On the efficacy of financial regulations

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Regulatory failures have been a significant contributor to the financial crisis, but that does not automatically mean more regulation is called for. The crisis happened because financial institutions and the whole economy used seemingly infinite amounts of cheap credit to create an asset price bubble. The banks played their part by creating all these complex structured products that continue causing difficulties. They did this under direct regulatory oversight.

Such excessive credit expansion is how most financial crises have played out throughout history. The exact same process can be prevented from happening in the future, but surely the next crisis will take a different form. It will be something completely unforeseen. One cannot regulate against such unforeseen events.

The crisis has its roots in the most regulated parts of the financial system, the banks, whilst the least regulated part, the hedge funds, are mostly innocent.

Is the problem lack of regulation? Or is the problem lack of understanding on how to regulate financial institutions properly? Depending upon the answer to the question, the correct approach to future financial regulations will be very different.

The unique element this time around has been the extensive use of statistical models to forecast prices, and risk as well as to price complex assets. It was the models that failed. Such models embed an assumption of risk being exogenous; market participants react to the financial system but do not change it. In practice, this is nonsense.

Market participants, especially in a crisis, receive the same signals and react in a similar way; they exert significant price impact resulting in risk being endogenous. This implies financial risk models are the least reliable when we need them the most and that regulation by risk sensitivity, such as risk sensitive bank capital, may increase financial instability.

The root causes of the crisis are the same as in most financial crises throughout history. These crises have happened under a wide range of regulatory mechanisms. Blaming the crisis on a narrow set of obvious regulatory causes, such as bonuses, hedge funds, universal banking, shadow banking, structured credit, lack of regulations, inadequate risk management is attacking a straw man. It takes the focus away from the necessary detailed examination of the causes of financial instability, which is the only way to design effective regulatory mechanisms.

We do not clearly understand what went wrong, and know even less how to design regulations to prevent such episodes from happening in the future, whilst maintaining the efficiency of the financial system.

This is why it would be preferable to study what went wrong and then in a few years carefully change regulations at a time when we know more. There is no hurry, we still haven't solved this crisis and the next one will not come immediately after the current crisis. The costs of inappropriate regulations are high and we do have the time to wait.

NB: Research papers of the author can be downloaded from www.riskresearch.org.

The financial crisis has been blamed on the failure of financial regulation, with more, and immediate, regulation the best way forward. However, the case for more regulation is not that clear. After all, the crisis has its roots in the most regulated parts of the financial system, the banks, whilst is the least regulated part, the hedge funds, are mostly innocent.

Is the problem lack of regulation? Or is the problem that we don't really know how to regulate financial institutions properly? Depending on answer to the question the correct approach to future financial regulations will be very different.

The prudent way forward is to first identify how financial regulations failed and try to find new approaches to regulation before regulating everything in sight. Inappropriate or ineffective regulation can be damaging to the economy and increase financial instability.

The crisis is from a historical context rather typical. Financial institutions increase lending in an economic upturn, positively affecting asset values, thus collateral, stimulating future lending. As banks chase increasingly bad credits, asset values are more and more out of touch with the underlying fundamentals. It takes an increasingly small event to cause a rapid reversal. We go 'up by the escalator down by the elevator' — banking is procyclical.

One thing that is unique this time around is the role of models in pricing, decision making and risk analysis. Indeed, a cursory glance at writings on the topic of the past years — prior to the crisis — one gets the impression that models represented a level of scientific finance, that we have managed to accurately represent the financial system by a series of equations. One of the earliest official expressions of this view is the *Amendment to the capital accord to incorporate market risks* (1996).

Models have had a profound impact on finance, both positive and negative. Many individuals have a rose tinted view of the efficacy of financial models, not realising the impacts of issues such as risk sensitive bank capital.

The nature of financial risk on a fundamental level is not known, rendering formal statistical modeling of financial risk rather difficult at best. The reason is that the financial system is composed of intelligent human beings that react to the world around them, including what the models say.

Under observation, the financial system changes. When models are put to use, the financial system changes. Therefore, attempting to systematically forecast prices or risk using past observations is generally impossible.

The output of most risk models, especially when they aggregate a large number of positions is quite unreliable. Getting risk measurements may provide comfort, but if the numbers are unreliable the comfort is false. Relying on risk models, especially for supervisors thinking about systemic risk, is the lazy way out. Especially considering the rather poor quality of state-of-the-art models.

In particular, exploiting the banks' internal models for the purpose of measuring systemic risk is not the right way to do it. The internal models were not designed with this in mind and to do this calculation is a drain on the banks' risk management resources.

If we don't understand how the system works, generating numbers may give us comfort. But the numbers do not imply understanding.

Unfortunately, many of the proposals for reform of the financial system are based on risk measurements and risk sensitivity, proposals in areas such as systemic risk and compensation. There is considerable research going on in this area is at the moment, the next crisis is not coming anytime soon. It would be better to delay the reform until we know more about what we are trying to regulate.

1| THE NATURE AND MEASUREMENT OF RISK

In 1921, Frank Knight made his increasingly famous distinction between *risk* and *uncertainty*. With risk we can assign mathematical probabilities to randomness whilst with *uncertainty* we can not. Stated differently, we can measure and model risk but not uncertainty.

Randomness in the financial system is either risk or uncertainty. Policy makers need to pick one. The choice leads to a very different approach to financial regulation.

The founding philosophy of most risk systems is risk measurability. The key part is a model — sort of a black box — into one end goes data, out the other comes a measurement like Value-at-Risk (VaR). VaR assumes randomness is risk in the Knightian sense. It is founded on the notion that the financial system can be represented by a sequence of mathematical equations, where one only need to find the right equations to measure risk.

VaR along with most, if not all, risk models currently in common use assumes that market data follows a stochastic process that only depends on past observations of itself and other market variables. Obviously, this facilitates modeling, but unfortunately by construction can only capture randomness when financial markets not in turmoil, at times when we can more or less safely assume that risk is *exogenous*.

These risk models assume that randomness is risk and not uncertainty in the Knightian sense. This means that the appropriate way to forecast risk is to take a chunk of historical data and feed it through a statistical model, whose purpose it is to deliver the distribution of the underlying data so that we can assign mathematical probabilities to particular outcomes. If the results are less than satisfactory, the solution is to further develop the model and/or expand the data set. All still comfortably within the universe of Knightian risk. In this particular view, the problem of imperfect risk measurement has a simple solution — more sophistication. So long as we have the right model we can measure risk. But is this really true?

Many market participants and policy makers think so, a phenomenon that may be called the *myth of the riskometer* (Daníelsson, 2009). It is based on the notion that we can stick some sort of a riskometer deep into the bowels of the financial system and get accurate measurements of the risk of complex financial products.

Where does this belief in the riskometer come from? Perhaps from applying what we know about natural sciences — physics — to the financial system. If the laws of physics are known, it is possible to create the most sophisticated structures and understand risk of those structures on a deep fundamental level. Randomness is risk not uncertainty, and the riskometer exists. In physical systems if we don't understand the riskiness, the solution is more complexity.

1|1 Challenges in forecasting market risk

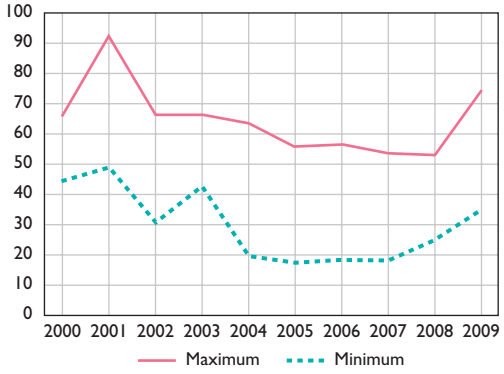
The most commonly used method for forecasting market risk is VaR, ever since its introduction to financial regulations in the 1996 Amendment to the Basel Accords.

VaR has well documented flaws. Theoretically, it is not subadditive, (see Artzner *et al.*, 1999) something that is hard to overcome in practice. The alternative risk measures that have been proposed as a replacement tend to be difficult or impossible to implement in practical use, methods such as tail VaR. For the better or worse, we seem to be stuck with VaR.

Besides the theoretic deficiencies, VaR gives surprisingly inaccurate risk forecasts, something repeatedly demonstrated, e.g. by Daníelsson (2002).

To address the accuracy of VaR consider what is one of the easiest risk forecasting exercises, daily VaR for IBM stock for the first day of the year from 2000-2009 on a portfolio of USD 1,000. The VaR is forecasted

Chart 1
Value-at-Risk
(USD)



with the most common models and assumptions used by the financial sector.[1] While the detailed results and the computer code is available for download[2] summary results are shown in Chart 1. It shows the maximum and minimum VaR across all the methods each year for the portfolio.

The difference between the lowest and highest VaR forecasts is lowest in 2003 at 50%. Most of the time it is more than double, reaching 320% in 2005. This points to the general unreliability of VaR as a measure of risk. Not only are the estimates very different dependent on the methods and assumptions, it is very challenging to select which estimate is best, as backtesting methods lack in robustness.

1|2 Death by a thousand cuts

One surprising result out of the Chart above, is how low the VaR is for the first day of this year, at the height of the crisis. Whilst asset values are collapsing, VaR indicates that the risk then is lower than at the beginning of the decade. Clearly, our perception of risk is much higher than then, so what is wrong?

One reason is that most risk models are dependent on some heroic assumptions. One of the most important is the focus on one-day VaR. The reason is simple, trying to forecast VaR for anything but one day is much harder than one day forecasting. The multi-day holding periods favored by some may provide the comfort of a number, but add little or no information to one day VaRs. They are either based on multi-day holding periods and hence inevitably small sampling periods, or use scaling law to get multi-day VaR, typically square root of time. In that case, the multi-day VaR is really only a single day VaR scaled up by a constant, and has exactly the same information content.

Another assumption that is usually made in VaR forecasting is that the mean is zero. This is generally reasonable, the mean is an order of magnitude lower than the VaR, and can therefore often be safely ignored. Specifying the mean would be after all quite challenging since there is no obvious number one could use.

Suppose, however, that the average return is somewhat negative, at the same time VaR is low. That will not be such a surprising state of the world, because VaR is only one point on the distribution of returns and does not capture the thickness of the tail or the real underlying risk.

In this case, we would experience multiple days of small negative returns — slowly bleeding out from thousand cuts. The signal from the risk measure is that everything is fine, whilst those in the market know it is anything but.

This often happens when markets are trending down. It is not uncommon for the markets to jump away from the trend, so that in boom markets prices trickle up and jump down. In bear markets it is the opposite. Surprisingly, the lower tails can be thinner in crisis than when things are better.

1|3 Models of systemic risk and asset dependence

The example above focuses on the problem of forecasting VaR for a single asset, and even in that case, the risk measurements are highly uncertain. Attempting to model portfolio risk is much harder still and even more so for some recent models of systemic risk based on conditional tail probabilities such as CoVar.

When modeling portfolio risk, we need to incorporate the interrelations between assets. Naïvely, one could do this with constant correlations, but then immediately run into the problem that correlations change often quite sharply over time. Two assets can be highly positively correlated one week, and sharply negatively correlated the following week, a phenomena known in the jargon as *non-linear dependence*.

Most risk models in practical use are still dependent on constant correlations as relaxing the assumption makes most models of dependence not estimable as the number of assets increases.

There is considerable research going on in more advanced methods for measuring such non-linear

1 *Estimation windows are 260, 500, 1,000 and 2,500 days, and the methods are historical simulation, moving window, exponential moving average, GARCH and fat tailed GARCH.*
2 *risk.lse.ac.uk/rr/files/bdf-2009.zip*

dependence, such as copula models, conditional tail dependence methods, conditional VaR and tail dependence. Unfortunately, they generally only work with very small portfolios, perhaps only two assets, and even in that case either rely on heroic simplifying assumptions or are quite technically involved.

Conceptually, such methods are interesting because they theoretically capture the dynamic structure of tail dependence. They do have certain attractiveness for the modeling of systemic risk and contagion. As practical methods for implementation, they are challenging as they compound three sources of error in estimation, the VaR calculation, the dependence structure, and the conditional tail probabilities.

1|4 Challenges in measuring credit risk

Credit risk presents different challenges. In the crisis, it is credit risk, and not market risk that has been the most important risk factor, in particular all the complex instruments, credit default swaps — CDSs, collateralised debt obligations — CDOs, structured investment vehicules — SIVs and the rest.

Some of the first instruments to be affected by the crisis were CDOs on US subprime mortgages. The mistakes in risk analysis of those instruments are illustrative of the subsequent difficulties in the credit markets.

Tranches of CDOs attracted credit ratings like any other corporate bond, but they are not like any other corporate bond. Coval *et al.* (2008) note that the particular prioritisation rule which allows senior tranches to have low default probabilities, and get high credit ratings, also implies that the risk in senior tranches is particularly concentrated on systematically bad economic outcomes — the CDOs are in effect economic catastrophe bonds. When default correlations increase during an economic downturn, we quickly observe that many senior tranches suffer from much higher rates of defaults than envisioned.

The subprime market took off in the early stages of the business cycle, under economic conditions that were generally improving; implying mortgage defaults were relatively independent events, reflecting individual difficulties rather than general economic problems.

Unfortunately, the data samples used to rate the CDOs contain subprime mortgages are not long enough to include a recession. This means in the data sample correlations are low. Even if the same contained a downturn it would be difficult to estimate them, as noted by Duffie (2007), there is a serious lack of good models for estimating correlations.

The sensitivity of the senior tranches is easily demonstrated with a typical CDO. Suppose we have a portfolio of 10 bonds each containing subprime mortgages and having 25% annual default probabilities. Of course, 25% may be a bit extreme, but it demonstrates how easy it is to turn junk into gold.

Use those 10 bonds to create a CDO. By using a sample credit transition matrix,[3] we can calculate the number of bonds in each tranche. Start with the assumption common before the crisis that the default correlations were zero, and increase to 50%, more typical of extreme economic downturns.

The following Table shows how many bonds would fit into the various tranches, ranging from Aaa to B, with the remainder going into the equity tranche.

When the default correlations are zero, 20% of the CDO get the highest rating Aaa, with the mezzanine tranches taking half. Simply by increasing the default correlations to 10% the Aaa tranche vanishes. By increasing the correlations to 30% the best we can do is Ba.

Table 1

Rating	Aaa	A	Baa	Ba	B	Equity
Moody's default probabilities	0%	0.02%	0.16%	1.16%	6.03%	
Default correlations	Size of tranches					
0%	2	0	1	1	3	4
10%	0	1	1	1	2	6
30%	0	0	0	2	3	6
50%	0	0	0	0	5	6

3 *Obtained from the Moody's website, average one-year rating transitions: sample period: 1970–2004.*

This demonstrates the extreme sensitivity of CDOs to correlations. Such instruments are even more sensitive to correlations than market risk portfolios, while at the same time the problem of measuring the correlations is even harder for structured credit products. After all, this is annual risk, and the last economic downturn was only 17 observations ago, in 1992. That was the last time correlations increased.

2| ECONOMIC ANALYSIS AND RISK FORECASTING

Statistical financial models have procyclical effects on asset prices and risk – causing bubbles. When the statistical models in widespread use are dependent on similar distributional assumptions, they will tend to give similar signals to market participants.

Suppose asset values are rising. The models will pick up on that and forecast higher asset values in the future. If financial institutions react to this, that fact by itself will endogenously cause values to increase. Similarly, measured risk will decrease. These processes become self reinforcing, eventually causing values to be seriously out of sync with the underlying economic fundamentals, whilst the risk measurements significantly underestimate the real risk.

In the end, it takes an increasingly small event to burst the bubble and everything goes into reverse but at a much faster speed. The models will then send the opposite signals, negative returns and high–risk, further exasperating the problems.

Such effects have started to make their way into formal economic models and hopefully will soon be incorporated into risk models.

2|1 How risk measurements affect the distribution of risk

Daníelsson *et al.* (2009) explicitly model the endogeneity of risk, originally proposed by Daníelsson and Shin (2003). They consider the case where the risks impacting financial markets are attributable (at least in part) to the actions of market participants. In turn, market participants' actions depend on perceived risk. Market outcomes are directly affected by constraints on financial institutions, how financial regulations or other restrictions affect their behaviour.

The results indicate that risk constraints induce higher volatility and correlations. During times of financial turmoil, correlations of returns increase with upward shifts in volatility. The model captures a common feature of asset price bubbles followed by a financial crisis, where the markets go through long periods of high return amid low volatility. Then suddenly, with the first hint of turbulence, the bubble bursts, giving rise to a pattern described by traders as going `up by the escalator but down by the elevator'.

The resulting shedding of exposures results in negative spillovers on other market participants from the sale of assets or withdrawal of credit. As prices fall or measured risks rise or previous correlations break down (or some combination of these), market participants respond by further cutting exposures. The global financial crisis of 2007-9 contains many examples of such distress episodes. This category of models is likely to form the cornerstone of future systemic risk models.

2|2 Risk models are least reliable when you need them the most

One lesson from the type of economic crisis models discussed above is that financial risk models are least reliable when they are needed the most. Because they are conditional on the sample used in the estimation, they generally build in momentum type effects into the forecasts.

Bubbles are generally slow affairs, with prices increasing steadily with low volatility. When the bubbles burst the price dynamics change sharply, even overnight, implying a structural break in the statistical processes governing market prices, meaning that any risk model estimated before the bubble burst is no longer valid.

2|3 Systemic risk measurement

A significant focus of many recent proposals for the reform of the financial system is systemic risk. Presumably, regulations would be designed to minimise future systemic risk, with the supervisors tasked with measuring systemic risk and reacting appropriately when it is perceived to be high. This is one of the ideas that sounds good in theory but whose time has not come in practice.

The problem of systemic risk is much harder than risk measurements for a single financial institution, not to mention individual asset risk measurements. The risk modeler has to take into account the individual and aggregate positions within a bank and then somehow aggregate that across the financial system, explicitly incorporating feedback effects between institutions.

A key element is how financial institutions react to signals, if one perceives a negative shock and starts selling how does that affect other institutions. The feedback effects between financial institutions will have to be the key ingredient in any future systemic risk model. What matters for such models is endogenous risk. Such models are still at an early stage, with considerable research being conducted, but they are not yet ready for prime time.

3| IMPLICATIONS FOR REGULATIONS

The challenges in measuring financial risk directly affects the regulations of financial institutions. The trend in financial regulations over the past few years and decades has been an increasing reliance on *risk sensitivity*. In principle, risk sensitivity is sensible, financial institutions should hold more capital when activities are risky and measure and manage risk using state-of-the-art methods.

Such risk sensitivity, at least as envisioned in Basel II, only really is sensible if riskiness is *risk* and not *uncertainty* in the sense of Knight.

3|1 Capital, risk and Basel II

Basel I was successful for its intended objectives, but has been due for an upgrade for a long time. However, for all its flaws, it had one redeeming quality, it was not based on the notion of risk sensitivity. It does not really depend on measuring risk.

Basel II, by contrast, is founded on risk measurements. Both Pillar 2 with its emphasis on internal risk management and Pillar 1 with its focus on capital.

The calculation of bank capitalisation is a surprisingly convoluted affair. Should the focus be on tier 2 and tier 1, only tier 1, narrower measures such as core tier 1, or even tangible equity? Is the denominator composed of risk weighted assets (RWA) or total assets (TA)?

In looking at tables showing bank capitalisations and rankings, very different pictures emerge dependent on whether one looks at something like tier 1/RWA as in Europe under Basel II, or the US leverage ratio tier 1/TA. Many financial institutions have appeared well capitalised under the former measure but really poorly capitalised under the latter.

The reason is what may be called the *financial engineering premium*. Sophisticated banks can make RWA really low by judicious measurement of risk, regardless of whether the assets contain a sizable chunk of toxic assets. They can not do that with total assets.

One problem with risk weighted capital is that it is only as good as the quality of the risk measurements. If, as argued above, the problem of measuring risk is much harder than it is claimed, then immediately risk weighted capital becomes suspect. Perhaps then we don't trust banks when they tell us they were well capitalised. Subsequently, they become stigmatised. Another problem with risk weighted capital is that it is inherently procyclical.

The problems with Basel II are increasingly understood, but the criticism of it was there from

the start. For example, *An academic response to Basel II* in 2001 stated:

- "value–at–risk can destabilise an economy and induce crashes when they would not otherwise occur."

- "The Basel Committee has chosen poor quality measures of risk when better risk measures are available."

- "credit rating agencies ... are unregulated and the quality of their risk estimates is largely unobservable."

- "Financial regulation is inherently procyclical. Our view is that this set of proposals will, overall, exacerbate this tendency significantly."

- "In so far as the purpose of financial regulation is to reduce the likelihood of systemic crisis, these proposals will actually tend to negate, not promote this useful purpose."

These views still have a resonance today.

3|2 Why are banks not lending

The basic principle of banking is that lending should reflect risk. The unfortunate consequence of that is procyclicality, i.e., that financial institutions lend too much in booms and too little in downturns. This is a basic facet of banking.

Financial regulations can either encourage or discourage this procyclicality, but generally they amplify it. Clearly, the notion of capital in Basel II is procyclical. One reason for this was noted by Daníelsson and Zigrand (2008) who model the behaviour of financial institutions when they are subject to risk constrains of the Basel type. They find that such risk constraints and the implied heightened risk sensitivity has a particular perverse impact, making banks behave more alike, they will have to sell the same risky assets and buy the same assets. That by itself makes the prices of the risky assets fall, which further increases risk and erodes capital, causing banks to withdraw from risk activities at exactly the moment when we want them to do the opposite.

Indeed, the banks are now doing what they are supposed to do. They are being prudent. It is a bit disingenuous of regulators and politicians demanding that the banks increase lending when the banks are just following the regulations proposed and approved by the very entities.

3|3 Hedge funds

Hedge funds have remained unregulated, but now we see increasing calls for the regulations of hedge funds, e.g. within the European Union on the regulation of hedge funds. Hedge fund regulation has remained controversial. In a previous Banque de France *Financial Stability Review* article in 2007 I argue that they should remain unregulated. Those arguments still hold today.

Hedge funds have had little or no contribution to the crisis, and have in many cases been a positive influence by providing liquidity and purchasing distressed assets. By putting a floor under asset values, hedge funds and private equity firms directly help the regulated banks.

The main focus of proposals for hedge fund regulations seems to be registration and disclosure. Receiving disclosure from hedge funds is like drinking from a fire hose. Many hedge funds do operate on the edge of the technological curve. The regulator, having to receive all that disclosure and using the numbers to understand systemic risk and would therefore be operating beyond the edge.

Ill–conceived disclosure regimes provide little or no information about financial stability, but have a downside of transferring responsibility to the supervisor.

3|4 Compensation in banks

One avenue which is receiving considerable attention is compensation in financial institutions. Certain individuals have been able to make exceptionally large bets and receive similarly outsized bonuses for their efforts. Now that many of these bets have failed how can such behaviours be prevented in the future?

Many proposals are based on top executives receiving shares that are not convertible into cash for a few years, even until retirement. More junior staff might have to keep money in escrow accounts for a few years until the final profitability of the trades in aggregate is known — so–called cash claw back solutions. Both suffer from fundamental problems.

First, because of the asymmetry between reward and punishment there is a promise of immense payoffs when things go well, with the only downside the loss of the reward if things go badly. The downside pain is not as big as the upside benefit.

In the old days many financial institutions had a partnership structure, with unlimited liability, which did directly expose the most senior management to downside risks. A failure of the bank might mean personal bankruptcy. Similarly, by having traders expose their personal wealth to trading positions, with permanent blacklisting in extreme cases, it would have the same effect.

Indeed, waiting for profitability may not prevent the so–called "collecting pennies in front of a steamroller" trades, i.e., trades were the mean is small but positive, with very thick lower tail. It is quite easy to create such positions, e.g. with derivatives or credit instruments, but can be harder to detect, especially with statistical methods. If we lengthen the bonus cycle, the trader can simply lengthen the instrument cycle.

Another avenue, and one proposed recently by the UK's FSA[4] is to risk adjust pay. The problem with such approaches is the accuracy of risk models and ability to game the models. Internal risk management financial institutions can adjust models and create Chinese walls between those taking risk and those managing risk to prevent data mining. This is much harder when models are used for compensation because they become a part of the contractual agreement between the trader and the financial institution. Making gaming a rather simple affair.

3|5 Utility banks and casino banks

The nature of banking has become an important topic for debate on regulatory reform, with many commentators calling for banks being split up along business lines. One model often heralded is the Glass–Steagall Act in the United States, which splits banks into investment and commercial banks. A more crude manifestation is the call for banks being split up into so called *utility banks* and *casino banks*, with the former providing useful banking services, and the rest taking risks. Generally, most such discussion calls for *narrow banking*.

In the Great Depression, countries with narrow banking, such as the United States, saw significant parts of their banking systems collapse. Canada, just to name one counter example, experienced no banking failures. Its banks were comfortably universal and have remained so to this day.

Distinctions between utility banks and casino banks are arbitrary and losses can occur everywhere. Narrow banks are inevitably less diversified, less stable, and less resistant to a crisis. Splitting banks up along business lines would be a mistake.

3|6 Do we know how to regulate banks?

The Basel II process demonstrates the difficulty in designing effective financial regulations and the resistance to outside criticism. Ineffective regulations can lead to complacency and hence increase financial instability. Badly designed regulations can impose significant costs on the financial system and the real economy whilst at the same time destabilising the system.

It is clear that widespread regulatory failures contributed to the crisis. However, the part of the financial system most affected by the crisis is the most regulated, the banks. So the question of whether we did not regulate

4 "Reforming remuneration practices in financial services", *March 2009.*

enough or we don't know how to regulate financial institutions effectively has not been answered.

We are unlikely to see another banking crisis for quite a number of years. There is no immediate hurry to reform the current regulatory structures, it would be better to be prudent, take the necessary time to study how best to regulate, and then few years down the road implement an effective system. The Larosiere and Turner reports provide useful points for discussion.

Regulations have failed. But the crisis did not happen because of a lack of regulations. The crisis is typical, banks lend to increasingly marginal credits, asset values are increasingly out of touch with the underlying economy and it takes increasingly little to burst the bubble. When that happens everything reverses but at much higher-speed.

This is how most financial crisis has played out throughout history. The exact same process can be prevented from happening in the future, but surely the next crisis will take a different form, something completely unforeseen. One cannot regulate against such unforeseen events.

This is why, it would be preferable to study what went wrong and then in a few years carefully change regulations at a time when we know more. There is no hurry, we still haven't solved this crisis and the next one will not come immediately after. The costs of inappropriate regulations are high and we have time to wait.

BIBLIOGRAPHY

Artzner (P.), Delbaen (F.), Eber (J. M.), and Heath (D.) (1999)
"Coherent measures of risk", *Mathematical Finance*, No. 9 (3): 203-228

Basel Committee (1996)
"Amendment to the capital accord to incorporate market risks", *Basel Committee on Banking Supervision*, http://www.bis.org/publ/bcbs24.pdf

Coval (J. D.), Jurek (J. W.), and Stafford (E.) (2008)
"Economic catastrophe bonds", *Mimeo*, Harvard University

Daníelsson (J.) (2002)
"The emperor has no clothes: limits to risk modelling", *Journal of Banking and Finance*, 26(7):1273-1296, download from http://risk.lse.ac.uk/rr/files/JD-00-6-10-960591721-1.pdf

Daníelsson (J.) (2009)
"The myth of the riskometer", *VoxEU.org*, http://www.voxeu.org/index.php? q = node/2753

Daníelsson (J.), Embrechts (P.), Goodhart (C.), Keating (C.), Muennich (F.), Renault (O.), and Shin (H. S.) (2001)
An academic response to Basel II. The new Basel capital accord: comments received on the second consultative package, Special paper No.130, ESRC Centre, May http://www.bis.org/bcbs/ca/fmg.pdf

Daníelsson (J.) and Shin (H. S.) (2003)
Endogenous risk. In modern risk management — A history, Risk books, http://risk.lse.ac.uk/rr/files/HSS-JD-02-9-22-1032695086-15.pdf

Daníelsson (J.), Shin (H. S.) and Zigrand (J.-P.) (2009)
"Risk appetite and endogenous risk", http://risk.lse.ac.uk/rr/files/JD-HS-JZ-34.pdf

Daníelsson (J.) and Zigrand (J.-P.) (2007)
"Regulating hedge funds", Banque de France, *Financial Stability Review*, Special issue on hedge funds, (10), http://www.banque-france.fr/gb/publications/rsf/rsf_042007.htm

Daníelsson (J.) and Zigrand (J.-P.) (2008)
"Equilibrium asset pricing with systemic risk", Economic Theory, 35:293-319. http://risk.lse.ac.uk/rr/files/JD-JZ-26.pdf

Duffie (D.) (2007)
"Innovations in credit risk transfer: implications for financial stability", *Mimeo*, Stanford University

Financial Services Authority (2009a)
"Reforming remuneration practices in financial services", Technical report 09/10, http://www.fsa.gov.uk/pubs/cp/cp09_10.pdf

Financial Services Authority (2009b)
"The Turner Review: a regulatory response to the global banking crisis", Technical report, http://www.fsa.gov.uk/pubs/other/turner_review.pdf

Knight (F.) (1921)
"Risk, Uncertainty and Profit", Houghton Mifflin

Larosière (J. de) (2009)
"The high-level group report on financial supervision in the EU", Technical report, http://ec.europa.eu/commission_barroso/president/pdf/statement_20090225_en.pdf