



# Capital regulation with heterogeneous banks – Unintended consequences of a too strict leverage ratio<sup>☆</sup>

Andreas Barth<sup>a,\*</sup>, Christian Seckinger<sup>b</sup>

<sup>a</sup> Goethe University Frankfurt, House of Finance, Theodor-W.-Adorno-Platz 3, Frankfurt am Main 60323, Germany

<sup>b</sup> Landesbank Baden-Wuerttemberg, Am Hauptbahnhof 2, Stuttgart 70173, Germany



## ARTICLE INFO

### Article history:

Received 4 February 2015

Accepted 9 January 2018

Available online 31 January 2018

### Keywords:

Leverage ratio

Bank regulation

Risk-taking

Financial stability

## ABSTRACT

We provide an equilibrium analysis of potential consequences from the introduction of a binding leverage ratio, as proposed in Basel III. If banks differ in their monitoring skills and their ability to successfully complete a risky investment project, a tighter leverage ratio does not only mitigate moral hazard arising from limited liability, but also carries an unintended consequence: high-quality banks are not allowed to absorb the entire supply of debt if it is too costly to issue new equity. This increases the market share of low-skilled bankers and decreases the average ability of operating banks. We further show that rising heterogeneity in the banking sector increases this negative effect.

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## 1. Introduction

In recent years, hardly any issue has been discussed as extensively as the appropriate amount of bank equity. Addressing excessive credit growth and leverage, the [European Systemic Risk Board \(2014\)](#), for example, issued a handbook on operationalizing macroprudential policy in the banking sector with one key instrument being the leverage ratio as a non-risk-weighted capital requirement. As part of Basel III, this concept gained a lot of attention and is expected to be implemented as a regulatory tool in addition to traditional risk-sensitive minimum capital requirements from 2018 onwards. Most public arguments as well as academic literature regarding tighter capital requirements refer to a lending

restriction,<sup>1</sup> and little is said about potential effects on the quality of the banking sector beyond moral hazard.

We provide, with an allocation effect, a novel mechanism that shows how the financial sector could be adversely affected by a binding, non-risk-weighted leverage ratio as long as various frictions making capital costly are not removed. In a world where banks differ in their ability to find good investment projects, higher capital requirements, while mitigating moral hazard and improving the quality of bank lending decisions, reduce the average quality of the banking sector: banks who are best able to find good investment projects are not allowed to absorb the entire supply of debt when issuing new equity is too costly, thereby encouraging less capable banks to gain some market share.

More precisely, we develop a theoretical setup closely related to the work of [Morrison and White \(2005\)](#) with a continuum of individuals that are heterogeneous with respect to an unobservable ability to successfully complete investment projects. These agents can invest their initial endowment in a risky project or deposit it with another individual. We refer to *banks* as borrowing agents that take deposits and invest in risky projects, and we refer to lending agents as *depositors*. It turns out that agents with a high

<sup>☆</sup> We thank Geert Bekaert (the editor), an anonymous referee, Iñaki Aldasoro, Monika Bucher, Christian Eufinger, Hans Gersbach, Rainer Haselmann, Florian Hett, Christian Laux, Lars Norden, Magdalena Pisa, Jean-Charles Rochet, Felix Rutkowski, Eva Schliephake, Alexander Schmidt, Isabel Schnabel, Iryna Stewen, Johannes Tischer, Tobias Waldenmaier, Laurent Weill, and Jochen Werth for valuable comments and suggestions. We also benefited from comments by participants of the 2014 Annual Meeting of the VfS, the 2014 Annual Meeting of the RES, the 17th SGF Conference, the 2013 Conference of Journal of Financial Stability, the Third Workshop on Financial Market Imperfections and Macroeconomic Performance of the Deutsche Forschungsgemeinschaft, the 3rd Workshop Banks and Financial Markets at University Augsburg, the 2nd Research Workshop in Financial Economics at JGU Mainz, the Summer Institute at GSEFM Frankfurt, and the Brown Bag Seminar at JGU Mainz. Financial support from Deutsche Forschungsgemeinschaft through SPP 1578 (Barth) and Frankfurter Institut für Risikomanagement und Regulierung (Seckinger) is gratefully acknowledged.

\* Corresponding author.

E-mail addresses: [andreas.barth@finance.uni-frankfurt.de](mailto:andreas.barth@finance.uni-frankfurt.de) (A. Barth), [Christian.Seckinger@LBBW.de](mailto:Christian.Seckinger@LBBW.de) (C. Seckinger).

<sup>1</sup> For example, in 2009, Ackermann, former CEO of Deutsche Bank, stated in an interview that “more equity might increase the stability of banks. At the same time however, it would restrict their ability to provide loans to the rest of the economy,” see [Ackermann \(2009\)](#). On the other hand, [Admati et al. \(2011\)](#) point out that the common arguments against too much equity are either fallacies, irrelevant facts, or even myths. In particular, they argue that higher capital requirements do not force banks to reduce lending activities since higher regulatory equity does not require banks to set capital aside or to hold additional reserves.

success probability decide endogenously to invest in a risky investment project, and individuals with a low success probability prefer to lend their funds to 'better' individuals. The deposit market with an endogenously determined interest rate serves as an instrument to transfer the funding resources and thus tries to balance demand and supply. In order to illustrate the impact of various levels of capital requirements on the size and the riskiness of the banking sector, we assume a regulator that implements a leverage ratio. We show that an increase in the regulatory capital adequacy implies three effects: first, as we assume that the established banks cannot raise new equity, the decrease in the demand for debt and the excess supply, *ceteris paribus*, lowers the deposit rate, which implies a lower return for *depositing*. Due to the decrease in the deposit rate, some former depositors find it now more profitable to run a bank by themselves. Since these agents unambiguously have a lower ability than the already existing banks, the average quality in the banking sector deteriorates, which, *ceteris paribus*, increases the average riskiness of banks. Second, there is a decrease in moral hazard in the sense of Jensen and Meckling (1976) as a direct effect. Banks have more 'skin in the game' and therefore, choose a lower project risk. Finally, the drop in the interest rate on debt weakens further moral hazard of banks as it incentivizes banks again to choose a lower project risk. Hence, the overall effect of regulatory changes on aggregate project risk is ambiguous.

The implications of our model are applicable in many contexts, as for example, with respect to the interbank market. Assuming that banks use the interbank market not only to absorb liquidity shocks and to fulfill minimum reserve requirements, but also to provide and obtain funding for longer term projects, the simple redistribution of resources from less able banks to more able banks depicts a welfare-improving function of the interbank market.<sup>2</sup> However, a tighter leverage ratio intensifies our allocation effect and limits the scale to which this redistribution can take place: less able banks are not allowed to lend the collected deposits on the interbank market to more able banks, which encourages them to invest these funds on their own.

The present paper can also be seen as a complement to current contributions focusing on the relation between shadow banking and capital regulation, as for example Plantin (2015) or Harris et al. (2014), and is similar to the model of Bernanke and Gertler (1985).<sup>3</sup> We do not model any intermediation outside the regulated banking industry and thus do not consider regulatory arbitrage. Nonetheless, the result of our paper that the banking sector is reduced in favor of agents with a lower ability to run successfully investment projects can be understood as a substitution between banks and shadow banks.

Our model further allows for a discussion of the allocation problem regarding the heterogeneity in the banking system. It can be shown that the degree of heterogeneity plays a crucial role in determining the strength of the allocation effect. More precisely, the positive effects of specialization can be exploited to a greater degree with a large leverage than under tighter regulation, such that the average ability of banks deteriorates as the dispersion in the individuals' ability to invest becomes larger.

The present paper adds to the literature on the impact of banking regulation on bank behavior. Many theoretical papers discuss partial equilibrium effects of whether tighter capital requirements

incentivize banks to increase their asset risk. This literature, however, is largely inconclusive, and the direction of the effect depends strongly on the assumptions.<sup>4</sup>

Interestingly, the empirical literature, too, provides conflicting answers on the question of how capital regulation works with regard to risk-taking: Shrieves and Dahl (1992), Aggarwal and Jacques (2001), and Rime (2001) find that asset risk is higher when banking regulation is tight, while Jacques and Nigro (1997) obtain lower risk levels in response to an increase in banks' capital requirements. Our paper features this mixed evidence with a novel allocation effect, countervailing to the well-known moral hazard effect. It remains a future exercise to reinvestigate empirically the relation between capital regulation and bank risk in the light of differences in the relative strengths of both effects for various degrees of heterogeneity within the banking sector and a distinctive auditing ability of the regulator.

This paper differs from the theoretical work above because we do not focus on partial equilibrium; rather we emphasize a general equilibrium as it has been done in a lengthy but still ongoing debate. Bernanke and Gertler (1985), for example, suggest that banking regulation of interest ceilings on deposits are not justified while regulation of capital requirements is useful. While both implications are also part of our model, we argue that the usage of the useful instrument of capital adequacies could feed back on deposit rates and thus induce an unintended effect corresponding to the one of interest rate ceilings. Not only do interest ceilings on deposits generate our novel allocation effect, but capital requirements are enough to introduce this effect.

Similar to Gorton and Winton (1995), our paper features the result that a social welfare-maximizing regulator should allow risky banks to operate. The reason for obtaining this result, however, differs substantially: our paper argues that the regulator must balance moral hazard and a proper allocation of capital, while Gorton and Winton (1995) argue that the regulator should use capital requirements to balance bank riskiness and bank market exits, which involve the loss of their charter value. Therefore, our allocation effect serves as an additional explanation to the charter value argument in Gorton and Winton (1995) about why too restrictive capital requirements might be harmful for the economy.

With an emphasis on systemic risk, the analysis by Feess and Hege (2012) concludes that the optimal system of capital requirements may adopt differentiated requirements for banks. If the regulator cannot observe the true portfolio risk, sophisticated banks will suffer from a similar moral hazard problem as banks in our model do. However, as long as the regulator can perfectly verify the true portfolio risk, sophisticated banks are allowed to grow larger by demanding lower capital requirements, while unsophisticated banks remain small and should concentrate the risky assets in their portfolios.

Also referring to systemic risk, Martinez-Miera and Suarez (2014) describe in a dynamic general equilibrium model both an intended and an unintended consequence of capital regulation. On the one hand, capital requirements can reduce incentives to take on systemic risk due to a 'last bank standing' effect, but on the other hand it comes at the cost of reducing credit and output in calm times. We thus provide a different channel for both an intended and an unintended effect of capital regulation than Martinez-Miera and Suarez (2014).

<sup>2</sup> In 2014, the share of interbank loans with a maturity of more than 5 years within Germany amounts to more than 50% of total interbank loans, see Deutsche Bundesbank (2015).

<sup>3</sup> Bernanke and Gertler (1985) describe a disintermediation process caused by a restriction of bank deposit rates "as it occurs in the U.S. in 1966, 1973, etc.". The allocation effect in our model provides an explanation for a reduction of the banking sector in favor of the shadow banking sector without putting an exogenous restriction on the deposit rate and thus, aims to explain the 'disintermediation process' for a broader set of countries.

<sup>4</sup> See, for example, the work of Koehn and Santomero (1980), Kim and Santomero (1988), Rochet (1992), Gennotte and Pyle (1991), Blum (1999), Hakenes and Schnabel (2011) for different channels of how stricter capital requirements may increase banks' risk-taking, and, *inter alia*, Furlong and Keeley (1989) and Hellmann et al. (2000) for the opposing result. See also VanHoose (2007) for a detailed review of the literature on bank capital regulation.

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