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# Deposits and bank capital structure ☆

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ABSTRACT

In a model with bankruptcy costs and segmented deposit and equity markets, we endogenize the cost of equity and deposit finance for banks. Despite risk neutrality, equity capital earns a higher expected return than direct investment in risky assets. Banks hold positive capital to reduce bankruptcy costs, but there is a role for capital regulation when deposits are insured. Banks could no longer use capital when they lend to firms instead of investing directly in risky assets. This depends on whether the firms are public and compete with banks for equity capital or are private with exogenous amounts of capital.

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## 1. Introduction

A growing literature exists on the role of equity in bank capital structure focusing on equity as a buffer, liquidity, agency costs, and various other frictions.[1] One important feature of these analyses is that they involve partial equilibrium models in which equity capital for banks is usually assumed to be a more expensive form of financing than deposits.[2] Although theoretical foundations for this assumption are in the literature (e.g., Myers and Majluf, 1984, or Bolton and Freixas, 2006), many papers have

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[1] See, e.g., Diamond and Rajan (2000), Hellmann, Murdock, and Stiglitz (2000), Gale (2004), Repullo (2004), Morrison and White (2005), Allen, Carletti, and Marquez (2011), and Acharya, Mehran, and Thakor (2012).

[2] See also Berger, Herring, and Szego (1995) and the survey by Gorton and Winton (2003) for a discussion of this issue.

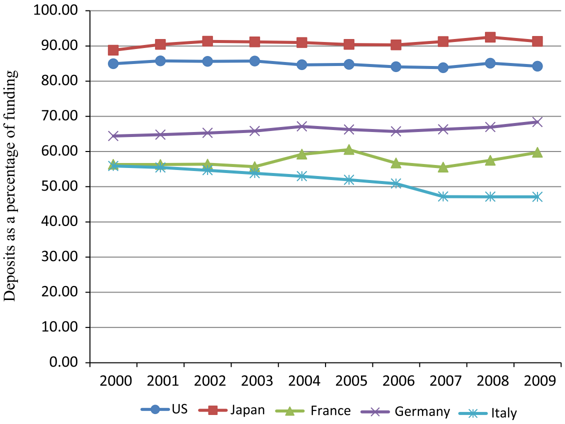

**Fig. 1.** The relative importance of customer deposit funding for banks. The figure plots (Customer deposits/(Capital and reserves+Borrowing from the central bank+Customer deposits+Bonds)) in percent for the years 2000–2009.
*Source*: Organization for Economic Co-operation and Development and Japanese Bankers Association.

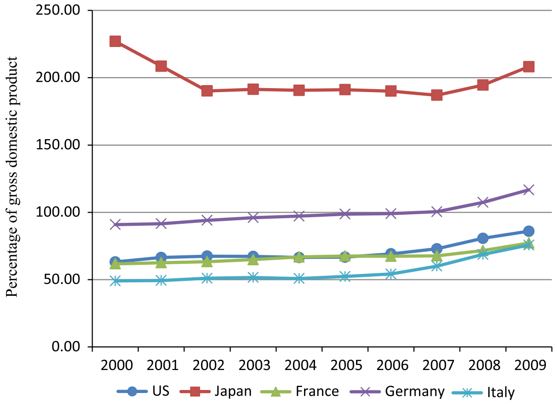

**Fig. 2.** The importance of deposit funding for banks relative to gross domestic product in percent for the years 2000–2009. Data source is World Bank Financial Development and Structure Dataset. Cihak, Demigurc-Kunt, Feyen, and Levine (2012) contains a description of the data.

questioned whether this assumption is justified in the banking system. Risky equity usually has a higher expected return than debt but, as in Modigliani and Miller (1958), this does not necessarily mean that it is more costly on a risk-adjusted basis (e.g., Miller, 1995; Brealey, 2006; Admati, DeMarzo, Hellwig, and Pfleiderer, 2010). Moreover, the cost of equity capital should vary with bank capital structure rather than being assumed to be fixed and invariant to it.

To address these issues in more depth, we develop a general equilibrium model of bank and firm financing based on two main elements. First, unlike nonfinancial firms, banks raise funds using deposits, which are special in that the market for deposits is segmented from that of equity. Second, banks and firms incur bankruptcy costs when they fail. Our aim is to determine the optimal bank and firm capital structures and the implications of these for the pricing of equity, deposits, and loans.

Although the role of deposits has varied over time, they remain an important source of funds for banks in all countries. Fig. 1 shows deposits as a proportion of bank liabilities for a number of countries from 1990 to 2009. In all these countries, deposits are the major form of bank finance. Deposits also play an important role in the aggregate funding structure of the economy, as shown in Fig. 2, where the ratio between deposits and gross domestic product in the period 1990 to 2009 is illustrated.

Several papers in the theory of bank funding have shown that deposits are often the optimal form of funding for banks (e.g., Diamond and Dybvig, 1983; Diamond, 1984, and many thereafter). In doing so, this literature tends to treat deposits simply as another form of debt.[3] However, considerable evidence shows that the market for deposits is significantly segmented from other markets. While most people in developed countries have bank accounts, with the exception of the US and a few other countries, the household finance literature finds that relatively few people own stocks, bonds, or other types of financial assets either directly or indirectly (see, e.g., Guiso, Haliassos, and Jappelli, 2002; Guiso and Sodini, 2013). The lack of participation in markets for risky financial assets, and in particular for equity, is known as the participation puzzle. The usual explanation is that there are fixed costs of participation. In addition to deposits held by households, considerable amounts are held in this form by businesses. These amounts are held for transaction purposes and reserves. In most cases, there are limited substitution possibilities with other assets, particularly equity.

The other important foundation of our analysis is the significance of bankruptcy costs. Considerable empirical evidence shows that these are substantial for both banks and nonfinancial firms. For example, James (1991) finds that when banks are liquidated, bankruptcy costs are 30 cents on the dollar. In a sample of nonfinancial firms, Andrade and Kaplan (1998) and Korteweg (2010) find a range of 10% to 23% for the ex post bankruptcy costs and 15% to 30% for firms in or near bankruptcy, respectively. A number of issues arise with the measurement of bankruptcy costs that suggest they are in fact higher than these estimates (see, e.g., Almeida and Philippon, 2007; Acharya, Bharath, and Srinivasan, 2007; Glover, forthcoming).

We start our analysis with a simple model in which banks finance themselves with equity capital and (uninsured) deposits and invest in risky assets.[4] The providers of equity capital can invest directly in the risky assets, while the providers of deposits have only a storage alternative opportunity with a return of one. For simplicity, both groups are risk neutral. There is a fixed supply of equity capital and deposits in the economy.

Several results hold provided that there are positive bankruptcy costs. First, as argued by Modigliani and Miller (1958),

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[3] For an exception, see Song and Thakor (2007). They show that core deposits are an attractive funding source for informationally opaque relationship loans.

[4] The case in which banks invest directly in risky assets captures the idea that banks invest in a line of business with a risky income such as market making, underwriting, proprietary trading, or fees from advisory services such as mergers and acquisitions.

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