



Equilibrium risk shifting and interest rate in an opaque financial system



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ABSTRACT

We analyse the risk-taking behaviour of heterogeneous intermediaries that are protected by limited liability and choose both their amount of leverage and the risk exposure of their portfolio. Due to the opacity of the financial sector, outside providers of funds cannot distinguish “prudent” intermediaries from those “imprudent” ones that voluntarily hold high-risk portfolios and expose themselves to the risk of bankruptcy. We show how the number of imprudent intermediaries is determined in equilibrium jointly with the interest rate, and how both ultimately depend on the cross-sectional distribution of intermediaries’ capital. One implication of our analysis is that an exogenous increase in the supply of funds to the intermediary sector lowers interest rates and raises the number of imprudent intermediaries. Another one is that easy financing may lead an increasing number of intermediaries to gamble for resurrection following a bad shock to the sector’s capital, again raising economywide systemic risk.

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1. Introduction

The ongoing worldwide financial and economic crisis has rejuvenated the interest in systemic risk in the financial system, its dramatic spill over to the real economy and whether and how it should be addressed by public policies. We contribute to this debate with an analysis of the risk taking behaviour of financial intermediaries that are protected by limited liability and may deliberately choose a level of risk in excess of the social optimum. We show how the level of economywide risk taking depends on the distribution of equity among intermediaries and the level of interest rate in the economy.

Our key assumption is that outside providers of funds cannot tell apart “prudent” and well diversified banks from “imprudent” ones overly exposed to one particular asset, because the balance sheets of individual intermediaries are imperfectly observable, or *opaque*. This assumption is consistent with the view of several commentators of the crisis including Brunnermeier (2009), Acharya and Richardson (2009), and Dubecq et al. (2009). In the decade prior to the crisis, risk transfer instruments, which have reached a very large scale in the U.S., have increased the opacity of banks’ leverage and risk-taking incentives (Acharya and Schnabl, 2009). First, regulatory loopholes allowed banks to evade capital requirements by securitising assets and providing (unregulated) liquidity support to “shadow” (i.e., off-balance-sheet) entities (Acharya

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and Richardson, 2009). Second, the financial sector as a whole effectively repurchased much of the senior tranches of structured products, whose payoff distributions was particularly difficult to assess (see, e.g., Coval et al., 2009). Third, some banks actively relied on “window dressing” to manipulate leverage figures – by selling asset before the books releases to repurchase them at a later date (see, e.g., The Financial Crisis Inquiry Commission, 2011). Last but not least, this opacity may have taken the form of shadow subsidiaries that were used to absorb poorly performing assets, as was revealed by the investigation on Lehman's bankruptcy. While the opacity of the financial sector may have reached unprecedented levels during the run-up to the crisis and the crisis itself, it has long been recognised as a key issue in that industry and one of the fundamental reasons for why it should be regulated. For example, Morgan (2002) shows that bond raters disagree significantly more about U.S. financial intermediaries than they do over other firms, and interprets this result as evidence that banks are intrinsically more opaque – essentially because their assets are difficult to observe and change at a fast pace.¹ This feature of the industry severely limits the ability of outsiders (investors and rating agencies alike) to assess changes in bank's capital structure in real time.

When intermediaries' balance sheets are opaque, those intermediaries with relatively low levels of capital may be tempted to hold high-risk portfolios, or even to gamble for resurrection in the face of worsening economic conditions. In our model, intermediaries' limited liability creates incentives to increase leverage and hold insufficiently diversified portfolios, which raise intermediaries' return on equity in case of success while transferring much of their losses to their creditors in case of failure. This tendency, however, is alleviated by the inside equity stake of intermediaries' shareholders, which disciplines risk-taking and thereby limits leverage and favours portfolio diversification. We show that this trade-off gives rise to an endogenous sorting of intermediaries along the equity dimension, with well capitalised intermediaries holding diversified portfolios and keeping a limited level of leverage (that is, behaving prudently), while poorly capitalised ones heavily resort to leverage and invest in correlated assets (i.e., behaving imprudently). Opacity implies that the former are not readily distinguishable from the latter, so that risk-prone behaviour may prosper without being immediately sanctioned by higher borrowing rates.

One property of our model is that the proportion of imprudent intermediaries and, therefore, the level of systemic risk in the financial system, crucially depend on both the cross-sectional distribution of capital and the prevailing interest rate. The endogenous determination of the number of imprudent intermediaries jointly with the interest rate is our key contribution. Equipped with this joint equilibrium outcome, we analyse the impact on the interest rate and the number of imprudent intermediaries of two exogenous aggregate shocks: a *lending boom* that shifts the loan supply curve rightwards; and an *equity squeeze* that shifts the distribution of banks' capital leftwards. As we show, the downward pressure on the equilibrium interest rate that follows the lending boom raises the number of imprudent intermediaries and hence the level of economywide risk shifting (the *risk-taking channel* of low interest rates). This mechanism is consistent with the recent microeconomic evidence on the risk-taking channel, which suggests that low interest rates tend favour bank risk-taking. For example Jimenez et al. (2011) present direct evidence that falling short-term interest rates systematically favour risk-taking by Spanish banks, especially those at the lower end of the capital distribution. Relatedly, Ioannidou et al. (2009) identify the exogenous impact of interest rate on bank risk taking by looking at dollarised Bolivia (1999–2003), and find that low interest rates were associated with the granting of loans with a higher probability of default, granted to low-rated borrowers, and commanding lower spreads. Altunbas et al. (2010) and Adrian and Shin (2009) focus on banks operating in the U.S. and Europe and point out to the same relationship between interest rates and bank risk taking. As far as we are aware, our paper is the first to offer a theoretical model wherein falling interest rates cause banks to choose riskier portfolios.

Finally, our model predicts that an equity squeeze (that is, a reduction in the overall equity level of the banking sector after a bad aggregate shock) also raises risk taking when the supply of funds is sufficiently elastic, due to a form of “gambling for resurrection” behaviour. Arguably, both shocks occurred in the run-up to the current crisis. In the first half of the 2000s, capital inflows from China and oil-exporting countries into the U.S. and the accommodative monetary policy of the Fed both contributed to keep the yield curve low. Second, the tightening of U.S. monetary policy in 2004 and the rise in delinquency rates on subprime mortgages from 2006 onwards may have deteriorated the equity position of exposed intermediaries and thereby favoured gambling strategies.²

In our model, systemic risk in the financial sector arises from the interaction between (i) intermediaries' limited liability and option to default (the *risk shifting problem*); (ii) their incentive to correlate their risk exposure (the *endogenous correlation problem*); and (iii) the difficulty for outside lenders to discriminate individual institutions on the basis of their true net worth level (the *opacity problem*). While our model is the first to explicitly connect these three dimensions, we build on many contributions that have studied each of them separately. Our modelling of the risk shifting problem closely follows Allen and Gale (2000) and Acharya (2009), who show that limited liability leads financial institutions to overweight

¹ See also Iannotta (2006) for similar evidence about European banks, and Flannery et al. (2010) on the increase in the opacity of U.S. banks during the crisis. A simple empirical investigation, presented in the separate technical appendix to the paper, confirms on a sample of 77 French banks that banks' capital to asset ratios are difficult to forecast accurately at the one-quarter horizon. First, the average standard deviation of these ratios between 1993Q2 and 2009Q1 is 4.42%. Second, standard autoregressive forecasting models are characterised by fairly large standard errors, 1.43% on average. The standard error of these forecasting models is greater than 1% for 36% of the banks, and greater than 3% for 17% of the banks. Such a large uncertainty about the one-quarter ahead values of individual bank capital to asset ratios is remarkable.

² Landier et al. (2010) provide direct evidence of this behaviour for New Century Financial Corporation, a major subprime originator prior to its bankruptcy in 2007.

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