Chapter 4
Black–Necked Swans and Active Risk Management

Tze Leung Lai
Stanford University, USA

Bo Shen
Stanford University, USA

ABSTRACT

This chapter gives a review of recent developments in sequential surveillance and modeling of default probabilities of corporate and retail loans, and relates them to the development of early warning or quick detection systems for managing the risk associated with the so-called "black swans" or their close relatives, the black-necked swans.

INTRODUCTION

Taleb (2007) proposed the Black Swan Theory to explain high-impact, hard-to-predict and rare events, which are far beyond the realm of normal expectations, i.e., black swans. He did not consider, however, what to do with the black swan's cousin, the black-necked swan. The black-necked swan, unlike the Australia-bound black swan, is born covered in white, but its neck gradually darkens from 3 months onward. Hence there is the "black-necked swan problem" concerning whether a given swan born white will stay white. And yet, an even harder problem is when and where it might possibly turn black (See Figure 1).

Risk management should take into consideration the possible appearances of these "black swans" and "black-necked swans". Once in a while a driver gets a traffic ticket; he/she starts to watch out for a few weeks and then forgets about everything until another traffic violation. Good risk management practice entails active vigilance and continuous monitoring of the financial situation and relevant macroeconomic variables. Early warning systems, surveillance technologies, and accurate, up-to-date and easily accessible databases are important tools to support this kind of active risk management.

This chapter describes statistical models and methods for on-line surveillance and early warning/quick detection of risk associated with "black-necked swans" and even "black-swans".

Figure 1. Black-necked swan
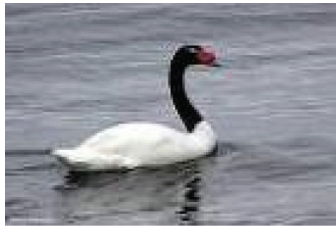
Traditional risk management considers risks associated with adverse events that occur with substantially higher, albeit small, probability. We first give a brief review of a number of important ideas in traditional risk management that is mostly passive and precautionary in nature. We then refine some of these ideas for active risk management, which also involves sequential detection of structural changes and surveillance of financial risks. In this connection, recent advances in on-line surveillance and sequential detection are also reviewed. We conclude with some remarks and further discussion of the advantages of active over passive risk management in today's complex financial markets.

MEASURES OF FINANCIAL RISKS AND THE BASEL ACCORD

In this section, we first summarize different categories of financial risks and commonly used risk measures; a classic reference on these topics is Jorion (2004). Then we review the regulatory background underlying statistical methods for risk management, focusing primarily on the Basel Accord. The Basel Accord was developed in 1988 by the Basel Committee on Banking and Supervision (2005, 2006) and was later widely endorsed by banks in G10 countries. It provides a unified statistical approach to measuring the risks in banks and specifying the amount of capital needed to hedge against these risks. The first Basel Accord introduced 8% as the minimum solvency ratio,

defined to be the ratio of capital to risk-weighted assets. We focus primarily on the internal ratings models, introduced by the second Basel Accord (Basel II), which use rigorous statistical models to calibrate the solvency ratio for each bank.

Categories of Financial Risks

The main types of financial risks are: market risk, credit risk, liquidity risk, operational risk, and legal risk. Market risk is the risk that the value of an investment, largely equity, interest rate, currency or commodity, will decrease due to changes in prices and the market. Credit risk is the risk due to uncertainty in a counter party's (also called an obligor's) ability to meet its obligations. Liquidity risk is the risk that an asset cannot be sold due to lack of liquidity in the market, usually associated with widening bid-ask spread. Operational risk is the risk of loss arising from execution of a company's business functions caused by people, procedures or systems. This includes human error and fraud. Legal risk is the risk of potential loss arising from the uncertainty of legal proceedings, such as bankruptcy laws.

Commonly Used Risk Measures

There is no single risk measure that is appropriate for every risk management application. We review several measures and briefly summarize their pros and cons.

Value at Risk. Value at risk (VaR) is a downside risk measure that focuses on losses. It measures the maximum loss of a financial institution's position due to market movements over a given holding period with a prescribed confidence level. Specifically, $VaR_\alpha = \inf\{y: P(L > y) \leq 1 - \alpha\}$, where L denotes the loss. Although it is widely used in risk management, VaR is not a coherent measure in that it does not satisfy subadditivity, e.g., diversification may not reduce VaR.

Related Content

Applied Cryptography in E-mail Services and Web Services

Lei Chen, Wen-Chen Hu, Ming Yangand Lei Zhang (2011). *Applied Cryptography for Cyber Security and Defense: Information Encryption and Cyphering (pp. 130-145).*

www.irma-international.org/chapter/applied-cryptography-mail-services-web/46240

Smart Card Applications and Systems: Market Trend and Impact on Other Technological Development

Gerald Maradan, Pierre Cotteand Thierry Fornas (2004). *Information Security Policies and Actions in Modern Integrated Systems (pp. 98-148).*

www.irma-international.org/chapter/smart-card-applications-systems/23370

Reverse-Engineering Malware

Marwan Omar, Luís Borges Gouveia, Jamal Al-Karakiand Derek Mohammed (2022). *Cybersecurity Capabilities in Developing Nations and Its Impact on Global Security (pp. 194-217).*

www.irma-international.org/chapter/reverse-engineering-malware/296838

Watermarking Images via Counting-Based Secret Sharing for Lightweight Semi-Complete Authentication

Adnan Gutub (2022). *International Journal of Information Security and Privacy (pp. 1-18).*

www.irma-international.org/article/watermarking-images-via-counting-based-secret-sharing-for-lightweight-semi-complete-authentication/285024

Cyber Security of Children: Implications for Sub-Saharan Africa

Stephen M. Mutula (2008). *Security and Software for Cybercafes (pp. 46-61).*

www.irma-international.org/chapter/cyber-security-children/28529