Journal of Financial Stability 16 (2015) 13–30

Contents lists available at ScienceDirect

Journal of Financial Stability

journal homepage: www.elsevier.com/locate/jfstabil

Optimal versus realized bank credit risk and monetary policy☆

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ARTICLE INFO

Article history:
Received 2 May 2014
Received in revised form 28 August 2014
Accepted 13 November 2014
Available online 20 November 2014

JEL classification:
G21
E5
C13
G01

Keywords:
Banks
Optimal credit risk
Profit maximization
Monetary policy

ABSTRACT

Standard banking theory suggests that there exists an optimal level of credit risk that yields maximum bank profit. We identify the optimal level of risk-weighted assets that maximizes banks' returns in the full sample of US banks over the period 1996–2011. We find that this optimal level is cyclical for the average bank, being higher than the realized credit risk in relatively stable periods with high profit opportunities for banks but quickly decreasing below the realized in periods of turmoil. We place this cyclicality into the nexus between bank risk and monetary policy. We show that a contractionary monetary policy in stable periods, where the optimal credit risk is higher than the realized credit risk, increases the gap between them. An increase in this gap also comes as a result of an expansionary monetary policy in bad economic periods, where the realized risk is higher than the optimal risk.

1. Introduction

Bank managers make risky decisions about the transformation of liabilities to assets so as to produce profits. However, they can also produce large losses if they take on too much risk or if structural and macroeconomic conditions change unexpectedly.[1] This implies that the risk–return relationship is nonlinear and that there should be an optimal level of credit risk. Further, the inherent maturity mismatch between the asset and liability sides of the bank balance sheet causes a problem of time inconsistency: banks might alter their optimal risk decisions in different times. Despite the fundamental role of this idea in any theoretical model of bank risk and default, the empirical literature has largely neglected distinguishing between the realized and optimal (equilibrium) credit risk for the average bank and over time. Thus, the important implications of this distinction for the monetary and macroeconomic environment have not been studied. In this paper, we aim to fill this gap in the literature.

Theoretical models of the banking firm operating under adverse selection, moral hazard, and/or incomplete contracting assume that banks choose between risky and less risky assets and manage liabilities to maximize their value or profits (e.g., John et al., 2000; Agur and Demertzis, 2012). Thus, banks make optimal decisions in light of the variable microeconomic problems they face, mostly related to informational asymmetry, and the regulatory and macroeconomic conditions. In this framework, equilibrium bank behavior can be compared and endogenized with optimality conditions for other agents (e.g., consumers or regulators) to study more general equilibrium relationships.

In practice, however, the realized level of credit risk is not equal to the optimal one in the short term. There can be many interrelated reasons for this discrepancy and three of them seem to be the most important ones. First, banks, like any other firm, can simply be inefficient and operate below capacity. In this sense, banks may fail to choose the optimal mix or level of risky assets, a situation exacerbated during periods of rising uncertainty (e.g., Berger et al., 1993). Second, the banking sector is notoriously characterized by herding behavior, which is usually pegged to the choices of

☆ We thank Iftekhar Hasan (editor), two anonymous referees, and the participants of the 3rd International Conference of the Financial Engineering and Banking Society for helpful comments.

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[1] In a recent paper Agur and Demertzis (2012) model a bank manager's investment decision as a choice between two projects, one of which has lower expected return and higher volatility than the other.

http://dx.doi.org/10.1016/j.jfs.2014.11.004
1572-3089/

leading banks or to the changing perceptions about the regulatory and macroeconomic environment. The history of banking crises has shown that herding behavior can be an important element in suboptimal risk decisions of banks in both good and bad economic periods (e.g., Acharya and Yorulmazer, 2007). Third, and perhaps most important, the maturity mismatch between assets and liabilities that is inherent in the banking business implies that the quality of bank balance sheets can quickly deteriorate in light of adverse developments due to depositor behavior in a classic Diamond and Dybvig (1983) framework, credit rationing *á la* Stiglitz and Weiss (1981), and other well-established mechanisms. Thus, banks can find themselves in situations where in good times they take on less than the optimal credit risk, while in bad times they are exposed to higher than the optimal risk. The outcome of both these states is lower than optimal returns.

We identify deviations between the realized and optimal bank credit risk using a simple empirical setup. We assume that bank profits depend on the risk decisions of bank managers and bank managers want to maximize returns on assets (or returns on equity if there is no principal agent problem). To do so, they seek the optimal level of credit risk. If bank managers decide to take on too little credit risk and hold a large share of liquid assets in their portfolios, bank profits will not be maximized. Bank returns will also be suboptimal if bank managers take on too much credit risk, leading for example to the accumulation of a high volume of nonperforming loans. Thus, profit as a function of risk may be described better by an inverted U-shaped curve.

Another important element of this setup is that the level of optimal credit risk must be time-varying. For instance, consider the situation in the period 2001–2007. Perceptions about the stability of the banking system were really optimistic and credit risk decisions were paying high yields. This implies that the optimal bank credit risk is relatively high during prosperous periods. When the housing bubble burst, banks found themselves exposed to very risky positions that started yielding losses because of the surging nonperforming loans. Furthermore, bank managers could not adjust the level of credit risk in the very short term, mainly because of issues related to maturity mismatch. Thus, in periods of stress, the optimal credit risk should be lower than the actual credit risk held in the portfolio of the average bank.

Using quarterly panel data for virtually all banks that operated in the United States (US) during the period 1996–2011, we identify the time-varying optimal level of credit risk mainly in terms of the ratio of risk-weighted assets to total assets. We indeed find a cyclical movement of the optimal level of credit risk for the average bank, which peaks just before the eruption of the crisis in 2006. The optimal credit risk quickly deteriorates from 2007 onward and this leaves banks with a higher than optimal credit risk in the crisis period. This explicitly shows how the deviations between the realized and optimal credit risk, owing to the three main channels highlighted above, leave the average bank operating in a suboptimal way.

These deviations have interesting implications for the monetary and the macroeconomic environment. A recent literature examines the interplay between banks' risk, monetary policy, and macroeconomic outcomes, suggesting that a monetary expansion leads banks to take on higher risks (e.g., Ioannidou et al., 2014; Delis et al., 2011). Our analysis is not about identifying the potency of this mechanism, which is termed the risk-taking channel of monetary policy. Instead, we opt for identifying a relation between the macroeconomic and monetary conditions, and the deviations between the optimal and the realized actual risk in bank portfolios. To this end, we use a vector error correction model (VECM) and time-series data on the federal funds rate and the median risk-weighted assets of US banks. We show that the optimal monetary policy from a macroeconomic viewpoint increases the deviations between the realized and optimal credit of banks, thus pushing banks to a suboptimal disequilibrium situation. In line with our result, Agur and Demertzis (2013) use a relevant theoretical model and show that because bank risk is sticky, monetary policy should keep rate cuts short to prevent excessive risk buildup.

Specifically, in good economic periods, the Fed has incentives to increase the interest rates. In these periods, where the optimal level of banks' credit risk is higher than the realized risk, we show that a monetary contraction will not only decrease the realized credit risk (in line with the existence of a risk-taking channel) but also increase the optimal level of credit risk. Similarly, in periods of turmoil in the banking sector, where the optimal level of banks' credit risk is lower than the realized risk, we show that a monetary expansion will increase the realized credit risk and decrease the optimal level of credit risk. Therefore, in both good and bad periods, the "optimal" monetary policy choices by the Fed aiming at smoothing the business cycle, force the realized level of banks' credit risk out of equilibrium. We contend that this finding has important policy implications for both the conduct of monetary policy and the prudential regulation of banks.

The rest of the paper proceeds as follows. Section 2 describes the empirical model used to estimate the optimal level of credit risk on the basis of specific theoretical considerations. Section 3 discusses the data set and the estimation method. Section 4 presents the empirical results from the estimation of the optimal credit risk. Section 5 examines the macroeconomic relations between the optimal level of credit risk, the realized credit risk, and the monetary conditions. Section 6 concludes the paper.

2. Identification of the optimal credit risk

2.1. Profitability equation and risky assets

Most theoretical studies model the banking firm as a wealth- or profit-maximizing entity. The premise is that banks use a set of inputs to invest in risky assets with a high return and in less risky assets with a low return (e.g., John et al., 2000). The bank is also required to hold a fair amount of reserves with the central bank, as well as capital to absorb losses. Thus, the basic banking model can consider the presence of reserve requirements, capital regulation, or other forms of intervention. The bank decides on the optimal allocation of resources of high- and low-risk assets given its budget constraint and the "safe and sound" banking constraint posed by the regulator (e.g., Kim and Santomero, 1988). One can also think that the bank has its own soundness constraint if its decision is to maximize wealth or profits subject to minimizing the probability of default. This relates to the notion of the market discipline of the banking firm (e.g., Flannery and Sorescu, 1996).

Hughes and Mester (1994, 1998) provide an influential empirical counterpart of this theoretical framework. The first of these studies tests whether bank managers are acting in the shareholders' interest and maximizing expected profits or a utility function that trades off risk for return. The findings rule in favor of the trade-off between profit and risk. The second study shows that in a similar model of the banking firm, banks of different size classes exhibit behavior consistent with risk aversion.

This basic modeling of the banking firm yields a profit equation of the form (or similar to):

$$\Pi = p_1 y_1 + p_2 y_2 + p_3 y_3 - C\left(\sum_{n=1}^{3} y, w\right) - p_k K \quad (1)$$

In this profit function, y_1 is the quantity of the risky asset (credit risk), which earns an average interest rate p_1. The interest rate on the risk-free asset y_2 is p_2 and $p_3 y_3$ is the revenue from other