Macroprudential Policy to Manage Systemic Risk Which Derives from Financial Institutions in Case of Mongolia

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ABSTRACT

This study presents a measurement model of systemic risk in the frontier market fully employing financial statement data. FTSE (Financial Times Stock Exchange) survey notes that the frontier markets exist in more than 150 countries. The sum of systemic risk in total frontier markets can hinder economic stability in terms of a herd of risk. The frontier markets would be likely to imply unpredicted systemic risk if we think based on previous lessons learnt from being unable to foresee the early signals of Lehman Brothers shock. The reasons for rarely studied these markets' systemic risk might be concluded that the markets are systemically not important and exist the lack of data access for publicly available. Therefore, I gave it my best shot to capture the systemic risk in the frontier market entirely using financial statement data.

It is sometimes said that the frontier market is systemically not important because of small, however, the research argued that the interconnection between financial institutions is highly likelihood to raise systemic risk even if it is small one. The fact is majority of financial institutions in developed, emerging, and frontier markets are deeply interconnected with each other via network. For instance, a financial market in Mongolia is one representative of the frontier markets. As a financial regulatory aspect, financial conglomerates are increasing and deepening the interconnection between them in the environment of bank-dominated, and underdeveloped capital market. Hence, the intuition is to catch the systemic uncertainty behind increasing the conspiracy in financial conglomerates to impact negatively on financial stability. To accomplish this, the methodology is carried out to measure financial institutions' contribution to systemic risk.

The financial institutions' contribution to systemic risk could be computed by systemic expected shortfall. The systemic expected shortfall would be dependent on marginal expected shortfall and in addition be explained by financial leverage and liabilities as increasing the predicting power. Moreover, financial statements are a situational mirror of financial institutions. Based on these assumptions, time-dimension and cross-dimension of systemic risk were empirically measured using financial statement data. Potential variables from financial statements were tested to pick up the variables which could forecast systemic risk. Because stock returns, capital market data, have been frequently experimented around the previous literatures, whereas financial statement data of the frontier markets are new for systemic risk measurement.

As a result of an analysis, systemic expected shortfall could explain cross-dimension systemic risk which financial institutions' contribution to systemic risk. Subsequently, time series of marginal expected shortfall has ability to forecast the amount of systemic risk in the next two periods. Eventually, macroprudential policy, policy tool of systemic risk, would be easily developed after forecasting financial institutions' contribution to systemic risk.

Key words: systemic risk, macroprudential policy, systemic expected shortfall, marginal expected shortfall, financial leverage, value at risk, expected shortfall, optimal tax

CHAPTER I. INTRODUCTION

Historically, economic crises have been prevalent and generated adverse follow-on effects. Prototypical examples include the economic meltdown of 2008, the Great Depression of 1929, the oil shock of 1979, and the Asian financial contagion of 1997. Main negative effects of such events often entail decreased purchasing power, mortgage foreclosures, job losses, and food scarcity, especially for the destitute. Admittedly, a wealth of information about such economic malaise and its attendant systemic risk exists.

Financial institutions face manifold risks: credit, market, operational, strategic, reputational, and systemic. Concurrently, they are also risk creators. For instance, when all institutions in a financial market are under distress, the economy is hampered, thus hindering economic growth. Existing financial systems have systemic risk. Such risk affects numerous participants, including households, investors, governments, businesses, and intermediaries in financial markets and can result in dislocations in an economy.

In today's globalized era, owing to world trade and technological advances, economies of scale help to reduce costs considerably, thus enhancing countries and their economies. Likewise, financial markets are highly interconnected, using technology for provision of financial services.

This research paper is about systemic risk, which is derived from financial enterprises in Mongolia. Macroprudential policy is a new policy tool to manage systemic risk and then enhance financial stability. The fundamental focus of interest is to assess the amount of financial institutions' contribution to systemic risk to enhance financial stability. An additional attempt is to explain the financial stability, systemic risk, its management referring to macroprudential policy, and its difference from microprudential policy to capture academic descriptions.

Mongolian financial market is bank-dominated and in an early stage of stock market development. On the other hand, the financial market is a frontier market. The market dominated by commercial banks are transferring to financial conglomerates and similarly, their interconnections are increasing. This gives a signal of the increasingly likelihood of facing unrecognizable systemic risk. Generally, the systemic risk in the frontier market need to be mandatory managed.

In particular, no study to our knowledge has considered any evaluation of systemic risk, and also implementation of macroprudential policy in the frontier market. To recover this research gap, I devoted to measure systemic risk in the frontier market by drawing available data from financial statements. As a result, this paper might become a potential literature getting an encouragement to other frontier markets.

This research paper covers seven parts. Chapter 2 presents a basic concept of systemic risk and macroprudential policy. The chapter aimed to express the definitions of financial

stability, systemic risk, financial instability and macroprudential policy which argued by research.

Chapter 3 provides a literature review about methodologies estimating financial institutions' contribution to systemic risk. Generally, this chapter covers several types of methodologies of conditional value at risk, its extensions, maximum likelihood estimations, extreme value theory, and Shapley value.

Chapter 4 offers the methodology employed for evaluating systemic risk contribution of Mongolian financial institutions. To evaluate this, an economic model formulated systemic expected shortfall which would be explained by marginal expected shortfall and financial leverage.

Chapter 5 is an empirical analysis consisting of two sections pertaining to Mongolian financial markets and the primary evaluation. Specifically, Mongolian economic and financial stability was explained as cyclical aspect. To find potential data, alternative variables from financial statement were tested. An analysis consists of time series and cross-sectional analysis to evaluate two stems of time-dimensional and cross-dimensional systemic risk.

Lastly, Chapter 6 reveals the conclusions.

CHAPTER II. THE CONCEPT OF FINANCIAL STABILITY AND SYSTEMIC RISK

Financial market's role in an economic growth is to provide an efficient capital allocation and play a role of an intermediary. Similarly, financial market's flat and continuous growth will support economic stability. Nonetheless, an overall financial market has not developed consistently smooth way throughout history, whereas there has occurred collapses, booms, and crises which worsen the economy and social well-being. To achieve and maintain financial stability has become more and more important for regulators, policymakers and market participants for pleasant life of human-being in terms of Sustainable Development Goals.

An implementation of the systemic risk management and its policy guidance has grown in recognition since 2008's Lehman Brothers shock in order that whole nation prevent from shocking fluctuations. Since then, macroprudential policy has been strengthened to implement actively around the world. In addition, the risk management perspective extended markedly from individual risk to systemic risk in order to build a tolerance against frequently occurred crisis.

Maintaining financial stability is not only responsibility for the government, but also supranational regulators are aware of it with respect to one of their basic roles. At the beginning of the research, I would like to answer the following questions: What is financial stability? How does systemic risk engulf it? and What mechanisms are carried out in an implementation of macroprudential policy?

2.1 Financial stability

Some scholars critically dig out to draw a big picture of financial stability, and then they could describe it to some extent. Subsequent paragraphs are scholars' constituted delineations about financial stability.

In accordance with Allen and Geoffrey (2005), financial stability is to be far away from instability so that fear of financial instability is not a material cause in economic decisions.

J.Schinasi (2004) highlighted that financial stability is to be able to implement its rules in economy that means to allocate capital efficiently, manage its risk, maintain its capacity to perform the functions and be flexible to external shocks. Alternatively, the financial system has capability of dissipating financial imbalances that arise endogenously from adverse shocks and unanticipated events. Additionally, Schinasi (December 2009) characterized globally that the financial system has built cross-border linkages through triad of institutions, markets and infrastructures from one country to another, and one country's problems transmitted to others via these linkages.

Moreover, the stability of financial institutions and markets make up the stable financial system, and market participants tend to be high degree of confident with their intermediaries that they could achieve their contractual obligations, in addition, the market must be provided to be far away short-term extreme volatilities.

To sum up, the financial stability means the financial market facilitates its function well to accelerate an economy in way of allocating assets to efficient investment opportunities. To achieve this, financial institutions and markets are able to internalize external shocks, be flexible to contagion effects, as well as the importance of participants' confidence with financial market. In addition, the financial system ought to create capacity and mechanism to manage its risks at the systemic and individual level in the globally interconnected environment.

Financial stability is long term consistent growth, in contrast to not being sudden up and down change of financial activities.

Based on definitions, systemic risk is one of causes is volatilizing financial stability which is lessons learned from Economic Crisis 2008.

2.2 Systemic risk

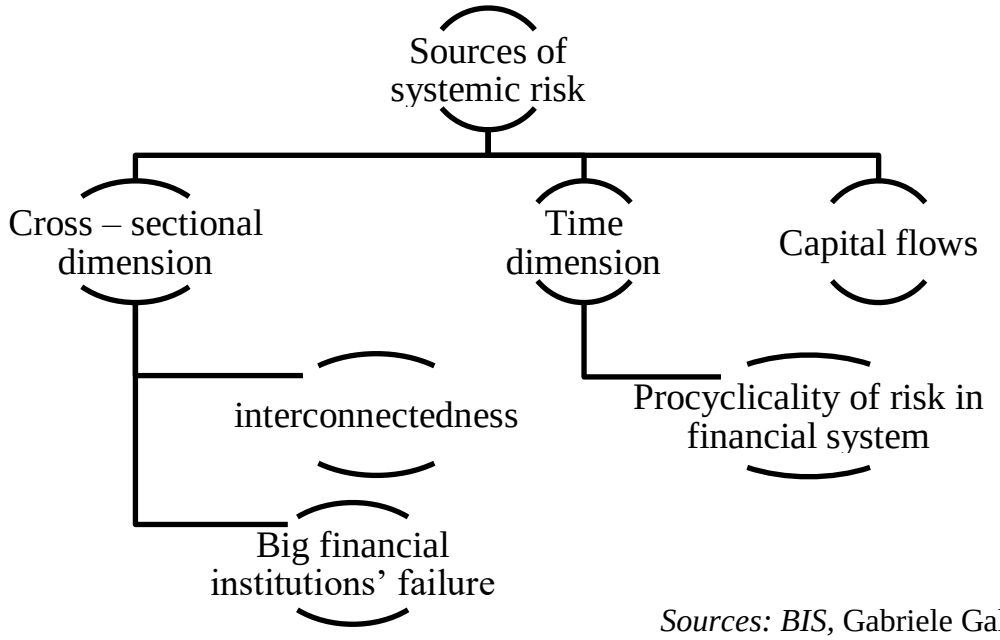
Systemic risk harms financial stability cause of propagation of contagion effects. Moussa (2011) concluded that systemic risk could occur in consequence of aggregate negative shocks affect all institutions in the system, and it differs from the risk in a financial institution by its spillover effect.

Figure 1 illustrates three main sources of systemic risk. First, cross-section dimension of systemic risk raises from contagion effects of the financial market, institutions and infrastructure in the networked and interconnected system. Too big to fail financial institutions have set out a concentration of the financial market by extending their business. Moreover, systemic risk does not solely come from systemically important entities, but also accumulated effects of minor financial institutions triggers to system as an aspect of herd of a risk.

Second, time dimension of systemic risk that long-term accumulated risks coincide with trough stage of a business cycle or hit by external shocks. Alternatively, these two sources are named as endogenous and exogenous systemic risk. Procyclicality of risk usually raises from economic cycle which means financial market is hit by economic shock.

Finally, capital flows in the international trade could hinder the financial market systemically when the shortage of capital inflows raise.

Figure 1. Sources of systemic risk



Sources: BIS, Gabriele Galati (2012)

First two resources of systemic risk directly come from financial market. Then following parts point out their factors.

Asymmetric information: Systemic risk can raise in condition of increasing asymmetric information in the market that causes of moral hazard, an adverse selection, moreover free-ride information.

Globalization: Globalization inherently implies systemic risk through all sector, whereby financial markets, supply chain, international trade and so forth. Lehman Brothers shock was first of the world-wide systemic risk in respect to globalization. Globalization in the financial market had constituted for 10 years, namely Golden decade 1998-2007.

Its first step coincided with the computerization that penetration of computer in financial activities, including stock order, business accelerated transactions. The negative aspect was technological risks likewise technical failure, cybercrime, and increasing cases of operational risks followed by human error to communicate with newly computerized environment. Moreover, regulators and policy makers released rules and opened the market internationally. It carried out to actively accelerate cross-border capital flow and increase densely interdependence in correspondence with technological advancement.

Financial deregulation: Financial markets were increased dramatically through the world-wide as a result of strong competition of countries to attract investors. Firstly, United states made deregulation in 1970, subsequently, United Kingdom and other countries in consequence of investment banks persuaded regulators to release strict ruling environment. Hence competition between financial hubs was grown and conducted increased profitability, tax revenue for government, as well as GDP, in result of every part of financial participants satisfied, including government. Unfortunately, value added situation was not so consistent

and everyone was cheated by short-term upstream because financial market was not stable, inherently implied systemic risk.

Deposit insurance: Government guarantee incentivizes to take excessive risk for mega financial conglomerates and conducted to high concentration. Financial market over the world has become more and more complex, massively interconnected (horizontally and vertically connected through the world), interdependent, however, non-managed the risk in systemic level.

New financial products: Newly issued products, namely shadow banking, alternative investment products, hedge funds, weren't regulated likewise traditional products. Particularly, securitization, collateralized debt, credit default swaps, asset-backed securities, and special-purpose vehicles buy risky assets from investment banks and cleared banks' balance sheet (statement of financial position) from bad debt.

Rating agencies: Big credit rating agencies evaluated worthiness of fixed income securities exaggeratedly until occurring burst the bubble of house price in 2008. The reason is a few rating agencies are monopolistic in the market. Primary issue is financial regulation had mandated that rating agencies are central source of creditworthiness of bonds. Second is Securities and Exchange Commission (SEC)'s established category of nationally recognized statistical rating organization which firstly approved only three rating agencies, so far, solely increased to 10. Moreover, SEC also set up protective entry barrier to other agencies. Third, conflict of interest between rating agencies and security issuers causing of changed model from investor pay to issuer pay as inform creditworthiness.

Direct and indirect connection: Golden (11 May 2014) worked out direct and indirect linkages of systemic risk. The direct linkage refers to interbank market of financial institutions and its complex and interconnected environment adheres to contagion effect. Additionally, systemic risk emerges from indirect linkage which means financial institutions diversifies its risk individually, but in fact, all of them invest only one basket of asset for the systemic level. Alternatively, Acharya (2009) defined the systemic risk that joint failure risk arising from the correlation of returns at the asset side of bank balance sheet. Last originator of systemic risk is information spillover (informational contagion), overlapping of herding behavior.

In accordance with Acharya (2016) definition, systemic risk can be thought of as widespread failures of financial institutions or freezing up of capital markets that can substantially reduce the supply of capital to the real economy.

Lastly, systemic risk is highly likelihood of happening absence of appropriate policy when unexpected losses raise and trigger, but its influence on financial market depends on the risk's dispersal of impact and transmission effects. Systemic risk triggers through contagion effect, then follows on the path to a loss of confidence and increased uncertainty, lastly instigates huge amount of negative impact on real economy. Hence systemic risk

wouldn't occur when it hasn't any possibility to transmit via contagion effect across financial markets. The contagion effect is a risk movement from one institution to another through market channel, information channel, payment system, interbank linkages, and liquidity.

Systemic risk has been defined in several ways. For instance, the European Systemic Risk Board has defined it as follows: "Systemic risk means a risk of disruption in the financial system with the potential to have serious negative consequences for the internal market and the real economy. All types of financial intermediaries, markets, and infrastructure may be potentially systemically important to some degree". According to Ian Golden (11 May 2014), systemic risk is the risk or probability of breakdowns in an entire system, as opposed to breakdowns in individual parts and components, and is evidenced by co-movements (correlation) among most or all parts. Regulating bodies also tend to have different perspectives on the systemic risk definition, depending on their regulating framework and legislation, particularly, supranational- and country-level regulators.

2.3 Financial instability

Financial instability is in condition of financial market doesn't function and not be able to perform its purpose. Mishkin (2007) described that this comes from asymmetrical information which is macroeconomic uncertainty, and inherently exists adverse selection and moral hazard. On the other hand, this becomes harder to make decision causing of raising information disruption in the financial market.

There are four categories of factors that lead to financial instability: increasing interest rates, increasing more and more uncertainty, asset markets affect on balance sheets, lastly problems in the banking sector.

2.4 Macroprudential policy

Main tool to manage systemic risk is macroprudential policy. Macroprudential policy has grown in recognition an extension of discovering policy papers in terms of Tinbergen principle since 2008.

Macroprudential policy has been actively developed by central authorities in each countries' policy makers, and international regulatory bodies: FSB, BIS, IOSCO, IAIS since Economic Crisis 2008.

IMF-FSB-BIS (31 August 2016) has defined the policy's objectives that:

"(1) increase the resilience of the financial system to aggregate shocks by building and releasing buffers that help maintain the ability of the financial system to function effectively, even under adverse conditions;

(2) contain the build-up of systemic vulnerabilities over time by reducing procyclical feedback between asset prices and credit and containing unsustainable increases in leverage, debt stocks, and volatile funding;

(3) control structural vulnerabilities within the financial system that arise through interlinkages, common exposures, and the critical role of individual intermediaries in key markets that can render individual institutions "too-big-to-fail"".

On the other hand, macroprudential regulation has attracted the attention of regulators during the past two decades. The Federal Reserve (Bernanke, 2009) has examined the possibility of creation of a systemic risk authority whose responsibility is to "(1) monitor large or rapidly increasing exposures across institutions and markets, rather than only at the level of individual institutions, (2) assess the potential changes in the markets and products that could increase systemic risk, (3) assess the risk of contagion between financial institutions within and across markets, such as the mutual exposures of highly interconnected institutions, and (4) identify possible regulatory gaps".

The macroprudential approach is limiting the significant macroeconomic costs which come from system-wide distress and shock effects in financial market (Hanson [2011] and Borio and Drehmann [2009]).

Kemp (2017) added to the research field that macroprudential policy is implemented by forward guidance to get feedback or abruptly to market financial institutions. But forward guidance is more preferable precisely because helping the regulator to update its policy based on an idea of public, on the other side, effective for institutions to change its working way of giving time to respond.

IMF concludes that an implementation of macroprudential policy has already spent two decades, and it was time to assess the policy in all advanced, developing and emerging markets, as a result they organized central macroprudential policy database. In accordance with an assessment, macroprudential policy has been becoming a crucial toolkit for policymakers around the world.

In conclusion, macroprudential policy complements public policy such as monetary, fiscal and microprudential to provide financial stability, furthermore, to achieve economic stability.

CHAPTER III. LITERATURE REVIEW

An evaluation of systemic risk in the frontier market is almost new thus it is necessary to find appropriate method. Therefore, what is the appropriate way?

Follow on the path of finding the appropriate method being able to penetrate to the frontier market, currently the methods were primarily experimented in the advanced markets. Around the literature, I attempted to capture the methodology which could compute the systemic risk in the frontier market from currently built on measurements rather than tend to it critically.

Systemic risk's stems come from any shocks and then its cause of becoming more and more is triggered through financial institutions' interlinkages, their balance sheet connection and systemically non-diversified assets. The systemically non-diversification implies that each financial institution manages its portfolio by diversifying, however, it is not diversified at the entire system, as a result of cost of information, and so forth. Hence, risk transfers by these channels through financial institutions, namely contagion effect, domino effect, spillover effect, and trigger event.

Currently, the probability of financial institutions failure causing of specific institution default or macro shock has been measured actively by scholars thus formulated several methodologies. Following parts briefly explain about currently made academic research in the field of systemic contribution and interconnection of financial firms.

Financial institutions' contribution to systemic risk is a main driver of cross-section systemic dimension. The amount of contribution is measured by a variety of methods, respectively.

ΔCoVaR: Tobias Adrian (September 2014) evaluated conditional value at risk and aim to measure the systemic risk both condition of sector specific shock and spillover effects, then formulated to measure how the exposure of financial institutions affect to the system-wide, and then raises systemic risk in aspect of cross-sectional dimension. Delta conditional value at risk (ΔCoVaR) to forecast systemic risk is different from conditional value at risk at the median level and a definite quantile level. Hereafter, the opposite condition was also considered that how much financial institutions were deteriorated cause of occurring financial crisis and estimate by exposure-ΔCoVaR. Moreover, this formulation extended to measure the procyclicality, future probabilities of systemic risk using forward ΔCoVaR by formulating to an intercept and macroeconomic and institutions' variables. Lastly, predicted ΔCoVaR was analyzed to forecast the future systemic risk by using panel data of lagged to one quarter, one year, and two year. They employed variables of public traded companies' weekly stock return, loan, leverage, maturity mismatch and risk-free investment products from financial statement for panel and cross-section series. Next, quantile regression method was evaluated by regressing at confidence level of 95, 99, 99.9 percent.

Bayesian inference for CoVaR: M.Bernardi (November 5, 2013) estimated dynamic co-movement of two institutions during changing over time using Bayesian inference for CoVaR. Data was employed from publicly traded companies which belongs to different sectors such as financials, consumer goods, energy, industrials, technologies and utilities. Primary assumption is future tail behaviors of systemic risk can be forecasted time series of its past movements on asymmetric Laplace distribution. The study analyzed dynamic co-movement of two institutions, and the tail movements between an individual institution and the whole system. Further extension is Segoviano and Goodhart (2009)' systemic impact index (SII) which is probability at least one bank becomes distressed.

SRISK: Brownlees (March 2017) quantified systemic risk contribution of financial firms, then formulated SRISK that is model of weighing expected capital shortfall of financial institutions throughout time-series dimension. The viewpoint is systemically risky institutions build up minor systemic risks through long period. The highest SRISK is more likely to make the largest contribution to the undercapitalization of financial system, as a result of summing all institutions' SRISK draw the total amount of whole systemic risk that might hinder the financial system. SRISK methodology formulated the regression model consisting of explanatory variables of leverage and long-run marginal expected shortfall fractioned by percentage of capital adequacy. The long-run marginal expected shortfall is a simulation of single institutions loss in an occurrence of market distress. Panel data composed of daily stock return, daily market capitalization, and quarterly accounting data (total asset, debt and equity) from financial statement for ten years (2003-2012).

Multivariate extreme value theory: Zou (December 2010) measures extreme co-movements in set of tail behavior covering both cases of financial institutions' default and systemic shock. It takes into account three set of assuming formulation. First, PAO (probability that at least one bank becomes distressed) model to capture probability of at least one extra financial institution's default in condition of another particular institution failure, simultaneously. Second, PAO model extension is systemic impact index that measures to capture the total number of expected defaults in case of a particular institution's failure. Lastly, vulnerability index analyses a failure of financial institutions in case of systemic distress. PAO model and vulnerability index provides information to rank systemically important institutions, whereas systemic impact index estimates the systemic impact of one financial institution's failure. Data are daily stock returns, total asset, total equity, and total debt. The scholar concluded that too big financial institutions do not directly become systemically important, instead of, if their business strategy, portfolio and balance sheet are interlinked to others, they would be highly likely to become systemically important institutions. Alternatively, too-connected small financial institutions could become more systemically risky than large one. The financial institutions become too big to fail in case of their diversified portfolio is systemically too connected and interconnected their balance sheet, although they are managed well, individually.

Shapley value approach: Tarashev (March 2011) estimated each bank's incremental contribution to systemic risk using participation and contribution approach based on game theory. The participation approach supposes that shocks propagate to other banks systemically through interbank network. On the other hand, contribution approach measures the amount of bank's own risk to influence on systemic level. Hence, Shapley value is an estimation of the total amount of interconnected banks' contribution to systemic risk. Data are loans and liabilities (size, interbank liabilities and interbank assets) on balance sheet, off balance sheet and the probability of bank default. Specifically, banks' interconnection was analyzed creating the correlation matrix of co-movement using independent variables of interbank and non-bank assets.

International Monetary Fund (IMF) introduced four complementary approach to assess financial sector systemic linkages on the publication of Financial stability report, 2009. Four approaches are explained in following:

1. The network approach: The safety and soundness of financial institutions are not only importance, but also their linkages to others need to be managed in order to maintain financial stability. Hence, this approach takes into account two related shocks: First, an analysis of domino effect. The domino effect is estimated the probability of transmission of defaulted financial institution using credit risk linkages. Second, financial institutions are burdened by liquidity shortage when they borrowed to defaulted institutions. To measure these, IMF used the data of cross-country bilateral exposures published by BIS, and estimated simulations between cross-institutions.
2. The co-risk model: The purpose is to measure the co-movement (co-risk, or conditional distribution) of financial institutions in the case of risk event of one institution. Estimating co-risk across financial institutions, the model was formulated non-linear relationship and used the quantile regression of daily credit default swap spreads of 2003 to 2008.
3. The distress dependence matrix is organized to capture linear and nonlinear interdependence among financial institutions, and volatility of economic cycle implied evolving conditional probability. Alternatively, this model draws the correlation matrix between financial institutions by their equity option.
4. The default intensity model describes default rate of spillover effect by measuring the linear and nonlinear linkages.

Huang (August 2011) used stress test to judge the systemic contribution of financial institutions to impose insurance premium. Main indicators are probability of default (PD), loss given defaults (LGDs), correlation and liability weights. Monte Carlo simulation method was employed to compute an expected credit losses of financial institutions in condition of market total loss exceeding a given threshold.

Adams (September 2012) estimated spillover effects among financial institutions by extending a state-dependent sensitivity VaR model. The model is constituted as total market

VaR is dependent on VaR of 3 indices: U.S.REIT index, GSCI Commodity index, and index of U.S non-financial index, plus dependent variable's own lag period. the indices covered data of commercial banks, insurance companies, hedge funds, and investment banks.

Bernardi (July 26, 2018) captured extreme tail co-movements converted the Markov switching model. The model concentrated on multivariate Gaussian and Student–t distribution assumption.

Engle and Manganelli (2004) assumed that the distribution of return volatility in stock market is autocorrelated and developed conditional autocorrelated Value at risk (CaViaR) by regression quantiles.

Currently, the measurement and management of systemic risk has been conducted at the level of countries and supranational regulators. Internationally, Financial Stability Board (FSB), Bank for International Settlement (BIS), International Organization of Securities Commission (IOSCO), and International Association of Insurance Supervisors (IAIS), they usually develop guidance to manage systemic risk based on member countries' experiences. Recently, International Monetary Fund (IMF) became a research maker in this field and has disclosed financial stability report semiannually. European Union established European Systemic Risk Committee to manage interconnected systemic risk across its member countries and provide the guidance. Countries with rich experiences of systemic risk management are United States, Japan, Great Britain, Mexico and South Korea.

The studies of financial institutions contribution to systemic risk were mostly made in advanced market, and data access could be compiled from file of capital market. In contrast, data availability is confined to the frontier market, thus making the research face with some challenges. This field is conducted to gap the bridge of data shortage to strengthen an analysis of systemic risk in the frontier market.

CHAPTER IV. METHODOLOGY

Financial systemic risk engulfs whole economy, causing of default in most of the financial institutions. The risk pushes pressure on government to pay recovery costs of defaulted system by taxpayers' money. Whereas financial institutions have a possibility to internalize external shocks by measuring their contribution to systemic risk during systemic distress, instead of insuring to government.

Managing systemic risk is a different process of individual one, which means computing total expected loss of too concentrated and interconnected financial market, systemically.

To accomplish, how to measure systemic contribution of financial institutions?

Hence, the methodology is based on assumption of imposing optimal tax on financial institutions. The amount of taxation depends on financial institutions' contribution to systemic risk. From this assumption, the contribution is estimated employing systemic expected shortfall (SES) (Acharya, 2016) which is dependent on marginal expected shortfall (MES), and financial leverage.

Subsequent parts are written about explanations of economic model proof.

4.1 Basic of systemic contribution model

The model of contribution to systemic risk is based on a standard risk measure of firm level. The standard risk measure is "Value at Risk (VaR)" and "Expected Shortfall (ES)".

VaR is the standard risk measurement for financial institutions, as well as financial regulators to measure market, credit and operational risk, respectively. Afterwards, the expected shortfall was developed as an extension of VaR for the purpose of estimating a tail risk. The VaR and ES are:

The probability of random loss raises from random variable X at the confidence level of α. Alternatively, the VaR model was developed to assess the amount of risk at the definite confidence level at the normal distribution from 1980s' and becomes standard measurement of market and portfolio risk for entities, individually. The expected shortfall (Artzner et al. 1997) is the conditional expectation of loss given that the loss is beyond the VaR level.

VaR solely measures the risk of one individual institution, whereas an estimation of systemic risk requires an additional extension. Alternatively, VaR model evaluates the amount of risk in the confidence level of normal distribution. In contrast, the systemic risk raises extremely at the outlier of normal distribution. Then ES during crisis extended to

marginal expected shortfall (MES) due to equation 1 and 2, which measures how total risk in the system added to the financial institution's overall risk.

$$ES_\alpha = - \sum_i^1 y_i \mathrm{E}[r_i | R \leq -VaR_\alpha] \qquad \textit{(Equation 1)}$$

$$\frac{\partial ES_\alpha}{\partial y_i} = - \mathrm{E}[r_i | R \leq -VaR_\alpha] \equiv MES_\alpha^i \qquad \textit{(Equation 2)}$$

where R is financial institution i's return, α is percent of extreme event, y_i is the weight of group i, r_i is each group's return.

Hereafter, measuring each institution's systemic expected shortfall, as a dependent variable, follows on three kinds of factors: banks' incentives to do business, negative externality, and optimal taxation.

4.2 Financial institutions' incentives

Financial institutions intermediate to allocate cash flows from one part who planned to spend in the future to other who is demanding at the moment. Therefore, they run a business to gain profit such as fee, interest rate, and so forth.

Their financial position statement stands at balancing of credit and debt sides. The financial institutions manage assets in way of managing their risk by creating a diversified portfolio. In addition, they also reserve a definite amount of assets to prevent from predicted risks.

Table 1 shows an economic model of bank's incentives to do business. The model supposed that N financial institutions run during two periods. Equation 3 explains about financial institutions' investment to acquire target asset at time 0. The investment raises from two sources: debt and equity.

Equation 4 depicts total market value at time 1 which financial institutions earn return from their investment. The total market value of them is equal to a difference of pre-distress income (return) and costs of financial distress.

The distress costs depend on the market value of financial institutions and face value of outstanding debt. In addition, the costs could occur even if the institution does not default, however, it is restricted by total assets. The costs are guaranteed by the government to limit becoming more than market value of total assets.

Equation 5 shows fractions of the government guarantee. Equation 6 explains about the institution's net worth. The net worth is the residual amount to institution's owners after paying debt claims which are owners' required return (opportunity cost) and their utilized assets.

Table 1. Bank's incentives

No.	Times	Equations	Explanations
1	t=0	$a^i = \sum_{j=1}^{J} x_j^i$ $a^i = w_0^i + b^i$ *(Equation 3)*	a^i: *total asset* *J: number of assets which invested by each bank* *i =1, 2, ….. N, number of financial firms* x_j^i*: each bank's investment into available assets* *t= 0, 1* w_0^i*: equity* b^i*: debt*
2	t=1	$y^i = \widehat{y^i} - \phi^i$ $\widehat{y^i} = \sum_{j=1}^{J} r_j^i x_j^i$ $\phi^i = \phi(\widehat{y^i}, f^i)$ *(Equation 4)*	y^i: *total market value of asset* $\widehat{y^i}$: *Pre-distress income* ϕ^i: *Costs of financial distress* f^i: *outstanding debt*
3	Government guarantee on debt	$b^i = \alpha^i f^i + (1 - \alpha^i) E[min(f^i, y^i)]$ *(Equation 5)*	α^i*: government guarantee*
4	t=1 Net worth	$w_1^i = \widehat{y^i} - \phi^i - f^i$ $w_0^i b^i$ max; $\{x_j^i\}$; $c(\underline{w_0^i} - w_0^i - \tau^i) +$ $E(u(1_{[w_{1>0}^i]} * w_1^i))$ *(Equation 6)*	w_1^i: *equity at time* 1 $\underline{w_0^i}$: remaining equity $u^i(x)$: owner's utility at time 1 τ^i: *tax* *c: opportunity cost*

Source: Acharya (2016)

Concluding from Table 1, financial institutions make a leverage to increase their own capital which lie behind that they take risks by collateralizing their own capital. Nevertheless, they burden to pay their outstanding debt in corresponded with distressed costs when crisis occurs. Looking through historical cases, financial institutions tend to take excessive risks than the government guaranteed amount, which is the reason for the government is in charge of their risks (Calomiris [October 2009]).

The government needs to recover defaulted system as a guarantor because of a lender of last resort, deposit insurer and providing economic stability at the trough of cycle. In this case, the government's risk fund might be insufficient to cover the default cost, thus taxpayers' money will be substituted. The result will direct to economic downturn, furthermore instability.

In contrast, the government aims to maximize welfare by building capital buffer shown in table 2. A regulator who represents government, makes an effort to capture the welfare function at the maximum. The welfare function consists of three parts in equation 7. "p^1" in equation 8 is the sum of utilities of all financial institutions as shown in equation 4

of table 1 and it represents risk tolerance. "p^2" in equation 9 is the expected cost of the debt guarantee which is covered by the government. "p^3" in equation 10 is a main focus of an analysis which formulates the condition of occurring of systemic risk. The systemic risk occurs in a case of aggregate equity falls below aggregate assets throughout the system.

Hence, the regulator imposes a tax "$\underline{\tau}$" as shown in equation 11. The amount of tax depends on each financial institution's financial leverage and flexibility to internalize external shocks. Initially, the tax will be imposed at time 0, in furtherance, the regulator balances its capital buffer with lump-sum taxes from time 1.

Table 2. Government welfare

	Equations
Regulator's goal: maximize the welfare function	$p^1 + p^2 + p^3$ *(Equation 7)*
Sum of the utilities of all the bank owners	$p^1 = \sum_{i=1}^{N} c(\underline{w_0^i} - w_0^i - \text{tax}) + \text{E}[\sum_{i=1}^{N} u^i(1_{[w_1^i>0]} * w_1^i)]$ *(Equation 8)*
The expected cost of the debt insurance program	p^2=E[g*$\sum_{i=1}^{N} 1_{[w_1^i<0]}\alpha^i w_1^i]$ *(Equation 9)* *g: administrative costs (costs of tax collection)* *(Cost is paid conditional on default by firm i)*
The externality of financial crisis	$p^3 = E[e * 1_{[W_1 <zA]} * (zA - W_1)]$ *(Equation 10)* *e: measures severity of the externality imposed on the economy* *A* =$\sum_{i=1}^{N} a^i$*: aggregate assets in the system* $w_1 = \sum_{i=1}^{N} w_1^i$: *aggregate banking capital to support it at* $t = 1$ *zA*>w_1: *systemic crisis occurs when the aggregate capital in the financial system falls below a fraction z of the asset A.*
Choose a tax system based on ex ante regulation	$\underline{\tau} = \sum_i \tau^i$ *(Equation 11)*

Source: Acharya (2016)

In summary, the government squeezes tax out of financial institutions as they increase leverage to restrict to take excessive risk.

Table 3 shows a model of optimal taxation to use building capital buffer in table 2. The model depends on each bank's expected shortfall and systemic expected shortfall, respectively. Expected shortfall is explained earlier, whereas systemic expected shortfall in equation 13 is the difference between the fraction of assets and capital equity in condition of owner's utility becomes lower than the risk-adjusted assets in terms of regulatory principle.

Finally, optimal tax to impose on each financial institution is the total sum of expected shortfall, systemic expected shortfall and lump sum tax (equation 14). First part in equation 14 measures financial institution's own risk. It is estimated that a financial institution's

probability of default times the expected losses. Second part in equation 14 depends on the probability of systemic risk thus it forces financial institutions to internalize the externality from aggregate distress. Financial institution's contribution to systemic risk is computed by SES, but this is weighted by the severity "*e"* divided by costs of capital "*c"*.

Table 3. Optimal taxation

Expected shortfall	$ES^i = -E[w_1^i \mid w_1^i<0]$ *(Equation 12)*
Systemic expected shortfall	$SES^i = E[zA^i - w_1^i \mid w_1 < zA]$ *(Equation 13)*
Optimal tax	$\tau^i = \frac{\alpha^i * g}{c} * \Pr(w_1^i < 0) * ES^i + \frac{e}{c} * Pr\ Pr\ (w_1 < zA)\ * SES^i + tax_0$ *(Equation 14)*

Source: Acharya (2016)

To build these three formulations in table 3, the importance is to capture the amount of individual institutions' contribution to systemic risk. As demonstrated in equation 15, the main key of measurement is systemic expected shortfall.

$$\text{SES}=b_1 * \text{MES} + b_2 * LVG \quad \textit{(Equation 15)}$$

Marginal expected shortfall (MES) happens frequently once a decade or two, hence, it is expressed as a worst case scenario. Then MES is measured at the 5 percent confidence level as shown in equation 16.

$$MES_{5\%}^I = -\text{E}\left[\frac{W_1^I}{W_0^I} - 1 \mid I_{5\%}\right] \quad \textit{(Equation 16)}$$

Our target model is measured by many methods as explained in the literature review. The method of systemic expected shortfall was chosen a reason for data availability in private owned companies. The research advanced continuously in 2009, 2010, 2012, and 2016 since it published first in 2001. The concept of model is close to conditional value at risk (Tobias Adrian September 2014).

SES is an ex-ante risk analysis and measures expected default loss which expected to contribute to a systemic crisis and then its explanatory variables are one-period lag.

The article of Measuring systemic risk (Acharya, Pedersen, Philippon 2016) is aimed to propose and apply a useful and model-based measure of systemic risk. The model's basic idea is based on the main reasons for regulating financial institutions are that 1) failing banks impose costs due to insured creditors and bailouts; and 2) undercapitalization of the financial system leads to externalities that spill over to the rest of the economy.

The principle of formulation which captures anticipation of systemic risk, systemic risk happens five times a century when it reaches its left tail dependence, namely systemic expected shortfall rather than systematic risk, namely beta (average covariance). Then equation of systemic expected shortfall is dependent on prior period of variables of marginal

expected shortfall and financial leverage in reason for return in tail dependence implies a signal of systemic risk from prior period.

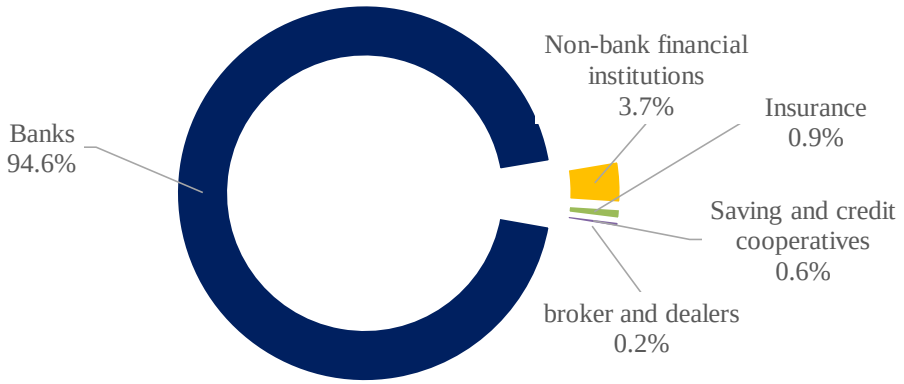
CHAPTER V. EMPIRICAL ANALYSIS

5.1 Background

Mongolia is classified in the countries of lower middle income by GNI per capita which is $1006-$3955 by World bank estimation in 2016 (Atlas of Sustainable Development Goals, 2018). The economy in Mongolia is in a stage of developing, whereas its financial market is belonged to low income developing in terms of "Index of Financial Development" published by the International Monetary Fund in 2013.

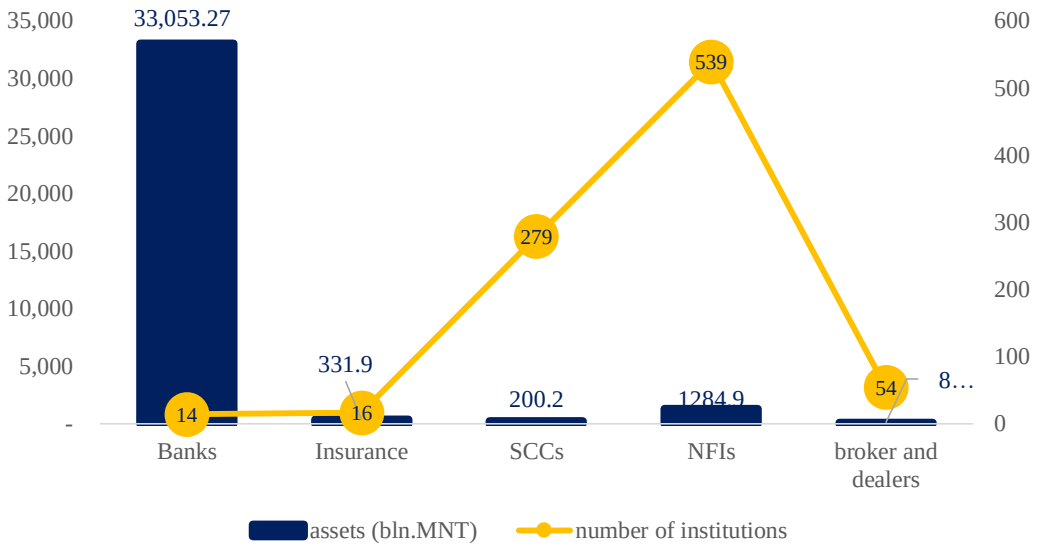
Additionally, commercial banks have dominated in financial market where approximately holding 94.6 percent of total assets as depicted in figure 2. Lately, this percentage decreasing little by little. Other financial sectors, such as insurance, investment institutions, broker dealers, and microfinance, have started to strengthen gradually. Particularly, dramatically increasing sector is non-financial institutions (NFIs), even it does not significantly influence on total market share. The reason is Mongolian economic growth has drastically descended since 2013 with respect to currency depreciation against dollars, and going down commodity prices, also in correspondent with becoming strictly the loan requirement in a banking sector. As illustrated in figure 3, the number of NFIs reached 539 in 2018 from 263 in 2013.

Figure 2. Market share by assets (4th quarter of 2018)



Sources: www.mongolbank.mn, www.frc.mn

Figure 3. Financial market structure in Mongolia (4th quarter of 2018)



Sources: www.mongolbank.mn, www.frc.mn

Economic cycle in Mongolia: As an economic stability aspect, Mongolia has been integrating with international financial and trade market, especially commodity prices are increasingly dependent on international commodity markets. Mongolian economic cycle was evaluated by Gan-Ochir (June 2017), hereby argued that Mongolia had faced with economic cycle twice with respect to commodity price volatility in international market and procyclical macroeconomic policy since 2003. First economic downturn which caused of Lehman Brothers shock, took place in 2008 and 2009 through the process of going down a price of raw materials in the mining sector, then transmitted to banking sector as a result of deterioration of loan quality.

The most recent started from decline in commodity prices in China in 2012. Thus Bank of Mongolia (Central bank in Mongolia) made intervention to sustain economic stability, however, commodity prices did not get better, and then the economy went down to its recession in 2015 and 2016. Average continuation of these economic cycle was approximately 7 years. Financial market in Mongolia is highly correlated with economic cycle, same as the majority of countries.

Business cycle in financial market: Myagmarsuren (April, 2017) estimated business cycle of financial market in Mongolia using Hodrick-Prescott, and concordance index. The conclusion is the period from through to peak is longer than from peak to through of cycle, and one full cycle is around 5.25 years. Specifically, phases of through happened in the second quarter of 2005, the third quarter of 2009, and the fourth quarter of 2015, respectively.

In accordance with amended Act of Security Market and newly enacted Act of Investment Fund in 2013, several institutional types (custody, investment management, investment, mutual and private fund and so on) were given permission to make a business,

consequently, the size of capital market was incentivized to become wider. Alternatively, Financial regulatory commission made a decree of commercial banks to enter to other financial sectors. Therefore, commercial banks have been actively establishing their subsidiaries in stock market, insurance sector, as well as micro-financial sector. Particularly, they set up their subsidiaries in all sectors of broker dealer, stock underwriting, investment advice, private investment fund, insurance, and microfinance. On the other hand, commercial banks transmission into conglomerates (financial group) have activated the market concentration and interdependence. Nevertheless, the systemic risk has not been managed yet.

5.2 Analysis

The basic assumption is the government ought to impose tax (insurance premium to insure against systemic risk) on financial institutions based on their contribution to the systemic risk, instead of recovering losses by taxpayers' money when crisis occurs. On the other hand, financial institutions are more willing to take risks when the government guarantees them. Imposing tax incentivizes financial institutions to manage their external shocks and then become more resilient to systemic shock by growing their own capital or descending leverage for not to pay huge amounts of tax.

All financial institutions, excluding brokers and dealers are covered to the analysis in order that it explores not only the impact of large financial institutions, but also many small institutions could raise systemic risk as parts of a herd. As a result, all possible institutions data were compiled in cross-section and time series. Financial statement data in brokers and dealers is not so concrete and reasonable which might be direct to incorrect conclusion then excluded from quantitative analysis.

Data collection: Data was compiled from two different kinds of resources. First, commercial banks' data come from audited financial statements in their publicly disclosed annual report via their websites. Nevertheless, the issue is banks reported their financial information in the same way. Particularly, capital adequacy ratio, some banks recorded Tier I and II, risk adjusted assets, separately, but others only capital adequacy, residuals did not disclose neither of them. Second, other sectors' data were compiled directly from regulatory data file.

The reason for using financial statement is in respect to lack of public data and underdevelopment of capital market in low income developing market (below the frontier market).

Table 5 depicts alternative variables[1] that is assumed to explain the dependent variable as well. Also, an equity ratio and debt ratio on private owned companies, which is

[1] *Note: For the data which picked up from commercial banks' financial statement was only named the one definite account according to International Financial Reporting Standards (IFRS)*

used for the analysis of Viral V. Acharya (November 1, 2009), covered as the independent variables.

Table 4. Alternative variables

1	Dependent variable	$Systemic\ expected\ shortfall\ (SES) = \frac{Risk\ adjusted\ assets}{TIER\ 1\ capital}$
2	Independent variable	$Marginal\ expected\ shortfall\ (MES) = Expected\ shortfall(in\ market) * Market\ share$ $Expected\ shortfall = return\ in\ 5\%\ confidence\ level$
3	Independent variable	$Leverage\ (LVG) = \frac{Total\ assets}{Average\ equity}$
4	Independent variable	$Equity\ ratio = \frac{Equity}{assets}$
5	Independent variable	$Long\ term\ debt\ ratio = \frac{Long\ term\ debt}{assets}$
6	Independent variable	$Other\ liabilities\ ratio = \frac{Other\ liabilities}{assets}$
7		Size of assets = total assets

As a result of an econometric analysis, following candidate independent variables were removed in table 5. Particularly, other liabilities ratio was reacted as an exponential variable, so instead of it, ratios of both long-term debt and other liabilities to assets combined into liability to assets ratio. In addition, the meaning of equity ratio is likewise to calculation of systemic expected shortfall. Systemic expected shortfall expresses more risk related meaning.

The capital adequacy ratio[2] of commercial banks which represents systemic expected shortfall was calculated due to 460th decree of Bank of Mongolia in 2010, "Rule in Commercial Bank's Capital Adequacy Ratio and Inspection".

An estimation was done by each financial sector, separately because of two reasons. First, private owned companies have disadvantage of lack of frequent market data. Second,

that implemented lately. So, some accounts of the 2000 to 2008 were named due to IFRS which was approved the most recent. Among commercial bank, some accounts were named differently, but it expresses the same meaning. In this case, there was used the benchmark name.

[2] *Capital adequacy ratio of some commercial banks that not disclosed via websites was measured according to 460th decree of Bank of Mongolia in 2010, "Rule in Commercial Bank's Capital Adequacy Ratio and Inspection".*

accounting standards and rules are different for sectors in terms of their distinctive activities. Hence, econometric analysis on cross-section data was analyzed by sector, separately.

SES is at the current period, whereas independent variables are one-year prior for the purpose of anticipating future tail risk.

5.2.1 Time-dimension of systemic risk

One source of systemic risk is the time dimension which minor risks are accumulated through time and broken down at the definite period. Therefore, marginal expected shortfall is evaluated employing time series analysis for the purpose of forecasting the total amount of loss in the financial system.

Sampling of time series covers 43 quarters in total from third quarter of 2006 to first quarter of 2017 because of data access.

A representation of marginal expected shortfall in time series is credit risk, same[3] as used in cross-sectional analysis. The credit risk in time series is the total amount of credit risk in commercial banks, non-financial institutions and saving and credit cooperatives, whereas insurance and broker, dealers have different business activities and then not included.

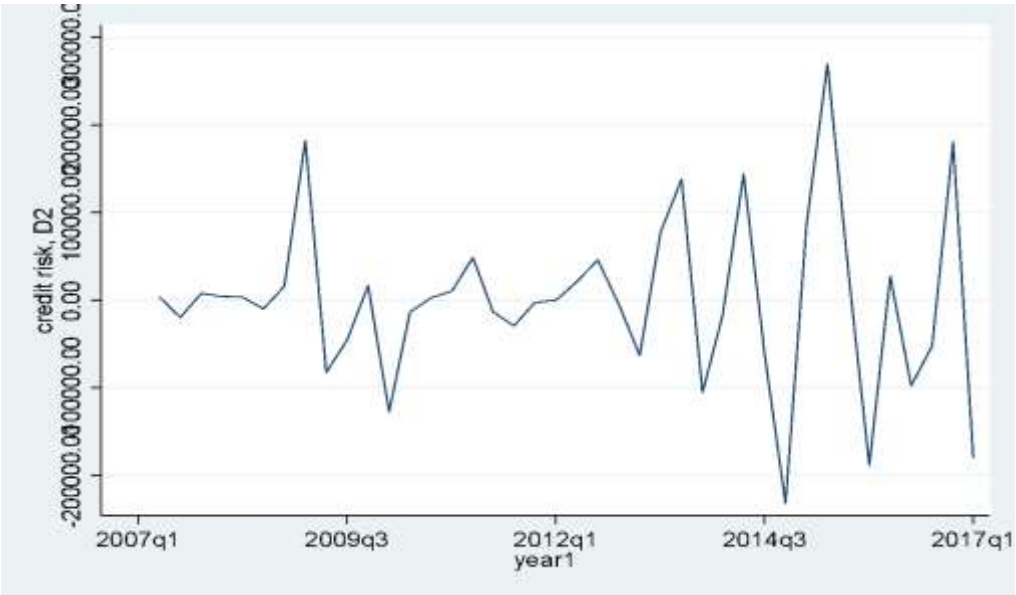
Time series analysis: As demonstrated in figure 4, the data is nonstationary, which mean and variance is nonconstant, and has upward trend over periods, thus it implies deterministic trend. It expresses that time series analysis need to be detrended.

Figure 4. Marginal expected shortfall

[3] In terms of cross-sectional analysis, credit risk is more correlated to the systemic expected shortfall.

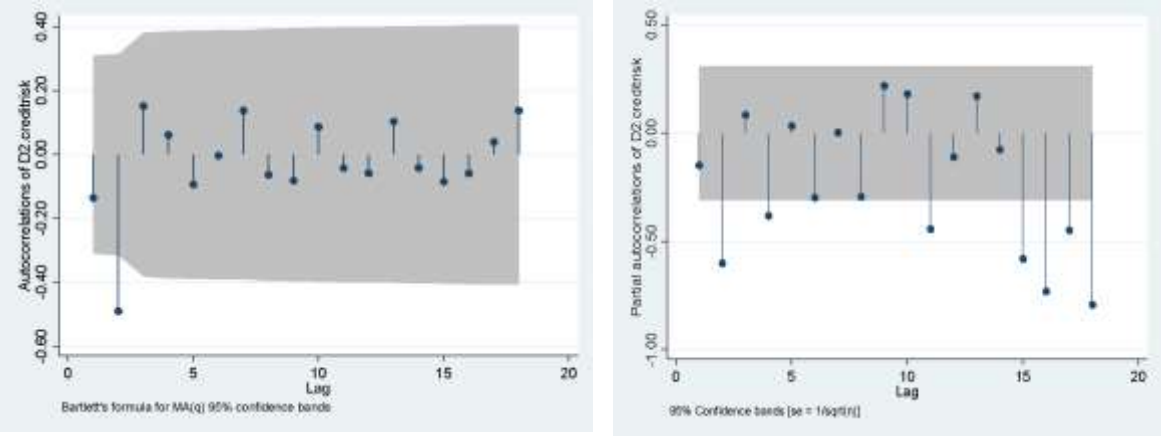
Additionally, the data was rejected the null hypothesis resulting from its p-value is 0.9987, test statistic is 2.018 based on Dickey-Fuller test. To convert stationary time series, it was made differencing and data stationary was stabilized at the second differencing where p-value is 0, test statistic is -6.739, also shows the data are detrended at the figure 5.

Figure 5. Second differenced marginal expected shortfall



Residual data contains autocorrelation which is marginal expected shortfall represents dependent on previous periods as illustrated in figure 6.

Figure 6. Autocorrelation and partial autocorrelation before autoregression



Therefore, ARMA (autoregressive and moving average) model is used to analyze at which time period is more influenced to current period results. The result appears that MES (credit risk) influences to the next two periods and does not have any effects of short-term shock as shown in table 5.

Table 5. Second order autoregression

Variable: MES1

	Coefficient	Standard error
Intercept	636.38	8897.01
	(0.07)	
L1	-0.18	0.14
	(-1.30)	
L2	-0.57	0.11
	(-5.07)	
σ	80435.97	7957.76
	(10.11)	

Notes: L1: lag 1
σ: standard deviation
z-statistics are given in parentheses.

Table 6. Third order autocorrelation

Variable: MES1

	Coefficient	Standard error
Intercept	282.86	9738.07
	(0.03)	
L1	-0.13	0.22
	(-0.60)	
L2	-0.56***	0.12
	(-4.56)	
L3	0.07	0.28
	(0.26)	
σ	80176.31	7871.91
	(10.19)	

Notes: L1: lag 1
σ: standard deviation
z-statistics are given in parentheses. ***:1% significant level.

As shown in table 6, only the coefficient of the second lag is significantly negative at 1% level. This time-series analysis of MES indicates that MES has ability to forecast the amount of systemic risk in the next two periods in terms of third order.

5.2.2 Cross-section analysis

Cross-section analysis covers three kinds of time period that are 2009, 2013, and 2017, respectively. 2009 and 2013 are business cycle's trough stage and dedicated to go through whether the model is reasonable and concrete. Whereas, 2017 is the most recent financial reporting period and aimed to forecast the likelihood of systemic risk.

Marginal expected shortfall (MES) for advanced financial market is return of stock price. Unfortunately, almost all financial institutions in Mongolia have not yet gone to public thus stock price evaluation is impossible for our analysis. MES was chosen from several alternative data in financial statement that being able to represent the expected shortfall, instead of stock return. The logic implied is financial institution would default if asset side of balance sheet decreases absolutely. Following variables are assumed to possible alternatives as a marginal expected shortfall:

1. Cash to total assets ratio
2. Net income to total assets ratio
3. Net income to total liabilities ratio
4. Cash to total liabilities ratio
5. Credit risk to total liabilities ratio
6. Credit risk (sum of non-performing loan and bad loan)
7. TOP-20 index
8. Credit growth

The expected shortfall of financial system was computed from the market's total amount of variables at the 5 percent confidence level. Afterwards, aggregate expected shortfall is distributed to each financial institution by percentage of their market share (size). Around the cross-sectional analysis, the same results were appeared for all variables in terms of correlation and regression.

A. Systemic expected shortfall in 2009

Financial market in Mongolia had deteriorated in 2009 in terms of Economic Crisis 2008. Then domestic currency, MNT, hugely depreciated against foreign currency. Simultaneously, one commercial bank which is one of two stock issued banks went to the bankruptcy causing of bad debts. Table 7 provides summary statistics (mean and standard deviation) of dependent and independent variables of each sector. Dependent variable is systemic expected shortfall, and independent variables are financial leverage, total liabilities to total assets ratio and marginal expected shortfall.

Summary statistics: The highest SES is appeared in insurance companies, which mean value is 4.47 and standard deviation is 10.52. Banks used the highest financial leverage of 9.8 and total liabilities to total assets ratio of 0.83.

Table 7. Summary statistics

Variables	NFIs		Insurance companies		Banks		SCCs	
	Mean	σ	Mean	σ	Mean	σ	Mean	σ
SES_2009	0.84	0.76	4.47	10.52	0.13	0.04	2.55	8.86
LVG_2008	1.28	0.70	3.45	3.47	9.80	3.29	5.98	17.77
TLTT_2008	0.10	0.18	0.52	0.24	0.83	0.12	0.46	0.36

MES1_2008	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00
MES2_2008	-4089.29	6916.22	0.01	0.01	0.00	0.00	0.00	0.00
MES3_2008	0.00	0.00			0.00	0.00	0.00	0.00
MES4_2008	0.00	0.00			0.02	0.02	0.00	0.00
MES5_2008	0.00	0.00			0.00	0.00	12.84	69.86
MES6_2008	-4217.44	7132.97			3128.45	2622.07		
MES7_2008	-20.41	34.53			-278.50	233.42		
MES8_2008					0.00	0.00		
No. obs	115		15		7		212	

Note: σ - standard deviation

Table 8 shows correlation of independent variables to a dependent variable. Correlation of financial leverage and total liabilities ratio is relatively high for all sectors, only total liabilities ratio in SCCs has lower correlation (0.12) with SES. MES correlation to SES is the highest in insurance companies 0.97, NFIs are 0.58, banks are 0.47, the lowest in SCCs 0.15.

Table 8. Correlation matrix with SES

Variables	NFIs	Insurance companies	Banks	SCCs
SES_2009	1	1	1	1
LVG_2008	0.61	0.95	0.59	0.72
TLTT_2008	0.56	0.55	0.54	0.12
MES1_2008	0.58	-0.97	0.47	0.15
MES2_2008	-0.58	0.97	-0.47	0.15
MES3_2008	-0.58		-0.47	0.15
MES4_2008	0.58		0.47	0.15
MES5_2008	-0.58		0.47	0.15
MES6_2008	-0.58		0.47	
MES7_2009	-0.58		-0.47	
MES8_2009			-0.47	

Furthermore, cash to total liability or asset ratio could represent marginal expected shortfall among alternative marginal expected shortfalls' expected variables in related to correlations of those variables are akin to each other and based on assumption of cash is liquidity in case of systemic risk which is possible to decline network effect.

Explanatory power of MES, LVG, and TLTT: Table 9 illustrates the power of MES, LVG and TLTT in explaining the realized SES of financial sectors during an economic downturn, respectively. R-squared is high for four sectors: NFIs are 0.49, insurance companies are 0.99, banks are 0.47, and SCCs are 0.53. Adjusted R-squared is close to R-squared, whereas for banks are -0.07 and not significantly. Because one public commercial bank went bankruptcy in 2009 cause of bad debt, thus survivorship bias, data was excluded from data file, influenced on adjusted R-squared to be non-significant.

Further test was reviewed by t-statistic. The t-statistic is statistically significant for: NFIs' financial leverage and MES at the 99 percent confidence level, insurance companies' total liabilities to assets ratio and MES at the 99 percent confidence level, and SCCs' financial leverage at the 99 confidence level and MES at the 90 percent confidence level, respectively.

Table 9. Regression analysis

Dependent variable: Systemic expected shortfall

	NFIs	**Insurance companies**	**Banks**	**SCCs**
Intercept	0.13 (0.89)	1.19 (1.19)	-0.02 (-0.15)	0.59 (0.86)
LVG_2008	0.40 (2.97)***	0.97 (1.33)	0.001 (0.13)	0.36 (14.81)***
TLTT_2008	0.40 (0.79)	-14.81 (-6.2)***	0.15 (0.63)	-0.71 (-0.58)
MES1_2008	174.12 (4.9)***	719.52 (3.86)***	0.93 (0.72)	402.91 (1.75)*
R-squared	0.49	0.99	0.47	0.53
Adj R-squared	0.48	0.98	-0.07	0.52

t-statistics are given in parentheses.
***, **, and * indicate significance at 1%, 5% and 10%, respectively.

In terms of regression analysis, goodness of fit and significant level in independent variables is high so regression equation is possible to assume individual financial institution's systemic contribution.

B. Systemic expected shortfall in 2013

Mining based economic growth in Mongolia increased again from 2010 after economic downturn of 2009. It achieved highest growth of 17.3 percent in 2011, however, this growth is not persistent and started to go down suddenly in 2013, then afterwards gradually. Similarly, banking sector's profitability decreased, inversely, non-performing loans were up. Following on the path to this, one commercial bank defaulted and re-established as a state-owned.

In contrast, the number of non-bank institutions (NFIs) have increased and have risen their profit and assets. Primary reason is loan requirement of commercial banks became stricter. Hence, NFIs were motivated to set up for recovering the gap of loan demand.

Whereas insurance sector's profitability was comparatively stable than others. Perhaps the government supports to an insurance sector influenced on it. Because the government has implemented the projects "Index-based livestock insurance" and "driver's

insurance" in way of giving the certain amounts of subsidies and consultation service through international projects.

Economic downturn in 2013 impacted hugely on stock market. Particularly, market capitalization of publicly traded mining companies radically went down in correspondent with declining of the world commodity price.

Summary statistics: Table 10 demonstrates that average of SES is for NFIs, insurance companies, banks, SCCs 0.24, 1.46, 0.3, 4.91 in 2013, respectively. Average and standard deviation of NFIs and insurance companies are less and banks and SCCs are more as compared to 2009s. It seems that risk tolerance improved for NFIs and insurance companies, whereas banks' and SCCs' deteriorated in 2013 than 2009s.

Table 10. Summary statistics

Variables	NFIs		Insurance companies		Banks		SCCs	
	mean	σ	mean	σ	mean	σ	mean	σ
SES_2013	0.24	0.96	1.46	0.79	0.30	0.39	4.91	26.96
LVG_2012	2.25	7.24	2.39	0.75	10.94	5.09	2.24	7.23
TLTT_2012	1.32	6.17	0.41	0.21	0.86	0.36	0.41	0.27
MES1_2012	0.00	0.00	-0.26	0.20	0.02	0.02	0.00	0.00
MES2_2012	-16614.18	31356.58			0.00	0.00	0.00	0.00
MES3_2012	0.00	0.00			0.00	0.00	0.00	0.00
MES4_2012	0.00	0.00			0.02	0.02	0.00	0.00
MES5_2012	0.00	0.00			0.00	0.00		
MES6_2012	-7609.41	14361.53			-5687.53	6307.55		
MES7_2012					-278.89	309.30		
MES8_2012					0.00	0.00		
No. obs	207		13		9		141	

Note: σ *- standard deviation*

Table 11 illustrates the correlation matrix of SES in 2013 to financial leverage (LVG), total liabilities to assets ratio (TLTT) and marginal expected shortfall (MES) in 2012. NFIs' correlations are negative and low which -0.02, -0.04, -0.03, respectively. Then it indicates inverse meaning comparing to 2009.

Insurance companies' explanatory variables are highly correlated which is 0.52, 0.51 and -0.87 and meaning is close to 2009s.

The correlation results of commercial banks are -0.86, -0.72, -0.46, respectively. It indicates that the magnitude of correlation of explanatory variables slightly increased, however, The direction of correlation changed from positive to negative starting from 2009.

SCCs' independent variables correlations to systemic expected shortfall are different. Particularly, financial leverage correlated highly and negative and meaning is -0.91. Total liabilities to assets ratio correlated by 0.29. Whereas correlation of marginal expected shortfall declined and indicates virtually uncorrelated. Therefore, the amount of correlation increased for variables of financial leverage and total liabilities to assets ratio, in contrast, marginal expected shortfall became virtually uncorrelated.

Table 11. Correlation matrix with SES

	NFIs	**Insurance companies**	**Banks**	**SCCs**
SES_2013	1	1	1	1
LVG_2012	-0.02	0.52	-0.86	-0.91
TLTT_2012	-0.04	0.51	-0.72	0.29
MES1_2012	-0.03	-0.87	-0.46	0.01
MES2_2012	0.03	-0.87	0.46	0.01
MES3_2012	0.03		0.46	0.01
MES4_2012	-0.03		-0.46	0.01
MES5_2012	0.03		-0.46	
MES6_2012	0.03		0.46	
MES7_2012			0.46	
MES8_2012			0.46	

Table 12 depicts regression analysis of systemic expected shortfall in 2013 which depends on financial leverage, total liabilities to assets ratio and marginal expected shortfall in 2012.

Explanatory power of MES, LVG, and TLTT: Table 12 shows the power of MES, LVG and TLTT in explaining the realized SES of financial sectors during an economic downturn, respectively. R-squared is high for four sectors: NFIs are 0.89, insurance companies are 0.77, banks are 0.80, and SCCs are 0.93 as like in 2009. Adjusted R-squared is close to R-squared. However, NFIs' adjusted R-squared is 0.0031, relatively non-significant, although their business activity strengthening.

The t-statistic is statistically significant for: NFIs' intercept at the 99 percent confidence level, insurance companies' MES at the 99 percent confidence level, and banks' intercept at the 99 percent confidence level and financial leverage at the 95 percent confidence level. SCCs' financial leverage and total liabilities to assets ratio at the 99 confidence level, and MES at the 95 percent confidence level, respectively.

Table 12. Regression analysis

Dependent variable: Systemic expected shortfall

	NFIs	**Insurance companies**	**Banks**	**SCCs**
intercept	0.27	0.50	1.19	0.67
	(3.43)***	(1.4)	(5.26)***	(0.58)
LVG_2012	-0.003	0.19	-0.06	-3.55
	(-0.29)	(0.88)	(-2.64)**	(-40.95)***

TLTT_2012	-0.007 (-0.6)	-0.99 (-1.17)	-0.41 (-1.26)	29.29 (12.25)***
MES1_2012	9.14E-07 (0.41)	-3.63 (-5.22)***	4.47 (0.83)	417.34 (2.35)**
R-squared	0.89	0.77	0.80	0.93
Adj R-squared	0.0031	0.72	0.68	0.93

t-statistics are given in parentheses.
***, **, and * indicate significance at 1%, 5% and 10%, respectively.

C. Systemic expected shortfall in 2017

Table 13 shows summary statistics of explained variable in 2017 and explanatory variables in 2016. A change in systemic expected shortfall does not indicate any large volatilities in comparison to 2013. The averages are -0.25, 2.49, 0.31, 4.47 from NFIs to SCCs, respectively. It is assumed that there didn't take place marked change between 2013 and 2017.

Table 13. Summary statistics

Variables	**NFIs**		**Insurance companies**		**Banks**		**SCCs**	
	mean	**σ**	**mean**	**σ**	**mean**	**σ**	**Mean**	**σ**
SES_2017	(0.25)	0.86	2.49	1.51	0.31	0.38	4.74	88.96
LVG_2016	1.23	1.79	2.10	1.14	9.33	4.81	9.38	65.23
TLTT_2016	0.07	0.16	0.43	0.11	0.73	0.31	0.66	0.42
MES1_2016	0.00	0.00	(0.23)	(0.67)	0.01	0.02	0.00	0.00
MES2_2016	(24,597)	47,628	(0.04)	(0.12)	(0.00)	0.00	0.00	0.00
MES3_2016	(0.00)	0.00			(0.00)	0.00	0.00	0.00
MES4_2016	0.00	0.00			0.01	0.02	0.00	0.00
MES5_2016	(0.00)	0.00			(40,500,00)	53,200,000		
MES6_2016					(6,077,216)	7,973,793		
MES7_2016					0.00	0.00		
MES8_2016					(26,780)	35,137		
MES9_2016					139,097	182,507		
MES10_2016					0.01	0.01		
No. obs	534		16		14		290	

Note: σ *- standard deviation*

Table 14 depicts information of correlation in systemic expected shortfall in 2017 which depends on financial leverage, total liabilities to assets ratio and marginal expected shortfall in 2016. The following things are notable changes in comparison to previous chosen two years: NFIs' correlation varied to positive and became 0.15, 0.38, 0.49 in terms of variables order in table 14, respectively. Insurance companies' correlations slightly

descended than 2013, but more than 2009. Commercial banks correlations became more like to 2009. SCCs correlations decreased less and less.

Table 14. Correlation matrix with SES

	NFIs	Insurance companies	Banks	SCCs
SES_2017	1	1	1	1
LVG_2016	0.152	0.751	-0.773	0.137
TLTT_2016	0.379	0.750	-0.826	0.010
MES1_2016	0.487	-0.912	-0.366	0.007
MES2_2016	-0.487	-0.912	0.366	0.007
MES3_2016	-0.487		0.366	0.007
MES4_2016	0.487		-0.366	0.007
MES5_2016	-0.487		0.366	
MES6_2016			0.366	
MES7_2016			-0.366	
MES8_2016			0.366	
MES9_2016			-0.366	
MES10_2016			-0.366	

From regression analysis in table 15, multiple regression's t-statistics are NFIs' -10.14, insurance companies' 1.18, commercial banks' 6.58, SCCs' 0.28 with adjusted R^2s of 0.26, 0.81, 0.64 and 0.01.

Explanatory power of MES, LVG, and TLTT: Table 15 is about the power of MES, LVG and TLTT in explaining the SES forecasting of financial sectors during, respectively. R-squared is comparatively different from previous realized SES assumption that is for NFIs are 0.27, insurance companies are 0.85, banks are 0.72, and SCCs are 0.02. Adjusted R-squared is close to R-squared.

T-statistic's significant level has increased in comparison with previous two realized SES. Particularly, the t-statistic is statistically significant for: i) NFIs' financial leverage, total liabilities to assets ratio, and MES at the 99 percent confidence level; ii) insurance companies' financial leverage, total liabilities to assets ratio and MES at the 99 percent confidence level; iii) banks' intercept at the 99 percent confidence level and total liabilities to assets ratio at the 90 percent confidence level; and iv) SCCs' financial leverage at the 99 confidence level and MES at the 90 percent confidence level, respectively.

Table 15. Regression analysis

	NFIs	Insurance companies	Banks	SCCs
intercept	-0.46	0.76	1.05	3.21
	(-10.14)***	(1.18)	(6.58)***	(0.28)
LVG_2016	-0.03	-0.80	-0.01	0.19
	(-1.27)	(-0.92)***	(-0.46)	(2.28)**
TLTT_2016	1.19	3.17	-0.79	-3.79
	(4.14)***	(1.07)***	(-1.97)*	(-0.26)

MES1_2016	531.99 (8.67)***	8.91 (-4.61)**	-4.17 (-0.97)	568.44 (0.19)
R-squared	0.27	0.85	0.72	0.02
Adj R-squared	0.26	0.81	0.64	0.01

t-statistics are given in parentheses.
***, **, and * indicate significance at 1%, 5% and 10%, respectively.

5.3 Main findings

Financial markets are categorized into 3 parts depending on its development phase: developed, emerging and frontier market. Currently, the majority of the systemic risk researches have been made in developed market and minority is in emerging markets, whereas frontier market's might be rare. Actions in developed markets impact hugely on externality and in addition, data access is available for public access. Therefore, most researchers give an awareness to it. In contrast, frontier market's impact on international level is not significant and public data is inappropriate because stock market doesn't develop quite well, then banking sector dominates. Henceforth, I didn't find any research paper in systemic risk which made in frontier market.

There are more than 20 emerging markets and 25 developed countries in terms of FTSE. It can be concluded that financial markets of more than 150 countries are running below frontier market. This expresses that frontier markets together can hinder economic stability as a herd of risk. Alternatively, there exists economic theory that all countries could transfer to developed phase. Therefore, there are two reasons to manage systemic risk in frontier markets. First is to prevent from a herd of systemic risk. Second is building concrete basis of systemic risk management while they are developing.

Financial market in Mongolia is one of frontier markets. My intuition is to manage systemic risk as early as possible to provide economic stability. Previous literatures usually use capital market data to their measurement of systemic risk. Whereas, this research tried to use data in financial market depending on data availability, instead of public data. The purpose is to capture the systemic risk from currently available data.

On the other hand, frontier markets resemble each other as early stage of business. Hence, we could build the market with healthy immunity system if systemic risk is managed as concrete basis as early as possible.

In summary, systemic risk in the frontier market could be forecasted using financial statement data in case of provided qualified data sources. The estimation result indicated that an influence of systemic risk which accumulated through time, exists in next two periods. Financial institutions' contribution to systemic risk is explained by risk level of their invested assets and their own capital to tolerate external shocks. The tolerance level highly correlated to financial leverage.

CHAPTER VI. CONCLUSION

Financial stability is one of the main providers of economic stability; it is the process of smooth and continuous growth of financial market to accelerate the economy. Financial markets throughout the world, however, have not yet developed a way to secure continued financial stability. On the contrary, systemic risk occurs every decade or two.

Systemic risk management began to grow in recognition among regulators and researchers after the Lehman Brothers shock. Macroprudential tool, the prudential tool to manage systemic risk, complements public policies (monetary, fiscal and microprudential) to encourage economic stability. Basel committee announced in 2018 that macroprudential policy has been practiced.

Research papers and policy guidelines discussing systemic risk have not yet raised these issues in the frontier market. Therefore, this research analyzed systemic risk in the frontier market using Mongolia as a case study-one cell in a herd of risk. The financial market in Mongolia is bank-dominated and is currently growing the number of financial conglomerates and being dense its interconnection. This indicates that systemic risk is likely to occur in Mongolia unless the financial market is managed more efficiently.

The mission of systemic risk management is to develop macroprudential policy, which could potentially manage risk at all levels. The vision of this research was to analyze financial institutions' contribution to systemic risk and use the analysis to prevent from contingent systemic risks.

To accomplish the analysis result, the systemic expected shortfall method-first employed in the advanced financial market of the United States-was applied. Systemic expected shortfall in this research was measured using financial statement data in the frontier market: data from financial statements that most coherently and concretely captured the expected systemic loss was examined.

First, the time dimension of systemic risk was computed using the time series of marginal expected shortfall, which was represented by the credit risk in total sum of banking and microfinance sector. An econometric evaluation argued that the effects of systemic risk accumulated over a long period will become apparent in the next two quarters. Second, cross-sectional dimension of systemic risk was analyzed. Financial institutions' contribution to systemic risk was estimated based on the systemic expected shortfall depending on marginal expected shortfall, financial leverage, and liabilities to assets ratio using multiple regression analysis.

To describe the challenges of analysis process, accounting standards have amended several times during estimation periods and then there was missed some variables owing to not consistently disclosed. Moreover, earlier periods data was complicated to compile

because some years' financial statements removed from computer-based regulatory storage file.

To further enhancing accurate analysis, financial regulators should organize an efficient management of financial statement data to provide long-term and qualified data and then create consolidated data center among themselves as enabling data access. As a result, panel data would be able to compile and achieve to compute systemic risk more reasonable.

The target result could be measured by variables of credit, liability, and capital adequacy. Nevertheless, more variables to forecast systemic risk should be consistently divulged by financial institutions for further real-time warning. Particularly, off-balance sheet data should be provided by financial institutions to completely evaluate the results. Because information in off-balance sheet includes more systemic risk related data, thus regulators should investigate whether financial institutions have fully disclosed this information.

Finally, academic researchers have disadvantage to financial statement data access to make analyses in the field of systemic risk in Mongolia. Regulators should cooperate with them and then give permission of data access in a way of maintaining informational confidentiality. It will open the door to make analyses in the field of systemic risk in the frontier market.

The scholar critically thinks to extend the made analysis by adding the measurement of liquidity thus to test the variables of cash flow and free cash flow to equity.

APPENDIX: CROSS SECTION DATA

Table 16 to 19 show the data used in empirical analysis by sector and by year, respectively. The number of NFIs and SCCs are more than 300. Hence, following tables solely depict the information of NFIs and SCCs which ranked top 15 by its SES.

Table 16. NFIs (TOP 15 by SES)

Panel A	**SES_2009**	**LVG_2008**	**TL/TT_2008**	**MES1_2008**
NFI 487	6.23	2.86	0.62	0.010
NFI 630	4.36	4.96	0.66	0.000
NFI 491	2.83	3.20	0.68	0.005
NFI 11	2.54	3.80	0.19	0.010
NFI 69	1.88	2.02	0.43	0.000
NFI 510	1.76	1.25	0.19	0.002
NFI 535	1.63	1.53	0.33	0.000
NFI 501	1.61	2.26	0.52	0.003
NFI 540	1.51	2.73	0.62	0.001
NFI 77	1.41	1.80	0.00	0.001
NFI 595	1.29	1.77	0.42	0.001
NFI 499	1.26	1.00	0.00	0.002
NFI 61	1.23	1.52	0.33	0.001
NFI 23	1.22	1.09	0.08	0.001
Panel B	**SES_2013**	**LVG_2012**	**TL/TT_2012**	**MES1_2012**
NFI 579	9.97	0.98	0.01	0.000
NFI 55	8.47	1.20	0.00	0.000
NFI 41	3.88	1.06	0.00	0.000
NFI 59	2.31	0.94	0.44	0.000
NFI 507	0.98	2.23	0.00	0.002
NFI 461	0.87	0.77	0.33	0.000
NFI 502	0.80	1.26	0.00	0.000
NFI 11	0.60	3.51	0.00	0.005
NFI 85	0.60	0.25	11.62	0.000
NFI 28	0.58	1.16	0.00	0.000
NFI 54	0.57	0.91	0.00	0.000
NFI 490	0.55	5.18	0.00	0.005
NFI 4	0.52	0.87	0.01	0.000
NFI 42	0.50	1.29	0.00	0.000
Panel C	**SES_2017**	**LVG_2016**	**TL/TT_2016**	**MES 1_2016**
NFI 241	11.73	12.74	0.90	0.003
NFI 487	6.92	3.19	0.69	0.004
NFI 494	3.56	1.03	0.00	0.002
NFI 71	3.09	1.10	0.00	0.000
NFI 531	2.90	1.10	0.01	0.001
NFI 492	2.77	1.19	0.03	0.002
NFI 79	2.67	1.16	0.00	0.000

NFI 397	2.37	1.00	0.00	0.002
NFI 83	2.36	2.93	0.65	0.001
NFI 53	1.95	1.02	0.00	0.001
NFI 446	1.88	3.22	0.68	0.001
NFI 493	1.83	1.05	0.01	0.001
NFI 270	1.79	3.23	0.68	0.000
NFI 11	1.61	3.75	0.75	0.005

Table 17. Insurance sector

Panel A	**SES_2009**	**LVG_2008**	**TLTT_2008**	**MES1_2008**
NLI2	2.55	3.56	0.70	0.00
NLI3	1.95	3.80	0.73	0.00
NLI12	1.64	1.56	0.32	0.00
NLI17	0.74	1.30	0.19	0.00
NLI5	2.88	3.44	0.69	0.00
NLI7	42.40	15.21	0.97	-0.01
NLI19	1.18	1.62	0.35	0.00
NLI4	1.16	2.06	0.51	0.00
NLI9	2.01	2.19	0.50	0.00
NLI20	3.55	4.86	0.72	0.00
NLI13	1.63	2.36	0.45	0.00
NLI20	1.60	4.86	0.72	0.00
NLI21	1.16	1.95	0.44	0.00
NLI10	0.88	1.99	0.45	0.00
LI1	1.68	1.00	0.02	0.00
Panel B	**SES_2013**	**LVG_2012**	**TLTT_2012**	**MES1_2012**
NLI1	0.82	2.05	0.37	-0.15
NLI2	1.11	2.33	0.55	-0.27
NLI3	2.16	2.82	0.56	-0.47
NLI4	0.72	2.84	0.30	-0.14
NLI5	1.39	2.59	0.55	-0.29
NLI6	1.38	3.91	0.68	-0.27
NLI7	3.89	3.59	0.72	-0.91
NLI8	2.31	3.27	0.68	-0.32
NLI9	1.52	2.46	0.59	-0.26
NLI10	0.90	1.83	0.28	-0.14
NLI11	0.71	1.85	0.42	-0.11
NLI12	0.71	1.57	0.20	-0.13
NLI13	1.62	2.18	0.48	-0.33
NLI16	1.00	2.70	0.26	-0.14
NLI14	1.41	1.26	0.22	-0.31
NLI15	1.73	2.05	0.02	-0.10
LI1	1.43	1.32	0.13	0.00

Panel C	SES_2017	LVG_2016	TLTT_2016	MES1_2016
NLI1	1.80	1.53	0.30	-0.14
NLI2	2.24	2.37	0.56	-0.21
NLI3	4.05	2.77	0.58	-0.27
NLI4	1.10	1.14	0.11	-0.10
NLI5	3.44	2.20	0.55	-0.25
NLI6	2.17	1.95	0.49	-0.22
NLI7	7.06	3.09	0.68	-0.67
NLI8	2.60	2.90	0.59	-0.37
NLI9	2.48	2.67	0.60	-0.23
NLI10	1.38	1.31	0.22	-0.12
NLI11	1.19	1.32	0.20	-0.12
NLI12	1.21	1.31	0.14	-0.15
NLI13	2.28	2.36	0.55	-0.25
NLI14	3.54	3.56	0.72	-0.38
NLI15	1.72	1.83	0.37	-0.17
LI1	1.54	1.24	0.20	0.00

Table 18. Banking sector

Panel A	SES_2009	LVG_2008	LTDR_2008	MES1_2008
bank 1	13%	10.24	0.90	0.03
bank 2	19%	12.16	0.90	0.04
bank 3	13%	11.77	0.72	0.04
bank 4	9%	11.37	0.91	0.01
bank 5	15%	8.19	0.88	0.00
bank 8	8%	3.00	0.61	0.01
bank 13	17%	11.84	0.89	0.01
Panel B	**SES_2013**	**LVG_2012**	**LDTR_2012**	**MES1_2012**
bank 1	11.60%	14.24	0.91	0.04
bank 2	11.10%	13.31	1.60	0.05
bank 3	11.18%	15.49	0.93	0.04
bank 4	17.08%	11.74	0.90	0.00
bank 5	14.31%	15.88	0.93	0.01
bank 6	14.28%	10.75	0.64	0.01
bank 9	44.90%	3.82	0.72	0.00
bank 11	129.93%	1.26	0.21	0.00
bank 13	11.18%	11.95	0.91	0.02
Panel C	**SES_2017**	**LVG_2016**	**LTDR_2016**	**MES1_2016**
bank 1	0.14	9.31	0.73	0.04
bank 2	0.19	10.36	0.70	0.04
bank 3	0.09	12.84	0.92	0.03
bank 4	0.13	16.48	0.92	0.00
bank 5	0.12	9.21	0.90	0.00
bank 6	0.13	11.95	0.91	0.01

bank 7	0.15	14.01	0.91	0.01
bank 8	0.12	11.64	0.91	0.00
bank 9	0.50	6.99	0.84	0.00
bank 10	0.09	9.39	0.88	0.00
bank 11	1.48	1.17	0.02	0.00
bank 12	0.52	1.02	0.04	0.00
bank 13	0.11	13.46	0.92	0.01
bank 14	0.61	2.72	0.56	0.00

Table 19. SCCs

Panel A	**SES_2009**	**LVG_2009**	**LT/TT_2009**	**MES 1_2009**
SCC517	98.93	196.63	0.99	0.0012
SCC398	46.19	51.30	0.96	0.0070
SCC510	21.81	42.33	0.95	0.0015
SCC365	18.41	36.86	0.95	0.0001
SCC331	18.37	34.82	0.94	0.0001
SCC376	17.21	29.33	0.93	0.0006
SCC387	16.88	13.54	0.85	0.0042
SCC363	13.21	2.37	0.16	0.0000
SCC413	12.55	20.05	0.90	0.0018
SCC369	11.86	24.05	0.92	0.0001
SCC537	9.55	19.25	0.90	0.0000
SCC436	8.44	18.81	0.89	0.0005
SCC448	8.05	11.41	0.82	0.0004
SCC494	7.41	13.68	0.85	0.0002
SCC449	7.30	7.73	0.74	0.0002
Panel B	**SES_2013**	**LVG_2012**	**LT/TT_2012**	**MES1_2012**
SCC103	321.55	-77.48	0.91	0.0003
SCC39	14.70	13.45	0.90	0.0107
SCC58	13.36	1.24	0.25	0.0000
SCC8	10.04	11.68	0.90	0.0024
SCC11	9.82	11.75	0.91	0.0010
SCC65	8.51	0.95	0.02	0.0001
SCC108	7.87	11.57	0.83	0.0001
SCC107	7.66	8.23	0.85	0.0066
SCC23	7.37	4.26	0.75	0.0003
SCC81	6.72	4.79	0.78	0.0002
SCC53	6.70	4.88	0.78	0.0004
SCC48	6.45	6.16	0.79	0.0017
SCC79	6.33	3.67	0.68	0.0018
SCC56	6.07	4.88	0.77	0.0003
SCC9	6.06	10.21	0.89	0.0007
Panel C	**SES_2017**	**LVG_2016**	**LT/TT_2016**	**MES1_2016**
SCC138	756.41	119.46	0.98	0.0001
SCC195	313.33	-109.30	1.04	0.0001
SCC267	147.78	76.82	0.97	0.0001

SCC222	120.18	75.48	0.95	0.0001
SCC152	104.70	-59.30	1.01	0.0001
SCC208	100.67	69.21	0.99	0.0001
SCC226	69.45	81.10	0.99	0.0001
SCC170	66.35	128.66	0.99	0.0001
SCC185	43.99	28.38	0.98	0.0001
SCC202	41.56	78.44	0.97	0.0001
SCC134	40.28	69.56	0.98	0.0001
SCC162	31.76	41.07	0.96	0.0001
SCC179	31.27	58.99	0.96	0.0001
SCC249	27.05	47.71	0.96	0.0001
SCC190	26.75	27.86	0.97	0.0001

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