Visualization of return and risk
— Decision making support method to choose optimum solution —

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Abstract: When a man takes some action, he unconsciously compares returns with risks, which may be derived from the action, and analyzes a large quantity of information in his mind in order to make a decision. Even humans in the primitive era, during hunting, might had instinctively compared returns (expected fullness after hunting) with risks (danger of counterattack or fatigue without getting any result). In this research, I am going to suggest how to face risks aiming at returns taking the case of the automobile industry, and finally try to attain "Visualization of return and risk".

Key Words: Visualization, returns, risks, production bases abroad, strategy of global outreach, positioning map,

1. Purpose of Visualization

1.1 Choosing financial products

When visiting counters of stock and bond houses, you may hear "If you wish to make a bigger gain, you also have to prepare for risks in its way." A proverb "Nothing ventured, nothing gained." may have the same sense.

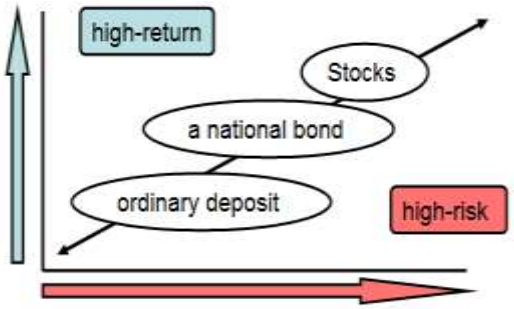

Fig.1 Risk/return relation of financial products

1.2 Sharpe ratio

The Sharpe ratio, invented by Professor William Sharpe in 1966 has been one of the most referenced risk/return measures used in finance due to its simplicity. The ratio's popularity has been boosted further since Professor Sharpe won the Nobel Memorial Prize in Economic Sciences in 1990 for his work on the capital asset pricing model (CAPM). Most people with a financial background can quickly comprehend how to use the Sharpe ratio and what the results represent. The ratio describes how much excess return you are receiving for the extra volatility that you endure by holding a riskier asset. When comparing two assets versus a common benchmark, the one with the higher Sharpe ratio provides better return for the same risk. In other words, the higher the number, the better the investment looks from a risk/return perspective.

Sharpe Ratio

$$S(x) = (r_x - R_f) / StdDev(x)$$

Where:

- X is the investment
- r_x is the average rate of return of x
- R_f is the best available rate of return of a risk-free security (i.e. T-bills)
- StdDev(x) is the standard deviation of r_x

It may be difficult to evaluate risks. But here, we replace return and risk with the expectation rate of return and standard deviation. Alternatives with higher standard deviation have more risk.

1.3 Why Visualization needed

It is thought that companies choose economic rationalities. So they will aim for maximum return with minimum risk. In the accepted theories as explained about financial products, higher risk could bring higher return, and higher return involves higher risk. Return and risk have strong positive correlation. When we have to choose the action from several alternatives, how the right decision could be made with the available information? I would like to take the case of a global automobile company which has to decide where to position new production bases. Each board member may have his/her own policy in mind, but cannot easily understand the stances of each other. By grasping return and risk quantitatively, he/she is able to clarify each position for return and risk. Let's try the "Visualization of return and risk".

2. Positioning map of return and risk

2.1 How to make the Positioning map

First, as a procedure, set return for the vertical axis, and set risk for the horizontal axis. Second, divide the field into four quadrants. The selectable alternatives may be mapped like an oval. Think about where the first choice is located. The first choice is the top right corner where low risk high return alternatives are located. However, when there is not a viable target there, we must search for the high-risk low- return area. I expressed this border as a straight line, and named it as "Marginal target line". The Marginal target line moves to the direction of the lower left until it meets a target. We will be able to choose more advantageous targets than others. However, it will be laborious to convert return and risk into measurable numerals, and make them measurable. And next, we have to consider how to calculate the slope of the Marginal target line and y-intercept of that. In this model, we extract factors

which determine them and adopted a weighted average according to the importance of each factor. In accordance with the above procedures, we can accomplish the positioning map as below.

Remarks:

1. Almost all targets in the world are divided into four quadrants from a viewpoint of return and risk.

2. Usually, higher risk could bring higher return, and higher return involves higher risk, and lower risk could bring not so many. So the distribution of targets may be mapped as an oval.

3. Choosing economic rationalities, the upper right would be the first choice, and the lower left should be avoided.

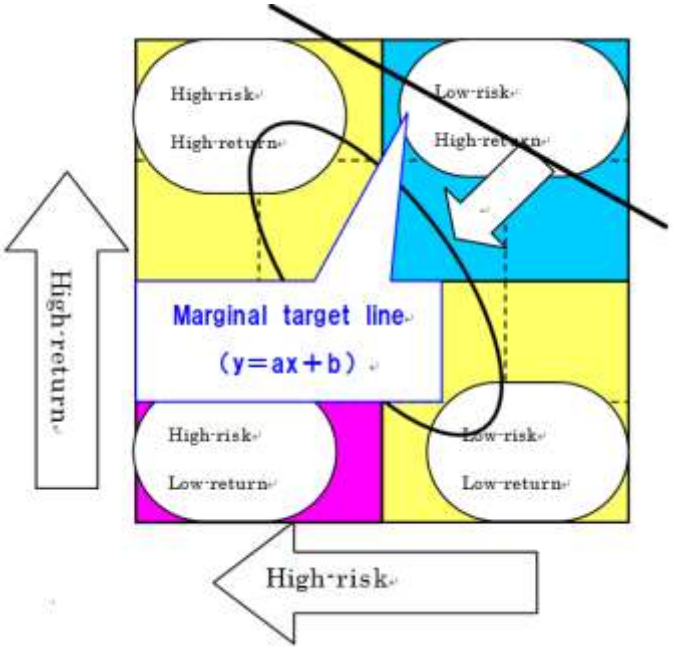

Fig. 2 Conceptual diagram of the positioning map

3. Model case of the judgment for overseas production bases

3.1 What the framework of return and risk is

Here, let's consider how the final decision should be made among possible alternatives. We deal with the case of the automobile company which plans to build overseas production bases. It depends on each company, in light of the market environment or competition, which factors should be emphasized in making decisions. This time, as a versatile model case, we have tried making framework of return and risk.

3.2 How to make framework of return and risk

First, as a procedure, make a“Mapping standards” extracting several factors which determine each item of mapping. And try indexation of each item by ranking or leveling of each factor. Second, make a “Mark list for each mapping area (return and risk)” and a“Mark list for trial companies (slope and y-intercept)” in the same way. Finally, by mapping each possible area of overseas production bases and overlay the Marginal target line of company A and company B on it. Then we can accomplish “Positioning map for advancement overseas”. As indexation of return, we adopt economic growth rate as representative, and make an adjustment by attracting industries policy or educational background and wage level of the local employees. And as indexation of risk, we adopt information on overseas safety from the Ministry of Foreign Affairs of Japan, and make an adjustment by the progress of infrastructure development or exchange rate volatility. As for slope of the Marginal target line, we adopt position in the competition and management philosophy or policy. And for y-intercept, we adopt the surplus of excess cash and so on. For these analyses I picked up data from the homepage of JETRO or each company when I made this paper in 2007. Therefore I hope you to understand the data is old at the present time.

		Division	Sub division	Standard		Ranking or leveling of each factor			
						1	2	3	4
		Automobile industry							
Marginal target line	a	Slope of the Marginal target line	Position in the competition	Strategy	Basic value	Leader -2.0	Follower -1.5	Challenger -0.5	Nicher 0.0
			Management philosophy or policy	Homepage of the Company	Correction	0.0	0.1	0.2	0.3
			Market share	20%	Correction	40%~ -1.0	30~40% -0.5	20~30% -0.3	~20% -0.1
	b	Y-intercept of the Marginal target line	The surplus of excess cash	Free cash flow	Basic value		-0.5	0.5	
			Superiority	5%	Correction	10%~ -1.0	5~10% -0.5	3~5% 0.0	~3% 0.5
			Growth rate of the industry	0%	Correction	3%~ -1.0	0~3% -0.5	0~-3% 0.5	~-3% 1.0
Attractiveness (vertical axis)	C	Attractiveness							
	C-1	Economic growth	Real GDP growth rate	Average values 02~05	Basic value	~3% -2	3~5% -1	5~8% 1	8%~ 2
	C-2	Market size	Source: Compiled using data from OICA	Region-by-region auto production volume 05	Correction	~1millions of cars -1.0	1~5millions of cars -0.5	5~10millions of cars 0.5	10millions of cars~ 1.0
	C-3	Attracting industries policy	Source: Compiled using data from JETRO	Encouragement about the foreign capital	Correction	-2 -0.5	-1 -0.2	1 0.2	2 0.5
	C-4	Actual conditions of [illegible]	Source: Compiled using data from OICA	The growth rate of production volume 05/04	Correction	~5% -0.5	5~15% -0.2	15~30% 0.2	30%~ 0.5
	C-5	Construction degree of the supply chain	Source: Compiled using data from JETRO	Further investigation by a field work	Correction	-2 -0.5	-1 -0.2	1 0.2	2 0.5
	C-6	Educational background	Source: Compiled from the website of Ministry of Education	Ratio of students who go on to secondary education	Correction	~50% -0.5	50~70% -0.2	70~85% 0.2	85%~ 0.5
	C-7	Wages level	Source: United Nations world statistical yearbook 2002~04	Average wages compared to Japan (Week = 4.3, Hour = 173)	Correction	50%~ -0.5	30~50% -0.2	10~30% 0.2	0~10% 0.5
Risk (horizontal axis)	D	Risk							
	D-1	Voyage risk	Source: Voyage risk information Ministry of Foreign Affairs	The maximum voyage degree of risk 04~05	Basic value	1 -2	2 -1	3 1	4 2
	D-2	Legal regulation (Environmental regulation)	From various information	Further investigation by a field work	Correction	× -0.5	△ -0.2	○ 0	◎ +0.3
	D-3	Development of infrastructure	From various information	Further investigation by a field work	Correction	× 1/W	△ 1/M	○ 1/Y	◎ [illegible]
	D-4	Fluctuation of exchange rate	Source: Rate of change 02~05	Yen-dollar rate (MAX-MIN)/MAX	Correction	~20%/Y -0.3	20~10% -0.3	10~5% 0	5%~ +0.3
	D-5	Raw materials procurement	From various information	Further investigation by a field work	Correction	-0.5 ~10%	-0.3 ~30%	0 ~10%	+0.5 ~50%
	D-6	Facilities maintenance	From various information	Further investigation by a field work	Correction	~30% -0.5	~50% -0.3	~80% 0	~100% +0.5
	D-7	Turnover rates	Retention rate over 3 years	Further investigation by a field work	Correction	80% -0.5	50% -0.3	30% 0	10% +0.5

Table.1 Mapping standards

4. Obtained results and remarks

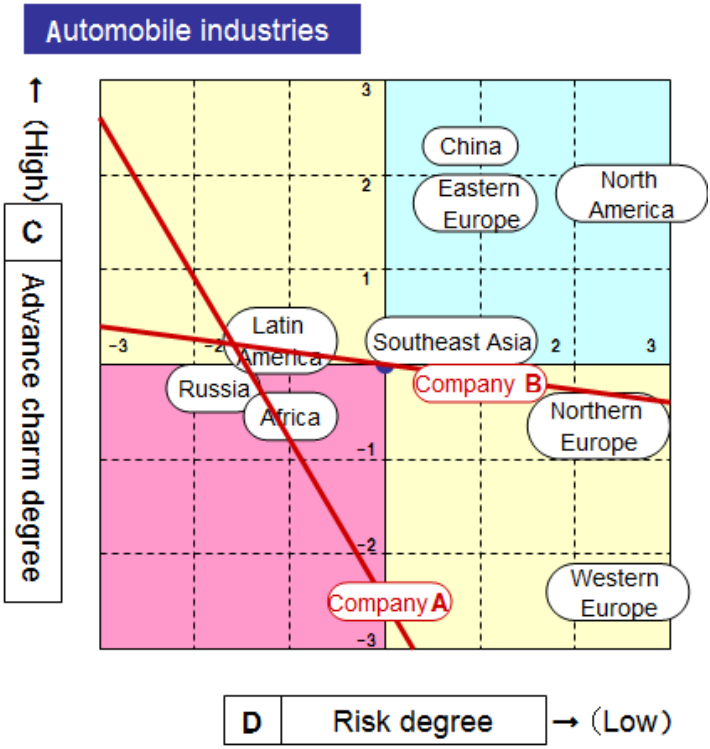

Fig.3 Positioning map for advancement overseas

4.1 Obtained results

Now, think about what kind of results could be obtained from the Positioning map. First, as the targets with high-return low-risk, North America and China were chosen. Allowing higher-risk and lower-return, Latin America or Russia becomes the target. If you can take effective measures to create new markets or hedge the risk, you can take the target on upper (higher return) or the farther right side (lower risk). Because company A, the leader in the industry, has ample funds in hand and its business is very stable, it could have

the advantage of choosing targets in many areas. On the other hand, company B which is more of a niche in the industry and has strengths in specific fields may not have a deep pocket. If Company B acquires more free cash flow and improves its physical strength, it will be able to pull down the Marginal target line. As a result, company B can expand the target range. Also challenging spirit against higher-risk may capture targets with higher return. As the Marginal target line gets closer to a horizontal line, the company does not have to be concerned about the risk so much. If the Marginal target line becomes completely horizontal, that means the company has nothing to do with the risk. By thinking in such a way, we can guess how the competitor has made a decision. This time, we have taken the case of overseas advancement of the automobile industry. For Company A, I quoted data of Toyota Motor Corporation. And as for Company B, I quoted data of Scania, a major Swedish automotive industry manufacturer of commercial vehicles – specifically heavy trucks and buses. Today, Scania has production facilities in Sweden, France, Netherlands, Argentina, Brazil, Poland, and Russia. In addition, there are assembly plants in ten countries in Africa, Asia and Europe. Scania's sales and service organizations as well as finance companies are worldwide. In this way, Scania is actively expanding its oversea business operations.

Based on the above observations, we conclude as follows.

- By organizing complicated information about the countries or areas where we plan to expand and visualizing their position, we can make each decision-maker's recognition clear.
- By changing the basic values or correction values according to the purpose of examination, we can customize positioning maps.
- We can predict acceptable degree of risk from the position of the countries or areas where we plan to expand, compared to our free cash flow.
- We also can infer competing company's determination process under the environment surrounding them.

Since this framework has versatility, it can be applied to our daily life. For example, how about the case of job searching or marriage partner searching. In the case of job searching, factors which determine return will be lifelong wages or the gratification of doing the work. On the other hand factors which determine risk will be employee turnover rate and so on. Factors which determine the Marginal target line will be employability or challenger's spirit. The 2012 White Paper on Small and Medium Enterprises in Japan says "As Asian markets grow, demand in Japan stagnates and customers move abroad, SMEs in manufacturing and the wholesale trade sectors, among others, are also moving overseas. In order to do business overseas SMEs will be required to overcome certain obstacles and cope with challenges and risks which are different from those in Japan. Numerous examples are found of SMEs that have established better overseas outlets taking advantage of their strengths that have lain semi-dormant in domestic markets and which revitalize their operations in Japan. In order to expand overseas businesses, SMEs need to have a clear understanding of the risks and challenges involved. SMEs which determine to advance overseas need to polish up their strengths at first. In other words, some type of competitive technique should be acquired. The 2012 White Paper also says "financial reserves were identified as the most necessary requirement for making foreign direct investments." Good physical condition is also required. If the above-mentioned conditions are met, by foreseeing with an assumed risk, mental strength is needed at last.

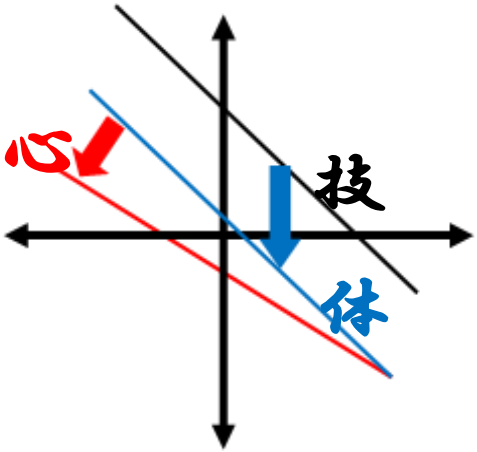

Fig.4 Three qualities for overseas advancement

心	Sin	heart	Human resources
技	Gi	technique	Technical skill
体	Tai	physique	Capital strength

Reference

[1] *Understanding the Sharpe Ratio,* Investopedia Staff

[2] *The 2012 White Paper on Small and Medium Enterprises in Japan* (in Japanese), Small and Medium Enterprise Agency (2013)

[3] *Wikipedia, the free encyclopedia, Scania*

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