Do Banks have an Edge?

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ABSTRACT

We decompose bank activities into passive and active components and evaluate the performance of the active components of the bank business model by controlling for passive maturity transformation strategies that can be executed in the capital market. We find that (1) unlevered bank assets underperform passive portfolios of maturity-matched US Treasury bonds after paying corporate taxes, (2) the cost advantage of bank deposits appears to have disappeared since 1986, (3) bank equities have CAPM betas near one, while passive maturity transformation strategies have CAPM betas near zero, and (4) portfolios of bank equities underperform portfolios designed to passively mimic their economic exposures. The very strong investment performance of passive maturity transformation strategies over this period may mask the underperformance of the specialized bank activities.

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This paper evaluates the performance of the aggregate banking sector from the competitive markets perspective developed in Black (1975), Fama (1985), Merton (1989, 1990, 1993), and Merton and Bodie (1993, 1995). The basic premise is that banks compete with other intermediaries in the market for financial services, specializing in the lending and deposit-taking segments of this market. For specialized bank activities, customers accept below (or pay above) market rates, presumably covering the frictional costs that lead to specialization, including costs associated with complying with government regulations. For non-specialized bank activities, customers are likely to receive or pay market rates. Bank activities embed economic exposures that are accessible to a passive investor in the capital market, providing an opportunity cost of capital for bank investments. Specialization and imperfect competition may allow banks to earn returns higher than their opportunity cost of capital, while poor execution may lead to lower returns (Black (1975)).

Fama (1985) argues that since banks are required to invest in non-interest bearing cash reserves in order to engage in deposit-taking, efficiency requires that they must have an edge elsewhere in their business model to overcome this frictional cost. Moreover, since bank time deposits compete directly with capital market alternatives and because non-loan investments are sourced from the capital market, their potential edge is likely to be in transactable deposit accounts and in their loan portfolio. The comparison to capital market investment alternatives highlights an additional frictional cost that banks must overcome, namely corporate taxes. As corporations, banks pay corporate taxes on their investment income, while capital market investment vehicles like mutual funds allow for the pass-through of investment income without incurring a corporate tax liability (Han, Park, and Pennacchi (2015)). Efficiency requires the banking edge to overcome this structural disadvantage as well.

We perform a simple benchmarking exercise based on the reported holdings of the aggregate banking sector, whereby we compare each component of the balance sheet to a maturity and credit matched capital market portfolio. The comparison of pre-expense returns to capital market returns allows us to determine where the edge in banking is and to measure its size. Consistent with the competitive markets perspective, we find that non-loan investments – presumably sourced in the capital market – earn returns that are nearly identical to maturity-matched UST bond portfolios *before* expenses and taxes. Additionally, we find that the aggregate bank loan portfolio earns a pre-expense credit risk premium that is about 1% higher than an equivalent capital market portfolio, again *before* taxes. Consistent with Fama (1985), we find that bank depositors forgo market returns on transaction deposits, but not for any other deposit product. For example, transactable accounts offer interest rates that average 2% less than the short-term riskfree rate, while six-month certificates of deposits essentially offer the six-month capital market riskfree rate. This effectively limits the scope for a bank funding advantage to around 40% of total funding. Non-deposit bank debt is priced similarly to other capital market debt, while banking services earn outsized returns before accounting for operating expenses.

The analysis suggests that the pre-expense edge comes from a relatively small portion of the total bank balance sheet and generates excess profits equivalent to 3.3% of total assets each year. In the aggregate, banks spend 3.4% in operating expenses, such that the aggregate pre-tax edge is essentially 0%. However, banks pay 30% of their net profits in corporate taxes, while a capital market investor does not pay corporate taxes on investment income held in a mutual fund or other past-through investment vehicle. Interestingly, bank stocks trade at market to book equity multiples that typically exceed 1, while open-end mutual funds typically trade at their net asset value (i.e. market-to-book ratio of 1), suggesting that the market expects a positive after-tax edge relative to capital markets in bank profits.

As capital markets have developed, the ability of an investor to diversify across a broad set of risks at low cost has expanded considerably and these exposures can typically be maintained in investment vehicles that allow for the pass-through of investment income without paying corporate taxes. Our bottoms-up benchmarking exercise effectively provides a mapping of bank activities into capital market exposures. A bank equity investor can own these exposures either through the equity of the bank operating structure or through capital market vehicles. After accounting for trading costs, borrowing costs, and taxes, the relative pricing of these two forms of bank-like exposures should be similar.

We construct a bank-like mutual fund, reflecting estimates of capital market trading costs, borrowing costs, and taxes, and compare the risk and return properties to a portfolio of bank equities. We show that the net cash flows associated with these two portfolios are quite similar, but the traded equity risks and returns are very different. Regressions of excess returns of bank stock portfolios on the Capital Asset Pricing Model (CAPM) (Sharpe (1964) and Lintner (1965)) show that bank equities trade very much like other stocks, with CAPM betas just over 1, high R-squares, and zero CAPM alpha. Including bond market factors related to the interest rate term structure (TERM) and credit risk (CREDIT) suggest that bank stocks have virtually no exposure to these risks. In contrast, the bottom-up construction of exposures suggests that bank equities are essentially levered bond portfolios with these factors being their primary risks. The bank-like mutual fund has a CAPM beta of 0.5 and an economically large CAPM alpha.

It is interesting that bank equity returns show little exposure to interest rate term structure factors because passive maturity transformation strategies that can be executed in the capital market have performed extremely well since 1981 (see Fama (2006)). This allows bank equity investors to not recognize and control for the strong investment performance of passive maturity transformation strategies, suggesting one possibility for how investors may perceive bank equities to be covering their CAPM cost of capital, while significantly underperforming a more comprehensive opportunity cost of capital that recognizes their net interest rate exposure.

We explore the possibility that banks effectively hedge CREDIT and TERM exposure, but it is difficult to identify a plausible mechanism. Effective hedging can come from explicit hedging like credit default swaps and interest rate swaps or through implicit hedging through the deposit edge increasing enough to offset the value decline in assets associated with an interest rate increase. Explicit hedging should be easy to identify through large trading losses, offsetting the reliably positive credit and term structure risk premia that have been realized over our sample, but we do not observe this. Implicit hedging is most likely through transaction deposit accounts, as time deposits accounts trade similarly to maturity-matched US Treasury bonds. Treating transaction deposits as effectively longer-term debt produces a time series pattern in benchmark returns that fits poorly relative to a benchmark that treats these accounts as short-term debt since the deposit rates reset frequently. Alternatively, it could be that market segmentation in the equity market allows investors to fail to notice the effectiveness of the mapping of bank activities into capital market exposures that we illustrate.

An investor who does notice the economic similarity in exposures would face significant limits to arbitrage if they were to engage in a long-short trade (Shleifer and Vishny (1997)). However, a long-term investor who swaps the bank-like mutual fund for bank stocks within their broader portfolio would experience meaningfully improved investment returns. The empirical results provide considerable support for the notion that banks, in aggregate, do not have an edge in any of their activities before taxes and consequently are disadvantaged relative to capital market alternatives after taxes. This puts pressure on the assumption of efficiency. A potential consequence of this interpretation is that there is too much banking -- because banks have had access to cheap equity capital, they have perhaps overinvested (Stein (2003)).

This paper is organized as follows. Section 1 describes the data. Section 2 summarizes the investment properties of US Treasury bond portfolios. Section 3 evaluates bank asset returns by asset class. Section 4 evaluates the relative costs of various bank funding types. Section 5 develops an empirical mapping of bank activities into capital market exposures and evaluates bank equity risk and return properties relative to a bank-like mutual fund portfolio. Section 6 concludes the paper.

I. Data Description

We use aggregate data on FDIC insured commercial and savings banks in the United States from the FDIC Historical Statistics on Banking (HSOB). These data are reported at an annual frequency from 1934 through 2017, and include information on the number of institutions and some detail on their structure, as well as financial data from income statements and balance sheets.

We use detailed bank-level data sourced from quarterly regulatory filings of bank holding companies (BHC) collected by the Federal Reserve in form FR Y-9C.[1] These data begin in 1986, but many important variables only become available in 1996. To obtain additional information on the maturity composition of bank balance sheets we link each BHC to its commercial banks that file forms FFIEC 031 and FFIEC 041 each quarter. We focus on the BHCs because they are more likely to be publicly traded, allowing us to examine stock market returns and valuations.

We use stock market data, including returns and market capitalization of publicly traded BHCs, from the Center for Research in Security Prices (CRSP). The Federal Reserve provides a table for linking the bank regulatory data with CRSP. We also use a variety of additional capital market data on US Treasury (UST) bonds, US corporate bond indices, and passive bond index

[1] A detailed description of our sample selection is in the Appendix.

portfolios available to retail investors through Vanguard. We obtain monthly yields on UST for various maturities from the Federal Reserve, monthly returns on the value-weighted stock market and the one-month US Treasury bill, as calculated by Ken French and available on his website, as well as returns on a short-term investment grade corporate bond fund (VFSTX) and an intermediate term high yield fund (VWEHX). Both funds are available from Vanguard and available monthly since 1982 and 1979, respectively. To calculate various bank debt alternatives, we use daily effective Federal Funds rates (converted to a monthly frequency) published by the Federal Reserve H.15 release, monthly yields on the BofA Merrill Lynch US Corporate AA bond index for different maturities, monthly secondary market rates on 6-month Certificates of Deposits (CDs) from the Federal Reserve (H.15) available since 1964, and quotes for 6-month CDs by banks from RateWatch since 1997.

II. Investment Properties of US Treasury Portfolios

The aggregate bank balance sheet is primarily comprised of bond-like assets and liabilities. Approximately 90% of the aggregate bank asset portfolio is interest earning assets, funded with around 80% of deposits and interest paying debt. This investment structure is commonly referred to as maturity transformation, whereby short-term debt claims are issued against portfolios of longer-term bonds. A maturity transformation strategy exposes the investor, or the equity claim, to an interest rate term risk. The simplest version of this strategy is free of credit risk on the asset leg of the trade, and nearly free of credit risk after levering the underlying interest rate exposure, so long as the leverage remains modest relative to aggressively stress-tested price fluctuations. Central to our empirical investigation will be a comparison of accounting-based returns to the various components of the bank balance sheet to the returns on maturity-matched US Treasury bond portfolios.

Investments in UST bond portfolios have performed remarkably well for the past 35 years. Fama (2006) argues and provides empirical evidence that the behavior of US interest rates appears to exhibit a persistent pattern in the post-WWII period, relative to what was likely expected *ex ante*. He writes, “the long up and down swing in the spot rate [1-year UST yield] during 1952-2004 is largely the result of permanent shocks to the long-term expected spot rate that are on balance positive to mid-1981 and negative thereafter.” The consequences for a maturity transformation strategy are economically meaningful. In particular, the investment leg of the strategy is consistently priced to earn more than turns out to be required to protect against the possibility of future interest rate increases. Therefore, the investor in intermediate-term US Treasury bonds both earns a term premium if the short-term riskfree rate of interest remains constant (yield on 5-year bond minus yield on 1-month bond) and realizes the persistent unexpected benefit of lower short-term interest rates, which has the effect of persistently increasing the value of the inventory of bonds in the portfolio, while ongoing funding costs persistently decline.

Given the centrality of maturity transformation to many banking activities, it is useful to characterize the risk and return properties of the components to passive capital market maturity transformation over our sample period, 1960-2016. The key to banks having an advantage in their distinctive activities beyond simple maturity transformation is that they will do better than this passive strategy.

A. The Historical Returns to Investing in US Treasury Bonds

As a first step to understanding the returns to maturity transformation, we examine the excess returns to a capital market version of this strategy. Specifically, we analyze the returns to a passive investment strategy that each month simply purchases an *h*-year US Treasury (UST) bond, where $h \in \{2, 4, 6, 8\}$, and holds it until maturity. Thus, each month the portfolio has an inventory of bonds with an average maturity of $h/2$. Following Fama (2006), we bifurcate our sample into pre and post June 1981, sub-samples. Bond returns are calculated based on monthly yields to maturity (YTM) reported by the Federal Reserve. Our calculation requires that each month we have a term structure of YTMs with monthly increments, which we estimate by linearly extrapolating between values reported at fixed maturities.

Figure 1 displays the time series of YTMs for the 5-year and 1-month UST securities, showing the steady rise and then decline in the level of interest rates turning in mid-1981. Additionally, the figure shows that the *gap* between yields, the so-called 5-year term spread, oscillates regularly around zero, averaging an annualized 0.13% in the pre-1981 period, while in the post-1981 period, the gap is consistently positive, averaging an annualized 0.85%. This pattern in interest rates has a significant consequence for a common bank performance metric called the net interest margin. By continuously investing in medium-term assets, each period banks earn the average of the historical medium-term interest rate, and since they finance this investment largely with short-term debt, each period they pay the short-term interest rate. The panels on the right of Figure 1 display the rolling five-year average rate on the five-year UST along with the one-month UST yield (top) and the resulting net interest margin (bottom), calculated as the difference in these interest rates. As the figure makes clear, the net interest margin benefits from both the large term spread and the steady decline in interest rates since mid-1981. The figure also highlights how the large unexpected increase in interest rates around 1980, leads to a multi-year negative net interest margin.

Table 1 reports CAPM-style regressions explaining the excess returns to the UST bond portfolios with the excess returns of the value-weight stock market, using both monthly and quarterly returns. Panel A reports results from the earlier sub-period, 1960 through mid-1981.

The slope coefficients are reliably positive, although economically small, ranging from 0.03 to 0.11, while the intercepts are virtually all indistinguishable from zero. The regression intercepts measure the average unearned return, given the required aggregate market risk premium, and are commonly called “alpha.” Since the CAPM risk model does not explicitly require a risk premium for the potential variation in interest rates that will affect the value of medium-term bonds (i.e. a term structure risk premium) the mean of such a risk premium will be included in the intercept. Consequently, we can think of the intercept as an estimate of the mean of the realized term structure risk premium. We report annualized alphas in percent. Panel B reports regressions from the recent sub-period, mid-1981 through 2017. The slope coefficients (or market betas) are economically small and statistically indistinguishable from zero with quarterly returns, while marginally statistically significant with monthly returns. The alphas are statistically and economically large. For example, the bond portfolio with an average maturity of 2-years earns 2% per year more than was required according to the CAPM risk-adjustment. The estimated alphas are all statistically significant and are monotonically increasing in portfolio maturity over the range considered, highlighting the excellent investment performance of passive maturity transformation strategies since mid-1981.

B. Comparing Accounting-based Returns to Market-based Returns

An empirical evaluation of bank asset returns requires us to adjust the accounting-based values and returns to make them comparable to market values and returns. The primary concern with comparisons of accounting values for bank assets (and liabilities) with the market values and returns associated with capital market substitutes is that the accounting rules allow for many asset values to remain at par value, while market values fluctuate based on changing economic conditions and investors’ assessments of these conditions. Our approach to this challenge is to measure and report the market values of our capital market replicating portfolios, but to also apply a simple hold-to-maturity accounting rule to these portfolios, such that the accounting values and returns should be more directly comparable. Specifically, we calculate an accounting value (or book value (BV)) of the portfolio using the standard capital accumulation rule, BV(t+1) = BV(t) + interest income – purchases + proceeds, where purchases and proceeds are measured at market transaction value and interest income is earned periodically according to the bond coupon terms. This results in the portfolio book value ignoring the effects of fluctuating interest rates on the market values of the bonds in the portfolio, implicitly assuming that their values equal par.

We first illustrate the economically important transformation of returns that hold-to-maturity accounting applies to passive US Treasury bond portfolios. Specifically, for passive strategies that each month invest in *h*-period bonds and hold them to maturity, where $h \in \{2, 4, 6, 8\}$. We calculate both the current market value and the hold-to-maturity accounting value of the portfolio each month from 1960 through 2016. From the time series of portfolio values we calculate both monthly and quarterly returns and drawdowns, with drawdowns defined as the percentage change in the current value from its previous maximum value. Figure 2 displays the time series plots of these returns and drawdowns under both market-based and accounting-based valuation schemes. The figure shows that the deviations between market and accounting returns increase with the maturity of the bonds in the portfolio. The portfolio that buys-and-holds 2-year bonds, and therefore has an average bond maturity of 1 year, has economically small deviations between market and accounting returns. However, as the average maturity increases to 4 years, return deviations between accounting schemes become economically meaningful. For example, risk assessments based on accounting returns would suggest that there is no risk to any of these portfolios, as every quarterly return is positive leading to no drawdowns, while market returns to the longer maturity bond portfolio reveal significant risk with a minimum drawdown of -9.6% that would completely exhaust the equity of a portfolio levered 10.4x with short-term riskfree debt (i.e. assets =100, equity = 9.6).

III. The Relative Investment Performance of Bank Assets

A. Measurement of Bank Asset Maturities

To determine the maturity properties of bank assets, we use granular information about the composition of bank level assets and their reported maturity distribution available since 1997. Bank assets are comprised of cash, securities, trading assets, various types of classified loans (e.g. business loans, mortgages, consumer loans), and other unclassified assets. In this sample, most cash earns interest. Interest bearing assets (IBA) account for 88% of total assets. On average, interest earning cash, securities, and trading assets together account for approximately 42% of IBA and classified loans account for the remaining 58%. Figure 3 displays the quarterly asset composition of total assets (Panel A) and as shares of IBA (Panel B).

We have detailed maturity information for IBA. Banks are required to report the remaining maturity on their assets for fixed interest rate contracts by reporting the amount of time remaining from the date of the filing (FR-Y-9C or equivalent) until the final contractual maturity of the instruments. For floating rate contracts, banks report the amount of time between the date of the filing and the next repricing date or the contractual maturity, whichever is earlier. Therefore, the reported maturities measure the period over which interest rates are contractually fixed, as opposed to the notional maturity of the asset. Figure 3 also displays the reported quarterly maturity distributions for securities and loans, and our estimates for total interest bearing assets. To estimate the maturity distribution for assets, we assume (1) specific maturities for the maturity categories reported for securities and loans and (2) specific maturities for cash and other unclassified assets. The following table shows our maturity assumptions for the reported categories:

Reported Maturity Category	<3mo	3mo-1yr	1yr-3yr	3yr-5yr	5yr-15yr	>15yr
Assumed Maturity in Months	1	7	24	48	120	180

We assume that cash and Federal Funds sold have a maturity of one-month (maturity category 1). Additionally, we assume that the unclassified other assets have a maturity of one-month (maturity category 1). This allows us to estimate the maturity distribution for total assets. For the benchmark portfolio, we model this maturity distribution as a weighted average of shortest-term maturity and the average maturity (long-term average maturity) across the remaining categories. This distinction between cash-equivalents and longer maturity bonds is motivated by empirical evidence that suggests that the very short-end of the yield curve is considerably lower than the adjacent maturities would predict.

The bottom-right panel of Figure 3 displays the average short-term (or cash-equivalent) share of assets (left axis) asset maturity and the long-term average maturity (right axis). Aggregate interest bearing assets have a fairly stable share of cash-equivalent assets, averaging 51.5%, with the remaining 48.5% invested in assets with an average maturity of 7.2 years.

B. Allocating Operating Expenses

An empirical evaluation of bank asset returns requires us to allocate a share of operating expenses to the asset-based banking activities with the remaining clearly being allocated to the liability-based activities. Table 2 reports some summary statistics on bank operating expenses and our assumptions about how these are allocated across various bank activities. Operating expenses for banks are large, averaging 3.3% of assets each year from 1997 to 2017, for the aggregate banking sector and being fairly similar across bank size categories. We assume that operating expenses are associated with the loan, deposit, and non-investment service activities in proportion to the size of each activity's asset base. The spirit of the calculation is that each side of the bank balance sheet represents a component of the business model, so we view the total bank activity denominator to be 2 times assets, and estimate the service activities component as 2 times assets less loans less deposits. This results in an annual expense ratio of 1.9% for bank loans, an annual operating cost of deposits averaging 1.7%, and a pre-tax profit margin of 28% on banking services. These expense ratios are economically large and will have a meaningful effect on returns. While the specific allocations are uncertain, it is clear that the sum these expenses were incurred. We also examine the robustness of inferences with different assumptions.

C. Bank Returns by Asset Category

The underlying premise is that the bank assets that have nearly perfect substitutes in the capital market will earn market returns before corporate taxes, while bank loans may be sufficiently distinct from other capital market securities that they are advantaged. Therefore, we bifurcate interest bearing assets into loans and bank investments, where bank investments include interest earning cash, securities, and trading assets. We calculate bank returns by asset type based on income statement information for each asset type and balance sheet values. The returns are calculated as the ratio of sums across banks, and therefore represent value-weighted portfolio returns. The return on investments and loans are calculated as follows:

$$Return\ on\ Investments_t = \frac{InvestmentInterest_t + Gains(Losses)on\ Securities_t}{Investments_{t-1}}, \qquad (1)$$

$$Return\ on\ Loans_t = \frac{LoanInterest_t - LossProvision_t - loanOPEX_t}{Loans_{t-1}}\ . \qquad (2)$$

We assume that there are no overhead charges associated with managing the investment portfolio. Within each bank size category, we determine the appropriate maturity distribution for each asset type and calculate the returns to a passive buy-and-hold UST strategy with an equivalent cash share and similar average longer-term maturity, and then apply hold-to-maturity accounting to this portfolio series to compare to the bank asset returns. The results of these calculations are summarized in Table 3.

In the aggregate, investments account for just over 40% of interest bearing assets. Bank investments include 58% cash-equivalent securities with the remaining investments having an average maturity of 9 years. The average pre-tax bank investment return from 1997 to 2017 for the aggregate banking sector is 3.75%, while a maturity-matched UST portfolio earned 3.87%, consistent with the competitive capital markets perspective. Smaller banks have considerably less cash-equivalents, and therefore a higher average maturity overall, but earn roughly the same return on their investments as larger banks. Due to the larger allocation to longer-term investments, a UST portfolio matched to the maturity of smaller banks earns considerably higher returns over this period, averaging over 5%, leading smaller banks to have investments that reliably underperform this benchmark by a full 1% per year.

Loans account for nearly 60% of interest bearing assets for the aggregate banking sector, ranging from 72% for smaller banks to 49% for the largest banks. We estimate that loan expense ratios average 1.9% and are fairly similar across bank size categories. A large portion of bank loans are floating rate contracts, which we consider to have a cash-equivalent maturity. The aggregate loan portfolio is composed of 46% cash-equivalents with the remaining 54% of loans having an average maturity of 6.2 years. The bank loan return reflects the credit losses realized over the sample. We calculate loss rates as the provision for loan losses divided by the gross loan balance. The average loss rates are monotonically increasing across bank size categories, ranging from 0.6% for the smallest banks to 1.3% for the largest banks. The average annual loan loss rate for the aggregate loan portfolio is 1.1%. The average aggregate bank loan return, after operating expenses, but before corporate taxes, is 3.63%, while a maturity-matched UST portfolio earns 3.82%.

The comparison between bank loan returns and UST portfolio returns ignores that loan losses tend to occur in poor economic states when a dollar is most valuable (Arrow (1964) and Debreu (1959)). Consequently, in addition to earning the term premium available in US Treasury bonds and covering the expected losses, capital market investors would also expect to earn a credit risk premium to compensate for the pain of when losses tend to occur. We estimate a crude proxy for the appropriate credit risk premium by matching the realized loan loss rates to a portfolio of corporate bonds. Specifically, we choose the portfolio weights for a combination of investment grade (IG) and speculative grade (HY) corporate bonds to realize similar average loss rates, relying on Moody's corporate loss rates. To match the mean loan loss rate for the aggregate loan portfolio, one could invest in a simple portfolio comprised of 58% IG and 42% HY. We estimate the realized credit risk premium available in the capital market using Vanguard mutual funds.[2] The capital market credit risk premium for a portfolio that matches the mean loss rate for the aggregate bank loan portfolio averages 0.74% per year. This implies that the aggregate pre-tax bank loan portfolio reliably underperforms a capital market equivalent benchmark by nearly 1% per year. This is surprising, as the bank loan activity is one of the more likely sources of a bank edge over capital markets. It is possible that we have allocated too large a portion of the operating expenses to this activity and also that some of the net income

[2] In particular, we calculate the IG credit risk premium as the mean difference in returns between the short-term investment grade bond index fund (VFSTX) and the short-term US Treasury bond index fund (VFISX) and the HY credit risk premium as the mean difference in returns between the intermediate-term speculative grade bond index fund (VWEHX) and the intermediate-term US Treasury bond index fund (VFITX).

generated from non-investment services should be allocated to this activity as they may not be feasible on their own. We investigate both of these possibilities in subsequent sections.

The final panel of Table 2 reports results for aggregate interest bearing assets both before and after corporate taxes. The pre-tax return on IBA is calculated by summing the numerators and denominators in equations (1) and (2). We also calculate an *unlevered* return on investable assets by removing the effects of financing to isolate the net income earned on asset-based activities. Specifically, we calculate the return on book assets in quarter *t* as in equation (3), based on the ratio of sums across firms to represent a value weighted average, and assuming an effective corporate tax rate of 0.3.[3]

$$pretax\ ROA_t = \frac{NI_t + Tax_t + InterestExpense_t + depositOPEX_t - depositIncome_t}{Unlevered\ Assets_{t-1}}, \tag{3.a}$$

$$aftertax\ ROA_t = \frac{NI_t + (1-\tau_{corp})[InterestExpense_t + depositOPEX_t - depositIncome_t]}{Unlevered\ Assets_{t-1}}, \tag{3.b}$$

where *NI* is net income, depositIncome is fees charged on deposit accounts, interest expense includes total interest paid on deposits and interest paying debt, unlevered assets are total book assets less non-interest cash, and τ_{corp} is the effective corporate tax rate. Note that we are effectively shrinking the bank balance sheet by subtracting non-interest cash from both assets and, in subsequent analyses, deposits to effectively allocate the foregone interest on cash reserves to the deposit-taking activity.[4]

Consistent with the earlier results on investments and loans, the mean pre-tax return on IBA essentially matches the return on the maturity-matched UST portfolio. After paying corporate taxes, the return on IBA reliably underperforms the UST portfolio. We also calculate

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[3] The time series average aggregate tax rate is 29.9%.
[4] Since 1997, the costs associated with foregone interest are minimal. However, in a longer sample period this will have an economically meaningful effect, as both the reserve level and the interest rate have been large.

an asset return that includes the profits earned by providing non-investment services. This calculation adds non-interest income, less the income generated from deposits, less our estimated operating expenses from service activities, and scales the asset-generated income by total effective assets. The pre-tax return on assets averages 4.13%. The maturity-matched UST portfolio return reflects our assumption that the unclassified other assets are cash-equivalent and therefore averages a somewhat lower 3.64% over this period. This results in a pre-tax asset risk premium of 0.49%. After paying corporate taxes, the asset risk premium is reliably negative, averaging -0.78% per year.

Figure 4 displays annualized quarterly returns for the various asset returns and the maturity-matched UST portfolios. The figure shows that the time series patterns are well explained by the passive maturity-matched UST portfolios for all of the asset return series. This supports the underlying premise that bank assets compete closely with capital market alternatives, but pushes against the notion that banks have an edge in their asset portfolios even after including the full benefit of banking services.

IV. The Relative Advantage of Bank Funding

Since Gorton and Pennacchi (1990), a bank funding advantage relative to capital markets is a common assumption and frequent conclusion in the banking literature. Recent papers like Stein (2012) and Hanson, Shleifer, Stein, and Vishny (2015) push the notion that all of the riskfree bank deposits may receive a money-premium, or funding edge over capital market funding alternatives. In contrast, Fama (1985) highlights that many of the insured accounts issued by banks compete with close substitutes in the capital market and provides some empirical evidence indicating that the rates paid by banks, gross of operating expenses, are similar for certificates of deposits (CDs) and maturity-matched US Treasuries.

This section analyzes the empirical validity of a bank funding advantage. To this end, we first explore whether bank customers accept below market investment returns on different debt-like claims issued by banks, e.g. short-term time deposits that do not offer transaction services, but are otherwise money-like (i.e. short-term and safe). The second issue we explore is whether banks produce money-like claims at a sufficiently low cost such that they come out ahead of their investors' opportunity cost of capital. The point here is that a diversified investor seeking to mimic the net exposure created with banks' issuance of riskfree debt can effectively fund a bank-like asset exposure by reducing their own allocation to short-term riskfree debt within their investment portfolio. This analysis requires a comparison of the full cost of deposits beyond simply the interest paid to maturity-matched UST portfolios available in the capital market.

A. Assessing Customers' Acceptance of below Market Returns by Bank Funding Type

Using the detailed maturity composition of various deposit account types reported in regulatory filings for each bank, we can classify deposits into transactable and time-deposit accounts and calculate the average maturity of each of these categories. We refer to "effective deposits" as deposits less non-interest earning cash. The maturity of a deposit account stipulates the period for which depositors cannot withdraw funds. What we term "transactable accounts" is defined as withdrawable within a week and includes all checking accounts and savings accounts that allow for multiple withdrawals within a month. In addition to being demandable, checking and savings accounts (up to $250K) are also riskfree for investors through FDIC insurance. Time deposits up to $250K are also FDIC insured.

The majority of bank deposits, equivalent to roughly 40% of assets, are transactable deposit accounts and we assume these are cash-equivalent (maturity category 1). The remaining “term-deposit accounts” have an average maturity of just under one year over this sample. The overall value weighted average maturity of all deposits averages 5 months.

There is considerable empirical support for the notion that customers are willing to pay for transaction services by accepting less than market interest on transactable deposits (Hannan and Berger (1991), Neumark and Sharpe (1992), O’Brian (2000), and Krishnamurthy and Vissing-Jorgensen (2012)). Additionally, the rate banks pay to customers on transactable accounts is relatively insensitive to changes in the market riskfree interest rate. We confirm these properties in our sample by comparing the deposit interest rate earned by customers on transactable accounts, net of the fees charged to customers, to the one-month US Treasury bill rate. Panel A of Figure 5 displays these quarterly returns. Table 3 reports that the annualized interest rate earned by bank customers on their transactable deposits, net of the fees charged, is 0% over the period 1997 to 2017, while investments in 1-month US Treasury bills earned 2.1% over this period. This significant difference in returns confirms that bank customers accepted, on average, 2.1% less on their transactable deposit accounts than they earned on their closest capital market alternative investment.

To determine whether these properties extend to time deposits, we do two things. First, we compare the rates paid on newly issued 6-month certificates of deposit (CDs), secondary market rates on 6-month CDs, and 6-month US Treasury bills (T-bills). The rates on US T-bills and secondary market CDs are available from 1965 through 2015, while the newly issued CD rates, calculated as the average rate offered and reported by RateWatch, are available from 1997 through 2015. Clearly, 6-month CDs are well integrated into capital markets as they are traded in the secondary market. The quoted rates on newly offered 6-month CDs average 2.10 % and are indistinguishable from 6-month US T-bill yields, which average 2.13% over this period.

Second, we compare the overall average rate paid to customers on time deposits to the return that would be earned on a maturity-matched portfolio of US Treasury bonds. The results of this analysis are reported in Panel B of Figure 5 and in Table 3. In each quarter, the rate earned by customers on time deposits looks very similar to the rate earned by investors in a capital market portfolio of similar maturity with similar accounting. Additionally, the mean returns on time deposits and maturity-matched UST bond portfolios are statistically indistinguishable from each other with small periodic deviations. This suggests that (1) rates on time deposits are sensitive to changes in capital market interest rates[5] and (2) the scope for this funding type to provide an advantage for banks is limited because from the customers' perspectives time deposits have excellent capital market substitutes (Fama (1985) and Merton and Bodie (1993, 1995)). Customers appear to sacrifice market returns only for bank deposits that offer transaction services.

B. The Full Cost of Bank Funding

Issuing debt via bank deposits is expensive. The deposit-taking activity requires building and maintaining a network of branches. Our assumed allocation of operating costs, described earlier, implies that the deposit-taking activity generates just under 30% of total operating expenses. This results in an average overall deposit expense ratio of 1.7% annually, while the pre-expense funding advantage on total deposits averages only 1.2%.

Since time deposits essentially pay the maturity-matched US Treasury rate, it seems reasonable to allocate the deposit operating expenses to the transaction deposits. With this

[5] Our interpretation of this result contrasts somewhat with the interpretations of Drechsler, Savov, and Schnabl (2017) who find that accounting asset returns net of accounting liability returns are immune to interest rate exposure. We view the apparent insensitivity to interest rates to be primarily a consequence of the accounting treatment and that the economically-relevant interest rate exposures of both assets and liabilities are better estimated from maturity-matched portfolios of US Treasury bond portfolios, with maturities coming from the detailed reported distributions of maturities and repricing dates by asset and liability type at the bank level from regulatory filings.

assumption, time deposits break-even and transaction deposits cost 88 basis points more than a maturity-matched US Treasury portfolio earns.

In addition to deposits, banks issue debt to the capital market. From the competitive markets perspective, we would expect that this debt is priced consistently with other capital market debt, being priced to earn a modest credit risk premium. We define bank debt as interest-paying non-deposit debt. Comparing the returns to bank debt to the returns on a maturity-matched UST portfolio indicates that the credit risk premium averages 40 basis points per year over this sample. Interestingly, the realized credit risk premium on bank debt is smaller than the wedge between the full cost of transaction deposits and the maturity-matched UST portfolio return, suggesting that bank deposits have been relatively expensive over the period 1997-2017.

V. Mapping Bank Activities into Capital Market Exposures

A key economic function of banks is liquidity provision, which is typically associated with the issuance of deposits (Gorton and Pennacchi (1990)) against a longer termed and potentially illiquid portfolio of loans and securities (Diamond and Rajan (2000); Dang, Gorton, Holmström, and Ordonez (2017)). Sometimes liquidity provision is associated with deposits funded on demand credit issuances (Kashyap, Stein, and Rajan (2002)). Thus, liquidity provision is similar to a levered credit issuance strategy, but with potentially enhanced funding terms. Since the levered credit strategy is itself primarily a maturity transformation strategy, the strategy refinements implied by liquidity provision do not take this distinctive bank activity too far from a simple maturity transformation strategy.[6]

[6] Gatev and Strahan (2006) argue and provide evidence that liquidity provision by banks embeds some features that we would relate to market timing. Specifically, their story involves bank deposits becoming safer relative to their closest capital market substitutes in periods of poor economic conditions, while the demand for credit increases, allowing for banks to experience relatively advantageous business opportunities in economic downturns. The parallel to a market timing opportunity within the levered credit issuance strategy, involves predictable variation in the attractiveness of potentially both the funding terms and the investment opportunities across economic states.

A. A Simple Capital Market Benchmark

The underlying premise behind our analysis is that there are some passive, or mechanical, components to bank activities that, increasingly over time, are likely to have close substitutes in capital markets. From the perspective of a moderately sophisticated investor (i.e. owner of diversified stock and bond portfolio), the passive economic exposures embedded in bank activities can be captured in the capital market, thus providing an opportunity cost of capital for these activities.

We assume that investment returns can be described by a factor structure with banks potentially earning better returns than are available in the capital market for similar economic exposures. Specifically, we assume that bank asset returns (i.e. unlevered asset returns) can be described by:

$$R_A(h, q, \beta) = Rf + TERM(h) + CREDIT(q) + MKT(\beta) + \alpha_A, \qquad (4)$$

where *Rf* is the return on cash-equivalent holdings, *TERM*(h) is the return on an h-maturity bond that is free of credit risk in excess of *Rf*, *CREDIT*(q) is the return on a risky bond in excess of the return on a maturity-matched credit-risk-free bond with credit quality q, and *MKT*(β) is the excess return associated with aggregate market risk, as proxied by a diversified stock market index, with exposure β, and α is the mean unearned return.

We assume that bank liabilities, including both deposits and interest-paying debt, are free of default risk and that these returns can be described by:

$$R_D(h) = Rf + TERM(h) + \alpha_D. \qquad (5)$$

What is not resolved is whether banks engaging in conditional liquidity provision, or market timing, earn risk-adjusted returns, as is implicitly assumed when these distinctive bank activities are viewed to be relatively efficient.

Define L = Assets / Equity. Consequently, we can describe the equity return as:

$$R_E(h, q, \beta) = L \cdot R_A(h, q, \beta) + (1 - L) \cdot R_D(h). \quad (6)$$

Given our assumption of riskfree bank debt, all of the underlying asset risk in our replicating asset portfolio is transferred to the equity, whereas some of the asset risk for banks may be transferred to the FDIC through deposit insurance and to bank debt investors. Thus, we may find too much risk in our replicating bank equity.

The opportunity cost for bank assets comes from capital market assets that offer similar economic exposures to TERM, CREDIT, and MKT. The same logic applies to bank debt. The credit-risk-free nature of most bank debt may not be available for an investor replicating a bank as a stand-alone entity, but the net economic exposures are easily reproduced from the perspective of a diversified investor. The implicit funding of riskfree debt comes from reducing these holdings within the diversified default portfolio, such that the net exposure available through direct investments in bank equity can be reproduced through altered portfolio weights. We will demonstrate the effectiveness of this approach by comparing the time series levels and variation of both cash flows and returns.

To the extent that there are material benefits of bank funding not available to the diversified capital market investor, these will show up in bank returns and not in the passive capital market portfolio. Similarly, if there are material benefits embedded in bank asset portfolios, these will show up in unlevered bank ROA and not be available in unlevered bank asset exposure mimicking portfolios. The equity cash flows, or the return on book equity, will reflect any realized “alpha” from bank activities. The capitalized value of any alpha generated by bank activities is expected to be included in the market value of the equity.

Maturity transformation appears to explain a large portion of total bank activity. There are several remaining issues to be explored, including the cash flows and risks associated with banking services, compensation for bearing credit risk, and corporate taxes. We approach these remaining issues from the perspective of an outside investor looking to reproduce the economic exposures embedded in bank activities, which highlights that various net exposures need to be appropriately sized relative to equity capital.

Equity is the residual claim, entitled to the cash flows remaining after all other liabilities have been paid. One attractive property of equity returns is that assumptions about how operating expenses should be allocated across activities can be completely skirted, as equity cash flows are net of these expenses. We measure invested capital based on our calculation of book equity (BE) beginning with assets and then subtracting deposits and interest-paying debt. The ratio of BE to assets averages 0.144 for bank holding companies over the period 1997-2017.

A final balance sheet reconciliation to be highlighted is that we have matched the interest bearing assets to capital market substitutes, but an additional 10% of total assets have not yet been matched to a capital market alternative. We assume that these residual assets are invested in either (a) one-month US Treasury bills or (b) invested in a portfolio of cash and the aggregate stock market to reproduce the estimated beta of actual bank stocks.

B. Sizing the TERM, CREDIT, and MARKET exposures

We calculate the amount of TERM exposure per dollar of invested capital by netting cash-equivalent assets and liabilities and calculating the asset and debt deltas for the non-cash-equivalent components. Deltas are defined as the value sensitivity of an asset or portfolio to interest rate shocks, sometimes referred to as the dollar value of a basis point (DV01) in the context of bonds. Specifically, we calculate portfolio deltas as the value change caused by a 1%

increase in the market interest rate (i.e. yield to maturity for each bond). These sensitivities are measured in dollars and are thus additive, allowing us to calculate net exposures, as is done in practice for hedging bond portfolios.

Table 4 summarizes these calculations. For our baseline calculations, relying on the reported maturities of various balance sheet items and assuming that the residual book assets are cash-equivalent assets, 56% of total effective assets are cash-equivalent and therefore contribute zero term structure sensitivity. The remaining 44% of effective assets have an average maturity of 6.8 years. Over the period 1997-2017, a passive buy-and-hold portfolio of UST bonds invested to maintain a constant average maturity of 6.8 years has an average interest rate sensitivity of -0.059 per invested dollar, thereby contributing -0.028 per dollar of total assets.

Together, bank deposits and interest paying debt account for 85% of assets for bank holding companies between 1997 and 2017. Bank deposit and debt funding is comprised of 45% cash-equivalent maturities with the remaining balance having an average maturity of 1 year. Short positions in equivalent maturity UST bond portfolios would contribute an interest rate sensitivity of 0.005 per dollar of assets. Thus, the net interest rate sensitivity of the aggregate bank equity to a 1% increase in interest rates is estimated to be -2.3% per dollar of assets, or -0.154 per dollar of equity capital. There are many portfolios that can be constructed to capture a similar TERM exposure. For example, this interest rate sensitivity is equivalent to 3.2 units of 5-year TERM exposure per unit of equity dollars.[7]

A calculation that is similar in spirit is performed to determine the required capital market investment to establish an equivalent credit exposure to the aggregate bank balance sheet. Loans are the primary contributor of credit risk in the asset portfolio, accounting for 3.6 times BE on

[7] Over the period 1997 to 2017, we estimate the delta of a passive portfolio invested in 5-year average maturity UST bonds to be -0.0481.

average, with bank debt bearing very little credit risk overall (low amount per dollar of debt and very little debt as a share of assets). As noted earlier, the bank loan loss rates average just over 1% per year, which is well-matched by a portfolio that mixes 60% investment grade and 40% speculative grade corporate bonds.

Services are generated as a consequence of both asset-based on deposit-based activities, making it difficult to determine the appropriate capital base. For benchmarking, we use the other book assets, excluding non-interest cash, which has effectively been removed from the balance sheet. The net cash flows generated by services are calculated by enforcing the net income identity to make sure that we fully account for all net cash flows. Our assumptions about how operating expenses are allocated across activities imply that the provision of bank services accounts for nearly one-half of total operating expenses in aggregate. We consider two risk profiles for banking services, short-term riskfree, and short-term systematic risk calibrated to ensure that the total equity beta of the benchmark portfolio equals that of an aggregate bank equity index beta. The estimated beta per dollar of other assets is either 0 or 0.2.

C. Generating Bank-like Cash Flows with Capital Market Portfolios

The previous section proposes that a capital market portfolio comprised of 3.2 units of 5-yr TERM and 3.6 units of CREDIT – comprised of a 60% allocation to investment grade and 40% speculative grade corporate bonds – has similar economic exposures to bank equity. Similar economic risks, TERM and CREDIT, sized to match the levered exposure that bank equity bears. Assuming that services are uncorrelated with aggregate risks, we initially set the market exposure (MKT) to zero. Since TERM and CREDIT are defined as zero-investment portfolios, the equity investment also earns the riskfree rate, RE = RF + 3.2 TERM(5yr) + 3.6 CREDIT(0.6IG + 0.4HY).

We compare the cash flows generated from actual bank activities with those generated by the capital market portfolio in Figure 6. The top panels display quarterly net cash flows from pure maturity transformation, RF + TERM, for both banks and the capital market portfolio. This includes the interest earned investments and loans, less the interest paid on deposits and interest-paying debt. We calculate the maturity contribution of loans as the interest earned on a maturity-matched UST portfolio, with the remainder of the loan cash flows being allocated to CREDIT. We allocate a portion of the operating expenses to the deposit net income, averaging approximately 30% of total operating expenses. Consistent with the previous analysis, both cash flow series share a similar overall time series pattern, with the capital market sourced exposure consistently generating higher average cash flows.

The second panels display the quarterly net cash flows to credit risk (i.e. the realized credit risk premium earned above maturity-matched US Treasury bonds). We allocate a portion of the operating expenses to the credit portion of the loan portfolio, averaging approximately 30% of total operating expenses. This has a meaningful effect on the profitability of the credit risk of the loan portfolio, as the quarterly cash flows net of operating expenses are nearly always negative, while capital market credit risk premia tend to be positive. We estimate the realized credit cash flows to the capital market portfolio as follows. Each year, we calculate the realized corporate bond loss rates from the Moody's loss rates for IG and HY corporate bonds. We calculate an annual excess loss rate as the difference between the actual loss rate each year less the mean loss rate over the sample as a proxy for the unexpected annual loss rate. We calculate the realized annual credit spread as 50bps per year less the excess loss rate. As will be discussed (and explored in more detail below) this is a conservative estimate of the realized credit spread to this portfolio. We then allocate one-fourth of the annual credit spread to each quarter within the year. The capital market sourced credit risk cash flows are generally larger than those earned by the aggregate banking sector. One difference in the time series pattern is that bank credit performs well during the 2000-2001 recession, relative to corporate credit, highlighting that these are not perfect substitutes.

The third panel displays the quarterly net cash flows to banking services. These are calculated as non-interest income less deposit fee income. It is interesting to observe that the time series pattern of the net cash flows generated by banking services experience meaningful losses during the 2008-2009 financial crisis, suggesting that these activities have some systematic risk, although they are benchmarked here against one-month US Treasury bills earned on non-interest earning assets excluding no-interest cash (approximately 10% to total effective assets).

The final panels display quarterly net cash flows from all activities available to equity before corporate taxes. This is simply the sum of the cash flows from the previous panels, which we reconcile with net income plus corporate taxes to ensure that we enforce the accounting identity in our decomposition of net income into these activities. Overall, the capital market portfolio designed to mimic the economic risks of bank equity consistently generates higher net cash flows than the aggregate banking sector over the period 1997 to 2017. Of course, banks paying corporate taxes will magnify this difference.

D. A Longer-term Perspective

As a reality check on the analysis, we compare the asset returns and the deposit costs for the commercial banking sector using the aggregate annual data provided by the FDIC to maturity matched US Treasury portfolios. The FDIC data begin in 1934, although to compare to maturity-matched US Treasury portfolios, this analysis begins in 1966. This allows us to compare returns through the interest rate spike in 1981 and to evaluate relative performance over the long-term decline in interest rates since then. The benchmark portfolios are defined based on the maturity distributions measured since 197, so they are not necessarily accurate as we extend back in time.

Figure 7 displays the unlevered asset returns, measured pre-tax in Panel A, and the deposit costs and deposit rates in Panel B, each compared to maturity-matched US Treasury portfolios. The overall time series patterns in bank returns and UST portfolio returns are highly similar, highlighting that passive maturity transformation explains the bulk of bank net profits over a long sample. The long-run mean return to pre-tax unlevered bank assets is 5.8% and is 5.9% for the maturity-matched UST portfolio, suggesting that the long-run realized risk premia for bank assets is essentially zero. The interest rate paid on deposits averages 1.85% less than the maturity-matched UST portfolio, while the full cost of deposits averages only 0.21% lower from 1966 to 2017. Since 1986, the full cost of deposits has averaged 0.42% more than the maturity-matched UST portfolio, suggesting that there has been no cost advantage of bank deposits over the last 30 years of the sample. Again, the overall time series pattern in deposit rates and costs are highly similar to the returns to maturity-matched UST portfolios.

E. Comparing Bank Equity Returns with Bank-like Capital Market Portfolios

In light of the earlier evidence showing how accounting returns alter measures of risk, we focus on a sample period where we have accurate market returns for each component of our capital market portfolio. Specifically, we focus on the period 1979 through 2016, where we have returns on traded bond portfolios.

We create a value-weight portfolio of all publicly-traded bank stocks, as identified by Fama and French (1997), over the period 1979 to 2016.[8] A regression of monthly portfolio

[8] Over a longer sample from 1960 to 2016, a regression of monthly portfolio returns in excess of the one-month US Treasury bill rate on the excess return of the market portfolio finds that bank stocks have a market beta of 1.12 (*t*-statistic = 29.8) with an annualized alpha of -0.36% (*t*-statistic = -0.2).

returns in excess of the one-month US Treasury bill rate on the excess return of the market portfolio suggests that bank stocks have a market beta of 1.06 (*t*-statistic = 25.7) with an annualized alpha of 0.46% (*t*-statistic = -0.2). From the perspective of the Capital Asset Pricing Model (CAPM) (Sharpe (1964) and Lintner (1965)), bank stocks have essentially earned their equity cost of capital over this period with regression intercepts, or alphas, that are indistinguishable from zero. These regression results are summarized in Table 5, which reports results from both monthly and quarterly return frequencies. In addition, Table 5 shows regression results from specifications that include TERM and CREDIT factors, as described above. Interestingly, bank stocks have little exposure to these factors, with statistically weak coefficients and virtually no change in adjusted R-square. The sensitivity to TERM increases to 0.42 as the holding period extends from monthly to quarterly, becoming marginally statistically significant, but economically modest relative to the bottom-up analysis that implies this coefficient should be 3.2. This is somewhat surprising in that bank portfolios contain both US Treasury bonds and clearly bear credit risk. In the presence of these bond market factors, the market beta continues to be reliably estimated near one.

Table 5 also summarizes the return properties of the capital market portfolio assembled to mimic the underlying economic exposures of bank equity. We assume that the leverage required to match the exposure of bank equity pays 50 basis points over the riskfree rate.[9] The capital market leverage could come from a brokerage margin account, which is made essentially riskfree through a combination of real-time monitoring of the market value of the portfolio and liquidation rights if the net portfolio value drops below some threshold level. Alternatively, the leverage could be obtained through futures and swap contracts. By construction, this portfolio is

[9] Estimates of the effective riskfree rate in capital markets implied from futures and options markets tend to be about 50 basis points above the short-term US Treasury bill rate (see Table 2 in Naranjo (2009)).

perfectly explained by a regression that includes TERM and CREDIT, so we only report the CAPM specification. The bank-like mutual fund portfolio has a market beta of around 0.5 and an annualized alpha exceeding 6%, highlighting the excellent investment performance of bond portfolios over this sample period.

The investment performance of bank stocks relative to the capital market alternative is displayed in Figure 8. The raw returns for the replicating portfolio are higher than actual bank stocks, which includes their benefitting from a 50% increase in valuation multiples over this sample period. The mean excess return for banks is 8.8% with 21% volatility, producing a Sharpe ratio of 0.42. The mean excess return for the capital market alternative portfolio is 10.4% with 16% volatility, producing a Sharpe ratio of 0.63. The figure shows that during the financial crisis of 2008-2009, banks stocks experience drawdowns of -75%, while the capital market alternative portfolio experiences a drawdown of around -50%.

F. Discussion

A key question is what is the source of the bank equity beta? The cash flows from banking services may contribute market beta, but it is surprising that this is enough to completely dominate the exposure to credit factors. To the extent that the market beta reflects an economic reality, as opposed to a tendency for stocks to trade like stocks, then this market exposure should be mimicked in the bank-like mutual fund portfolio. Adding passive market exposure adds a positive risk premium to the capital market portfolio, preserving the CAPM alpha. Specifically, we add 0.5 units of stock market exposure to the bank-like mutual fund portfolio.

Another possibility is that the estimated market beta reflects a downside market risk created by high leverage and liquidity provision, much like hedge fund exposure (Jurek and Stafford (2015)). Note the drawdown in 2008 is -75% for banks and only -50% for the capital market bank-mimicking portfolio. Regressions that include the excess return on the put writing strategy described in Jurek and Stafford find that bank stocks have a large exposure to the put writing factor in a univariate regression (slope coefficient = 2.0, *t*-statistic = 10.9, which results in an annualized alpha of -16%, *t*-statistic = -3.1), but that this exposure is near zero when the market factor is included. As discussed in Jurek and Stafford (2015), modest return smoothing in just a few months can have a significant effect on distorting the exposure to a downside risk factor and the sluggish response of bank stocks may reflect such a situation.

Another question we investigate is what would it take to eliminate the outperformance of the bank-like mutual fund? Clearly, the TERM exposure of banks would have to be much lower, since this is the factor that is outperforming the standard risk model over this period. The mechanism for TERM being lower is likely on the deposit side. The assets seem to be very well described by their maturity-matched benchmarks. Time deposits and bank debt are well matched with their maturity matched benchmarks. Moreover, explicit hedges would produce large trading losses to offset the large TERM premia realized since 1981, which we do not observe. In fact, our casual reading of annual reports suggests that much of the explicit interest rate hedging is designed to offset the *positive* relation between interest rate shocks and quarterly earnings, which *adds* interest rate exposure as defined in an investment context where one is concerned about the negative value consequence of a positive interest rate shock.[10] This leaves transaction accounts as the most plausible source for an offsetting effect.

We consider the possibility that transaction accounts may have longer effective maturities than the cash-equivalent classification that banks report. Suppose that the transaction accounts are effectively 1yr – 3yr maturity. Recall that maturity refers to the time period over which

[10] For example, see page 121 in the JP Morgan Chase & Co. Annual Report 2016, https://www.jpmorganchase.com/corporate/investor-relations/document/2016-annualreport.pdf.

interest rates will remain fixed, not how long the customer will stay with the bank. We re-run the analysis with this assumption. The net TERM exposure falls from 3.2 units per dollar of book equity to 2.2. With this adjustment, the average annual bank deposit cost is 36 basis points less than maturity-matched US Treasuries with our assumed operating cost allocation (approximately 30% of total operating costs allocated to deposits). The reduction in TERM exposure does not meaningfully alter the market beta of the bank-like mutual fund portfolio (0.49). The CAPM alpha remains economically large at 4.2% per year (*t*-statistic = 2.2). However, the time series variation in funding costs is explained less well with this assumption than the initial one. Specifically, a regression explaining the quarterly change in the aggregate deposit rate with quarterly changes in the capital market portfolio return has an R2 of 0.35 using the reported maturities and only 0.13 using the hypothetical longer effective maturity category for transaction deposits. While transaction deposit account interest rates are lower than market rates, they do reset fairly quickly when market rates adjust.[11]

It is hard to argue that banks do not bear credit risk, but the nature of their credit risk could be different from corporate credit risk that we have relied upon as being comparable. One possibility is that banks bear a worse type of credit risk, with losses concentrated in especially bad economic states. This should command a larger risk premium, and would make their underperformance worse. Alternatively, it could be a less severe credit risk. The government is taking the really bad risks off the table, lowering the required return. The capital market portfolio – without the risk reducing insurance – appears to be bearing this credit risk more efficiently with less overall market exposure. This suggests that perhaps real world banking frictions create additional risks that are not being properly compensated.

[11] We thank Jamie Dimon for a helpful discussion on this issue.

VI. Conclusion

Banks compete with other intermediaries in the market for financial services, specializing in the lending and deposit-taking segments of this market. Banks are highly regulated and specialized in activities that are rife with market frictions. Fama (1985) argues that because banks incur the costs associated with market frictions, efficiency requires that they must have an edge elsewhere in their business model. This paper highlights that the corporate form exposes banks to a tax disadvantage relative to capital market investment vehicles that allow for the pass-through of investment income without paying corporate taxes. Given the onerous effective corporate tax rate that has averaged 30% for the aggregate banking sector over our sample, efficiency requires that the edge should be substantial, and thus, fairly easy to measure. In contrast to this prediction, we have a hard time finding a pre-tax edge, suggesting that the after-tax edge is negative.

We conduct a simple benchmarking exercise to assess which activities have a pre-expense edge over capital markets and to measure how large is the relative advantage. Consistent with the competitive markets perspective, we find the pre-expense (and pre-tax) returns associated with activities that have the closest capital market substitutes are highly similar to the returns on maturity and credit matched capital market alternatives. We identify the loan portfolio, transaction deposit accounts, and banking services as providing pre-expense returns that are advantaged over their closest capital market alternative, but that after operating expenses these activities generate pre-tax returns that are comparable to capital market alternatives. This analysis highlights that the majority of the aggregate bank balance sheet can be well mimicked in a passive capital market portfolio, which would not be subject to corporate taxes.

The empirical results provide considerable support for the notion that banks, in aggregate, do not have an edge in any of their activities before taxes and consequently are disadvantaged relative to capital market alternatives after taxes. This puts pressure on the assumption of efficiency. Interestingly, bank equity returns show little exposure to credit and interest rate term structure factors, which is important because passive maturity transformation strategies that can be executed in the capital market have performed extremely well since 1981 (see Fama (2006)). This allows bank equity investors to not recognize and control for the strong investment performance of passive maturity transformation strategies, suggesting one possibility for how investors may perceive bank equities to be covering their CAPM cost of capital, while significantly underperforming a more comprehensive opportunity cost of capital that recognizes their net interest rate exposure.

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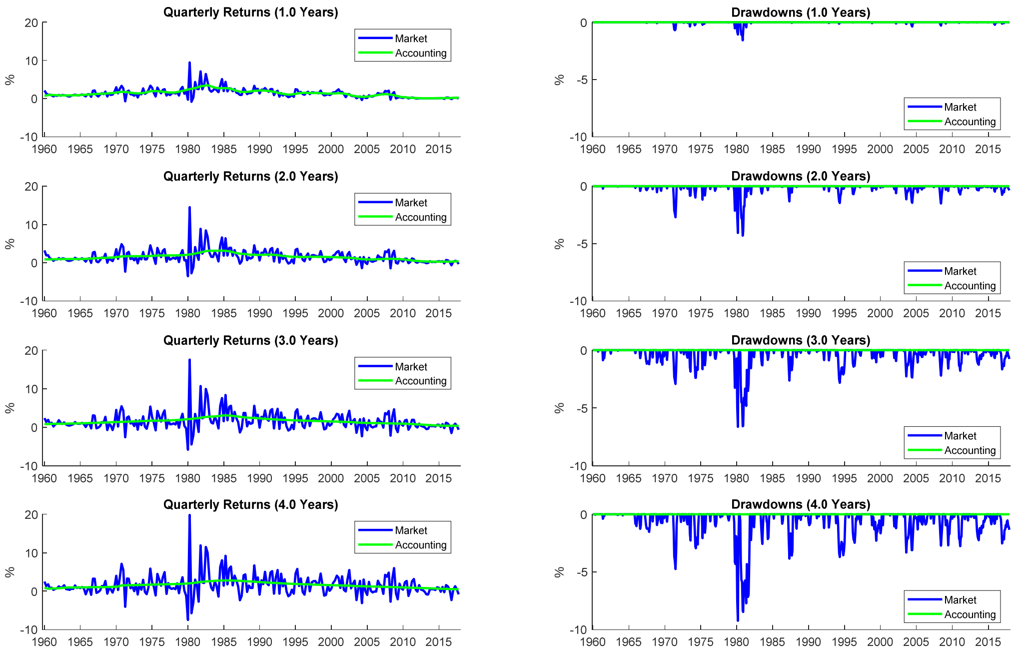
Figure 1. US Treasury Bond Yields and the Consequences for Banks (1960 – 2017).
This figure shows the monthly time series of five-year and one-month US Treasury (UST) bond yields (top left) and the difference is these two series, [5-0] Yield Term Spread (bottom left). The yields are from the Federal Reserve. The top right panel displays the five-year average of the five-year UST yield along with the one-month UST yield to represent the interest rates earned and paid on a maturity transformation portfolio, while the bottom right panel plots the net interest margin, calculated as the historical average yield minus 0.85 x the one-month yield to reflect that deposits plus interest paying debt divided by effective total assets averages 0.85.



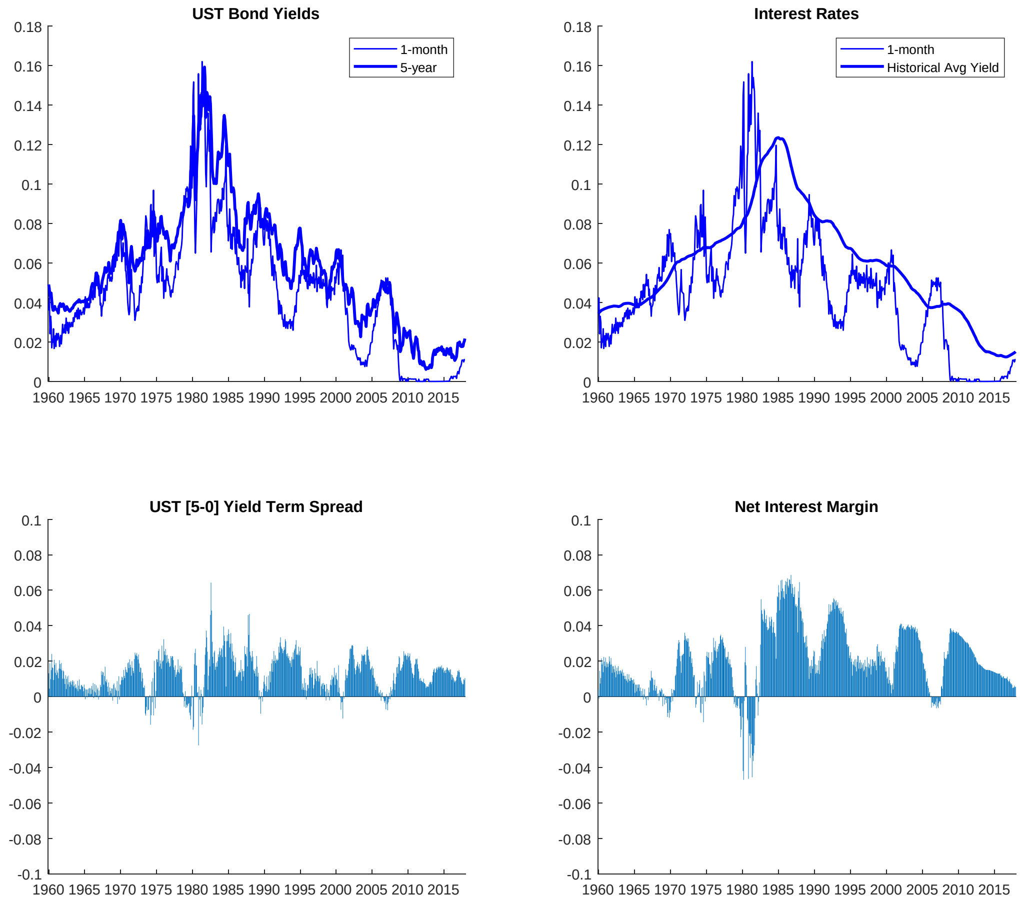


Figure 2. Effect of Hold-to-Maturity Accounting on Bond Portfolio Returns with Various Average Maturities.

This figure shows the quarterly returns and monthly drawdowns of passive portfolios of US Treasury bonds with various average maturities. Portfolios represent passive strategies that invest each month in a *h*-period US Treasury bond and hold it until maturity, where $h \in \{2, 4, 6, 8\}$, with the average maturity of the bonds in the portfolio equaling $h/2$. Returns and drawdowns are calculated from portfolio values that are reported under both market value and accounting value. Market value measures the portfolio value as the weighted sum of closing market prices, while accounting value measures periodic portfolio values of recently transacted holdings at their market value, but all other holdings at their historical cost. The drawdown is calculated as the current portfolio value measured as a percentage of its previous maximum value.

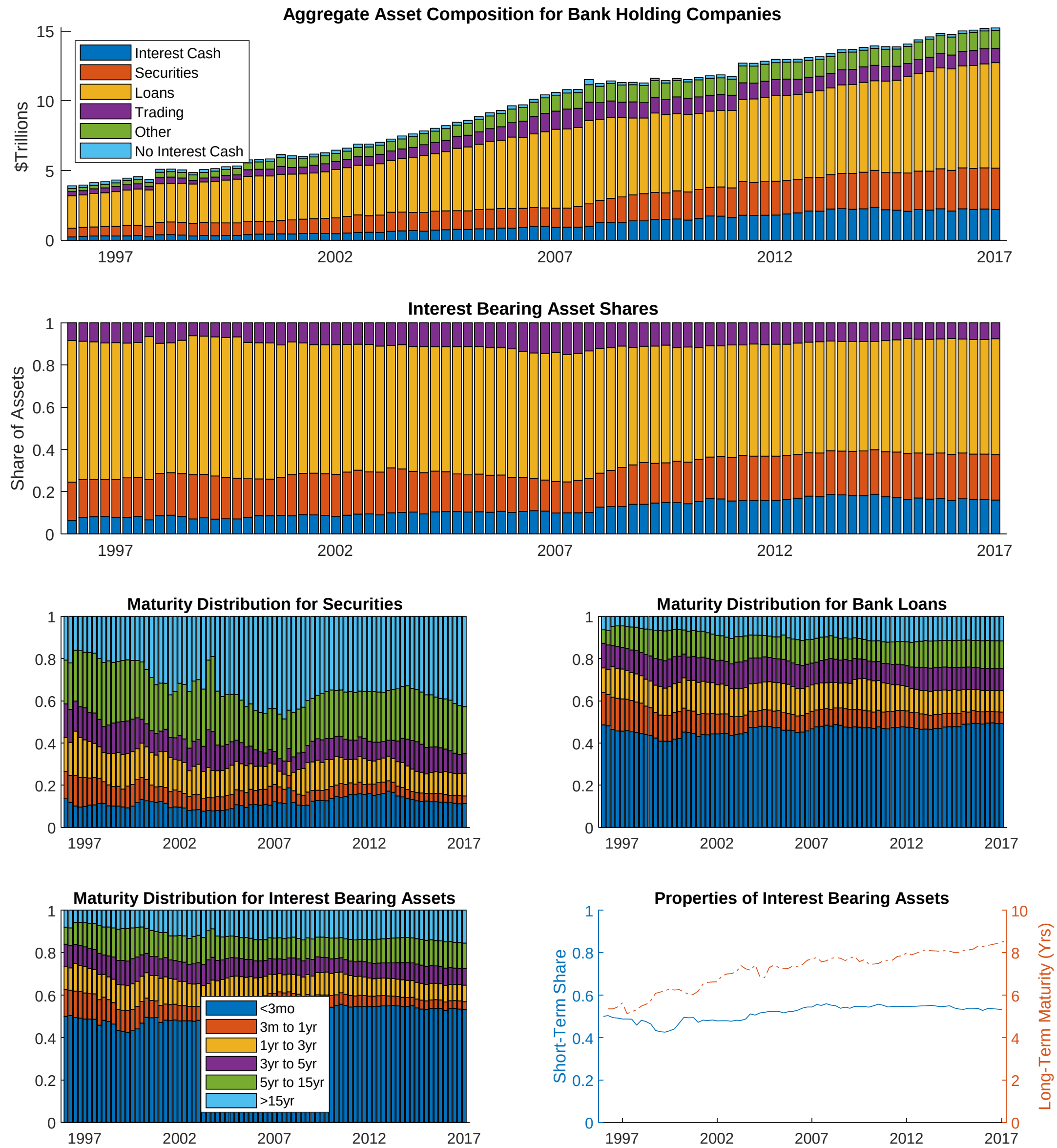


Figure 3. Aggregate Asset Composition and Maturity Distributions (1997-2017).

Panel A displays the dollar amount of bank assets components. Panel B displays the various components of Interest Bearing Assets, including Interest Earning Cash, Securities, Loans, and Trading, all reported as a share. Panel C shows the maturity distribution (calculated from the commercial bank level data set) for securities and loans. To calculate banks' assets maturity distribution and average asset maturity (Panel D), we use the maturity information given by the data and implied by short term instruments such as cash and Federal Funds sold, and assume a maturity of one month for the remaining share of assets.

Figure 4. Aggregate Bank Asset Returns (1997-2017).

This figure displays annualized quarterly returns for bank assets and maturity-matched US Treasury portfolios with hold-to-maturity accounting. Panel A displays the returns to bank investments, including interest earning cash, securities, and trading assets. Panel B displays the returns to the aggregate bank loan portfolio. Panel C shows the unlevered return to Interest Bearing Assets, including all bank investments and loans. Panel D show the unlevered return to total assets, which includes all interest bearing assets and unclassified other assets. All bank returns are before corporate taxes except where noted.

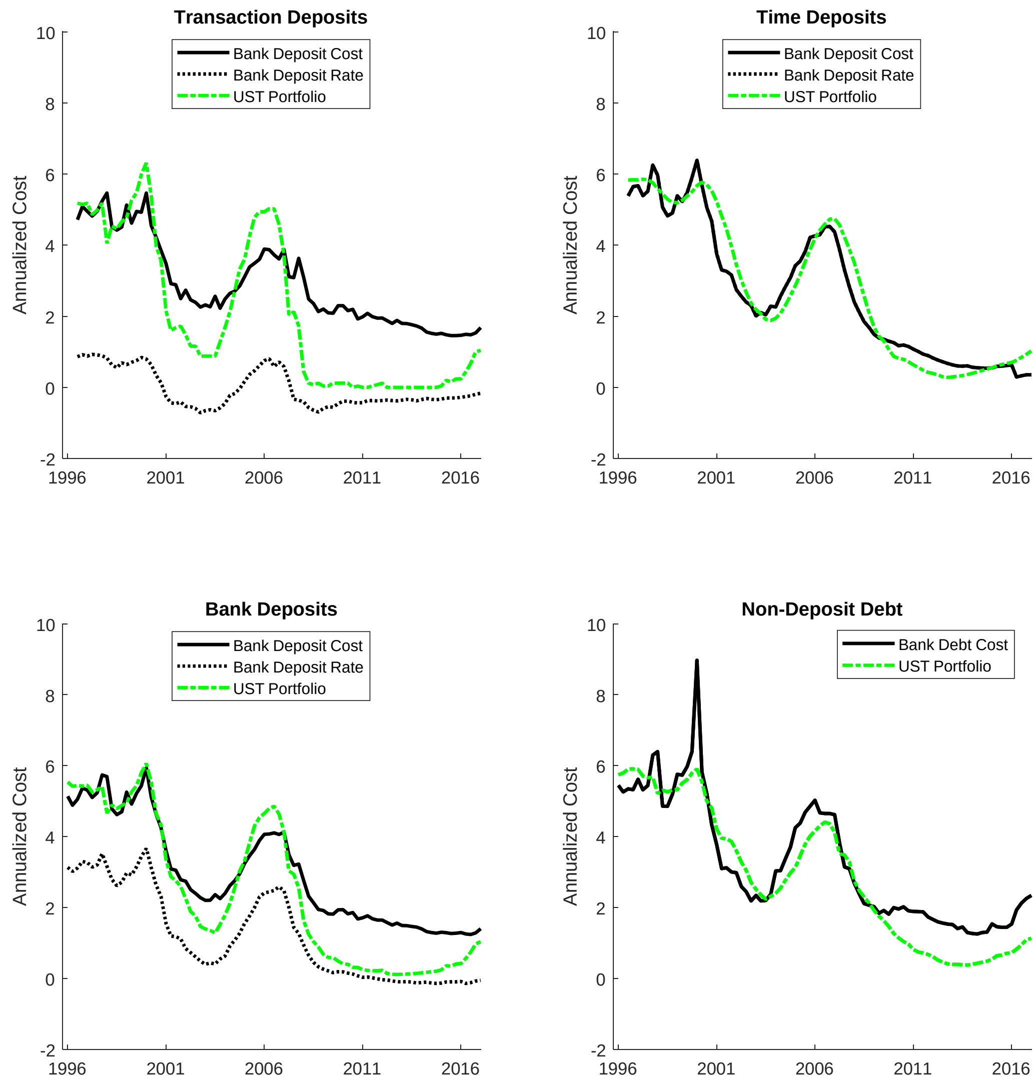


Figure 5. Aggregate Bank Funding Rates (1997-2017).

This figure displays annualized quarterly returns for bank deposits , bank debt, and maturity-matched US Treasury portfolios with hold-to-maturity accounting. Panel A displays the returns to bank transaction deposits. Panel B displays the returns to the aggregate bank time deposits. Panel C shows the return to aggregate bank deposits net of non-interest earning cash, representing the sum of transaction deposits and time deposits. Panel D show the return to interest paying debt. All bank returns are before corporate taxes.

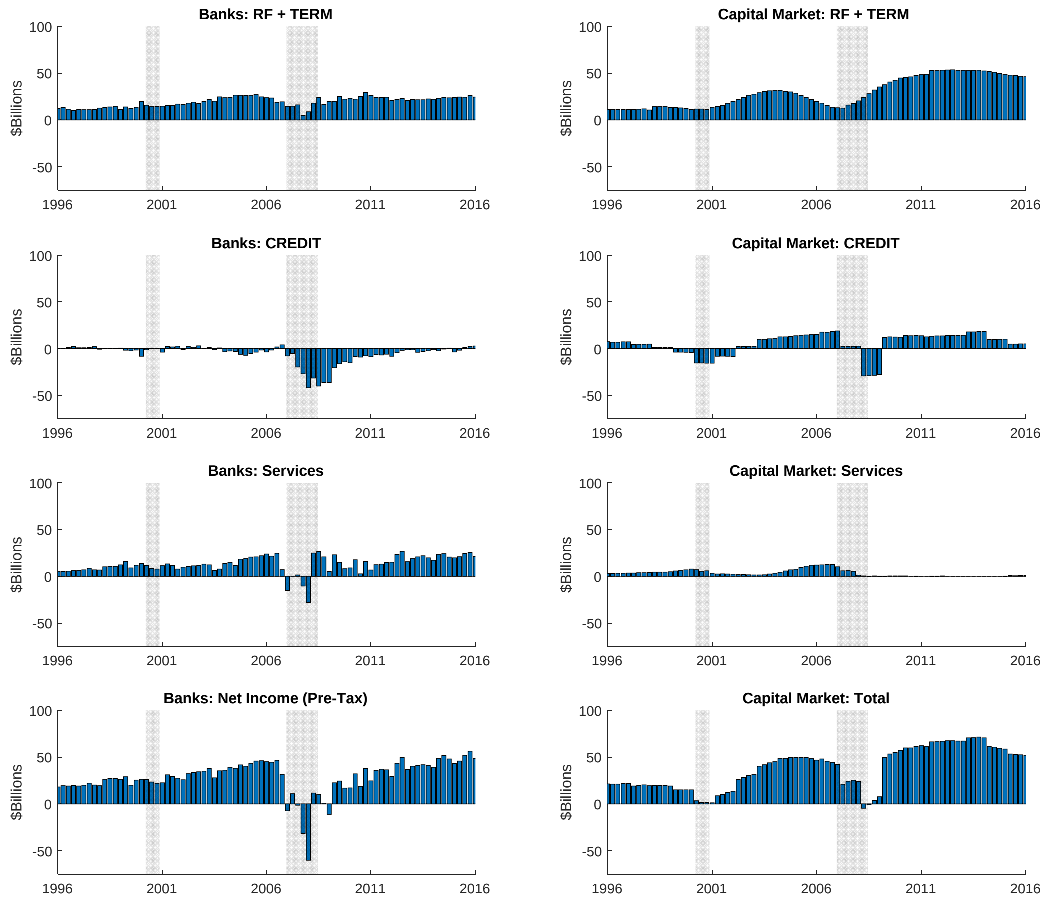


Figure 6. Banking Sector Pre-Tax Cash Flows Compared to Capital Market Equivalent (1997-2017).

This figure displays quarterly net pre-tax cash flows for various bank activities and for capital market portfolios designed to match the maturity and credit risk properties. All bank cash flows are before paying corporate taxes. The top panel displays the interest from cash-equivalent and long-term securities and loans less the interest paid on deposits and interest paying debt, net of the operating expenses allocated to deposits (approximately 30% of total operating expenses). The second panel displays the credit risk premium, measured as the difference in return on a credit sensitive portfolio less the return on a passive maturity matched US Treasury bond portfolio. Loans and interest-paying debt are the components of the bank balance sheet viewed to be exposed to credit risk, with loans accruing a portion of operating expenses (approximately 30% of total operating expenses). Services cash flows are measured as the non-interest income less deposit fee income less the remaining operating expenses, and are benchmarked against one-month US Treasury bills earned on the non-interest earning assets (approximately 10% of total effective assets). The bottom panel displays the total pre-tax income, representing the sum of the previous panels and reconciled to match net income plus corporate taxes.

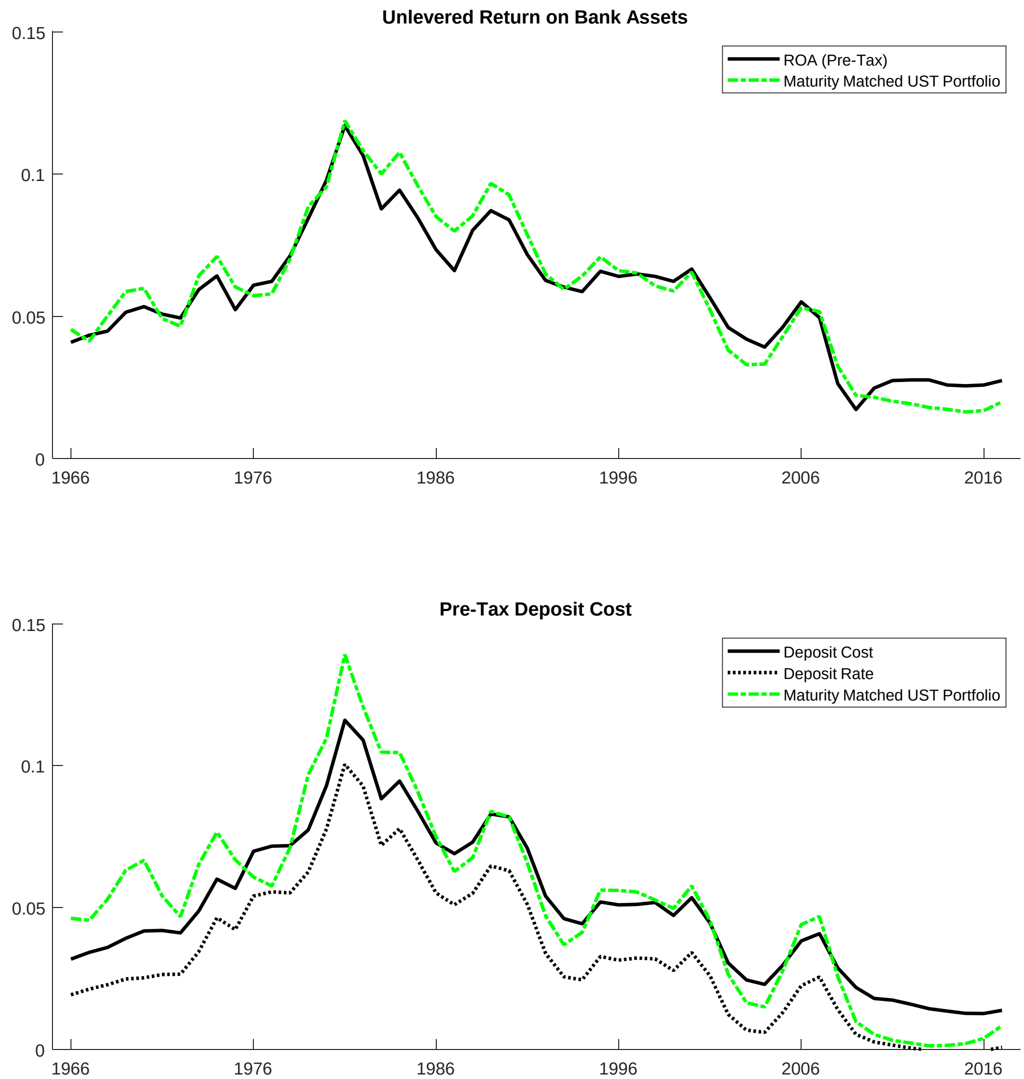


Figure 7. Aggregate Banking Sector Returns Compared to US Treasury Portfolios (1966-2017).

This figure displays annual unlevered asset returns and deposit funding costs for the aggregate commercial banking sector covered by the FDIC. Panel A displays the pre-tax unlevered return on assets, calculated as net income plus corporate taxes plus interest expense minus service charges on deposit accounts plus the operating expenses allocated to deposits (approximately 30% of total operating expense), all divided by the previous period assets. Panel A also plots the accounting returns on a passive portfolio that invests each month half of its value in one-month US Treasury bills and half in a six-year US Treasury bond and holds it until maturity with a three-year average maturity of the bonds in the portfolio. In Panel B, the annual cost of deposits is calculated as deposit interest minus service charges on deposit accounts plus the allocation of operating expenses to deposits, all divided by the previous period deposits.

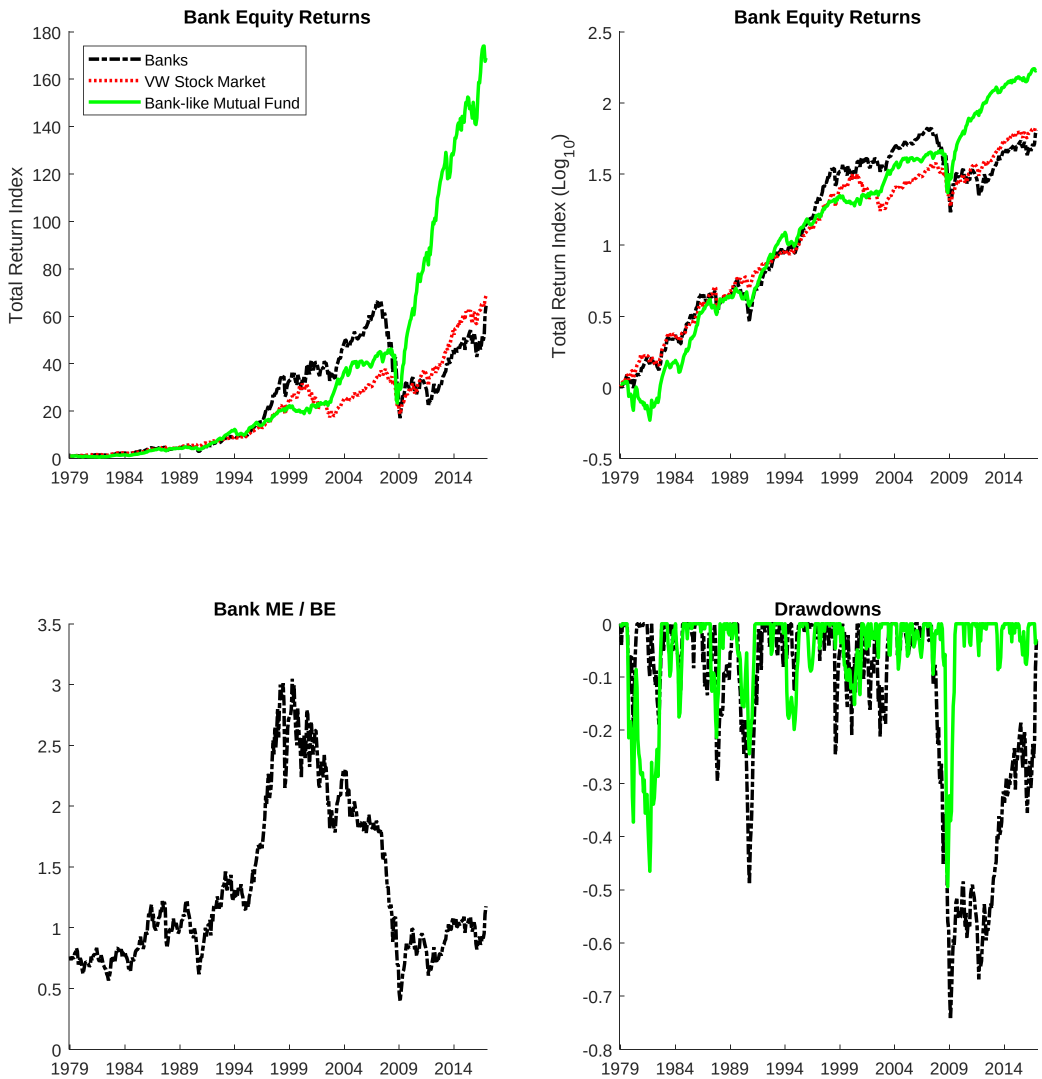


Figure 8. Bank Stock Performance relative to Capital Market Equivalent Portfolio (1979-2016). The bank stock portfolio is a value weighted portfolio of all US publicly listed bank stocks identified by the Fama and French (1993) industry classification. The value-weight (VW) stock market portfolio is calculated by Ken French. TERM is the excess return of a US Treasury (UST) bond portfolio with an average maturity of five years. The IG credit spread is calculated from the Barclay's total return index for investment grade corporate bonds with an average maturity of one to three years, from which we subtract the return to a passive UST portfolio with an average maturity of two years. The HY credit spread is calculated from the Vanguard Intermediate Term High Yield Bond Index Fund (VWEHX), from which we subtract the return to a passive UST portfolio with an average maturity of six years. The CREDIT factor is calculated as 60% IG spread plus 40% HY spread. The bank-like mutual fund portfolio excess return is comprised of 3.2 units of TERM and 3.6 units of CREDIT, with all leverage paying 0.5% above the riskfree rate. Market value to book value (ME/BE) is calculated as the ratio of sums across banks. Drawdown is calculated as the current price level measured as a percentage of its previous maximum price level.

Table 1
Regressions Explaining the Excess Returns to Portfolios of US Treasury Bonds

This table reports regressions of monthly and quarterly portfolio excess returns on the excess returns of the value-weight stock market. Portfolios represent passive strategies that invest each month in a *h*-period US Treasury bond and hold it until maturity, where $h \in \{2, 4, 6, 8\}$, with the average maturity of the bonds in the portfolio equaling *h*/2. Returns are measured in excess of the 1-month US Treasury bill rate, Rf_t. Regressions are of the form: $Rp_t – Rf_t = a + b\,(Rm_t – Rf_t)$. The regression intercepts, *a*, are annualized (x12 for monthly and x4 for quarterly) and reported in percent (x100). The number of observations is denoted *N*, the regression R-square is denoted R^2, and *t*-statistics are reported in parenthesis.

Panel A: 196001 - 198106

Avg. Maturity	Monthly a	Monthly b	Monthly R^2 / N	Quarterly a	Quarterly b	Quarterly R^2 / N
1.0	0.26	0.03	0.07	0.22	0.04	0.09
	(0.74)	(4.49)	258	(0.46)	(2.81)	86
2.0	0.10	0.05	0.07	0.04	0.07	0.09
	(0.17)	(4.40)	258	(0.05)	(2.86)	86
3.0	-0.45	0.07	0.07	-0.53	0.09	0.10
	(-0.59)	(4.50)	258	(-0.50)	(3.00)	86
4.0	-0.74	0.07	0.07	-0.83	0.11	0.10
	(-0.83)	(4.33)	258	(-0.67)	(2.98)	86

Panel B: 198107 - 201712

Avg. Maturity	Monthly a	Monthly b	Monthly R^2 / N	Quarterly a	Quarterly b	Quarterly R^2 / N
1.0	1.20	0.01	0.01	1.24	0.00	0.00
	(6.71)	(2.00)	437	(4.96)	(0.07)	146
2.0	1.96	0.01	0.01	2.05	-0.00	0.00
	(5.79)	(2.01)	437	(4.40)	(-0.04)	146
3.0	2.54	0.02	0.01	2.70	-0.00	0.00
	(5.20)	(1.93)	437	(4.04)	(-0.13)	146
4.0	2.93	0.02	0.01	3.14	-0.00	0.00
	(4.73)	(1.95)	437	(3.76)	(-0.18)	146

Table 2
Bank Asset Returns and Risk Premia (1997 – 2017)

This table reports annualized returns on bank assets for US bank holding companies and measures these returns relative to passive maturity-matched portfolios of US Treasury bonds. The returns for each bank size category are value-weighted averages. The size categories are defined based on ranking of assets in the previous quarter, with the largest 5 banks identified as mega, the next 45 largest banks labeled large, the next 100 being labeled medium, and the remainder being considered small. Bank asset returns are calculated each quarter with assumptions about the share of non-interest expense allocated to asset-based activities. Investments are non-loan interest bearing assets and are assumed to have no associated operating expenses. Annual loan operating expenses ratios are calculated based on the share of gross loan value to total actively managed bank activities. The mean returns on the benchmark are accounting returns. Each month, for each size category, the benchmark portfolio invests the short-term asset share in one-month US Treasury bills and the remaining in a *h*-period US Treasury bond that is held until maturity, where *h* = 2 x the long-term average maturity of assets in that size category, with the average maturity of the bonds in the portfolio equaling *h*/2. The *t*-statistics use standard errors of the mean difference that are calculated assuming that the number of observations is based on the annual rather than quarterly frequency as an adjustment for the autocorrelation in accounting returns.

	Small	Med	Large	Mega	All
Panel A: Return on Non-Loan Investment Portfolio (Pre-tax)					
Investments / IBA	27.6	29.6	32.4	50.6	41.5
Cash-Equiv Shr	20.2	20.5	41.7	71.9	58.4
LT Avg Maturity (Yrs)	7.8	8.0	8.9	10.2	9.4
Bank Investment Return	3.94	4.06	3.85	3.66	3.75
UST-equiv Return	5.00	5.02	4.40	3.28	3.78
Risk Premium	-1.06	-0.96	-0.55	0.38	-0.02
t-statistic	(-12.26)	(-11.68)	(-4.43)	(2.56)	(-0.22)

	Small	Med	Large	Mega	All
Panel B: Return on Loan Portfolio (Pre-tax)					
Loans / IBA	72.4	70.4	67.6	49.4	58.5
Operating Expense Ratio	1.91	1.83	1.98	1.83	1.88
Shr of Total Oper Exp	39.2	36.4	32.9	24.9	29.4
Cash-Equiv Shr	30.7	34.7	49.2	51.4	46.4
LT Avg Maturity (Yrs)	5.1	5.6	6.3	6.7	6.2
Loan Loss Rate	0.64	0.68	1.01	1.28	1.07
IG-Equiv Shr	73.96	72.81	60.69	50.78	58.41
Cap Mkt Credit Premium	0.68	0.69	0.73	0.77	0.74
Loan Return	4.17	3.97	3.47	3.60	3.63
UST Equiv Return	4.10	4.08	3.75	3.74	3.82
Risk Premium	0.07	-0.10	-0.28	-0.14	-0.20
t-statistic	(0.58)	(-0.70)	(-1.58)	(-0.75)	(-1.21)
Loan Return	4.17	3.97	3.47	3.60	3.63
Cap Mkt Equiv Return	4.78	4.76	4.48	4.51	4.57
Bank Loan Advantage	-0.61	-0.79	-1.01	-0.91	-0.94
t-statistic	(-5.30)	(-5.33)	(-5.71)	(-5.01)	(-5.75)
Loan Ret (Pre-Expense)	6.08	5.80	5.45	5.43	5.51
UST Equiv Return	4.10	4.08	3.75	3.74	3.82
Risk Premium	1.97	1.72	1.70	1.70	1.69
t-statistic	(17.98)	(12.18)	(8.86)	(8.41)	(9.60)
Loan Ret (Pre-Expense)	6.08	5.80	5.45	5.43	5.51
Cap Mkt Equiv Return	4.78	4.76	4.48	4.51	4.57
Bank Loan Advantage	1.29	1.04	0.97	0.92	0.95
t-statistic	(11.78)	(7.34)	(5.03)	(4.57)	(5.38)

	Small	Med	Large	Mega	All
Panel C: Return on Interest Bearing Assets					
Pre-tax Return on IBA	4.37	4.26	3.83	3.76	3.86
UST Equiv Return	4.36	4.36	3.96	3.50	3.80
Risk Premium	0.02	-0.10	-0.13	0.25	0.06
t-statistic	(0.14)	(-0.71)	(-0.81)	(1.72)	(0.57)
After-tax Return on IBA	3.08	2.94	2.64	2.60	2.67
UST Equiv Return	4.36	4.36	3.96	3.50	3.80
Risk Premium	-1.27	-1.43	-1.32	-0.90	-1.13
t-statistic	(-9.79)	(-9.30)	(-9.70)	(-5.62)	(-9.14)
Panel D: Return on Unlevered Assets, Including Contribution from Banking Services					
Pre-tax Asset Return	4.28	4.20	4.41	3.96	4.13
UST Equiv Return	4.23	4.21	3.78	3.35	3.64
Risk Premium	0.04	-0.01	0.63	0.60	0.49
t-statistic	(0.41)	(-0.05)	(4.09)	(3.41)	(3.72)
After-tax Asset Return	3.01	2.90	3.04	2.74	2.86
UST Equiv Return	4.23	4.21	3.78	3.35	3.64
Risk Premium	-1.22	-1.31	-0.73	-0.61	-0.78
t-statistic	(-8.77)	(-8.25)	(-4.66)	(-3.56)	(-5.33)

Table 3
Bank Funding Rates and Full Costs (1997 – 2017)

This table reports annualized returns on bank assets for US bank holding companies and measures these returns relative to passive maturity-matched portfolios of US Treasury bonds. The returns for each bank size category are value-weighted averages. The size categories are defined based on ranking of assets in the previous quarter, with the largest 5 banks identified as mega, the next 45 largest banks labeled large, the next 100 being labeled medium, and the remainder being considered small. Bank asset returns are calculated each quarter with assumptions about the share of non-interest expense allocated to asset-based activities. Investments are non-loan interest bearing assets and are assumed to have no associated operating expenses. Annual loan operating expenses ratios are calculated based on the share of gross loan value to total actively managed bank activities. The mean returns on the benchmark are accounting returns. Each month, for each size category, the benchmark portfolio invests the short-term asset share in one-month US Treasury bills and the remaining in a *h*-period US Treasury bond that is held until maturity, where *h* = 2 x the long-term average maturity of assets in that size category, with the average maturity of the bonds in the portfolio equaling *h*/2. The *t*-statistics use standard errors of the mean difference that are calculated assuming that the number of observations is based on the annual rather than quarterly frequency as an adjustment for the autocorrelation in accounting returns.

	Small	Med	Large	Mega	All
Panel A: Effective Bank Deposits (Pre-tax)					
Deposits / A	78.8	74.1	65.3	48.5	57.8
Transaction Deposits / A	46.6	46.3	42.7	28.1	35.6
Time Deposits / A	32.2	27.8	22.7	20.3	22.2
Dep OpEx / Deposits	1.60	1.57	1.78	1.61	1.66
Dep OpEx / Total OpEx	39.2	36.4	32.9	24.9	29.4
Cash-Equiv Shr	59.0	62.4	64.8	57.1	61.1
LT Avg Maturity (Yrs)	1.1	1.1	1.1	0.8	1.0
Deposit Cost	3.20	2.97	2.93	2.93	2.93
UST Return	2.42	2.39	2.37	2.33	2.38
Bank Cost Advantage	-0.78	-0.58	-0.55	-0.59	-0.55
t-statistic	(-4.45)	(-3.26)	(-3.29)	(-3.92)	(-3.62)
Deposit Rate	1.55	1.35	1.07	1.23	1.19
Bank Rate Advantage	0.88	1.04	1.30	1.10	1.19
t-statistic	(4.99)	(5.63)	(6.54)	(6.70)	(6.78)

	Small	Med	Large	Mega	All
Panel B: Transaction Deposits (Pre-tax)					
Deposit Cost	3.22	2.89	2.98	3.05	2.97
UST Return	2.09	2.09	2.09	2.09	2.09
Bank Cost Advantage	-1.13	-0.80	-0.89	-0.97	-0.88
t-statistic	(-4.19)	(-2.93)	(-3.55)	(-4.30)	(-3.73)
Deposit Rate	0.34	0.22	0.02	-0.17	0.00
Bank Rate Advantage	1.75	1.87	2.07	2.26	2.08
t-statistic	(5.45)	(5.58)	(5.78)	(5.99)	(5.93)
Panel C: Time Deposits (Pre-tax)					
Deposit Cost	3.03	2.93	2.66	2.65	2.71
UST Return	2.90	2.90	2.90	2.66	2.84
Bank Cost Advantage	-0.13	-0.03	0.24	0.01	0.13
t-statistic	(-0.81)	(-0.17)	(1.62)	(0.05)	(1.01)
Deposit Rate	3.03	2.93	2.66	2.65	2.71
Bank Rate Advantage	-0.13	-0.03	0.24	0.01	0.13
t-statistic	(-0.81)	(-0.17)	(1.62)	(0.05)	(1.01)
Panel D: Interest Paying Debt (Pre-tax)					
Debt / A	10.0	13.6	19.6	34.8	26.7
Cash-Equiv Shr	28.3	39.9	27.8	36.8	34.8
LT Avg Maturity (Yrs)	1.5	1.5	1.6	1.6	1.5
Bank Debt Cost	3.84	3.65	3.50	3.13	3.25
UST Equiv Return	2.89	2.76	2.93	2.82	2.85
Bank Debt Risk Prem	0.95	0.89	0.57	0.30	0.40
t-statistic	(5.25)	(5.88)	(3.19)	(1.77)	(2.69)

Table 4
Maturity Properties of Aggregate Bank Balance Sheet (1997 – 2017)

This table reports the average proportions of various components of the aggregate banking sector measured relative to effective assets. Effective assets are total book assets less no-interest cash, which is also subtracted from deposits. The difference between assets and liabilities is labeled book equity (BE). We use the maturity information reported by bank holding companies to determine the mix of short-term (Cash equivalent) and longer term assets within each category. The Delta for the long-term portion of each category measures the sensitivity of value to an unexpected interest rate shock. The Dollar Delta is the product of the category weight times the long-term share times the long-term delta.

	Weight	Cash Share	Long-term Share	Long-term Avg Maturity	Long-term Delta	Dollar Delta
Investments	0.3739	0.5841	0.4159	9.36	-0.0772	-0.0120
Loans	0.5327	0.4639	0.5361	6.21	-0.0557	-0.0159
Other Assets	0.0933	1.0000	0.0000	0.00	0.0000	0.0000
Total Effective Assets	1.0000	0.5589	0.4411	6.81	-0.0586	-0.0279
Deposits	0.5789	0.6112	0.3888	0.96	-0.0103	-0.0023
Debt	0.2730	0.3481	0.6519	1.54	-0.0159	-0.0028
Total Liabilities	0.8520	0.4489	0.5511	0.98	-0.0103	-0.0051
Residual (BE)	0.1480					-0.0228
					$Delta / BE	-0.1541

Table 5
Bank Equity Excess Returns (1979 – 2016)

This table reports regressions of monthly and quarterly bank returns in excess of the one-month US Treasury bill rate on various capital market factors. All capital market factors represent portfolio excess returns. Bank stocks are identified by the Fama and French (1993) industry classification. The value-weight (VW) stock market portfolio is calculated by Ken French. TERM is the excess return of a US Treasury (UST) bond portfolio with an average maturity of five years. The IG credit spread is calculated from the Barclay's total return index for investment grade corporate bonds with an average maturity of one to three years, from which we subtract the return to a passive UST portfolio with an average maturity of two years. The HY credit spread is calculated from the Vanguard Intermediate Term High Yield Bond Index Fund (VWEHX), from which we subtract the return to a passive UST portfolio with an average maturity of six years. The CREDIT factor is calculated as 60% IG spread plus 40% HY spread. The bank-like mutual fund portfolio excess return is comprised of 3.2 units of TERM and 3.6 units of CREDIT, with all leverage paying 0.5% above the riskfree rate. The adjusted R-squared is denoted R2 and *t*-statistics are in parenthesis.

Panel A: Summary statistics

Portfolio	**Mean Excess Return**	**Standard Deviation**	**Sharpe Ratio**	**CAPM Beta**	**Annual CAPM Alpha (%)**	**Worst Draw-down**
Bank Stocks	8.80	21.18	0.42	1.06	0.46	-74.38
Bank-like mutual fund (Services = RF)	10.44	16.52	0.63	0.53	6.29	-49.42
Bank-like mutual fund (Services = 0.5MKT)	14.37	21.38	0.67	1.03	6.29	-62.29
VW Stock Market	7.87	15.40	0.51	1.00	0.00	-50.39
TERM	2.90	5.12	0.57	0.04	2.62	-10.94
IG Credit Spread	0.69	2.18	0.31	0.03	0.47	-9.79
HY Credit Spread	0.89	7.26	0.12	0.24	-1.04	-37.32
CREDIT: 0.6IG+0.4HY	0.77	3.86	0.20	0.11	-0.13	-21.06

Panel B: Excess return regressions

Intercept	MKT	TERM	CREDIT	R^2 / N
Panel A: Monthly bank stock portfolio				
0.0004	1.0593			0.5924
(0.21)	(25.74)			456
-0.0001	1.0446	0.2028	0.0644	0.5926
(-0.03)	(21.00)	(1.39)	(0.30)	456
Panel B: Quarterly bank stock portfolio				
0.0010	1.1022			0.6201
(0.16)	(15.73)			152
-0.0017	1.0247	0.4163	0.5420	0.6246
(-0.28)	(11.72)	(1.93)	(1.39)	152
Panel C: Monthly bank-like mutual fund portfolio (Services = RF)				
0.0052	0.5270			0.2398
(2.66)	(12.02)			456
0.0000	0.0000	3.2000	3.6000	1.0000
n.a.	n.a.	n.a.	n.a.	456
Panel D: Monthly bank-like mutual fund portfolio (Services = 0.5MKT)				
0.0052	1.0270			0.5463
(2.66)	(23.43)			456
0.0000	0.5000	3.2000	3.6000	1.0000
n.a.	n.a.	n.a.	n.a.	456

Appendix

A. Data:

Reporting requirements for form FR Y-9C are related to asset size and have changed over time. Specifically, in March 2006, the asset-size reporting requirement was increased from $150M to $500M, and in March 2015, it was increased from $500M to $1B. To create a more consistent sample over our sample period, we require banks to have assets exceeding a size cutoff rule defined as follows: $1B in March 2015 deflated at the quarterly rate of 1.5%. Additionally, we restrict the sample to US banks with deposits equaling at least 20% of assets. This results in an average quarterly sample size of nearly 600 BHCs that is roughly constant through time. Despite the size-based sample restrictions, the resulting sample is heavily tilted towards small banks. Most banks are three orders of magnitude smaller than the largest three banks. The following exhibit shows the size distribution of the bank sample with categories based on average asset values measured at the end of 2005.

Exhibit A: Size Distribution of US Bank Holding Companies Based on Average Quarterly Assets (2005Q4).

Size Category	Count	Mean	Min	Max	Share
Small	624	1,011,584	487,274	2,980,757	7%
Medium	100	5,830,890	2,762,966	14,642,982	7%
Large	45	54,556,556	12,103,390	209,465,000	28%
Mega	5	997,958,934	481,741,000	1,494,037,000	58%