The Economic Journal, doi: 10.1111/j.1468-0297.2010.02383.x. © The Author(s). Journal compilation © Royal Economic Society 2010. Published by Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

Technical Appendix to

FINANCIAL (IN)STABILITY, SUPERVISION AND LIQUIDITY INJECTIONS: A DYNAMIC GENERAL EQUILIBRIUM APPROACH

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Economic Journal, doi: 10.1111/j.1468-0297.2010.02383.x

Appendix A. Real Data

A.1. *Computation and Sources*

We use real quarterly US data from 1985Q1 to 2008Q2. Nominal data are deflated by the GDP deflator (stock and flow data) or the CPI (financial data and interest rates). More precisely:

- Interbank loans: include all loans and advances to credit institutions, Fed funds and RPs with banks, repayable on demand or with agreed maturity. Data are obtained from the quarterly aggregated and seasonally adjusted balance sheet of commercial banks in the US. *Source*: Federal Reserve System statistics.
- Market book: includes treasury and agency securities and other fixed and variables securities. Data are obtained from the quarterly aggregated and seasonally adjusted balance sheet of commercial banks in the US. *Source*: Federal Reserve System statistics.
- Loans to firms: includes commercial and industrial loans and real estate loans for commercial activities. Data are obtained from the quarterly aggregated and seasonally adjusted balance sheet of commercial banks in the US. *Source*: Federal Reserve System statistics.
- Others (assets): defined as the difference between total assets and the sum of market book, interbank loans and loans to firms.
- Interbank deposits: includes all borrowings from banks. Data are obtained from the quarterly aggregated and seasonally adjusted balance sheet of commercial banks in the US. *Source*: Federal Reserve System statistics.
- Consumer deposits: includes transaction and non-transaction deposits. Data are obtained from the quarterly aggregated and seasonally adjusted balance sheet of commercial banks in the US. *Source*: Federal Reserve System statistics.
- Own funds: defined as subscribed capital plus reserves including past profits bring forward. Because of the lack of data on these components, own funds are approximated by the gap (residual) between total assets and liabilities. *Source*: Federal Reserve System statistics.
- Profits: quadratic interpolation of commercial bank annual profits data, published by the Federal Deposit Insurance Corporation (FDIC), Table CB 04.

- Others (liabilities): data are obtained from the quarterly aggregated and seasonally adjusted balance sheet of commercial banks in the US. *Source*: Federal Reserve System statistics.
- Deposit rate: quarterly average of monthly interest rates on certificate deposits (non-transaction deposits) minus 100 basis points. *Source*: Federal Reserve System statistics, series H 15. This adjustment is justified by the existence of transaction deposits (as checkable deposits or savings deposits) paying lower or even zero interest rates. The size of this adjustment is chosen from the monthly survey of FRBSF regarding the interest rates on deposits and loans.
- Interbank rate: quarterly average of daily data on London interbank offered rate for US dollar. *Source*: Bloomberg, series US0003M.
- Borrowing rate: quarterly average of monthly interest rates on bank prime loans plus 150 basis points. *Source*: Federal Reserve System statistics, series H 15. This adjustment is justified by the existence of borrowers riskier than prime ones. The size of this adjustment is chosen from the monthly survey of FRBSF regarding the interest rates on deposits and loans.
- Default rate for banks (Z-score, see Appendix B for details): calculated from aggregated and seasonally adjusted balance sheet of commercial banks in the US (Federal Reserve System) and interpolated annual profit (FDIC).
- Default rate for banks (BLS): quarterly and seasonally adjusted number of closings (*source*: BLS, series financial activities, 1992-2008) divided by the number of financial institutions (quadratic interpolation of yearly data, *source*: US courts).
- Default rate for banks (FDIC): own computation of quarterly and seasonally adjusted number of commercial bank failures (based on declared date of bank failure, seasonally adjusted with Census X12, *source*: FDIC) divided by the number of commercial banks (quadratic interpolation of yearly data, *source*: FDIC).
- Default rate for firms (US courts): ratio of the quarterly number companies failure (seasonally adjusted with Census X12, *source*: US courts) to the total number of firms (quadratic interpolation of yearly data, *source*: US courts).
- Default rate for firms (BLS): quarterly and seasonally adjusted number of closings (*source*: BLS, series total private industry, 1992-2008) divided by the total number of firms (quadratic interpolation of yearly data, *source*: US courts).
- Default rate for firms (bad loans): ratio of commercial loan charge-off for all banks to total of commercial loans. *Source*: Federal Reserve Bank of St. Louis, seasonally adjusted quarterly data.
- Investment: seasonally adjusted quarterly real private fixed investment. *Source*: Bureau of Economic Analysis.
- Consumption: seasonally adjusted quarterly real private consumption. *Source*: Bureau of Economic Analysis.
- Gross Domestic Product: seasonally adjusted quarterly real gross domestic product. *Source*: Bureau of Economic Analysis.

A.2. *Banks Balance Sheet*

Figure A.1 depicts an aggregate balance sheet for the US banking sector (average 1985Q1–2008Q2).

Appendix B. Z-score: An Application to US Bank Default

The Z-score index is a distance to default indicator (DD) calculated from bank's balance sheet and profit account, rather than an option-based measure as the standard DD indicator. The

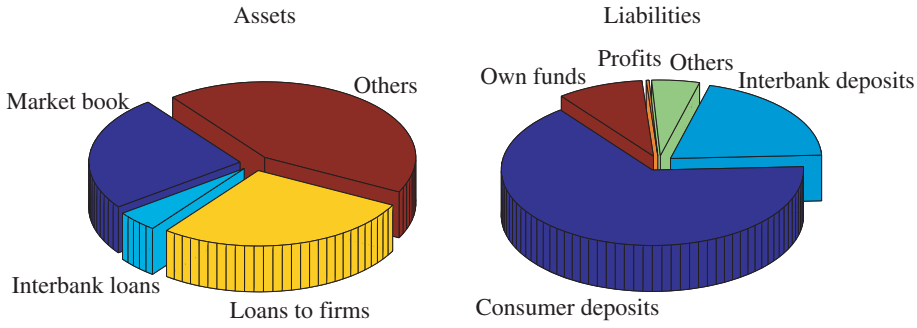

Fig. A1. *Aggregate Balance Sheet of US Banks* (average 1985Q1–2008Q2)

advantage of the Z-score (book value) relative to DD (market value) is the ability to evaluate the default risk of non listed companies.

The Z-score is defined as $z = (\mu+k)/\sigma$, where μ is the average return on assets (ROA), k is the ratio of own funds to total assets, and σ is the ROA standard deviation. In other words, the Z-score measures the number of standard deviations a return realisation would have to fall within in order to deplete banks' own funds, under the assumption of normality of returns. As with DD, the higher level of the Z-score the better the quality of the bank and the lower its probability of insolvency.

In this article, we derive the Z-score for the US aggregated banking sector from quarterly financial statements. The sample period covers 1985Q1 to 2008Q2. We adopt the Maechler *et al.* (2007) approach and use an eight-quarter rolling Z-index calculated from the 8 quarter moving average of the three above mentioned variables. We then take the logarithm of the result to get z.

As the Z-score is, by assumption, normally distributed with a mean zero and a standard deviation equal 1, the probability of default of the banking sector at time t is $P_t = F(-z_t)$, where F is the cumulative normal distribution.