due to transaction fee. Another solution is to add some threshold and try to avoid unnecessary lost.

My MA pair choosing:

I have tested a lot of different pair of MA pair I have eventually choose MA25 and MA60 with a 25-minute period. My main idea is to reduce unnecessary trade. I have observed that bounded region fluctuation might often occurs within 3~6 hours, so choosing a slightly longer period can dilute those fluctuation. Also, choosing a slightly faraway pair can also serve the same purpose.



Trading Conclusion:

Through testing lots of different pairs of MAs, you can discover that one single pair of MA might earn a lot for some period of time and lose more in other period. As the saying goes, there is no free lunch and the best way is to change your strategy while the environment of the market change. Trying to arbitrage through one single trading strategy is unrealistic and dumbed actually. So, if any trader wishes to earn for a long period, lots of effort is needed and his or she has to modify the strategy while the market perform different.

Also, this remind me that I've once heard a quant trade startup company's trader says that they will modify their trading strategy almost every few days and might reuse it in the future. Since algorithm trading is a mind game and how can you expect that others will let you earn forever?

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