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An Evaluation and Management of the Systemic Risk of the Banking System -A Literature Review

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Abstract
There is consensus among financial regulators that the recent global financial crisis has highlighted the need of addressing incomplete reforms, one of them being the contribution of financial risks in destabilizing the financial markets. One of the most important form of financial risks is the systemic risk that is imposed by the inter linkages and interdependencies in a financial system. The purpose of this paper is to review some of the updated research articles published on the evaluation and management of the systemic risk between 2005 and 2015 by using diverse systemic risk analytics. The paper highlights the main contributions of the authors to the research. The discussion on the literature is classified into two parts namely empirical and non-empirical studies. The results show that the cross section measures proposed down by Acharya et al (2010) and Adrian and Brunnermeir (2011) MES and ΔCoVaR respectively have gained popularity in evaluating the systemic risk, however the proposed measures should be used with warning. Moreover, despite the fact that the interest in the topic of management of systemic risk has grown tremendously, but little research has been conducted in developing countries.
Keywords: Macroprudential policy, Systemic risk, Systemic financial institutions, financial regulation.

1. Introduction

The global financial system is experiencing, what is widely known as the havoc economic crisis since the Great Depression, encountered in 1929 (Ely B, 2009). Initiating in 2007, with the collapse of US subprime mortgage market, the crisis led to a low interest rate environment (Brunnermeier M, 2008), harboring a meltdown in economic activity, which reemerged as a recession, eventually escalating into an unexpected financial turmoil.

The recent global financial crisis emphasizes the importance of tackling some of the incomplete financial reforms. One of these unaddressed reforms has been the contribution of systemic risk in destabilizing financial markets. Experts are considering that global financial crisis was brought by both market failures and financial institution failures, because of the simultaneous failure of several banks in a financial system could adversely affect other industries and could have severe macroeconomic implications (Chava and Purnanandam, 2011),thus any regulatory framework for managing systemic risk should address markets and financial institutions. However there is no a single definition of systemic risk but various researchers and policy makers have discussed it in different ways, Bisias et al. (2012), international institutions such as the IMF, the BIS and the SFSB stated that systemic risk can be defined as a ‘‘risk of disruption to financial services that is caused by an impairment of all or parts of the financial system and has the potential to have serious negative consequences for the real economy.’ Similarly, the Group of Ten (2001) defines systemic financial risk as the risk that an exogenous shock will trigger a loss of economic value in a substantial portion of a financial system causing significant adverse effects on the real economy. The recent studies done by Adrian &Brunnermeir (2011); Acharya et al (2010); and Tarashev et al (2010) have examined the systemic risk by measuring how much a bank contributes to the overall risk of the financial system.

A financial crisis is systemic in nature if many banks and financial institutions fail together or if one banks failure propagates as a contagion causing the failure of many banks. The Financial Stability Board which acts as an international standard setter and coordinator of issues related to systemic risk has identified financial institutions into two parts namely global systematically important financial institutions (G-SIFIs) and domestic systematically important banks (D-SIBs), according to this board a financial institution is said to be G-SIFI if its failure could impact other financial institutions ,the wider financial system and both domestic and international economies (FSB,2011a,2011b). The Basel Committee on Bank Supervision adopted a score based valuation approach for globally systematically important banks and selected the following as the evaluation criteria: size, interconnectedness, lack of readily available substitutes, global (cross-jurisdictional) activity and complexity (BCBS, 2011). In November 2015 the FSB published a list of 30 banks designated as G-SIBs; the list is updated annually depending on the new data and published by the board each November. The Board has also asked local authorities to identify whether a large domestic bank is systemically important from a domestic perspective and whether can pose systemic risk to the national and regional financial systems.

Banks and other financial institutions are important sources of capital as well as systemic risk, and most of these large banks and multinational financial institutions contribute to systemic risk due to their size, complexity and interconnectedness of the global financial system (Moshirian, 2010, 2012).Various theories and conjectures have been developed to support the view that large and complex banks contribute to systemic risk.

Unstable banking hypothesis reveal that large banks usually tend to involve in the very risky activities and be financed more with short-term debt, which makes them more vulnerable to generalized liquidity shocks and market failures such as liquidity shortages and fire sales (Shleifer and Vishny, 2010; Gennaioli et al., 2013;).

According to the too-big-to-fail hypothesis, regulators are reluctant to close large and complex banks, resulting in moral hazard behavior that leads banks to take on excessive risks in the expectation of government bailouts. Basing on this theory a bank is assumed to be too big to fail if its prominent market share cannot be substituted easily by the competitors. The German federal government and Great Britain's Treasury subsidized both Commerzbank AG and Northern Rock respectively to survive basing on this argument (Schrors and Luttmer, 2010)

Lastly the agency cost hypothesis unveil that large and complex banks that engage in multiple activities (e.g., combining lending and trading) suffer from increased agency problems and poor corporate governance that can translate into systemic risk (e.g., Bolton et al., 2007; Leaven and Levine, 2007). Basing on this view, banks tend to have a natural tendency to take on excessive risks and to grow in size, while regulators, by focusing on micro prudential regulation, did little to prevent the resulting build-up of systemic risk. As a result, large banks tend to share many of the risk factors that other theories have identified as being important drivers of systemic risk, such as high leverage, activity diversity, and interconnectedness.

It is thus clear that the goal of evaluation and management of systemic risk should be to ensure the financial stability of the system as a whole. Regulatory approaches that are commonly based only on financial entity's own risk fail to mitigate aggregate risk shifting incentives and can in fact accentuate systemic risk. Regulation is shown to operate at a collective level regulating each bank and financial institutions as a function of both its joint risk with other banks or financial institutions as well as its individual risk.

1.1, Macro prudential policy

One of the important aspects of these regulatory frameworks for management of systemic risk of the banking system is macro prudential policy and in particular regulatory capital requirement as stipulated in Basel III. According to (Caruana, 2010a) the implementation of Basel III will considerably increase the quality of banks capital and significantly raise the required level of their capital, in addition it will provide a macro prudential overlay to better deal of systemic risk. Macro prudential policy is seen to meliorate the financial stability of the system, Gallati G&Moessner R (2011) have defined this view of financial stability into two parts, firstly they define financial stability in terms of robustness of the financial system to external shocks (Allen and Wood ,2006) ;Padoa-Schioppa,2003). Secondly they emphasize the endogenous nature of financial distress and describes the financial stability in terms of resilience to shocks originating within the financial system (Schinasi,2004)or the vulnerability to the financial distress in response to normal sized shocks rather than large shocks (Borio &Drehman,2009a).

It should be understood that the general view of macro prudential policy is about the limiting of risks and costs of systemic crises. It is argued that one key purpose of macro regulation is to act as a countervailing force to the natural decline in measured risks in a boom and the subsequent rise in measured risks in the subsequent bust, thus it can be used to mitigate the risk of episodes of system wide distress that have significant macroeconomic costs (Borio &Drehman, 2009a). While the financial meltdown has sparked an extensive study by economists, policy makers and researchers on macroprudential policy on global financial stability,but this domain of policy development is still in its infancy and requires more work (Arnold et al,2012), furthermore a comparable consensus is still missing in the literature on the macroprudential policy (Gallati G&Moessner R(2011), however the FSB has made an improvement in this case including the measures to identify and monitor systemic risk of both regulated banking and shadow banking's FSB (2011a) pinpointed a range of tools to be used by countries to address systemic risk, these tools fall under1.tools to address financial stability risks arising from rapid credit expansion 2. tools to address amplification mechanisms of systemic risk such as leverage and maturity mismatches and 3. tools to limit spillover effects from the failure of SIFIs. However to be able to identify and contain systemic risk remain a new domain of development (Ellis L et al, 2014)

Table 1 adapted from Hannoun (2010) and (Gallati G&Moessner R (2011) gives an overview of the toolkits to meliorate financial stability.

Tool set	Goal	Instruments
Prudential policy-Micro prudential	Limit distress of individual institutions	e.g quality/quantity of capital/leverage ratio
Prudential policy-Macroprudential	Limit system-wide distress	e.g countercyclical capital charges
Monetary policy	Price stability	Policy rate ,standard repos
	Liquidity management	Collateral policies, interest on reserves, policy corridors
	Lean against financial imbalances	Policy rate ,reserve requirements, mop-up of liquidity ,FX reserve buffers
Fiscal policy	Manage aggregate demand	Taxes, automatic stabilizers, discretionary countercyclical measures
	Build fiscal buffers in good times	e.g measures to reduce debt levels, taxes/levies on the financial system
Capital controls	Limit system-wide currency mismatches	e.g limits on open foreign exchange positions; constraints on the type of foreign currency assets
infrastructure policies	Strengthen the resilience of the infrastructure of the financial system	e.g move derivative trading on exchanges

Table 1, Source: adapted from Hannoun (2010) and (Gallati G&Moessner R (2011)

Bank governance is another important aspect for systemic risk management which has been mislooked by many scholars. Ellis L et al (2014) have named governance as the fifth pillar of effective reform of regulatory regime which has yet largely untouched. The recent empirical studies have mentioned governance as an important aspect in the financial crisis and that there is a strong link between governance and risk taking especially for financial firms (Beltratti and Stulz, 2009, Ferreira et al 2012, Laeven and Levine, 2009). If reform can act on these incentives at source it reduces the chances of regulators chasing risk around the system (Haldane, 2012). This is to say that effective governance reform can be used to curb risk taking without generating regulatory arbitrage.

1.2 Systemic risk measures

These encompass the analytics used to assess the systemic importance of the financial institutions or the contributions of the financial institutions to the systemic risk. Bisias et al (2012) gives an analysis of 31 different quantitative measures of systemic risk that can be applicable in the management of the systemic risk in different aspects. Moreover Bisias et al (2012) suggest that it is not possible to have a single measure of systemic risk as it may result in a "Maginot line" situation in which vulnerabilities building in other parts of the financial system are missed. Most of the measures that can be tested empirically can be broadly classified into the measures based on the balance sheet variables and measures based on the financial market data. Whereas the measures based on the balance sheet are slow moving and back ward looking in nature, the market based measures can provide more timely and forward time looking assessments of systemic risk. On the other hand FSB and the Basel Committee for Bank Supervision (BCBS) have developed the guidance on how to assess the systemic importance of financial institutions and institutions. This guidance includes size, interconnectedness, lack of readily available substitutes, global (cross-jurisdictional) activity and complexity (BCBS, 2011) as explained in the preceding section. Moreover the guidance suggests that the regulators should use a scorecard based on these criteria to determine the degree of systemic importance of each bank.

We find motivated in writing this review paper as there are scant of literature reviews on this topic. This review paper will fascinate other scholars and policy makers to be conversant with the subject matter and come up with diverse quantitative and qualitative measures of managing systemic risk, most of the quantitative articles discussed here are built on the cross section measures of systemic risk developed by Acharya et al (2010), Adrian and Brunnermeir (2011), Huang et al (2009, 2010) and Tarashev et al (2010) that aims to examine the co-dependence of institutions on each other's health, however some of the qualitative studies (literature review) has also been contained . This review paper is motivated by the work of Gallati G & Moessner R (2011) who conducted a literature review on macroprudential policy. Our work differ in various dimensions, we review some of the articles published in the time frame of 2005-2015 since the period in between were heavily impacted by the financial meltdown, our work is mainly concerned with evaluation and management of the systemic risk of the banking system unlike Gallati G&Moessner R (2011) who reviewed the use of macro prudential policy in parallel with the literatures based on monetary policy, and according to our knowledge this is among the first

studies that involves a systemic review of articles on evaluation and management of systemic risk of the banking system.

1.3, Review methodology

The concept of systemic risk can be understood from various fields but mainly falls in the domain of economics, finance and banking. This study reviewed the literature on evaluation and managing of systemic risk through various databases and sources like Science Direct, Emerald Insight and various search engines like google scholar and Bing (academics).The following criteria were used to search for the sources and select the papers;

- The keywords measuring, evaluation and managing systemic risk, interbank market , macroprudential policy, capital requirements were used to search the titles and abstracts of the paper
- Papers reviewed were published between the year 2005-2015.
- Masters theses, doctoral dissertations, text books and unpublished work were excluded because academics and practitioners usually use journals to acquire information and disseminate new findings except for few working papers which develop measures of systemic risk. In other words journals represent the highest level of research.
- Following Alavi and Carlson (1992), we classified our articles into empirical and non-empirical studies.

2. Discussion on the recent research literature.

2.1, Empirical studies

Empirical articles includes those studies relying on field observations usually captured through a number of methodological research techniques such as field surveys, case studies, field studies, interviews, as well as laboratory and field experiments. According to Alavi and Carlson (1992) empirical articles are classified as qualitative research if they had an emphasis on the description and understanding of the context and the environment of the research phenomenon. On the other hand, studies using numerical analysis to illustrate the relationship among factors in the phenomenon studied were classified as quantitative research. Most of the papers reviewed are seen to fall under quantitative analysis however some of the studies used both quantitative and qualitative methods.

For systemic risk to be managed, it is important for the risk managers to identify, assess and measure the extent of the risk. Other risks are not amenable to formal measurement but are nonetheless important. The role of the financial manager is to evaluate both risks using quantitative tools and judgement.The study below explores various dimensions of systemic risk such as modeling and measuring systemic risk, by knowing the extent of the risk would help the supervisory authorities to manage the systemic risk.

It is noticeable that a lot of researchers have examined the regulation of the systemic risk by focusing on the measures of systemic risk and systemic risk contributions factor. The most widely measure of risk VaR has been confronted for not capturing the systemic risk of the financial system as a whole; it looks systemic risk of the banking system in isolation. Value at Risk and expected shortfall (ES) measures can be used only in normal times; as result of this there is considerable interest in other risk measures which improve the value at risk shortcomings.

One of the most recent cited articles is Adrian and Brunnermeir (2011) whose work is devoted to the systemic risk of single institutions. They employ the concept of conditional Value at risk (CoVaR) which is defined as the VaR of the financial system conditional on the default of one bank. By conditioning on another institutions financial distress, they go beyond idiosyncratic risk and capture spillovers among financial institutions. The CoVaR systemic risk approach has the ability to discern the risk on the system by individually systemically important financial institutions, which are so interconnected and large that they can cause negative risk spillover effects on others and in addition to the smaller institutions that are systemic when acting as part of a crowd. More importantly CoVaR is a measure which does not rely on contemporaneous price movements and thus can be used to anticipate systemic risk. This measure captures institutional externalities such as “too big to fail”, “too interconnected to fail”, and crowded trade positions. This approach (CoVaR) is synonymous in structure to The Co-Risk measure proposed by the International Monetary Fund (2009a), except that Co-Risk examines the CDS spread of one firm, conditional on the CDS spread of the other, each at the respective 95th percentile of its empirical distribution, Adrian and Brunnermeier (2011) use quantile regressions to get the empirical relationship between VaRs in the tails of the joint distribution as an alternative to least-squares regressions, that concentrate on the relationship at the mean of the distribution. Girardi, G. & Ergun, A. (2012) measures the systemic risk using multivariate generalized autoregressive conditional heteroskedastic (GARCH) estimation of CoVaR. This model assumes that the conditional variance depends on the latest innovation and on the previous conditional variance. They modify Adrian and Brunnermeier**’s** (2011) CoVaR approach.While Adrian and Brunnermeier (2011) find that institutions’ VaR and their Co- VaR have only a weak relation in the cross section and a very strong relation between the two in the time-series the latter suggest that VaR and CoVaR are weakly related in the time-series as well as in the cross-section. These findings can suggest that monitoring a

firm's tail risk in isolation is not sufficient to determine its systemic risk contribution

This is to say that most of articles are built basing on the concept of Adrian and Brunnermeier (2011). Lopezespinosa, G et.al (2012) uses CoVaR approach to identify the main factors behind systemic risk in a set of large international banks. They came up with the evidence that short-term wholesale funding is a key determinant in triggering systemic risk episodes. In contrast they find weaker evidence that either size or leverage contributes to systemic risk within the class of large international banks. Since short-term wholesale funding has evolved as the most relevant systemic factor, then their findings support the Basel Committee's proposal to introduce a net stable funding ratio, penalizing excessive exposure to liquidity risk.

Apart from CoVaR, the Marginal Expected Shortfall is widely used as the indicator of systemic risk, Acharya et al (2010) introduce systemic expected shortfall (SES) in order to gauge listed financial institutions contributions to systemic risk. SES is explained as an institutions propensity to be undercapitalized when the financial system as a whole is undercapitalized, they also introduce MES as a measure of institution's losses in the tail of the system's loss distribution. Acharya et al (2010) recommends focusing on the 5% highest share price losses of the financial system over time. Brownlees and Engle (2011) adopt the methodology of Acharya et al (2010) by using a systemic risk index which is determined by the expected MES and the degree of leverage of a firm. Leverage information is taken from the balance sheets while MES is estimated by time varying share price volatility and its correlation with the market. Puzanova et al (2012) explores on systemic risk contributions by using VaR and ES, they define the MES by following the Euler principle and comprehends information on the riskiness of the banking sector, including the size of institutions, current probabilities of default and correlation among banks, they treat the credit portfolio as a hold to maturity loan book where default risk is the only source of uncertainty however their approach does not go beyond the notion of linear correlation. Their work supplements the ongoing debate on how to make systemic capital surcharges operational. They suggested that macroprudential supervision should be on a solid capital base throughout the financial cycle. Avramidis, P. & Pasiouras, F. (2015) builds a model based on Puzanova et al (2012) but with extension to include two factor models ,the double t -factor and the t -factor that imply higher extreme dependence and mark to market approach that yields capital charges against default losses and losses due to downgrade of credit state. They illustrate the systemic risk capital as the amount of capital that insures the portfolio value against unexpected losses. One of the findings they captured is that in the presence of positive extreme event dependence, the Gaussian model underestimates the risk on average of 40%; also SIFI should consider size, standalone risk and bank correlation as an important systemic risk determinant.

Moreover, Yun, J. & Moon, H. (2014) use dynamic conditional correlation model to examine systemic risks in the Korean banking sector by using MES and CoVaR measures. Their findings unfold that systemic risk contributions are closely related to certain bank characteristic variables such as VaR size and leverage ratio .They also recommend the use of aggregate MES as an overall systemic risk indicator for the banking system through a threshold called VAR model which is used to analyze the dynamic relationship between this indicator and real economic activity. Jacob K &Tobias N (2015) explores the drivers of systemic risk and contagion among European banks from 2007 to 2012 using MES and conditional VaR. Their findings implies that regulators have to consider a broad variety of indicators for assessing systemic risks, since the existing micro prudential-oriented rules are less effective, and policymakers may consider new measures like asset diversification to mitigate systemic risks in the banking system. In another study Iqbal J et al (2015) use MES and SRISK measures proposed by Acharya et al (2012) to study the relationship between corporate governance and systemic risk of US financial institutions between 2005-2010 using MES and SRISK. SRISK has been defined by Acharya et al (2012) as the amount of capital that a firm is expected to get if there is another financial crisis, and in reality SRISK is estimated depending on the marginal expected shortfall that endeavors to capture the expected loss of equity capital of a firm amidst market meltdown. Their empirical findings indicate that financial institutions with stronger and more shareholder focused corporate governance structures and board of directors are associated with higher systemic risk. They suggest that banking supervisors and regulators should apply more stringent monitoring to financial institutions with strong, shareholder oriented corporate governance mechanisms in order to assess their contribution toward systemic risk.

Laeven L et al (2014) examines the significant variation in the cross section allocation of standalone and systemic risk of large banks and its effect on capital requirements on bank, and used SRISK and CoVaR to measure systemic risk. They find that systemic risk grows with bank size and inversely related to bank capital and that could be seen as evidence in support of calls to limit the size of bank activities however the optimal size of the bank should be identified. Their results contribute to the ongoing debate on the merits of imposing systemic risk based capital requirements on banks. Weiss, G., et al (2014) also examined the determinants of contribution of international banks to global and local systemic risk using MES and lower dependence tail as measure of systemic risk. Their findings found no empirical evidence supporting conjectures that size, leverage and non-interest income are powerful determinant of systemic risk. They further reveal that global systemic risk is predominantly driven by characteristics of regulatory regime and therefore bank with systemic risk should be

regulated with stringent supervision. Yan W et al (2014) examines systemic financial risk and analyze influential factors by estimating CoVaR model and extremal quantile regression. They find that value at risk and systemic risk contribution are very different when measuring the risk of a financial institution, when value at risk is used to measure risk, the risk of banks is lower than that of securities. However, measurement of systemic risk contribution has indicated that the overall risk contribution of banks to financial systems is generally higher. Banks were found to have the highest systemic risk contribution albeit under different quantiles, the rank of financial institutions with highest systemic risk contribution may vary.Size and Leverage ratio are considered to be two significant and important factors influencing an institution's systemic risk, thus should be taken into account when regulating and constraining financial institutions.

More importantly, Huang, X.et al (2009) introduces other measures that do not analyze individual systemic risk, but aim for the identification of system risk within a group of banks. They provide framework for measuring and stress testing the systemic risk of a group of major financial institutions in US measured by the price of insurance against financial distress. The contributions of these institutions can inform the design and calibration of policy tools aimed at preventing the system distress. Huang, X.et al (2010) examines the systemic risk of a banking sector as a hypothetical distress insurance premium. Based on their proposed approach to quantifying the marginal contribution of individual banks to the systemic risk they recommend that "too-big-to-fail" is a valid concern from a macro-prudential perspective of bank regulation. In another study Huang, X et al (2011) find that a bank's contribution to the systemic risk is roughly linear in its default probability but highly nonlinear with respect to institution size and asset correlation, the decomposition analysis shows that the marginal contributions of individual banks to the systemic risk indicator are determined mostly by bank size, consistent with the "too-big-to fail" doctrine and this supplement the ongoing discussion of the imposition of capital surcharges on SIFIs. Another similar study was provided by Black, L.et al (2015) who provides a systemic risk indicator that quantifies the risk of the European banking system using distress insurance premium that grabs the cost of insuring the banking system against extreme losses. They also find that size and leverage forecast increases in systemic risk while short term liquidity adequacy and a favorable market valuation ratio forecast decreases in systemic risk.

Generally the Distress Insurance Premium (DIP) measure proposed by Huang et al is an ex ante systemic risk metric that represents a hypothetical insurance premium against a systemic financial distress, defined as total losses that exceed a given threshold, say 15%, of total bank liabilities and it can be applicable to any pre-selected group of firms with publicly tradable equity and CDS contracts. Each institution's marginal contribution to systemic risk is a function of its size, probability of default and asset correlation.

In another study, Patro, D et al (2010) explores the effectiveness of stock return correlations among financial institutions as an indicator of systemic risk among 22 U.S. bank holding companies and investment banks using correlation measures namely Parametric Pearson correlation, nonparametric spearman and Kendall correlations. Their empirical findings on the trend of the correlations of banks' systematic returns and idiosyncratic returns are consistent with the systemic risk-shifting incentive of banks suggested by Acharya (2009), who argues that banks prefer correlated investments which give rise to an inefficiently high correlation of asset returns in order to survive together, or fail together. Thus they suggest that regulators and businesses monitor daily stock return correlations among those large and highly leveraged financial institutions to track the level systemic risk. Jobst A (2013) uses SRL model which represents a structural approach to measure systemic liquidity risk using both prices and quantities to assess the risk adjusted impact of maturity mismatches in excess of a market based threshold of stable funding. They find the model useful as it help to measure the marginal contribution of each institution to total systemic liquidity risk ,and thus can be used to design regulation that provides incentives for the internalization of the social cost of the negative externalities of individual funding decisions.

More ever Tarashev et al (2010) introduce an allocation procedure based on the game theory. They apply the Shapley Value methodology to a system of 60 international banks by looking at each banks marginal contribution to a system risk measure in all possible subsystems it could be part of, and take the average of these marginal contributions. They presented a framework for the analysis of determinants of systemic importance: bank size, bank-specific risk, and the commonality of banks' exposures. Their studies reveals that increase in bank size leads to a more than proportional increase in systemic importance and thus the application of Shapley Value methodology can be used in designing prudential policy tools with system-wide objectives. In another contribution to research Drehmann and Tarashev (2011) extended it by taking into account the contagion through the interbank market since the former show does not handle correctly the risk that banks impose on each other through interbank linkages. In this paper they unveil that systemic importance depends on the risks it poses to other banks both as a borrower and as a lender Following Tarashev et al (2010) number of studies has explored the Shapley value methodology in systemic risk attribution. Gauthier et al (2010) have calculated Shapley values in a system of five large Canadian banks. They defined macro prudential capital requirements as a fixed point at which each banks capital requirement equals its contribution risk of the system and considered five different

mechanisms to allocate risk namely Component VaR, Incremental VaR, Shapley value expected loss, CoVaR and MES. They find that macro prudential capital allocations can differ as much as 25% from observed capital levels, and also across all risk allocation mechanisms macroprudential capital requirements downsize the default probabilities of individual banks as well as the probability of systemic crisis by 25% and concluded that financial stability can be substantially enhanced by implementing a systemic perspective on bank regulation.

Liao S. et al (2015) use the same concept like those of Gauthier C. et al (2010). They examined on how to manage systemic risk in Netherlands by exploring the effects of systemic risk of macroprudential capital requirements which require banks to hold capital that is proportional to their contribution to systemic risk. While the former used a network model that accounts for asset correlation risk through fire sales; the latter used a Merton style network model that accounts for bankruptcies both through asset correlation and interbank contagion. They find that macro prudential capital requirements differ from the current observed capitals by as much as 40% and that they are positively related to bank size and interbank exposure. In addition to that macroprudential capital requirements can reduce individual and multiple banks default probabilities by up to 26%, suggesting that financial stability can be improved by implementing macroprudential regulations.

Another strand of literature focus on the network models. Financial networks represent complex financial systems with nodes representing financial institutions or country, analysis of these networks would awake the supervisory authorities about the resilience of the system which might be affected by the contagion risk through which shocks propagate, yet they help to test the effectiveness of the macroprudential policies.

Researchers usually make use of mathematical algorithms like Maximum entropy to supplement the data by making statistical assumptions incase the empirical data is not sufficient .Most of these studies involves simulations and usually idiosyncratic or exogenous macroeconomic shocks represent the starting point of the simulation. Elsinger et al (2006) collect the balance sheet information of 800 institutions and employ maximum entropy mechanism to create an exogenous shock that impacts the Austrian banking sector. They differentiated between primary defaults and defaults by contagion and 7% of the simulated losses were subject to contagion default. Memmel et al (2011) use the bilateral interbank liabilities of 15 German banks and run simulations on idiosyncratic defaults for each of the institution allowing only one bank to fail at time, failure is explained at Tier 1 capital falling below 6% of risk weighted assets.

Kanno M (2015) evaluated the systemic risk of the global banking systems basing on financial networks. They clarified the network structure using the estimated bilateral exposure matrix and modeled contagious defaults in the global interbank market based on Eisenberg-Noe framework (2001). They conducted a stress test and analyzed the possibility of contagious defaults conditional on a banks basic default at an evaluation point in the future. They find that the bilateral exposures matrix has high possibility of monitoring systemic risk as it captures more possibilities of default contagion, however their method has chance to be meliorated to a more realistic bilateral exposures matrix.

2.2, Non empirical studies

Non-empirical research encompass articles based either on authors' subjective opinions and/or literature reviews, but did not include empirically collected data, Alavi and Carlson (1992). Non-empirical researches are mostly sub classified into literature reviews, conceptual articles, and illustrative contributions. Literature reviews are commonly based on secondary sources and reported no empirical findings. Conceptual articles are non-empirical studies describing frameworks, models, or theories.

The reviews below encompass the discussion of researchers on the evaluation of systemic risk by developing theoretical framework which may guide the supervisory authorities in identifying and managing of systemic risk. Acharya V (2009) presented a model where the correlation of bank failures probabilities hinges on their common exposure to systemic risk factors. The paper showed that banks in general have an incentive to choose similar exposures, both because diversification opportunities are the same to all banks and because regulatory patient is more likely in situations where several banks are in distress together. The findings unfold that regulating each bank's risk cannot capture fully the risks that could propagate through a nexus of contracts. Prudential regulation is shown to operate at a collective level, regulating each bank as a function of both its joint risk with other banks as well as its individual risk.

Kara G (2015) examines the incentives of national regulators to coordinate capital adequacy requirements in the presence of systemic risk in global financial markets using a two-country, three-period model. Unlike Acharya (2009) in this paper, systemic risk in international financial markets arises as banks from two countries experience correlated liquidity shocks, and financial amplification effects are triggered due to fire sales. Their paper shows that the regulator of the high-return country or the country with a larger population of global investors chooses more lax capital regulations and is less willing to compromise on stricter regulatory standards that are optimal from a global perspective. Another study closely related to Acharya (2009) is the study done by Zhou C (2013) who explores the impact of imposing capital requirements on systemic risk and explains why imposing capital requirements may not reduce systemic risk and maintain the stability of the

banking system. They constructed a static model on financial institutions risk taking behaviour to quantify the systemic risk in cross sectional dimension in both regulated and unregulated systems, the model shows the double edged impact of imposing capital requirements, despite the fact that it can lower individual risk ,it simultaneously enhances systemic linkage within the system. Their model reveals higher dependence in the regulated system to be an endogenous consequence of banks individual risk management while in Acharya (2009) the higher dependence under regulation stems from systemic moral hazard.

In another study Bluhn M& Krahnen J (2014) examines Systemic risk in an interconnected banking system with endogenous asset markets and analyzed its emergence of in a network model of interconnected bank balance sheets. In network based approach the Shapley metrics are used to gauge bank contributions to systemic risk. While Gauthier et al (2010) use network model to measure the systemic risk and banks contribution to it employing several risk allocation mechanisms, In this paper they extend the approach with distributional assumptions on the vector of shocks to the financial system which combine Shapley value approach to compute expected values for systemic risk as well as banks contribution to it. They suggested a new macroprudential risk management approach building on a system wide value at risk (SVaR).They find that banks' fair systemic risk charge diverges from their optimal macroprudential capitalization and thus have implications for the design of macroprudential capital surcharges. Capponi A& Chen P (2015) examined the systemic risk mitigation in financial networks and also assessed sensitivity of systemic risk to variations in interbank liabilities as well as to their correlation structure. They proposed a multi-period clearing framework built on Eisenberg and Noe (2001) where the level of systemic risk is mitigated through the provision of liquidity assistance. They find that policies targeting systemically important banks are more effective in core-periphery network structures, whereas those maximizing the total liquidity in the system are preferred in random network configurations.

More ever Bramer, P et al (2014) introduce a network model to assess system risk in the banking sector and run simulations based on theoretical data. Their paper build on the network simulation of Memmel et al (2011) and incorporate an exogenous shock on the market that comprehends the primary default of one or more institutions and examine the degree of volatility of the system. Their model includes multiple variables and illustrates the importance of single determinants such as Tier 1 capital ratio and relative size of bank. Basing on major determinants of contagious defaults their findings illustrates that regulation measures focusing on banks' Tier 1 capital are useful and stabilizing system risk. Ladley, D. (2013) use a computational model with endogenous bank behaviour and interest rate to identify the situations of which interbank lending encourages stability through risk sharing or provides a channel through which failure may propagate. They find that for a large economy wide shocks, more interbank lending relationship aggravate systemic events and in opposite direction for smaller shocks

More importantly, other strand of researchers have discussed on issues to be considered to meliorate financial stability based on literature reviews. Arnold, B.et al (2012) explores the issues that need to be considered so as to promote greater financial stability, the measurement of systemic risk and of individual institutions' contribution to it. It discusses aspects of macroprudential frameworks, including how the countercyclical capital buffer envisaged in Basel III takes into account the properties of the financial cycle and the strengths and weaknesses of macro-stress tests. In general the paper reveal that more capital is good, and it makes the system more resilient to systemic risk.

Elis L et al (2014) examines the issues and the relationship with respect to systemic risk, governance and global financial stability They argued that since the financial system is diverse then the risk that the individual institutions face are also diverse and thus the single measure of systemic risk is not applicable universally . They offer solutions to improve bank governance and mitigate systemic risk, this comprise; increasing the regulatory capital base of banks, reformation of the compensation structure of managers and also efforts should be made to put in place resolution regimes which offer the credible prospect of bailing in creditors in the event of stress. Chitiba C (2012) explores how to manage systemic risk by using the regulatory framework. This paper argue that if properly designed and implemented it can downsize financial markets systemic risk, and the regulatory approaches includes averting panics, requiring increased disclosure, imposing financial exposure limits, limiting financial institution size, ensuring liquidity and market discipline, which will be achieved through the application of the macroprudential policy.

Stefan Schwerter (2011) studies the ability of Basel III to mitigate systemic risk. The paper evaluates the Basel Committee's efforts to address the weaknesses of Basel II through Basel III by investigating its incentives and its ability to reduce both drawbacks of Basel II as well as systemic risk factors. The paper reveals that despite the advanced development of Basel III , providing some stabilizing incentives, there are still issues calling for closer consideration to counter all Basel II drawbacks and systemic risk factors adequately, this comprises a risk-weighted leverage ratio; a more thorough treatment of procyclicality; adjustments for Net Stable Funding ratio and the mandatory issue to internalize negative externalities from financial institutions, that is, the call for pricing systemic risk. Michael S &Jakub S (2015) examines the number of issues that should be considered by regulators of systemic risk and pinpoints the weakness of the method suggested by the Basel

Committee for Banking Supervision (BCBS) for assessment of banks' systemic importance. Their paper manifests that in some cases, use of individual-level rather than consolidated-level data may be preferable, in contrast to what the BCBS guidance suggest. Karim P (2014) examines the basic reasons underlying the Basel failure in mitigating systemic risk supported by various factors such as: complexity, variations in measurement of risk -weighted assets across banking institutions, ability to game the system. They suggest that a simple TCE leverage rule is superior to Basel in controlling systemic risk

Moreover, Prasanna G et a l (2007) examines how central banks and other financial regulators might respond to volatility with a clearer, more rigorous, operational framework for their systemic financial stability work through analytical models developed at the Bank of England. They suggest that financial innovation and integration, coupled with greater macroeconomic stability, have served to make systemic crises in developed countries less likely than in the past, but potentially more severe. Sigbjorn B (2011) reviews the proposed measures of systemic importance such as MES, CoVaR, and DIP and discusses their merits relative to how a regulator would ideally wish to calibrate surcharges on systemically important banks, and evaluate how useful proposed measures of the systemic importance of financial institutions will be to regulators. They explain that the measures proposed by the researchers do not constitute satisfactory bases for calibrating systemic surcharges on banks as most of them are based on the market data

2.3, Distribution of analyzed papers-

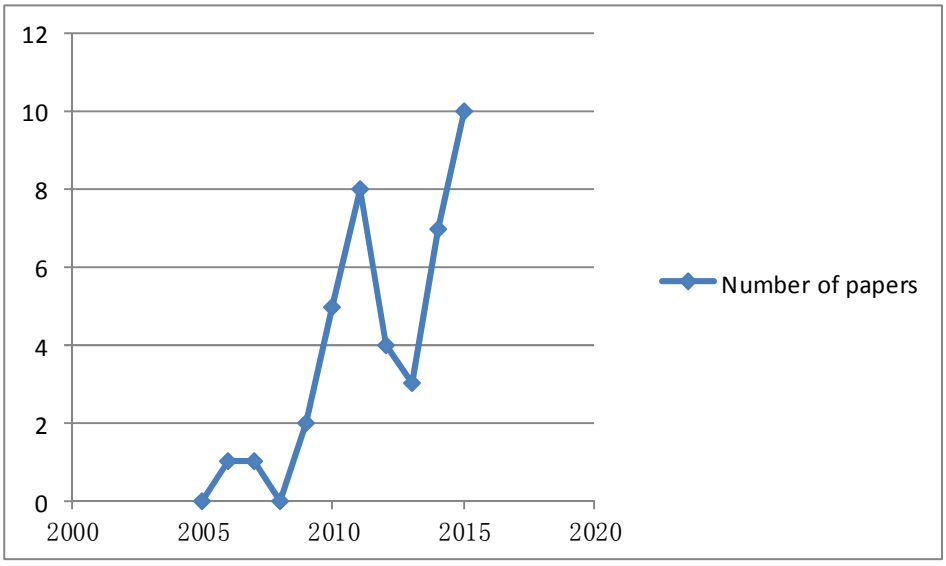

Figure 1.Distribution of papers analyzed

Considering the discussion above, further analysis was conducted to understand how the articles published have been distributed by the year of publication. This analysis will give insights and future research prospects on the topic. We analyzed 41 published papers and its distribution has shown (see Figure 1).From this figure it can be seen that there is an increasing trend in the number of articles during this period. This has been almost contributed by the occurrence of the global financial crisis in 2006-2008 which affected and propagated the failure of some financial institutions around the globe. From this trend it would be meaningful to say that the attention given to evaluation and management of systemic risk has increased over time and remains an important domain for research.

3.0 Toward a research agenda

The recent financial crisis has emphasized the need to address the incomplete reforms within the financial system. There is a consensus among the policy makers and regulators that the proper regulation of systemically important banks is imperative for downsizing the probability of major financial turmoil in the future. Following that, the FSB has identified the G-SIFIs and has directed the national regulators of each country to identify the D-SIFIs, this would enable the national regulators to identify and measure the systemic risk which might be imposed by these institutions.

Following the existing literature review above, we have observed that most of these studies are mostly addressed in the developed countries and therefore there is a need to the researchers and regulators in emerging countries to conduct such kind of studies, this is motivated by the fact that there is interconnection and interlinkage of the banking system around the globe, thus the studies would enable the bank regulators to identify, measure and manage the systemic risk of the their banking system.

Another important observation is that almost all quantitative analysis of systemic importance measures in the literature is based on market data and thus on market participant's perception of risk exposures and of how banks are connected. The underlying problem with market prices is that they are likely to reflect the private costs of systemic events rather than social costs.

Most of the measures reviewed in this literature mainly look on the risk elements which are expressed on the asset side of the balance sheet. This is also supported by Tarashev et al who unveil that the focus on the asset side may be misguided. Thus, they argue that it is also important to consider risks on the liability side of the balance sheet as most of the contagion effects were obviously true during the recent financial turmoil.

Moreover the measures developed implicitly assume that the SIFI will be permitted to fail and therefore focus on the cost of outright failures. According to the definition of a systemically important bank is that outright failure may not be permitted to happen as it would be socially very costly. In practical life there will be a significantly positive probability that distressed SIFI will be rescued by the government in terms of bail outs. If there is a positive probability that some banks will be maintained as going concerns, measures of systemic importance should also take into consideration the expected costs of the potential rescue operation

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