ENHANCING DATABASE STRATEGIES FOR MANAGEMENT INFORMATION SYSTEM (MIS) AND BANK SUSTAINABILITY UNDER MACRO EFFECTS - A CASE STUDY IN VIETNAM LISTED BANKS

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ABSTRACT

During industry 4.0 with effects from US-China commerce war, in bank sector in emerging markets such as Vietnam, we need to enhance better database for bank risk and bank sustainable development. This is one goal of this study, esp. under applications of IoTs and internet data.

Currently there are about 7 big banks in Vietnam listed on stock exchange and have enough data in period 211-200 for us to present a study case or an example of risk database modeling. Banks in Vietnam has gained big achievements and play a major roles in providing loans and financial services to socio-economy and contribute to community activities over years. But there are certain weaknesses in risk database modeling.

This study mainly use combination of quantitative methods (statistics, calculation formulas) and qualitative methods including synthesis, inductive and explanatory methods.

The research findings tell us that Organizing better Risk management information system with support of software and showing in forms of charts, figures and tables will provide data for management to analyze, and for establish suitable risk policies:
For instance, because CPI has negative higher effects on market risks of banks, Ministry of Finance, State bank of Vietnam and relevant agencies need to control inflation (not decreasing so much) for managing risk.

Besides, this study also give out recommendations for enhancing risk an sustainability database of banks in digital era.

Keywords: Risk Database, Sustainability, Vietnam Banks, Beta CAPM, MIS, Macro Effects

JEL: M21, G30, G32, G38

Abbreviation: G: GDP Growth, CPI: Inflation, RF: Risk Free Rate, R: Lending Rate, IM: Industrial Manufacturing, RMIS: Risk Management Information System, MIS: Management Information System

INTRODUCTION

First, we recognize the importance of digital technology in banking also increase to a new level in digital era, as well as the increasing meanings of organizing better risk management information system for commercial banks.

In the context of digital transformation, information is considered vital for businesses. People focus a lot of energy and intelligence to have fast and accurate information. Whoever has the information wins. Therefore, information has become the hunted target of those who want to get

ahead, and at the same time something that everyone tries to keep. In fact, in order to protect their information, businesses need to computerize to ensure information security. Thus, the protection of information is the building of a database management system for all that information. This is also the work that businesses need to do to conduct digital transformation in the context of the industrial revolution 4.0.

Next, We emphasize that the role of reliable internet data increasing in recent years. There is evidence in banking sector showing that internet data serving better for building information system for better bank management.

In this paper we mainly focus on using reliable internet data in proposing suitable and better database organized for risk modeling and for bank sustainable development assessment.

All internet data such as stock price, exchange rate, inflation, GDP growth, risk free rate we take from reliable internet data sources, esp. from website of State Bank of Vietnam, Bureau of Statistics, Ministry of Finance, banks, etc.

Research Question

Question 1: What are recommendations for building better risk database in bank sector and for better organization of MIS and Risk management information system (RMIS) in banks? What are macro factors affecting bank market risk measured by beta CAPM?

Question 2: What are suggestions for building database for bank sustainable development? What are factors affecting bank net profit?

LITERATURE REVIEW

First, Trivelas & Satouridis (2013) stated that in Greece a) the externally focused Management Information System (MIS) effectiveness archetypes (OS, RM) reflecting innovation, creativity, goal setting and planning enhance task productivity b) the Internal Process (IP) model of MIS effectiveness influences negatively task productivity.

Arasu, et al., (2014) found the Internet has revolutionized services across institutions. The Banking sector has registered significant change in the quality of service owing to the bandwidth of information flow ensuring greater customer-satisfaction. This has also brought into perspective the security environment within which information flow takes place.

Balasubramanian, et al., (2014) specified that the banking sector has always been in the vanguard of technology in order to add value to its products, services and efficiency. The Internet has galvanized business by increasing customer base, reducing transaction costs, and enabling sale of products globally. Khrais (2019) mentioned Business information systems are interconnected structures or procedures within a business entity that uses Information and Communication Technology (ICT) to support decision making by generating, processing and providing useful information for the entity. Business information systems have five key components. These are the people using the system, the hardware, software, database and network. Good business information systems are flexible such that they can be able to anticipate and adapt to changes in the information needs of the business. They are also must efficient, meet the demands of the business, and are designed according to the financial and human resource capacity of the business entity. Furthermore, good businesses are cost effective.

Moreover, Gupta (2019) specified that Information System (IS) is important in almost all the functional areas of any bank *i.e.*, HR, Marketing, Finance, etc. It also helps in risk management and cash management along with maintaining long run customer relationship.

And last but not least, Sibanda, et al., (2020) mentioned digital technology has transformed banking from classical model to innovative Fintech collaborative model.

Then, We summarize previous studies as follows (Table 1):

Table 1
SUMMARY OF PREVIOUS STUDIES

Authors	Year	Contents, results
Karim, A.J	2011	Management Information Systems (MIS) is the key factor to facilitate and attain efficient decision making in an organization.
Avegrou, C.	2008	Information system (IS) in emerging markets research has expanded the IS research agenda and developed new understanding of IS innovation phenomena, mainly through its attention to social context and strategic concerns associated with socio-economic development. As it encounters questions on policy and practice of development, it is confronted with critical issues associated with the role of Information and Communication Technology (ICT) in the transformation of social relations and macro-level institutions.
Huy, D.T.N	2015	We need to enhance risk management system and MIS in banks
Giebe et al	2019	a progressive tool for providing customer-oriented services and products, in the banking sector, is currently defined as "Big Data & Analytics".
Feitosa et al	2019	Disruptive technologies are triggers that transform the nature of work, leading to profound changes in organizational structure, labor relations, employee skills, customer relationship and communications.

METHODOLOGY

Method and Data

This study mainly uses combination of quantitative methods and qualitative methods including synthesis, inductive and explanatory methods. And it emphasizes again important roles of internet data in sustainable modern bank management
For quantitative analysis, the study is supported with OLS regression.
The formula to calculate weighted beta CAPM expressed as follows:

$$\text{Beta (at time t) weighted} = \sum n \text{ Beta (bank i at time t)} \times \text{Market value of stocks (bank I at time t)} / \sum_{i=1}^{n} (\text{Market value of stocks of banks})$$

In which beta bank i at time t is estimated in traditional formula of beta CAPM.
Data is collected from reliable internet sources and websites.

MAIN RESULTS

Process of Modeling of Analysis Steps of Risk Database and Bank Sustainable Development

First we collect data from reliable websites as follows (Table 2):

Table 2
VARIABLES - DATA DESCRIPTION

Variable name	Sign	Data source	Reference source
Dependent variable			
Market risk (BetaCAPM)	BetaCAPM	HOSE and HNX	Jack Treynor (1961, 1962), William F. Sharpe (1964), John Lintner (1964) và Jan Mossin (1966)
Independent variables			
GDP growth	g	Bureau statistics	**Dinh Tran Ngoc Huy (2021, Springer Verlag book chapter)** "Impacts of Internal and External Macro Factors on Firm Stock Price in An Econometric Model – A Case In Viet Nam Real Estate Industry"
VNIndex	VNindex	HOSE and HNX	**Dinh Tran Ngoc Huy "**Econometric model for ACB bank stock price 2008-2011, Sai Gon university journal, No.22, 2015"
Risk free rate	Rf	Ministry of Finance (MOF)	**Dinh Tran Ngoc Huy "**Econometric model for ACB bank stock price 2008-2011, Sai Gon university journal, No.22, 2015"
Lending rate	r	Commercial bank	**Dinh Tran Ngoc Huy (2021, Springer Verlag book chapter)** "Impacts of Internal and External Macro Factors on Firm Stock Price in An Econometric Model – A Case In Viet Nam Real Estate Industry"
Exchange erate	Ex_rate	Commercial bank	**Dinh Tran Ngoc Huy (2021, Springer Verlag book chapter)** "Impacts of Internal and External Macro Factors on Firm Stock Price in An Econometric Model – A Case In Viet Nam Real Estate Industry"
S&P500	SP500	NYSE	**Dinh Tran Ngoc Huy "**Econometric model for ACB bank stock price 2008-2011, Sai Gon university journal, No.22, 2015"
BOT(trade balance)	BOT	Bureau statistics	Author synthesis
IM (Industrial manufacturing index)	IM	Bureau statistics	Author synthesis

Then we use statistics softwares (such as Eviews, Stata, SPSS,...) to run correlation and descriptive statistics as follows:

Step 1:

	BETA_VIE...	CPI	EX_RATE	G	IM	R	RF	SP500	TRADEBA...	VNIINDEX
Mean	0.532250	0.049970	22394.20	0.057150	162.0550	0.112630	0.055213	2245.493	-75.16000	680.2135
Median	0.421500	0.035350	22700.00	0.059700	150.4000	0.102500	0.059850	2138.720	-125.0000	606.6300
Maximum	2.534000	0.181300	23230.00	0.070800	267.2000	0.190000	0.132000	3703.060	498.0000	1067.500
Minimum	-0.282000	0.006300	20618.00	0.018100	117.4000	0.080000	0.012200	1292.280	-1162.000	351.5500
Std. Dev.	0.636001	0.045765	837.4044	0.013917	36.96982	0.030423	0.027599	685.2655	402.1636	226.7034
Skewness	1.613717	1.928654	-0.853154	-1.442505	1.394427	1.349477	0.911109	0.363508	-0.667135	0.267939
Kurtosis	6.092193	5.913603	2.379814	4.632589	4.628737	4.016835	4.234518	2.307065	3.848882	1.664441
Jarque-Bera	16.64832	19.47325	2.746765	9.157194	8.692074	6.931922	4.037095	0.840594	2.084063	1.725736
Probability	0.000243	0.000059	0.253249	0.010269	0.012958	0.031243	0.132848	0.656852	0.352737	0.421950
Sum	10.64500	0.999400	447884.0	1.143000	3241.100	2.252600	1.104250	44909.86	-1503.200	13604.27
Sum Sq. Dev.	7.685444	0.039794	13323677	0.003680	25968.59	0.017586	0.014472	8922186.	3072975.	976494.2

FIGURE 1
DESCRIPTIVE STAT BY EVIEW

(Source: Author calculation and stock exchange)

Step 2:

Correlation Matrix										
	BETA_VIE...	CPI	EX_RATE	G	IM	R	RF	SP500	TRADEBA...	VNIINDEX
BETA_VIE...	1.000000	-0.130200	0.042392	0.155772	0.716165	0.083025	-0.077289	0.000787	0.150732	0.086030
CPI	-0.130200	1.000000	-0.516593	0.038007	0.184050	0.547153	0.603133	-0.599312	-0.131135	-0.554246
EX_RATE	0.042392	-0.516593	1.000000	0.145012	0.071635	-0.470835	-0.851995	0.720764	0.048661	0.696179
G	0.155772	0.038007	0.145012	1.000000	0.244021	-0.040216	0.068575	-0.185033	-0.300285	0.012915
IM	0.716165	0.184050	0.071635	0.244021	1.000000	0.128743	-0.019349	-0.074514	-0.083567	0.052526
R	0.083025	0.547153	-0.470835	-0.040216	0.128743	1.000000	0.484905	-0.756602	0.027941	-0.790059
RF	-0.077289	0.603133	-0.851995	0.068575	-0.019349	0.484905	1.000000	-0.846717	-0.277080	-0.804579
SP500	0.000787	-0.599312	0.720764	-0.185033	-0.074514	-0.756602	-0.846717	1.000000	0.375157	0.949626
TRADEBA...	0.150732	-0.131135	0.048661	-0.300285	-0.083567	0.027941	-0.277080	0.375157	1.000000	0.347578
VNIINDEX	0.086030	-0.554246	0.696179	0.012915	0.052526	-0.790059	-0.804579	0.949626	0.347578	1.000000

FIGURE 2
CORRELATION MATRIX BY EVIEW

(Source: Author calculation and stock exchange)

Step 3:

Covariance Matrix										
	BETA_VIE...	CPI	EX_RATE	G	IM	R	RF	SP500	TRADEBA...	VNIINDEX
BETA_VIE...	0.384272	-0.003600	21.44860	0.001310	15.99712	0.001526	-0.001289	0.326026	36.62590	11.78393
CPI	-0.003600	0.001990	-18.80785	2.30E-05	0.295828	0.000724	0.000724	-17.85533	-2.292851	-5.462813
EX_RATE	21.44860	-18.80785	666183.9	1.605465	2106.844	-11.39540	-18.70619	392926.2	15568.47	125556.2
G	0.001310	2.30E-05	1.605465	0.000184	0.119271	-1.62E-05	2.50E-05	-1.676366	-1.596602	0.038709
IM	15.99712	0.295828	2106.844	0.119271	1298.429	0.137561	-0.018755	-1793.367	-1180.342	418.2200
R	0.001526	0.000724	-11.39540	-1.62E-05	0.137561	0.000879	0.000387	-14.98483	0.324771	-5.176583
RF	-0.001289	0.000724	-18.70619	2.50E-05	-0.018755	0.000387	0.000724	-15.21285	-2.921606	-4.782333
SP500	0.326026	-17.85533	392926.2	-1.676366	-1793.367	-14.98483	-15.21285	446109.3	98219.50	140149.9
TRADEBA...	36.62590	-2.292851	15568.47	-1.596602	-1180.342	0.324771	-2.921606	98219.50	153648.7	30104.85
VNIINDEX	11.78393	-5.462813	125556.2	0.038709	418.2200	-5.176583	-4.782333	140149.9	30104.85	48824.71

FIGURE 3
COVARIANCE MATRIX BY EVIEW

(Source: Author calculation and stock exchange)

From above figures we can see that standard deviation of each variables (figure 1) and correlation between variables (figure 2).

Step 4:

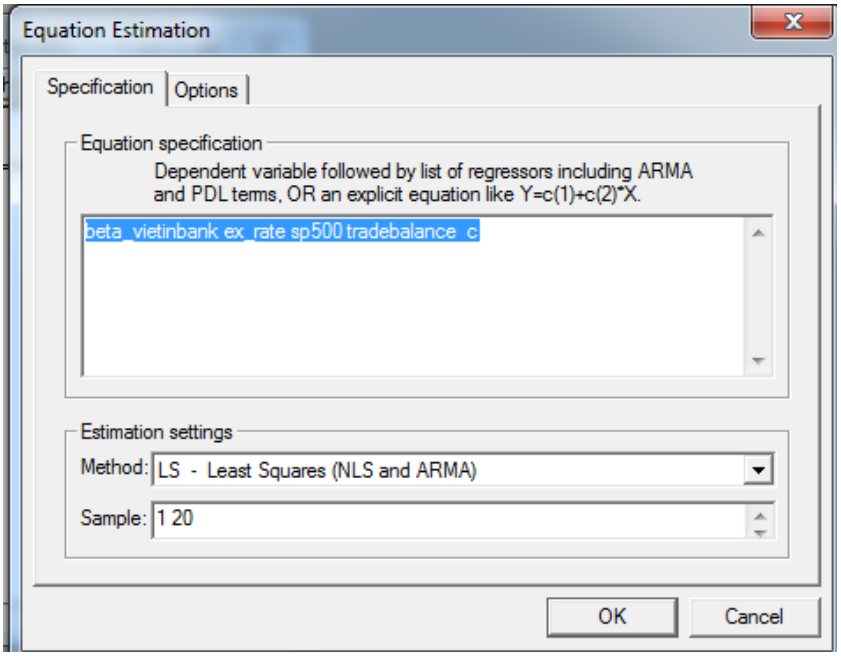

FIGURE 4
RUN REGRESSION EQUATION FOR MACRO EXTERNAL FACTORS
(source: made by author)

Step 5:

Dependent Variable: BETA_VIETINBANK
Method: Least Squares
Date: 08/12/21 Time: 11:10
Sample: 1 20
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EX_RATE	0.000145	0.000286	0.506498	0.6194
SP500	-0.000205	0.000376	-0.544415	0.5937
TRADEBALANCE	0.000355	0.000445	0.797184	0.4370
C	-2.221726	5.774879	-0.384723	0.7055

R-squared	0.041704	Mean dependent var	0.532250
Adjusted R-squared	-0.137977	S.D. dependent var	0.636001
S.E. of regression	0.678460	Akaike info criterion	2.238875
Sum squared resid	7.364933	Schwarz criterion	2.438021
Log likelihood	-18.38875	F-statistic	0.232099
Durbin-Watson stat	1.416048	Prob(F-statistic)	0.872673

FIGURE 5
GET RESULTS
(Source: Author calculation and stock exchange)

Step 6:

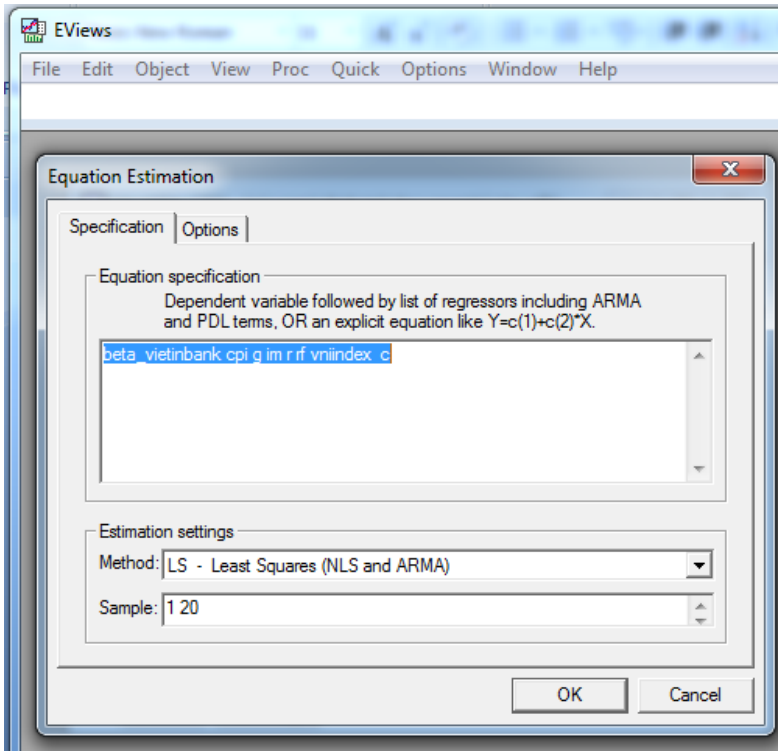

FIGURE 6
RUN REGRESSION FOR INTERNAL MACRO FACTORS
(source: made by author)

Step 7:

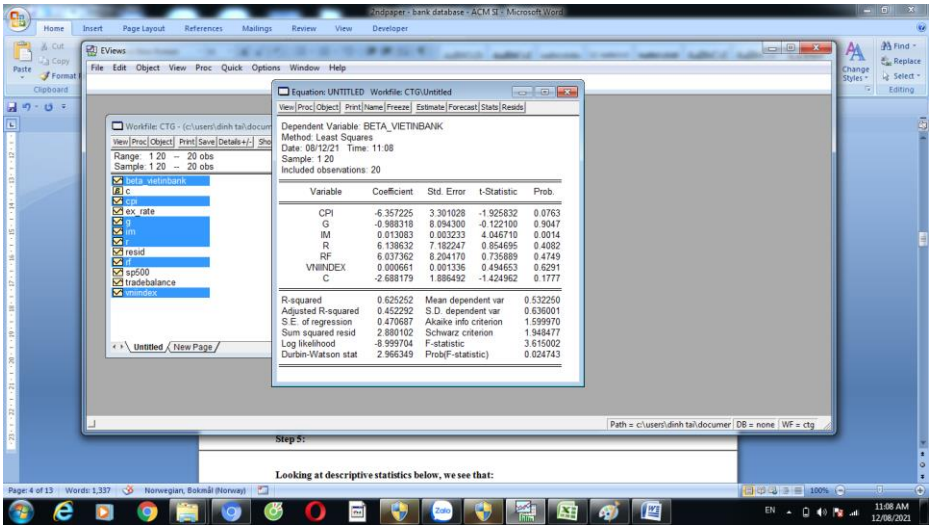

FIGURE 7
GET RESULTS
(Source: Author calculation and stock exchange)

Step 8:

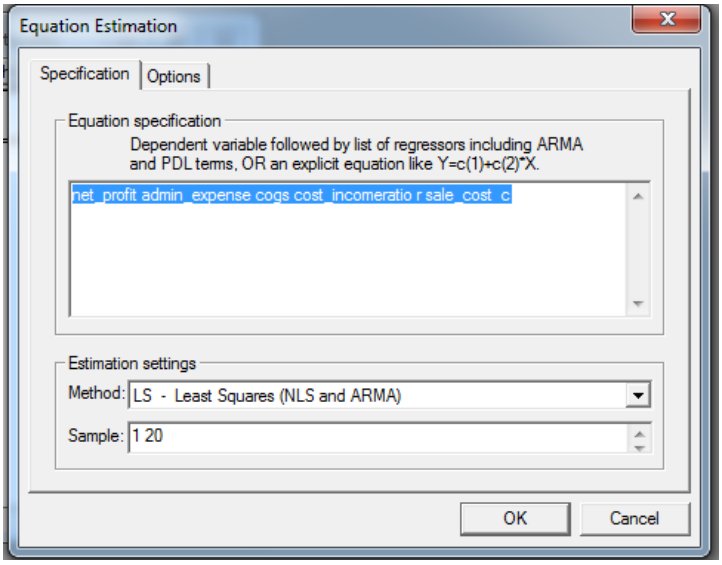

FIGURE 8
FOR BANK SUSTAINABILITY WE CAN REGRESSION FOR INTERNAL COST FACTORS

(source: made by author)

Step 9:

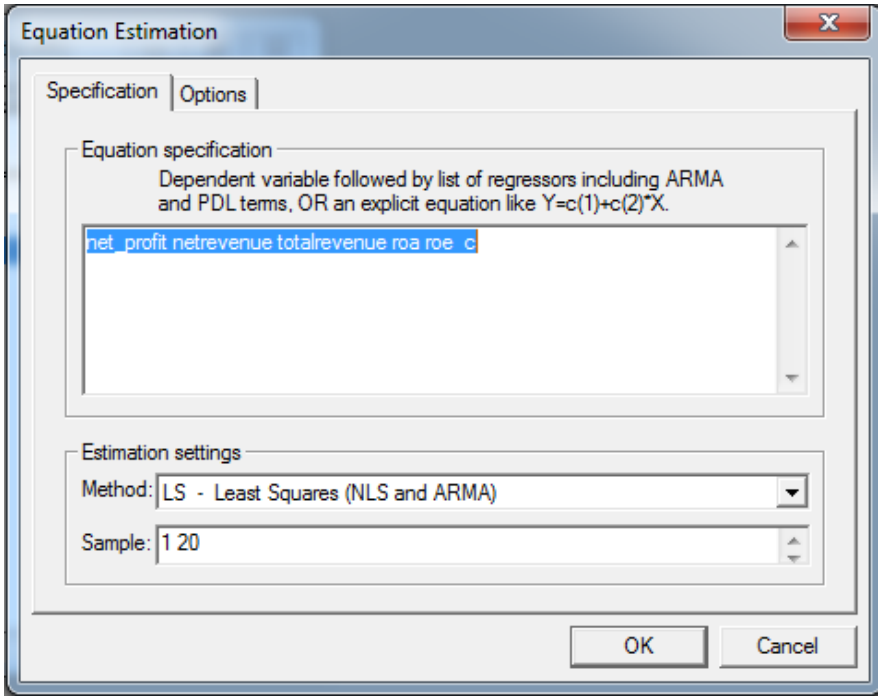

FIGURE 9
FOR BANK SUSTAINABILITY WE CAN REGRESSION FOR INTERNAL REVENUE FACTORS

(Source: Made by author)

From above steps we see that with support of software statistic, we can get results of regression of risk determinants, in which there are internal macro factors and external macro factors.

Modeling Determinants of Bank Risk Database and Bank Sustainable Development Database

This section we will show two database modeling: risk modeling and bank sustainability modeling.

Determinants of Bank Risk Database

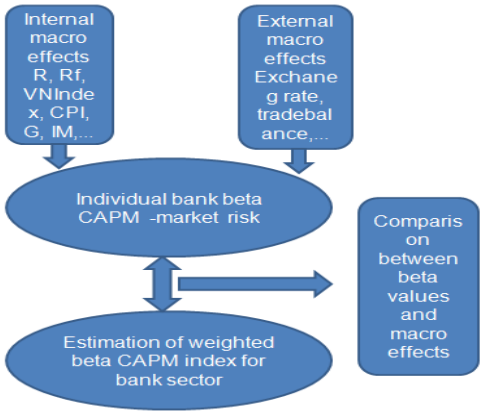

FIGURE 10
BANK RISK MODELING

Source: Made by authors

Determinants of bank Sustainable Development Database

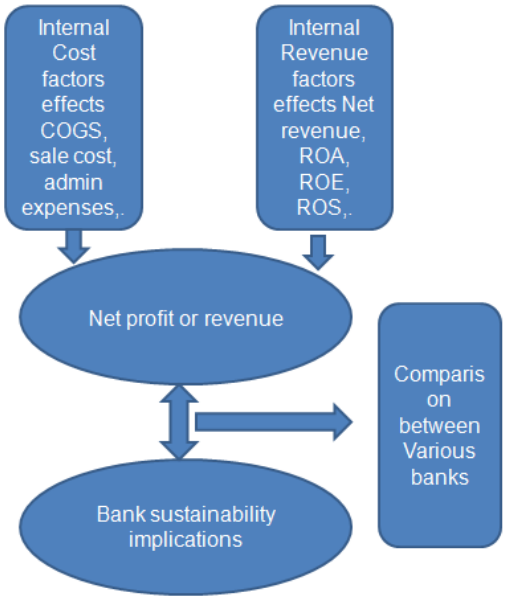

FIGURE 11
BANK SUSTAINABILITY MODELLING

Source: Made by authors

Management Implications from Analysis of Bank Risk Data

Then we can organize and present bank risk determinants in below tables3,4:

Table 3
EXAMPLE OF RISK VOLATILITY AND WEIGHTED BETA ESTIMATION IN BANK SECTOR

	Beta CTG	MV (CfG)	Beta EIB	MV (ElB)	Beta SHB	MV (SHB)	Beta NVB	MV (NVB)	Beta ACB	MV (ACB)	Beta STB	MV (STB)	BetaVCB	MV(VCB)	Weighted Beta CAPM
Jun-15	0.58	49148.94	1.08	23605.11	0.97	7679.60	0.05	253.92	0.7I	18821.75	0.94	20679.46	1.64	I 19126.41	1.20
Dec-15	0.85	40957.45	1.34	22252.74	0.69	5783.40	0.07	1815.78	0.97	17208.46	0.84	2 1I02.75	1.76	I 13263.36	1.36
Jun-16	0.43	42446.8I	I.I4	20531.53	0.84	5783.40	I.I5	1666.95	0.49	17208.46	0.85	20381.28	0.87	124722.95	0.78
Dec-16	0.55	33510.64	0.58	18502.97	I.I3	5148.29	-0.36	1428.81	0.40	15774.42	0.56	17044.52	2.10	126641.45	1.45
Jun-17	2.53	53989.37	2.50	24896.02	-1.46	8393.95	3.54	2589.73	3.37	25732.02	2.65	256I I.88	0.79	138514.09	1.65
Dec-17	1.29	59946.8I	2.00	29752.28	0.66	10408.49	0.63	2145.60	0.75	36379.76	I.II	23176.95	I.II	195358.83	1.16
Jun-18	0.4I	53989.37	1.5I	29813.75	1.07	9865.58	0.6I	2264.80	1.04	38607.9I	I.I2	20832.20	1.35	208670.58	1.17
Dec-18	0.37	52313.83	1.59	23728.06	1.0I	8662.46	0.8I	2831.00	1.09	36916.09	1.43	21553.66	1.06	192469.92	1.02
Jun-19	-0.28	70000.0I	1.68	23973.94	0 69	8181.22	0.42	2384.00	0.86	36043.07	1.05	20471.47	0.59	261475.86	0.55
Dec-19	0.65	62925.54	1.38	25387.79	0.96	7699.97	0.6I	3825.80	0.60	37602.90	0.89	18307.08	1.39	335653.41	1.20
Jun-20	0.13	66090.43	0.39	5410 48830.24	0.18	2457472	-0.0I	350 0.20	0.52	392 40.60	0.85	203 81.28	0.60	308949.49	0.39
Dec-20	0.36	71117.0	1.47	42661.32	0.89	30542.8	0.26	3744.40	1.08	60415.5	1.2I	30571.	1.04	361986.	0.99

(source: Vu Quynh Nam, Dinh Tran Ngoc Huy, Nguyen Thi Hang, Le Thi Thanh Huong, 2021).

Table 4
EXAMPLE OF MARKET RISK DETERMINANTS IN BANK SECTOR (MACRO) UNDER INTERNAL AND EXTERNAL EFFECTS

	VCB - Coefficient		ACB - Coefficient		STB- Coefficient	
	Internal	External	Internal	External	Internal	External
CPI	-3.14		-3.1		-5.2	

G	-46.4		-13.5		-45	
IM	0.006		0.009		0.004	
R	9.8		6.4		-33.5	
Rf	-2.3		4.8		43.2	
VNIndex	0.005		0.003		0.005	
Ex_rate		4.11E		-9.77E		0.0001
SP500		0.001		0.0007		-0.001
Trade balance		0.0009		0.0005		-0.0004
R-squared	0.67	0.53	0.53	0.53	0.22	0.22
Akaike info criteria	1.9	1.75	1.4	0.84	3.68	2.6

(Source: Author calculation and stock exchange)

DISCUSSION

Digital transformation is an inevitable trend of businesses when switching to new ways of doing business in the 4.0 digital era. Digital transformation is an opportunity for businesses to create a competitive advantage in the market. The way to implement digital transformation starts with small steps, with a well-defined strategic plan. The first key toa successful digital transformation business is technology. To successfully implement digital transformation, businesses need to choose the right IT partner. One of the criteria used to choose the right IT partner is based on reputation, capacity and customer experience. The first thing that businesses need to do to implement digital transformation is to design a process, each person in the enterprise's apparatus must be knowledgeable about digital transformation. If a business has not applied modeling, automation and continuous improvement in its operating processes, it should not start other digital transformation technologies. In addition, businesses need to choose tools and methods to perform digital transformation accordingly. Process management software is an optimal solution that businesses should use to improve the efficiency of their business processes.

Digital transformation can be done at all businesses, as long as businesses really want to transform when user behavior is changing in a complex direction. Technology is an Important basis for businesses to better understand human behavior.

From figure 6, we see that we can estimate weighted beta CAPM index from estimations of beta CAPM of single bank.

Then, from above table, we find out that: risk determinants of banks can be classified into internal and external macro elements, for instance, CPI will have negative correlation with beta of all 3 banks. And for external factors, trade balance will have higher effects on beta (see table 3).
And next, we also can present risk data in the form of line figures as in below:

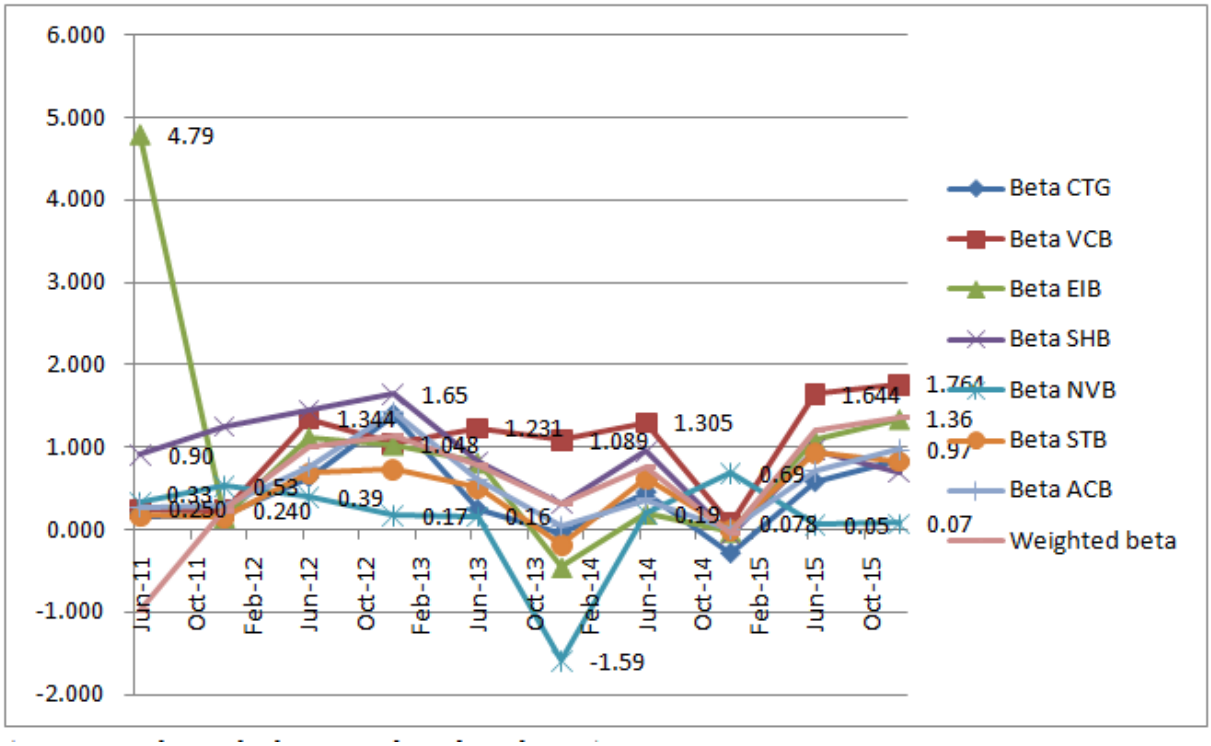

FIGURE 12
MOVEMENT OF WEIGHTED BETA INDEX AND BETAS OF BANK SECTOR

(source: author calculation and stock exchange)

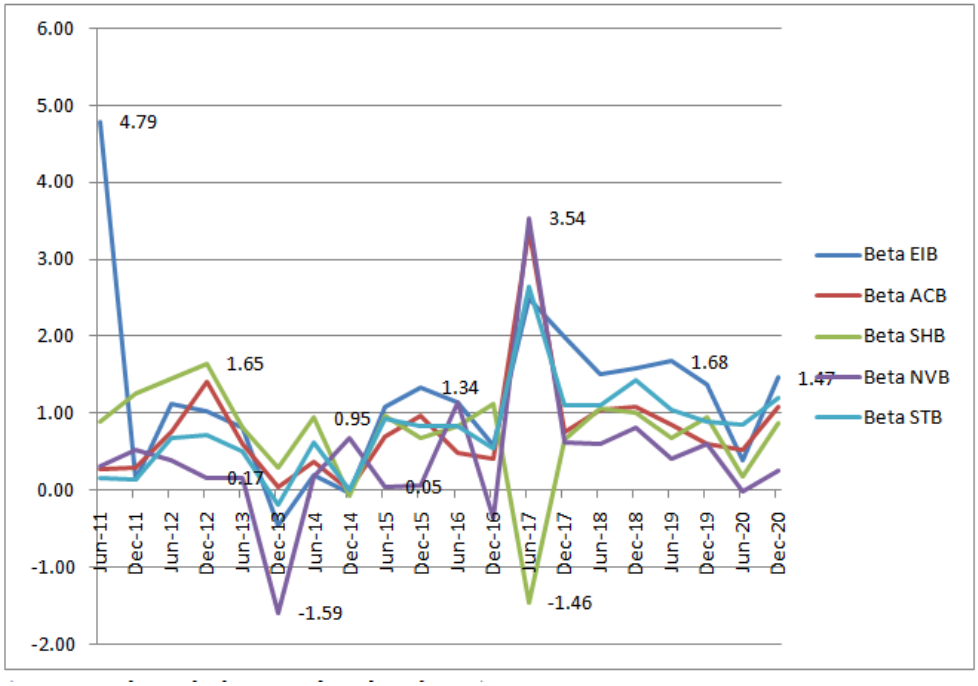

FIGURE 13
FLUCTUATION OF BETA OF VIETNAM BANKS PERIOD 2011-2020

(Source: Author calculation and stock exchange)

CONCLUSION

For bank sector, attention must be paid to the management of information and data to ensure information security and convenient storage. Therefore, the collection, processing and storage of information are extremely necessary to help businesses effectively manage information sources in the context of digital transformation. In the process of information management, there are often many incidents as well as the loss and change of information. To perform information management, digital enterprises need to build an information system with basic functions: System functions: assigning access rights, different priority levels for user members…

Organizing better Risk management information system and MIS with support of software and showing in forms of charts, figures and tables will provide data for management to analyze, and for establish suitable risk policies:

For instance, because CPI has negative higher effects on market risks of banks, Ministry of Finance, State bank of Vietnam and relevant agencies need to control inflation (not decreasing so much) for managing risk.

Mukhamadeev, et al., (2019) stated that the role of information systems for entrepreneurship education in developing countries on the example of the Azerbaijan education system and Internet banking. The information systems role in entrepreneurship education was determined with the help of online questionnaire. As a result of the study, it was found out that about 29% of higher entrepreneurship education institutions use IT technologies and e-learning principles in the learning process.

LIMITATION OF RESEARCH

We can expand our research model for other industries and other markets.

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