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Macroprudential stress testing of credit risk: A practical approach for policy makers☆

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ABSTRACT

Drawing on the lessons from the global financial crisis and especially from its impact on the banking systems of Eastern Europe, the paper proposes a new practical approach to macroprudential stress testing. The proposed approach incorporates: (i) macroeconomic stress scenarios generated from both a country specific statistical model and historical cross-country crises experience; (ii) indirect credit risk due to foreign currency exposures of unhedged borrowers; (iii) varying underwriting practices across banks and their asset classes based on their relative aggressiveness of lending; (iv) higher correlations between the probability of default and the loss given default during stress periods; (v) a negative effect of lending concentration and residual loan maturity on unexpected losses; and (vi) the use of an economic risk weighted capital adequacy ratio as the relevant outcome indicator to measure the resilience of banks to materializing credit risk. The authors apply the proposed approach to a set of Eastern European banks and discuss the results.

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1. Introduction

The financial crisis has revealed the need for better macroprudential oversight and a more appropriate policy response. It is widely accepted in the literature that the contribution of financial sector stability and its maintenance are vital for economic growth. Any disruptions to the functioning of the financial sector due to excessive exposures to risk and financial deleveraging are known to be detrimental to economic growth, resulting in reduced incomes, greater income inequality, reduced employment levels and social unrest. With every financial crisis or disruption of the functioning of the financial system, confidence in such a system and its potential contribution to economic growth can decline. Vigilant prudential monitoring of financial systems that supports informed and timely policy decisions on supervisory interventions and appropriate changes in financial regulation are therefore an important task of any supervisory institution.

The main tool of macroprudential monitoring is regular stress testing of the financial system. Stress testing is particularly important during periods of benign conditions when the memory of past detrimental events has faded out. The development, institutionalization and regular application of stress tests forces financial sector specialists, supervisors and policy makers not to forget past crises and thus enhances macroprudential monitoring and crisis preparedness. Despite the widely recognized importance of conducting stress tests, there appears to be a consensus among macroprudential practitioners that stress tests were not informative enough and did not enforce an adequate policy response prior to the global financial crisis (Haldane, 2009; Čihák, 2007; Turner, 2009; de Larosiére, 2009; Sorge, 2004; Galati and Moessner, 2011). This partial failure of stress tests has led to the development of a new generation of stress testing models based on the lessons learned from the recent crisis (Foglia, 2009; Swinburne, 2007; Breuer et al., 2009; Schechtman and Gaglianone, 2012; Huang et al., 2012).

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It is important that both key macroprudential and microprudential aspects are appropriately incorporated when constructing macroprudential stress tests. This being said, it has to be emphasized that macroprudential stress tests need to capture different features than standard microprudential stress tests which are commonly applied to individual banks. The reason for this is that macroprudential stress tests need to be explicitly linked to changing macroeconomic conditions. They also need to be tractable and easily understood by policy makers who have to be able to detect the main risks to the banking system at various levels of aggregation, i.e., at the individual bank level, the bank group level and at the system level, in order to serve as a useful tool for policy analysis and as a unifying framework for policy debate.

Recent history has shown that credit risk is at the heart of solvency problems in the banking sector, manifesting itself largely through balance sheet and cash flow solvency problems of banks.[2] The objective of this study is to design a credit risk stress testing methodology that can be used for macroprudential monitoring and which reflects on the impact of the global financial crisis on the banking systems of Eastern Europe. Eastern Europe was arguably one of the most heavily affected regions by the spillovers from the global financial crisis (World Bank, 2008). This paper thus develops and illustrates with an empirical application a comprehensive stress-testing framework of credit risk that is flexible, yet still tractable enough to be useful for practical macroprudential monitoring and informative for policy decision-making. The flexibility of the approach is particularly appealing as it allows the stress tester to further develop or replace individual components as modeling technology and data become available. Our proposed approach also introduces, with the use of simple functional forms, new credit risk penalties that incorporate microprudential as well as macroprudential risks, which have often been neglected in existing stress-testing methodologies.

The proposed stress testing methodology produces outcome indicators that account for systemic as well as idiosyncratic economic risks at the level of an individual bank and the banking sector. This is accomplished by integrating the following components into the proposed stress testing methodology. First, we explicitly link non-performing loans to changing macroeconomic conditions by estimating the elasticities of non-performing loans to a set of key macroeconomic variables. This captures the systemic transmission from the macroeconomy to the performance of bank credit portfolios. Second, we construct macroeconomic Stress scenarios in two different ways, where one is based on a country specific macroeconomic model, and the other is computed from historical macroeconomic data of countries that have experienced financial crises in the past. Third, we allow the sensitivity of credit risk to changing macroeconomic conditions to increase during crisis times. Fourth, we approximate the underwriting standards of individual banks by the aggressiveness of their lending in the individual asset classes at the peak of the most recent credit cycle or during the most recent credit boom period, and penalize banks that grew their asset class faster than the average bank. Fifth, we employ a bank and asset class specific penalty linked to the share of unhedged foreign currency lending. Sixth, we build on the results of the study by Moody's (2010) and allow the correlation between the probability of default and the loss given default to increase in times of stress. Seventh, we account for a bank's lending concentration within individual asset classes in the computation of the bank and asset class specific capital charges.[3] These seven components are combined to construct a more relevant outcome indicator for measuring bank resilience to macroeconomic as well as bank specific shocks.

Some of the early stress testing approaches which were intended for use by policy makers, as, for example, that of Čihák (2007), are fundamentally financial simulations where no formal links to the macroeconomy are established. These approaches are still being used by many institutions, especially in emerging market economies, as they are tractable and easily understood by policy makers compared to some of the more data intensive and complex frameworks. In the latter frameworks, the mechanics underlying the model are hidden away and the intuition about the links to and influences from the macroeconomy is non-transparent or unavailable. Currently, there exists a substantial interest in connecting the macroeconomy to the financial sector more formally. This has led practitioners to use regression techniques to more explicitly link non-performing loans, loan loss provisions or probabilities of defaults to macroeconomic fundamentals (Sorge, 2004; Foglia, 2009).

The effect of macroeconomic variables on bank losses has also been analyzed by means of loss distribution simulations, where the joint loss distribution of banks is constructed with Copulas (see Basurto and Goodhart, 2009; OeNB, 2010, among others). Others, such as De Nicolo and Lucchetta (2010) estimate factor models to study the systemic effects of financial stresses. The estimated models are subsequently used for forecasting purposes and to provide early warning signs of possible future financial crises.

Another stream of policy research has focused on accounting for feedback effects from the financial sector to the real economy. This is implemented by designing structural macroeconomic models (and more recently Dynamic Stochastic General Equilibrium models) where a financial sector is explicitly incorporated into the model to capture the systemic effects that the financial sector has on the real economy. The implementation of these models, nonetheless, comes at the cost of having a higher level of aggregation so that the risk profiles of individual banks and their heterogeneous behavior are not studied (Kumhof et al., 2010; Christiano et al., 2010).

While retaining tractability, our methodology attempts to improve on existing approaches in the literature by linking the financial sector explicitly to the macroeconomy and accounting for both systemic risk factors due to changing macroeconomic conditions as well as for idiosyncratic risk factors due to the diverse lending practices and risk profiles of individual banks. It should be emphasized that each component of the proposed stress testing framework presently constitutes a separate research agenda in the literature. The objective of the proposed methodology is thus not to improve on current frontier models of the individual components, but rather to provide policy makers and practitioners with an integrated, flexible and policy relevant tool that can be readily implemented. We illustrate the usefulness of the proposed methodology for policy decision making with an empirical application to a set of Eastern European banks and an ensuing discussion of the results in regards to their potential implications for supervisors.

The remainder of the paper is structured as follows. Section 2 gives a conceptual outline of the proposed stress testing methodology. Section 3 discusses the generation of the macroeconomic scenarios. Section 4 shows how that the systemic and idiosyncratic risk factors are constructed. Section 5 describes the computation

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[2] This should not, however, diminish the importance of appropriately integrating stress tests for any of the idiosyncratic risks that banks face in their operations in addition to credit risks. In that regard, the interplay between credit risk and liquidity risk is especially important.

[3] We handle the effect of maturity transformations on capital charges similarly to the approach in Basel II and leave the individualized computation of the average maturity of liabilities (funding) for future research.

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