

## Development of New Management Prediction Support System based on Non-stochastic Model

Toshihiro Kaino\* Kaoru Hirota\*\* Akimichi Mitsuta\*\*\* Yasuyuki Miura\*\*\*

\*School of Business Administration, Aoyama Gakuin University

4-4-25, Shibuya, Shibuya-ku, Tokyo 150-8366, Japan, kaino@mue.biglobe.ne.jp

\*\*Department of Computational Intelligence and Systems Science

Interdisciplinary Graduate School of Science and Engineering

Tokyo Institute of Technology, Midori-ku, Yokohama 226-8502, Japan, hirota@hrt.dis.titech.ac.jp

\*\*\* CSD Corporation,

605 West KSP, 3-2-1 Sakado, Takatu-ku, Kawasaki 213-0012, Japan

**Abstract** -In the field of financial technology, it is the U.S. initiative, and Japan is obliged to flattery in many respects. Currently Japan is in a too much defenseless situation that the economic structure is based on U.S. theory. In the conventional stochastic theory, it is also facts that the prediction sometimes does not hit in the actual problem because it assumes a known probability distribution, none of which illustrates the real situation. A new research and development of management prediction support system is proposed based on fuzzy measures, that deals with the ambiguous, subjective evaluation by the people living in the real world well. Especially, the system will support venture, small, and medium companies.

### I. Introduction

Now, there is nothing until it says that the U.S. pre-dominancy in advance computing technology, but also in the field of financial technology, it is the U.S. initiative, and Japan is obliged to flattery in many respects. As a mental climate, there is a view that making is more valuable than the economic profits creation by paper operation in Japan. Also, in the economic field, the U.S. has developed a rich successful theory and technique in the field which predicts the near future in stochastic theory from the past time series data. In Japan, it is in a too much defenseless situation that the economic structure is based on U.S. theory. In Japan, it is too much defenseless situation in the U.S. theoretical data presentation. Japanese government aims the Advanced Information and Telecommunications Society. So, it is necessary to show the new management science, which can exceed the U.S. further. In the former stochastic theory, it is also facts that the prediction sometime does not hit in the

actual problem because it assumes a known probability distribution. Then, we propose research and development of the new management prediction support system based on fuzzy measures<sup>[1]</sup>, which deals with the ambiguous subjectivity evaluation of man in the real world well. Especially, this system will support minor companies and promote venture companies. Furthermore, we will develop the corporate valuation system based on the theoretical result and an actual corporate database. And it will be provided to venture, small and medium companies as the consulting service in order to promote the new industry.

### II. Significance of Research

In 1973, F. Black and M. Scholes proposed the option pricing model<sup>[2]</sup> based on the stochastic theory. Against "Nixon Shock (1971)", "End of Smithsonian Regime (1973)", "First Oil Shock (1973)", and "Inflation (since 1970)", various derivatives were developed for the risk hedge (refer to Table 1).

Table 1. Example: Financial Derivatives

Underlying Securities	Exchange	OTC (Over The Counter)
Interest Rate	Interest Rate Future Interest Rate Future Option	Interest Rate Swap Swaption FRA
Currency	Currency Future Currency Future Option	Forward Currency Swaption FXA
Bond & Note	Bond & Note Future Bond & Note Future Option	Bond & Note OTC Option
Stock	Nikkei225 Future Nikkei225 Future Option TOPIX Future TOPIX Future Option	Stock OTC Option
Commodity	Commodity Future Commodity Future Option	Commodity Swap

Also after that, against the further financial liberalization, various kinds of synthetic derivatives continue being developed one after another. Financial Engineering accomplished the further development in a variety of domain (refer to Table 2).

Table 2. Domain of Financial Engineering

(1)	Asset Allocation
(2)	Portfolio Management
(3)	Asset and Liability Management (ALM)
(4)	Risk Management
(5)	Debt Management
(6)	Project Finance
(7)	Mergers and Acquisitions (M&A)
(8)	Real Option

And, for example of some hedge funds (LTCM, Quantum Fund, and Tiger Fund, etc.), derivatives have power to the extent that it has big influence on the national economy because of their leverage power (refer to Table 3). Probably, the Asian economic crisis of the 90s will be new to your memory.

Table 3. Dealing amount of financial derivatives (OTC)<sup>[3]</sup>

Country	Billion dollars per day	Country	Billion dollars per day
British	171	Germany	34
U.S.A.	91	Singapore	11
France	46	Hong Kong	4
Japan	42	<b>Total</b>	<b>362</b>

Moreover, the real option theory<sup>[4]</sup> into evaluation of a real asset (venture business, real estate, and the weather, etc.) is developed by the Black & Scholes option pricing model based on the stochastic model. This theory is beginning to be applied in all industrial fields (refer to Table 4).

Table 4. Application area of real options

Industries	Applications
Energy	Adjournment Option
Foods	Weather Derivatives (Raw-material Supply)
Biotechnology and Drugs	Planning of R&D Investment Strategy Valuation of Gradual R&D Investment Cooperation Strategy with R&D Ventures
Metal	Designing the Contract Term with Suppliers Valuation of Plant Investment
Manufacturing	Option Valuation of Equipment Investment Designing the Insurance of Supply Apparatus International Permits Trading of CO <sub>2</sub>
Trading	Investment Valuation of Business
Retailer	Designing the Contract terms of SCM
Finance Service	Consultation & Development Risk Hedge Products Foundation of Risk Asset Exchange
Real Estate	Valuation of Real Estate Investment Trust

Transportations	Designing the Logistics Depot Designing the Logistics Services with Guarantee
Media and Tele-Communication	Designing the Strategy of Multi-Media Business Valuation of IT Business Investment Foundation of S/W Distributing Right Exchange Valuation of Rights (Broadcasting Right etc.)
Gas & Electricity	Valuation of Plant Investment Energy Derivative Trading
Service	Designing the Large-sized Performance Development the new service with new insurance

By the way, although the Black & Scholes model is premised on following log normal distribution by the underlying price, it is pointed out by many researchers that this assumption is not necessarily realized<sup>[5][6][7]</sup>. Although various kinds of improvements are done, there is still an application limit in respect of the statistics distribution and additivity of probability measure. In evaluation of venture, small and medium companies, underlying assets are a companies, the distribution of the value of underlying assets was not probability distribution. So, our research group proposes the new corporate evaluation model based on Choquet Integral<sup>[8][9]</sup>. It can deal with ambiguous and discrete data better. As a result, if the IT venture businesses grow up greatly by this proposed theory (system), it will greatly contribute also to Japanese economical development, Japan itself will be activated, and it will contribute also to stabilization of international economy.

### III. Overview of Research

In this research, it is the purpose of the first phase to make the new theoretical model for the corporate evaluation for venture, small and medium companies especially itself. By this theoretical model, a company can grasp the current company value exactly, and predict the company future value when the management plan is attained. In this field, some package software products have begun to appear. However, most of them are based on the U.S. conventional statistics technique. Many researchers point it out that the corporate value is not well evaluated by this statistical technique. In this application field, it is necessary to evaluate the corporate value using the ambiguous and discrete data. In order to deal with this ambiguous and discrete data, it is necessary to apply the new option pricing model using Choquet Integral<sup>[8]</sup>. As a concrete design, the long-term debt rating model<sup>[9]</sup> using Choquet integral is examined. Further, the management advice system using the differentiation of Choquet integral<sup>[9]</sup> will be built. In order to improve corporate value efficiently,

this system advises which evaluation index should be raised. Moreover, corporate evaluation by the real option pricing model using Choquet integral is examined by an actual data (which S & P can deal with, and cannot be dealt with). For that purpose, accumulation of real data is very important, and the corporate database for valuation should be established. Furthermore, in all the actual corporate activities, it is very important to grasp the management situation of a customer

company, in order to hedge the risk by a customer's bankruptcy etc. Moreover, there is the problem how to evaluate the partner company "whose face is not visible" on the internet and it becomes the obstacle of e-business market growth. This model should be helpful to evaluate such a partner company on cyber space, and promote the e-business & IT industry.

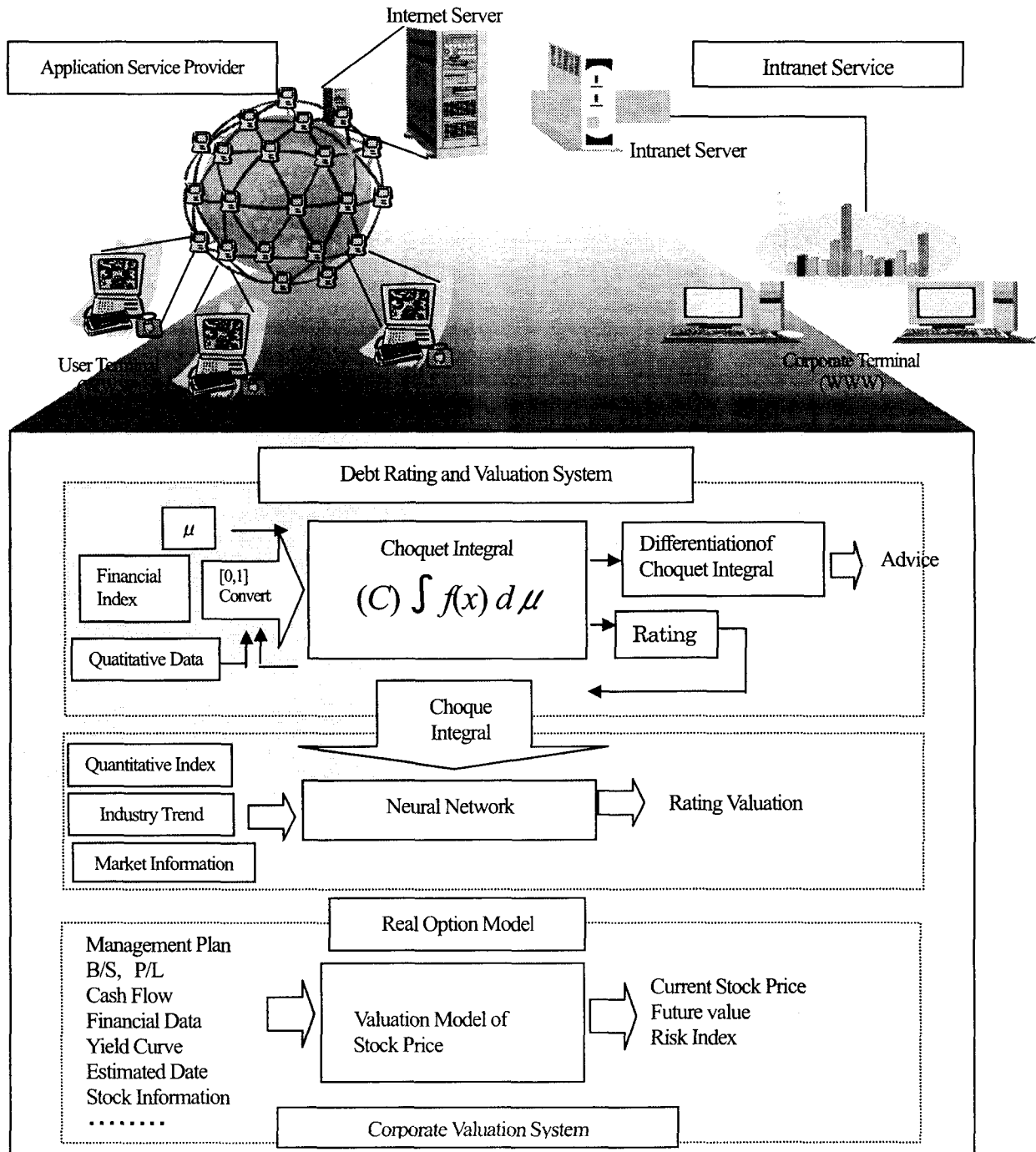


Figure 1. New Management Prediction Support System

#### IV. Conclusions

In venture, small and medium companies, it is most important to reserve their cashflow and increase their customer base by strengthening their business administration. However, it is very difficult for venture, small and medium companies to take out a loan from banks in Japan. So, bankruptcy is increasing every year. Generally, the financial institution takes time to evaluate venture, small and medium companies because of their little information disclosure. Then, it has become the cause of bankruptcy that financing does not go smoothly. Incidentally, it is easy for financial institutions to support big enterprises because that the debt rating system is almost established by Moody's and Standard & Poor's. On the other hand, there is few management know-how and skillful staffs at venture, small and medium companies. But, the number of venture, small and medium companies is 90% or more of all companies in Japan. It is an emergent subject for Japanese economy to support those venture, small and medium companies. By the way, the most of US's corporate evaluation model is based on a statistics model, but the details of that model are not disclosed. So, it is very difficult for each rated companies to find how to raise the rating results, clearly. In this research, a new management prediction support system based on non-stochastic model (refer to Figure 1) will provide this needs for venture, small and medium companies strongly.

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