VALUING STRATEGIC FLEXIBILITY WITH BLACK-SCHOLES OPTION PRICING MODEL

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Abstract

Purpose: The purpose of the research paper is to present a real option valuation model that will help to identify the value drivers of the JSC Rietumu Banka: one of the biggest Latvian banks that specializing in private and investment banking as well as measure the value of its strategic flexibility.

Design/methodology/approach: The empirical research appears to be correlational one as it is to study and describe issues related to Real Options Valuation – both general: application and comparison to DCF method and specific: value of JSC Rietumu Banka and the value of strategic flexibility. The rationale behind choosing a commercial Bank as a unit of research has a number of reasons. The model of Black-Scholes of option pricing is very topical for valuing companies, assets and liabilities of which are relatively comparable and continuously change in value. Thus, JSC Rietumu Banka was chosen specifically, because it is known for being more active in corporate investing activities than other commercial banks in Latvia.

Findings: The research outcomes of the paper were divided into three parts accordingly to the research questions. The first part was dedicated to estimating the value of the Bank through traditional DCF approach. The second part was answering the research question by identifying the equity value of the bank using Real Options Valuation through Black-Scholes option pricing model. The third part was dedicated to identifying implications behind valuation of a commercial bank using ROV. The main drivers that determine value of a bank and its strategic flexibility were explained and discussed.

Research limitations/implications: The main data needed for the research are financial statements for JSC Rietumu Banka. Financial reporting for company includes statements for the Bank and not for the Group. Limitation of this approach is the quantification. Real option evaluation of strategies can get lost in the mathematics.

Practical implications: There are few academic works on the topic, yet none of the major companies in the Latvia have publicized ROV application. However, the value of strategic flexibility appears to play a pivotal role nowadays, given the transition condition of Latvian economy. Furthermore, bankers can benefit from using ROV methods when analyzing and selecting the strategic alternatives.

Social implications: The paper is to sketch the outlines of a more differentiated approach towards the contribution Strategic Management and Financial Management which can help to most managers and their needs to replace traditional approaches to strategic planning and company valuation with a more aggressive one in transition economy settings.

Originality/value: Surprisingly, very few paper and books have discussed the valuation of the bank. Even in bestselling book on valuation of companies written by Koller et al, 2010, there is no example of Real Option Valuation for a bank valuation.

Keywords: real option valuation, bank valuation, strategic flexibility, transition economy
Classification: research paper

All business decisions are real options, in that they confirm the right but not the obligation to take some initiative in future. Judy Lewent, CFO, Merck

1. INTRODUCTION

Real Options methodology advantage is that it allows to value company equity taking into account the flexibility to adapt to the changing market conditions and make decisions into fast changing market settings. The purpose of the paper is to present a real option valuation model that will help to measure the value of strategic flexibility as well as identifies the value drivers of the JSC Rietumu Banka: one of the biggest Latvian banks that specializing in private and investment banking. Surprisingly, very few paper and books have discussed the valuation of the bank (Dermine, 2010). Even in bestselling book on valuation of companies (Koller et al., 2010), there is no example of Real Option Valuation (ROV) for a bank valuation. The needs to value any asset,

whether this asset is financial security, a firm or a bank, have been long recognized (Myers, 1977; Damodaran, 2002). While there are numerous valuation methods developed, Discounted Cash Flow (DCF) approach to valuation is predominantly and consistently applied to derive the value of any asset (Koller et al., 2010). The main advantage of ROV is that it accounts for strategic flexibility and deals with uncertainty, which are crucial factors in banking business, whereas DCF methods are static and do not reflect them. Real options as tools are mostly suitable for identifying the strategic capabilities of a bank to react to arising challenges successfully and profit from them. Such challenges are waiting for the banking sector in Latvia, which is one of the most developed sectors in the country. What we want to know is what market opportunities exist for maximizing the bank value? ROV would help identifies the various value drivers of the Bank and demonstrate how to capitalize of new opportunities of latest changes of Latvian legislation.

2. LITERATURE REVIEW

The originator of the theory of the DCF analysis was Williams in 1938 who wanted to find a better way of valuing stock following the 1929 crisis. The work was "rediscovered" by Shapiro and Gordon in 1956. Lately, in the changing business environment, Damodaran in 2005 states that both academics and practitioners have made an argument that conventional the DCF methods do a poor job of capturing and reflecting the value of the options that are embedded in many corporate decisions making by management. A very important limitation of DCF methods is its failure to account for the value of strategic flexibility, which is inherent in the strategic decision (Brandao et al., 2004). ROV takes it's offset in the progression in the 1970s, where Fischer Black and Myron Scholes in 1973 successfully developed models that could value financial options. It is possible to view almost any asset in an option pricing framework as pointed out Black and Scholes in 1973. Given the model's power, there have been many recent attempts to translate the models to corporate valuation technique commonly known as real option (Koller et al., 2010).

To stretch the understanding of option pricing to corporate valuation technique we can ask ourselves what the graph of call option's value relative to intrinsic would like of, hypothetically, an option were written that never matured. First answer is it would be like owning the stock itself, except the investor would receive neither dividends nor have voting right. "This is an interesting view on equity itself, which is that, as a claim against the value of the levered firm. It is rather like an option itself in which the debt represent the exercise price. It may be pointed out that option-pricing framework can provide insight to valuation of real investment opportunities as well as pricing of financial securities of all sort" (Kester, 1997).

Second answer is it would be equity that can be viewed as a call option of the bank where exercising the option requires that the bank be liquidated and the face value of the debt (which corresponds to the exercise price) paid off. If the debt in the bank is a single issue of zero-coupon bonds with a fixed lifetime, and the bank can be liquidated by equity investors at any time prior, the life of equity as a call option corresponds to the life of the bonds (Damodaran, 2002) as shown in Figure 1.
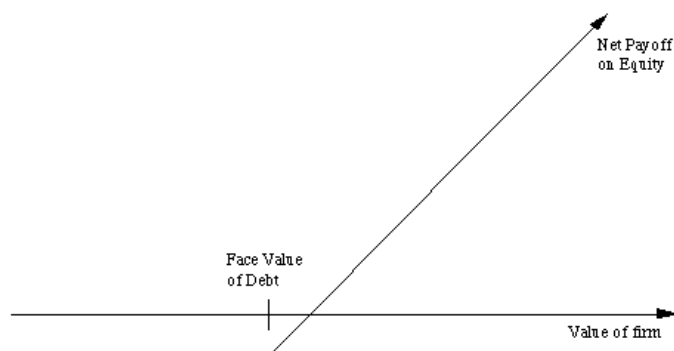

Figure 1. Payoff Diagram for Equity of Bank as a Call Option
Source: Damodaran (2002)

The most comprehensive answer has been given by Giamarinno et al. in 1988. Bank's equity can be interpreted as a call option on the bank's assets, where spot price (*S*) is to the total value of bank's assets and strike price (*X*) is the face value of total debt liabilities including deposits. Shareholders of a levered bank can, at maturity of the outstanding debt; either "repurchases" the bank from depositors by making the required principal repayment and interest payment or walks away from their liability and thus relinquishes ownership of the bank to the creditors. Thus, equity value of the bank is a value of call option.

Undoubtedly, the option valuation model is feasible for usage in bank valuation, since operations on both assets and liabilities are significant for the banking business structure. Banks manage assets in a dynamic environment that is always subject to change and bankers have the options to modify strategies to adapt to the change and to capitalize a new opportunities or respond to new challenges. ROV framework recognizes that future growth opportunity value deriving from the bank's strategic flexibility that must explicitly accounts for adaptability and competitive responsiveness and gain competitive advantage via time-to-market and first- or second-mover advantages (Smith and Trigeorges, 2006). However, ROV is still not a recognized a bank valuation technique. It might be because of ROV analytical approach used is subject to certain limitations as well. One should be stressed that due to the mathematical complexity involved, ROV application might get lost in the building of mathematical models and computation.

3. RESEARCH QUESTIONS AND HYPOTHESIS

Dependent variable is the value of equity of the Bank. Independent variables are inputs and factors, which influence the dependent variables (Sekaran, 2003) and they are as follows in current research: valuation method; volatility; risk free rate; time to maturity; total assets and liabilities; net income; cost of equity; market risk premium, beta and economic and legislation influences. Further, independent variable will be described in details. Depending on the valuation approach applied, the value might vary as different methods share both same and different input variables. Volatility is one of the most important factors of ROV. It is one of the independent variables that distinguish it from DCF analysis; therefore it is a key component to identifying viability of application of ROV. Risk free rate is used by several valuation theories to determine additional risk that should be rewarded with a rate higher than it or the rate at which market participants are able to borrow. Time to maturity is another unique factor of ROV. According to the model, it will affect the value of a business as debt liabilities financially give managers room for investing, thus potentially increasing value of the whole firm. Total assets and liabilities are variables that lie in the basis of ROV. Net income is inputs to calculating free cash flows, therefore will affect the dependent variable when calculating it through DCF methods. Cost of equity in the DCF model addresses the time-value of money and a market risk. The most common way to estimate the cost of equity within corporate finance is by use of the Capital Asset Pricing Model (CAPM). The CAPM states a linear relationship between the return on a stock and its beta, the market risk premium and the risk-free rate. Out of these, only one is individually defined for an investment: beta that measures the sensitivity of the movement in returns of a stock (dividend adjusted) relative to the movement in returns on some measure of the market. Economic and Legislation Influences: Above-mentioned dependent variable is also subject to macro and micro economical influence as well as changes in the Latvian legislation. As a result of variables review involved in the theoretical framework, the author has figured out first research questions: what is the value of JSC Rietumu Banka through application of DCF? The first research question deals with evaluation of the bank using traditional DCF approach. The second research question accounts for valuing the bank employing ROV application on the basis of Black-Scholes option-pricing formula: what is the value of JSC Rietumu Banka through application of Real Options Valuation? The value of the call option (in the research a value of bank equity) would be hypothetically bigger using ROV comparing to DCF models

taking into consideration the value of strategic flexibility. Thus, third research has been posted as follows: what value drivers would maximize the value of the bank over the next five years according to Real Options Valuation method? The third research question will be devoted to exploration of strategic opportunities of ROV application on the basis of Black-Scholes option-pricing formula.
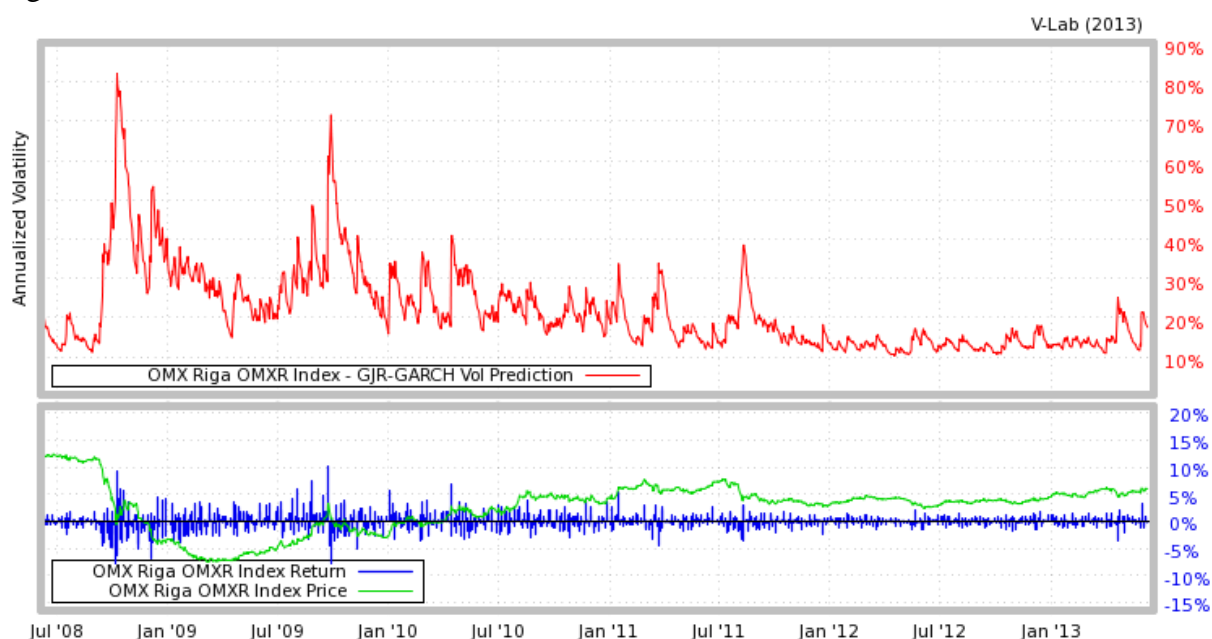

Figure 2. Volatility of NASDAQ OMX Riga
Source: V-Lab of the Volatility Institute of NYU Stern, USA (2013)

We deliver a hypothesis: Real Options Valuation is relevant in Latvian stabilized market as volatility is almost consistent according to V-Lab of the Volatility Institute of NYU Stern, USA as shown in Figure 2.

4. RESEARCH DESING

The purpose of the paper is to present a real option valuation model that will help to measure the value of strategic flexibility as well as identifies the value drivers for the JSC Rietumu Banka. Correlational investigation is one that is focused on outlining one or more factors associated with the problem by Sekaran, 2003. Thus given research appears to be correlational one as it is to study and describe issues related to Real Options Valuation – both general: application and comparison to DCF method and specific: value of JSC Rietumu Banka and the value of strategic flexibility. The rationale behind choosing a commercial Bank as a *unit of research* has a number of reasons. Firstly, it is very difficult to identify cash flows correctly for financial institutions by outsiders, which makes it difficult to fairly evaluate the firm. Secondly, the model of Black-Scholes of option pricing is very topical for valuing companies, assets and liabilities of which are relatively comparable and continuously change in value. Thus, JSC Rietumu Banka was chosen specifically, because it is known for being more active in corporate investing activities than other commercial banks in Latvia. The main data needed for the research are financial statements for JSC Rietumu Banka. Financial reporting for company includes statements for the Bank and not for the Group. For this study results are taken from separate reporting for the Bank: Income Statement; Balance Sheets, Statement of Cash Flows and Risk Management. The research is to consist of in-depth financial analysis and valuations. To answer first research question and to identify future free cash flows, income statement for future period has been projected for next 5 years based on the interview data with the Head of Risk Control Department of the Bank conducted and collected by Aleksandrs Sorokins, EBS program final year student of RISEBA, in May, 2013. To answer the second

research question, specially designed financial software will be used when Black-Scholes formula is applied. Regarding to volatility that should be estimated, it is advised to use fluctuations of company's shares prices for the calculations. However, in this particular case of JSC Rietumu Banka, the company is not listed on the stock exchange; the analyst may take the local stock exchange index for estimations as recommended by Golovina, 2010. Weighted average duration of debts will be taken from the banks financial statements' part of risk management to assess a time to maturity following Golovina, 2010, recommendations. Risk free rate is taken according to yield of governmental securities – such as bonds, Latvian 5-year bond will be used for this purpose. Assets and liabilities of the bank will be gathered from the bank's balance sheets. Answering third research question, the author will determine which components of the Black-Scholes formula are crucial to define the value of the Bank and study their meaning when estimating the value drivers of a commercial bank in the case of JSC Rietumu Banka.

5. RESEARCH RESULTS

In order answer the first question and to estimate cash flows that are needed to apply the DCF models, the researcher has to produce pro forma financial statements for the bank. Forecast will be made for a 5-year period, as projections for a longer term are considered inaccurate. The growth rates have been acquired through an in-depth interview with Head of Risk Department of the Bank. The technique for identifying the discount rate used will be CAPM.

Inputs:
• 5 year detailed growth rate forecast developed by Rietumu Banka analysts
• Market variables: Risk free rate, Banking sector beta, Latvian market rate
• Terminal value with application of constant growth rate of free cash flow beyond 2018 year 3.6 %
• Betas of Scandinavian Bank working in Baltic States: SEB Beta=1.66; Danske Bank Beta =2.02; DnB Beta = 1.54; Swedbank Beta = 2.05; Nordea Beta =1.60.
• Bottom up Beta for JSC Rietumu Banka =1.77
• CAPM application for JSC Rietumu Banka, Cost of Equity 20.83%

Result:
• Thus, value of the Bank has been calculated and equals LVL **192,046,000**.

Second research question aims at identifying the value of the Bank using ROV techniques. In order to apply ROV model to valuing a firm, Black-Scholes model should be applied. The Black-Scholes model is aimed to calculate a call price (c) or put price (p) using the 5 key determinants of an option's price: current market (spot) price of share (S_0), future exercise (strike) price (K), time to expiry (in years) (T), risk-free rate (r), and variance in stock price (σ^2). Additionally, intermediate values are using as $N(x)$ is the probability that a normally distributed variable with a mean of zero and a standard deviation of 1 is less than x (cumulative normal distribution function of d_1 and d_2), e is mathematical fixed constant = 2.718…, and ln is natural log. Thus, the value of a call option for a non-dividend-paying underlying stock in terms of the Black–Scholes parameters is:

$$c = S_0\, N(d_1) - K\, e^{-rT} N(d_2)$$

$$p = K\, e^{-rT}\, N(-d_2) - S_0\, N(-d_1)$$

$$\text{where} \quad d_1 = \frac{\ln(S_0 / K) + (r + \sigma^2 / 2)T}{\sigma \sqrt{T}}$$

$$d_2 = \frac{\ln(S_0 / K) + (r - \sigma^2 / 2)T}{\sigma \sqrt{T}} = d_1 - \sigma \sqrt{T}$$

(1)

The formula for calculating bank equity value (*C*) is as follows: value of underlying assets of bank (S_0), value of outstanding debt (*K*), time to maturity (bank debt duration) (*T*) (in years), government treasury bond rate corresponding to option life cycle (*r)*, variance in stock exchange index (σ^2). After, written the formula would represent the numerical result of bank equity. Therefore, the bank is being computed as follows.

As for all the calculations risk-free rate equals Latvian governmental bond rate, which is 5.25% (2012). For evaluating a firm using option-pricing techniques, we take assets as the spot price and liabilities as the strike price. A very important step is to estimate debt duration for the bank. For this case, having used Excel program SUMPRODUCT function, time to maturity has been calculated as weighted average duration of debt liabilities (Golovina, 2010) as it shown in the Table 1.

Table 1

Analysis of the duration of financial liabilities (contractual undiscounted cash flows)

Financial liabilities	2012 '000 LVL	2011 '000 LVL	2010 '000 LVL	2009 '000 LVL	Average time to maturity, years
Total gross amount	1,499,071	1,312,490	996,294	777,320	
Demand and less than 1 month	1,222,891	997,607	745,013	548,340	0.042
From 1 to 3 months	24,557	40,687	50,047	43,296	0.168
From 3 months to 1 year	92,918	109,285	131,965	169,665	0.633
From 1 year to 5 years	113,496	120,203	68,439	15,510	3.000
More than 5 years	45,210	44,708	830	509	5.000
Aggregate liabilities : Demand and less than 1 month	0.816	0.760	0.748	0.705	0.042
From 1 to 3 months	0.016	0.031	0.050	0.056	0.168
From 3 months to 1 year	0.062	0.083	0.132	0.218	0.633
From 1 year to 5 years	0.076	0.092	0.069	0.020	3.000
More than 5 years	0.030	0.034	0.001	0.001	5.000
Weighted average time within one financial year	0.474	0.535	0.334	0.240	
Average time to debt maturity within four financial years					0.391 year or 141 days

Source: prepared by authors based on Risk Management chapters of Annuals Reports of the JSC Rietumu Banka for the period 2009-2012 years

Volatility is another important value driver of the ROV model. Because JSC Rietumu Banka is not listed on a stock exchange, the author takes OMX NASDAQ Riga index for our calculations again in according with recommendations of Golovina, 2010.

Now,
Inputs:
•NASDAQ OMX Riga Volatility 22.47% (NYU Stern)
•NASDAQ OMX Stockholm 21%; OMX Tallin 25.25%; OMX Vilnius 25%; OMX Helsinki 20.99% (NUY Stern)
•Latvian risk free rate 5.25%
•Bank Debt duration 141 days
•Bank asset value according to Balance Sheets
•Bank Liabilities according to Balance Sheets

Result:

• Value of JSC Rietumu Banka: LVL 242,495,866

Volatility of OMX NASDAQ Riga is 22.4% according to Volatility Institute of NYU Stern School of Business, May 2013 constantly updated data using GARCH model and that has been applied for the computation. Having used Black-Scholes formula (1), the bank equity value was estimated by the author to: **LVL 242,495,866** respectively (see table 2).

Table 2

Black Scholes option-pricing formula for valuation of JSC Rietumu Banka (30th May, 2013)

Inputs :

ASSETS: $S_0 =$	LVL1,638,967,000
LIABILITIES: $X =$	LVL1,441,730,000
Annualized variance =	0.05
Debt duration: days to option maturity =	141 days
Annual risk-free rate =	5.25%

Results:

$S_0*N(d_1) =$	LVL1,426, 576,590
$X*e^{-rT}*N(d_2) =$	LVL 1,184, 080,700
C : Value of Equity of JSC Rietumu Banka =	LVL 242,495,000

Source: prepared by authors

As a result, applying ROV the bank equity is more valuable up to LVL **50.5** M due to a value of strategic flexibility embedded in ROV formula.

What strategic decisions would maximize the value of the bank value over the next years according to Real Options Valuations? The main value drivers that make ROV unique and allow it to reflect strategic flexibility are *volatility* and *time of duration*. Due to stabilizing of Latvian economy in terms of volatility of OMX Riga index decreasing and stable forecast of GDP growth rate as 4.1% for forthcoming years according to European Commission Spring 2013 report as well as introduction of Euro in Latvia as from 01.01.2014 that would smooth volatility also, the time of duration of debt liabilities of the bank is the most significant value driver as shown in the Table 3. Table 3 has summarized strategic and financial issues as follows.

Important influence on the Bank equity value has given in terms of ROV application approach a following strategic decision. Starting from December 7, 2012, bonds of the Bank are listed on the NASDAQ OMX Baltic Bond list. The listing of the bonds issued by the Bank at NASDAQ OMX has significant influences on the value of the bank in accordance with Real Options method. Bonds add long-term debt that increase time of duration of liability, thus, increase strategic flexibility and consequently banks value. Listing Bank's bonds on the NASDAQ OMX Baltic Market will enable investors to assess the current value of their investments, as well as promote trading of these securities on the secondary market. Thus, duration of liabilities in ROV formula will rise and thus the value of equity will rise as shown in Table 3 (short term scenario)**.**

Table 3

Scenario planning: a change of debt duration as a value driver

Scenarios	Debt duration (days)	Variance	Equity value (LVL)
1	**144**	0.05	**LVL242 495,886**
2	**252**	0.05	**LVL 278 867,044**
3	**360**	0.05	**LVL 310 966,062**

Source: prepared by authors

A volatility changes is not important value drivers as shown in Table 4.

Table 4

Scenario planning: a volatility changes as a value drivers

Scenarios	Debt duration (days)	Variance	Equity value (LVL)
NASDAQ OMX (Riga)	144	**0.050**	**LVL 242 495,886**
S&P 500 (US)	144	**0.023**	**LVL 230 016,452**
CAC40 (France)	144	**0.020**	**LVL 237 499,543**
RTS (Russia)	144	**0.096**	**LVL 264 076,589**

Source: prepared by authors based on V-Lab of the Volatility Institute of NYU Stern, USA data (2013)

What is more, foreign companies may benefit from using Latvian holding companies for short-term investments following latest amendments to the country's Corporate Income Tax Act. From 2014, withholding tax will not be levied on dividends, interest and royalties paid to foreign companies, except for those paid to tax haven entities. Latvian government's proposed amendments may encourage multinationals to use Latvia as a regional mini-holding company jurisdiction for Eastern Europe.

Then, latest Latvian legislation on Latvia Temporary Resident Permit (Latvia TRP) through investments in Subordinate Capital would also give excellent opportunities for the Bank in long run period within next 5 years. This is the shortest and the quickest way of obtaining Latvian TRP for investors. Investors who are interested in TRP just need to make a financial investment in tune of 200000 LVL (286000 Euro) in subordinated capital of a credit institution (debt or debentures) or a term deposit. The deposit term is irrevocable 5 years investment carries an annual rate of interest at 4.0-5.0%. Interest on the investment is transferred half yearly. The agreement signed is irrevocable and investors do not have privilege of terminating or carry out premature withdrawal of this deposit. Duration of liabilities in ROV formula will rise and thus the value of equity will rise as shown in Table 3 (long term scenario). New legislation amendments would lead to increasing of time of duration of liabilities in ROV formula and thus the value of the Bank equity will rise within long term strategic horizon. The Bank should be able to capitalize a new amendments of legislation opportunities by attracting new long term investors and thus to maximize a value. Thus Real Options Valuations usage would help the Bank management on combine strategic thinking and financial valuation.

6. CONCLUSION AND FUTURE WORK

Our research paper contributes with identification of strategic opportunities that exist in Latvian contemporary political and economical settings for maximizing the bank equity value. We have identified the various value drivers of the Bank and show using Black-Scholes option pricing formula (1) how to exploit new economic realities to capitalize of latest changes of Latvian legislation.

The research outcomes of the paper were divided into three parts accordingly to the research questions. The first part was dedicated to estimating the value of the Bank through traditional DCF approach. For this purpose, the cash flow of the bank was forecasted and discounted for the next 5 years. According to the DCF method applied, the value of the bank is LVL 192,046,000. The second part was answering the research question on identifying the equity value of the bank using Real Options Valuation through Black-Scholes option pricing model. The value of JSC Rietumu Banka using ROV is LVL 242,495,866.   The third part was dedicated to identifying implications behind valuation of a commercial bank using ROV. The main drivers that determine value of a bank and its strategic flexibility were explained and discussed.

Strategic flexibility is valuable. As a result, applying ROV the bank equity is more valuable up to LVL **50.5** M due to a value of strategic flexibility embedded in ROV formula. This difference suggests that real option valuation provide value of strategic flexibilities not found in other methods. We also derive that recent convertible bond issued by the bank as well as new forthcoming Latvian legislation's amendments have resulted in significant value drivers in short and long terms perspective.

The research results imply that option-based methods have empirical relevance in the bank valuation analysis. Following theoretical and practical research outcomes have been derived from the research paper. First, for banks that are not listed on an exchange, *volatility of local stock exchange index* can be used as a proxy. Second, *time to maturity is a very significant value driver* of the Bank and the indicator of strategic and financial flexibility of a bank. Third, recommendation for practitioners and the Bank management has been formulated as follows: *attract more long-term investors to maximize strategic flexibility and thus increase the Bank value*.

Hypothesis has been confirmed: ROV is relevant in Latvian transition economic settings. Furthermore, bankers can benefit from using ROV methods when analyzing and selecting the strategic alternatives. By using of ROV method, the Group of companies of JSC Rietumu Banka would be able to select the best strategic alternatives dealing with uncertainty, coping with competitive pressures and enhancing their competitiveness. Limitation of this approach is the quantification. Real option evaluation of strategies can get lost in the mathematics. Future work is to be considered to apply ROV for valuation of whole Group of companies of JSC Rietumu Banka. That would help to identify of new Real Options by exercising which the Group would be dynamically capable achieve new financial resources configuration and thus extend competitive advantages period in Baltic banking sector.

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