DIRECTED RISK RESEARCH PROPOSAL

Risk Theme	Systemic risk

Client Info: *(only applicable if proposal is in response to a client problem statement)*

Problem Title	Network structure and shock propagation in financial networks				
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University		**Classification**	
Problem Nr.	PS16002	**Type**	
Proposal Nr.	RP16001	**Date**	29 July 2016

PROJECT TITLE: Network structure and shock propagation in financial networks

PROJECT GOAL:

Build a model to investigate how shocks propagate through different financial networks based on liquidity risk and contagion.

PROJECT SCOPE

This project attempts to compare the robustness of certain financial structures and how well they can withstand external shocks. The complexity of financial networks make it difficult to gauge the effect of the structure on stability. For this reason we consider a simplified banking system that can be considered more realistic than previously proposed systems.

The Basel Committee on Banking Supervision (BCBS) was instructed by the Financial Stability Board of the G20 to improve its Basel II regulatory framework following the latest international financial crises. This led to the development of Basel III, which is aimed at improving some of the shortcomings of the Basel II framework. One of the most important objectives of Basel III is to ensure that banks are better able to withstand future potential financial crises, thereby aiming to strengthen the system as a whole. The BCBS proposed a phased implementation of the Basel III guidelines and provided timelines for banks to meet the different regulatory guidelines.

Regulatory requirements such as Basel III essentially aim to influence the system in such a way as to make it more robust. In light of this, it is important for regulators to be aware of the properties of the system that make it prone to collapse. These properties need to be monitored and controlled by regulators in order to protect the system as a whole.

Many of these studies assume an Erdös-Rényi structure for the connections between the banks, which simplifies some of the computations involved. However, this is not a representative structure for most real life systems. Previous studies (for example [1] and [2]) suggest that certain banking system represents a 'tiered' network where there are a few large and highly interconnected institutions, and a number of smaller institutions that mainly connected to the larger ones. This highlights the need to look at structures other than that imposed by the Erdös-Rényi assumption.

[1] M. Boss, H. Elsinger, M. Summer, and S. Thurner. Network topology of the interbank market. Quantitative Finance, 4(6):677–684, 2004.

[2] R. Cont, A. Moussa, and E. B. Santos. Network structure and systemic risk in banking systems. Handbook of Systemic Risk, pages 327–368, 2013.

PROJECT OBJECTIVES

A network approach is used to mimic the behaviour of a banking system when it is subject to an external shock. The basics of the model used for investigating the propagation of shocks are similar to that used by Haldane and May [3] and Nier et al [5]. However, the model proposed here can be regarded as a refinement as it incorporates liquidity effects (similar to [4], but with slightly different dynamics) as well as a proxy for investor/depositor psychology. It is assumed that the network is closed in the sense that banks/institutions outside the network have no effect on the cascade once it is in progress. As the results are to be interpreted from a regulator's point of view, the model also disregards the presence of a possible lender of last resort. By excluding a central bank, the model enables the relevant central bank to assess its risk and to analyse various forms of interventions. The model can be extended to include a central bank, along the lines of [6], where a dynamic model of systemic risk is considered. However, a dynamic model might be regarded as speculative, seeing that there currently exists no proper understanding of the behaviour of complex banking networks under stress, even in a static sense. The time evolution of such system is currently even less clear and is open to significant future research. The aim is then to compare the different structures in terms of robustness and perform sensitivity tests on the factors that influence stability. A final aspect that is to be investigated is the merging/splitting of nodes in a system, including in networks that stylistically comparable to South Africa.

[3] A. G. Haldane and R. M. May. Systemic risk in banking ecosystems. Nature, 469:351 – 355, January 2011.
[4] R. M. May and N. Arinaminpathy. Systemic risk: the dynamics of model banking systems. Journal of the Royal Society, 7(46):823–838.
[5] E. Nier, Y. T. Yang, Jing, and A. Alentorn. Network models and financial stability. Working paper 346, Bank of England, April 2008.
[6] Georg CP. The effect of the interbank network structure on contagion and common shocks. Journal of Banking & Finance, 31;37(7):2216-28, July 2013.

RESEARCH OUTPUTS / DELIVERABLES

PUBLICATIONS:	**Name(s) / Title(s)**
Articles	2

STUDENTS:	Name(s) of Student(s)
Ph.D	Nadine Walters

APPROACH TO BE FOLLOWED

1) Study existing network models of systemic risk and decide on different structures to investigate (completed).
2) Program and document the new, refined network model of systemic risk (completed).
3) Compare different network structures, evaluate sensitivities and assess the impact of splitting/merging nodes in a banking system similar to South Africa's system.

STRATEGIC VALUE TO DIRECTED RISK RESEARCH

This research will contribute to the literature on financial network models of systemic risk and will investigate network structures not previously investigated by means of network models. The outcome of the research will be relevant to the regulatory requirements imposed by the Basel accords and the South African Reserve Bank. This research project forms part of an overarching systemic risk research initiative to develop macro-economic models (e.g. for South Africa) that can be used to study systemic risk.