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FINANCIAL MATHEMATICAL MODELS AND HEDGING ACCOUNTING

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Abstract

The application of financial mathematical models to evaluate the fair value of financial assets played an important role in the development of the financial market and the management process of financial risks because of the close relationship between the methods of financial mathematics models and the hedge activities in commodity market and financial markets. Moreover, they bring the relevance and reliability of financial statements. Applying financial mathematic models were an essential factor for the development of financial market and economy. Currently, Vietnamese accounting is using historical cost methods for the financial assets, the fair value of financial assets was not only evaluated by financial mathematics models was but also applied by firms. How was the effect of using of financial mathematics models and hedging activities for financial risks? If the enterprises apply financial mathematics models for hedging activities, how will they get benefits? The article analyzed and emphasized using the method of derivative instruments accounting, financial mathematic models and financial analysis to find out affecting factors to help managers evaluate the actual value of financial assets and investors well manage financial risks

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1. Introduction

As published by the Vietnamese Chamber of Commerce and Industry (VCCI) and the World Bank (WB), in 2011 Vietnam had 622,977 entities in which 79,014 entities were bankrupted. This problem is concerned with financial risks or not and why? Thus, the article reviews the use of derivative financial instruments for financial hedge and their effects to minimize the financial risks of the entities and bankrupt entities as well as their impacts on financial markets through decisions of investors and managers because their decisions are based on analysis results of financial statements. A country's accounting policy has not applied the derivative financial instruments for financial hedging, leading to affect that country's economy or not? Especially, the financial markets of Vietnam or countries with similar economies have not also applied the hedge accounting to their hedge activities. The article uses the accounting theories of international accounting standards and Generally Accepted Accounting Principles in the United States and applies the methods of data analysis in the financial statements to show the results of hedge accounting that are concerned with bankruptcy, financial risks and economy decline. Moreover, the hedging activities are necessary for the entities and investors. Even though the entities and investors do not expect the risks, the risks are still always present in all investment decisions or transactions of the entities, investors, and these risks can transform their dreams from "sweet dreams" to "bitter consequence". Depending on the risk level can cause financial losses, or it makes the entities in the exhausted financial state and even bankrupt. Therefore, the entities or investors need to consider the hedging activities in order to minimize the damage caused by the risks for the entities and investors. Many financial institutions and entities have used the derivative financial instruments to hedge exposure to different risks (e.g. Interest rate risk, foreign exchange risk, commodity risk, etc....).

Currently, although Vietnam hasn't issued the financial instruments accounting standards yet, in November 6, 2009 the Vietnamese Ministry of Finance issued Circular No. 210/2009/CMOF to guide the application of international accounting

standards (financial statements presentation and financial instruments disclosure) and this Circular is applicable to all entities' financial business fields. These international accounting standards include IAS 32 Financial Instruments: Presentation; IAS 39 Financial Instruments: Recognition and Measurement; International Financial Reporting Standards (IFRS 7) Financial Instruments. However, the drafted guideline contents are also unclear and irrelevant, leading to the entities' the practical application of this circular face many difficulties.

2.METHODOLOGY

The article applies the financial mathematical formulas to evaluate the fair value of assets such as crude oil, coffee prices and securities prices. Applications of derivative instruments for hedging activities are necessary. In addition, the application of financial mathematical formulas for stability of the exchange rate and commodity price when the prices and exchange rates are varied on the market.

2.1 Evaluation of Forward Price

The forward contracts are applied to a big volume of goods transactions (common goods, financial assets, exchange rates, etc.), and are determined at a time in the future at a fixed price and are agreed under regulations at the time of contract signing. From date of contract signing to the date of contract maturity that is called contracts period and the contract's payment date is called date of maturity.

The forward contracts for trading foreign currency or imported and exported goods are evaluated by forward rate formula as follows:

- (1), F is the forward rates
- (2), r_d : the interest rate of the evaluated currency, i.e. Viet Nam Dong (VND) rates
- (3), r_y : the interest rate of the basic currency, i.e. United States Dollar (USD) rates
- (4), S is the current rates, such as $S = \text{USD} / \text{VND}$.

$$F = s \times \frac{(1+r_d)}{(1+r_y)} \quad \text{Formula (1)}$$

The formula (1) assesses as follows:

The first case: if the interest rate of the evaluated currency is greater than the interest rate of the quoted currency:

$$r_d > r_y \Rightarrow 1+r_d > 1+r_y \Rightarrow \frac{(1+r_d)}{(1+r_y)} > 1 \Rightarrow F > s. \text{ It is called an increase in the forward rate point.}$$

The second case: if such interest rate of the evaluated currency is less than the interest rate of the quoted currency:

$$r_d < r_y \Rightarrow 1+r_d < 1+r_y \Rightarrow \frac{(1+r_d)}{(1+r_y)} < 1 \Rightarrow F < s. \text{ It is called deduction of forward rates point.}$$

Combining two cases above we see that the forward rate can be summarized as follows: $F = S + \text{forward point}$, in which the forward point can be positive (+) or negative (-) and is determined based on the current price ratio and interest rate differences between the evaluated currency and the quoted price. Assuming that the fiscal year is 360 days and the interest rate is percentage per year.

Forward rate of purchase:

$$F_p = s_p + \frac{s_p \times (Lgt(VND) - Lcv(NT)) \times N}{100 \times 360} \quad \text{Formula (2)}$$

Forward rate of sale:

$$F_s = s_s + \frac{s_s \times (Lcv(VND) - Lgt(NT)) \times N}{100 \times 360} \quad \text{Formula (3)}$$

In which:

- (1), F_p : forward rate of purchase and s_p is the current rate of purchase,
- (2), F_s : forward rate of sale and s_s is the current rate of sale,
- (3), $Lgt(VND)$: deposit interest rate and $Lcv(VND)$ is loan interest rate in Viet Nam Dong (VND).
- (4), $Lgt(NT)$: deposit interest rate and, $Lcv(NT)$ is loan interest rate in foreign currency
- (5), N is the number of days of the forward contracts.

2.2. Evaluation of Forward Rates

Swaps are foreign exchange transactions that simultaneously include both transactions: purchase and sale of the same amount of currency among different countries, in which the maturity of two different transactions and rates of two transactions are determined at the time of the contract signing. Characteristics of foreign exchange (FOREX) Swaps.

- (1), In the swap contracts, if the first partner carries out the first purchase and last sale, the second partner will carry out the first sale and last purchase (or vice versa).

(2), Purchase and sale are signed on the same day of the contract signing date (trading days) in the same contract and with the same partner (or vice versa).

(3), The amount of purchase and sale of currency is equal for both sides (purchase and sale) of swap contracts.

Purchase value and sale value is on the same date. Formula (2) and (3) are evaluated for forward rates of foreign exchange. The enterprises can use the financial mathematical models to evaluate the fair value to adjust the value of financial assets and financial liabilities when using derivative instruments to evaluate effectiveness of contracts by the formula of discounted cash flow. The percentage-discounted rate is evaluated as follows:

$$PV = \sum_{t=1}^n \frac{C_t}{(1+r)^t} \quad \text{Formula (4)}$$

In which:

(1), PV: Current estimated fair value

(2), T: Time of cash flow

(3), N: Total execution time

(4), r: interest rate

(5), C_t : The net cash flow at time t

Discounted cash flow (DCF) is a means of determining the present value of future cash flow by using the concepts of time value of money. According to time value of money, money now (due to its earning potential) is worth more than money in the future. The further into the future cash is to be received, the less it is worth today.

3. RESULTS

The authors apply financial mathematical formula to evaluate the fair value of assets such as the value of crude oil, coffee, and securities prices from actual data. These results are basis to assess the effects of the business and find out the impact factors of commodity price fluctuation on the market.

3.1. Evaluation of forwards price of purchased commodity

The article is assumed from the actual data of Dung Quat oil factory. The monthly price of crude oil is varied in the world and together with demand for imported crude oil of Dung Quat oil factory, how does this varied price affect his profits? The article uses the method of derivative instruments accounting and evaluating formulas to assess their effectiveness based on data on oil price volatility as follows:

Table 1- Oil price volatility in 2011 and 2012

Month	Monthly average price: \$ unit/barrel
Sep-2011	85.51
Oct-2011	86.32
Nov-2011	97.16
Dec-2011	98.56
Jan-2012	100.27
Feb-2012	102.20
Mar-2012	106.15
Apr-2012	103.60

Sources: www.worldoils.com/oilprice.php

Assume that Dung Quat oil refinery factory has to import crude oil to process and sell for domestic agents and maximum capacity of the factory is 6.5 million tons of crude oil/year, equivalent to 148,000 barrels/day. However, fluctuation of crude oil price has affected his input material. If the factory does not use derivative instruments to hedge the price, he will pay at market price. As the result, he will suffer heavy losses due to price volatility of crude oil in the market. In case he uses derivative instruments to perform transactions with partners, how does he get benefits? These problems are provided below.

Step 1: The firm uses forward contracts for crude oil transactions and determines the crude oil reserves of 8 months, equaling to 240 days. It means that he begins signing contracts with partners to purchase crude oil in Sep – 2011 and the maturities of contracts are in Apr-2012. Simultaneously, he determines VND deposit interest rate and foreign currency interest rate in Sep – 2011. Assume that the State Bank of Vietnam issued the Circular No.30/2011/TT-NHNN to guide specified maximum interest rate that is 14.5%/year for deposits in Vietnam dong of organizations and individuals in credit institutions and branches of foreign banks and foreign currency is freely convertible 6.6 % /year. When the forward contracts are signed with a partner, these contracts are considered the assets of the enterprise. So, they are evaluated following fair value at the date of the financial statements.

Step2: using a formula (2) to evaluate forward price of crude oil barrel with VND interest rate of 14.5%/year, the foreign currency is 6.6%/year and the spot price is \$85.51/barrel in Sep-2011 as follows:

$$F_p = \$85.51 / \text{barrel} + \frac{\$85.51 / \text{barrel} \times (14.5\% - 6.6\%) \times 240}{100 \times 360} = \$86.07$$

The enterprise can base on this forward rate to sign the contracts with partners at price level of \$86.07/barrel. Although he cannot forecast market price increase or decrease of crude oil in the future, he still can determine crude oil price to pay in the future.

Step3: quarterly, the enterprise can use discounted cash flow formula (4) to evaluate the value of forward contracts following market price at 6.6 %/year interest rate of foreign currency, equivalently to 0.55%/month. It means that in Nov-2011, he evaluates the fair value of the forward contracts at the market price of \$97.16/barrel as follows:

The value of adjusted inventory is $148,000 \text{ barrels} \times (\$97.16 - \$86.07) = \$1,641,320$. The fair value of the forward contracts is

$$PV = \frac{\$1,641,320}{(1+0.55\%)^5} = \$1,596,919$$

The market price of increased crude oil leads to increase of crude oil inventories and equals to \$85.51 (value book) plus (\$97.16/barrel minus \$86.07/barrel) equal to \$96.60/barrel or \$ 96.60/barrel multiply 148,000 barrels equal to \$14,296,800. This method is Mixed-attribute model. From the results above, we can adjust forward contracts decrease and is \$1,596,919 and Adjustment of crude oil inventory increase is \$1,641,320 leading to difference level of cash flow impact is $\$1,641,320 - \$1,596,919 = \$44,401$.

In Feb-2012, the market price of crude oil still increases to \$102.20/barrel leading to the value of crude oil inventories is $\$102.20 - \$97.16 = \$5.04/\text{barrel}$, $\$5.04/\text{barrel} \times 148,000 \text{ barrels} = \$745,920$. The evaluation of forward contracts' fair value is:

$$PV = \frac{\$745,920}{(1+0.55\%)^2} = \$737,782.08$$

This case is similarly adjusted as above. Because, the market price of crude oil still increases leading to decrease of the forward contracts and increase of crude oil inventories. Forward contracts are adjusted to be \$737,782.08 and Crude oil inventories are adjusted to be \$745,920 leading to different level of cash flow impact is \$8,137.92.

In Apr-2012, the accumulated value of crude oil inventory is varied by market price, equal to \$85.51 (value book) + (\$97.16/barrel - \$86.07/barrel) + (\$102.20 - \$97.16) = \$101.64 /barrel $\times 148,000 \text{ barrels} = \$15,042,720$. This month is also the settlement date of contract. So, the enterprise only pays the partner at forward price of \$86.07/barrel with amount of \$86.07/barrel $\times 148,000 \text{ barrels} = \$12,738,300$. The value of crude oil inventories is calculated at market price and is \$103.60/barrel $\times 148,000 \text{ barrels} = \$15,332,800$. The enterprise makes the accumulated adjustment of forward contracts: $\$1,596,919 + \$737,782.08 = \$2,334,701$.

The accumulated value of crude oil inventories is varied by market price, equals to $\{11.09 + 5.04 + (\$103.60 - 102.20)\} = \$17.53/\text{barrel} \times 148,000 \text{ barrels} = \$2,594,440$.

Alternatively, we can calculate the value of crude oil inventories can be varied by market price, equal to $(\$103.60/\text{barrel} - \$86.07/\text{barrel}) \times 148,000 \text{ barrels} = \$2,594,440$. It means that the market price at the settlement of contract minus the forward price and multiply the volume of commodities. The value of commodities increases when the market price of commodities varies.

The financial assets are evaluated by market price and the discounted cash flow leads to the different results between the value of the adjustment account of forward contracts and the account of commodity value. The different value level is \$52,539, note: $\{(\$1,641,320 + \$745,920) - (\$1,596,919 + \$737,782.08)\}$. On the other hand, we can calculate it by $\$44,401 + \$8,137.92 = \$52,539$. This is total difference level of cash follow impact.

From the results above, the enterprise gets profit from the difference between market price and forward price. Simultaneously, he applies forward contracts for hedging activities and it brings about his business effectiveness.

From the results, the author set up Table 2 to summarize the impact on income, the result in this table indicates the volatility of crude oil price. The data of Table 2 shows the volatility of crude oil price from Sep - 2011 to Apr - 2012. This volatility has affected the income of crude oil when crude oil prices are \$97.16/barrel, the enterprise uses forwards price to purchase crude oil with price of \$86.07/barrel, leading to his inventories is $148,000 \text{ barrels} \times (\$97.16 - \$86.07) = \$1,641,320$. The enterprise uses discounted cash flow method leading to the value of the forward contracts is \$1,596,918.995 and impact of cash flow result is $\$1,641,320 - \$1,596,918.995 = \$44,401.005$. The next volatility of crude oil prices is explained similarly leading to the results in Table 2 that we can see the impact of cash flow at the market value.

Table 2 – Summarization of impact on oil income

Date	Inventories adjustment (A)	Forward contracts adjustments (B)	Cash flow impact (C)
Sep-2011	\$0.00	\$0.00	\$0.00
Nov-2011	\$ 1,641,320	-\$1,596,918.995	\$ 44,401.005
Feb-2012	\$745,920	-\$737,782.079	\$8,137.921
Apr-2012	\$207,200	-\$259,738.925	-\$52,538.925
Total:	\$2,594,440	-\$2,594,440	\$0.00

Note: The results of (C) = results of (A) + results of (B)

3.2. Evaluation of fair value of sold commodity:

Also, the article is assumed from actual data of Robusta coffee. Assume that the Robusta coffee business firm applies forward contracts to sell it. In this case, how much profit can he get? From market price volatility of Robusta coffee in the world of table below, the article can prove how much profit he can get.

Table 3 – Robusta Price volatility from Jul-2012 to Mar-2013

Month	Robusta coffee Price	
	(US cents per Pound) equal to	(USD per Pound)
Jul-2012	113.37	\$1.1337
Aug-2012	113.01	\$1.1301
Sep-2012	110.87	\$1.1087
Oct-2012	109.89	\$1.0989
Nov-2012	102.94	\$1.0294
Dec-2012	102.3	\$1.023
Jan-2013	105.79	\$1.0579
Feb-2013	109.7	\$1.097
Mar-2013	112.67	\$1.1267

Sources: www.indexmundi.com.

The data in the table No 3 shows Robusta Price volatility on the market from Jul-2012 to Mar-2013 and together with data reported by the Highland Coffee Investment import-export joint-stock Company, he exports 200,000 tons of coffee per year, equivalently to 440,924,524.37 pounds (1 pound = 0.45359237 kg). This volume of export coffee is huge. If he does not use forward contracts, Robusta Price volatility will significantly affect his benefits. Therefore, the enterprise can use forward contracts for hedging the price volatility.

Step 1: the firm uses discounted cash flow formula (3) to evaluate forward price and determine the loan interest rate (VND), deposit interest rate of foreign currency (USD) and the spot price at the signing date of contract. In this case, the spot price is \$1.1337/pound in Jul-2012. In December 2012, Governor of the Vietnam State Bank issues the circular No.33/2012/TT-NHNN to guide regulations of short-term interest rates in Vietnam dong of credit institutions and branches of foreign banks and the maximum short-term interest rate in Vietnam dong is 13%/year. In June 1, 2011, Governor of the Vietnam State Bank also issued the Circular No.14/2011/TT-NHNN to guide regulations of maximum interest rate in the dollar of 2%/year, and maturity date of the contract in Mar-2013, equal to 270 days (Year = 360 days). This information is basis to evaluate forward price of the contracts.

Step 2: Applying the formula (3) to evaluate forward contracts as follows:

$$F_s = \$1.1337/\text{pound} + \frac{\$1.1337/\text{pound} \times (13\% - 2\%) \times 270}{100 \times 360} = \$1.1346$$

At the signing date of forward contracts, the fair value of forward contracts is evaluated equally to zero. Assume that quarterly, the forward contracts are evaluated by market price at the date of financial statements. Sep-2012 is the date of the financial statements. So, the fair value of forward contracts is evaluated as follows:

In Sep-2012, the market price of Robusta coffee is \$1.1087/pound and the fair value of forward contracts is evaluated following formula (4), $C_t = \$1.1346/\text{pound} - \$1.1087/\text{pound} = \$0.0273/\text{pound} \times 440,924,524.37 \text{ pounds} = \$11,435,510.919$, with the discount rate of 2%/month.

$$PV = \frac{\$11,435,510.919}{(1+2\%)^6} = \$10,154,406.437$$

This case, the enterprise can get the present value of \$11,596,314.99 at maturity date of contracts within 6 months.

In Dec-2012, the enterprise evaluates the value of forward contracts to determine coffee price volatility at the date of financial statements. This time, the coffee price decreases to \$1.023/pound, but the enterprise still gets the amount due to price difference of coffee. $C_t = \$1.1087/\text{pound} - \$1.023/\text{pound} = \$0.0857/\text{pound} \times 440,924,524.37 \text{ pounds} = \$37,787,231.74$. The value of forward contracts is \$37,787,231.74, within 3 months. The accumulated gains of forward contracts: $\$10,154,406.437 + \$35,607,752.43 = \$45,762,159$

Mar-2013 is the maturity of forward contracts and the enterprise sells the coffee at market price of \$1.1267/pound lead to difference price between the forward price and the market price. Assume that in May 2012, the enterprises' input of the Robusta coffee Price is \$0.953/pound (Sources: www.thuongmai.vn). The enterprise can recognize as follows:

Determining the value of assets, sales revenue and cost of goods sold etc relates to recognition such as: The cash amount of sale and sales revenue are calculated: $\$1.1267/\text{pound} \times 440,924,524.37 \text{ pounds} = \$496,789,661.61$. The cost of goods sold is $\$0.953/\text{pound} \times 440,924,524.37 \text{ pounds} = \$420,201,071.72$.

This market price is \$1.1267/pound, the firm has loss of \$45,723,873.18 note: $(\$1.023/\text{pound} - \$1.1267/\text{pound}) \times 440,924,524.37 \text{ pounds}$. If the enterprise sells coffee at \$1.023/pound, he will have losses of \$45,723,873.18, because of the lowest Robusta coffee Price. The accumulated gain of forward contracts is $\$10,154,406.437 + \$35,607,752.43 + (-\$45,723,873.18) = \$38,285.69$ and; The accumulated amount of cash flow is $\$11,435,510.92 + \$37,787,231.74 + (-\$45,723,873.18) = \$3,498,869.48$ or the amount of cash flow could be evaluated such as $440,924,524.37 \text{ pounds} \times (\$1.135/\text{pound} - \$1.127/\text{pound}) = \$3,498,869.48$. Two results are the same. The calculated formula is the sale volume of Robusta coffee \times (forward price – market price at maturity date of forward contracts). This result is different between the accumulation of cash flow and the accumulation of forward contracts e.g. $\$3,498,869.48 - \$38,285.69 = \$3,460,583.79$. This difference level is adjusted increase of forward contracts account and other comprehensive income account. This difference level is adjusted forward contracts account as

follows $-\$45,723,873.18 + \$3,460,583.79 = -\$42,263,289.38$. If the coffee is sold, the other comprehensive income is recognized in sales revenue.

In the case, the enterprise uses forward contracts to sell commodity and uses a discounted cash flow methodology to assess the impact of cash flow when commodity prices fluctuate. The results in Section 3.1.2 are set on the table and it shows fluctuation of Robusta Price in the market from Jul - 2012 to Mar - 2013. In Sep - 2012, the market price of Robusta coffee is \$1.1087/pound and the fair value of forward contracts is evaluated following formula (4), $C_t = \$1.1346/\text{pound} - \$1.1087/\text{pound} = \$0.0273/\text{pound} \times 440,924,524.37 \text{ pounds} = \$11,435,510.919$, with the discount rate of 2%/month. The enterprise uses discounted cash flow method to evaluate the sale price of \$10,154,406.437 and unrealized profits between the market price and the forward price of \$11,435,510.92. This result, Cash flow impact is \$1,281,104.48 ($\$11,435,510.92 - \$10,154,406.44$) and in Dec-2012, the result of Cash flow impact is similarly evaluated.

Table 4 – Summarization of impact on income

Date	Gain/loss (A)	Forward contracts adjustments (B)	Cash flow impact (C)
Jul-2012	\$0.00	\$0.00	\$0.00
Sep-2012	\$11,435,510.92	\$10,154,406.44	\$ 1,281,104.48
Dec-2012	\$37,787,231.74	\$ 35,607,752.43	\$2,179,479.31
Mar-2013	-\$45,723,873.18	-\$42,263,289.38	-\$3,460,583.79
Total:	\$3,498,869.48	\$3,498,869.48	\$0.00

Note: The results of (C) = results of (A) – results of (B)

Results of the table above shows gain/loss of Forward contract adjustments and the impact of cash flow, which help investors and managers, see the volatility of financial assets at date of financial statements.

3.3. Evaluation of Forward Rates of Foreign Currency Exchange

The biggest risk is significant investment in the stock market while the economy is unstable. The economy can go up or can also go down quickly and make investors unpredictable. The negative factors of the economy could cause the stock market index fell sharply lagged. In general, the risk factors of the economy are beyond the control of the investors. Almost investors will be severely affected, if the economy goes down. Besides, the inflation also affects the investors and firms. Because of the inflation, the firms always adjust the value of securities inventories by market price or the quoted price at date of financial statements. The investors or managers should apply derivative instruments to hedge risks as assumed below:

In February 2013, the firm had transactions of foreign currency with the Bank (Techcombank) as follows:

- (1), Sold foreign currency with an amount of \$200,000 (beginning debit balance), current exchange rate was VND20,855/\$1, historical exchange rate was VND20,720/\$1, and exchange rate on the payment date of firm was VND20,815/\$1.
- (2), In March 2013, purchased foreign currency to pay the first economic transactions with an amount of 120,000 USD, current exchange rate was VND20,855/\$1, and spot rate was VND21,960/\$1. (Deposit interest rate of USD is 2%/year, deposit interest rate of VND is 9%/year, loan interest rate of USD is 5%/year, loan interest rate of VND is 15%/year, those data from the Source: website: vietcombank.com.vn of the bank).

This case, the firm also uses swap contracts for purchase and sale of foreign currency with the Bank (Techcombank) and the maturity of the contract is 3 months. The bank and the firm identify and agree upon forward rate and they swap this exchange rate together with relationship of purchase and sale as follows: (applying formula (2) and (3)). The forward rate for sale bases on, $Lcv(VND) = 15\% / \text{year}$, $Lgt(NT) = 2\% / \text{year}$, $N = 3 \text{ months} = 90 \text{ days}$.

$$F_s = 20,855 + \frac{20,855 \times (15\% - 2\%) \times 90}{100 \times 360} = \text{VND}21,465 / \$1$$

The forward rate for sale equals to (VND/USD) 20,857. The forward rate for purchase bases on, $Lgt(VND) = 9\% / \text{year}$, $Lcv(NT) = 5\% / \text{year}$ and $N = 3 \text{ months} = 90 \text{ days}$.

$$F_p = 20,855 + \frac{20,855 \times (9\% - 5\%) \times 90}{100 \times 360} = \text{VND}21,042.7 / \$1$$

The forward rate for purchase equals to VND21,043/\$1. The asset value is evaluated at forward rate: $F_p = 20,042.7$; $F_s = \text{VND}21,465 / \1 as follows:

- (1), Sale of foreign currencies: the forward rate: VND 4,293,000,000 equal to \$200,000 multiplies VND21,465 /\$1.
- (2), Historical exchange rate: VND 4,144,000,000 equal to \$200,000 multiply VND20,720 /\$1.
- (3), Difference of two exchange rates between forward rate and historical rate: VND 149,000,000 equal to \$200,000 multiply VND21,465 /\$1 minus VND20,720/\$1].
- (5), Purchase of foreign currencies, the spot rate: \$2,635,200,000 equal to \$120,000 multiply VND21,960/\$1.
- (6), The forward rate: VND 2,525,400,000 equal to \$120,000 multiply VND21,042.7/\$1.

Difference of two exchange rates between forward rate and spot rate: VND110,076,600 equal to \$120,000 multiply [VND21,960/\$1 minus VND21,042.7/\$1].

4. DISCUSSION

Accounting methods play an important role in the recognition process and adjustment of the economic transactions that occur. At the same time, these methods help enterprises track the volatility of asset values. The results above show that when enterprises use forward contracts to purchase crude oil, these contracts bring profits for enterprises.

The item 3.1 shows methods of accounting recognition of the other comprehensive income and adjusted balance account. When he uses forward contracts, these forward contracts will become his property and he needs to open account of forward contracts to track the volatility of asset values. Quarterly, the enterprise needs to evaluate the property at date of financial statements, and uses a discounted cash flow (DCF) formula to evaluate their effectiveness. This article gives the accounting methods and guides recognition of the asset value volatility such as forward contracts accounts, cash accounts, other comprehensive income account and inventory account. In case the enterprise uses forward contracts to purchase commodities, contract performance will occur two cases. The first case, the market price is higher than forward price at the date of the financial statements. The second case, the market price is lower than the forward price at the date of the financial statements. The cases above, the volatility of crude oil prices is always increased leading to forward contracts is lost, but the inventories increase, why?

If the value of forward contracts is evaluated by market price, the market price of crude oil increases. It means that the enterprise must pay more money. However, the payment amount is recognized in the value of oil inventories as the forward price of \$86.07/barrel, but at the date of the financial statements, the price of crude oil increase to \$ 97.16/barrel leading to increase the value of the contract. It means that when the value of forward contracts increases, the amount paid to a partner also increases. If the enterprise does not use forward contracts, he will pay \$1,641,320 more. Moreover, the inventory value is still evaluated increase by an increased market price. The difference level between the increased or decreased value of crude oil inventories and the fixed price of forward contracts is gain or loss. In the case above, the enterprise gets profit. The results above show that the value of forward contracts is evaluated by market price while the market price always increases. Therefore, the results in table 4 do not show the gain on forward contracts due to increase of the market price at the time of the contract's value evaluation. In Mar-2012, the forward contracts are gained because the market price increases to \$106.15/barrel. However, in Apr-2012, the market price decreases to \$103.60/barrel leading to the enterprise has losses of \$377,400. It means that if the market price approximates with the fixed price of forward contracts, unrealized profits go down. If the market price equals to the fixed price of forward contracts, the unrealized profits will be zero. If the market price is lower than the fixed price of forward contracts, the unrealized profit will be negative leading to losses.

The cash flow on forward contracts is evaluated by the discounted cash flow method. Because, the contract is long-term, it can be considered as an investment project. Therefore, the enterprises should use the discounted cash flow method to assess the benefit and the impact of the time value of cash flow.

+ $PV > 0$: to determine the discount rate r , the present value of the income flow is greater than the initial investment cost.

+ $PV = 0$: to determine the discount rate r , the present value of the income flow equals to the initial investment cost.

+ $PV < 0$: to determine the discount rate r , the present value of the income flow is less than the initial investment cost.

For the reasons above, the value of forward contracts is evaluated lower than its real value to ensure the safety of investment capital, leading to the difference between the evaluated value of forward contracts and evaluated values of crude oil inventories. This difference level is adjusted decrease of cash account as the adjusting entry above. Simultaneously, unrealized profit is adjusted accordingly. The debit balance or credit balance of other comprehensive income account will be recognized in sales revenue when inventories are sold. If the inventories have not sold yet, it will be recognized like the unrealized profit of the equity in the balance sheet. The case above, the crude oil inventories is not sold leading to \$2,334,701 of credit balance of other comprehensive income account is still an unrealized profit of equity in the balance sheet. The results show that the value of crude oil inventories equals to $\$86.07/\text{barrel} \times 148,000 \text{ barrels} = \$12,738,360$, and amount of payment equals to $\$86.07/\text{barrel} \times 148,000 \text{ barrels} = \$12,738,360$ lead to non-difference. However, the process of their evaluation and adjustment leads to the difference. E.g., the sales revenue is \$16,724,000, the cost of crude oil inventories is \$12,738,360 and the accumulated value of crude oil inventories is varied by market price of \$2,594,440. Total crude oil inventories equals to $\$12,738,360 + \$2,594,440 = \$15,332,800$. The undistributed profits equals to $\$16,724,000 - \$15,332,800 = \$1,391,200$. This difference level of \$2,594,440 is recognized in the undistributed profit account, equal to $\$1,391,200 + \$2,594,440 = \$3,985,640$. This result shows that if the enterprise uses forward contracts to purchase 148,000 barrels of crude oil per day, he has profit of \$2,594,440. If the enterprise purchases volume of crude oil to reserve inventories in 8 months, he has profit of $240 \text{ days} \times \$2,594,440 = \$622,665,600$ from the difference between forward price and market price.

Note: when the forward contracts are settled, two cases will occur.

The first case, the commodities are purchased by the market price and amount of payment is calculated by the forward price, which leads to the difference between them. This difference level is recognized in the undistributed profit account in the balance sheet. E.g. the value of crude oil inventories equals to $\$103.60/\text{barrel} \times 148,000 \text{ barrels} = \$15,332,800$, but amount of payment equals to $\$86.07/\text{barrel} \times 148,000 \text{ barrels} = \$12,738,360$ and the difference level is \$2,594,440 and is recognized in the undistributed profit accounts in the balance sheet.

The second case, if the value of crude oil inventories equals to $\$86.07/\text{barrel} \times 148,000 \text{ barrels} = \$12,738,360$ and amount of payment also equals to $\$86.07/\text{barrel} \times 148,000 \text{ barrels} = \$12,738,360$ leading to non-difference. However, the process of their evaluation and adjustment leads to the difference and this difference level is recognized in sales revenue.

In spite of the difference between two accounting methods, the results of profit are the same. This proves as follows: for the first case, if the sale price of crude oil is \$113/barrel, the sales revenue equals to $\$113/\text{barrel} \times 148,000 \text{ barrels} = \$16,724,000$,

and the cost of crude oil inventories is \$15,332,800. From the sales revenue and the cost of crude oil inventories, the undistributed profits equals to $\$16,724,000 - \$15,332,800 = \$1,391,200$. After that difference level of \$2,594,440 between the market price and the forward price is recognized in undistributed profit equaling to $\$1,391,200 + \$2,594,440 = \$3,985,640$ and total undistributed profit is \$3,985,640.

In the second case, the sales revenue is also \$ 16,724,000, the cost of crude oil inventories is calculated by forward price and is \$12,738,360. The accumulated profit of crude oil inventories is adjusted by market price and is \$2,594,440. From cost of crude oil inventories and the accumulated profit of crude oil inventories, total of crude oil inventories equals to $\$12,738,360 + \$2,594,440 = \$15,332,800$. This difference level of other comprehensive income is \$2,594,440 that is recognized in sales revenue. This sales revenue equals to $\$16,724,000 + \$2,594,440 = \$19,318,440$. As a result, the undistributed profit equals to $\$19,318,440 - \$15,332,800 = \$3,985,640$.

The 3.2 item shows the inventory adjustment, forward contract adjustments and cash flow impact. At the beginning, this value is adjusted and it is zero, in Nov-2011, the inventory adjustment account is adjusted increase to \$1,641,320, the forward contract adjustment account is adjusted decrease to \$1,596,918.995, leading to the difference of \$ 44,401.005 between them. It means that the impact of the time value of cash flow is \$44,401.005 with determined interest rate of foreign currency that is freely convertible 6.6 %/year and equals to 0.55%/month. In Feb-2012 and Apr-2012, the results are discussed the same as above. From the results of this table, the enterprise can assess the effect of using forward contracts at the date of financial statements.

The item 3.2 also shows the recognition method of accounting which is applied to commodity sale. This case, the enterprise can use other comprehensive income account and forward contracts account to adjust the difference level between the forward price and market price at the date of financial statements. The forward contracts are applied to sell Robusta coffee when the Robusta coffee price is volatile by market price. If the market price is lower than the forward price, the difference level is adjusted increase in other comprehensive income account and adjusted decrease in forward contracts account. If the market price is higher than forward price, they will be contrarily adjusted. When the forward contracts are settled, this account balance will be recognized in the cash account and sales revenue account. In Sep-2012, the difference level is \$10,154,406.44, in Apr-2013, the difference level is \$35,607,752.43 with the discount rate of 2%/month. In Mar-2013, the market price of coffee suddenly increases to \$1.1267/pound. If comparing the market price with the price of the accounting period in Dec-2012, the enterprise has loss of \$42,263,289.38. However, the forward price is still higher than the market price at settlement date of forward contracts. Therefore, he has profit of \$3,498,869.48. Besides, the results of table 4 show volatility of the market price and the impact of cash flow when the method of discounted cash flow is applied to assess the cash flow effect of forward contracts. In Sep-2012 and Dec-2012, the volatility of market price has a favorable trend for enterprise. However, in Mar-2013, the volatility of market price has an unfavorable trend for him because the market price approximates the forward price. If the value of forward contracts is evaluated in full time, the enterprise still has profit. In addition, the results of this table are the bases for investors to be able to assess the financial risk of the enterprises fully.

4.1. Difference of Accounting Method between Forward Contracts for Purchase and Sale:

The research results above show the difference between using forward contracts for purchase and sale. This difference, the firm can clearly understand the application of accounting methods and their benefits as follows:

4.1.1. Application of forward contracts for commodity purchase

For commodity purchase, the forward contracts are considered as assets so that they are tracked, and evaluated at the date of financial statements. The inventories are adjusted gain or loss. After that, the gain or loss of inventories and the other comprehensive income are accumulated on the maturity date of forward contracts. The gain or loss of account balance of other comprehensive income is recognized in the undistributed profit when commodity inventories are sold. If the value of commodity purchase and amount of payment is calculated by forward price, the total value of inventories equals to value of commodity purchase by the forward price plus accumulation of gain or loss of inventories.

4.1.2. Application of forward contracts for commodity sale

For commodity sale, the inventories are not adjusted, but the forward contracts and other comprehensive income are adjusted. The maturity date of forward contracts, the gain or loss of forward contracts and the other comprehensive income are accumulated. After that, the other comprehensive income is recognized in sales revenue, and the gain or loss of forward contracts is recognized in the cash account. The sales revenues and receivable account are calculated by forward price. The difference helps the firms avoid mistakes when they apply the forward contracts for purchase and sale. The accounting methods affect the relevance and reliability of accounting information.

4.2. Disadvantage of non-applying derivative instruments

In case of non-application of derivative instruments, the firms can encounter financial risk when goods price is varied by market price. From the facts above, the results can be compared below.

4.2.1. Results of profit

The securities transaction is calculated as follows: when foreign currencies are sold, the exchange rate of payment is VND $4,163,000,000 = \$200,000 \times \text{VND}20,815/\1 . The historical exchange rate is VND20,720/\$1, the historical cost of foreign currency is VND $4,144,000,000 = \$200,000 \times (\text{VND}20,720/\$1)$. The difference level of two exchange rates between the exchange rate of payment and historical exchange rate equals to VND $19,000,000 = \$200,000 \text{ USD} \times [\text{VND}20,815/\$1 - \text{VND}20,720/\$1]$.

From the results above, the profit of Robusta coffee equals to \$496,789,661.61 minus \$420,201,071.72 equal to \$76,588,589.89. The profit of crude oil equals to \$16,824,640 minus \$15,332,800 equal to \$1,491,840 and profit of foreign currency equals to VND 19,000,000 (Revenue of Financial Activities) minus VND 0,000 (Financial expense equal to zero) equal

to VND 19,000,000, equivalently to (\$1/VND 20,856) \$911.01. If the firm does not apply derivative instruments accounting, the total profit equal to \$76,588,589.89 plus \$1,491,840 plus \$ 911.01 equal to \$78,081,340.90.

4.2.2. Comparing between two financial statements

The objective of financial statements is to provide useful financial information to investors and managers. Because, this financial information helps them analyze financial targets. From result of analysis, they can decide investment or not. However, when the principles, requirements and guidelines of established financial statements are not clear and uncompleted and lack uniformity, or are difficult to understand for application, the financial statements will not ensure the relevance and reliability and will be less useful. Useful financial information will draw special attention of many professional organizations, researchers, organizations of accounting practices in the world in recent years.

From the analysis results above, these results are compared to assess the effectiveness of two accounting methods when they are applied in the same economic event that occurs. How is the difference between application and non-application of derivative instruments for the crude oil trading? When the crude oil is purchased, the firm's profit is \$2,334,701 per day from different price. If the volume of his crude oil is purchased to reserve for a year, the firm's profit will increase to \$2,334,701 per day multiply 360 days equal to \$840,492,360 from use of forward contracts. However, in case, the firm does not apply them, the different price will not occur leading to the firm will lose \$840,492,360 per year (If not using of forward contracts). The sales of Robusta coffee are also similar, in case the Robusta coffee transaction is applied derivative instruments for hedging activities and the firm has the profit of \$3,498,869.48 per year. If the firm does not apply derivative instruments for hedging activities, the firm will not have the profit of \$ 3,498,869.48 per year.

For foreign currency transaction, this transaction is applied swap contracts for purchase. The firm has the profit of VND110,076,600 with exchange rate is (\$1/VND 21,042.7), equivalently to \$ 5,231.11 from difference level between the forward exchange rate and market exchange rate and the sale profit of \$1,313.77. The total firm's profit is \$1,912.16. However, if the foreign currency transaction is not applied swap contracts, the firm's profit is only \$ 911.01. It means that the firm loses \$1,001.15.

All transactions are not applied derivative instruments for hedging activities leading to the firm loses \$1,348,553,740.49 per year. These results demonstrate that if the derivative instruments are not applied to hedging activities, the firm suffers heavy losses and gets high financial risk.

5. CONCLUSION

From the price volatility of goods that actually occurs. This article uses derivative instruments to find out the hedging effectiveness when they are applied in commodity trading. The results above show that the use of derivative instruments has avoided the risk of price fluctuation. In particular, they can be applied to any category of goods that often have price volatility and affect the business results of enterprises such as crude oil, coffee etc.

The article also provides the enterprises with the accounting methods to apply in the occurring transactions. Simultaneously, the article also combines the evaluation method of fair value and discounted cash flow to evaluate the value of the financial assets. The results above show that use of derivative instruments accounting to recognize trading of some scarce commodities and financial assets is necessary. In addition, the article also demonstrates the useful results of using derivative instruments and they are very effective hedging instruments. They are applied not only in the commodity markets, but also in the financial markets such as stock markets, interest rates, exchange rates etc.

For accounting methods: the article also shows that the steps are detailed to help enterprises use them as references for the application of commodity transactions and financial asset transactions that can occur. Although this article only gives the derivative instruments accounting methods that are applied trading goods and securities, it also brings usefulness to the enterprises. Besides, the enterprises can apply forward contracts, futures contracts, swap contracts and option contracts for hedging securities risk, interest rate risk, exchange rate risk (financial assets and financial liabilities) and these fields can be researched in another article.

For use of derivative instruments to hedge financial risk: The enterprises should use derivative instruments for hedging financial risk. Especially, the developing countries need to apply derivative instruments accounting for hedging activities because their financial markets contain much risk. Currently, some countries' accounting standards have not been converged in to international accounting standards such as Vietnam, Lao, and Cambodia etc, while their economy and financial markets are developing. If they do not apply derivative instruments accounting for hedging activities, they will face up with high financial risk. Besides, the research results also indicate the financial damage if the enterprises do not use derivative instruments for hedging activities, e.g. the fluctuation of crude oil price. Specially, the commodities affect the entire economy such as crude oil, when crude oil price increases, leading to transportation costs also increase. This cost impacts the cost of business inputs. It means that the cost of the business inputs increases leading to cost price increases and this make the competitiveness of enterprises reduced.

From the above reasons, the government should consider building the accounting policies of derivative financial instruments and issuing them for the enterprises to apply and hedge financial risk of the economy. However, the application of derivative instruments for hedging activities does not mean that the seller or the purchaser shall suffer loss business that the commodity price has to be reconciled between the seller and the buyer. The formulas above are used to calculate the price level to purchase or sell at the average price level of commodity price fluctuation, the buyer and seller share loss of business in order to minimize business risk.

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