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## Journal of Financial Stability

journal homepage: [www.elsevier.com/locate/jfstabil](http://www.elsevier.com/locate/jfstabil)



# On the independence of assets and liabilities: Evidence from U.S. commercial banks, 1990–2005

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### ARTICLE INFO

#### Article history:

Received 13 August 2007

Received in revised form 21 March 2008

Accepted 14 April 2008

Available online 29 April 2008

#### JEL classification:

G21

G32

#### Keywords:

Asset–liability management

Canonical correlation

Commercial banks

Deregulation

Technological change

### ABSTRACT

Traditional asset–liability management techniques limit banks' abilities to structure their balance sheets—but more recently, financial innovations have allowed banks the chance to manage interest rate risk without constraining their asset–liability choices. Using canonical correlation analysis, we examine how the relationships between asset and liability accounts at U.S. commercial banks changed between 1990 and 2005. Importantly, we show that asset–liability linkages are weaker for banks that are intensive users of risk-mitigation strategies such as interest rate swaps and adjustable loans. Perhaps surprisingly, we find that asset–liability linkages are stronger at large banks than at small banks, although these size-based differences have diminished over time, both because of increased asset–liability linkages at small banks and decreased linkages at large banks.

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## 1. Introduction

The savings and loan crisis of the 1970s and 1980s was the largest financial disruption in the United States since the Great Depression of the 1930s, and stood as the largest financial disruption in the United States until the subprime lending crisis of 2007–2008. While the crisis unfolded in several increasingly complicated stages and took over a decade to run its course, the initial cause of the crisis was quite simple: savings and loans (or thrifts) funded long-term fixed rate mortgage loans with short-term certificates of deposit and demandable deposit accounts. Under normal credit market conditions

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– that is, an upward sloping yield curve – this maturity mismatch was quite profitable, but it left thrifts vulnerable to interest rate risk. When U.S. interest rates spiked in the late 1970s thrifts' cost of funds also spiked, resulting in negative interest margins which – coupled with capital losses from discounted loan sales, loan defaults in markets with falling real estate values, and imprudent risk-taking by thrift owner-managers desperate to generate profits – consumed the equity capital of hundreds upon hundreds of thrift institutions. Over a thousand thrifts became insolvent, with the ensuing bailout of the government safety net costing U.S. taxpayers approximately \$125 billion.

The thrift crisis was a wake-up call to U.S. banks and thrifts underscoring the importance of asset-liability management (ALM) for mitigating interest rate risk. In its most simple form, ALM requires banks to select a liability structure that matches the expected maturity or duration of their existing assets, thus immunizing bank earnings from interest rate movements. More recently, a variety of developments have allowed banks to mitigate interest rate risk without having to practice this strict form of ALM. Financial innovations such as interest rate derivatives, adjustable rate loans, and asset securitization have expanded the methods banks can use to manage interest rate risk both on and off the balance sheet, and have reduced the costs of doing so. Geographic deregulation has allowed banks of all sizes to grow larger, providing a wider set of investment and funding options for small banks and allowing mid-sized banks easier access to off-balance sheet risk-management tools and tactics. Expansion into non-traditional banking services securities brokerage and insurance sales, as well as a general shift away from portfolio lending and toward securitized lending and contingent credit contracts, have generated streams of off-balance sheet income which, in some cases, has reduced banks' reliance on interest-based income and lessened the importance of asset-liability mismatch to their overall risk positions.

Because these developments have arguably reduced the need for banks to practice strict ALM, the composition of banks' assets and liabilities should have become measurably more independent over the past two decades. We ask and attempt to answer two basic questions related to the development and application of these potential risk-mitigation tools: have bank assets and liabilities become measurably more independent over time? And if so, is the application of interest rate derivatives, adjustable rate loans, and other off-balance sheet tools empirically associated with increased asset-liability independence? While conventional wisdom suggests that the answer to both of these questions is "yes," we are not aware of any systematic empirical investigation of these phenomena.

We apply canonical correlation analysis to balance sheet data for U.S. commercial banks between 1990 and 2005. Although canonical correlation analysis is seldom used in financial or banking research, it is a most appropriate tool for our purposes. Developed by Hotelling (1935, 1936), canonical correlation is a multivariate version of the familiar linear correlation analysis—more exactly, linear correlation is a special case of canonical correlation analysis in which the two vectors being examined each contain just a single variable. The technique measures the degree to which one set of correlated variables (say, the portfolio of loans, investments, and other assets held by banks) is useful for explaining the variance in another set of correlated variables (say, the mix of liabilities and equity capital used to fund bank assets). As such, the technique captures – in a single, summary measure – the essence of traditional asset-liability management: whether the maturity mix of banks' liability accounts reflects the maturity mix of banks' asset accounts. Moreover, the technique also identifies the most important underlying relationships between and among the individual elements in the two vectors, which allows us to infer which assets banks tend to match with which liabilities in the course of performing ALM. Finally, canonical correlation imposes no structure on the data and makes no assumptions about the causal direction between the two vectors; this flexibility is essential for our experiment, since some commercial banks have strong deposit franchises and search for profitable lending opportunities, while other commercial banks have strong lending programs and must search for funding.

We have four main findings. First, we find that the strength of asset-liability linkages is positively related on average to bank size. This is a surprising result, as one may easily have expected that small banks would be the stalwart practitioners of on-balance sheet ALM. This result (a) suggests that small size and local geographic focus impart a granularity to individual loans and an inflexibility to deposit mix, both of which constrain on-balance sheet ALM and (b) offers an explanation for the relatively low levels of financial leverage typically found at small banks, i.e., these banks hold extra capital against risk they cannot otherwise hedge on the balance sheet.

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