Ethical Issues in Financial Stress Testing

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1. Introduction

The banking business and culture have often been considered unethical (Cohn *et al.* 2014, Palazzo and Rethel 2008, Watkins 2011). This is problematic because of the crucial role banks play in the economy as financial intermediaries. Historically, a number of banks have failed due to unethical and illegal behaviour; prominent examples include Barings Bank, Fortis, and Lehman Brothers.[1]

Bank failures put domestic and global banking systems at risk and lead to potentially enormous social and economic costs, including public bailouts (Young 2011). In this respect, the global financial crisis (2007-2009) revealed an erosion of ethics in the banking sector, with serious consequences for homeowners, taxpayers, and investors (Donaldson 2012, Sternberg 2013, Schoen 2017).

Since then, central banks and other banking authorities have significantly increased the use of financial stress tests to assess and improve the stability of individual banks and banking systems. Stress tests are also carried out by banks themselves at the entity or portfolio level, as well as by the International Monetary Fund (IMF) and the World Bank at the financial sector level of their member states.

However, setting prudential rules for stress testing is not enough. First, these rules must also be applied appropriately, and second, all related decisions and actions must satisfy the moral standards implicit in the idea of stress testing (see Boatright 2013).[2] Prudential regulation and ethics are therefore no substitutes, but rather complements that reinforce each other.

The purpose of this chapter is therefore to provide insights into the overlap between financial stress testing and ethics. To organise the discussion, the chapter begins by introducing the fundamentals of financial stress testing and continues with developing a simple normative

[1] For further information on the above examples, see Drennan (2004), Fassin and Gosselin (2011), and Stevens and Buechler (2013).

[2] For an overview of the ethics of financial regulation, see Hendry (2013).

framework based on a set of normative principles. Building on this, various stress test applications are discussed, using the normative framework as an analytical lens.

The chapter is structured as follows. Section 2 introduces the fundamentals of financial stress testing. Section 3 develops a normative framework based on previous considerations about ethics in finance. Section 4 is the focus of this chapter and provides a critical discussion of ethical issues associated with financial stress testing. Section 5 summarizes and concludes the chapter.

2. Fundamentals of Financial Stress Testing

This section outlines the fundamentals of financial stress testing to facilitate the discussion of ethical issues that follows in section 4. These fundamentals include a brief introduction to the concept of stress testing (subsection 2.1) and a historical overview of the origins and evolution of financial stress testing (subsection 2.2).

2.1 The Concept of Stress Testing

In general, stress testing is a tool used to evaluate the stability of a given system or entity under adverse conditions. The concept is used in a variety of disciplines, including medicine, materials science, and engineering. In finance, stress tests are used to assess the resilience of portfolios, individual banks, or entire banking systems against adverse changes in macro-financial variables.[3]

As the preceding paragraph suggests, *stress testing* is a generic term that comes in many different shapes and sizes. Borio *et al.* (2014, p. 4) put it as follows: "[stress tests] are not a single tool, but a toolbox." Although this quote was made in the context of stress tests used by central banks and other banking authorities for supervisory purposes, it applies equally to other uses of financial stress testing.

Stress testing generally involves designing stress scenarios, modelling the impact of these scenarios on risk parameters[4] and key metrics,[5] reporting the results, and taking appropriate

[3] While univariate analyses of a single macroeconomic or financial variable are known as simple *sensitivity tests*, multivariate analyses are commonly referred to as *scenario analysis* (CGFS 2000).

[4] For example, probability of default (PD), loss given default (LGD), and exposure at default (EAD) in the case of credit risk stress tests.

[5] Including stressed regulatory, economic, and book capital, stressed value at risk (VaR), as well as liquidity gaps and ratios.

management or supervisory actions to mitigate the risks identified. For a comprehensive overview of stress testing methodologies and applications at the bank and supervisory level, see Bellini (2016) and Quagliariello (2009), respectively.

2.2 A Brief History of Stress Testing in Finance

Financial stress testing emerged in the early 1980s when risk managers in banks began to stress test interest rate risks in the banking book (Houpt and Embersit 1991). In the wake of the Asian (1997) and Russian (1998) financial crises, banks also started to conduct stress tests on market, liquidity, and credit risk (CGFS 2000, 2001).[6]

Since the 1996 Market Risk Amendment to the Basel Capital Accord (Basel I), banks that used the internal models approach to calculate their market risk capital requirements have been obliged to stress test the market risk in their trading book (BCBS 1996). Similarly, Basel II required banks that used the internal ratings-based approach to calculate their credit risk capital requirements to conduct stress tests for credit risk (BCBS 2004, 2006).

Imposing the requirement for credit risk stress testing was deemed necessary because the development and application of stress tests for credit risk lagged significantly behind those for market risk (BCBS 1999). The requirements for market and credit risk stress testing were continued and significantly expanded under Basel III (BCBS 2011, BCBS 2017). That way, stress tests have become a regulatory requirement for many banks today.

In light of the above reference to the banking and trading books, the following excursus briefly describes the main differences between these two portfolios of a typical bank before proceeding with the introduction of stress test applications for supervisory purposes.

[6] Since early 2000, the Committee on the Global Financial System (CGFS) has occasionally surveyed current stress-testing practices at major financial institutions, see CGFS (2000, 2001, 2005). For a summary of the key findings from the 2001 CGFS survey, see Fender *et al.* (2001).

The banking book consists of financial assets and liabilities that are expected to be held to maturity, *e.g.* loans to and deposits from retail and corporate customers. Banks are not required to mark banking book items to market; instead, they are usually held at historical cost. In contrast, trading book assets and liabilities are available for sale and held for trading purposes; this includes the banks' own securities positions (proprietary trading) and derivatives that are held to hedge such positions. Trading book items are marked to market on a daily basis.

With the launch of the joint Financial Sector Assessment Program (FSAP) of the International Monetary Fund (IMF) and the World Bank in 1999, stress testing began to address broader financial stability concerns. From the early 2000s onwards, FSAP assessments encouraged central banks and other banking authorities to develop and implement their own, independent stress-testing programs (Jones *et al.* 2004).

In 2002, the US Office of Federal Housing Enterprise Oversight (OFHEO) started to stress test the two major government-sponsored enterprises in the US secondary mortgage market: the Federal National Mortgage Association and the Federal Home Loan Mortgage Corporation, commonly known as *Fannie Mae* and *Freddie Mac*. However, the OFHEO stress-testing program failed quickly after coming into effect and lends itself as a negative prime example for methodological flaws and ethical problems.[7]

Since the global financial crisis (2007-2009), central banks and other banking authorities in most advanced economies have significantly expanded the use of stress tests in the supervision of banks. This process has started in 2009 with the US Supervisory Capital Assessment Program (SCAP) and the first EU-wide stress test. These exercises have been followed by a series of comparable supervisory stress tests, particularly in the US and the EU. Today, Comprehensive Capital Assessment Reviews (CCAR), Dodd-Frank Act Stress Tests (DFAST), ECB Comprehensive Assessments, and EU-wide stress tests have become regular

[7] Frame *et al.* (2013, 2015a, 2015b) devoted several studies to the failure of the OFHEO stress-testing program and the rescue of Fannie Mae and Freddie Mac. The two main reasons that caused the stress tests to fail were the outdated model specifications and parameters (which remained unchanged for almost a decade) and insufficiently severe stress scenarios for the development of house prices (Frame *et al.* 2013, 2015a). Both main reasons are consistent with other studies in the field, see, for example, Gross and Población (2019) and Geršl and Seidler (2011). The OFHEO experience is not covered in this chapter because the stress-testing program ceased to exist.

and indispensable macroprudential tools. Figure 1 summarises the above and shows the evolution of financial stress testing over time.

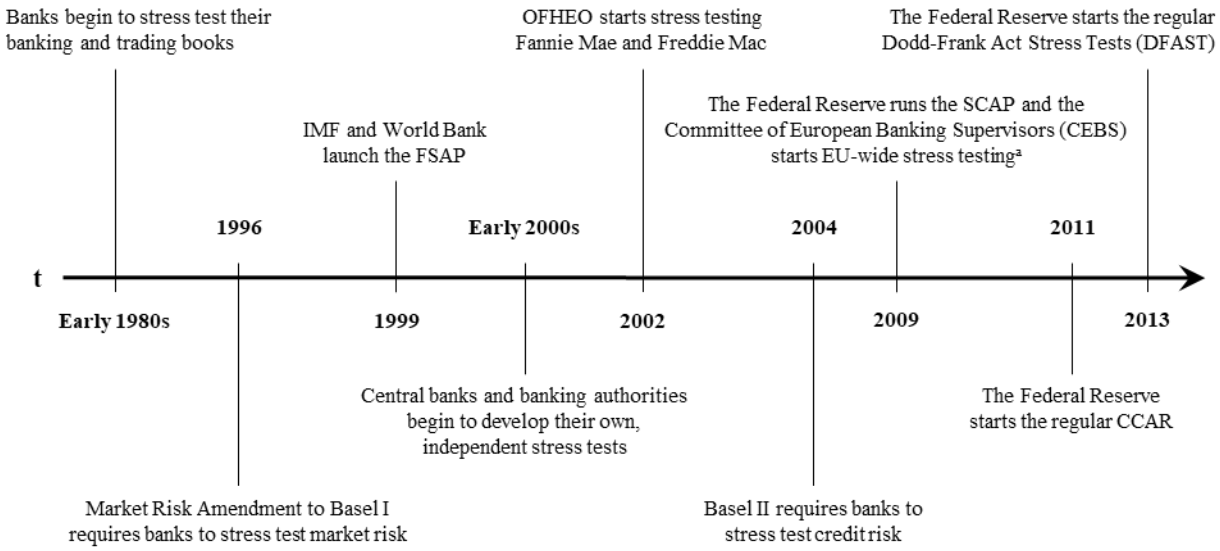

Figure 1. Milestones in financial stress testing. [a] The first EU-wide stress test in 2009 has been followed by a series of similar exercises coordinated by the Committee of European Banking Supervisors (CEBS) or, since 2011, by the European Banking Authority (EBA).

3. Ethical Considerations

The purpose of this section is to discuss the reasons for the need for ethics in finance (subsection 3.1) and how ethical finance can be defined and assessed (subsection 3.2). Building on these general considerations, a simple normative framework is developed that can be applied in the specific context of financial stress testing (subsection 3.3).

3.1 Why is Ethics Necessary in Finance?

Finance is a very broad field with numerous actors and competing interests, and in which return, risk, and uncertainty play a central role. These conditions expose finance to a complex variety of ethical issues and dilemmas.

In an attempt to provide a systematic overview, Dembinski (2017) gives a number of structural reasons for the need for ethics in finance. First, he reminds of the three main resources used in finance: money, trust, and time or, more specifically, the future. He argues that money is a social institution that is heavily loaded with emotions and meanings and that money transactions, especially deposits, are impossible without a minimum level of trust. Taking also the time resource and the financial intermediary function of banks into account,

Dembinski (2017, p. 3) pithily summarizes that bankers are "earning their living by handling other people's futures, trust and money". The final structural reason he puts forward is the predominance of quantitative language and numbers, which tend to obscure the real socio-economic context of financial transactions. This tendency is likely to continue in view of the increasing digitalization of financial processes, for example automated credit decisions or high-frequency trading.[8] In addition to the structural reasons mentioned above, Dembinski (2017) also gives some contemporary reasons for the need for ethics in finance. These include, amongst others, the high level of fragmentation of financial processes, which has led to a diffusion of responsibility, and the large size and complexity of banks, which is associated with systemic importance and high macro-social impact.

The above reasons can be considered the root causes of the need for ethics in finance. As such, they are largely consistent with more detailed explanations in the ethical finance literature (*e.g.* Boatright 2013, Dobson 1997, and Hendry 2013).Boatright (2013), for example, attributes the causes of misconduct to a number of organizational factors as well as financial and technological innovations. These factors include, but are not limited to, flawed leadership, organizational failures, and misguided incentives for employees that lead to conflicts of interest. He also points out that technological disruptions and financial innovations often create windows of opportunity for misconduct until they are properly regulated and supervised. He further cites a weak business culture and intense pressure as possible reasons for wrongdoing (see also Cohn *et al.* 2014). Building on this basic introduction to the need for ethics in finance, the next subsection explains how ethics in finance can be defined and assessed.

3.2 What is Ethics in Finance and How to Assess It?

The term *ethics*, or *moral philosophy*, is generally understood as the moral principles that guide conduct and regulate between good and bad behaviour. Boatright provides a more specific definition for the field of finance:

> Ethics in finance consists of the moral norms that apply to financial activity broadly conceived. Moral norms, in this context, may be understood as prescribed guides for behavior or conduct about what is right or wrong or about what ought to be done, using such concepts as duty or obligation, rights, and fairness or justice. Boatright (2013, p. 14)

[8] For more information on ethics and digital finance, see, for example, Argandoña (2020), Davis *et al.* (2013), and Mittelstadt *et al.* (2016).

Several authors have developed comprehensive frameworks for the analysis of ethical issues in finance, for example Aragon (2011), Boatright (2013), and Soppe (2017). However, these frameworks tend to have a fairly broad scope and therefore do not fit the specific purposes of this chapter. Soppe's (2017) cross-disciplinary approach, for example, is based on seven main criteria: justice, nature, sustainability, legality, risk and return, stakeholders, and monism.

In contrast, Cowton (2002) offers a simpler approach that focuses on three ethical terms: *integrity*, *responsibility*, and *affinity*. He argues that *integrity* is a necessary condition in order to build the trust a customer needs to enter into a deposit agreement with a particular bank. Similarly, banks must act *responsibly* with regard to their lending policies and the resulting consequences. This includes concepts such as fair lending and financial inclusion, but also finding the right balance between lending too much and lending too little, and considering the possible consequences before cancelling a non-performing loan. Finally, *affinity* refers to the means by which banks can deepen the relationship between depositors and borrowers beyond the conventional boundaries of western banking. Although Cowton's (2002) approach provides meaningful moral standards for the role of banks as financial intermediaries, its usefulness in other areas of finance, including financial stress testing, is limited. Therefore, the next subsection develops an approach that takes into account the specific ethical issues of financial stress testing.

3.3 A Normative Approach to Ethics in Financial Stress Testing

There are basically two main directions by which ethics can be assessed: *normative ethics* and *descriptive ethics*. That is, how people *should* behave according to moral standards and what they actually *do*. In an empirical study, Oberlechner (2007) describes the observable behaviour of bank employees in different situations – this is an example of descriptive ethics. Another example of a descriptive (positivistic) approach to ethics in finance is documented in Aragon (2011).

However, the vast majority of academic literature in this subject focuses on normative ethics and the moral standards that define right and wrong conduct (*e.g.* Dobson 1997, Hendry 2013, Soppe 2017). Normative ethics is characterized by the fact that it only assumes one

ultimate standard, or *norm*, of moral conduct.[9] This standard can be a single rule[10] or a set of principles against which behaviour is judged. There are three major classes of normative ethical theories that can be used to establish moral standards: virtue, duty, and consequentialist theories. Table 1 provides an overview of these theories and their characteristics.

Table 1

Overview of the Three Major Classes of Normative Ethical Theories

Criterion	Virtue Theories	Duty Theories	Consequentialist Theories
Moral standards	Virtues, good habits of character	Duties, rights, categorical imperative	End results of cost-benefit considerations
Motivation	Inner freedom	Social duty	Rational reasoning
Foundation	Ideology	Supervision	(Corporate) culture
Moral source	Voluntary	Imposed	Reason
Decision mechanism	Intuition and metaphysics	Will power	Rationality
Moral responsibility	Individual	Individual and collective	Collective

Note. Adapted from Soppe (2017, Table 2.1).

Given the multitude of – potentially conflicting – moral standards, applied normative ethics typically develops frameworks of consistent normative principles that are relevant to the specific context in question. Following this approach, a simple normative framework is developed that guides the ethical discussion about financial stress testing that follows in section 4. The framework consists of a set of normative principles commonly used in applied ethics analysis and is based on duty and consequentialist theories. In other words, the following discussion is guided by a framework of selected normative principles that serves as an analytical lens for assessing ethical issues associated with financial stress testing. Table 2 illustrates this framework by listing the five normative principles on which the ethics discussion in section 4 is based.

[9] For a detailed overview of normative ethics in the context of finance, see Hendry (2013) and Soppe (2017).

[10] A classic example of a normative standard is the Golden Rule, an ethic of reciprocity that can appear in positive or negative form: "treat others as you would like others to treat you (positive form)" or "do not treat others in ways that you would not like to be treated" (negative form).

Table 2

Framework of Normative Principles for the Discussion of Financial Stress Tests

Principle	Explanation	Stress Test Related Example
Lawfulness	The principle of compliance with the law	Compliance with the methodology and rules governing a supervisory stress test
Honesty	The principle of not deceiving others	Stress scenarios are properly designed, neither too benign nor too severe
Paternalism	The principle of helping others pursue their best interests when they cannot do so themselves	Stress tests are carried out by international financial institutions such as the International Monetary Fund or the World Bank, where the domestic authorities lack the necessary experience
Social benefit	The principle of recognizing the extent to which an action has beneficial consequences for society	The decisions and actions required to conduct a stress test are geared towards social benefit (*e.g.* risk reduction) rather than personal benefit
Personal benefit	The principle of recognizing the extent to which an action has beneficial consequences for the person concerned	

Note. Adapted from Fieser (2020, Section 3a).

The above principles were selected based on their general relevance to financial stress testing; other principles might be equally relevant in more specific research contexts. The first three principles listed in Table 2 are based on duty theories, while the last two principles are derived from consequentialist theories (see Table 1). In all cases, the principles selected must have a sufficiently broad focus and must have merit for people on both sides of the ethical issue in question (Fieser 2020). In the following discussion, the normative principles mentioned above are applied to ethical issues in financial stress tests to assess the attitudes towards action and the use of leeway in decision making in an otherwise rule-based environment.

4. Financial Stress Tests and Ethics

This section opens the "toolbox" mentioned in subsection 2.1 and discusses the moral standards that should be applied in various stress test applications. This includes stress tests at the entity or portfolio level for internal risk management purposes (subsection 4.1) as well as supervisory stress tests for surveillance and financial stability purposes (subsections 4.2 and 4.3). Although all stress tests are subject to a range of ethical questions, different stress test applications are differently well suited to discussing specific ethical issues. Each stress test application therefore serves as an example for discussing specific ethical issues that may be

relevant to other stress test applications as well. These issues typically relate to the purpose and process of financial stress testing, as shown in the following subsections.

4.1 Stress Testing Portfolios – Do Good Numbers Mean Good Ethics?

The purpose of portfolio stress tests is to identify risks and vulnerabilities within banking entities or individual banking divisions for their internal risk management. The results are intended to support the management of risks, the setting of risk limits, and the efficient allocation of capital across risk-taking units and activities. Prior to the global financial crisis (2007-2009), the regulatory requirements for stress testing were rather limited, which gave banks considerable discretion in the design and implementation of stress tests (Schuermann 2014). But even in the post-crisis period, banks usually still have considerable leeway, particularly when designing stress scenarios and selecting statistical risk models that link risk parameters[11] with the macro-financial conditions assumed in the scenarios. Before the actual discussion, the following stylized process illustrates the typical sequence of a portfolio stress test for internal risk purposes.

Stress tests are an integral part of the Internal Capital Adequacy Assessment Process (ICAAP) and the Internal Liquidity Adequacy Assessment Process (ILAAP) of a bank. The stress testing process begins with the design of stress scenarios, *i.e.* endogenous shocks on macro-financial variables and their transmission to the bank's books. Stress scenarios may be based on historical or hypothetical events, or a combination of both. The next step is to model the impact of the stress scenarios on the bank's risk parameters as well as on its capital and liquidity ratios. Finally, the results of the stress test are reported to senior management and the bank's supervisory board. After the stress test, senior management should take appropriate action to respond to the results, for example by improving the bank's capital base or adjusting risk-taking practices.[12]

The ethics discussion below is based on the principle of honesty and social versus personal benefit considerations (Table 2). The discussion focuses on two key elements of the stress-testing process: scenario design and model selection.

[11] For example, probability of default (PD), loss given default (LGD), and exposure at default (EAD) in credit risk stress tests.

[12] For more details on stress testing at the entity or portfolio level, see Bellini (2016), Chorafas (2011), and Rösch and Scheule (2008).

According to the stress testing principles issued by the Basel Committee on Banking Supervision (BCBS), stress scenarios should be "severe but plausible" (BCBS 2009, p. 2; BCBS 2018, p. 6). However, this requirement is somewhat arbitrary as there are no further specifications regarding the severity and plausibility that are necessary to meet the requirement. As a result, banks have some leeway to manipulate the outcome of a stress test by designing the underlying scenarios in any direction. From a moral point of view, the outcome of a stress test should reflect the real risk of a portfolio and should not, in any way, downplay or obscure its vulnerability. This is where the principle of honesty comes into play. Stress test results can only be informative for senior management and serve as a basis for appropriate action if they are based on honest assumptions in the underlying scenarios. There have been several suggestions for operationalizing the goal of selecting "severe but plausible" stress scenarios, for example by Breuer *et al.* (2009), Breuer and Csiszár (2013), and Mokinski (2017). These suggestions use systematic (rule-based) search methods to select the most severe scenario from a set of equally plausible candidate scenarios. However, the use of handpicked scenarios that are prone to misconduct and deception, still prevails today.

The principle of honesty is also an important moral standard for the selection of the model that transmits the scenario-based stress to the risk parameters of the bank. Gross and Población (2019) showed that more than one third of the total uncertainty in stress tests can be attributed to model uncertainty. Given that banks use stress tests to calculate their regulatory capital requirements (see subsection 2.2), they have an incentive to select models that reduce the amount of capital that needs to be held. In other words, banks are incentivized to choose models that underestimate risk. This problem is consistent with the literature on regulatory arbitrage, model-based capital regulation, and incentives for the measurement of risk, for example Begley *et al.* (2017), Behn *et al.* (2016), and Plosser and Santos (2018). To adhere to the principle of honesty, banks should select the model that maximizes the accuracy of results, rather than the model that minimizes the amount of capital requirements. Alternatively, banking authorities could require banks to use model-averaging methods, as suggested by Gross and Población (2019), to mitigate the impact of models chosen for the wrong reasons.

The above discussion of the need for honesty in scenario design and model selection also reveals an underlying rivalry between social and personal benefit considerations. From a social benefit perspective, scenarios and models should aim to prevent banks from financial distress and failure in order to minimize socio-economic costs such as public bailouts, credit crunches,

and economic downturns. However, from the personal benefit perspective of a bank employee, there might also be merit in striving for maximizing the personal income. This dilemma raises looting concerns in the sense of Akerlof and Romer (1993)[13] and is closely related to the risk culture of banks. In an exploratory study, Fritz-Morgenthal *et al.* (2016) analysed the relationship between banks' risk cultures and their results in the 2014 ECB stress test. They found evidence that a better risk culture corresponds to a relatively better stress test result. However, their findings do not allow for causal inferences to be drawn and do not provide insights into whether the positive stress test results are due to proper and honest risk management or to the use of creative leeway. In order to improve the governance of risk-management practices, the bank's senior management and supervisory board should critically question the model selection and scenario design used for portfolio stress testing. They should not accept stress test results without challenging the underlying decisions and assumptions and comparing the results with appropriate benchmarks (Sangha and Lin 2013). Their assessment should not be limited to the ability of a stress test to protect the bank from harm, but should also aim at "achieving the highest possible level of exemplary ethical conduct" Boatright (2013, p. 8).[14]

4.2 Stress Testing Financial Systems – Assistance in Promoting Financial Stability

This section is about the Financial Sector Assessment Program (FSAP), which was jointly established by the International Monetary Fund (IMF) and the World Bank in May 1999 in response to the financial crises in Asia (1997) and Russia (1998). The FSAP has a twofold objective: to assess the resilience of member states' financial sectors against adverse macroeconomic conditions and to examine the potential contribution of the financial sector to economic growth and development (IMF 2019).

Although FSAP assessments use a variety of methods, stress testing is a key element that has been used continuously since the beginning of the program (Jones *et al.* 2004).[15] Stress tests under the FSAP differ from portfolio stress tests (subsection 4.1) because their objectives

[13] Akerlof and Romer (1993) developed a model in which bank employees take high risks in order to maximize their bonuses through short-term gains while ignoring the risk of long-term losses. If their bonuses are paid out before the losses are realized, they have actually looted the bank. Such behaviour was also observed during the global financial crisis (2007-2009), see, for example, Bebchuk *et al.* (2010) and Johnsen (2014).

[14] Dermine (2013) comes to a somewhat different conclusion: for the sake of clarity and efficiency, the senior management and supervisory board of banks should focus on the benefit of the shareholders (as the owners of the bank), while banking authorities should ensure the benefit of society.

[15] For a comprehensive overview of FSAP assessment standards and methods, see World Bank (2020a).

are different. While portfolio stress tests aim to support the risk-management process within individual banks, FSAP stress tests focus on systemic risks and the overall stability of the financial system. Compared to other supervisory stress tests (subsection 4.2), however, the scope of FSAP stress tests tends to be much broader and can also include parts of the non-banking sector (Adrian *et al.* 2020).[16]

In the wake of the global financial crisis (2007-2009), the IMF integrated the FSAP into its ongoing surveillance of the international monetary system and required 25 member states whose financial sectors were considered systemically important to undergo an FSAP assessment every five years (IMF 2010). In 2013 the methodology was revised and, as a result, the number of member states with systemically important financial sectors increased to 29 (IMF 2014a).[17] Although the FSAP is a joint program, FSAP missions in advanced economies are the sole responsibility of the IMF, while missions in developing and emerging economies are the joint responsibility of the IMF and the World Bank (IMF 2019). By mid-2018, the IMF and the World Bank had completed 346 FSAP assessments across 173 member states (Baudino *et al.* 2018).

The key ethical issue of stress tests under the FSAP is the principle of paternalism (Table 2). That is, the IMF and World Bank have been helping their member states to assess the risks and vulnerabilities of their financial sectors when the member states did not (yet) have the capabilities, resources, and experiences necessary to conduct sector-wide stress tests themselves. This is particularly true today for member states with developing or emerging economies. Examples of recent FSAP missions are Morocco, Lebanon, Bosnia and Herzegovina, Thailand, Jamaica, and El Salvador (World Bank 2020b).

However, in its initial phase, the FSAP provided similar assistance to member states with advanced economies. At this point in time, the domestic authorities had basically no experience with stress testing at the national level (section 4.3). Although most advanced economies are now running their own, independent stress-testing programs, few central banks and other national banking authorities had made such attempts prior to the FSAP. The IMF and the World

[16] Čihák (2007) provides an introduction to stress testing under the FSAP. For more elaborate discussions of stress-testing approaches and IMF stress test experience, see Moretti *et al.* (2008) and Ong (2014).

[17] The original 2010 list included the following jurisdictions: Australia, Austria, Belgium, Brazil, Canada, China, France, Germany, Hong Kong, India, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, Russia, Singapore, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. After the methodological revision in 2013, Denmark, Finland, Norway, and Poland were added to the original list. For more information on the effective list of IMF member states with systemically important financial sectors, see IMF (2014b).

Bank have therefore played a major role in the development and implementation of stress testing as a macroprudential tool, irrespective of the level of development of the economy.

The main ethical aspect is that the FSAP has been providing paternalistic assistance in improving financial stability in the member states of the IMF and the World Bank when the domestic authorities were unable – and sometimes unwilling (Jones *et al.* 2004) – to do this themselves. In this context, it should also be noted that FSAP assessments have contributed both explicitly and implicitly to financial inclusion. On the one hand, the FSAP explicitly promotes financial inclusion through its growth and development objective.[18] Its financial stability objective, on the other hand, implicitly supports financial inclusion by improving the resilience and sustainability of the financial system. By participating in the FSAP, domestic policy makers are informed about the need for action in areas that require urgent attention. In addition, FSAP assessments may bring financial sector analysis more into the focus of economic policy discussions in member states as well as within the IMF and the World Bank (World Bank 2020c).

4.3 Stress Testing Banking Systems – Rules and Their Interpretations

Encouraged by their stress test experiences from FSAP assessments, central banks and other banking authorities started to develop and implement their own, independent stress-testing programs in the early 2000s (Jones *et al.* 2004). At that time, the main objective was to create stress-testing frameworks that were workable at the supervisory level.

In an international review of financial stability reports (FSR) published from 1995 to 2005, Čihák (2006) showed that references to stress tests increased form virtually zero to about 75% by the end of 2005. Useful entry points into the extensive literature on supervisory stress testing are the Risk Assessment Model for Systemic Institutions (RAMSI) of the Bank of England (Alessandri *et al.* 2009), the Systemic Risk Monitor (SRM) of the Austrian Central Bank (Boss *et al.* 2006), and the macro stress testing framework of the ECB (Dees *et al.* 2017, Henry and Kok 2013).

[18] To help its member states improve financial inclusion, the World Bank is focusing on the following nine areas in connection with FSAP assessments: promoting national financial inclusion strategies, modernising retail payment systems and government payments, reforming national payments systems, including remittance markets, diversifying financial services for individuals, leveraging technology for financial inclusion, strengthening competition and expanding access points, protecting financial consumers, increasing financial capability, surveying financial inclusion data. For more information, see World Bank (2020d).

However, it was not until the global financial crisis (2007-2009) that supervisory stress testing became fully established. The US Supervisory Capital Assessment Program (SCAP) was launched in February 2009 shortly after the bankruptcy of Lehman Brothers in September 2008 (Fed 2009). The SCAP marked a turning point in the crisis, but also caused a permanent change in the use of supervisory stress tests. The primary reason for the SCAP was a high level of uncertainty and a lack of confidence about the amount and quality of capital held by large US banks (Fed 2009).[19]

To regain confidence and trust, the SCAP introduced three major innovations: forward-looking capital ratios under stress (projections), public disclosure of bank-level results, and a credible financial backstop through the US Treasury (Hirtle and Lehnert 2015). The 2009 SCAP was followed and replaced by the Comprehensive Capital Analysis and Review (CCAR) and the Dodd-Frank Act Stress Test (DFAST), which started in 2011 and 2013, respectively, and continue to this day. While the CCAR examines the capital adequacy and capital planning process of large banks,[20] the DFAST requires individual banks to conduct forward-looking stress tests.

Similarly, the Committee of European Banking Supervisors (CEBS) started a forward-looking EU-wide stress test on the aggregate banking system in May 2009 (CEBS 2009). This first EU-wide stress test has been followed by a series of similar exercises, initially carried out by the CEBS and later by its successor, the European Banking Authority (EBA). EU-wide stress tests have largely shared the innovative features introduced by the SCAP; however, there is still no credible EU-wide financial backstop.[21] Probably the most relevant feature from an ethical point of view, however, is the choice between a *top-down* or *bottom-up* approach to supervisory stress testing.[22] The CCAR and DFAST are examples of top-down stress tests, whereas EU-wide stress tests are based on a constrained bottom-up approach.

In top-down stress tests, the required statistical risk models are developed by the central bank or banking authority performing the exercise. In contrast, supervisory stress tests with a

[19] Several researchers have argued that the crisis revealed methodological flaws in the method of calculating regulatory capital ratios; as a result, regulatory capital ratios were no longer credible and were largely discounted by the market (Hirtle and Lehnert 2015, Schuermann 2014, Wall 2014a, 2014b).
[20] Defined as any bank holding company (BHC) with at least USD 50 billion in total consolidated assets.
[21] In addition, the CEBS did not disclose the results of its 2009 stress test at the bank level (only aggregate results); bank-level results of EU-wide stress tests have only been disclosed since 2010.
[22] The remarks in subsection 4.1 on the need for honesty in designing scenarios and selecting appropriate models for portfolio stress tests also apply to supervisory stress tests.

bottom-up approach make use of the internal risk models of the participating banks. Neither approach is free of criticism and the advantages of one approach are the disadvantages of the other. A top-down stress test enables better control over the results and ensures that the participating banks are treated equally and consistently, as a common model is used for all banks. However, a uniform model is necessarily less accurate than bank-specific internal models, which are based on more granular data and better insights into the underlying business. On the other hand, reliance on internal models undermines control over the exercise and makes bottom-up stress tests prone to manipulation. For example, banks could try to downplay the stress test results in order to weaken supervisory response measures (Casellina *et al.* 2020).[23] This is an example of the need for the principles of lawfulness and honesty (Table 2).

As shown above, the top-down approach tends to be ethically less problematic, while the bottom-up approach is an example of a principal-agent problem: the supervisor (principal) instructs the bank (agent) to use its internal models to estimate the impact of a stress scenario on the bank's books and decides on supervisory response measures based on results that are subject to asymmetric information (Casellina *et al.* 2020). In order to reduce the principal-agent problem while preserving the advantages of the bottom-up approach, supervisors try to limit the banks' leeway through detailed methodologies and rules governing a supervisory stress test.

The EBA, for instance, uses a *constrained bottom-up approach* for its EU-wide stress tests (de Guindos 2019). That is, banks must adhere to extensive methodical regulations, including specific constraints. A thorough quality assurance process is designed to ensure that banks are applying the methodology correctly. This includes consistency checks, independent model-based estimates (top-down model challenge), and reliability assessments of the underlying data and assumptions. The quality assurance process was found to cause banks to revise their stress test results before publication (de Guindos 2019). This experience shows that the principles of lawfulness and honesty can guide conduct and help regulate moral behaviour in supervisory stress tests.[24]

[23] For a discussion of the different approaches to supervisory stress testing and the associated incentives, see Quagliariello (2020).

[24] The EBA's dual attempt to oblige banks to a prescribed methodology and to thoroughly monitor compliance with it is also consistent with Borio *et al.* (2014), who mention the cross-checking of model outputs (including bottom-up and top-down contrasts) and the buy-in of all stakeholders as elements of good stress testing practice.

5. Summary

This chapter provides a discussion of ethical issues related to financial stress testing. The discussion is based on a simple normative framework (*i.e.* a set of selected normative principles) that serves as an analytical lens. The normative principles that guide the discussion are based on general considerations about the need and presence of ethics in finance and how ethical issues can be assessed. These principles are: lawfulness, honesty, paternalism, social benefit, and personal benefit.

Prior to the discussion, the basics of financial stress testing are introduced. This includes the concept of stress testing and a historical outline of the origins and development of stress testing in finance. Although all stress tests are subject to a range of ethical questions, different stress test applications are differently well suited for discussing specific ethical issues. Therefore, the discussion of ethical issues in one stress test application is also meaningful for other applications. The need for honesty in model selection is discussed in connection with portfolio stress tests, for example, but it is also important for bottom-up supervisory stress tests.

The ethical discussion is necessarily broad, given the wide scope of the topic and the limited space of this chapter. Basically, the ethical value of financial stress tests is to prevent banks and banking systems from failing, thereby avoiding enormous social and economic costs. The ethical issues discussed in this chapter typically relate to the specific purpose and process of stress test applications.

The discussion shows that stress tests, in order to be effective, have to comply with the methodologies and rules governing them (principle of lawfulness). However, honest behaviour when selecting models and designing stress scenarios is just as important (principle of honesty). The parallel need for lawful and honest behaviour reflects the general tension between rule compliance and moral judgement and is evident in the current debate about rule-based versus principle-based regulation.[25] It should also be noted that the motives and incentives influencing the discussion about the need for honesty reveal an underlying rivalry between social and personal benefit considerations (principles of social and personal benefits). Finally, the example of financial sector stress tests conducted under the FSAP shows the paternalistic aspect of stress testing in the sense of support for those who cannot run stress tests themselves (principle of paternalism). The discussion presented in this chapter does not claim to be

[25] For a more detailed discussion, see Hendry (2013).

complete or definitive; rather it should be viewed as an early attempt to provide insights into the ethical specifics of financial stress testing.

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