



Regtech meets financial supervision: how climate scenario analysis by supervisors is ushering in a new regulatory paradigm

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Financial Supervision in the Stone Age...

To begin, consider this example: a bank regulator has sent out a survey to its banks on the latest trending topic – “green finance”. The idea is for the regulator to understand what percentage of a bank’s lending portfolio is “green” (i.e. associated with environmental benefits). One of the larger banks in the jurisdiction judiciously fills out the survey, and, given that plants and trees are literally ‘green’, they decide to label their entire agricultural lending as “green finance” – everything – from palm oil to fertilizer companies, close to 100% of their portfolio.

What sounds like a farcical anecdote is actually the real-world experience for many financial supervisors. Indeed, financial supervisors know the process all too well: when there is a new regulatory

agenda – in this case “green finance” – they send out a survey, and then the confusion ensues. One response to this process could simply be to blame the supervisors: after all, shouldn’t they be more precise about what constitutes “green finance”? This is a valid point, however, even the most well-designed survey processes can be very complex, as they need to be appropriate for diverse institutions and be able to address capacity gaps. Those who have ever had to fill out a form in their private life and mixed up the “Last Name” and “First Name” boxes perhaps understand the struggle.

People’s inability to fill out forms is a relatively significant problem. It is expensive for banks, insurance companies and pension funds to have to design their own responses. However, there are many banks that hire staff exclusively for the purpose of filling out surveys. Every topic is

important, so every topic warrants a survey. This process is inefficient for supervisors, who have to create questions and deal with survey responses. In the best-case scenario, the surveys provide a rough idea of what the bank is doing, and in a worst-case scenario, the results are useless and incoherent. The absolute worst-case scenario occurs when all of the results make sense and are consistent – but the wrong questions were asked. The masochists will then restart the process, sending out another survey, and so on, and so on. All of these processes tend to cost an incredible amount of time and money.

Stone Age Tools in the face of Star Wars Technologies...

The proliferation of threats to and challenges faced by financial markets makes the current ‘survey’ process used to assess lending portfolios’ compositions increasingly unsustainable. The world of financial supervision is changing; the last decade of financial supervision was largely dedicated to dealing with the fallout of the global financial crisis of 2007-2008 – nursing financial institutions and markets back to health. The past couple of years in turn have slowly seen the rise of a change in narrative, as the aftermath of the financial crisis is receding from view and a return to normalcy is on the horizon.

In this context, financial supervision is starting to assess its future role, facing an out of the frying pan and into the fire metaphor. The post-financial crisis world is very much the pre-crisis world in terms of the medium- and long-term climate-related risks it faces. Climate change represents a fundamental threat to global prosperity, and the associated transition to a low-carbon economy is set to drive significant value destruction in the dinosaur industries of the past – fossil fuels to name the most prominent example. Meanwhile, robotics and artificial intelligence are ushering in the next industrial revolution, just as the dust from the exponential growth of computing power and the internet revolution is starting to settle. Of course, this dynamic also represents an opportunity to strengthen the role of financial markets in protecting the common good – aligning with and contributing to macro policy objectives.

In the face of these challenges, financial supervision will need to develop new tools and instruments to be able to respond to them. The outdated approach to financial supervision as described in the introduction of this article will simply be unable to deal with these challenges – it is too cumbersome, slow, and imprecise to handle the analytical challenges faced by financial supervisors. Financial supervisors face a daunting future: mega risks are set to increase in number and at a potentially destructive scale. Some of these risks are mutually reinforced and although they originate from economic trends, they may be amplified by financial markets – in particular financial markets that themselves become automated and faster.

To date, the potential for technology in financial markets has to a large degree emphasised its impact on financial institutions and the ecosystem itself – the ‘fintech’ boom. Financial transactions and investing are increasingly being automated. In 2018, algorithmic trading represented roughly 85% of market volume (Malinowski, R., (2018)). As non-human strategies overtake, it will become both increasingly difficult to regulate and supervise, as well as increasingly likely that computers will amplify real economic trends. Meanwhile, financial advice to retail and institutional investors is also being automated. The market, while starting at low levels, may reach 10-15% market share by 2020 and command over \$10 trillion in assets under management (2dii, 2017a).

Technology is also breaking up natural monopolies and vertical integration. Blockchain has the potential to replace some of the traditional market functions of banks – with uncertainty as to which economic actors will structure and organise these functions and the extent to which this will be a ‘crowd-based’ future. On the other hand, complex technologies may create new natural monopolies, as can be seen in the tech sector, which may stifle competition and create new challenges for supervision.

While the attention of the potential technology revolution has emphasized the private sector, financial supervision is similarly ripe for disruption. Financial supervisors know this, and in response to

the challenges described above, are starting to both reframe supervision post-financial crisis and bring about the era of 'regtech' supervision. Financial supervisors face two options: either to ignore these long-term risks or to help shape and protect a sustainable future.

The (Financial Supervision) Empire Strikes back...

This interpretation of financial supervision is already starting to be explored by financial supervisors. Fintech departments are being set up: a range of central banks and supervisors have established the Network for Greening the Financial System (NGFS) – which looks to address issues around sustainability and climate change. Indeed, through addressing these risks – driven and mitigated by the technology revolution under way – the infant signs of a technology revolution can also be identified. Climate scenario analysis is increasingly appearing as the starting point for this technology revolution in supervision.

One of the key prerequisites for tackling the new regulatory challenges described above is mobilising new data and accounting frameworks. These data needs extend across both traditional financial data as well as micro datasets that are currently only partially or not at all exploited. They include industrial information, social & environmental data, corporate relations data, financial data, and citizens information. Extending to these alternative data sources is crucial as a way to deliver the policy supervision required to understand the new generation of risks and to be able to monitor them appropriately. These alternative datasets then have to be linked to a new type of scenario (e.g. climate transition scenarios, artificial intelligence (AI) scenarios, physical risk scenarios) in order to inform macro- and microprudential supervision. One key challenge in this regard is connecting data across the financial network from economic and environmental information at micro asset level all the way through the financial system to the ultimate asset owner. A number of financial supervisors have begun conducting climate scenario analysis specifically using this new type of data, and in doing so, have

shifted away from the 'survey' dynamic and reporting burden.

In early 2017, a project was launched by a number of financial supervisors who began the consolidation of a global database of economic assets focused on high-carbon or 'climate-relevant' assets. In total, there are over 1 million production sites/assets, including power plants, aeroplanes, ships, automobile plants, steel plants, cement factories, oil & gas fields and coal mines. Collectively, these assets represent around 70-90% of CO2 emissions in financial markets (2di, 2017b).

Next, these physical assets were matched through a network of ownership trees to the global universe of financial instruments – from corporate loans to global capital markets. The exercise created an 'X-ray' instrument that allowed for the analysis of financial assets beyond their financial characteristics to their underlying economic fundamentals. It allowed, for example, a policyholder in a pension fund in Australia to quantify the percent of ownership of the coal-fired power plant in the city across the river through their equity pension plan – tracing the policy to the pension fund, their equity portfolio, the funds in that portfolio, the funds of funds, the specific equity instruments and companies in each fund and the ownership of these companies of coal-fired power plants through their subsidiaries. This 'X-ray' system was then used to model the economic trajectory of financial portfolios and their performance relative to various decarbonisation scenarios – notably those scenarios mapping a future consistent with limiting global warming to 2°C or well-below 2°C above pre-industrial levels (2017c).

The real innovation came into play when the financial supervisors liaised with think tanks, and a simple innovation in the model was created: one line in the software that repeated the code – the equivalent of replaying the score of a sheet of music. The difference between running the code on one portfolio or on – hypothetically – an infinite number of portfolios.

Equipped with this innovation, the tool was designed in a way to run the supervisory data through it that European supervisors had started collecting on

insurance companies as part of the Solvency II Directive that had started about a year prior (EUR-Lex, (2009)). Instead of asking their regulated insurance companies what their portfolios contained, they simply ran the tool over the portfolio data that the supervisor had already collected. The tool provided a simple, low-cost economic analysis framework to analyse any number of regulated entities and portfolios of any size in a loop, empowering the supervisors to conduct daily scenarios.

Crucially, the analysis in the first instance was an economic analysis. It 'X-rayed' portfolios for their economic diversification, not just at sector level, but in the millions of assets around the world linked to their financial value. Of course, the infrastructure equally helped lay the groundwork for financial modelling of potential asset price movements. It then matched the analysis to scenarios to compare the level of exposure to climate-related risks and the evolution of that exposure over time.

The California Insurance Commissioner, Dave Jones, then took this work a step further. Instead of just analysing portfolios, he decided to share the results with the regulated entities directly by printing an automated report, tailor-made to the portfolio, summarizing individual results (California Department of Insurance (2018)).

Both the US and European supervisors benefitted from having already collected portfolio data, and this is where the Swiss government innovated on the delivery system. Instead of centralizing the analysis, the Swiss Federal Office for the Environment and the State Secretariat for International Affairs decided to bring the system to the insurance companies and pension funds. Setting up a voluntary disclosure system, each pension fund and insurance company could run the analysis and simply provide the anonymized results, using a survey system with the software to fill out the survey. This method ensured 100% comparability and comprehensiveness at minimal cost to the insurance company or pension fund – simply running the portfolio through the software. Despite being voluntary, around 80% of the Swiss insurance market and close to two-thirds of the

pension fund market (measured in assets under management) participated in the initiative (2dii (2017b)).

Regtech Meets Financial Supervision: A new hope

Initiatives by the Bank of England, the Dutch Central Bank, and the California Insurance Commissioner led to a process that prompted the analysis of 2,000 regulated entities' portfolios climate transition-related risks in just 18 months. The California Insurance Commissioner alone conducted 'scenario analysis' on 672 insurance companies operating in California, using software to automatically generate 672 individual reports sent to each insurance. At 30 pages a report, that averages about 60 pages of writing a day or 40,000 words per day.

Instead of sending out a survey, financial supervisors work hands-on to solve the problem themselves. Using a combination of granular data on physical assets (power plants, automobiles, etc.), existing data collected from regulated entities, and software code, they reverse the asymmetry of information and save tens of thousands of hours for both themselves and the insurance companies they supervise. At an average productivity of about one page per day (including the research that goes into it), somebody would have to work for nearly 60 years to recreate the output. Instead, the solution that has been designed is a window into the future of financial supervision – efficient, lean, and effective to tackle both the current and future challenges facing financial markets.

The work was designed to respond to a specific policy concern – climate scenario analysis, understanding the alignment of financial portfolios with economic decarbonisation pathways and potential financial risks that may materialise as a result of this decarbonisation for companies, financial instruments and institutions.

In providing a solution to this specific policy initiative however, it in parallel – and somewhat by coincidence – helped define a potential new pathway for policy and regulatory intervention. Instead of a

survey, big data, some software wizardry, and a dash of innovation can dramatically reduce the transaction costs of supervision – while improving the supervisory insight and outcomes.

Data is one key part of the puzzle: the growth of global databases across a range of indicators can help create transparency across a range of issues. Techniques like text-string matching can help match economic assets to financial instruments.

Software is the other piece of the puzzle: in the pilots with supervisors, the software is set up in a way where it can hypothetically be run every day by simply pushing a button (an exercise admittedly of limited utility given the fact that the data is only collected on a quarterly basis). A financial supervisor can generate 1,000 analytical reports every day, automatically printed and individually configured. Instead of biannual stress-tests at astronomical costs, streamlined software can help create live monitoring systems.

Real estate is a case in point: from a purely technical perspective, a financial supervisor today could apply a dashboard involving live monitoring of real estate prices based on an online rental and housing website, and match this to mortgage-backed securities. This would allow for a live monitoring of the price instruments for every mortgage-backed security in the world; not science fiction, but eminently feasible given the availability of current technology.

Of course, challenges remain. For financial supervisors, long-term mega risks represent both macro- and microprudential challenges. Depending

on the risk, certain trends may represent a macroeconomic threat – climate change, nuclear war, etc. – whereas other issues like the transition to a low-carbon economy may be more sectoral/micro in nature and thus are likely only to affect specific financial institutions and/or pockets of the market (although of course network effects may amplify this story).

Cementing and determining economic relationships remain both the elusive and the most important elements to track. This is particularly the case in the real economy. Other uncertainties exist around accounting and modelling principles. Somebody still has to parameterise the model, design it, and maintain it. Even when reporting something as standardised as portfolio data, inputting errors abound – human error being another challenge to surmount – and, without a doubt, future roadblocks will arise.

However, as financial markets evolve and ‘fintech’ disrupts the traditional business models of financial institutions, so too does the disruption of these new applications to the business models of financial supervisors: ‘Regtech’ meets financial supervision.

The good news is that there has never been a better time to upgrade. The relative calm before the storm that financial markets enjoy today needs to be used by financial supervisors as the moment to prepare for the future. It is in this moment that technology is starting to play a key role in bringing financial supervision into the 21st century. Speaking to supervisors, they can’t wait...

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