

# Elimination of systemic risk in financial networks by means of a systemic risk transaction tax

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Financial markets are exposed to systemic risk (SR), the risk that a major fraction of the system ceases to function and collapses. Since recently it is possible to quantify SR in terms of underlying financial networks where nodes represent financial institutions, and links capture the size and maturity of assets (loans), liabilities, and other obligations such as derivatives. In particular it is possible to quantify the share of SR that individual nodes contribute to the overall SR in the financial system. We extend the notion of node-specific SR to individual liabilities in a financial network (liability-specific SR). We use historical, empirical data of interbank liabilities to show that a few banks in a nation-wide interbank network contribute to the major fraction of the overall SR. We propose a tax on individual transactions that is proportional to their contribution to overall SR. If a transaction does not increase SR it is tax free. We use a macroeconomic agent based model (CRISIS ABM) with a financial economy to demonstrate that the proposed Systemic Risk Tax (SRT) leads to a self-organized re-structuring of financial networks, that are practically free of SR. This is because risk-increasing transactions will be systematically avoided when a SRT is in place. Systemic stability under a SRT emerges due to a *de facto* elimination of system-wide cascading failure. ABM predictions agree remarkably well with the empirical data and can be used to understand the relation of credit risk and systemic risk.

Keywords: systemic risk, DebtRank, agent based model, self-organized criticality, multiplex network

## INTRODUCTION

Failure to manage systemic risk (SR) has been proven to be extremely costly for society. The financial crisis of 2007-2008 and its consequences demonstrated the importance to reduce it. The threat of collapse of large parts of the financial system forced national governments to bail out hundreds of banks [1]. As a result one observed falling global stock and real estate markets [2–4], a severe and global credit crunch [5], skyrocketing and prolonged unemployment rates [6–8], and several Western governments at the verge of bankruptcy [6]. Bank bailouts caused dangerously high levels of sovereign debt around the world, and it becomes necessary to find alternatives to finance bailouts. The International Monetary Fund proposed a tax on banks, called the “financial stability contribution” (FSC) that can be seen as a contribution of the financial sector to the public costs of the financial crisis, and to create reserves for future crises. Bank taxes have been implemented in many countries around the world, such as the “Financial Crisis Responsibility Fee” in the US. The European Commission proposed an EU-wide bank tax under the “Single Resolution Mechanism”. In addition to bank taxes a financial transactions tax (FTT) is considered by many countries. FTT is not a tax on financial institutions *per se*, but a levy placed on specific types of financial transactions. Its main purpose, besides generating revenue for governments, is to curb volatility of financial markets [9, 10]. Empirical studies are generally inconclusive, and a causal relation between volatility and FTTs remains ambiguous [11, 12]. In response to the financial crisis of 2007-2008 a consensus for the need of new financial regulation emerged. New

financial regulation should be designed to mitigate the risk of the financial system as a whole. This approach to financial regulation is known as *macroprudential regulation*, and is currently put in place around the globe [13–15]. The Basle III framework recognizes systemically important financial institutions (SIFI) and recommends increased capital requirements for them, the so called “SIFI surcharges” [16, 17]. Basle III further introduces *countercyclical buffers* that allows regulators to increase capital requirements during periods of high credit growth.

No matter how well intended these developments might be, they miss the central point about the nature of SR, and might not be suitable to improve stability of the financial system in a sustainable way. SR is tightly related to the *network structure* of financial assets and liabilities in a financial system. Management of SR is essentially a matter of re-structuring financial networks such that the probability of cascading failure is reduced, or ideally eliminated.

Credit risk is the risk that a borrower will default on a given debt by failing to make the full pre-specified repayments. It is usually seen as a risk that emerges between two counterparties once they engage in a financial transaction. The lender is the sole bearer of credit risk, and figures the likelihood of failed repayments into a risk premium. Lenders usually charge higher interest rates to borrowers that are more likely to default (risk-based pricing). Credit risk is relatively well understood, and can be mitigated through a number methods and techniques [18]. The Basle accords provide an extensive framework dealing foremost with the mitigation of credit risk [19–21].

When two counterparties are part of a financial system, for example as nodes in a financial network, the situation