

A LITERATURE REVIEW ON COMPLEXITY OF FINANCIAL  
REGULATION

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## ABSTRACT

Since the financial crisis, which finally aroused the public vigilance against inefficient regulation, there have been remarkable literatures on over-complexity and several rounds of reform in financial regulation. Yet, some relevant questions still remain unanswered. This paper, in the form of literature review, summaries the most critical problems on complexity and the efforts have been made so far to solve them.

Started from Introducing the importance of complexity through regulation and crises, the complexity of financial regulation is presented by time first, showing complexity significantly expanded after Basel II. Next several comparisons between complex and simple regulatory rules reveal the its incapability. Then incentives behind complexity, three economic theories, and three typical methods of quantitative analysis are discussed sequentially, implying over-complexity is self-filling and detrimental. And it is imperative for regulators to find a simple and transparent replacement. While some plausible solutions have been tried, the validity of most is limited, among which market-based approaches seems to be most promising. Looking further, complexity might mitigate in the form of regulatory rules, it, however, will pervade the whole regulation framework by more reliance on supervisory discretion.

Keywords: Complexity, Financial Regulation, Basel Accord, Simplification

## PREFACE AND ACKNOWLEDGEMENTS

The basis for this thesis originally stemmed from my confusion and anger while reading the book *The Big Short* a few years back. The book consists of several real stories depicting few “paranoid maniacs” who gained huge fortune in the financial crisis of 2008, because of their insightful vigilance, whereas most investors even financial regulators were fooled in reality. The question why regulation didn’t prevent the crisis haunted me ever since. Later, after engaging with more knowledge about risk management, particularly Basel Accord, I was surprised by its intricacy, which deepened my doubts on complexity of financial regulation. Therefore, I followed my instinct and chose this topic.

On and off, I’ve been working on this thesis for more than ten months, during which I was diagnosed with depression. Truthfully, I almost gave up in the summer because of overwhelming stress. Here, thanks for my supervisor Juuso Välimäki first, the thesis won’t even be here at the first place without his silent help and patient waiting. Secondly, thank my family for standing by me when I was so mentally and financially helpless, particularly my father, who reassured me even if I may not finish my degree. Last, my friends, Yibang Long, Xiaoran Wei, and others. Though I haven’t been socialized for a long time, some of you still remember me.

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# TABLE OF CONTENTS

<b>ABSTRACT</b>	<b>1</b>
<b>PREFACE AND ACKNOWLEDGEMENTS</b>	<b>2</b>
<b>TABLE OF CONTENTS</b>	<b>3</b>
<b>LIST OF TABLES</b>	<b>5</b>
<b>LIST OF FIGURES</b>	<b>5</b>
<b>1 FROM CRISES TO REGULATION</b>	<b>6</b>
<b>2 EXISTENCE OF COMPLEXITY</b>	<b>8</b>
<b>2.1 BEFORE THE CRISIS</b>	<b>8</b>
<b>2.2 AFTER THE CRISIS</b>	<b>12</b>
2.2.1 IN THE STATES	12
2.2.2 IN EU	14
<b>3 PERFORMANCE OF COMPLEXITY</b>	<b>17</b>
<b>3.1 COMPLEXITY IN DEFINITIONS OF CAPITAL</b>	<b>17</b>
<b>3.2 COMPLEXITY IN RISK WEIGHTS</b>	<b>18</b>
3.2.1 FIXED WEIGHTS	19
3.2.2 MECHANISM OF IRB APPROACHES	20
<b>3.3 COMPLEXITY OF CAPITAL REQUIREMENT</b>	<b>21</b>
<b>3.4 COMPLEXITY IN REGULATING PROCEDURE AND ENTITIES</b>	<b>23</b>
3.4.1 INFORMATION DISCLOSURE	23
3.4.2 STRESS TESTS	24
3.4.3 JURISDICTION	25
<b>4 INCENTIVES BEHIND COMPLEXITY</b>	<b>26</b>
<b>5 EXPLANATIONS FROM ECONOMIC THEORIES</b>	<b>28</b>

<b>5.1 REGULATION THEORY</b>	<b>28</b>
5.1.1 INNOVATION AND ARBITRAGE	28
5.1.2 SPEED OF RISK AND REGULATION	31
<b>5.2 DEVELOPMENT THEORY</b>	<b>34</b>
<b>5.3 COMPLEX SYSTEM</b>	<b>36</b>
5.3.1 TAPPING POINTS AND WARNING SIGNALS	37
5.3.2 TOO CENTRAL TO FAIL	38
5.3.3 AGENTS AND BEHAVIOR	39
<b>6 TYPICAL METHODS OF QUANTITATIVE ANALYSIS</b>	<b>41</b>
<b>6.1 CHRONOLOGICAL ANALYSIS</b>	<b>41</b>
<b>6.2 CROSS-COUNTRY ANALYSIS</b>	<b>42</b>
<b>6.3 COST-BENEFIT ANALYSIS</b>	<b>46</b>
<b>7 SOLUTIONS OF COMPLEXITY</b>	<b>51</b>
<b>7.1 SIMPLIFICATION OF REQUIREMENTS</b>	<b>51</b>
<b>7.2 SIMPLIFICATION OF FINANCIAL SYSTEMS</b>	<b>53</b>
<b>7.3 CONDITIONAL INSTRUMENTS</b>	<b>54</b>
7.3.1 GUARANTEES	55
7.3.2 CONTINGENT CONVERTIBLE DEBT	56
<b>8 CONCLUSION</b>	<b>58</b>
<b>THE REFERENCE</b>	<b>61</b>

## LIST OF TABLES

<i>Table 1 The number of pages of historical financial regulation</i>	8
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## LIST OF FIGURES

<i>Figure 1 Average solvency ratios of major global banks, end–2006.</i>	22
<i>Figure 2 Investor perceptions — “Has your confidence in RWAs gone up or down?”</i>	24
<i>Figure 3 Factor Scores among Countries with Different Income Levels</i>	44
<i>Figure 4 Factor Scores across EU and Non-EU Countries.</i>	45

# 1 From Crises to Regulation

Economic growth and efficiency require well-functioning and stable financial markets. Such markets allocate resources towards their efficient uses and in particular, they provide an effective platform for risk sharing amongst investors and firms. When a financial crisis hits, financial markets are disrupted and as a consequence the real economy stagnates or perhaps falls even in a recession.

While bank runs and the failure of banks may be the most striking examples of financial turmoil, other examples of systemic disturbances are also possible. In recent decades, various countries and currencies have been hit by speculative attacks. These attacks resemble bank runs, but have individual currencies rather than individual banks as their targets. We tend to remember the banking crises of 2008 because of its large-scale effects on the global economic system. Stable financial institutions are necessary in that fight against all systemic disturbances in the financial market.

To understand the mechanics behind a banking crisis, consider the balance sheet of an individual bank. The bank holds its assets in various forms, only a fraction of which are liquid. These liquid assets are sufficient to cover random withdrawals by its individual depositors, but not the simultaneous withdrawal by a large fraction of the depositors. In a bank run, the depositors start worrying about the health of the bank in a coordinated manner. If a depositor knows that the others are going to withdraw their deposits from the bank, she knows that the bank will face a liquidity crisis and probably fall as a result. Because of this, it is optimal for the depositor herself to withdraw even if she knows that the bank is solvent, i.e. its total assets (including illiquid assets with long maturities) cover its liabilities. Hence, a bank run becomes a self-fulfilling prophecy. Meanwhile, moral hazard and adverse selection make a disadvantageous position for banks in lending

activities. And the drawbacks from sides can amplify each other, says I. Goldstein and A. Razin. (2015).

Regulation seems to suggest a way out of this problem. Financial crises have a long history. With the context of a series of bank failures triggered by the collapse of the Bretton woods system and the growing inflation with volatility of exchange rates, the Basel Accords were established in 1974 to address the pressing need to set a global banking rule from both sides of the Atlantic, which now has turned into the global banking rules on both sides of the Atlantic. These accords have since evolved into the main approach with regard to bank regulation, believed by Kobrak, C., & Troege, M. (2015). In the first version of Basel I before 1980'2, the main focus was on book equity rather than capital adequacy. Book equity is often considered easily manipulatable, and as a consequence, Basel II was introduced in 2004 to cover market risk and operational risk. Basel II abandoned the one size fits all approach and adopted a simple model for small banks and a standardized internal ratings based model for larger banks. After the crisis of 2008, a new approach based on macro-prudential goals was implemented under the name of Basel III in 2013.

The development from Basel I to Basel II led to a more well-rounded regulatory framework. Even this increased sophistication that is also visible in Basel III was not enough to prevent the financial crisis. As a result, we are forced to ask how well the new regulations will protect us in the future. Does the extended complexity offer us adequate protection from financial turmoil? If not, what is the possible solution? Maybe a simpler and more transparent regulation?



## 2 Existence of Complexity

“Regulatory capital ratios may have become too complex to verify, too error-prone to be reliably robust and too leaden-footed to enable prompt corrective action”, Andrew Haldane (2011) summarized the problem of complexity precisely. At a cursory glance of the number of pages of historical financial regulation in Table I, we can find a clear trend.

Table 1 The number of pages of historical financial regulation

Documents	Size (pages)
Basel I (1988) agreement	30
Basel II (2004)	347
Basel III (2010)	616
<i>USA</i>	
Glass-Steagall Act (1933)	37
Dodd-Frank Act (2010)	848
Implementation of Dodd-Frank (per July 2012) +	8,843

Source: Haldane (2012)

### 2.1 Before The Crisis

As the only indicator for decades in the earliest stage, capital regulation was not that complex all the time. The use of quantitative standard can be dated back to movement to mark a minimum capital requirement in the states in 1981. Before that, the prevalent method was to force the capital ratios of each bank stay at the same level as their peer group. Nevertheless, to overcome a prevalent downward trend among the entire group of banks, regulators came up with a specific capital adequacy target, known as a ratio of a regulatory capital to total assets. Apart from the France, due to the nationalization of major banks and Japan experiencing a booming of real estate and stock market, surprisingly this action was adopted broadly in few years afterwards. Two reasons, however, undermined the effort. First, banks replaced riskier assets with relatively safe ones on their balance

sheets while rebuilding them as off-balance-sheet activities to avoid capital requirement without a proportionate deduction in risk under the defect of setting total assets as a benchmark of risk. Second, quite a few international banks believing that they were underpriced overseas and losing advantages to Japanese banks under lower requirements, called for an internationally unified standard including Japan.

The commonly-shared view that banks with international activities had been exposed to risk beyond their abilities to absorb loss, finally activated the birth of earliest Basel Accord and Basel Committee, who became the organization of international bank supervision, starting to take the responsibilities of formulating and coordinating rules.

The negotiations were made tough because of the dissent from many countries and the variety of countries participating, so the Basel Accord compromised to various demands was often criticized to be a rubber stamp, says R. Herring (2017). After deciding surprisingly quickly that the denominator, the regulatory assets, should be risk-weighted assets (RWA), a number of years was spent debating the numerator, required regulatory capital. These negotiations took on farcical aspects. Germany insisted the required regulatory capital should be only equity, while France required massive long-term debt to include considering issuing any new equity is not easy because of the early nationwide bank nationalization. Ironically, the tensions got resolved with the compromise made by the Committee. Two regulatory capitals came, Tier 1 and Tier 2. Tier 1 capital consisted of mainly equity. Tier 2 capital contained diverse instruments to reach the agreement, like vast sums of debt for France, 45% of unrealized profit from common stock for Japan and abundant of loan loss reserve to satisfy the states.

As for the settlement of risk weights, the process turned out to be unbelievably smooth. Foreseeing multifarious work to set relative riskiness for different assets one by one and

plausible accusation of micromanaging weights in favor of any party, the committee smartly adopted a concise bucket system, where all assets, according the definitions and characters, fall into one of four buckets with risk weights of 0%, 20%, 50% and 100%

The problem of off-balance-sheet activities was also addressed. It started with the how much the off-balance-sheet activities are like the on-balance-sheet loans, and this was solved by introducing a conversion factor transforming notional amount into a loan-equivalent amount. Then the amount was classified into some bucket, based on the reputation or identity of counterparties that the bank dealing with. By the method of transformation, risk-weighted assets covered both on-balance-sheet and off-balance-sheet exposure.

Having the definition work done, the final was to set the numbers for Tier 1 and Tier 2 capital ratio. The minimum acceptable ratios of capital to risk-weighted-asset were 4% and 8%, for Tier 1 and Tier 1 plus Tier2 respectively. And they were made in an incredible consensus, probably because it didn't cause any trouble for most international banks with the low level which they were set at.

The unarguable simplicity and transparency of the regulation rules won favors. The regulation rules assisted and supervised the changes of one bank's capital condition over time, and also facilitate the multidimensional comparison across banks and countries at any point of time, regardless of various implementation details and accounting rules across regions.

Nevertheless, the flaw of overlooking market risk urged the amendment in 1996, see Basel Committee (1996)<sup>1</sup>, in the overall context where banks didn't limit themselves to lending

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<sup>1</sup> The Basel Committee define market risk as the risk of losses in on and off-balance- sheet positions arising from movements in market prices. The risks subject to this requirement are:

- the risks pertaining to interest rate related instruments and equities in the trading book;
- foreign exchange risk and commodities risk throughout the bank.

activities and started to provide trading service for major customers beyond their banking books. Regulators felt obliged to make sure banks' abilities of surviving from the increasingly volatile market rates and prices. After a long discussion, the Basel Committee gave a new set of tools to fit banks' own internal models addressing market risk, aiming to improve efficiency and cut compliance costs. Surely there were conditions to use internal models: the risk management system needs to be proven functional and working with integrity, staff must be skilled enough to use subtle statistical models, the models must be backed by historical data and working well under frequent stress tests. Except the overconfidence of authorities in safety that it provided, the switch in regulatory method was considered as a remarkable success.

The process of formulating Basel II is generally symbolized as the watershed of complexity. Inspired by the good performance of amendment on market risk, regulators started to think of the unification of methodologies applying to both market and credit risk. Besides, the distrust of simplicity prevailed over time because of potential regulation arbitrages it neglected. The committee attempted to close up those loopholes by replacing the original way to identifying counterparties with a new method to decide the riskiness. Given a bigger variety of risk weights, banks were allowed to evaluate by ratings from independent credit rating agencies or by using the own internal models, say internal ratings based (IRB) approaches. However, this movement of improving risk-sensitivity of regulation exacerbated the opacity of regulations undoubtedly.

Meanwhile, the process of regulation got more complicated, the concept of "three pillars" were come up with. The first pillar, minimum capital requirement, aligned with the previous version. The second pillar, supervisory review, provide a framework addressing other risks like legal risk, reputation risk and concentration risk. And the third pillar, market discipline, was mainly a bunch of information disclosure requirements.

Crucially, while the skeleton of Basel II has already formed in 1999, the formal document didn't come out till 2004. Moreover, the exact time of being put into effect was even more elusive. It differed in legislation process across regions, it differed in when banks adopted IRB approaches among individuals. A lot of European banks started to use new methods by 2008 after successful legislation of European Parliament, see European Parliament (2011). But the implementation happened quite late in the united states of America<sup>2</sup>, due to the resistance from smaller banks and the dissent about leverage ratio requirements, believed by Herring (2007). At that time, the financial crisis was underway.

## 2.2 After the Crisis

Not long after the Basel II was put in force globally, the financial crisis destroyed the confidence in the new conceived regulation accord. The schedule to formulate a new version was settled urgently by the Basel Committee. Yet, the new regulation was not a complete replacement of the old, instead a complement of advanced internal ratings-based framework in Basel II, with just some more strict modifications, like liquidity requirement and the conservation buffers.

### 2.2.1 In the States

In the united states of America, the Dodd-Frank Act, released in July 2010, was regard as the principal drive of the post-crisis regulation reform. The major components of the Dodd-Frank Act were: 1) requiring banks to be better capital structured in case of possible

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<sup>2</sup> The US issued the legally binding regulations necessary to implement Basel II with respect to the very largest US banks that are active internationally in late 2007 (effective as of 1 April 2008). US supervisors — primarily the Federal Reserve Board and the Office of the Comptroller of the Currency (OCC) — must individually approve each of these banks as having adequate systems to reliably run the complex models necessary for the “advanced approaches” of Basel II. By 2011, US supervisors have not provided that approval for any US bank, and it is not clear when such approvals will occur. As a result, although US banks have raised over USD 300 billion in new equity capital since the start of the financial crisis in 2007, they remain subject to the Basel I capital requirements, not Basel II.

unexpected losses, 2) requiring banks to hold more liquid assets in case of abrupt cash need or market freezes in a short time, 3) requiring banks to set a feasible resolution plan or living will in advance, see F. Allen, I. Goldstein and J. Jagtiani (2018). With the mixture of Dodd-Frank Act and Basel III, there was a universal increase in all kind of capital requirement ratios, and the stricter definition of capital improved the quality of capital.

The new regulation was proven also of cross-sectional and time-series relevance, which exaggerated the complexity and opacity of regulation as well. After the regulators figured out the importance of macro-prudential approach to the systematical stability, banks reckoned as the Globally Systemically Important Banks (the G-SIBs) were demanded with an additional capital requirement, systemically important financial institution (SIFI) surcharge, because their insolvency could worsen financial market. Besides, when the economy was considered booming, the time-adjust counter-cyclical buffers around 2.5% of risk-weighted assets would be charged because of an increasing overall risk.

Independent of capital requirements, the whole new liquidity requirements imposed on large banks, like new liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR), were invented to reassure the public confidence in case of market dry-out. The LCR measured the ability of one bank to resist a serious market freeze of more than 30 days. It encouraged banks to hold a minimal amount of easily-cashable liquid assets to meet the possible cash outflow in the stressed market conditions. The NSFR was designed in a longer-term framework to alleviate maturity mismatch risk. Straightforwardly, it was the ratio of available amount of stable resource with maturity over a year to the needed amount of stable resource within a year. The idea was partially inspired by the massive rollover failures during the financial crisis.

Regulating procedure became various as well. Not only must banks under regulation obey

the minimal ratios, but also most banks have to take regular stress tests. The big size banks with assets exceeding \$50 billion must take stress tests, the annual Comprehensive Capital Analysis and Review (CCAR), all mid-size banks with assets between \$50 billion and \$10 billion must take Dodd–Frank Annual Stress Testing (DFAST). That is to say, they were also subject to the capital requirement under projected stressed market and economic scenarios.

### 2.2.2 In EU

On the other side of the Atlantic, the situation of increasing complexity was no better. The attempt of incorporating Basel III into European Union legislation started immediately after the agreement was made on the new regulation in December 2010. In terms of capital requirements, the capital requirements directives IV (CRDIV) replaced the capital requirements directives III (CRDIII) in mid 2011. In line with Basel III, the CRDIV used the stricter definitions on capital and the prevailing higher ratios, besides, it introduced two new buffers to absorb unexpected losses, the capital conservation buffer and the countercyclical capital buffer. The former was set the same among all individuals within the EU jurisdiction, while the latter gave some degree of freedom to national authorities. Complexity came as the price of flexibilities.

The authorities in EU also introduced the concept of liquidity requirement, even though it was informally applied at the beginning. The both LCR and NSFR were put into use gradually with incremental ratio year by year.

Had the lesson of failed banks getting bailed out with money of taxpayers, EU seemed to be more serious about recovery and resolution. The framework to prevent bailouts applied to all credit financial institution and some investment firms, see L. Quaglia (2013).

Regulators were empowered differently at the stage of prevention, early intervention and resolution. Similarly, the regulated institutions were asked to build implementable recovery plans, and authorities in charge of resolution would form resolution plans at both group and individual levels at prevention stage. Regulators were entitled to demand a legal or operational structure change of a bank to make sure it was resolvable, and regulators could also appoint certain management to the bank for a period of time if necessary.

The extended scope of the regulated entities assisted the growth of complexity as well. Credit Rating Agencies (CRAs) was a clear example. For a long time, CRAs were neglected by formal regulation organization, see Brunnermeier et al. (2009), until they were thought as accomplices who caused the financial crisis.<sup>3</sup> To following the benchmark given by new IOSCO code, EU authorities released the regulation on CRAs and built a new supervising entity, European Securities and Markets Authority (ESMA) to monitor CRAs registering and operating within the EU. The regulation coverage also extended to hedge funds. In 2009, the draft of Alternative Investment Funds Managers (AIFMs) directive came out, aiming a boarder financial institution like real estate funds and private equities funds.

The derivatives transaction traded over the counter (OTC) was included into the reform as well. The OTC derivatives, lacking deposits and margin calls, are considered less transparent and riskier than derivatives through central counterparties (CCPs). In 2010, European Market Infrastructure (EMIR) were proposed to transfer derivatives activities form OTC to CCPs to eliminated counterparty risk. Before that OTC used to take 90% of the whole derivatives transaction.

Moreover, the regulation organization structure and the regulating procedure also became

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<sup>3</sup> Before that they only followed the voluntary code of ethics, namely Code of Conduct Fundamentals issued by International Organization of Securities Commissions (IOSCO) in 2004.



unprecedented complicated due to the sophisticated relationships between member states with sovereignty. To facilitate supervision on macro-prudential framework, European Systemic Risk Board (ESRB) was built with independent legal personality and budget in the first place. The following new establishments included, the European Banking Authority (EBA), the European Insurance and Occupational Pension Authority (EIOPA), and the European Securities Markets Authority (ESMA). EBA and EIOPA conduct stress tests of banks and insurance firms plus pension funds respectively while ESMA supervises activities in securities market including CRAs. The institutional reforms were not that smooth due to the conflict among EU and member states. The UK, Ireland and Luxemburg were unwilling to give up powers to entities outside their borders. And the UK government in the concern of national budget, refused to let EU authorities make resolution decisions with its public funds, see Buckley and Howarth (2010). On the very contrary, the European Parliament complained there was still far more to do before European Supervision Authorities can really do their jobs effectively.

Overall, the complexity of financial regulation has been increased in the past decades, and especially, the trend hurtled upwards after the financial crisis happened in 2008. The growing complexity is no longer merely reflected via the calculation of capital requirement ratios, it becomes a holistic change of regulation system including methodology, regulating entities and procedures. It Inevitably induces opacity and raises board concerns.

## 3 Performance of Complexity

The thorough demonstration of changing history of regulation on banking industry confirmed the existence of increasing complexity. But, before we blame it all on complexity, it is necessary to find out how the complexity in regulation really performed empirically.

### 3.1 Complexity in Definitions of Capital

The various definitions of capital seem always recondite. In Basel I, only two types of capital were defined, Tier 1 and Tier 2. And it required a minimum ratio of 4% to Tier 2 capital and a minimum ratio of 8% to Tier 1 plus Tier 2. Also, the Basel Committee never explained the rationality behind the choices of the two numbers. Now according to the newest regulation, there exist Core Tier 1, Non-Innovative Tier 1, Innovative Tier 1, Upper Tier 2, Lower Tier 2 and Tier 3. The definitions of each respectively may need pages-long explanations, let alone the ratio requirement imposed on them and the numerical relationships between ratios. Again, the Committee barely made no explanation in number choosing.

After the considerably simple Basel I was enacted, the tax law was generally in favor of funding by debt rather than equity for most nations. Interest payment was deductible from total revenues while calculating taxable profit, whereas the dividend payment induced by equity cannot. Normally the increasing cost of interest during stressed economic condition would cancel out the financial drive of tax avoidance, but big size banks with reputation would be able to bypass the implicit constraint. This led to popular use of certain funding instruments to facilitate the tax deduction, meanwhile the instruments were able to be accounted into Tier 1 capital like equity. One example was Trust Preferred Shares

(TruPS), it was extremely popular in the states for years afterwards. The decision of counting TruPS into Tier 1 great undermined the original purpose of safeguarding the financial system by regulatory requirement.

Even though those instruments did no help to the survivability of banks, the regulators allow them into Tier capital with only one condition of not exceeding 50% of total Tier 1 capital. Might as it seems a slight increase in complexity of capital composition, it made an incredible increase in leverage.<sup>4</sup> The authorization was made without intention of leverage growth, but it was a vivid example of detriment caused by complex capital definitions lacking transparency.

As a conclusion, the whole set of different kinds of capital is merely an unrealistic hope on their function of loss-absorbing in a harsh time. Nothing but the core Tier 1 equity could be helpful to the survivability of banks. This conclusion is backed by the empirical study by DemircucKunt et al. (2013). Started from the sense of better capitalized banks would have better stock returns in the financial crisis, they examine the relationship of stock return and all kinds of capital ratios, using the data of 381 banks from 12 regions from 2005 to 2009. The capital of higher quality, like Tier 1 capital and common equity were positively correlated with stock market performance.

### 3.2 Complexity in Risk Weights

The risk-weighted assets are generally seen as the obvious representation of complexity in financial regulation. Moreover, the use of risk weights is not flat and sustained, instead the small changes in the process of weights choosing makes it more sophisticated.

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<sup>4</sup> In a rough calculation by R. Herring (2018), average leverage could be 100:1, a shockingly reckless number for any company financial structure.

### 3.2.1 Fixed Weights

The Basel I was considered a failure in preventing prevailing regulation arbitrage behavior of banks, because of the loopholes in rough risk weight bucket system. For instance, banks started to invest in riskier firms since the all corporate bond went same bucket. Some banks managed to prettify risk-weighted assets without deduction in exposure by loan restructure. For instance, they replaced the sovereign debt with short-term loan to a nationalized bank within that nation. Even more, some banks explored the gap between the risk weights of on-balance-sheet commitments and off-balance sheet commitments. In practice, instead of holding a portfolio of loans on balance sheet, banks could sell it out to a trust and buy back the bottom tranche package of the portfolio. In that case the exposure declined to size of bottom tranche package from the size of whole portfolio. All of those phenomena were attributed to the lack of risk-sensitivities in Basel I.

To alleviate the regulatory arbitrage in risk weights, Basel II was modeled with more so-called risk-sensitivities on purpose. However, for banks who used standardized approaches if they were not qualified to use IRB models, relying on riskiness evaluations conducted by CRAs was subject to the neglected flaws in CRAs per se. Most of CRAs didn't restrain themselves to rating business only, instead they usually had consulting business with banks. In the fierce competition with other CRAs, they tended to loosen standards of credit rating in exchange for profit from consulting. The degradation of rating quality originated from conflict of interest in the rating procedure, was a reasons of the financial crisis. Besides, they were proven doing an unsatisfactory job of unveiling the true riskiness of sophisticated structured asset-backed financial productions by which institutions shielded massive exposure.

### 3.2.2 Mechanism of IRB Approaches

At the same time, banks were provided another option of their own internal models if using internal rating based (IRB) approaches, this was generally applied to banks big enough to afford a professional risk-managing personnel group.

With required Value-at-Risk (VaR) model using Monte Carlo simulation, the calculation became several orders of magnitude harder than ever, and estimated parameters like default probability and loss-given-default rate became thousands or even tens of thousands more. The evolving complexity of regulation was so obvious and vitally detrimental. In principle, larger banks should be imposed harder restrictive requirement in the sense of more externalities of financial instabilities caused by their bankruptcies. Yet, adoption of advanced IRB approach allowed larger banks a lower capital requirement than smaller banks using standardized approach.<sup>5</sup> A more generally finding by Mariathasan and Merrouche (2014) showed a remarkable decline in overall riskiness existed in the report of 115 banks within more than 20 OECD countries after shifting to IRB framework. The seemingly sophisticated approach warned no portent signal and did the very opposite.

### 3.2.3 Model risk of IRB approaches

Despite of the fact that the flawed mechanism of IRB approach acquiesced in continuing manipulation of risk weights among big size banks, the IRB approach itself suffered from a severe hidden model risk, which partially caused the financial crisis. The assumption to build simulation was proven far from correct because of unexpected correlation in the crisis. Promoted by the low interest policy and booming real estate market, the volume of house mortgage upsurged unprecedented on the eve of the crisis. Knowing the potential

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<sup>5</sup> Northern Rock, one of the collapsed banks in the first wave of the financial crisis, got granted of using this more complex method to calculate its capital requirement for mortgages, few weeks before its failure. The implementation led a decline in capital required and the bank announced a surprising 30% increase in its dividend at the last gasp.

default risk, banks pooled the various loans together and packaged them into mortgage-backed securities<sup>6</sup> (MBSes) in the sense of risk diversification. Then they further packaged different MBSes and divided it into structured collateralized debt obligation<sup>7</sup> (CDOs) with different tranches, according to the different priorities of payment. Banks bought back the prime tranches which performed a triple A credit rating in the IRB regulation framework. However, the models were built on the assumption excluding the chance of a nationwide mortgage default. The illusive trustworthiness immediately fell apart due to the neglected concentration of portfolios and unperceived correlation in components of the structured financial instruments.

More generally, a study by T. Neumann (2015) pointed out several defects of the IRB models theoretically. The more complicated model used by IRB approaches, the more it produced larger variability of estimation, which meant a higher likelihood of false signals. And it was more so, especially under the circumstance of little and sparse data. And that is the exact case in financial sector, because default events are widely distributed but stand a relatively small proportion. A simpler but biased model could outperform a true but more complicated one, the reason is simple models present fewer possible outcomes.

### 3.3 Complexity of Capital Requirement

The effectiveness of complex capital requirements as a whole has been non-stopped questioned and compared with simpler leverage ratio as well. The study by Berger and Bouwman (2012), and the one by Mayes and Stremmel (2012) coincidentally found the two types of regulatory indicator, the risk-weighted capital requirement ratios and leverage

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<sup>6</sup> A mortgage-backed security is a type of asset-backed security (an 'instrument') which is secured by a mortgage or collection of mortgages. The mortgages are aggregated and sold to a group of individuals (a government agency or investment bank) that securitizes, or packages, the loans together into a security that investors can buy.

<sup>7</sup> A collateralized debt obligation is a type of structured asset-backed security (ABS). Originally developed as instruments for the corporate debt markets, after 2002 CDOs became vehicles for refinancing mortgage-backed securities (MBS). Like other private label securities backed by assets, a CDO can be thought of as a promise to pay investors in a prescribed sequence, based on the cash flow the CDO collects from the pool of bonds or other assets it owns.

ratios, tend to be the same level of effectiveness in terms of predictive power. Haldane and Madouros (2014) used the sample including 100 of most complex and biggest banks in the world to do an ex ante distinguishing of failed banks and survived banks. The result in Figure 1 shows the simpler leverage ratio does a better job than complex risk-based capital ratio. Quantitatively, this conclusion also is supported by empirical study by DemirgucKunt et al. (2013). It demonstrated the correlation relationship driven by the leverage ratios outperformed one driven by the risk-based capital ratios.

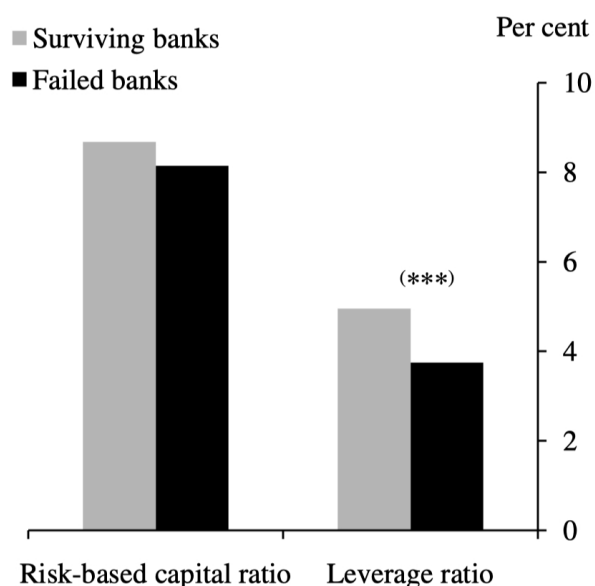


Figure 1 Average solvency ratios of major global banks, end–2006.<sup>8</sup>

Source: Haldane and Madouros (2014)

One possible explanation is given by Haldane (2015). The leverage ratio captures the risk which risk-weighted models fail to detect with limited data. The practice of risk weights does help to understand the known risk more elaborately, but the complexity of model eroded the necessary discretion for “unknown unknowns”.

<sup>8</sup> Note: The classification of bank distress is based on Laeven and Valencia (2010), updated to reflect failure or government intervention since August 2009. \*\*\* Denotes null hypothesis of mean equality rejected at the 1% significance level.

### 3.4 Complexity in Regulating Procedure and Entities

The long evolution of regulation has made regulating banking beyond putting ratio requirements on banks, gradually how supervision is conducted and who conducts the supervision become the complicated questions.

#### 3.4.1 Information Disclosure

The ever-growing complexity seems to be contradicted with principles in Pillar 3 (market discipline). The earliest idea of information disclosure was stated in Basel II Pillar 3 and amended in 2009. The Committee further revised and completed first phase in 2015 and second one in 2017, see Consultative Document BCBS (2018). It gradually included a board set of issues. The goal is to increase the transparency of supervision and rebuild public confidence damaged in the financial crisis. For example, in 2009 the result of first supervisory stress test, Supervisory Capital Assessment Program (SCAP) was released to public. It was proven helpful to build a greater confidence of market. For example, firms disclosed in test, which needed to raise more capital, could issue new funding instruments more easily. However, there are also some accusations that information disclosure may exacerbate financial instability by encouraging market participant over-react. A paper by Goldstein and Leitner (2015) concludes it is optimal to do no disclosure during a normal time and partial disclosure under stressed conditions. Albeit the function of information disclosure in financial regulation remains controversial still and a lot of debate will be gone through before reaching a finally acceptable conclusion, the information disclosure becomes more of a norm for all regulation authorities after the crisis.

As disclosure promotes the understanding of supervision and sharing of on-time information, the complexity certainly does no much help. The Figure 2 shows that the



public have a growing distrust and doubt in increasing complex regulation rules.

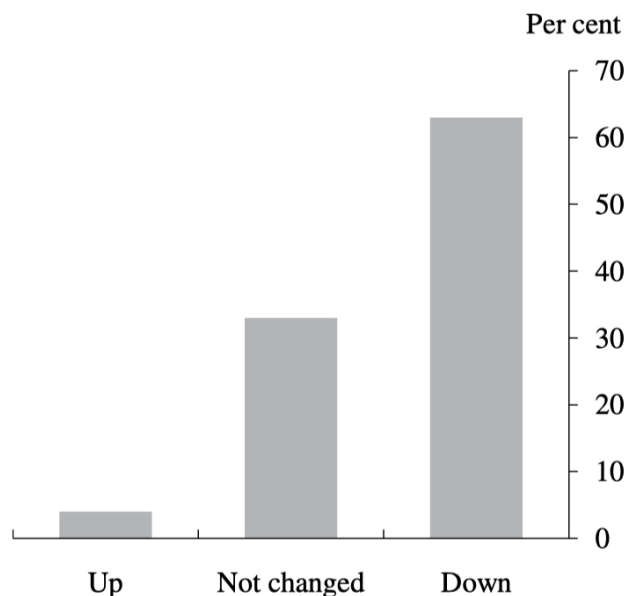


Figure 2 Investor perceptions — “Has your confidence in RWAs gone up or down?”<sup>9</sup>

Source: Barclays Capital.

### 3.4.2 Stress Tests

Stress tests, as a new countermeasure after the crisis, provides a new angle of regulation, market-based approaches. It aims to figure out the health of banks under predicted stressed circumstances, unlike the fact-based supervision before. As a result, dynamic projections on all of factors like revenue, asset, liabilities and a bunch of regulation ratios are required. Since it is market-orientated and forward-looking, there are reasons to believe it serves well as a crisis warning or predictor. At the same time, it is not simple and contains subjective assumptions and inferences, its effectiveness is questionable. The present method, bottom-up approach is extremely time-consuming and resource-intensive. Lang and Jagtiani (2010) give an idea that it is a powerful supervisory tool if used correctly but

<sup>9</sup> Note: Based on survey responses of over 130 investors carried out in 2012 H1 (of perceptions over the previous year).

is not likely to safeguard market against a crisis. And it is more effective while it is integrated into a decision-making process. Regardless of the ongoing dispute, stress tests have become the measure taken by regulators internationally and stress test reports are published on a regular basis with massive readers.

### 3.4.3 Jurisdiction

The complexity of jurisdiction is also problematic. And it is extremely obvious in EU. The regulation reform after the financial crisis was fragmentary and inconsistent to some extent, because of unique policy-making mechanism. The European Commission is the agenda-setter of regulation reform and the Council and European Parliament are the key decision-makers. Moreover, some member states have decisive veto power and most of them do not share same interests at all. Likewise, Germany and Italy insisted lenient rules and a relatively longer transitional period, whereas the UK demand tightening capital and liquidity requirements. Not only did this slow down the negotiation, but also created policy dispersion in the necessary compromises. One example could be the leading banks in eastern Europe, which are mainly foreign owned. Consequently, problems rise like local regulators have limited measures on them within border or their unexpected strategic withdraw hurts systematic stability. In the post-reform period, we see a fight for power between EU and member states. The evidence is the stagnated unification reform of the bank union and following sovereign debt crisis.

## 4 Incentives behind Complexity

When we try to explore the advanced economic theories to explaining the ever-growing complexity of regulation, we usually ignore the simple fact that the regulation rules are made by human beings. Understanding the incentives of various parties in the game of rule-setting would be vital in understanding why it becomes more complex.

Ideally, the authorities should be the protectors of certain public interest, who are free from personal temptations. But It is important to realize any organization consists of individual persons. By applying the basic assumption that human beings are self-interested, we suppose the regulators seek maximal economic rent. In the democratic societies, leading positions in authorities are elected publicly. The winner gains support from normal people who don't have the time or the abilities to handle intricate functionalities of financial system. The public voters make their judgments based on the information from media. And the more exciting the news in the media is, the more audience will pay attention to.

Therefore, as an incumbent regulator, the simplest way to get elected again is to exploit wide public emotional reaction responding to events. It is all about attention. To impress public, incumbent regulators are most likely to initiate reform as a patch for the most obvious loopholes. In that sense, a piling up of massive patches makes regulation system more complex.

More complexity is also a perfect excuse for a growing size of bureaucracy. Empirical evidences by Murphy, K.J. (1999) demonstrate a positive correlation between the compensation of leading management and the size of organization. Naturally, there is an incentive for decision-makers to make the rules more complicated and require and more staff to implement the rules.<sup>10</sup>

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<sup>10</sup> For instance, in the UK there was one UK regulator for roughly every 11,000 people employed in financial industry. whereas there was one regulator for every 300 people employed in 2011. See Haldane (2012).

The third party, like consultants and lawyers seem to favor more complexity as well. This holds particularly for who have already master the competence in the sophisticated regulation. A growing complexity is a potential entry barrier for other new-comers, after they put many-year and vast human capital in understanding the complex rules

As to financial institutions under regulation, they seem to resist more complexity for higher administrative cost it brings. Yet, it might be that case for small firms, large firms are likely to gain scale advantages or even benefits like entry barriers with come complexity.

Meanwhile, if more complexity makes financial institution look too big to fail or too interconnected to fail, it is their interest to take the implicit subsidy from authorities, see T., Berglund (2014). Hannkens and Schnabel (2014), while addressing the agency problem under an anticipated bail-out, use a theoretical model to demonstrate that launching a more complex regulation system is what banks favor, especially for management. Specifically, when regulators have more dispersed skills and get paid less than bankers, they tend to rubber-stamp risk models of banks in order not to admit that they know little about those models.

## 5 Explanations from Economic Theories

After seeing the path to greater complexity of financial regulation, we figure out the complexity in regulation, started with as a little more sophistication of capital requirement rules, now gradually becomes a systematic wholesale including the enforcement entities and implementation procedures. A reliable economic theory to explain and appraise the trend is proven an indispensable prerequisite before tackling it right and efficiently.

### 5.1 Regulation Theory

Regulation on financial sector is essentially a type of regulation. There are regulators, the authority agencies, there are targets being regulated, the financial institutions, here we mainly consider banks. Thus we can use regulation theory in economics to explain the interactions between them.

#### 5.1.1 Innovation and Arbitrage

It is a widely convinced belief that the complex financial regulation is a spontaneous response to a growingly complex financial system. Regulation on financial sector, as a type of regulation per se, is subject to the behavior of regulatory avoidance and arbitrage from regulated targets. Complexity seems to come inevitably as a by-product in the game of loophole-seeking and loophole-fixing.

Financial innovation, seen as amazing device to circumvent regulation, is usually a broad concept not limited to new financial instruments. It includes all new financial products and services, new financial intermediaries or markets, and even new delivery channels. For instance, ATM, mobile pay, money market funds compared to traditional bank deposits,

and more recently venture capital, structures financial instruments. Goetzmann and Rouwenhorst (2005) classify them based on three different characteristics. Ones increase the efficiency of transfer like ATM, ones improve the possibilities of risk-sharing like venture capital, and ones improve the negotiability of contracts like securitization. For a long time, innovation helps the growth of economics in the history. Laeven et al. (2015) cites few examples, like specialized investment banks assisted the build of massive railway lines in the US and Europe during 1800s and early 1900s, and emerging venture capital firms supported IT start-ups in 1990s who turn out to be tech giants later. Some empirical studies, for example, Amore et al., (2013), Chava et al., (2013), Laeven et al., (2015), and Beck et al. (2016), conclude that regions which have more financial innovation in banking industry are more likely to have a higher economic growth.

However, the innovation is not always that charming as it may seem to be, more frequently, people talk the aftermath it brings. There are incentives to bypass regulation because the leverage fit best to interests of banks is higher than the socially optimal one, which is cause by the failure of cost internalization. The cost hurts depositors and financial system stability when banks face insolvency. This consequentially creates a so-called shadow banking sector, where the activities essentially like depositing, operate under inadequate supervision with a new name. From most observation, the increasing shadow banking sector is triggered by regulatory arbitrage, claimed by Acharya, Schnabl, and Suarez (2013), Gorton and Metrick (2010), and Pozsar et al. (2010). A widely convinced belief is that, since the financial crisis in 2008, regulation is imposed more severely on the traditional banks, such as tightened capital requirements and new liquidity requirements. Whereas authorities have found fewer viable measures to bridle shadow banking sector than the traditional one. When a massive shift from the traditional banks to shadow banking sector happens, an increase in overall exposure might offset the any effort made to alleviate aggregate risk. With the rapidly changing trends in financial, legal and accounting

tools, deregulation becomes the possibly feasible answer. In the quantitative study of Guillaume Plantin (2014), it points that if regulation is ineffectively strict in banking industrial, banks tend to unload more risk in shadow banking sector excessively, the growing complexity becomes meaningless.

The recent securitization wave demonstrates this belief. The assets commercial banks are generally regarded as illiquid. The illiquidity among roots from the information, which banks generate while originating and pricing loan, also the in subsequent stage of monitoring. This alleviates asymmetric information problem. However, securitization transform the illiquid assets into tradable securities, where credit risks can be apart from the other type risks. Therefore the traditional relationship among banks, borrowers and depositors deteriorate, inducing the problem of reduced willingness in due diligence. This depicts why banks are becoming factories of asset-backed security. Once created, those products are bought by hedge and mutual funds and banks themselves also. With the huge amount and high payback plus the plausible low risk, banks find it is hard to resist the tempt of holding those securities themselves. Thus they create a special purpose entity independent from the banks with founding, then take the advantage of the USA General Accepted Accounting Principles (GAAP) to build the equity structure in which no single institution holds the majority of risk and rewards, so that banks do not need to include the so-called vehicles to their balance sheet.

In the inevitable evolution of financial innovation process, the complexity in those new tools is certainly increasing. This justifies the action to include the new tools and updated regulation system regularly correspondingly. But the effectiveness of growing complexity in regulation has not caused enough awareness and introspection until the financial crisis.

### 5.1.2 Speed of Risk and Regulation

“As finance has become more complicated, regulators have tried to keep up by adopting ever more complicated rules. It is an arms race that underfunded government agencies have no chance to win”, said Kenneth Rogoff on The Guardian (September 2012). There seems always to be a pessimistic atmosphere pervading the explanation of relationship between the financial crises and regulation. The one-step-behind story stating the systematic incompetency of regulators, becomes the main trophy holding by the skeptics. As it is being taken for granted by more people without a moment of thinking, the Ralph Chami, Thomas Cosimano, Connel Fullenkamp and Celine Rochon (2017) provide a fresh new point of view. They try to explain the problem of regulation feasibility via the speed of financial risks.

They argue the speed of financial risks, instead of the speed of regulatory authorities, plays a leading role of financial crises. The financial risks are not moving with a same pace, rather they can be distinguished and classified by the speed of their occurrence. What clearly differentiates the fast-moving and slow-moving risks is the time, the former generates a large amount of loss almost simultaneously with the emergence of signals, while the latter needs time to establish in which countermeasures are implementable.

For example, market risk and liquidity risk are fast-moving risk, while credit risk and interest rate risk are slow-moving risk. During most past of history, the two kind of risks are separated into the different institutions, the banks specialize slow-moving risks and other non-bank institutions focus on most fast-moving risk. Since the wave of financial deregulation of supervision and interest rate in last century mid, banks started to handle the fast-moving risk as well. However, people might disagree. They think, firstly central banks can play the role as landers of last resort; secondly deposit insurance potentially removed



the incentives of bank run. Nevertheless, fast accumulation of huge quantities of risky loans still put banks into the danger of fast-moving risk.

So historically speaking, all the financial crises can be attributed to slowing-moving risk, particularly the credit risk, the deterioration of credibility of obligors. Except the last one happened in 2008, are caused by the mix of slow-moving and fast-moving risks. Banking crises are slow-moving, as it may take a few years to develop. Stefan Ingves, who is the head of Sweden's central bank and former chair of the Basel Committee on Banking Supervision, suggested that it generally will need three years to bankrupt a bank from rapid loan expansion to the insolvency of the bank. In that sense, the crises are manageable or even preventable. Take 1989 Russian default as the example. Even though the regulators are one step behind the default, when the default hit the Long Term Capital Management (LTCM) hedge fund and sequentially endangered the systematic stability, regulators arranged a confidential bailout by a funding pool consisting of several banks who had lent to the hedge fund, and this move happened within only a weekend. The regulation authority didn't anticipate the occurrence of Russian default, but they foresee the consequence to market if LTCM started fire sale. Besides, it shows that though the fundamental cause is slow-moving risk, the banks subject to the crises were segregated adequately from the fast-moving risks due to their exposure was indirect by the loans. In that case, banks and their regulator are free from fast-moving risks to some extent.

This belief held till the breakdown of segregation since new millennium, when banks started to deal with proprietary trading like commercial paper and repurchase agreements (repo). Before 2008, significant indicators show banks have been excessively entangled with capital markets and alienated from depositors. However, as quickly as funding can be gathered, it can leave in lightning pace as well. The potential liquidity risk acts way too fast than traditional deposit runs, banks put themselves into a danger with which regulators

could not deal in time. When we look back to past fifty years, crises were generated by banking financial institution instead of non-banking ones, even in the crisis of 2007-2009 it was banks or quasi-banks like Fannie Mae and Freddie Mac who played the leading roles. In other words, the combination of slow-moving and fast-moving risks caused systematic instabilities.

There are two ways of mixing two different risks: in the asset portfolio; and funding slow-moving risks assets by fast-moving risks liabilities. In the case of the former, it generally means banks conduct proprietary trading on behalf of themselves. Facts observed are trading itself seems not to lead distress, even during the period of crises, thanks to the strict legislation like Volcker Rule in the united states of America. and ringfencing rule in the UK. Due to the lack of cases in which banks went into distress caused by market fluctuations, Chami et al. (2017) use a model focusing on a banking holding company consisting of trading department and lending department. In his analysis, there are two scenarios when fast-moving risk causing trouble: severe loss by market risk in trading activities makes banks holding company insolvent; inadequate allocation of funding to lending part with incompatible exposure. Both cases state that mixing of risks can be fatal to banks.

As to the second way of mixing risk, funding slow-moving risk Assets with fast-moving risk liabilities, it involves the liquidity risks. It then also can be divided into two types. The first one is funding liquidity risks, which are usually triggered by confidence loss in banks' solvency. The tragedy of Northern Rock is a vivid example, its securitized assets were considered to perfectly safe and sound, however the simultaneous distrust of the public prevented it from rollover. And the second one is market liquidity risks related with collateral value. When the value of collaterals decreases because of the market changes, this leads the collateral call requiring more assets as collaterals, usually in the form of cash,

which is quite demanding for banks because of the high cost of holding large amount of cash. In return, selling assets is what banks do often, however, it may deteriorate price of collateral. This is most likely to lead a collateral death spiral in the end.

In all, there are several types and subtypes of fast-moving risks which banks deal with. The one of combining slowing-moving risks on asset side of balance sheet with fast-moving risks on liability side, seems to be extreme destructive. It combines the features of other types, and it will cause a detrimental chain reaction once the wire is set on fire. However, we should bear in mind that one-step-behind narrative is not the best explanation. Because the slow-moving risks is the fundamental reason, while the mixture only exaggerates the possibility and consequence of crises. That is to say, regulation is theoretically viable and essential to handle the slow-moving risks, as the previous crises are products of intentional temporizing and forbearance of regulators. Conclusively this builds a base to rationalize the growing complexity of regulations in banking industry.

## 5.2 Development Theory

There is also a new angle to look at the complexity issue, to see it as a symptom rather than a pestilence per se. This is what M.D. Ermolova and H.I. Penikas (2017) have done in order to explain complexity through the development of different financial systems. They argue the complexity comes while regulators chase meaningless artificial homogeneity, whereas the key to promote financial stability is target natural heterogeneity.

The Basel committee started the Regulatory Compliance Assessment Program (RCAP) in 2012, so as to ensure all members implement the rules more strictly than the original one. The research aims to explore the relationship between the national economic development and the compliance degree of banking regulation with the Basel standards. Because if it

exists, it would be essential to set parameters of applied regulation to assure regulation is optimal for countries individually.

The effort to build a uniform regulation was started in the 1970s. At that time, it was banks themselves that required the rules standardized between jurisdictions, for the first, to make it more convenient for banks operate internationally; and the second, to eliminate unfair advantages of banks in certain areas like Japan who enjoyed relatively soft regulations. Even though the Basel Committee on Banking Supervision (BCBS) takes the different development level into Quantitative Impact Studies, when exploring the impact of unified rules on capital regularly, the fact is that development level is still poorly reflected. This is somehow caused because analysis is heavily relied on data quality and completeness, which happens to be the strengths the developed countries. Meanwhile, regulation is still being conducted regardless of local features of national economy, even if the requirements put on banks grow in numbers and complexity. Because authority does not have enough time to integrate every local feature

Thus, it goes against the prior responsibility of regulation authorities, financial stability. To avoid the quick spread of crisis in financial system, the smart move is to ensure banks respond to the crisis differently in order to weaken the resonance effect, like the example of soldiers crossing the bridge. In other words, the system ought to have heterogeneity so that crises are less severe and less frequent if it reacts slower.

They first examine which the key dependent economic factors have correlation with RCAP status, then use those key factors to explain RCAP statuses. The quantitative analysis conforms a few conclusions. The areas having higher CDP tend to have a system in more compliance with Basel III standards. Because those areas have more incentives to do so in order to attract more investment from overseas and reduce the costs of funding. Moreover,

the higher openness the economy is, the less likely national banking regulation is in line to Basel III standards. Also, the figure of outstanding international public debt securities to GDP has a negative relationship with RCAP status, because the lower attractiveness by the bad reputation of overdue debt makes it less incentive in compliance.

All above show that BCBS members differ in terms of the development level and sizes of banking system. The move of pushing a bundle of over complex and sophisticated regulation standards to fit all, is fruitless and harmful for the systematic stability of banking industry. In the long-going history of unification, the complexity issue, as a significant side effect, has been warning us that the uniform Basel regulation is a dangerous obsession in vain. While it's a relief that people finally noticed the oddness of fast-growing complexity, it's somehow strange that people are still debating about whether complexity is good or where is the border of complexity. Because from the theory of financial system development, the meaningless chasing for regulation unification leads to excessive complexity, and the behavior of chasing per se is wrong.

### 5.3 Complex System

The complexity of financial regulation is essentially a kind of complexity, which surely falls into the discussion field of complexity science, the science of complex adaptive systems. It is not news anymore complexity theory has made a lot of inspiration in areas like the internet, the environment, health care, intellectual property and telecommunication. Then why cannot it offer insights to the regulatory systems, which is also a highly structured and heterogeneous system. Actually, there has been more than a substantial voice demanding to regulate the regulation itself. S. Battiston et al. (2016) come up with the idea of using complexity theory to explore the inside of the interconnected economic and financial macrosystem. And before that, we have witnessed words from complexity

science get used increasingly frequently in financial and regulatory researches, even though it still reminds a quite early stage in term of using complexity science.

### 5.3.1 Tapping Points and Warning Signals

The financial market has been observed having abrupt and unpredicted collapses, and they are usually systematic and highly contagious. In the complex theory, it is described as a transition caused by a sequence of unseen stochastic events. Nevertheless, most of time there is a time when “we feel something is wrong”. To put it more straightforward, the complex adaptive system is losing its resilience gradually. That is the case in the climate system, so does in the financial system. A small deviation may lead to a butterfly effect, which reacts inside the system and presents a final crisis we see. Some researches have showed empirical evidence that certain quantitative indicators of resilience might be useful to detect the tapping point, such as growing correlation between nodes in a network and the increases in correlation, variance and skewness of fluctuation patterns. A study based on the Dutch interbank network demonstrates, that standard analysis according to homogeneous network model cannot detect the happening of the financial crisis in 2008 in advance, whereas a more realistic heterogeneous one gives an advance warning 3 years earlier.

Ecologists have developed tools to measure abstract concepts like stability, robustness and resilience of food webs quantitatively. Also, epidemiologists use tools to predict the possibility and range of breakouts to pinpoint source and core groups, which are essential for infection persistence and contagion limiting. However, the extrapolating conclusion from the natural science to social science is not easy. For instance, the Lucas critique, that revealing of in-advance warning influences the behavior and changes the results irreversibly. Whereas, it holds the same if signals are kept to regulators only or there are well-built

network barriers to slow down contagion.

### 5.3.2 Too Central to Fail

Another advantage of complex adaptive system is that it depicts the strong and elusive cascading effects of economic and financial macrosystem, where any shock has the huge potential if got amplified. A solid conclusion has been proven that individual safety of financial institution hardly guarantees the whole systematical stability. That is why authority, like the Bank of International Settlements, started including the data reflecting the interconnectedness between banks into its decision-making process. Also, the issue of too-central-to-fail might outmatch the too-big-to-fail, and the ability to capture those interactions is vital to identify the stress on the individual entity and to verify the systematical risk.

The old problem of information asymmetry is also addressed in the complexity science. The banking industry has a core-periphery structure in terms of information as well. Apart from the information generated inside the individual entity, abundant information is exchanging among different entities, where position is critical because information flows with certain directions. It implies the existence of a core group consisting of a few closely interconnected banks, who have also been sharing almost identical business and risk models. That is to say, the defaults are usually correlated and even simultaneous, so it creates a collective moral hazard issue, that critical entities move reckless after knowing they are indispensable. Besides, the capacity of the system is designed to handle only limited volume of default at the first place.

For regulators, the difficulty has always been to estimate the systematical risk with discrete and fractional data. Since the information of interaction of banks is confidential, tools are

adapted to fit partial information, which implies that public information may not be able to construct a reliable analysis of risk. In addition, it means estimation will be improved a lot if information of connections is disclosed publicly.

### 5.3.3 Agents and Behavior

Regulation is targeting the regulated, whose behavior does not always principle-abiding. Using agent-based models (ABMs) is certainly a way, where the behavior of agents and the interactions is observed to imitate the inner acting logic of agents. As ABMs are commonly used in traffic control, epidemiology, or battlefield conflict analysis, they also show surprising vitality in financial and economic macrosystem. They give a great rationalization of why the volatility of prices is clustered and time-varying. The study by C. Aymanns, J. D. Farmer, *J. Econ.* (2015) and S. Thurner et al. (2012) confirm that the changing of risk limits causes fluctuation of prices. Therefore, they have been taken into regulation reforms by the BCBS to identify the systematic risk.

Given the fact regulation authorities start to emphasize information disclosure, ABMs are also helpful to understand how opinions vary and replicate on the social networks, and in return how they impact the behavior of market participators. This is very important to the maintain the stability and resilience of financial and economic macrosystem. Laboratory experiments with human being subjects have offered a way to build acting and interacting principles of agents. But an empirical study from T. Bao, C. Hommes, T. Makarewicz (2015), proves that the participants do not guarantee a rational efficient equilibrium at both individual and aggregate levels. The features of persistent deviations from equilibrium and long-lasting bubbles and crashes can be somehow well depicted by the positive feedback systems, which contain observed trend-following and herding behavior. Furthermore, a behavioral model, where agents gradually moving to a better performing heuristics,



imitates the individual and macro behaviors. And it has been successfully used to control panic contagion in financial systems.

## 6 Typical Methods of Quantitative Analysis

While we have been talking so much about how complexity comes, it still remains quite elusive and impalpable that how does complexity in banking regulation perform in a quantifiable way. It not surprising that economists are still struggling to find viable methods to analysis how complexity has been working. It was not even long since we realized complexity is a problem, let alone quite some time spent on how to measure the complexity. Thus this section will show some papers which quantify the problem of the complexity of financial regulation.

### 6.1 Chronological Analysis

After sensing the incapacity of the growing complexity, the quick reaction of researchers is to chronologically examine the evolvement of regulation documents, and compare it with the historic financial crises. Consequentially it becomes easy for readers to attribute the tragedies to the oversight of regulation due to the complexity, because it is so convenient to take the complexity issue as a scapegoat when it is basically in our faces. But in fact, most studies just simply show the description results and make no causal conclusion.

Afterwards, the performance comparison of a simple regulation framework or a complicated one becomes a more compelling method. This requires a counterfactual result reflecting what if the simple rules had been implemented. One of the obvious examples is the differentiation power comparison made by Andrew G. Haldane and Vasileios Madouros (2014). When they exam the performance of risk-weighted capital ratios in Basel Accord, and the performance unweighted leverage ratios, they do an ex ante analysis using both two rules to differentiate the survived and failed banks in the financial crisis. The data cover 100 of the world's largest and most complex banks. And the analysis result shows

that the simple leverage ratio can differentiate the banks on a 1% significant level while the complicated risk-based capital ratio can barely tell the difference. The conclusion by the chronological comparison is widely cited. However, there are potential flaws, since it still relies on the relatively restricted assumption of the counterfactual. After all, we cannot assure the artificial results to be exactly what the situation would have been if the other regulation rules were applied at the first place.

## 6.2 Cross-Country Analysis

Another dimension is the horizontal comparison on the jurisdiction level. Although, the Basel Accords is implemented in almost all big economies, in terms of implementation details like legislation, acting entity and specific rules, there are quite a lot differences. Therefore the cross-country analysis is a feasible way, which has been already used by some studies.

Mojmir Mrak and Vasja Rant (2014) make a cross-country analysis based on data of banks under the Basel II framework. The original goal is to spot the main dimensions of capital regulation existing among different areas. The data obtained from the latest survey conducted by the World bank in 2013. It contains comprehensive features of regulatory and supervisory frameworks across countries. Then they choose 59 out of 791 variables, which are most relevant to capital regulation. And they build a questionnaire including 40 questions towards the various capital regulation characteristics so as to narrow down the searching area.

After using the multivariate normal regression as imputation method to address the missing values, they utilize the factor analysis to pin down the main dimensions depicting capital requirements across areas. The outcome shows that the first two factors should be picked.

The closer examination shows that factor 1 is significantly correlated with variable representing how complex the capital regulation is, such as the use of the Basel II capital framework, accounting for market risk in minimum capital requirements and legally allowing Tier 3 capital as part of regulatory capital. Thus it should be referred as the indication of the complexity of capital regulation. And the factor 2 is correlated with variables relevant to how stringently the capital regulation is put into power, such as ability of the supervisory agency to forbearance, inclusion hybrid debt capital instructions and general provisions as a part of Tier 2 and the use of a regulatory leverage ratio. Hence, factor 2 should be seen as the representative of the stringency of capital regulation.

Afterwards, they examine the factor scores with features of countries like income level, EU membership and geographic position.

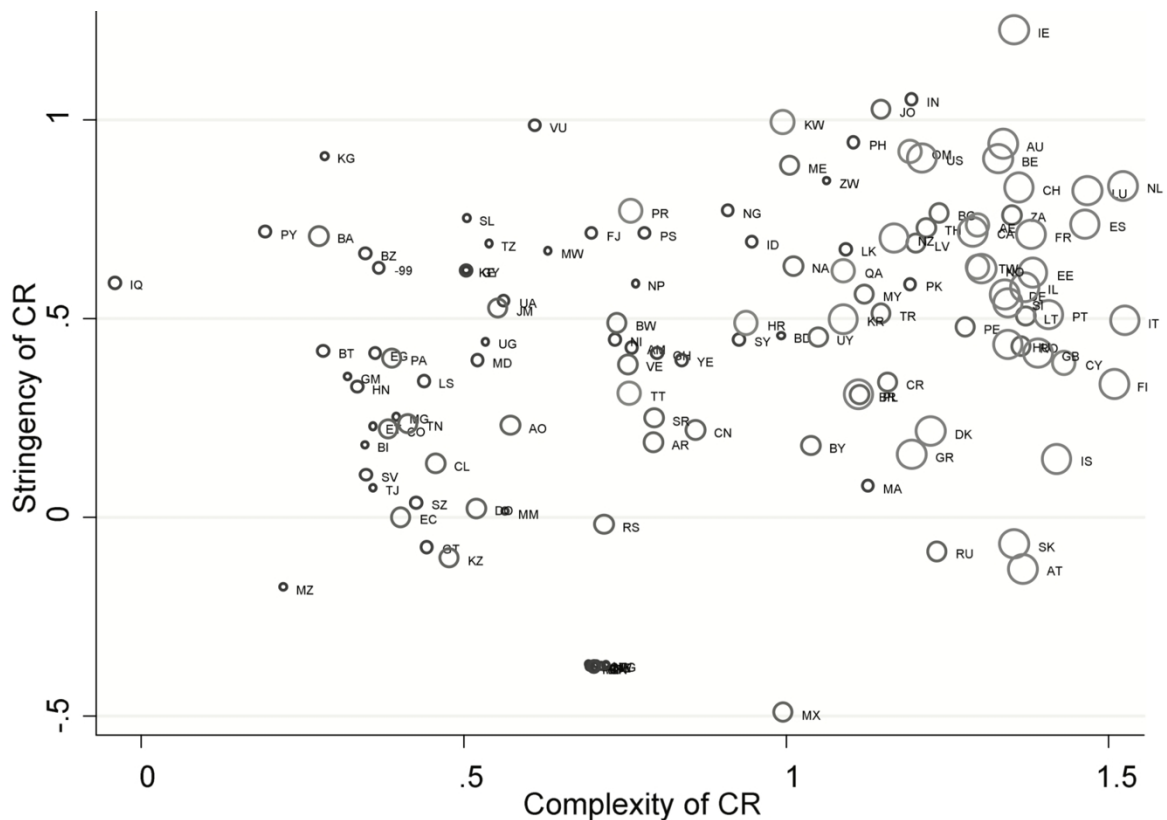


Figure 3 Factor Scores among Countries with Different Income Levels<sup>11</sup>

Source: Mojmir Mrak and Vasja Rant (2014).

From Figure 3, it can be seen that the low-income nations are featured with low complexity of capital regulation, while the high-income areas have high one. On the other side, the stringency of capital regulation dispersed within two different groups. The possible explanation given in paper is the development of financial and economic macrosystem drives the complexity of capital regulation. The early developed nations, who have high income, have a longer reforming history of financial regulation. Correspondingly, in the long-lasting trend of becoming more complicated, they evolve a relatively more complex regulation system than those in a slower or later development. Meanwhile, due to the different stages and structures of financial market, the developed nations tend to choose incentive-driven and market-based regulation; whereas the developing nations need

<sup>11</sup> Note: The size of the circle indicates the level of income in the specific country. There are five sizes: (i) high-income, OECD; (ii) high-income, non-OECD; (iii) upper-middle-income; (iv) lower-middle-income; (v) low-income.

control-oriented direct regulation to facilitate economic growth. Yet, a detailed causal research is needed to prove the conclusion of causality.

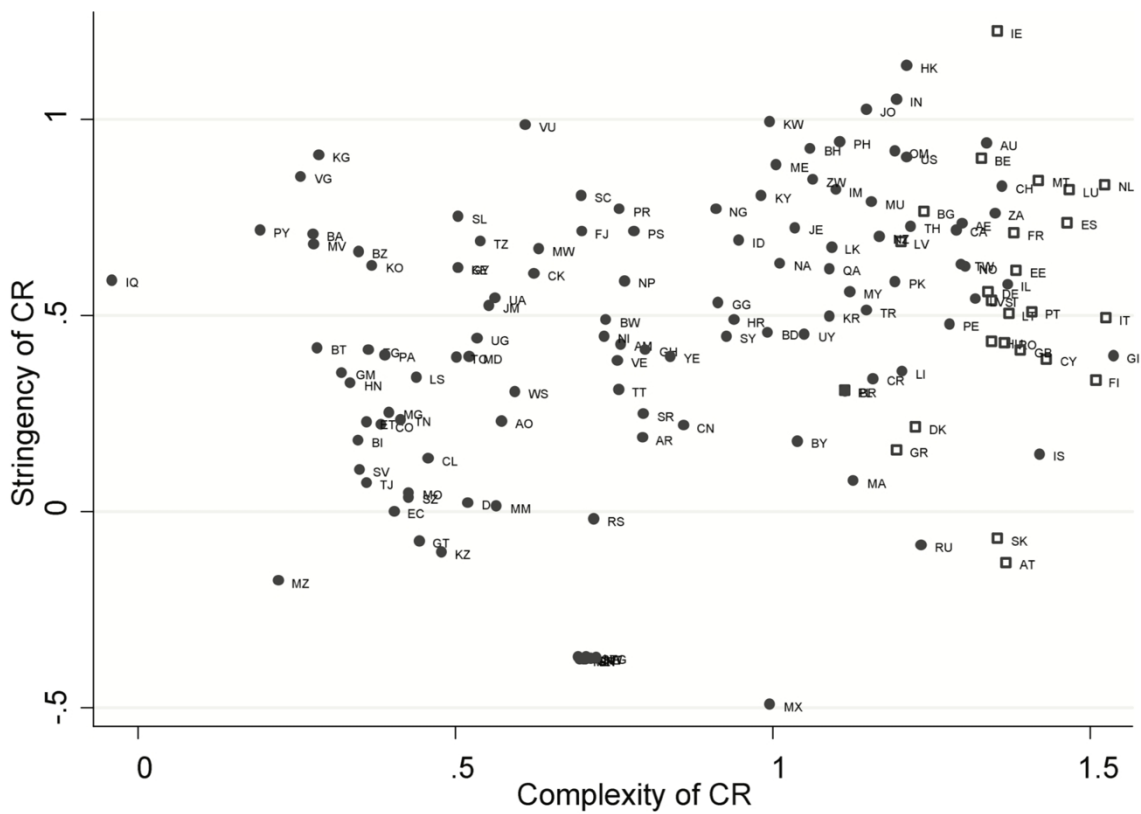


Figure 4 Factor Scores across EU and Non-EU Countries.<sup>12</sup>

Source: Mojmir Mrak and Vasja Rant (2014).

<sup>12</sup> Note: EU countries are denoted by squares, and non-EU countries by circles.

Figure 4 shows factor scores across the EU and on-EU countries, which vividly shows that EU countries generally have a higher level of complexity of capital regulation than non-EU countries, but the stringency of capital regulation among EU countries stays quite dispersive. It can be concluded that EU has done a good job on the dimension of complexity of capital regulation in terms of regulation unification, however, not on the one of stringency of capital regulation.

The paper believes that, first, it's critical to build a level playing field for banks; second, countries in EU, which have low stringency of capital regulation, are more fragile during distress time and can be the triggers of financial instability of the whole EU. Therefore, it suggests that a unified high stringency and a perhaps lower complexity of capital regulation in EU should be pursued.

### 6.3 Cost-Benefit Analysis

The cost-benefit analysis is also another method, by which we are able to elaborate the pros and cons of the complexity of financial regulation. It is not hard to figure that out, since it is one of the most common-used decision-making methods in business and economics. Although what cost-benefit analysis can provide still remains quite ambiguous and certainly it cannot put an end to the major policy dispute over complexity of regulation, it should be brought up, as it gives indispensable insights to the process of choosing certain complexity level and it forces regulators to confront their theories with evidence.

Prasad Krishnamurthy (2014) has made a quite comprehensive and innovative summary about the application of cost-benefit analysis on complexity of financial regulation.

Methodologically, It may not seem that quantitative, however, it gives a brand new angle to

establish and modify regulation policy. In his opinion, complexity stands for the extent to which regulations prescribe different consequence for different conduct. So it makes complexity another fundamental choice, beside the choice of a rule or standard.

Historically, regulatory agencies are never under effective monitoring of any party, and they are not asked to offer a convincing and efficiency-based rationalization for intended regulations. It is also supported by the analysis of previous section 4, the incentive behind complexity. We will never get optimality, if we ignore the anfractuosity of interaction among all various stakeholders. Therefore, in the rising doubts toward broad grants of discretionary authority and the vigilance to complexity of financial regulation, the introduction of cost-benefit analysis to the reform is very constructive, as it clarifies the powers and responsibility and it provides a feasible way to settle disputes from the source.

The emergence of the regulation of banking industry, or more specifically, the emergence of the minimum-capital requirement rule on banks was mainly driven by the presence of aggregate risks, regulatory uncertainty, and agency costs. The regulatory agencies could not efficiently identify the rising risks in the banking industry and compel banks to adjust their behavior towards the potential externality accordingly. Thanks to minimum-capital requirement, the regulatory agencies are able to put some restrictions on the aftermath of risk-taking behavior without comprehending the risks precisely. That is to say, the requirement is an efficient method of supervision, as it offers an enforceable regulation within a reasonably-low cost.

The later introduction of risk-weighted capital requirement, seen as the expression of increasing complexity of financial regulation, is hoped to be the useful counteraction of risk-shifting behavior of banks. The regulatory agencies insisted the transformation to risk-weighted framework was necessary and effective, but they never provided any estimation of how banks might respond to the new requirements. And the validity of risk-weighted



rules is decided by effect of regulation requirements on risk shifting behavior of banks and the ability of regulatory agencies to identify the risk precisely. Unfortunately, both of them stayed ambiguous in the academic researchers at that time. Given the high cost of compliance and access, the risk-weighted requirements contradict the fundamental regulation principle on which it was built, that regulators as outsiders cannot accurately identify the risk of banks and they use the minimum-capital requirement as a compromised bridle. Besides, if there is evidence showing that the social cost of banks holding higher capital is not prohibitively high, an increase of capital requirement ratio on the unweighted rules is definitely a better solution. Therefore, the cost-benefit analysis on the choice of complexity level of financial regulation can be helpful here.

Calculating the trade-offs between these potential benefits and drawbacks of risk weighting, is eventually an empirically problem, which demands us to estimate those costs from data extracted from the real world. The main argument supporting risk-weighted capital regulation originates from the concern, that the unweighted capital regulation will encourage banks to choose riskier assets and off-balance sheet commitments. And the evidence backing up the concern was the decline of cash and government debt as a fraction of total bank assets after the 1970s. However, no solid proof showed the downward trend was attributed to implementation of the unweighted capital requirements. On the contrary, the symptom was primarily caused by the pressures on bank asset returns, which had nothing to do with regulation. At that time, banks faced extremely fierce competition for deposits due to emergence of money market funds and prevalent financial deregulation, say the relaxation of deposit rates in the banking industry, see Marcus (1983).

Although the increased off-balance-sheet activities were accused as another typical doing of regulation arbitrage, both theoretically and practically, there is economic value beyond its negative effect on regulatory requirements. Loan sales and standby letters of credit,

much like secured debt, gives banks the possibility to trade cash flows for future investment opportunities, see James (1988). Besides, securitization such as loan sale and debt pooling, realizes the cheap way of risk diversification. And derivative transaction like interest rate and currency swaps, offers the fast lane to hedge for both banks and clients. Meanwhile, the literature focusing on the mutual impacts of between off-balance-sheet activities and bank risk on each other, was reckoned equivocal. On one hand, the study by Pavel and Phillis (1987) claim less capitalized banks issue more standby letters. On the other hand, there was also evidence showing standby letters are a signal of the financial strength of banks, say banks having more funding resource are able to issue more standby letters, see Koppenhaver and Stover (1991).

If the assumption that off-balance-sheet activities attributed to economic force are independent of financial regulation, simply increasing the required ratio of unweighted capital regulation is a possible solution. And the another should be to add the nominal exposure of all off-balance-sheet items to total assets. Those issues of off-balance-sheet activities, like how to convert them into regulation requirements effectively, has been occupying the regulatory agencies for half century. Cost-benefit analysis, even though doesn't guarantee an optimal solution, will force regulatory authorities to confront these potential alternatives.

Apart from the insight on handling off-benefit-sheet issue it can provide, the cost-benefit analysis is also useful to pushing regulators to improve the accuracy of risk weight, if risk-weighted regulation is a must, hypothetically. The weights contain useful information. After the adoption of risk-weighted regulation requirements, the high fraction of assets falling into the categories of higher weights means a poor financial and operational performance. And the relative sizes of the various risk weights are compliant with the magnitudes of consequences. Nevertheless, long time ago Cordell and King (1995)

empirically demonstrate that bank risks accessed by market-based methods, like option derivation, are not strongly correlated with regulatory risk weights. What's the most important is that those conclusions will be valid if the detected relationships are going to exist after the implementation of risk-weighted regulation framework. To make sure that, risk weights have to be able to not only limit the risk shifting after the implementation, but also detect the shifting led by other causes irrelevant with risk and regulation. In that sense, cost-benefit analysis could improve the classification of assets into particular risk buckets.

The risk-weighted capital requirements, as one of the typical representation of complexity in financial regulation, provide some lessons to learn for enhanced prudential supervision as well. The advantage of more complicated regulation frameworks is that it differentiates safer and riskier banks, in order to encourage banks to restrict risk-taking themselves. Yet, under the circumstance that holding more capital is not a heavy economic burden for large banks with market-traded debt and equity, suggested by Admati and Hellwig (2013), and Admati et al. (2011) and Krishnamurthy (2014). Moreover, risk shifting is less likely to happen in highly capitalized banks than highly leveraged ones, so accessing the risk in well-capitalized banks for regulators will be far easier. Combined all mentioned above, simply raising the ratio of capital requirement of unweighted regulation becomes an attractive option.

In conclusion, demanding cost-benefit analysis of financial regulation, while helping to understand complexity, will not explicitly solve the question "what is the optimal complexity". That is beyond its duty. Cost-benefit analysis will, however, provide more valuable insight and mitigate the possible errors of regulatory reform.

## 7 Solutions of Complexity

It didn't take a long time to convince people that the complexity of financial regulation is a problem waiting to be addressed, but it made people wander for a long time to reach a feasible and efficient solution. It has been at least 15 years since some articles published on the mainstream financial and economic academic magazines, which expressed the distrust towards the more complicated Basel II Accord. Various ideas based on different theories have been come up with, such as the deposit insurance, readopting the unweighted capital requirements, adopting leverage ratios, building Bank Union, and banking institution reform. All of them have a whole set of justification, some of which have won a lot of support from the academic. Furthermore, there are some have been successfully put into power as policies by the authority. This section summarizes some of those potential solutions, they may or may not be applied so far, but all have some indispensable insights.

### 7.1 Simplification of Requirements

The most obvious and straightforward solution of the complexity issue of financial regulation is definitely the simplification of regulatory requirements. And this is also what exactly regulators have been always trying, from the earliest time dating back to the Basel III to now the upcoming the Basel IV. The Basel Committee made its attitude clear when deciding to remove internal models called Advanced Measurement Approach (AMA), from operational risk regulation in consideration of risk-weighted asset variability. In their own words, AMA, due to its “inherent complexity and the lack of comparability”, have heavily burdened the regulatory calculation.<sup>13</sup> And it is also confirmed by some side description of scholars. Aikman and colleagues (2014) show that the Basel Committee promises to

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<sup>13</sup> Supervisory experience with the AMA has been mixed. The inherent complexity of the AMA and the lack of comparability arising from a wide range of internal modelling practices have exacerbated variability in risk-weighted asset calculations, and have eroded confidence in risk-weighted capital ratios. The Committee has therefore determined that the withdrawal of internal modelling approaches for operational risk regulatory capital from the Basel Framework is warranted. (p.1, Basel Committee on Banking Supervision 2016)

finalize the new risk-weighted approach before 2017. Generally, it promises the calculation of RWAs to be at least simpler than under the Basel II standard and freedom of internal model to be restricted, which was confirmed to be accomplished in late 2016. In 2014, the BCBS clarify a leverage ratio, which can efficiently avoid excessive complexity because of its independence of accounting rules, and planned to finalize the calibration of its international standard by 2016.

The effort the regulatory authorities made are laudable, but it can make matters worse. As the decisive direction hasn't been announced clearly, the Basel Committee seems to be wandering in the fuzzy middle zone. On one side, they are reluctant to denounce the internal model approach, on the other side, they comprised with simplification, which is the introduction of simple requirements. Thus, we see a huge mixture of all kinds of rules and standards, the attempt to simplify Basel added more complexity.

People can argue that the turning around of vehicle is easy, while one for a train may be almost impossible. The regulation has become that complicated so far and internal models and risk-weighted assets approaches have been used for a long time. A sharp change should be delivered only when the applicability is ensured. The regulatory agency in the US, who always seen as the one less devout than the European, has been considering another path differing from the Basel Committee. Although it is still unsettled whether the allowing to use internal models for large banks will continue, the regulators make progress in broadening the discussion, such as the effort of issuance of “advance notice of proposed rulemaking” with great transparency. When considering a reform of the existing regulation framework, it is critical to engage the public, the congress and the industry, especially at a crossroads.

## 7.2 Simplification of Financial Systems

From the rationalization of the financial system development theory, the intricate financial regulation could be taken as the result of the inherent complexity of modern financial institution and financial system. In that sense we should simplify the financial institution to simplify the regulation.

And this is also confirmed by the risk speed explanation of regulation theory. Innovation, which has been blamed for causing the financial crises, is never the main factor. And the belief that regulation is always one step behind, is also not substantiate. The fact is all the historical financial crises are attribute to fast-moving risk, except the nearest one happened in 2008 is due to the combination of fast-moving and slow-moving risks. The regulators are capable of managing the slow-moving risks, of which the loss takes time to happen, and the historical tragedies were more or less led by the temporizing and forbearance of regulators. As to the fast-moving risks, there is still a shortage of effective and practical solutions. In this case, segregation of banking industrial dealing with different speed risks is the best policy, the commercial banks handle slow-moving risks only and investment banks handle the fast-moving risks only.

And efforts towards reshape the structure of financial system have been attempted by authorities. The Volcker rule, retail ring fencing in the UK, CCP requirements, and STC (simple, transparent, comparable) securitization initiatives, are the examples of reforms towards a simpler structure of financial system. However, the attitudes of most regulatory authorities to simplification of the financial institution, stay vacillating. From the history, the size and complexity of banks' structure is fluctuating corresponding to the changing stringency of restrictions, which is supported by a lot literature on banks' merger and acquisition.

For example, the Volcker rule, which prevents banks from utilizing their private accounts for short-term proprietary trading, including securities, derivatives and commodity futures, as well as options on any of these instruments, has been subject to wide criticism ever since it comes out. The validity was questioned by governmental department, the U.S. Chamber of Commerce. They think it was not qualified by a cost-benefit analysis and its costs might outweigh its benefits in long run.<sup>14</sup> In 2017, one of top risk officer of International Monetary Fund (IMF) said that the rule can be hard to enforce, and it might diminish liquidity in the bond market. And after the executive order made by the U.S. President Donald Trump to review existing financial system regulations, Treasury officials have revealed multiple documents arguing for changes to Dodd-Frank Act, including a recommended proposal to grant financial institutions with wider exemptions. During the time when this thesis is being written, the Volcker Rule overhaul aiming to ease restriction gets the one last approval from five agencies. Yet, this move strikes a lot concerns including the denouncement from the former Fed Chairman Paul Volcker after whom the name of the rule was name at the same time.<sup>15</sup>

### 7.3 Conditional Instruments

It may surprise you if I suggest that some simple financial instruments would help to solve the long lasting complexity problem. But the answer is positive, there are some hopeful instruments have been proven helpful.

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<sup>14</sup> The Chamber opposed the Volcker Rule at its inception because of its potential to negatively impact the market-making and underwriting activities needed for businesses to access liquid debt and equity markets. In the alternative the Chamber proposed higher capital standards as a means to promote financial stability if a covered financial institution chose to engage in proprietary trading.

<sup>15</sup> In a letter to Fed Chairman Jerome Powell in August, Volcker, 92, said that the proposed rule went far beyond simplification. "The new rule amplifies risk in the financial system, increases moral hazard and erodes protections against conflicts of interest that were so glaringly on display during the last crisis," Volcker wrote.

### 7.3.1 Guarantees

The bank guarantees working as the intervention to stop crises, deviates the original idea of avoiding the occurrence of financial crises, instead originates from the concept of putting out the financial fire quickly at the moment they start. Two commonly-used explicit guarantees are bail-outs and deposit insurance. Bail-outs have inflicted a lot criticism and condemnation ever since massive adoption during the recent financial crises, because they cost a big amount of money from taxpayers. Therefore, we see countries like the US and UK gradually exclude bailouts from its intervention toolkit. And here it is the mainly deposit insurance that is talked about.

At the first place, banks work merely as the financial intermediary, transforming the liquid assets holding by depositors to illiquid assets holding by firms, where banks suffer from potential panic-based bank run depending on the beliefs of depositors. Deposit insurance assures the deposit to be repaid even if banks fails, which can effectively mitigate the self-fulfilling simultaneous withdraw as it eliminates the incentive. This, however, holds on a very important assumption that banks invest riskless assets only, according to Diamond and Dybvig (1983). Realistically, deposit insurance is not flawless, it weakens the incentive of depositors and regulators to monitor banks, and it also cause the moral hazard problem of encouraging banks to take more risk. Furthermore, in that paper he supposes the mere announcement of deposit insurance policy can avoid bank run, and he does not provide a viable and credible design of the deposit insurance scheme, which is considered necessary to change the expectation of depositors. This circumstance of banks increasing risk-taking, could be theoretically presented by market discipline hypothesis. Meanwhile, under the charter value hypothesis, banks facing reduced risk premium and lower refinancing costs could reduce the risk-taking, which was first mentioned by keeley (1990). Thus the practically effect of deposit insurance is determined by which hypothesis prevails.



Improving the design of deposit insurance plans, like using risk-adjusted pricing, and excluding part depositors, is deployed to overcome the moral hazard problem by most economies. Gropp and Vesala (2004), using European data, conclude that deposit insurance framework excluding non-deposit creditors will effectively reduce the risk-taking of banks. It is because the uninsured subordinated debt holder are usually financial institutions, who have easier access to information of banks and enough power to influence the decisions of banks, particularly for small banks with a high percentage of subordinated debt holders. Anginer et al. (2014), comparing the effect on bank risk from two different periods of time, before the crisis and during the crisis, concludes that deposit insurance can be a powerful regulatory weapon in distressed times.

### 7.3.2 Contingent Convertible Debt

“It could be argued that not only have the regulators produced a superfluity of regulatory ratios, but also, they have focused on the wrong ratios,” Herring (2018) expresses his concern. “It is troubling that despite the number of required capital ratios, no measures based on market value measures of capital rather than accounting measures have been included. Such measures could be observed and verified in real time.” He points out a brand new way to tackle the complexity and inefficiency problem of financial regulation, a long neglected but seemingly feasible one, using of market-value ratios. The rationalization behind is not beyond understanding, which can be sensed from the example of Citigroup he gives. Measured by the regulatory capital ratio standard during the financial crisis, Citigroup had a great performance of 11.8% on Tier 1 capital ratio when its market capitalization was only around 1% of the book value of its assets.

In an early paper, Calomiris and Herring (2013) come up with a perfect application using

market value principle, the contingent convertible debt (CoCos). In their design, CoCos predefine the debt before issue, which converts to equity when the 90-day moving average of the ratio of the market value of equity to the sum of the market value of equity and the face value of debt, falls to 8%. And the suggested share of it and book equity to book assets should both be 10% to ensure the conversion, when the preset rate is reached, is at least sufficient to maintain the face value of the CoCos regarding the market value of the new equity. Therefore, the potential dilution of original equity holders will force banks to improve risk management and limit risk-taking behavior. The scenario is the management will try their best to avoid the stock price striking the trigger point, which is worse than the alternative of announcing new equity offering or shrink assets. In that sense, CoCos render the insolvency of banks extremely unlikely.

Moreover, the CoCos scheme is relatively simple rule. The compulsory issuance of CoCos for banks reverses the incentive of regulation arbitrage to reach for yield. Also, the riskiness of banks becomes quite easy to measure to not only the regulatory agencies but also the public, and the regulation becomes far more verifiable and transparent.

Consequentially, the market discipline is integrated into regulation to alleviate systematical risk, and the regulation framework is simplified accordingly.

## 8 Conclusion

The introduction of complexity of financial regulation by its invalidity in the financial crisis surely revives the painful memory, even after almost a decade. However, the rudderless struggle continues, and the fear of when and how it will happen again, still haunts all us. It is urgent to figure out where we are now and where to go next, in terms of the complexity issue of financial regulation. Trying to answer those, this thesis determined to summarize all the relevance based on previous literatures.

Actually, the earliest concern to the growing complexity of financial regulation could dates back to later 1990s, in the predawn of the Big Bang of complexity. Afterwards follows the large leap of the Basel II, which introduces the risk-weighted assets and sequential using of internal models. It makes the regulation of agencies and compliance of banks several orders of magnitude more complicated. Then, along with the criticism of negligence in the crisis, regulators shift to stricter requirements and embrace simpler rules like leverage ratios. However, because of the swing attitude, it deteriorates. To prove the inefficiency of over complex regulation, numerous empirical studies have been conducted. The comparison between one simple and one complicated rule, in terms of the different forms of complexity existing in the financial regulation, implies the complexity is usually overrated in its functionality, even though not many conclude a causality. All of those make the public question who led to this situation ignoring the warning and why. The thorough analysis on incentive behind complexity demonstrates this doing fits the interest of all stakeholders in the game including agencies, banks and the third party, which makes the issue of complexity more urgent and detrimental.

Various theories have been used to explain the complexity, such as regulation theory, development theory, and complex system. Conclusions are made so differently, some stand

for complexity, some support simplicity. And the methods to conduct empirical studies are also of diversity from different perspectives, like time-orientated, comparison-based, and cost-benefit analysis. Efforts aiming simplifying regulation have been made from all directions, such as the simplification of requirements, the simplification of the financial system, and some conditional instruments. Few of them are promising, while the most seem not to be able to play the critical role in tackling complexity.

In 2016, the former Chairman of the Basel Committee, Stefan Ingves remarked that “simple rules can sometimes be more risk-sensitive and robust than complex ones, and can better meet supervisory objectives. I would encourage further research to develop this point.” Ever since the adoption of the Basel II Accord, the debate surrounding the merits of simplicity verses complexity is never stopped. Kevin Davis (2017) on the speech Prepared for 22<sup>nd</sup> Melbourne Money and Finance Conference mentions that, to some extent, the debate is misplaced. Risk-weighted capital requirements are still simple rules, as it demands banks to hold capital more than a threshold as well, except the way to calculate the threshold is sophisticated. That is to say, it essentially is a rule-based regulation with single goal, to force banks to have capital than a certain fraction. But while we headed forward from Pillar 1 to Pillar 2, the more critical questions are what should be the regulatory objectives and whether the rule-based regulation is sufficient to render regulatory objectives.

For the first question, an indisputable trend is the transformation from micro-focused to macro-focused, specifically from assurance of individual solvency to systematic stability maintaining. And the regulation also changes from unidirectional to multitask-oriented, such as preventing crisis, increasing the transparency of regulatory bureaucracy, and improving information disclosure. As to the second question, we see an interesting phenomenon that regular stress test starts to replace rule-based requirement and regulatory

agencies are entitled to more intervention power, which of both demonstrate the increasing reliance on supervisory assessment and discretion. And the shift is partially driven by the first question, as it is surely easier to complete goals with flexible framework of the principle-based regulatory discretion than stiff one of the rule-based requirements.

While the surface remains as the battle of simplicity and complexity, the underlying core has become the relative importance of Pillar 1 versus Pillar 2 in terms of the regulation framework. Pillar 1 represents the rule-based approaches, whereas Pillar 2 represents the standard-based approaches relying on supervisory capabilities. The rules may be simpler, but regulation overall may be more complex.

## The Reference

- Admati, A., Demarzo, P., Hellwig, M. & Pfleiderer, P. (2010). Fallacies, Irrelevant Facts, and Myths in the Discussion of Capital Regulation: Why Bank Equity is Not Expensive. *IDEAS Working Paper Series from RePEc*.
- Aikman, D., Galesic, M., Gigerenzer, G., Kapadia, S., Katsikopoulos, K. V., Kothiyal, A., . . . Neumann, T. (2014). Taking Uncertainty Seriously: Simplicity versus Complexity in Financial Regulation. *SSRN Electronic Journal*. doi:10.2139/ssrn.2432137
- Allen, F., Goldstein, I. & Jagtiani, J. (2018). The Interplay among Financial Regulations, Resilience, and Growth. *Journal of Financial Services Research*, 53(2-3), pp. 141-162. doi:10.1007/s10693-018-0291-z
- Anginer, D., Demirguc-Kunt, A. & Zhu, M. (2014). How does deposit insurance affect bank risk? Evidence from the recent crisis. *Journal of Banking and Finance*, 48(C), pp. 312-321. doi:10.1016/j.jbankfin.2013.09.013
- Bao, T., Hommes, C. & Makarewicz, T. (2017). Bubble Formation and (In)Efficient Markets in Learning-to-Forecast and optimise Experiments. *The Economic Journal*, 127(605), pp. F581-F609. doi:10.1111/eoj.12341
- Berger, A. N. & Bouwman, C. H. (2013). How does capital affect bank performance during financial crises? *Journal of Financial Economics*, 109(1), pp. 146-176. doi:10.1016/j.jfineco.2013.02.008
- Berglund, T. (2014). Incentives for complexity in financial regulation. *The Journal of Risk Finance*, 15(2), pp. 102-109. doi:10.1108/JRF-12-2013-0083
- Basel Committee (1996). Amendment to the capital accord to incorporate market risks. BIS, Basel. available online at: <https://www.bis.org/publ/bcbsc222.pdf>
- Basel Committee (2016). Consultative Document Standardized measurement approach for operational risk. BIS, Basel. available online at: <https://www.bis.org/bcbs/publ/d355.pdf>
- Basel Committee (2018). Consultative Document Pillar 3 disclosure requirements – updated framework. BIS, Basel. available online at: <https://www.bis.org/bcbs/publ/d455.pdf>

Brunnermeier, M., Crockett, A., Goodhart, C., Persaud, A.D., Shin, H.S. (2009). The fundamental principles of financial regulation. Geneva Reports on, the *World Economy*, 11. available on online at: [https://scholar.princeton.edu/sites/default/files/geneva11\\_0.pdf](https://scholar.princeton.edu/sites/default/files/geneva11_0.pdf)

Buckley, J. & Howarth, D. (2010). Internal Market: Gesture Politics? Explaining the EU's Response to the Financial Crisis. *Jcms-Journal Of Common Market Studies*, 48, pp. 119-141.

Calomiris, C. W. & Herring, R. J. (2013). How to Design a Contingent Convertible Debt Requirement That Helps Solve Our Too-Big-to-Fail Problem\*. *Journal of Applied Corporate Finance*, 25(2), pp. 39-62. doi:10.1111/jacf.12015

Cordell, L. R. & King, K. K. (1995). A market evaluation of the risk-based capital standards for the U.S. financial system. *Journal of Banking and Finance*, 19(3), pp. 531-562. doi:10.1016/0378-4266(94)00138-S

Demirguc-Kunt, A., Detragiache, E. & Merrouche, O. (2013). Bank Capital: Lessons from the Financial Crisis. *Journal of Money, Credit and Banking*, 45(6), pp. 1147-1164. doi:10.1111/jmcb.12047

Diamond, D. W. & Dybvig, P. H. (1983). Bank Runs, Deposit Insurance, and Liquidity. *Journal of Political Economy*, 91(3), pp. 401-419. doi:10.1086/261155

European Parliament (2011). US Implementation of Basel II: Final Rules Issued, but No Supervisory Approvals to Date. available online at: <http://www.europarl.europa.eu/document/activities/cont/201110/20111012ATT29102/20111012ATT29102EN.pdf>

Goldstein, I. & Leitner, Y. (2018). Stress tests and information disclosure. *Journal of Economic Theory*, 177, pp. 34-69. doi:10.1016/j.jet.2018.05.013

Goldstein, I. & Razin, A. (2015). Three branches of theories of financial crises. *Foundations and Trends in Finance*, 10(2), pp. 113-180. doi:10.1561/05000000049

Gropp, R. & Vesala, J. (2004). Deposit insurance, moral hazard and market monitoring. *Review of Finance*, 8(4), pp. 571-602. doi:10.1007/s10679-004-6280-0

Hakenes, H. & Schnabel, I. (2013). Bank Bonuses and Bail-Outs. *IDEAS Working Paper Series from RePEc*.

Haldane, A. G. & Madouros, V. (2012). The dog and the frisbee. *Revista de Economia Institucional*, 14(27), pp. 13-56.

Haldane, A. G. & Madouros, V. (2014). *Complexity in Financial Regulation*.

Herring, R. (2007). The Rocky Road to Implementation of Basel II in the United States. *Atlantic Economic Journal*, 35(4), pp. 411-429. doi:10.1007/s11293-007-9094-6

Henning, L. (2015). Anat R. Admati and Martin Hellwig: The Bankers' New Clothes—What's Wrong with Banking and What to Do About It. *Financial Markets and Portfolio Management*, 29(1), pp. 81-84. doi:10.1007/s11408-014-0244-y

Herring, R. (2018). The Evolving Complexity of Capital Regulation. *Journal of Financial Services Research*, 53(2-3), pp. 183-205. doi:10.1007/s10693-018-0295-8

James, C. M. (1988). The use of loan sales and standby letters of credit by commercial banks. *Journal of monetary economics*, pp. 395-422.

Keeley, M. C. (1990). Deposit Insurance, Risk, and Market Power in Banking. *The American Economic Review*, 80(5), pp. 1183-1200.

Kobrak, C. (2015). From Basel to bailouts forty years of international attempts to bolster bank safety. *Financial history review*, 22(2), pp. 133-156.  
doi:10.1017/S0968565015000165

Koppenhaver, G. & Stover, R. D. (1991). Standby letters of credit and large bank capital: An empirical analysis. *Journal of Banking and Finance*, 15(2), pp. 315-327.  
doi:10.1016/0378-4266(91)90070-3

Lang, W. & Jagtiani, J. (2010). The Mortgage and Financial Crises: The Role of Credit Risk Management and Corporate Governance. *Atlantic Economic Journal*, 38(3), pp. 295-316. doi:10.1007/s11293-010-9240-4

Marcus, A. J. (1983). The Bank Capital Decision: A Time Series–Cross Section Analysis. *Journal of Finance*, 38(4), pp. 1217-1232. doi:10.1111/j.1540-6261.1983.tb02292.x



Mariathanan, M. & Merrouche, O. (2014). The manipulation of Basel risk-weights. *Journal of Financial Intermediation*, 23(3), pp. 300-321.  
doi:10.1016/j.jfi.2014.04.004

Mayes, D. G. & Stremmel, H. (2012). The Effectiveness of Capital Adequacy Measures in Predicting Bank Distress. *SSRN Electronic Journal*. doi:10.2139/ssrn.2191861

Murphy, K. (1999). Chapter 38 Executive compensation. *Handbook of Labor Economics*, 3(2), pp. 2485-2563. doi:10.1016/S1573-4463(99)30024-9

Neumann, T. (2015, August 12). It's a model: but is it looking good? When banks' internal models may be more style than substance. available online at:  
<http://bankunderground.co.uk/2015/08/12/its-a-model-but-is-it-looking-good-when-banks-internal-models-may-bemore-style-than-substance/>

Pavel, C. & Phillis, D. (1987). Why commercial banks sell loans: An empirical analysis. *Economic Perspectives*, 11, pp. 3-14.

Quaglia, L. (2013). Financial regulation and supervision in the European Union after the crisis. *Journal of Economic Policy Reform*, 16(1), pp. 17-30.  
doi:10.1080/17487870.2012.755790