POSSIBILITY TO USE DERIVATIVES IN MONGOLIAN COMMODITY MARKET AND CURRENCY EXCHANGE

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ABSTRACT

In the last years, derivatives became increasingly important in finance. Futures and options are actively traded on many exchanges throughout the whole world. Many varieties of derivatives are entered into by financial institutions, fund managers, and corporate treasurers within the OTC market. Generally, derivatives is used as a tool to transfer risk, to earn profit, and to broaden financial market. This paper is concerned with possibility to use derivatives in Mongolian commodity market and currency exchange. In particular, it defines whether it's possible or not. As for the commodity, this study focuses on three commodities such as gasoline, gold, and silver and compares their volatility between Mongolia and the United States where commodity derivatives trading is perfectly developed as well as uses statistical analysis through testing variance equality F-Test. As for the currency exchange, seven most commonly traded currencies are selected and the paper exploited trend lines using Least Squared method. The result indicates that it's possible to use derivatives in Mongolian commodity market and currency exchange since it is found out that Mongolian commodity market is highly volatile. Therefore, it can be used as a risk hedging tool in transactions of this market. If derivatives can be used effectively, it can also manage the depreciating inflation and currency exchange rate in Mongolia.

KEYWORDS: *Derivatives, Forward, Future, Option, Swap, Variance, Standard deviation, Volatility, Price return*

I.   INTRODUCTION

The development of derivatives market plays an important role in financial system of the country and contributes significantly to various economic issues. In recent years, financial derivatives market instruments have been widely used to hedge, and they have also been one of the most effective ways to increase returns and reduce portfolio management risks. Since the establishment of the first organized futures market in the United States, many other developing countries have been trading derivatives in their financial markets. However, Mongolia remains still one of the few countries where derivatives, the key to efficient risk transfer, have not been established, while other countries are developing their derivative financial markets. Derivatives are used for hedging or speculation or arbitrage. They play a key role in transferring a large range of risks within the economy from one entity to another [1]. American economist Alan Greenspan states about derivatives that "What we have found over the years in the market place is that derivatives have been an extraordinarily useful vehicle to transfer risk from those who shouldn't be taking it to those who are willing to and are capable of doing so".

Emerging economies have less sophisticated markets and derivatives operate in a less competitive environment, even so the turnover of derivatives has grown more rapidly in emerging markets than in developed countries. Derivatives trading has already been installed in many emerging markets, but Mongolian financial market still hasn't adopted it yet. Only commercial banks are currently using derivatives as currency forwards and swaps in Mongolian financial system. So the few questions came up: Why derivatives market isn't existing in Mongolia? Is there any possibility to use derivatives in Mongolia?, etc. Those questions highly motivated me to study this topic and it would be very interesting field to study. Related to the fact that derivatives was firstly established in commodity trading purpose, I considered research area that Mongolian commodity market.

This paper tries to identify the possibility to use derivatives in Mongolian commodity market and currency exchange /to identify whether it's possible or not/. In order to accomplish above research goal, we did qualitative /theoretical research/ and quantitative research by the way that collecting secondary data within certain time ranges. Furthermore, this paper will be of interest to somebody who wants to exploit possibility to use

derivatives in their country's financial markets. So as to settle derivatives, trading systems and technologies play a huge role in transactions. To perfectly develop a derivative trading system in a country, necessary research must be made about derivatives platform.

II.   LITERATURE REVIEW

There is a popular definition of derivatives by Warren Buffett, derivatives are financial weapons of mass destruction. Many authors have given their own interpretation and definitions about origin of derivatives. But most of them believe that the first manifestation of the derivative originated in the food trade, especially in the agricultural sector. In general, derivative come in many different forms. According to the Options Clearing Corporation, derivative is a financial contract where the value is derived from the performance of underlying market factors [2]. The most popularly known derivatives are futures (forwards), options, and swaps.

A forward contract is a bilateral agreement between two parties to trade in a specified quantity if a specified good at a specified price on a specified date in the future. Forwards are traded in over-the-counter market. The forward price for a contract is the delivery price that would be applicable to the contract in the future, but which is negotiated today, while futures price is the price for the underlying asset is determined today, but settlement is on a future date. A future contract is a standardized forward contract that is traded on an organized exchange, neither party knows the other one and bears the default risk. At the end of both forward and futures agreement, the long party has obligation to buy the specified asset and the short party has obligation to sell the asset.

Sundaram and Das [3] defines option as a financial security that gives the buyer the right but not the obligation to buy or sell a specified asset at a specified price on or before a specified date. The important feature of the option is 'optionality' which means the holder has a right to participate in the specified trade but is not obligated to do that. There are two most common types of options: calls and puts. Call option gives the holder the right to buy an asset by a certain date for a certain price, while put option gives the holder the right to sell an asset by a certain date for a certain price. Call and put options are used by investors to hedge against existing investments risks.

According to the definition of Hall [1], "A swap is an over-the-counter agreement between two companies to exchange cash flows in the future and this agreement interprets the dates when the cash flows are to be paid and the way in which they are to be calculated. Usually the calculation of the cash flows involves the future value of an interest rate, an exchange rate, or other market variable". In general, there are two basic types of swap transactions which are interest rate swap and currency swap. Since the first interest swap appeared in 1981 between IBM and the World Bank, this market is rapidly developing and now swap contracts make up the majority of over-the-counter derivatives.

Advantages and disadvantages of using derivatives

Using derivatives has many benefits including lower transaction costs, reduce the risk, lower the cost of debt and equity, and tax savings. Nguyen [4] observes that the cost of debt and cost of equity can be lowered with the use of derivatives. This lower cost of capital and may lead to firm have a higher valuation and positive net present value projects by lowering the discount rate and required rate of return. Furthermore, derivatives can give a firm tax savings and low tax liability. Smith and Stulz [5] claim that derivatives can smooth the value of a pre-tax corporation, which in turn reduces corporate tax liabilities when the tax function is convex. Alan Greenspan [6] once stated that derivatives is a useful vehicle to reduce risk by transferring to someone. However he noted that of course, failure to effectively manage the risks associated with the benefits of derivatives can reduce the benefits to individual institutions and the financial system as a whole, and lead to financial instability. Furthermore, as for some specific financial transaction, derivatives may provide lower transaction costs. McDonald [7] suggests that derivatives can create a way to bet with high leverage and a clear view.

Besides many advantages, using derivatives has plenty of disadvantages and it may lead traders face many risks. For instance, Mayer [8] stated that one downside of derivative is the unlimited leverage, because the initial profits will be placed on derivatives traded on the exchange, but the leverage is unlimited in the over-the-counter market. Although improved regulation of derivatives reduced the risk, the recent housing bubble, tulip mania, South Sea Company bubble which caused by credit default swaps are not insignificant [1-Nguyen]. Mallikarjunappa and Asfal [9] noted that the nature of the volatility pattern changed in the post-derivative period. In particular, they found out that introduction of the derivative did not result in a reduction in the volatility. Some researchers believe that another disadvantage of derivative is high transaction cost [10], whereas some researchers find that derivatives offer low-cost and effective way to transfer risk [11].

Current derivatives market

Financial derivative instruments are traded in over-the-counter (OTC) market or an official exchange. The number of derivatives transactions per year in OTC markets is smaller than in exchange traded markets, but the average size of the transactions is much greater [10]. Compared to

exchange, OTC is a less formal and less transparent market. Dealers play a big role in OTC as "market makers" who quotes the price to buy or sell to customers. The price they offer or bid is not always the same between customers and not always the same to another dealer. OTC market operates with fewer rules than the exchange do.

According to statistical release by Bank for International Settlements, as of first half of 2019, the total notional amounts of OTC derivatives reached $640 trillion which was the highest level since 2014. The notional amounts determine the contractual payments. In comparison with end of the previous year, it increased by 17.6% [12].

Figure 1. Outstanding notional amounts of OTC derivatives, USD trillions
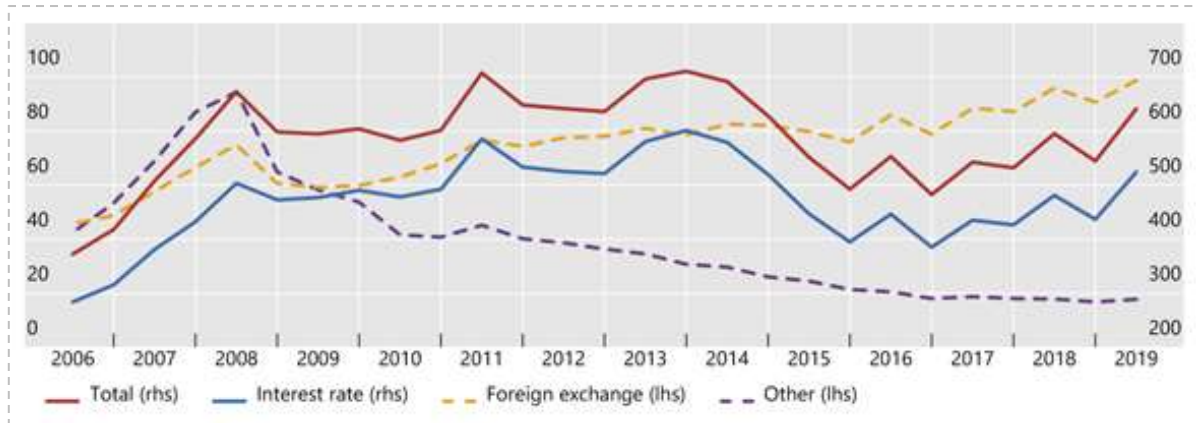
(Source: BIS OTC derivatives statistics)

Derivatives usage in emerging countries

Mihaljek and Packer [13] noted that derivative turnover in emerging markets remains rapid than in developed economies and it's becoming more global. As for the developed countries, one third of the derivatives turnover occurs over-the-counter, whereas for the emerging markets, it is half of the derivatives turnover. Share of emerging market transactions cross-border is increasing as well as the importance of the two largest financial centers in Asia (Singapore and Hong Kong) is growing as they account for a significant share of over-the-counter trading outside the local currency.

Upper and Valli [14] stated that only 10% of global derivative turnover is in contracts designated in emerging market economy currencies, which are much smaller than share of these economies in world trade or global GDP. In terms of the exchange traded derivatives in emerging markets, 86% of daily average turnover of the whole contracts are denominated by Brazilian Lira, Korean Won and Chinese Yuan [12].

Financial derivatives are used as a risk management tool to protect against business risks such as security price risk, currency risk, interest rate risk, commodity risk and credit risk [15]. Atilgan et al., [16] studied that foreign exchange futures and swaps usages are predominated in emerging market and academic literatures covering the risk management of derivative in emerging markets focus mostly on the usage of currency derivatives. But in Mongolia, only commercial banks are currently using derivatives as currency forwards and swaps. As of

august of 2011, the amount of derivative contracts written by Mongolian banks were 132.6 billion MNT (114.3 million USD by historical exchange rate) which was equal to only 1.69% of the whole assets of the integrated balance sheet of banks.

III.   METHODOLOGY

This paper has a main purpose that to identify the possibility to use derivatives in Mongolian commodity market and currency exchange /to identify whether it's possible or not/. So as to complete above research purpose, this study made based on qualitative and quantitative researches. Qualitative research is adopted when reviewing literatures and quantitative research is adopted when collecting secondary data to analyze. In particular, we used qualitative research method in order to develop our theoretical framework using secondary data. As stated by Benbasat et al., [17], qualitative research supports the researcher to understand the complexity of the phenomenon being considered and enable research in relative new areas of research. Despite that we also used quantitative research using secondary data as well. Dawson [18] suggests that quantitative research is usually selected when it is necessary to analyze a huge amount of quantitative data to test hypotheses or verify the theories. We aimed to collect data from the most reliable and official resources within high range of time series. In order to analyze data through statistical analysis, we used a Microsoft Excel 2013 program.

The main purpose of derivatives is to transfer any possible risk. Most commonly used risk

measurement is standard deviation and we can simply say higher the standard deviation, higher the risk and higher the need of derivatives. Further on this paper, we estimated volatilities in Mongolian commodity market and currency exchange rate. At first, theoretical frameworks about return and standard deviation, F-test for variance equality, and least squares method are briefly mentioned.

Return and Standard deviation
Return measures the percentage change of a variable in a unit of period. In example, if a stock return is 5%, the price of the stock will increase by 5% for the next period. Logarithmic return is commonly used in financial practice.

$$r_t = \ln(S_t) - \ln(S_{t-1})$$

Standard deviation measures the amount of possible magnitude of fluctuation from its mean. Sample standard deviation can be calculated as:

$$\sigma = \sqrt{\sum_{i=1}^{n} \frac{(X_i - \bar{X})^2}{n-1}}$$

F-test for variance equality
To check if the variances of two series are equal or not, F-test can be performed. Its null hypothesis states that the variances of two series are equal. On the other hand, alternative hypothesis states that the variances are not equal.

$$F_{stat} = \frac{s_1^2}{s_2^2}$$, in which s_1^2 is the larger variance and s_2^2 is a smaller variance. Critical value of F-test can be obtained from F-distribution table, with n-1 and m-1 degree of freedom. If the probability to accept null hypothesis (Prob.) is lower than chosen significance level, null hypothesis of equal variance is rejected.

Least Squares Method to run regression
Least squares method estimates a linear regression, in which the sum of squared residuals is minimized. The equation can be specified as:
$Y = a + b * X$, in which:
a — intercept of the linear regression
b — slope of the linear regression
Y — dependent variable
X — independent variable.

Calculations of the coefficients are:

$$b = \frac{N\sum(XY) - \sum X \sum Y}{N\sum(X^2) - (\sum X)^2}, \qquad a = \frac{\sum Y - b\sum X}{N}$$

Volatility in commodity market
If we take an example of a country such as United States where commodity derivatives trading is perfectly developed, in commodity specifying, there'll be countless number of kinds of commodities. But in this paper, we focused on only 3 commodities: gasoline, gold and silver to compare their volatility between Mongolia and United States.

About the gasoline, to compare the volatility of price return from gasoline in Mongolia with the same in the USA, we can check if the variance of gasoline price return in Mongolia is equal to variance of gasoline price return in the USA using variance equality F-Test. The time frame is ranging from Dec-2010 to Feb-2020, including 110 monthly observations. To make the measurement comparable, we took per 1 liter price as base measurement and adjusted USA gasoline price. Furthermore, because it's true that gasoline price strongly affect Mongolian inflation, we studied trend lines in Mongolian and US gasoline price.

$$H_0: \sigma^2_{gasolineMNG} = \sigma^2_{gasolineUSA}$$
$$H_a: \sigma^2_{gasolineMNG} \neq \sigma^2_{gasolineUSA}$$

In which $\sigma^2_{gasolineMNG}$ is variance of return of gasoline price in Mongolia, $\sigma^2_{gasolineUSA}$ is the same in the USA.

For gold and silver, we used same method to compare the volatility of price return from gold and silver in Mongolia with the same in the USA. The time frame is ranging from Jan-2013 to Feb-2020, including 85 monthly observations. To make the measurement comparable, we took per 1 ounce price as base measurement and adjusted Mongolia gold and silver prices. We can check if the variance of gold price return in Mongolia is equal to variance of gold price return in the USA using variance equality F-Test.

$$H_0: \sigma^2_{goldMNG} = \sigma^2_{goldUSA}$$
$$H_a: \sigma^2_{goldMNG} \neq \sigma^2_{goldUSA}$$

In which $\sigma^2_{goldMNG}$ is variance of return of gold price in Mongolia, $\sigma^2_{goldUSA}$ is the same in the USA.

We can also check if the variance of silver price return in Mongolia is equal to variance of silver price return in the USA using variance equality F-Test.

$$H_0: \sigma^2_{silverMNG} = \sigma^2_{silverUSA}$$
$$H_a: \sigma^2_{silverMNG} \neq \sigma^2_{silverUSA}$$

In which $\sigma^2_{silverMNG}$ is variance of return of silver price in Mongolia, $\sigma^2_{silverUSA}$ is the same in the USA.

F-statistic is found as: $F_{stat} = \frac{\sigma_L^2}{\sigma_S^2}$, where σ_L^2 (σ_S^2) is larger(smaller) of variances of 2 returns.
For the F-test 2 sample for variances analysis, we assumed that significance level alpha or α equals to

0.05 which means probability of rejecting the null hypothesis when it is true.

Volatility in currency exchange rate

Currently, only Mongolian Central Bank and other commercial banks use derivatives as a tool to transfer possible risks in currency exchange. Most commonly traded currencies are: USD, GBP, EUR, KRW, RUB, JPY, and CNY. In order to extract MNT's volatility and explain depreciation or appreciation against the currencies, we checked linear trend lines in currency exchange rates using LS (least squared) method.

$$CURRENCYi = a_{CURRENCYi} + b_{CURRENCYi} * time$$

In our case, our X axis is time horizon, and Y axis is the value of the currency. For currency exchange rate, the time frame is ranging from Jan-2006 to Dec-2019, including 168 monthly observations. The research data sample area and resources are presented in Table 1.

Table 1.
Research data sample area and resources

Data label	Data sample range	Number of observation	Data sources
Gasoline	December 2010 to February 2020	110 monthly observations	Mongolia regular A80 gasoline price- *National Statistic Office, 2020* [19] USA regular gasoline price- *U.S. Energy Information Administration, 2020* [20]
Gold	January 2013 to February 2020	85 monthly observations	The price of gold and silver, per 1 gr by MNT- *Bank of Mongolia, 2020* [21] Gold price per ounce- *Bullion Vault Ltd, 2020* [22]
Silver	January 2013 to February 2020	85 monthly observations	The price of gold and silver, per 1 gr by MNT- *Bank of Mongolia, 2020* [21] Silver price per ounce- *Bullion Vault Ltd, 2020* [23]
Currency	January 2006 to December 2019	168 monthly observations	JPY, KRW exchange rates- *Bank of Mongolia, 2020* [24] Other exchange rates- *Mongolian statistical information service, 2020* [25]

IV.   FINDINGS AND DISCUSSIONS
1.) Volatility in commodity market

In case of gold, silver and gasoline, we ran F-test Two-Sample for Variances between series of Mongolian and US price returns. Our null hypothesis states that the variances of two series are equal. If the probability to accept the null hypothesis is lower than significance level of 0.05, we reject the stated null hypothesis. Following Table 2 shows results from variance equality test for price return of gasoline.

Table 2.
F-Test Two-Sample for variances, gasoline price return

F-Test Two-Sample for Variances		
	USA	*MNG*
Mean	-0.001849626	0.003525957
Variance	0.002852398	0.000465966
Observations	110	110
df	109	109
F	6.121469046	
P(F<=f) one-tail	3.06629E-19	
F Critical one-tail	1.372282589	

We can see that P value is less than 0.05, therefore we rejected the null hypothesis that two variables are equal. It means that the variance of price return of gasoline price in Mongolia is unequal to variance of price return of gasoline price in the USA. On the other hand, there is statistically

significant difference between 2 variables.

In order to exploit which country has higher percentage price volatility in gasoline price, we also checked standard deviations of each as presented in Figure 2.
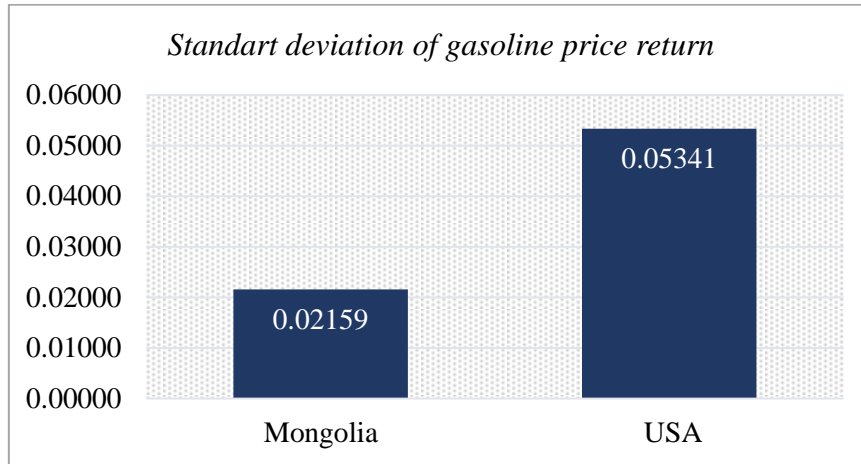

Figure 2. Standard deviation of gasoline price return

In this comparison, monthly fluctuation of price return in the USA is 3.2% higher than that of Mongolia. But it does not solely mean retail gasoline price is not that risky in Mongolia. Macro economically, Mongolian inflation rate is highly dependent of fuel price. According to the survey covering impact of fuel price in national inflation made by Mongolian Central Bank (Bank of Mongolia), prices of 98% of retail products are positively affected by price change in fuel.

Table 3.
F-Test Two-Sample for variances, gold price return

F-Test Two-Sample for Variances		
	USA	*MNG*
Mean	0.00039997	0.011086699
Variance	0.001456252	0.002839899
Observations	85	85
df	84	84
F	0.512783015	
P(F<=f) one-tail	0.001247156	
F Critical one-tail	0.696995574	

As shown in Table 3, the probability of F-test to accept null hypothesis is much less than significance level as well. It means that the variance of price return of gold price in Mongolia is unequal to variance of price return of gold price in the USA. In this case, we concluded that volatility of return of gold price in Mongolia and USA are unequal. Standard deviations of gold price return is presented in below Figure 3.
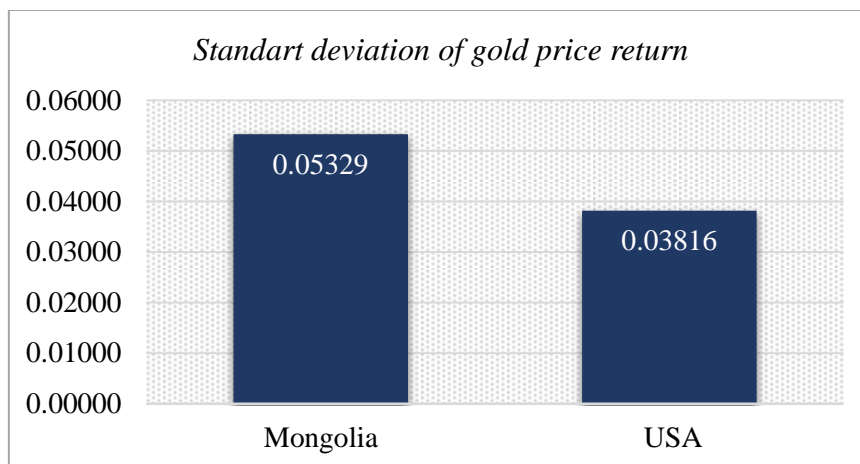
Figure 3. Standard deviation of gold price return

This result indicate that standard deviation in gold price return in the USA is 1.5% less than that of Mongolia. On the other hand, gold price in Mongolia takes more risk than gold price in the USA.

Table 4.
F-Test Two-Sample for variances, silver price return

F-Test Two-Sample for Variances		
	USA	*MNG*
Mean	-0.00665457	0.008666421
Variance	0.00354282	0.009753367
Observations	85	85
df	84	84
F	0.363240654	
P(F<=f) one-tail	0.000002898	
F Critical one-tail	0.696995574	

In case of silver, we also used the variance equality test to check whether variance of price return of silver in Mongolia is equal to that of the USA or not. The result shown in Table 4 says that null hypothesis is not supported by F-test due to the less probability than the significance level of 0.05. For that reason, we rejected the null hypothesis and found out that the risk of silver return in Mongolia and US are not the same. Furthermore, we compare the absolute values of standard deviations in Figure 4.
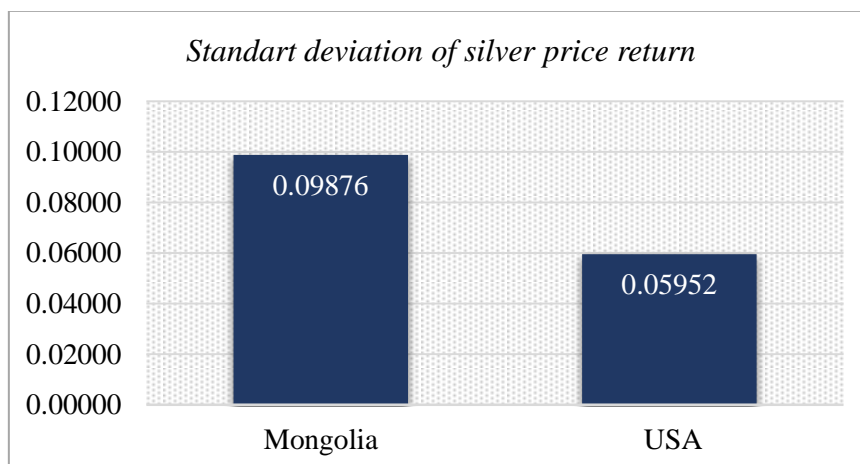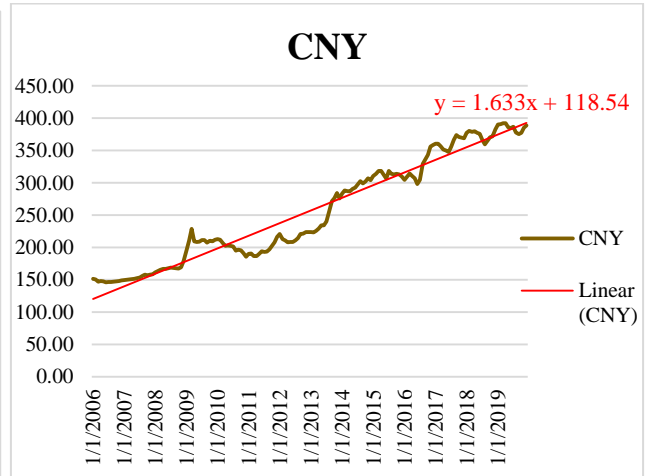

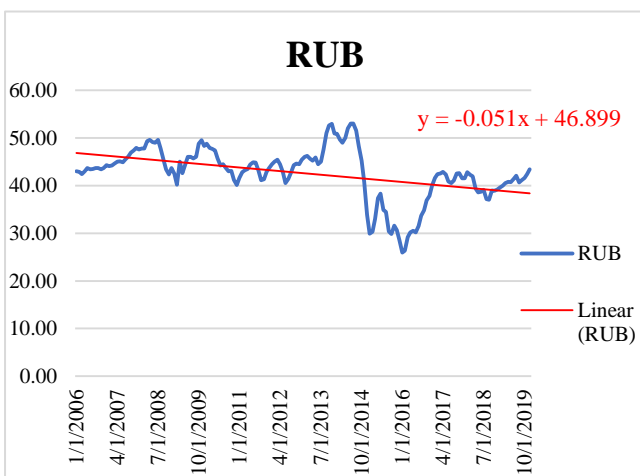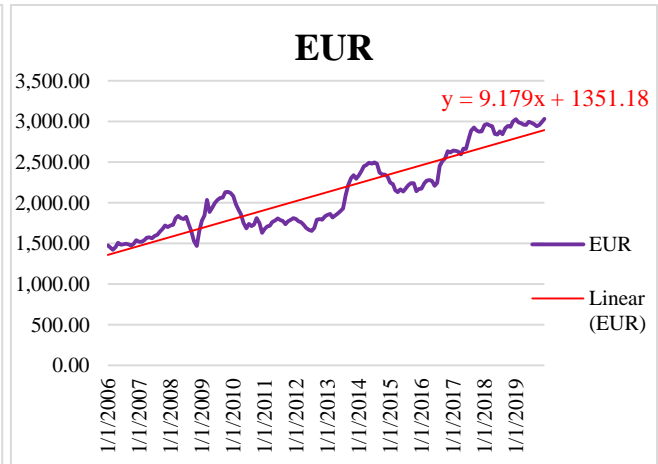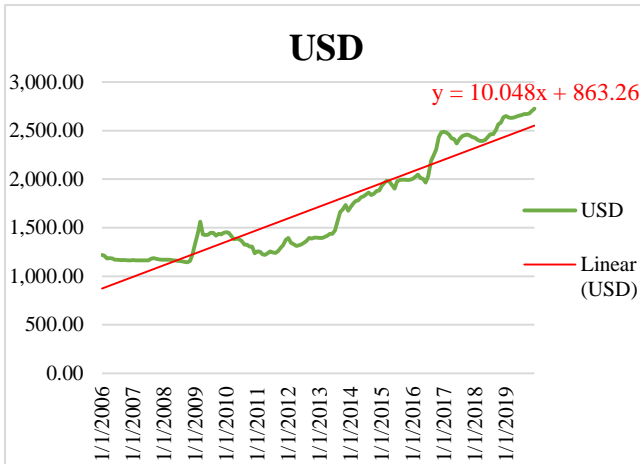**Figure 4. Standard deviation of silver price return**

Monthly standard deviation in silver price return in Mongolia is 3.9% higher than that of the USA. In other words, silver price in Mongolia bears more risk than silver price in the USA.

2.) Volatility in currency exchange rate

Mongolian Central Bank and other commercial banks use currency derivatives, specifically options, forward and swaps. The most commonly traded currencies are USD, EUR, RUB, CNY, JPY and KRW. To check if MNT is generally depreciating or appreciating, we exploited trend lines with each currency pair.

As shown in Figure 5, all the exchange rates excluding RUB have positively sloped trend line and as time moves, the patterns are drawn the same. It suggests that generally MNT has depreciated against other currencies over time. The reason of negatively sloped trend line in RUB can be also depreciation of RUB, consistent with depreciation of MNT.
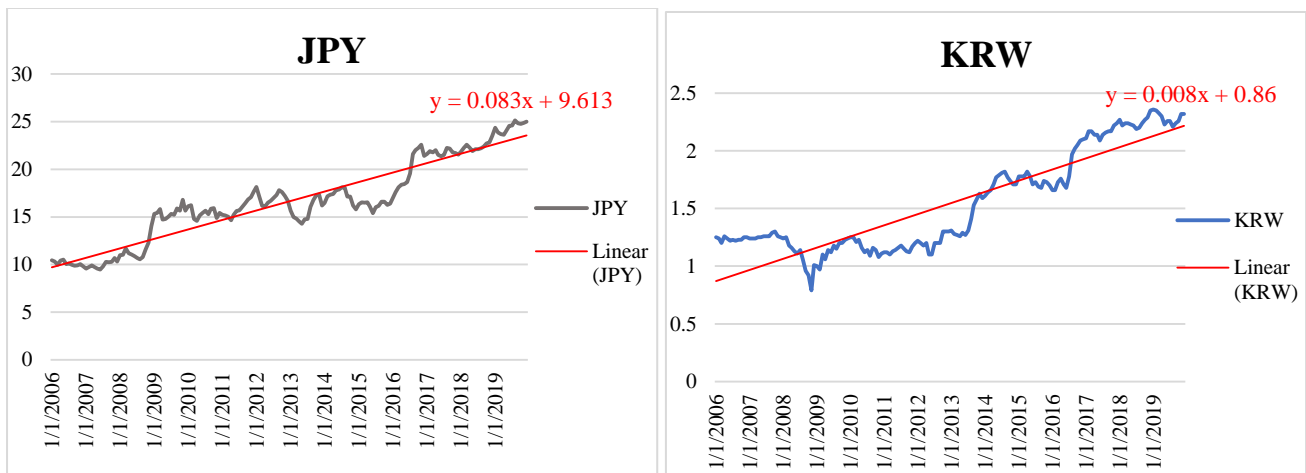

USD — $y = 10.048x + 863.26$

EUR — $y = 9.179x + 1351.18$

RUB — $y = -0.051x + 46.899$

CNY — $y = 1.633x + 118.54$

Figure 5. Exchange rate movements and trends

Table 5 presents the intercepts and slopes of trend lines which shown in Figure 5.

Table 5.
Intercept and slopes of trend lines

	USD	EUR	RUB	CNY	JPY	KRW
Y intercept /C/	863.25915	1351.183	46.89893	118.539	9.613322	0.862535
Slope	10.047696	9.178713	-0.0508	1.633477	0.083028	0.008075

Based on the results, we suggest that:
1. Controlling the depreciation in exchange rate by effectively using derivative transactions.
2. In a multinational operation, exchange rates risk severely affects the profitability of the firm. Implementing currency derivatives in the operation can manage this risk.

V.   CONCLUSION

The global derivatives market is huge market in worldwide, which can be divided into OTC and exchange market. Derivatives trading has already been installed in many emerging markets, but the Mongolian financial market still hasn't adopted it yet. Only currency forwards, swaps, and options are currently used between domestic and international commercial banks in Mongolian financial system. The main findings provided from empirical analysis in this study are summarized as following list.

- For the gold, variance of gold price return in Mongolia is not same as that of US. On the other hand, we concluded that volatility of return of gold price in Mongolia and USA are unequal. About standard deviation, Mongolian market is riskier than US market.
- Regarding silver, fluctuation between silver price in Mongolia and in the USA are not equal as well. We determined standard deviation in silver price return in Mongolia is 3.9% higher than that of the USA. In other words, silver price in Mongolia, bears more risk than silver price in the USA. To hedge these risks in Mongolian gold

and silver commodity market, derivatives can be used.
- As for gasoline, variance of price return of gasoline price in Mongolia is unequal to variance of price return of gasoline price in the USA. Study shows that monthly fluctuation of price return is 3.2% lower in Mongolia. But it doesn't fully support Mongolian fuel price is not riskier than that of US. Macro economically, retail fuel price strongly affects consumer price index. To conclude it with the usage of derivatives, even inflation can be manipulated by effective usage of derivatives contracts.
- Mongolian currency, MNT, has been almost constantly depreciating against foreign currencies, except RUB. To deal with this disastrous depreciation, effective currency derivatives usage in Mongolian Central Bank can play big role. If The Central bank succeed in forecasting exchange rates and implement a convenient derivatives' strategy, it can boost foreign currency reserves in Central Bank.

Based on the empirical result of the study, we concluded that it's possible to use derivatives in Mongolian commodity market and currency exchange as well as we can install derivatives in Mongolian financial market. This is due to the fact that Mongolian commodity market is highly volatile and derivatives can be used as a risk hedging tool to participate in transactions of this market. Therefore, if derivatives can be used effectively, they can even manage the declining inflation and currency

exchange rate in Mongolia.

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