KNOWLEDGE LEVEL MODELING FOR SYSTEMIC RISK MANAGEMENT IN FINANCIAL INSTITUTIONS

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KNOWLEDGE LEVEL MODELING FOR SYSTEMIC RISK MANAGEMENT IN FINANCIAL INSTITUTIONS

金融机构系统性风险管理的知识层面建模

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ABSTRACT

The subprime mortgage crisis is an ongoing economic problem characterized by contracted liquidity in the global credit markets and banking system. Many banks, real estate investment trusts (REIT), and hedge funds have suffered significant losses as a result of mortgage payment defaults or mortgage asset devaluation. The current subprime mortgage crisis is a typical case for systemic risk in financial institutions. Systemic risk refers to the risk or probability of breakdown (losses) in individual parts of components and is evidenced by co-movements (correlation) among most or all parts. Many factors contribute to the complexity of the systemic risk management (SRM) in financial institutions at modern society, e.g. financial innovations. So as mentioned by Nobel laureate, Dr. A. Michael Spence, an important challenge in going forward is to better understand these dynamics and complexities of SRM in financial institutions as the analytical underpinning of an early warning system with respect to financial instability. The objective of this thesis is to fill this gap.

Knowledge based technologies have been used considerably to solve complex problems during the last few decades. In order to further our understanding and communication about SRM in financial institutions, this thesis proposes a knowledge level model (KLM) for systemic risk management in financial institutions. As first proposed by Newell, the main focus of KLM is to capture and represent knowledge without paying more attention to implementation.

There are two parts considered in the proposed KLM are: ontologies and problem solving method (PSM). Ontologies are adopted to represent a knowledge base of KLM, which
integrates top level ontology and domain level ontologies. And then the problem solving method is given to show the reasoning process of this knowledge. Further, the details of domain level ontologies for SRM, the focus of which is the contagion effect of systemic risk, are also discussed in this thesis. Three categories of ontologies, including static ontology, dynamic ontology, and social ontology are developed to deal with different perspectives in this domain.

The symbol level of KLM is also discussed which integrates OWL, SWRL and JESS. Further, two financial cases are provided to illustrate how proposed KLM is used in financial institutions, including the LTCM case in 1998 and Lehman Brother’s minibonds case in 2008.

With these, first, they will enhance the interchange of information and knowledge sharing for SRM within a financial institution. Second, they will assist knowledge base development for SRM design, for which a prototype of financial systemic risk management decision support system is given in this study. Third, they will support coordination among different institutions by using standardized vocabularies. And finally, from the design science perspective, the whole proposed framework could be meaningful to models in other domains.

**Key words:** systemic risk, knowledge level modeling, ontology, problem solving model, SWRL, OWL, JESS, subprime crisis
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