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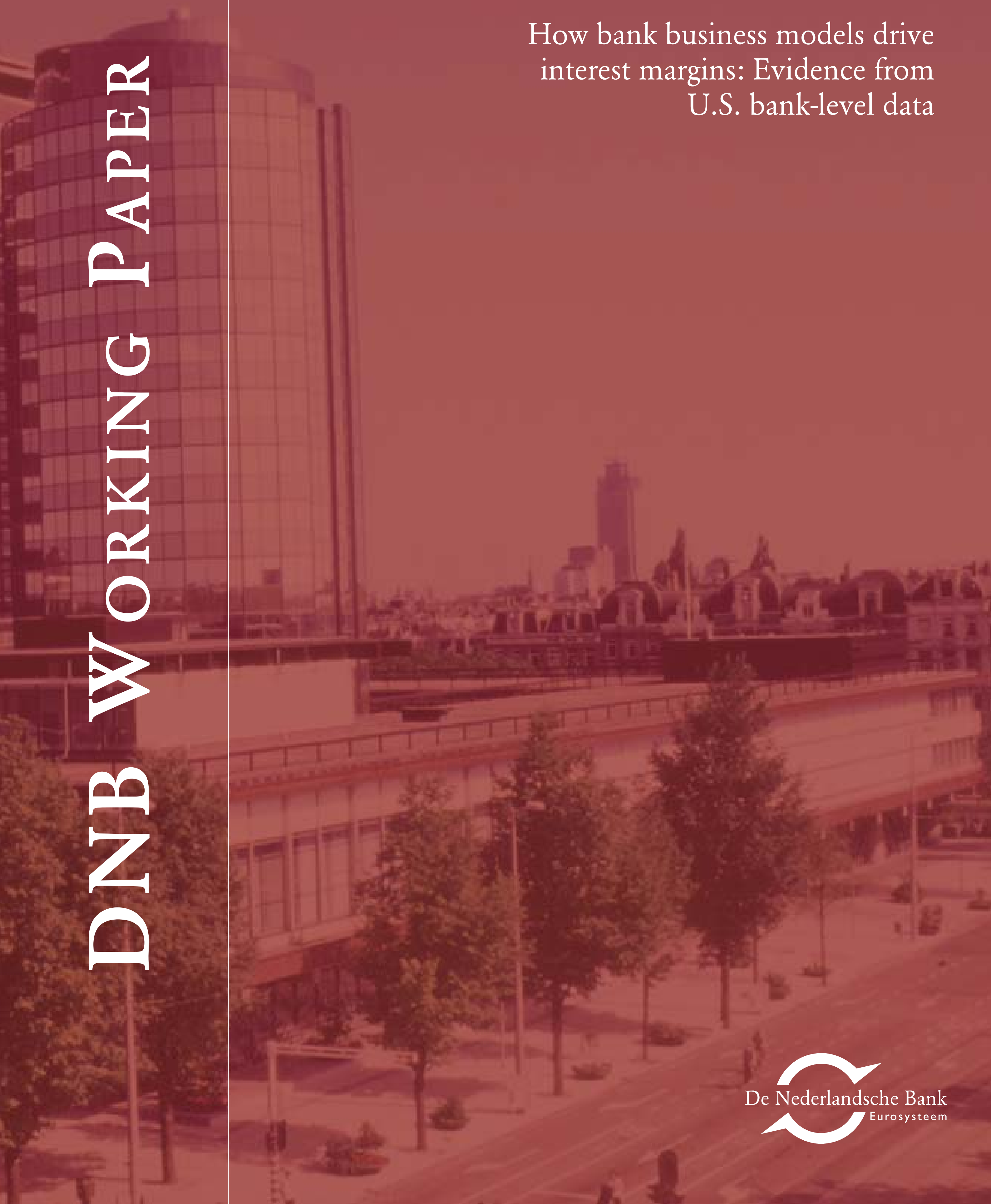

DNB Working Paper

De Nederlandsche Bank
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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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# How bank business models drive interest margins:

## Evidence from U.S. bank-level data

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**Abstract**

The two decades prior to the credit crisis witnessed a strategic shift from a traditional, relationships-oriented model (ROM) to a transactions-oriented model (TOM) of financial intermediation in developed countries. A concurrent trend has been a persistent decline in average bank interest margins. In the literature, these phenomena are often explained using a causality that runs from increased competition in traditional segments to lower margins to new activities. Using a comprehensive dataset with bank-level data on over 16,000 FDIC-insured U.S. commercial banks for a period ranging from 1992 to 2010, this paper qualifies this chain of causality. We find that a bank's business model, measured using a multi-dimensional proxy of relationship banking activity, exerts a robust, positive effect on interest margins. Relationship banks still enjoy considerable interest margins. Our results provide evidence that banks' quest for growth, not the level of competition in traditional retail segments, has transformed banks' balance sheets and has reduced interest rate margins as a by-product.

Keywords: interest margins; relationship banking; transaction banking; bank risk-taking
JEL Codes: G21; G28

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## 1. Introduction

Interest margins in developed banking sectors have experienced a steady decline during the past two decades. In explanation of this phenomenon, the literature describes a causality that runs from increased competition in the retail segments to lower margins to new activities. A common argument runs as follows: heightened competition and disintermediation depressed interest margins in traditional retail markets, motivating banks in developed countries to diversify into new lines of business in order to increase their non-interest income (Allen and Santomero, 2001; Lepetit *et al.*, 2008; Valverde and Fernández, 2007; Albertazzi and Gambacorta, 2009). However, empirical research by Elsas (2005) and DeGryse and Ongena (2007) shows that heightened interbank competition *reinforces* banks' focus on traditional, relationship lending activities. These seemingly contradictory findings call into question the exact nature of the relationship between competitive conditions, bank strategy and interest margins.

This paper seeks to qualify the chain of causality running from competition to lower margins to new activities. We propose an alternative explanation for the decline in interest margins, which, in our view, better fits the empirical and narrative evidence on bank behavior in the run-up to the credit crisis. The two decades prior to the credit crisis also witnessed a strategic shift from a relationships-oriented model (ROM) to a transactions-oriented model (TOM) of financial intermediation in developed countries. Although theory suggests that this development has important repercussions for the size of net interest margins, it has largely been omitted in the empirical research on bank interest margins.

Using a comprehensive dataset with bank-level data on over 16,000 FDIC-insured U.S. commercial banks for a period ranging from 1992 to 2010, this paper tests whether a bank's business model is empirically important in explaining the size of bank interest margins. In addition to a number of univariate proxies commonly used in the literature, we utilize factor analysis to measure the variable of interest, i.e. relative adherence to ROM, using five different dimensions. In doing so, we provide a more detailed and accurate description of the chain of causality leading to lower interest margins in developed banking industries than the one that is available now. The key difference with the traditional explanation is that banks' quest for growth, not the level of competition in traditional retail segments, has transformed banks' balance sheets and has reduced interest rate margins as a by-product.

There are several reasons why we think our empirical agenda is important. First, earlier research on the impact of competitive conditions on bank interest margins has proven inconclusive (see section 2). This implies that there is room for an alternative or complementary explanation. Second, the sample periods of recent studies in the field end in 2001 (Valverde and Fernández, 2007 and Hawtrey and Liang, 2008) and thus do not cover the period in which the strategic shift towards transaction banking has been most prominent. Other recent studies focus on low-income countries instead of developed economies (e.g. Poghosyan, 2012). The only exception is a small-scale study by Liebeg and Schwaiger (2009), looking at the determinants of interest margins of small, local banks in Austria, with a sample ranging to 2005. While the shift from relationship towards transaction banking in advanced economies has figured prominently in debates on the causes of the credit crisis (Buiter, 2008), its implications for interest rate margins have thus not been researched previously. Our U.S. sample covers the period 1992 – 2010, and promises to yield interesting results in this respect. Finally, a better understanding of the different banking models and their impact on bank earnings profiles can contribute to the policy debate sparked by the credit crisis.

This paper is structured as follows. Section 2 provides an overview of the relevant literature. Section 3 describes our methodology and dataset and lists the hypotheses for testing. Section 4 reports the results. Section 5 concludes.

## 2. The impact of bank business models on interest margins

Central in empirical research in the field of interest margins is the model developed by Ho and Saunders (1981). Combining the at that time concurrent hedging and expected utility approaches, Ho and Saunders (henceforth HS) model banks as risk-averse 'dealers' in deposits and loans. Banks demand a positive spread as the price for providing immediacy of service in face of this transactions uncertainty. According to HS, the optimal mark-up and thus the interest margin of a bank are a function of (i) competitive conditions and (ii) a risk-adjustment term, depending on three factors: bank's management's coefficient of risk aversion, interest rate volatility and transaction size.

Over the years, authors have made several extensions to this model. Allen (1988) incorporates loan heterogeneity in the model. Angbazo (1997) and Maudos and De Guevara (2004) formally include respectively credit risk and operating costs. Empirical research on the determinants of interest margins in developed economies has attested to a positive relationship between bank interest margins and for example interest rate risk (Angbazo, 1997; Saunders and Schumacher, 2000; Valverde and Fernández, 2007) and credit risk (HS; Angbazo, 1997; Maudos and De Guevara, 2004; Hawtrey and Liang, 2008). Section 3 describes the different determinants of bank interest margins and their measurement in more detail.

HS posit that competitive conditions influence the size of bank interest margins, such that higher market power leads to higher margins. In the past two decades, the interest margins of banks in many developed banking industries, including the United States, have been declining steadily. In explanation of deteriorating or low margins, studies in the field of interest margins show a strong focus on market structure (Demirgüç-Kunt and Huizinga, 1999; Maudos and De Guevara, 2004; Gischer and Jüttner, 2003; Berger *et al.*, 2004; De Guevara *et al.*, 2005; Lepetit *et al.*, 2008), following for example the traditional structure-conduct-performance hypothesis or similar paradigms.

One often-used argument is the following: increased competition and disintermediation lowered margins in traditional retail markets, and in response banks in developed countries branched into non-traditional activities in order to increase their non-interest income. Thus, for example Allen and Santomero (2001, p. 274) recount: "As traditional businesses began to dry up, the management of those institutions was forced to become entrepreneurial and develop new businesses in order to survive." Lepetit *et al.* (2008, p. 2325) state that: "Commercial banks suffered from a sharp decline in interest margins and profitability on traditional intermediation activities. Banks reacted to this new environment by diversifying into new activities." See Valverde and Fernández (2007, p. 2058) and Albertazzi and Gambacorta (2009, p. 395) for further illustrations of this line of reasoning. Common to these quotes is a causality that runs from competition to lower margins to new activities.

The empirical evidence, however, is hazy at best. Authors in the field generally agree that market structure, often measured using an index of market concentration or market power such as the Herfindahl index or Lerner index, affects margins positively. Demirgüç-Kunt *et al.* (2003) find that the generally positive relationship between concentration and bank margins breaks down when controlling for institutional development. Valverde and Fernández (2007) also suspect that the relationship between concentration and interest margins may be influenced by third variables and find that market concentration can even affect margins negatively. Demirgüç-Kunt and Huizinga (1999) and Gischer and Jüttner (2003) find evidence that banks in countries with a more competitive banking sector have smaller margins. Yet in contrast, Maudos and De Guevara (2004) attribute the fall of margins in the European banking system to a relaxation of competitive conditions rather than heightened competition. The heterogeneity of the available evidence calls into question the exact nature of the relationship between competitive conditions and margins.

Authors such as Allen and Santomero (2001), Lepetit *et al.* (2007) and Albertazzi and Gambacorta (2009) assume that increased competition in the traditional, retail segments motivated banks to move from a traditional, relationships-oriented model towards a transactions-oriented model of financial intermediation. However, this is not obvious from the literature. Boot and Thakor (2000) predict that increased interbank competition (as opposed to competition driven by capital markets or disintermediation) renders relationship lending *more* attractive for banks since it provides better insulation against price competition (see also Elsas, 2005). This is affirmed by the empirical findings of Elsas (2005) and DeGryse and Ongena (2007), who find that fiercer interbank competition reinforces banks' focus on relationship lending activities.

We put forward an alternative or more complete explanation. In the past two decades, many banks in developed countries moved from a traditional, relationships-oriented model of financial intermediation (ROM) towards a transactions-oriented model of financial intermediation (TOM). Thus, Durguner (2012) documents a decline in the importance of borrower-lender relationships in the U.S. banking sector, consistent with a movement towards more hard-information based lending. This shift in business model is obviously closely related to the structure of the markets in which banks operate and also affects banks' market power, but not in the way in which this relationship is usually modeled in the literature on bank interest margins.

Because of their ability to invest in customer-specific information – often 'soft' in nature –, relationship banks can produce differentiated products, create local market power and establish information monopolies (e.g. Rajan, 1992; Boot, 2000; Elyasiani and Goldberg, 2004). These locally focused banks have the potential to earn high margins: paying a low interest rate to a loyal base of core depositors, they can charge high interest rates to an information-problematic class of borrowers, which otherwise would have difficulty obtaining funding from the capital markets, and over which they have market power due to information-based switching costs. In contrast, transaction banking focuses on the efficient use of 'hard' information and the commoditization of financial services. Transaction banks take advantage of economies of scale in the production, marketing, securitization and servicing of 'transaction loans'. These banks operate with low unit costs, but are likely to earn low interest margins as they are essentially selling financial commodity products in highly competitive markets. As a result, spreads for transaction banks are likely to be smaller (DeYoung *et al.*, 2004, DeYoung and Rice, 2004b, and DeYoung, 2010).

It seems deregulation and technological advances left banks with a strategic choice between ROM and TOM (see also DeYoung, 2010). The former is a profitable strategy, with the opportunity to exploit local market power and achieve considerable interest margins. Yet the opportunity for growth in this strategy is inherently limited, both because transportation and monitoring costs increase with geographical distance to the borrower (e.g. DeGryse and Ongena, 2005) and because smaller banks have a competitive advantage in processing the soft information used in relationship lending (e.g. Berger and Udell, 2002, and Stein, 2002). Large banks, given the scale of their operations, were better equipped to react to the strategic opportunity posed by the new technologies such as credit scoring and securitization. Slow growth in the traditional deposit and loan segments constrained these banks in their quest to maximize return on equity (ROE). Wholesale funding and securitization enabled them to free themselves from these constraints as they accessed the international markets, and opened up a quick route to expansion and higher ROE. Huang and Ratnovski (2010) call this one of the "bright sides" of wholesale funding. Although the move towards TOM entails a move into more competitive market segments with lower interest margins, the scalability of their operations and the opportunity to supplement their interest income with fee income from loan origination, securitization and loan servicing, allows transaction banks to earn higher returns on equity than traditional banks (DeYoung *et al.*, 2004, and DeYoung and Rice, 2004b).

The contribution of the present paper is to incorporate the shift from traditional intermediation services to transaction banking in an empirical model of margins. The shift towards transaction banking blurs the conventional relationship between market structure, competition and interest margins as investigated in empirical studies of bank interest margins. The balance sheets of today's banks are an assortment of ROM elements (loans and deposits) and TOM elements (securities and money-market funding). Banks conducting business in the international money and capital markets hold little market power. As a result, near-competitive conditions hold, and TOM-margins will either be thin or reflect (excessive) risk-taking. For the ROM-share of the balance sheet, however, different conditions hold and banks may be able to exploit market power due to local presence or information monopolies. A bank's overall net interest margin will reflect the composition of the balance sheet and specifically the allocation across ROM- and TOM-activities. The strategic repositioning from ROM towards TOM can thus provide an explanation for the negative relationship between concentration ratios and interest margins that is occasionally found in the literature (e.g. Maudos and De Guevara 2004). When transaction banking and bank consolidation are two contemporaneous trends, a larger concentration ratio is likely to coincide with lower interest margins. It is therefore important to disentangle the TOM-effect by including a variable measuring the shift to transaction banking into an empirical model of interest margins.

In conclusion, in an era of rapidly changing banking models, an empirical model of interest margins should take bank balance sheet composition into account as a relevant driver of margins. And if the strategic shift amongst banks in the past two decades proves to be an important driver of spreads, our results provide a more accurate explanation for the decline in interest margins that occurred in many developed countries than the one that is available now. The following section puts forward our model for testing and lists the associated hypotheses.

**3. Data and methodology**

This paper uses bank-level data from the call reports (also: Thrift Financial Reports) published on a quarterly basis by the Federal Deposit Insurance Corporation (FDIC). Our panel dataset contains quarterly balance sheet and income statement data on every FDIC-insured commercial bank for a period ranging from 1992 to 2010. The cross-section includes more than 16,000 banks (unbalanced sample). Note that at the time, at which we built our database, statements of condition and income were only publicly available on a quarterly basis from 2001 onwards. Including the years 1992 – 2000 in our quarterly dataset thus requires a conversion of the end-of-year income data to approximate average quarterly income in these years. Since the 1990s were a period characterized by industry deregulation and increased transaction banking activity, we prefer analyzing the entire sample period 1992 – 2010 using the annual data, and utilize the quarterly dataset for robustness testing. The number of bank-year observations is 161,239; the number of bank-quarter observations is 385,971.

The length and size of our sample poses some challenges in terms of data handling. The following describes the main decisions made in this respect. First of all, we follow Demsetz (1999), Kashap and Stein (2000), Maudos and De Guevara (2004) and Claeys and Van der Vennet (2008) in conducting our analysis on the bank-level (as opposed to the holding company level) and use unconsolidated data. We consider the bank an appropriate decision-making unit as regards the distribution of activities between ROM and TOM. Second, to eliminate the distorting effect of bank mergers and acquisitions for the continuity of our time series, we follow Kashap and Stein (2000), Campello (2002) and Cebenoyan and Strahan (2004) and eliminate all bank-quarters, in which mergers or acquisitions took place, from our sample. Thus, we removed all bank-quarter (bank-year) observations, in which asset growth was above 100 percent or below 100 percent as well as those in which total loan growth was above 50 percent or below 50 percent (Cebenoyan and Strahan, 2004). Further, we lose some data due to obviously incorrect data. For instance, we dropped those observations from the sample, for which balance sheet ratios either exceeded 1 or were negative. Finally, the ratios of securities plus other assets to total loans, operating costs to gross income and loans to employees contain some very large positive and negative outliers. To make sure that these outliers do not drive our results, we have Winsorized these variables at the 0.5% level (Cebenoyan and Strahan, 2004). These corrections leave us with a total sample of 139,362 observations using annual series (or 313,219 using quarterly series).

The macro-level variables included in our analysis have three different sources. Quarterly and annual GDP statistics are obtained from the OECD National Accounts. Data on inflation or the rate of change of the consumer price index (CPI) is taken from the OECD Economic

Outlook. Finally, daily (quarterly, annual) rates on Treasury bills with different maturities are obtained from the Federal Reserve Bank.

Following more recent iterations of the HS model (including those of Angbazo, 1997, Maudos and De Guevara, 2004, and Hawtrey and Liang, 2008), we test an extended empirical specification, incorporating the effects of such factors as credit risk, operating costs, managerial efficiency and scale on bank interest margins. We add an additional variable to capture the extent to which banks are operating according to either a relationships-oriented or a transactions-oriented model (*relbank*). This leads to the following specification:

$$\begin{aligned} margin_{i,t} = \alpha &+ \beta_1 * relbank_{i,t-1} + \beta_2 * capstruc_{i,t-1} + \beta_3 * dgdp_t + \beta_4 * inflation_t \\ &+ \beta_5 * i\text{-}level_t + \beta_6 * i\text{-}vol_t + \beta_7 * credrisk_{i,t-1} + \beta_8 * opex_{i,t-1} + \beta_9 * c5_t \\ &+ \beta_{10} * implint_{i,t-1} + \beta_{11} * oppcost_{i,t-1} + \beta_{12} * riskexp_{i,t-1} + \beta_{13} * maneff_{i,t-1} \\ &+ \beta_{14} * scale_{i,t-1} + \varepsilon \end{aligned} \quad (1)$$

In this equation $i$ denotes bank $i$ and $t$ denotes period $t$. The dependent variable, net interest margin (*margin*), is defined as net interest income as a percentage of average total assets or (interest income – interest expense)/average total assets (see also Angbazo, 1997, Demirgüç-Kunt and Huizinga, 1999, Maudos and De Guevara, 2004, and Hawtrey and Liang, 2008). The bank-specific independent variables are lagged by one period. The estimation uses panel least squares, White period standard errors to account for serial correlation, and cross-section (i.e. bank) fixed effects.

We measure a bank's business model, using five different dimensions. There are several bank-level measures of relationship banking found in the literature. Asset-based measures include small business loans (with original dollar amounts of <$1M or <$500K) as a percentage of total assets (Goldberg and White, 1998, and Elyasiani and Goldberg, 2004); the ratio of commercial and industrial loans to total assets (Goldberg and White, 1998); and the ratio of commercial and industrial loans plus construction loans, agricultural loans and leases to total assets (Peek and Rosengren, 1995, and Goldberg and White, 1998). These studies indicate that these are loans typically made by local banks, characterized by informational opacity and not easily securitized. More recent research by Berger and Udell (2006) nuances this view, stressing that lending technology used rather than client group served determines whether a loan should be classified as a relationship loan. Thus, asset-based lending technologies (including factoring, fixed-asset lending and leasing) are based on hard information about the quality of the underlying asset and are correctly classified as transactions lending technologies.

Taking this into account, we construct two assets-based measures of relationship banking activity. The first is based on the amount of corporate loans on a bank's balance sheet, excluding those loans that are secured by real estate, land, or other means. Construction, land development and other land loans reported to the FDIC are secured by real estate or land and therefore fit Berger and Udell's definition of transaction loans, as do leases. However, commercial and industrial loans and farm loans are generally unsecured. We therefore use the ratio of commercial and industrial loans plus farm loans to total assets as a first measure of relationship banking activity (*corploass*). Secondly, from 2003 onwards, the June call reports include a statement of small business lending, allowing us to perform an additional regression on 47,653 bank-quarter observations. Drawing upon this schedule, we use the ratio of small business loans (with original amounts of $1M or less) to total assets (*sbloass*) as an alternative assets-based proxy of relationship banking activity.

A second, liabilities-based measure of relative relationship banking activity found in the literature is the core deposits to total liabilities ratio. Berlin and Mester (1999) were the first to link deposit-funding to relationship lending. They show that banks funded more heavily with core deposits, like savings or demand deposits, are able to provide more inter-temporal loan rate smoothing in response to exogenous credit shocks, a feature often attributed to relationship lending (e.g. Allen and Gale, 1997; Boot, 2000). Song and Thakor (2008) expand this notion and establish that banks want to match the highest value-added liabilities (core or retail deposits) with the highest value-added loans (relationship loans). In doing so, banks minimize the fragility imposed by withdrawal risk and maximize the value added in relationship lending. We use the ratio of retail deposits to total liabilities as a third measure of bank business model (*depliab*).

Next, we include the ratio of interest income to total income (i.e. interest income plus non-interest income) (*intincrel*). Non-interest income includes income from trading and securitization, investment banking and advisory fees, brokerage commissions, venture capital, and fiduciary income, and gains on non-hedging derivatives. DeYoung (2007) and Brunnermeier *et al.* (2011) suggest that a higher ratio of non-interest income to total income is as such related to an increase in non-traditional (or transaction banking) activities (whilst interest income derives from more traditional banking activities).

Fourth, we include the natural logarithm of the number of domestic offices divided by total loan volume (*branchnet*) as a measure of local presence. We posit that a higher ratio of domestic offices to loan volume is indicative of a stronger branch network, which is a feature of a traditional, relationship banking strategy, rather than an arm's length or transactions-oriented model of financial intermediation.

Finally, the literature suggests that the implementation of ROM versus TOM is related to bank size. Whereas large banks may have a competitive advantage in making 'hard'-information based transaction loans, small banks have a competitive advantage in lending technologies that are based on relationship lending and 'soft' information and are best managed in small, closely-held organization with few managerial layers. Recent research by Berger and Black (2010) and De La Torre *et al.* (2010) affirms the relative advantages in the different lending technologies related to asset size, but dispels the notion that this means that large banks are per definition better at catering to large, transparent organizations, and small banks to small and opaque borrowers, for the reasons described by Berger and Udell (2006). We explore the role of bank size by analyzing subsamples based on asset size (*assetclass*). Following DeYoung (2007), we divide banks in the sample in four asset classes: (i) large banks, with more than $20B of assets; (ii) medium banks, with assets between $10B and $20B; (iii) large community banks, with assets between $500M and $2B; and (iv) small community banks, with assets of $500M or less (compare DeYoung *et al.*, 2004; Stiroh, 2006; and DeYoung, 2010). We use 2007 as our base year and track the banks in the different classes over time.

There is a certain measurement error in making inferences about a bank's business model from any single one of the bank-level relationship banking measures described above. Thus, for example not all small business loans are in fact relationship loans (Berger and Udell, 2006). However, using multiple measures of a construct tends to reduce the effect of measurement error in any individual indicator on the accuracy of results (Kline, 2005). We therefore perform a factor analysis (e.g. Diamantopoulos *et al.*, 2008). In our tests of specification (1), we thus include six univariate proxies of relationship banking activity. In addition, we include two composite measures of a bank's business model, which load on five different dimensions. We expect a significant, positive relationship between all these variables, indicative of bank's business model, and a bank's net interest margin.

We will briefly comment on the other, control variables in equation (1). As is common to more recent iterations of the HS model, we include the core capital-to-assets ratio (*capstruc*) to capture the effect of bank capital structure or solvency on margins, and expect a positive effect (Angbazo, 1997; Demirgüç-Kunt and Huizinga, 1999; Valverde and Fernández, 2007). We incorporate both economic growth (*dgdp*) and inflation (*inflation*) in our model to control for the macroeconomic environment. We include both interest rate level and interest rate volatility (*i-short* and *i-vol*). In line with recent research by Borio and Zhu (2008) and Maddaloni and Peydró (2010), the coefficient for interest rate level captures the effect of monetary policy on bank risk-taking and, ultimately, interest margins. Interest rate volatility is the conventional proxy for interest rate risk. In the original HS framework, this is expected to bear a positive sign. In line with HS, Saunders and Schumacher (2000), Maudos and De Guevara (2004) and Hawtrey and Liang (2008), we use the annual (or quarterly, where appropriate) standard deviation of daily interest rates on 3-month Treasury bills to proxy interest rate risk. To test the sensitivity of interest rates to longer-term volatility and add to the robustness of our results, we repeat our regression analysis using the rates on 1-year and 3-year Treasury bills.

We follow HS and Angbazo (1997) and use net loan charge-offs/average total assets to measure credit risk (*credrisk*) and expect a positive sign. We check whether the results obtained using this measure hold when using alternative proxies of credit risk, such as the loans-to-assets ratio (e.g. Maudos and De Guevara, 2004) and loan loss allowance as a percentage of total assets (e.g. Angbazo, 1997). We include operating costs (*opex*, measured using operating expenses divided by average assets) in our specification and expect a positive effect on interest margins (Maudos and De Guevara, 2004; Valverde and Fernández, 2007; Hawtrey and Liang, 2008). As a proxy for market structure, we use the fraction of assets held by the five largest banks in the sample (*c5*) and, alternatively, the fraction of assets held by the three largest banks (*c3*). As mentioned, traditionally, higher market concentration is expected to lead to higher margins, but when bank consolidation and transaction banking are two simultaneous trends in banking, this country-wide concentration index could yield a negative coefficient.

Following HS, Angbazo (1997), Saunders and Schumacher (2000) and Maudos and De Guevara (2004), we include both implicit interest payments, defined as operating expenses minus non-interest income divided by average assets (*implint*), and opportunity costs or non-interest-bearing reserves divided by total assets (*oppcost*). Following Maudos and De Guevara (2004) and Hawtrey and Liang (2008), we use the ratio of operating costs to gross income (*maneff*) as a proxy for managerial efficiency, and, to check the robustness of the results obtained, alternatively, the loans-to-employees ratio. We expect a negative coefficient, as efficiency gains are passed onto the customer (e.g. Gischer and Jüttner, 2003, and Hawtrey and Liang, 2004). Since there is no direct measure of bank management risk aversion, we follow Hawtrey and Liang (2008) and use securities plus other assets divided by total loan volume. This is a measure of risk exposure rather than risk aversion (*riskexp*). As such, this variable can be interpreted as a banks' deliberate engagement in transaction banking activities, which we expect to affect margins negatively. Lastly, we follow Maudos and De

Guevara (2004) and Hawtrey and Liang (2008) in using the natural logarithm of the volume of loans to proxy transaction size (*scale*). HS expect transaction size to influence margins positively, but Maudos and De Guevara (2004) and Hawtrey and Liang (2008) find a negative relationship between transaction size and interest margins, arguing that the cost-reductions associated with scale efficiencies outweigh a premium for increased credit risk.

Finally, a recent string of literature suggests that banks have become increasingly risk-taking in the past decade (Rajan, 2006; Borio and Zhu, 2008; Maddaloni and Peydró, 2010). Adrian and Shin (2008) suggest that in times of rising asset prices, banks expand their balance sheets, raising leverage and their share of money-market funding to fuel their growth. We posit that the shift towards transaction banking was in large part motivated by aspirations to balance sheet expansion. Thus, we run an additional regression with the change in the core deposits/liabilities ratio (*ddepliab*) as dependent and asset growth as independent variable, including some macroeconomic control variables. We hypothesize a significant, negative relationship between asset growth and changes in the deposits/liabilities ratio. The relevant specification is as follows:

$$ddepliab_{i,t} = \alpha + \beta_1 * assetgrowth_{i,t} + \beta_2 * dgdp_t + \beta_3 * inflation_t + \beta_4 * i\text{-}short_t + \varepsilon \qquad (2)$$

Figure 1 and tables 1 and 2 provide a few descriptive statistics for our sample of U.S. commercial banks. Figure 1 displays the mean interest margins of U.S. commercial banks during the period 1992 – 2010. The figure shows both the industry-wide downward trend in interest margins and the within-industry differences in average margins of banks in different asset classes. It appears from this figure that smaller, community banks have considerably higher interest margins than larger banks (with assets >$10B). Notably, the interest margins of the largest banks (with assets >$20B) show the strongest decline in the period leading up to the credit crisis (1992 – 2006).

[insert figure 1 here]

Table 1 displays mean values of various financial ratios for banks of different asset sizes over the period 1992 – 2010. We include credit card loans (a classical financial commodity) as a business line that is characterized by easy securitization and economies of scale. In contrast, we include the ratio of small business loans and commercial and industrial loans with original amounts of less than \$1 million, often relationship loans, to total loans. Large banks typically provide more credit card services, whereas small banks have a higher share of small business loans. Notably, the mean yield on loans is substantially higher for small community banks (8.10%), than for large banks (6.66%), as well as higher than that on securities. Table 1 shows small banks to have a larger share of deposit funding than large banks. Large banks make considerably more use of federal funds purchased overnight from other banks. The mean interest margin of large banks is 0.5% lower than that of small community banks. As expected, large banks rely more on non-interest income.

The data suggest the existence of a spectrum with TOM on the far left side and ROM on the far right, with large banks (assets >\$20B) occupying the left of this spectrum and small community banks (assets <\$500M) occupying the right. These statistics corroborate the results of DeYoung *et al.* (2004), DeYoung and Rice (2004b) and DeYoung (2007, 2010).

Table 2 provides some descriptive statistics regarding earnings volatility of U.S. commercial banks during the period 1992 – 2010. It is not immediately clear that a move towards TOM results in improved *risk-adjusted* returns. Research by DeYoung and Rice (2004a) and Stiroh (2006) suggests that the return volatility of non-interest income is significantly higher than that for traditional activities. Thus, the risk-adjusted returns of transaction banks may actually be comparable to (DeYoung and Rice 2004b) or worse (Stiroh 2006) than those of traditional, community banks. In the pre-crisis period (1992 – 2007), large banks clearly outperformed smaller banks both in terms of mean ROE and ROA. It would thus appear that their different activity mix achieves a higher average return. These high ROE ratios, however, plummeted during the crisis years (2008 – 2010). This could point to excessive risk-taking. In contrast, small community banks, with a modest pre-crisis ROE of 10.97%, remained profitable during these years. Notably, large banks (with assets >$20B) show evidence of higher earnings volatility, even in the pre-crisis period (1992 – 2007).

If a move towards TOM is indeed risk-return inefficient, this lends some plausibility to the conclusions of Kane (2000), Bliss and Rosen (2001), Penas and Unal (2004) and others, who suggest that banks' decisions to expand or merge may have been influenced by motives other than maximizing the firm's value, such as increased managerial compensation and a desire to obtain 'too-big-to-fail' status. These statistics raise some concerns about the desirability of the shift from relationship to transaction banking.

[insert tables 1 and 2 here]

Table 3 presents the results of our factor analysis. The reported fit indices provide an indication of the overall fit of the measurement model. In general, it can be submitted that the smaller the $\chi^2$, the better the fit (conversely, the *p*-value should be large, preferably above 0.05, see e.g. Kline, 2005, and Byrne, 2001). Both the generalized fit index (GFI) and comparative fit index (CFI) should be close to 1, with a revised cut-off value of 0.90 or, more recently, 0.95 (Byrne, 2001). Finally, values for the root mean squared residual (RMSR) and the root mean square error of approximation (RMSEA) should be close to 0. Values for RMSEA less than 0.05 indicate a good fit, however, values as high as 0.08 represent reasonable errors of approximation in the population (Byrne, 2001). We use a Kaiser-Guttman criterion to select the number of factors. Convergence was achieved after four iterations. Table 3 presents the results.

[insert table 3 here]

With values of selected fit indices of $\chi^2$ = 4.682, p = 0.03, GFI = 0.999, CFI = 0.999, RMSR = 0.002 and RMSEA = 0.006, the measurement model reported under (1) 1992 – 2010 shows a good fit. The table displays the rotated factor loadings. So as to test the reliability of these results, we re-run this factor analysis using, first, the quarterly dataset and, secondly, the June schedule dataset (which includes data on small business loans). The goodness of fit of the measurement model is even better using quarterly data, with selected fit indices of $\chi^2$ = 0.737, p = 0.39, GFI = 0.999, CFI = 1.000, RMSR = 0.000 and RMSEA = 0.000. Also the fit of the model obtained using the June schedules, which provide information on small business loans, is satisfactory, with a CFI of 0.999 and RMSEA of 0.020. The latter uses the same five variables, only it substitutes small business loans (*sbloass*) for commercial and industrial loans (*corploass*). Also the factor loadings are consistent, with a similar pattern arising from the three samples. Thus, the first common factor loads on *branchnet* and *depliab*, and to a lesser extent on *assetclass*. The second factor loads on *corploass* (or alternatively *sbloass*), *intincrel* and *assetclass*. In the following, we will refer to these two factors using the labels *factor1* and *factor2*.

Table 4 provides a correlation matrix for the different variables included in specification (1). There are no significant problems of multi-collinearity between the regressors. The relationship banking variables are positively correlated. There is some correlation between the macro-economic variables (viz. *dgdp*, *inflation* and *i-short*), further, *scale* is negatively correlated with *branchnet* and the two relationship banking factors. These correlations do not bias our results. The correlation between *scale* and *branchnet* is sufficiently large to pose a problem. Potential remedies to such a problem of multi-collinearity include gathering more data and omitting regressors. Since *scale* is often insignificant, we therefore at times exclude this variable from the specification.

Finally, we perform unit root tests on the dependent and independent variables of our model. For the bank-level variables, we use Levin-Lin-Chu (2002) panel unit root tests; for the macro-level variables, we use both augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) tests. Table 5 reports the results. For *implint* and *scale*, we fail to reject the null hypothesis of a unit root (table 5A). We run the regression with a level-specification as well as in first differences to see whether this affects our results. As it turns out, restating these variables in first differences does not affect the significance or direction of the relationships measured. We therefore proceed to report the outcome of our regression in levels (the absence of cointegration precludes running a vector error correction model). Also for *factor2* we cannot reject the null hypothesis of a unit root using the annual dataset. Yet, in the quarterly dataset and the June dataset, the series is stationary. We therefore refer to these datasets for its interpretation. The reverse holds for *branchnet*. Turning to the macro-level variables (table 5B), the ADF-test fails to reject the null of a unit root for the concentration index (*c3* and *c5*) and *i-short*. The KPSS-test affirms that both *c3* and *c5* have a unit root. With a KPSS test-statistic of 0.391, the presence of a unit root in *i-short* is less obvious. We run the regression restating *i-short* in first differences, but this renders a previously significant coefficient insignificant, leaving the other coefficients unchanged. Conceptually, it makes more sense to include *i-short* in levels. We therefore proceed with our regression, using *c3* and *c5* restated in first differences, but leaving *i-short* in levels-specification. The following section reports our results.

[insert tables 4 and 5 here]

**4. Results**

Table 6 summarizes the results of our panel regression. We use two sample periods, one excluding the recent crisis period (1992 – 2007) and one including the crisis years (1992 – 2010). Note that the high goodness of fit (adjusted $R^2$ values of around 70%) is in part due to the inclusion of cross-section fixed effects, which because of size and nature of the dataset explain a relatively large part of the variance.

[insert table 6 here]

Table 6A shows the results obtained using the annual dataset. The table shows a significant, positive effect of the relationship banking variables on bank interest margins. Panels (1) and

(4) include both the core deposits-to-liabilities ratio (*depliab*) and the ratio of commercial and industrial loans plus farm loans to total assets (*corploass*). For the 1992 – 2007 sample period, the coefficient for *depliab* is 0.014. This means that if the core deposits-to-liabilities ratio were to drop by 10%, interest margins are reduced by 14 basis points. The coefficient for the corporate loans-to-assets ratio (*corploass*) is 0.009. This indicates that if the ratio of a bank's commercial and industrial loans plus farm loans to total assets drops by 10%, its interest margin is reduced by 9 basis points. Including the crisis years in our sample affirms these results. Panels (2) and (5) in addition include the ratio of interest income to total income (*intincrel*) and the natural logarithm of the number of domestic offices divided by total loan volume (*branchnet*). All four proxies of relationship banking activity exert a robust, positive effect on interest margins in this specification. Only the coefficient for *intincrel* is significant and positive in the pre-crisis sample period (0.022), but insignificant in the total sample period.

Panels (3) and (6) show the results obtained using the composite measures of relationship banking activity: *factor1* and *factor2*. We again see a significant, positive relationship with interest margins. To illustrate the strength of the relationship, the standard deviation of *factor1* for the period 1992 – 2010 is equal to 0.777. The coefficient of 0.239 indicates that with a one standard deviation increase in *factor1* during this period, a bank's interest margin would rise by more than 18 basis points. Conversely, a one standard deviation decrease in *factor1* in the same period would cause a bank's interest margin to decrease by 18 basis points. This relationship holds for both sample periods (in- and excluding the crisis years).

To ensure robustness of these results, we next turn to the results obtained using the quarterly dataset. Table 6B again displays significant, positive coefficients for all relationship banking variables. Note that for this dataset, a bank's interest margin is defined as the net interest income earned in one quarter as a percentage of total assets. To obtain the annual equivalent would require adding the interest income earned in four consecutive quarters. Thus, for example, the coefficients for *depliab* and *corploass* of 0.003 in the period 1992Q4 – 2007Q4 correspond to and confirm the coefficients obtained using the annual dataset.

Finally, we look at the results obtained using the June schedules. These schedules provide information on the small business loans extended by a bank. Note that the number of observations in this dataset is somewhat smaller than that in the annual and quarterly datasets. For this dataset, interest margin is defined as the net interest income earned in quarters 1 and 2 as a percentage of total assets. Again, the relationship banking variables display significant, positive coefficients. For example panel (1) in table 6C shows that the impact of the core deposits-to-liabilities ratio (*depliab*) and the ratio of small business loans (with original amounts of $1M or less) to total assets (*sbloass*) on a bank's interest margins is positive and significant. The coefficient for *sbloass* is 0.004, indicating that a 10% reduction in the ratio of small business loans to total assets would result in an 4 basis points reduction of interest margin, as earned over two quarters (the annual effect is approximately two times as large). Panel (3) shows the impact of the two composite measures. *Factor2* does not display a significant relationship with margins, which is likely due to the lack of observations.

Overall, tables 6A through C all document a consistently positive relationship between the variables reflecting a bank's engagement in relationship banking activities and the size of interest margins. Thus, adherence to a traditional model of financial intermediation appears to influence margins positively. This finding is in line with the theoretical predictions by, amongst others, DeYoung *et al.* (2004), Elyasiani and Goldberg (2004), DeYoung and Rice (2004b) and DeYoung (2010). It is also in line with the empirical findings by Liebeg and Schwaiger (2009), who, in a small-scale study of small, Austrian banks, find a positive and significant effect of relationship banking on interest margins. Concomitantly, a move away from the relationships-oriented model, towards transaction banking, reduces interest margins significantly. According to these results, transaction banks' appropriation of a growing share of the U.S. market in the period 1992 – 2007, should thus be part and parcel of any explanation of the industry-wide decline of interest margins.

We will briefly comment on the results obtained for the other, control variables. These largely confirm our hypotheses. Bank capital structure (*capstruc*) shows a significant, positive sign, which would suggest that better capitalization lowers the cost of debt, thereby contributing to higher margins (Angbazo, 1997; Demirgüc-Kunt and Huizinga, 1999; Valverde and Fernández, 2007; Claeys and Van der Vennet, 2008). Economic growth (*dgdp*) exerts a significant, positive influence on interest margins. This is in accordance with the findings of Claeys and Van der Vennet (2008), which indicate that the business cycle is positively related to interest margins in developed financial markets, but not in transition economies. The results for inflation (*inflation*) are mixed. Inflation in the U.S. was relatively low and stable during our sample period (1992 – 2010). This lack of sample variance could help explain why we do not find the regular, positive relationship.

The coefficient for interest rate level (*i-short*) has a significant, positive sign. This is in accordance with the empirical research by a.o. Jiménez *et al.* (2007), Ioannidou *et al.* (2009), and Altunbas *et al.* (2010), who find that low interest levels increased bank risk-taking substantially in the period leading up to the crisis, motivating banks to expand their balance sheets, making use of money-market financing to fund investments in riskier, non-traditional activities. Interest rate risk (*i-vol*) displays a significant, negative coefficient (except in the June dataset). The negative coefficient for *i-vol* (and *riskexp*, see table 6) provides some evidence for our risk-taking hypothesis. It suggests that banks no longer require compensation for an increase interest rate risk in the form of higher interest margins. We find that credit risk (*credrisk*), measured using the ratio of loan charge-offs to assets, tests insignificant for the pre-crisis period, and significant and negative for the total sample period. Analyzing only the crisis years (2006Q4 – 2010Q4), we find a significant, negative relationship between the measures of credit risk and interest margins. It would appear that during these crisis years, the materialization of (unexpected) loan losses depresses bank interest margins, giving rise to a negative coefficient. Next, in line with expectations, operating costs (*opex*) exert a strong, positive influence on interest margins. This confirms the hypothesis that banks pass higher operating costs fully onto customers (Demirgüç-Kunt and Huizinga, 1999; Maudos and De Guevara, 2004, Claeys and Van der Vennet, 2008; Hawtrey and Liang, 2008). The industry-wide market concentration indices, *d(c5)* and *d(c3)*, yield mixed results. This lack of robustness is in line with the findings of De Guevara *et al.* (2005), Valverde and Fernández (2007) and Claeys and Van der Vennet (2008), who suggest that market concentration is not a good proxy for competitive conditions (or at least not as intended by HS).

Implicit interest payments (*implint*) are significantly and positively related to interest margins, but this effect is not robust to different specifications. The coefficient for opportunity costs (*oppcost*) is insignificant in most specifications. Risk exposure (*riskexp*) displays a strong, negative relationship with net interest margins. In the scenario where banks have become increasingly risk-taking in the past decades, this measure of relative risk exposure (defined as securities plus other assets divided by loans) can be interpreted as a bank's deliberate engagement in transaction banking activities. These exert a downward pressure on its interest margin. Managerial efficiency (*maneff*), measured using operational expenses over gross income, displays a significant, negative relationship with interest margins, but the coefficient is small. Finally, we do not find a robust effect of transaction size measured using *scale* on margins.

We conclude with the estimation of a panel regression using changes in the core-deposits-to-liabilities ratio (*ddepliab*) as dependent and asset growth as independent variable. The specification includes economic growth, inflation and interest rate levels as macro-economic control variables. The estimation uses panel least squares, with White period standard errors, and cross-section fixed effects. Taking into account the literature by Rajan (2006), Borio and Zhu (2008) and Maddaloni and Peydró (2010), we anticipate a significant, negative relationship between asset growth and changes in the core deposits-to-liabilities ratio. We use two sample periods, one excluding the recent crisis years (1992 – 2007) and one including the crisis (1992 – 2010). In the run-up to the credit crisis, banks were eager to expand their balance sheets and moved towards TOM. The crisis period has shown us the reverse side of the same coin; now that disaster had struck and banks' asset growth had halted, banks have started expanding their deposits base and moved back to ROM. Table 7 displays the results of the regression for both the entire sample and four subsamples based on asset size.

[insert table 7 here]

Table 7A documents a significant, negative relationship between asset growth and changes in the core deposits-to-liabilities ratio. This relationship is strongest for large banks (with total assets > $20B), for which the coefficient for asset growth is -0.294. Also medium-sized banks (with assets $10B – $20B) have a relatively high coefficient: -0.233. These results suggest that (aggressive) balance sheet expansion causes a bank to move into the capital markets and towards a transactions-oriented model of financial intermediation. This negative relationship becomes stronger with asset size, as large banks have arguably pursued a more aggressive growth strategy during the 1992 – 2007 period.

With comparable coefficients and slightly higher R-squared values, table 7B shows that the negative relationship between asset growth and changes in the core deposits-to-liabilities ratio indeed holds equally well for the sample including the crisis years. Also these outcomes are robust to estimation using quarterly data (yielding comparable coefficients and significance levels).

**5. Conclusion**

This paper analyzes the determinants of interest margins in the U.S. commercial banking sector using a comprehensive dataset with bank-level data obtained from the FDIC call reports. The main contribution of this paper is the inclusion of a bank's business model as an explanatory variable in an empirical model of margins. During the 1992 – 2007 period, many banks in the U.S. moved from a relationships-oriented (ROM) to a transactions-oriented model of financial intermediation (TOM). By making the impact of this strategic shift amongst banks explicit, we provide a more accurate description of the chain of causality leading to lower interest margins in developed banking industries than the one that is available now.

We find a significant, positive relationship between a bank's business model, measured using a multi-dimensional proxy of relationship banking activity, and net interest margins. Conversely, a move away from this model, towards transaction banking, reduces interest margins considerably. This outcome is consistent with the predictions of the financial intermediation literature (e.g. Rajan, 1992; Boot, 2000; DeYoung *et al.*, 2004; Elyasiani and Goldberg, 2004; DeYoung and Rice, 2004b; and DeYoung, 2007, 2010). Thus, by investing in customer-specific information, relationship banks can produce differentiated products, create local market power and establish information monopolies, which allows them to charge higher margins. Transaction banking, which focuses the advantages of scalability, precludes this. Transaction banks' appropriation of a growing share of the U.S. market in the period 1992 – 2007 should thus be part and parcel of any explanation of the decline of average interest margins in the industry.

Running a separate regression shows that there exists a significant, negative relationship between asset growth and the change in the deposits-to-liabilities ratio. This suggests that bank balance sheet expansion was an important driver of the move towards TOM.

We would like to conclude by considering a statement by Allen and Santomero (2001, p. 274): "As traditional businesses began to dry up, the management of those institutions was forced to become entrepreneurial and develop new businesses in order to survive." Our results qualify this statement. We put forward that as traditional businesses, while profitable, offered few opportunities for higher growth, the management of those institutions became more risk-seeking and expanded into transactions-oriented activities. Although transaction banks achieve higher returns on equity, these returns are marked by higher earnings volatility. Our results show that relationship banks still enjoy considerable interest margins and were better equipped to weather the financial crisis than transaction banks. These findings raise some concerns about the desirability of the shift from relationship to transaction banking.

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## Figures and tables

**Figure 1: Mean interest margins for U.S. commercial banks 1992 – 2010**

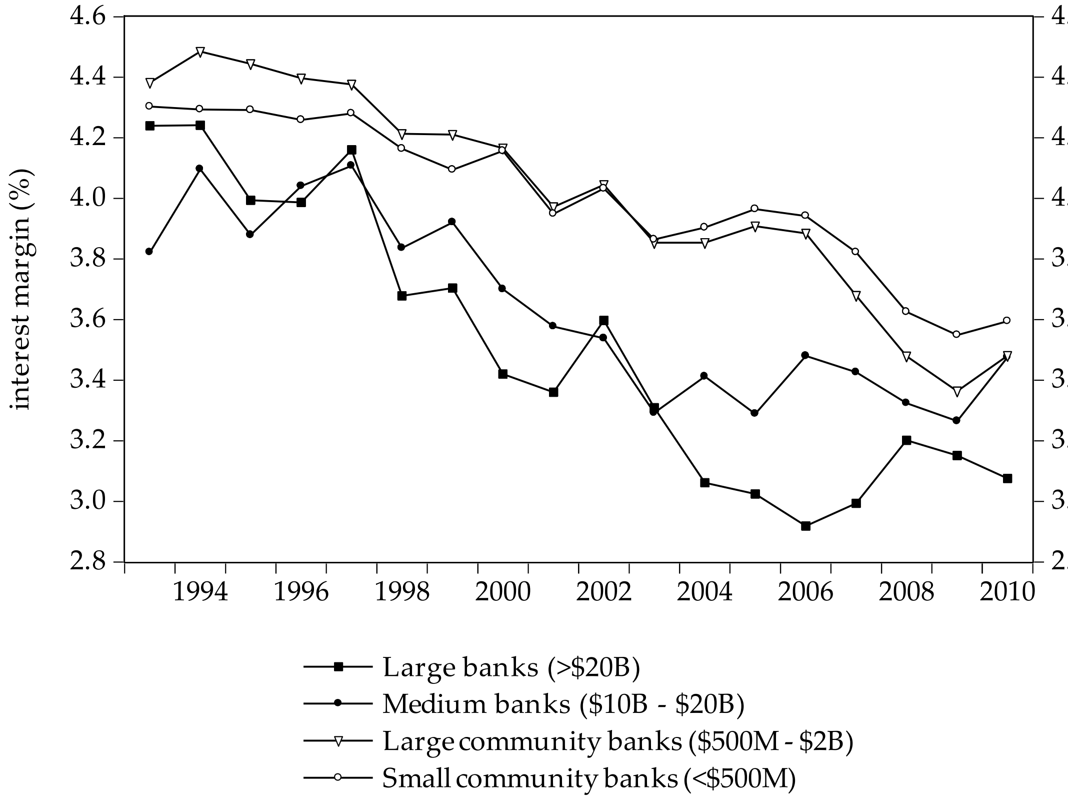

**Table 1: Mean values for U.S. commercial banks 1992 – 2010 (%)**

| | All institutions | i. Large banks | ii. Medium banks | iii. Large community banks | iv. Small community banks |
|---|---|---|---|---|---|
| Asset size | Any | >$20B | $10B - $20B | $500M - $2B | <$500M |
| Number of observations | 105,216 | 718 | 503 | 11,244 | 92,751 |
| Credit card loans/Loans | 0.51 | 11.24 | 1.74 | 0.90 | 0.37 |
| Small business loans/Loans* | 40.51 | 6.79 | 12.36 | 24.69 | 42.71 |
| C&I loans w. orig. amts. <$1M/Loans* | 11.84 | 3.56 | 5.79 | 8.83 | 12.28 |
| Yield on loans | 8.03 | 6.66 | 6.97 | 7.61 | 8.10 |
| Yield on securities | 4.92 | 5.01 | 4.96 | 4.86 | 4.92 |
| Fed funds purchased/Total assets | 1.33 | 7.73 | 8.52 | 3.02 | 1.04 |
| Retail deposits/Deposits | 84.62 | 70.59 | 79.74 | 82.78 | 84.98 |
| Deposits/Total liabilities and equity | 84.49 | 66.54 | 73.47 | 81.86 | 85.01 |
| Yield on deposit funding | 2.70 | 2.47 | 2.28 | 2.65 | 2.71 |
| Yield on non-deposit funding | 3.02 | 3.25 | 3.35 | 3.11 | 3.00 |
| Net interest margin | 3.98 | 3.49 | 3.61 | 3.99 | 3.99 |
| Non-interest income/Total income | 10.54 | 27.59 | 20.12 | 13.73 | 9.97 |

Note: Compare DeYoung (2007). Variables indicated (*) derive from schedule SB, published in June from 2003 onwards, and provide mean values for the period 2003 – 2010. Number of observations is 57,153 for all institutions; (i) 384 for large banks; (ii) 268 for medium banks; (iii) 5,759 for large community banks; and (iv) 50,742 for small community banks. ANOVA F-test for the equality of by-group means shows the differences to be significant with $p$-values of 0.000.

**Table 2: Earnings volatility at U.S. commercial banks (%)**

| | All institutions | i. Large banks | ii. Medium banks | iii. Large community banks | iv. Small community banks |
|---|---|---|---|---|---|
| Asset size | Any | >$20B | $10B - $20B | $500M - $2B | <$500M |
| Mean ROE 1992 – 2007 | 11.26 | 15.70 | 15.25 | 13.11 | 10.97 |
| Mean ROE 2008 – 2010 | 4.07 | 0.95 | -0.24 | 2.30 | 4.31 |
| St. dev. of ROE 1992 – 2010 | 8.50 | 10.93 | 11.42 | 9.02 | 8.37 |
| Mean ROA 1992 – 2007 | 1.15 | 1.44 | 1.27 | 1.25 | 1.14 |
| Mean ROA 2008 - 2010 | 0.31 | 0.03 | -0.35 | 0.01 | 0.35 |
| St. dev. of ROA 1992 – 2010 | 1.01 | 1.25 | 1.20 | 1.19 | 0.99 |
| Mean interest and non-interest income divided by average assets 1992 – 2007 | 4.90 | 6.66 | 5.42 | 5.24 | 4.84 |
| St. dev. of interest and non-interest income divided by average assets 1992 – 2007 | 1.39 | 4.63 | 1.56 | 1.86 | 1.24 |
| St. dev. of interest margin 1992 – 2007 | 0.96 | 1.64 | 0.88 | 0.94 | 0.78 |
| St. dev. of non-interest income 1992 – 2007 | 1.28 | 3.91 | 1.51 | 1.94 | 1.09 |

Note: ANOVA F-test for the equality of by-group means and Bartlett test for the equality of the by-group standard deviations show differences to be significant with *p*-values of 0.000.

**Table 3: Factor analysis**

| | (1) 1992 – 2010 | | | (2) 1992Q4 – 2010Q4 | | | (3) 2003Q2 – 2010Q2 | | |
|---|---|---|---|---|---|---|---|---|---|
| | *factor 1* | *factor 2* | Comm. | *factor 1* | *factor 2* | Comm. | *factor 1* | *factor 2* | Comm. |
| *branchnet* | 0.707 | 0.016 | 0.51 | 0.808 | 0.012 | 0.66 | 0.998 | 0.007 | 1.00 |
| *assetclass* | 0.215 | 0.368 | 0.23 | 0.248 | 0.396 | 0.27 | 0.208 | 0.487 | 0.34 |
| *depliab* | 0.616 | 0.057 | 0.40 | 0.518 | 0.056 | 0.29 | 0.339 | 0.155 | 0.17 |
| *corploass* | -0.034 | 0.163 | 0.02 | -0.027 | 0.168 | 0.03 | | | |
| *sbloass* | | | | | | | 0.022 | 0.487 | 0.24 |
| *intincrel* | -0.049 | 0.639 | 0.39 | -0.081 | 0.611 | 0.36 | -0.143 | 0.513 | 0.24 |
| *N* | 104,453 | | | 261,720 | | | 56,175 | | |
| $\chi^2$ | 4.682 | | | 0.737 | | | 24.157 | | |
| *p*-value | 0.03 | | | 0.39 | | | 0.00 | | |
| GFI | 0.999 | | | 0.999 | | | 0.999 | | |
| CFI | 0.999 | | | 1.000 | | | 0.999 | | |
| RMSR | 0.002 | | | 0.000 | | | 0.005 | | |
| RMSEA | 0.006 | | | 0.000 | | | 0.020 | | |

Note: The table displays the rotated factor loadings (oblique Varimax rotation). The 2003Q2 – 2010Q2 sample derives from schedule SB, published in June from 2003 onwards, and offers fewer observations; as some of the uniqueness estimates were non-positive, it uses a Heywood solution.

**Table 4: Correlation matrix**

| | *depliab* | *corploass* | *intincrel* | *branchnet* | *factor1* | *factor2* | *capstruc* | *dgdp* | *inflation* | *i-short* | *i-vol* | *credrisk* | *opex* | *d(c5)* | *implint* | *oppcost* | *riskexp* | *maneff* | *scale* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *depliab* | 1,000 | | | | | | | | | | | | | | | | | | |
| *corploass* | 0,041 | 1,000 | | | | | | | | | | | | | | | | | |
| *intincrel* | 0,101 | 0,110 | 1,000 | | | | | | | | | | | | | | | | |
| *branchnet* | 0,446 | 0,029 | 0,073 | 1,000 | | | | | | | | | | | | | | | |
| *factor1* | 0,787 | 0,039 | 0,139 | 0,888 | 1,000 | | | | | | | | | | | | | | |
| *factor2* | 0,322 | 0,237 | 0,891 | 0,288 | 0,432 | 1,000 | | | | | | | | | | | | | |
| *capstruc* | -0,182 | -0,008 | 0,032 | 0,077 | -0,020 | 0,045 | 1,000 | | | | | | | | | | | | |
| *dgdp* | 0,224 | 0,046 | 0,073 | 0,264 | 0,274 | 0,110 | -0,016 | 1,000 | | | | | | | | | | | |
| *inflation* | 0,037 | 0,025 | 0,054 | 0,071 | 0,062 | 0,053 | 0,003 | 0,400 | 1,000 | | | | | | | | | | |
| *i-short* | 0,201 | 0,061 | 0,173 | 0,273 | 0,270 | 0,186 | -0,004 | 0,601 | 0,453 | 1,000 | | | | | | | | | |
| *i-vol* | -0,067 | 0,010 | 0,027 | -0,058 | -0,069 | 0,007 | -0,001 | -0,126 | 0,432 | 0,106 | 1,000 | | | | | | | | |
| *credrisk* | -0,136 | -0,004 | -0,113 | -0,178 | -0,192 | -0,149 | -0,042 | -0,194 | -0,171 | -0,192 | -0,054 | 1,000 | | | | | | | |
| *opex* | 0,022 | -0,021 | -0,596 | 0,129 | 0,083 | -0,458 | 0,010 | -0,005 | -0,009 | -0,002 | -0,004 | 0,208 | 1,000 | | | | | | |
| *d(c5)* | -0,078 | -0,002 | -0,036 | -0,093 | -0,097 | -0,045 | 0,015 | 0,268 | 0,243 | -0,023 | 0,202 | -0,060 | -0,017 | 1,000 | | | | | |
| *implint* | 0,186 | 0,049 | 0,153 | 0,239 | 0,267 | 0,230 | -0,076 | -0,015 | -0,018 | 0,005 | -0,009 | 0,059 | 0,407 | -0,033 | 1,000 | | | | |
| *oppcost* | 0,248 | 0,069 | -0,193 | 0,298 | 0,312 | -0,066 | 0,007 | 0,111 | 0,023 | 0,116 | -0,012 | -0,056 | 0,243 | -0,050 | 0,139 | 1,000 | | | |
| *riskexp* | 0,072 | -0,218 | 0,004 | 0,317 | 0,250 | 0,039 | 0,254 | 0,092 | 0,021 | 0,077 | -0,038 | -0,121 | -0,079 | -0,045 | -0,161 | 0,059 | 1,000 | | |
| *maneff* | 0,012 | -0,009 | -0,052 | 0,041 | 0,034 | -0,030 | -0,022 | -0,012 | 0,002 | -0,020 | 0,007 | -0,021 | 0,093 | -0,002 | 0,086 | 0,043 | -0,015 | 1,000 | |
| *scale* | -0,378 | -0,129 | -0,226 | -0,646 | -0,685 | -0,519 | -0,235 | -0,186 | -0,048 | -0,193 | 0,043 | 0,158 | -0,062 | 0,067 | -0,232 | -0,269 | -0,368 | -0,034 | 1,000 |

Note: Period 1992 – 2010. Ordinary Pearson product-moment correlations.

**Table 5A: Panel unit root tests**

| | 1992 – 2010 *p*-value | 1992Q4 – 2010Q4 *p*-value | 2003Q2 – 2010Q2 *p*-value |
|---|---|---|---|
| *margin* | 0.000 | 0.000 | 0.000 |
| *depliab* | 0.000 | 0.000 | 0.000 |
| *corploass* | 0.000 | 0.000 | |
| *sbloass* | | | 0.000 |
| *intincrel* | 0.000 | 0.000 | 0.000 |
| *branchnet* | 0.000 | 1.000 | 0.000 |
| *factor1* | 0.000 | 0.000 | 0.000 |
| *factor2* | 1.000 | 0.000 | 0.000 |
| *capstruc* | 0.000 | 0.000 | 0.000 |
| *credrisk* | 0.000 | 0.000 | 0.000 |
| *opex* | 0.000 | 0.000 | 0.000 |
| *implint* | 1.000 | 1.000 | 0.000 |
| *oppcost* | 0.000 | 0.000 | 0.000 |
| *riskexp* | 0.000 | 0.000 | 0.000 |
| *maneff* | 0.000 | 0.000 | 0.000 |
| *scale* | 1.000 | 1.000 | 0.000 |

Note: Levin Lin Chu (common unit root, individual effects, automatic lag selection)

**Table 5B: Unit root tests macro-level variables**

| 1992 – 2010 | *p*-value (ADF) | *LM* Stat. (KPSS) |
|---|---|---|
| *c3* | 0.945 | 0.574 |
| *c5* | 0.978 | 0.581 |
| *dgdp* | 0.051 | 0.276 |
| *inflation* | 0.010 | 0.232 |
| *i-short* | 0.173 | 0.391 |
| *i-vol* | 0.007 | 0.451 |

Note: ADF test – level, intercept in test equation, automatic lag selection; KPSS test – level, intercept in test equation, Bartlett kernel spectral estimation method, automatic bandwidth selection. Asymptotic critical values: 0.347 (10% level), 0.463 (5% level) and 0.739 (1% level).

## Table 6A: Determinants of interest margins

| | Dependent variable: $margin_{i,t}$ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) 1992 – 2007 | | (2) 1992 – 2007 | | (3) 1992 – 2007 | | (4) 1992 – 2010 | | (5) 1992 – 2010 | | (6) 1992 – 2010 | |
| | Coeff. | *t*-stat | Coeff. | *t*-stat | Coeff. | *t*-stat | Coeff. | *t*-stat | Coeff. | *t*-stat | Coeff. | *t*-stat |
| *intercept* | 3.203 *** | 9.78 | 0.758 | 1.52 | 1.684 *** | 3.93 | 3.824 *** | 13.51 | 2.986 | 5.14 | 2.684 *** | 7.09 |
| Relationship banking measure | | | | | | | | | | | | |
| $depliab_{i,t-1}$ | 0.014 *** | 16.40 | 0.014 *** | 17.58 | | | 0.012 *** | 14.74 | 0.012 *** | 15.15 | | |
| $corploass_{i,t-1}$ | 0.009 *** | 9.65 | 0.008 *** | 9.27 | | | 0.011 *** | 13.71 | 0.011 *** | 13.18 | | |
| $intincrel_{i,t-1}$ | | | 0.022 *** | 7.52 | | | | | 0.006 | 1.26 | | |
| $branchnet_{i,t-1}$ | | | 0.081 *** | 3.91 | | | | | 0.136 *** | 7.69 | | |
| $factor1_{i,t-1}$ | | | | | 0.271 *** | 8.37 | | | | | 0.239 *** | 8.29 |
| $factor2_{i,t-1}$ | | | | | 0.364 *** | 5.39 | | | | | 0.247 *** | 4.14 |
| Other variables | | | | | | | | | | | | |
| $capstruc_{i,t-1}$ | 0.026 *** | 7.67 | 0.030 *** | 9.20 | 0.041 *** | 10.65 | 0.024 *** | 8.30 | 0.050 *** | 8.76 | 0.037 *** | 11.19 |
| $dgdp_{t}$ | 0.028 *** | 12.73 | 0.034 *** | 14.82 | 0.039 *** | 15.06 | 0.032 *** | 19.51 | 0.031 *** | 18.33 | 0.034 *** | 17.69 |
| $inflation_{t}$ | -0.000 | -0.05 | 0.027 | 6.36 | 0.007 | 0.80 | 0.008 *** | 3.70 | 0.008 ** | 3.17 | -0.013 *** | -4.29 |
| $i\text{-}short_{t}$ | 0.034 *** | 14.44 | 0.022 *** | 9.57 | 0.024 *** | 7.30 | 0.044 *** | 17.28 | 0.042 *** | 13.02 | 0.046 *** | 16.39 |
| $i\text{-}vol_{t}$ | -0.083 *** | -16.94 | -0.080 *** | -16.73 | -0.060 *** | -8.68 | -0.069 *** | -12.74 | -0.073 *** | -13.21 | -0.033 *** | -3.62 |
| $credrisk_{i,t-1}$ | 0.055 | 1.54 | 0.050 | 1.43 | 0.080 *** | 1.73 | -0.015 | -0.48 | -0.000 | -0.01 | 0.004 | 0.11 |
| $opex_{i,t-1}$ | 0.095 *** | 3.63 | 0.164 *** | 4.75 | 0.220 *** | 4.08 | 0.089 *** | 4.00 | 0.106 *** | 3.68 | 0.167 *** | 3.42 |
| $d(c5)_{t}$ | -1.52 *** | -10.08 | -0.967 *** | -5.62 | -0.406 ** | -2.05 | -1.233 *** | -8.09 | -1.051 *** | -5.67 | 0.092 | 0.41 |
| $implint_{i,t-1}$ | 0.104 *** | 2.93 | 0.042 ** | 1.26 | 0.068 | 0.91 | 0.078 ** | 2.53 | 0.065 * | 1.93 | 0.072 | 1.11 |
| $oppcost_{i,t-1}$ | -0.003 | -0.94 | -0.001 | -0.35 | 0.000 | 0.14 | -0.000 | -0.11 | -0.000 | -0.15 | 0.001 | 0.50 |
| $riskexp_{i,t-1}$ | -0.220 *** | -11.74 | -0.219 *** | -12.02 | -0.251 *** | -9.35 | -0.246 *** | -14.08 | -0.241 *** | -13.73 | -0.296 *** | -12.19 |
| $maneff_{i,t-1}$ | -0.002 *** | -5.23 | -0.001 *** | -4.59 | -0.003 *** | -5.59 | -0.001 *** | -3.31 | -0.001 *** | -3.29 | -0.001 *** | -4.29 |
| $scale_{i,t-1}$ | -0.103 *** | -5.07 | | | 0.091 *** | 3.34 | -0.146 *** | -8.77 | | | 0.015 | 0.66 |
| *N* | 119,853 | | 119,660 | | 78,479 | | 139,238 | | 138,417 | | 95,944 | |
| *Adj.* $R^2$ | 0.715 | | 0.719 | | 0.731 | | 0.702 | | 0.674 | | 0.686 | |

Note: Cross-section fixed effects, White period standard errors, $p < .10$*, $p < .05$**, $p < .01$***.

**Table 6B: Determinants of interest margins**

| | Dependent variable: *margin* $_{i,t}$ | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) 1992Q4 – 2007Q4 | | | (2) 1992Q4 – 2007Q4 | | | (3) 1992Q4 – 2007Q4 | | | (4) 1992Q4 – 2010Q4 | | | (5) 1992Q4 – 2010Q4 | | | (6) 1992Q4 – 2010Q4 | | |
| | Coeff. | | *t*-stat | Coeff. | | *t*-stat | Coeff. | | *t*-stat | Coeff. | | *t*-stat | Coeff. | | *t*-stat | Coeff. | | *t*-stat |
| *intercept* | 0.925 | *** | 14.06 | 0.574 | *** | 5.42 | 0.013 | | 0.12 | 1.067 | *** | 19.48 | 0.980 | *** | 16.57 | 0.424 | *** | 3.78 |
| Relationship banking measure | | | | | | | | | | | | | | | | | | |
| *depliab* $_{i,t-1}$ | 0.003 | *** | 14.19 | 0.003 | *** | 14.31 | | | | 0.002 | *** | 9.74 | 0.002 | *** | 9.91 | | | |
| *corploass* $_{i,t-1}$ | 0.003 | *** | 11.62 | 0.003 | *** | 11.77 | | | | 0.004 | *** | 18.16 | 0.004 | *** | 17.86 | | | |
| *intincrel* $_{i,t-1}$ | | | | 0.003 | *** | 4.59 | | | | | | | 0.000 | | 1.53 | | | |
| *branchnet* $_{i,t-1}$ | | | | 0.024 | *** | 5.57 | | | | | | | 0.035 | *** | 10.26 | | | |
| *factor1* $_{i,t-1}$ | | | | | | | 0.122 | *** | 10.66 | | | | | | | 0.095 | *** | 8.37 |
| *factor2* $_{i,t-1}$ | | | | | | | 0.087 | *** | 4.95 | | | | | | | 0.067 | *** | 4.87 |
| Other variables | | | | | | | | | | | | | | | | | | |
| *capstruc* $_{i,t-1}$ | 0.005 | *** | 6.39 | 0.005 | *** | 7.07 | 0.008 | *** | 8.81 | 0.006 | *** | 12.62 | 0.006 | *** | 12.04 | 0.008 | *** | 13.86 |
| *dgdp* | 0.010 | *** | 11.12 | 0.007 | *** | 7.94 | 0.020 | *** | 16.87 | 0.017 | *** | 23.46 | 0.016 | *** | 23.28 | 0.021 | *** | 25.03 |
| *inflation* | -0.000 | | -0.15 | -0.001 | | -1.38 | -0.005 | *** | -6.89 | -0.004 | *** | -9.63 | -0.004 | *** | -10.06 | -0.005 | *** | -12.31 |
| *i-short* | 0.011 | *** | 23.82 | 0.008 | *** | 13.25 | 0.006 | *** | 8.40 | 0.015 | *** | 36.24 | 0.015 | *** | 33.98 | 0.012 | *** | 23.16 |
| *i-vol* | -0.026 | *** | -9.11 | -0.026 | *** | -9.16 | -0.025 | *** | -7.36 | -0.035 | *** | -17.67 | -0.037 | *** | -18.39 | -0.061 | *** | -19.21 |
| *credrisk* $_{i,t-1}$ | 0.016 | | 0.80 | 0.017 | | 0.81 | 0.026 | | 1.10 | -0.063 | *** | -6.38 | -0.055 | *** | -5.07 | -0.060 | *** | -5.05 |
| *opex* $_{i,t-1}$ | 0.031 | ** | 1.89 | 0.050 | ** | 1.88 | 0.094 | ** | 2.20 | 0.036 | ** | 2.51 | 0.037 | ** | 2.41 | 0.086 | *** | 2.67 |
| *d(c5)* | 0.432 | *** | 12.90 | 0.395 | *** | 11.95 | 0.609 | *** | 15.38 | 0.426 | *** | 15.20 | 0.422 | *** | 14.89 | 0.538 | *** | 18.07 |
| *implint* $_{i,t-1}$ | 0.045 | * | 1.80 | 0.022 | | 0.76 | -0.003 | | -0.06 | 0.002 | | 0.11 | 0.007 | | 0.44 | -0.034 | | -1.26 |
| *oppcost* $_{i,t-1}$ | -0.001 | | -0.75 | -0.000 | | -0.17 | -0.001 | | -0.69 | -0.001 | | -1.46 | -0.001 | | -1.34 | -0.001 | * | -1.65 |
| *riskexp* $_{i,t-1}$ | -0.072 | *** | -15.03 | -0.073 | *** | -15.20 | -0.082 | *** | -13.20 | -0.079 | *** | -19.42 | -0.079 | *** | -19.30 | -0.096 | *** | -20.22 |
| *maneff* $_{i,t-1}$ | -0.000 | *** | -6.00 | -0.000 | *** | -3.98 | -0.000 | *** | -4.50 | 0.000 | | 0.45 | -0.000 | | -0.09 | -0.000 | | -0.25 |
| *scale* $_{i,t-1}$ | -0.025 | *** | -6.08 | | | | 0.075 | *** | 7.96 | -0.035 | *** | -10.61 | | | | 0.039 | *** | 4.00 |
| *N* | 216,473 | | | 216,016 | | | 165,325 | | | 297,638 | | | 295,191 | | | 240,902 | | |
| *Adj.* $R^2$ | 0.696 | | | 0.716 | | | 0.713 | | | 0.665 | | | 0.670 | | | 0.676 | | |

Note: Cross-section fixed effects, White period standard errors, $p < .10$*, $p < .05$**, $p < .01$***. For this dataset, interest margin is defined as the net interest income earned in one quarter as a percentage of total assets.

## Table 6C: Determinants of interest margins

| | Dependent variable: *margin* $_{i,t}$ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) 2003Q2 – 2010Q2 | | | (2) 2003Q2 – 2010Q2 | | | (3) 2003Q2 – 2010Q2 | | |
| | Coeff. | | *t*-stat | Coeff. | | *t*-stat | Coeff. | | *t*-stat |
| *intercept* | 2.654 | *** | 10.45 | 2.442 | *** | 10.53 | 1.764 | *** | 60.04 |
| Relationship banking measure | | | | | | | | | |
| *depliab* $_{i,t-1}$ | 0.004 | *** | 4.60 | 0.004 | *** | 4.85 | | | |
| *corploass* $_{i,t-1}$ | | | | 0.003 | *** | 3.49 | | | |
| *sbloass* $_{i,t-1}$ | 0.004 | *** | 8.39 | 0.003 | *** | 6.43 | | | |
| *intincrel* $_{i,t-1}$ | | | | 0.000 | * | 1.73 | | | |
| *branchnet* $_{i,t-1}$ | | | | 0.098 | *** | 4.97 | | | |
| *factor1* $_{i,t-1}$ | | | | | | | 0.043 | ** | 2.44 |
| *factor2* $_{i,t-1}$ | | | | | | | 0.006 | | 1.44 |
| Other variables | | | | | | | | | |
| *capstruc* $_{i,t-1}$ | 0.005 | * | 1.90 | 0.005 | * | 1.85 | 0.006 | *** | 2.99 |
| *dgdp* | 0.057 | *** | 7.00 | 0.053 | *** | 6.41 | -0.173 | *** | -17.73 |
| *inflation* | -0.071 | *** | -4.45 | -0.066 | *** | -4.21 | -0.277 | *** | -25.28 |
| *i-short* | 0.032 | *** | 18.67 | 0.031 | *** | 18.11 | 0.088 | *** | 29.72 |
| *i-vol* | 0.194 | *** | 5.07 | 0.161 | *** | 4.23 | 0.895 | *** | 21.48 |
| *credrisk* $_{i,t-1}$ | -0.007 | | -0.15 | 0.006 | | 0.12 | -0.086 | *** | -4.61 |
| *opex* $_{i,t-1}$ | -0.033 | | -1.11 | -0.033 | | -1.13 | 0.031 | ** | 2.35 |
| *d(c5)* | 0.755 | *** | 6.34 | 0.736 | *** | 6.17 | 2.065 | *** | 15.43 |
| *implint* $_{i,t-1}$ | 0.014 | | 0.55 | 0.015 | | 0.61 | -0.021 | | -1.46 |
| *oppcost* $_{i,t-1}$ | -0.000 | | -0.25 | -0.000 | | -0.33 | -0.001 | | -0.90 |
| *riskexp* $_{i,t-1}$ | -0.187 | *** | -7.78 | -0.180 | *** | -7.34 | -0.180 | *** | -12.63 |
| *maneff* $_{i,t-1}$ | -0.000 | | -0.32 | -0.000 | | -0.95 | -0.000 | | -0.96 |
| *scale* $_{i,t-1}$ | -0.102 | *** | -5.27 | | | | | | |
| *N* | 47,653 | | | 47,068 | | | 37,178 | | |
| *Adj.* $R^2$ | 0.735 | | | 0.742 | | | 0.763 | | |

Note: Cross-section fixed effects, White period standard errors, $p<.10$*, $p<.05$**, $p<.01$***. For this dataset, interest margin is defined as the net interest income earned in quarters 1 and 2 as a percentage of total assets.

**Table 7A: Growth and balance sheet composition**

Dependent variable: *ddepliab*
1992 – 2007

| | All institutions | | i. Large banks (>$20B) | | ii. Medium banks ($10B - $20B) | | iii. Large community banks ($500M - $2B) | | iv. Small community banks (<$500M) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coeff. | *t*-stat | Coeff. | *t*-stat | Coeff. | *t*-stat | Coeff. | *t*-stat | Coeff. | *t*-stat |
| *intercept* | 3.215 *** | 24.04 | 2.678 | 1.04 | 5.285 * | 1.78 | 2.650 *** | 4.88 | 3.179 *** | 21.72 |
| *assetgrowth* | -0.088 *** | -19.76 | -0.294 *** | -4.10 | -0.233 *** | -3.06 | -0.093 *** | -6.89 | -0.073 *** | -12.98 |
| *dgdp* | -0.423 *** | -18.04 | -0.531 | -0.95 | -0.462 | -1.11 | -0.708 *** | -7.38 | -0.325 *** | -12.54 |
| *inflation* | -0.786 *** | -19.95 | 0.026 | 0.03 | -1.030 | -1.43 | -0.586 *** | -3.66 | -0.873 *** | -19.95 |
| *i-short* | -0.116 *** | -7.68 | -0.141 | -0.34 | -0.146 | -0.61 | 0.159 *** | 2.58 | -0.153 *** | -9.17 |
| *N* | 119,698 | | 583 | | 406 | | 9,285 | | 75,894 | |
| *Adj.* $R^2$ | 0.028 | | 0.070 | | 0.138 | | 0.017 | | 0.034 | |

Note: Cross-section fixed effects, White period standard errors, $p$ <.10*, $p$ <.05**, $p$ <.01***.

**Table 7B: Growth and balance sheet composition**

| | Dependent variable: *ddepliab* 1992 – 2010 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All institutions | | | i. Large banks (>$20B) | | | ii. Medium banks ($10B - $20B) | | | iii. Large community banks ($500M - $2B) | | | iv. Small community banks (<$500M) | | |
| | Coeff. | | *t*-stat | Coeff. | | *t*-stat | Coeff. | | *t*-stat | Coeff. | | *t*-stat | Coeff. | | *t*-stat |
| *intercept* | 1.963 | *** | 26.42 | 6.390 | *** | 3.87 | 6.809 | *** | 5.79 | 2.405 | *** | 9.73 | 1.742 | *** | 22.25 |
| *assetgrowth* | -0.089 | *** | -21.82 | -0.229 | *** | -3.70 | -0.229 | *** | -3.86 | -0.100 | *** | -8.19 | -0.075 | *** | -14.91 |
| *dgdp* | -0.132 | *** | -8.26 | -1.289 | *** | -3.53 | -0.947 | *** | -4.28 | -0.454 | *** | -8.34 | -0.013 | | -0.78 |
| *inflation* | -0.446 | *** | -15.31 | -0.305 | | -0.46 | -0.577 | | -1.04 | -0.402 | *** | -4.02 | -0.483 | *** | -14.91 |
| *i-short* | -0.240 | *** | -17.86 | -0.358 | | -1.15 | -0.397 | ** | -2.20 | -0.055 | | -1.08 | -0.276 | *** | -18.57 |
| *N* | 138,988 | | | 695 | | | 488 | | | 11,166 | | | 92,561 | | |
| *Adj.* $R^2$ | 0.035 | | | 0.091 | | | 0.198 | | | 0.042 | | | 0.039 | | |

Note: Cross-section fixed effects, White period standard errors, $p$ <.10*, $p$ <.05**, $p$ <.01***.

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