# THE CYCLICALITY OF PRICE-COST MARGINS IN BANKING: AN EMPIRICAL ANALYSIS OF ITS DETERMINANTS

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*We study the determinants of the cyclical behavior of banks' price-cost margins in the United States banking sector, using time series quarterly data for the period 1979–2005. We contribute to the literature by building an empirical model of the countercyclical behavior of these margins first documented by Aliaga-Díaz and Olivero (2010a). Doing so we are able to explore potential explanations for this behavior, and to show that margins are consistently countercyclical, even after controlling for the effects of credit risk and monetary policy. As a mechanism for the propagation of aggregate shocks, the countercyclical nature of margins in banking can provide additional support to stabilization policy.* (*JEL* E32, E44, G21)

## I. INTRODUCTION

In this paper, we study the cyclical behavior of price-cost margins in banking (calculated as the difference between the interest rate on loans and deposits), using time series quarterly data for the period 1979–2005 in the United States.

This cyclical behavior of banks' price-cost margins, a key fact about business fluctuations, has received little attention before. Dueker and Thornton (1997) find evidence that in cyclical downturns banks opt for a relatively high price-cost margin. However, they focus exclusively on the markup of the bank prime lending rate over the marginal cost of funds for banks. Mandelman (2006) presents evidence on the cyclicality of margins for a large sample of countries, and uses foreign

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**ABBREVIATIONS**

2SLS: Two-Stage Least Squares
3SLS: Three-Stage Least Squares
ADF: Augmented Dickey–Fuller
BCIs: Business Cycle Indicators
BEA: Bureau of Economic Analysis
BG: Breusch–Godfrey
CDs: Certificates of Deposits
CPI: Consumer Price Index
DS: Difference Stationary
DW: Durbin–Watson
FDIC: Federal Deposit Insurance Corporation
FF: Federal Funds
GDI: Gross Domestic Private Investment
GDP: Gross Domestic Product
GLBA: Gramm–Leach–Bliley Act
GNP: Gross National Product
HHI: Herfindahl–Hirschman Index
HP: Hodrick–Prescott
NBER: National Bureau of Economic Research
NIM: Net Interest Margin
NIPA: National Income and Product Accounts
NSA: Not Seasonally Adjusted
RBC: Reserve Bank of Chicago
RCI: Call Reports on Condition and Income
SA: Seasonally Adjusted
TB: Treasury Bill
TS: Trend Stationary
VAR: Vector Auto-Regression



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bank penetration to explain the behavior of margins.[1]

In Olivero (2005), Aliaga-Díaz (2006), and Aliaga-Díaz and Olivero (2010a), we document the countercyclicality of banks' price-cost margins in the United States. In that paper, we do so using an *atheoretical* methodology based on VAR forecast errors to measure comovement between variables.[2] In this paper, we build on this atheoretical evidence and take a step further by constructing an empirical model of the determinants of the cyclical behavior of margins. Here, we take a *theory-based* approach to decide on the inclusion of the relevant regressors that belong to this model. Doing so allows us to contribute to the literature by providing potential explanations for the previously documented countercyclical nature of margins.

Monetary policy and credit risk could be suggested as the main, and potentially the only, determinants of the cyclical behavior of margins. On the one hand, the bank lending channel of monetary transmission predicts that the Federal funds rate (as a monetary policy indicator) and margins are directly related. Therefore, if policy rates exhibit a particular cyclical behavior, not controlling for monetary policy could bias the estimations on the cyclical behavior of margins. On the other hand, credit risk is expected to be countercyclical and to raise margins, so that default should help explain the countercyclicality of the latter.

Based on these two observations, our empirical methodology consists of two steps. In a first step, we test whether the negative and significant contemporaneous sample correlations between margins and a business cycle indicator are robust to the inclusion of controls related to monetary policy, default risk and banking regulation. Results show it is, so that there seems to be other channels through which fluctuations in the economy give rise to the observed countercyclicality of margins. In a second step, we look for these channels and offer several potential explanations for the observed behavior. Interest rate risk, the economy's financial depth, banks liquidity and capitalization, and the share of total assets held by large banks all exert a significant impact on the behavior of margins over the business cycle. These conclusions are consistent across alternative definitions of the margins and the business cycle indicator.

Our work is linked to two strands of research in macroeconomics. First, our countercyclicality results are linked to the large literature on countercyclical markups in goods markets and its effects on aggregate demand started by Rotemberg and Saloner (1986) and Rotemberg and Woodford (1992). Second, price-cost margins that vary endogenously and countercyclically in response to the state of the economy are a necessary condition for the existence of a financial accelerator as an amplifier of business fluctuations (see for example Bernanke and Gertler 1989 and Bernanke, Gertler, and Gilchrist 1998). Therefore, the countercyclical nature of price-cost margins that we study here provides empirical support to the large body of literature in macroeconomic theory on this financial accelerator.

With price-cost margins in the market for credit being countercyclical, credit becomes more expensive in bad times; firms may delay investment and production as a result, and recessions may be exacerbated. Thus, the countercyclical nature of margins can provide additional grounds for stabilization policy in the United States.

The paper proceeds as follows. In Section II, we present the data and some preliminary evidence on the cyclicality of margins. In Section III, we develop an empirical model of margins, and test for asymmetries in their cyclicality across phases of the business cycle. In Section IV, we provide several potential explanations for the cyclical nature of margins documented in Section III. Section V concludes and outlines some directions for further research. A data appendix contains a detailed description of the data. In an online appendix, we present an extended set of results.[3]

## II. PRELIMINARY EVIDENCE ON THE CYCLICALITY OF MARGINS

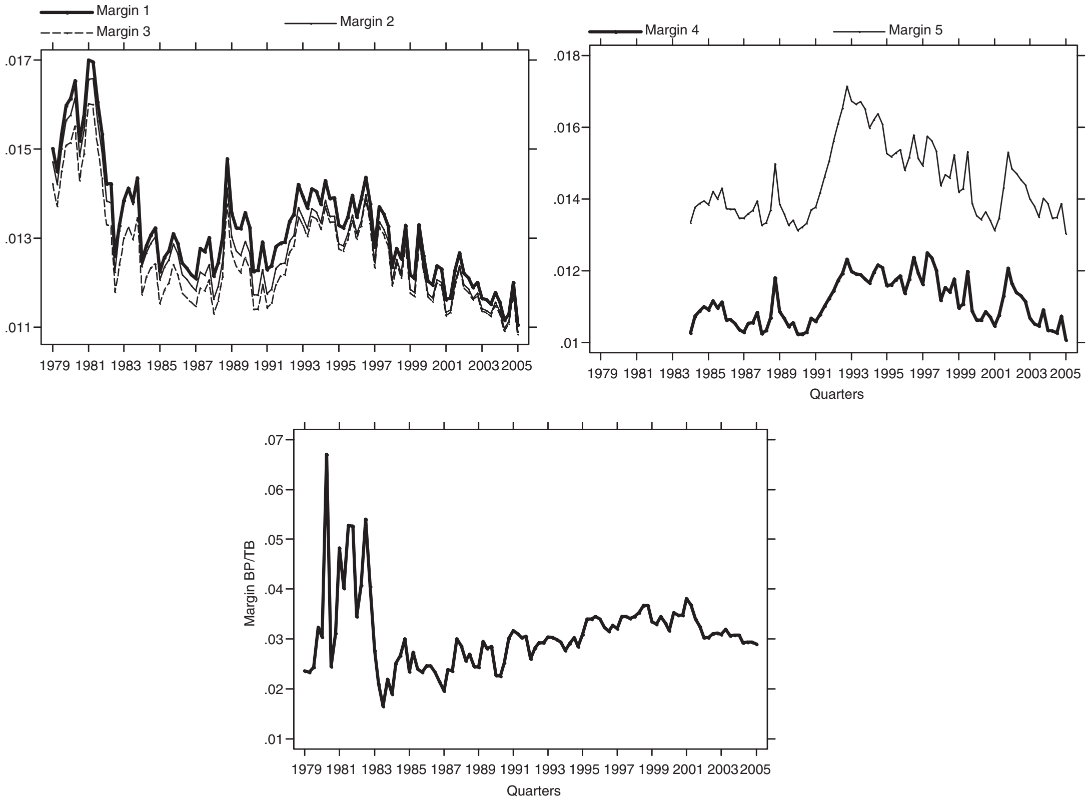
In this study, we use time series quarterly data for the period 1979–2005. These are bank-level balance sheet and income statement

1. The cross-sectional nature of his study restricts Mandelman (2006) to use a relatively short time series of yearly data which affects the conclusions that can be drawn on the behavior of margins at business cycle frequencies. Mandelman (2006) does not account for the effects of credit risk, monetary policy, and the term structure of interest rates. Chen, Higgins, and Mason (2005) provide support to our results, by documenting a substantial element of procyclicality in banks' efficiency in the U.S. economy.

2. This methodology is developed in den Haan (2000).

3. This appendix is available at http://faculty.lebow.drexel.edu/OliveroM/.

**FIGURE 1**
Banks Price-Cost Margins




*Source:* RCI data and Board of Governors.

data from the Call Reports on Condition and Income (RCI), available for all banks regulated by the Federal Reserve System, the Federal Deposit Insurance Corporation (FDIC), and the Comptroller of the Currency.[4]

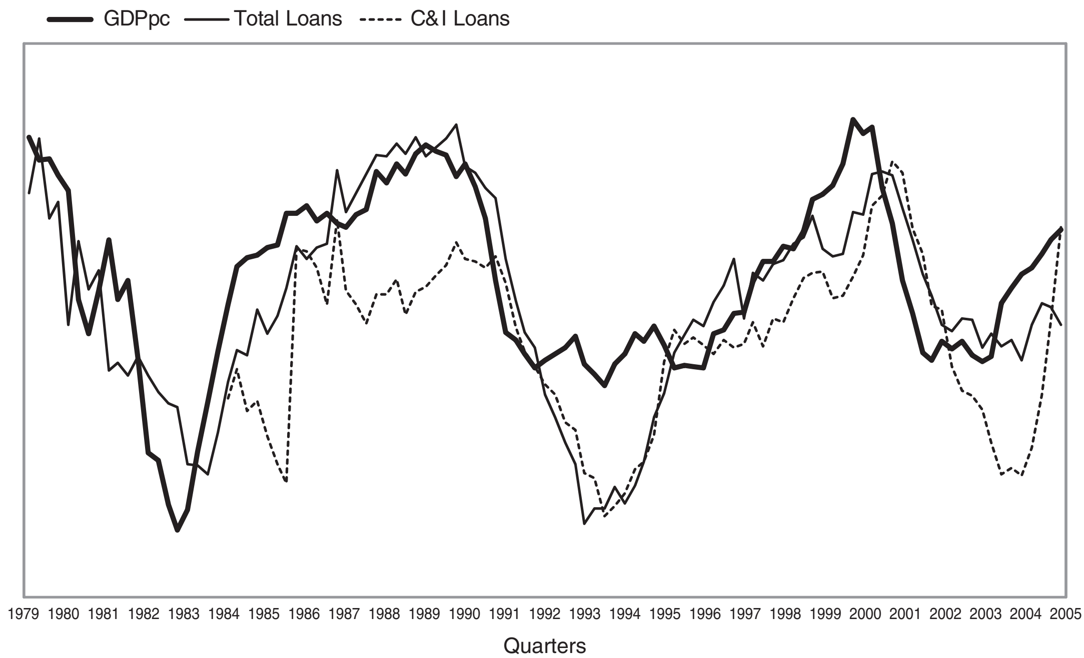
We use six alternative definitions for margins. Margins 1, 2, and 3 are all calculated as the difference between the ratio of interest income on loans to the volume of loans and the ratio of interest expense on deposits to the volume of deposits. The main difference among these three is given by the way in which the loans volume is adjusted for delinquent loans. Margin 4 is calculated as the ratio of the difference between interest income and expenses to bank assets. Margin 5 is calculated as the ratio of the difference between interest income and expenses to bank loans. The spread between bank prime and Treasury bill rates is the only case for which cited interest rate series are used.[5] The reader is referred to Appendix A for the details on variable definitions and sources. Figure 1 plots all the price-cost margin measures.[6]

4. These data are available from the Federal Reserve Bank of Chicago. Consistent time series have been built for this study to account for the changes in the Call Reports between 1987 and 1988. See Appendix A for details.

5. The Treasury bill rate is taken as a proxy for the interest rate on deposits paid by commercial banks. Dueker and Thornton (1997) also use the bank prime as the lending rate, arguing that a change in the prime rate is indicative of a general shift in lending rates.

6. It is important to state here the distinction between spreads and net interest margins (NIMs). The pure spread is the rate spread between loan and deposit rates. NIMs are calculated as the ratio of the difference between interest revenues and interest expenses to assets, whereas spreads are obtained as the difference between interest returns (i.e., interest revenues/earning assets) and interest costs (i.e., interest expenses minus provisions for loans losses, divided by interest bearing liabilities) (Angbazo 1997). In this sense, margins 1, 2, and 3 more closely measure spreads, while margins 4 and 5 are strictly "NIMs." Refer to Table A1 for margin definitions.

**FIGURE 2**
Detrended Business Cycle Indicators




*Source:* RCI data and NIPA-BEA.

We use seven alternative business cycle measures. Five are macroeconomic measures: gross domestic product (GDP), GDP per capita (GDPpc), gross domestic private investment (GDI), GDI per capita, and the unemployment rate. The two other business cycle indicators (BCIs), based on banks' balance sheet information, are total and commercial and industrial (C&I) loans. Adding loans as an alternative measure is useful because they may be even more sensitive to the cycle than GDP. We also conjecture that loans may reflect more closely than GDP the behavior of aggregates that are key to study the cyclicality of banks' price-cost margins. This is because these aggregates, such as investment and production, depend critically on bank financing. For comparison, Figure 2 plots the two balance sheet-based indicators along with GDPpc as one of the macroeconomic indicators.

To provide a first insight into the cyclicality of margins, Table 1 shows the sample raw correlations between alternative measures of the detrended margins and detrended BCIs.[7] The contemporaneous correlations are always positive when the unemployment rate is used as a business cycle indicator, and negative in all other cases. Correlations are significant in the vast majority of the cases, and they preserve the correct sign when they become insignificant. It is relevant to highlight that the nonsignificance of the correlations in these cases is not necessarily evidence against the countercyclicality of margins. Several forces not accounted for in these correlations may be distorting the picture. Later we show that when controlling for the effects of banking regulation as well as monetary policy and default risk, the coefficient on the business cycle indicator becomes negative and significant in more than 80% of the 42 possible combinations of margins and BCIs (see Table 2).

Following this preliminary evidence, our empirical methodology consists of two steps. In a first step, we test whether the negative and

7. We follow Dolado, Jenkinson, and Sosvilla-Rivero (1990) to detrend the variables. Please refer to Subsection C in Section III for details on this methodology, and to Table A5 for the specific method used for each variable. We obtain consistent evidence when we use the Hodrick–Prescott filter and the band-pass filter (Baxter and King 1999) to detrend the variables. These results are available from the authors upon request.

**TABLE 1**
Sample Correlations of NIMs with Cycle Measures

| | Margin 1 | Margin 2 | Margin 3 | Margin 4 | Margin 5 | BP/TB |
|---|---|---|---|---|---|---|
| **GDP** | −0.007 | −0.0225 | −0.0009 | −0.2039 | −0.2659 | −0.2104 |
| | (0.9437) | (0.8198) | (0.9924) | (0.0613) | (0.0139) | (0.0312) |
| **GDPpc** | −0.201 | −0.2349 | −0.2131 | −0.2601 | −0.3413 | −0.2445 |
| | (0.0397) | (0.0158) | (0.0291) | (0.0162) | (0.0014) | (0.0119) |
| **GDI** | −0.051 | −0.0494 | −0.0269 | −0.1492 | −0.1706 | −0.2009 |
| | (0.6053) | (0.6168) | (0.7853) | (0.1729) | (0.1186) | (0.0399) |
| **GDIpc** | −0.0533 | −0.0514 | −0.0294 | −0.1586 | −0.1762 | −0.1991 |
| | (0.5895) | (0.6026) | (0.7659) | (0.1471) | (0.1067) | (0.0417) |
| **Urate** | 0.1293 | 0.1638 | 0.1446 | 0.2428 | 0.3822 | 0.1181 |
| | (0.1887) | (0.0950) | (0.1411) | (0.0252) | (0.0003) | (0.2303) |
| **Loans** | −0.354 | −0.4182 | −0.3991 | −0.3105 | −0.5222 | −0.1057 |
| | (0.0002) | (0.0000) | (0.0000) | (0.0038) | (0.0000) | (0.2834) |
| **C&I Loans** | −0.3381 | −0.3966 | −0.394 | −0.3542 | −0.5294 | 0.0086 |
| | (0.0016) | (0.0002) | (0.0002) | (0.0009) | (0.0000) | (0.9379) |

*Note:* See Table A1 for margin definitions. GDPpc, GDP per capita; GDI, gross domestic private investment. Variables detrended following the methodology in Dolado, Jenkinson, and Sosvilla-Rivero (1990), see details in Table A5. Significance levels shown in parentheses. We obtain consistent evidence when we use the Hodrick–Prescott filter or the band-pass filter (Baxter and King 1999) to detrend the variables. These results are available upon request.

significant sample correlations between margins and the business cycle indicator are robust to the inclusion of controls related to monetary policy, default risk and banking regulation. Results show that it is. Therefore, there seems to be other channels through which economic fluctuations give rise to the observed countercyclicality of margins. In a second step, we look for these channels and offer alternative explanations for the observed behavior. In a regression where margins are the dependent variable no explanatory power should be left to the business cycle measure after an expanded set of controls is introduced. Section III presents step 1, and Section IV presents step 2.

## III. STEP 1: AN EMPIRICAL MODEL FOR PRICE-COST MARGINS

The empirical model for margins is shown in Equation (1).

$$(1) \quad y_t = \alpha + \beta \log(X_t) + \sum_{i=1}^{K1} \gamma_i Z_{i,t} + \sum_{i=1}^{K2} \delta_i R_{i,t} + \sum_{i=1}^{3} \theta_i Q_{i,t} + \epsilon_t$$

where $y$ is the margin measure and $X$ is the business cycle indicator. We use six measures of margins and seven BCIs all presented in detail in Appendix A. The countercyclicality of margins should be documented by a negative and significant $\beta$ coefficient.

The $R$ matrix includes dummy variables to control for three important regulatory changes that took place in the United States banking sector during the period covered by our study. First, in 1980 the Depository Institutions Deregulation and Monetary Control Act eliminated the deposit interest rate ceilings imposed by Regulation Q and increased the limit of deposit insurance by the FDIC from $40,000 to $100,000 per account. Second, in 1994 the Riegle-Neal Interstate Banking and Branching Efficiency Act repealed the Douglas Amendment, allowing national banks to operate branches across state lines after June 1, 1997. Third, the Gramm–Leach–Bliley Act (GLBA) enacted in November of 1999 increased the activities allowed for commercial banks and their holding companies, including investment banking.

The $Q$ matrix includes dummy variables to control for seasonality in the quarterly data.

Monetary policy and default risk could be suggested as the only determinants of the cyclical behavior of margins, so that failing to account for them would make the exercise almost trivial. Presenting evidence supporting the financial accelerator requires showing that there is an independent relationship between business cycles and margins, and that the comovement between them is not entirely explained by the cyclical pattern of these two variables. Thus, to assess whether there is any explanatory power left to the cycle indicator after controlling for the effects of monetary policy and credit risk, we include these two determinants as controls in regression equation (1). Our key finding is that this comovement remains negative and statistically significant even after controlling for these determinants. Subsections A and B in Section III discuss the bases for the inclusion of these controls.

### A. Cyclicality of Monetary Policy

Monetary policy is an obviously relevant determinant of margins. There are several reasons to expect a positive effect of the federal funds rate on margins, i.e., a positive coefficient on this rate in regression equation (1). Angelini and Cetorelli (2003) suggest that interest rates on deposits are characterized by more inertia than those on loans, so that monetary policy shocks should imply a positive relationship between interest rates and margins. Hannan and Berger (1991) and Neumark and Sharpe (1992) also find evidence for the rigidity of deposit rates.

Another rationale is given by the bank lending channel of monetary policy. As a result of a contractionary monetary policy, banks can react to the fall in reserves by relying more on nonreservable liabilities, such as certificates of deposits (CDs) to finance loans. However, these alternative funds are not covered by deposit insurance, and this leaves investors exposed to credit risk. Thus, if there are adverse selection problems in the CD market, banks may choose to not fully offset the effects of the policy, and they may let lending fall as a result. When lending falls, the cost of borrowing increases and this effect is added to any increase in interest rates on open market securities. If interest rates on deposits closely follow those on open market securities, interest rate margins can be expected to increase as a result.

We use the federal funds rate as a measure of the stance of monetary policy.[8] The federal funds rate is procyclical (see Table A4). Then, if indeed this policy rate and margins are directly related, not including a control for monetary policy might bias the estimation of the $\beta$ coefficient in Equation (1) upwards.

Last, since the level of economic activity can respond to monetary changes with a lag, both the current and the lagged values of the federal funds rate are included to appropriately account for the effects of monetary policy.[9]

### B. Credit Risk

Optimally chosen margins should be enough to cover the cost of increasing banks' capital as risk exposure increases. Thus, an increase in the economy's default rate on loans should imply an increase in the margin charged by commercial banks. If, as expected, a higher credit risk is associated with periods of declining economic activity, risk is a very important candidate to explain the countercyclical behavior of margins.[10] Thus, failing to control for the effect of risk might bias the coefficient $\beta$ in Equation (1) downwards.[11]

Moreover, it could happen that just credit risk fully explained the cyclicality of margins and that no explanatory power was left to business cycles per se. However, we do not expect this. All our price-cost margins use ex-post interest rates on loans, calculated using the actual income obtained by banks after accounting for bad loans. Actually, a negative sign can be expected for the coefficient on the risk variable for these margin measures. The reason is that an increase in the share of bad loans can imply a fall in the income used to compute ex-post margins. The spread between the bank prime and the Treasury bill rates, also used as one of our margin measures, is an ex-ante variable.[12] However, credit risk should not play an important role even in this case since both rates used to calculate this spread include only a small risk premium.

We use the net charge-off rate as a measure of the degree of default or credit risk in the economy. This rate is defined as loan charge-offs

8. Kashyap, Stein, and Wilcox (1993) and Bernanke and Blinder (1992) discuss the advantages of using the federal funds rate over the Romer-dates as an indicator of the stance of monetary policy.

9. As a robustness check, we included up to four lags of the federal funds rate in the regression, and obtained the same qualitative results. They are available from the authors upon request.

10. The contemporaneous correlation of GDPpc and total loans with the default measure are $-0.22$ and $-0.13$, respectively. See Table A4.

11. For a model where countercyclical default coexists with countercyclical bank profit margins, see Corbae and D'Erasmo (2010).

12. It is calculated using cited interest rates series as opposed to banks actual interest income.

net of loan recoveries as a percentage of total loans.[13]

### C. Empirical Methodology

To test for the presence of unit roots we ran augmented Dickey–Fuller (ADF) tests on all the variables in our sample. Except for a few obvious cases, we did not have a priori on the process followed by each variable under the null of a unit root. Thus, we follow the methodology proposed by Dolado, Jenkinson, and Sosvilla-Rivero (1990). In short, this methodology starts from the most unrestricted model for the behavior of a variable $y$ that includes a constant and a time trend like in Equation (2).

$$(2)\quad y_t - y_{t-1} = \alpha + \beta t + \gamma y_{t-1} + \sum_{j=1}^{p} \phi_j \Delta y_{t-j}$$

Then we test for the joint significance of $\alpha$, $\beta$, and $\gamma$ using the critical values tabulated by Dickey and Fuller. If this model cannot be rejected, then the hypothesis of a unit root (i.e., $\gamma = 0$) is tested using critical values from the Student's $t$ distribution. The advantage of this method is that once the "true" model is known under the null, the power of the unit root test can be increased by using the usual critical values from the $t$ distribution instead of the critical values tabulated by Dickey and Fuller (this result is due to Sims, Stock, and Watson 1990). If the model in Equation (2) is rejected, then the methodology continues in the same fashion with the more restricted model of difference stationary with drift variables. Again, if this more restricted model cannot be rejected, then ordinary critical values from the $t$ distribution are used to test the null of $\gamma = 0$. Finally, if this second model is rejected, the methodology ends by testing the null of a difference stationary process using the Dickey and Fuller critical values.[14]

Trend stationary variables were detrended by regressing them on a constant and a polynomial of time, where the order of the polynomial was chosen based on fit, while difference stationary variables were "detrended" using the Hodrick–Prescott filter with a smoothing parameter of 1600. All detrended variables were proven to be stationary using ADF tests. Last, the original model was redefined in terms of these stationary variables.

In the estimation of regression equation (1), we tested for autocorrelation in the disturbances using two alternative tests: A Durbin–Watson (DW) test for first-order autocorrelation and a Breusch–Godfrey (BG) test for possible autocorrelation of up to order 4. It has been suggested that an AR(4) model is appropriate for quarterly data because of seasonal autocorrelation. Indeed, in several cases the null of no autocorrelation cannot be rejected with the DW statistic, but it is rejected when using the BG test (see Table 5). In all cases in which some form of autocorrelation was found, standard errors were obtained by using the Newey–West robust, consistent estimator for autocorrelated disturbances of unspecified structure.

Our specification also presents potential endogeneity problems. A system of equations bias can be affecting our results if, as expected, some of the explanatory variables are simultaneously determined with the dependent variable. Specially prone to this bias are the business cycle indicator and the share of total assets held by large banks. It could be argued that aggregate economic activity as measured by the business cycle indicator is in turn a function of the cost of credit, as proxied by the level of margins. Also, it is reasonable to expect the market share held by large banks to be strongly correlated with market concentration in banking, and concentration might itself be a function of the level of margins, the dependent variable. To account for this endogeneity, we also estimated the model by two-stage least squares (2SLS). The instrumented variables are the cycle indicator and "Share large." The instruments used are two lags of the instrumented variable. Since instrumental variables methods are relatively inefficient compared to OLS, a Hausman specification test was run in order to evaluate the compromise between efficiency and consistency of our estimations.[15]

13. Charge-offs are the value of loans removed from banks' books and charged against loss reserves. We use a 1 period lag of the charge-off rate arguing that banks respond to changes in credit risk adjusting the price of loans only with a lag.

14. The optimal number of lags $p$ for the ADF regressions is chosen using the Akaike Information Criterion and the Schwartz Bayesian criterion, as well as the Box-Pierce Q test for white noise of the errors. Table A5 shows the results of these stationarity analyses.

15. Three-stage least squares (3SLS) would have allowed for correlation among the error terms of the three equations: the margin, the cycle indicator, and the share of large banks in total assets. 3SLS gives more efficient estimates, but those from 2SLS are still consistent. Moreover, 3SLS would pose the risk that wrongly specified equations for the instrumented variables bias the estimators of interest in the margin equation.

Last, variance inflation factor tests detected no multicollinearity in our regressions.

*D. Results*

Results for this specification are summarized in Table 2. The countercyclicality of price-cost margins is documented with a negative and significant coefficient β for most specifications of the business cycle indicator and price-cost margins.[16] Note that margins are countercyclical even after controlling for the effects of monetary policy and default risk. The result is robust to the inclusion of controls for banking regulation and seasonality in the data.

A positive and significant effect of the federal funds rate is obtained for most specifications. We interpret this positive coefficient as evidence for the bank lending channel of monetary policy being at work in the U.S. economy.

According to our results the credit risk measure has no significant impact on margins. This is also true when using the delinquency rate,[17] the loss rate,[18] and the Baa-Treasury bond spread[19] as measures of credit risk. Price-cost margins are still countercyclical in all these cases.

As a robustness check, we also studied the cyclical behavior of margins without controlling for monetary policy and default risk. The countercyclicality of price-cost margins is robust to this change in the econometric specification.

Last, since aggregate margin measures are calculated as asset-weighted averages of the bank-level margins, and since we could expect a skewed distribution for total assets in which a few big banks hold large market shares, it could be argued that the cyclicality properties we capture in our analysis using asset-weighted averages are probably related to the behavior of large banks. To test this idea, as a robustness check we conducted a median analysis, in which aggregate margin measures are calculated as the median of the distribution. Doing so we obtain results consistent with those in the benchmark specification for all margin measures and all BCIs. This consistency in results leads us to conclude that there is no evidence for a compositional effect of the distribution of assets across banks of different sizes driving the countercyclicality of margins at the aggregate level. To save space, we do not present these results here, but they are available from us upon request.

Having documented the countercyclical nature of margins for a wide range of margin measures and of BCIs, in what follows we focus only on three margins and on two cycle indicators: GDPpc as one macroeconomic indicator, and total loans as one of the measures based on banks' balance sheet information.

*Economic Significance of the Results.* In this section, we assess the quantitative importance of our results, which facilitates the comparison of the degree of cyclicality of margins across different margin measures.

The coefficients shown in Table 2 can be misleading if one omits the standard deviations from the analysis. For example, the coefficient of −0.011 of Margin 1 on GDPpc shows that a one standard deviation increase in output from its trend (roughly a 2% increase) is associated to a fall of approximately 1/3 of a standard deviation of the margin relative to its own trend (around 0.02% points fall in the margin). Meanwhile, the coefficient of −0.0072 on the logarithm of total loans, although lower than that on GDPpc, actually implies a larger effect; it shows that a one standard deviation increase of loans from their trend implies a fall of 1/2 of standard deviation of Margin 1 relative to its own trend.[20] Thus, Table 3 better shows the economic significance of the results, by presenting the number of standard deviations by which margins change after a one standard deviation increase in the cycle measure. Alternatively, the coefficients in Table 3 can be interpreted as the share of the typical deviation of each price-cost margin that can be explained by the typical deviation in each business cycle indicator.

*E. Asymmetries in the Cyclicality of Price-Cost Margins*

Bernanke and Gertler (1989) suggest that the external finance premium may behave

16. Only the coefficients on the business cycle indicator are shown in this table to save space. The full regression output, including the coefficients on the monetary policy and risk variables, are available from the authors upon request. As expected, in most cases the coefficient on the unemployment rate turns out to be *positive* and significant, which serves as evidence for countercyclical margins.

17. According to the Federal Reserve's definition, delinquent loans and leases are those past due 30 days or more and still accruing interest, as well as those in nonaccrual status.

18. Defined here as the ratio of loans loss allowances to total loans.

19. This spread has been suggested as an indicator of the default risk prospects on private debt.

20. See Table A3 for the standard deviations of detrended margins and business cycle measures.

**TABLE 2**
The Cyclical Behavior of Banks Price-Cost Margins

| | Margin 1 | | | | | | | Margin 2 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GDP** | −0.0145 | — | — | — | — | — | — | −0.0155 | — | — | — | — | — | — |
| | (0.115) | — | — | — | — | — | — | (0.100) | — | — | — | — | — | — |
| **GDPpc** | — | −0.0111 | — | — | — | — | — | — | −0.0122 | — | — | — | — | — |
| | — | (0.011) | — | — | — | — | — | — | (0.006) | — | — | — | — | — |
| **GDI** | — | — | −0.0039 | — | — | — | — | — | — | −0.0038 | — | — | — | — |
| | — | — | (0.018) | — | — | — | — | — | — | (0.019) | — | — | — | — |
| **GDIpc** | — | — | — | −0.0039 | — | — | — | — | — | — | −0.0039 | — | — | — |
| | — | — | — | (0.015) | — | — | — | — | — | — | (0.016) | — | — | — |
| **Urate** | — | — | — | — | 0.0133 | — | — | — | — | — | — | 0.0155 | — | — |
| | — | — | — | — | (0.112) | — | — | — | — | — | — | (0.078) | — | — |
| **Loans** | — | — | — | — | — | −0.0072 | — | — | — | — | — | — | −0.0078 | — |
| | — | — | — | — | — | (0.000) | — | — | — | — | — | — | (0.000) | — |
| **C&I Loans** | — | — | — | — | — | — | −0.0063 | — | — | — | — | — | — | −0.0071 |
| | — | — | — | — | — | — | (0.002) | — | — | — | — | — | — | (0.000) |
| Obs. | 104 | 104 | 104 | 104 | 104 | 104 | 84 | 104 | 104 | 104 | 104 | 104 | 104 | 84 |
| Adj. $R^2$ | 0.103 | 0.201 | 0.085 | 0.086 | 0.143 | 0.363 | 0.309 | 0.073 | 0.191 | 0.050 | 0.050 | 0.128 | 0.388 | 0.342 |
| | **Margin 3** | | | | | | | **Margin 4** | | | | | | |
| **GDP** | −0.0137 | — | — | — | — | — | — | −0.0065 | — | — | — | — | — | — |
| | (0.127) | — | — | — | — | — | — | (0.288) | — | — | — | — | — | — |
| **GDPpc** | — | −0.0113 | — | — | — | — | — | — | −0.0052 | — | — | — | — | — |
| | — | (0.009) | — | — | — | — | — | — | (0.099) | — | — | — | — | — |
| **GDI** | — | — | −0.0035 | — | — | — | — | — | — | −0.0012 | — | — | — | — |
| | — | — | (0.029) | — | — | — | — | — | — | (0.316) | — | — | — | — |
| **GDIpc** | — | — | — | −0.0035 | — | — | — | — | — | — | −0.0013 | — | — | — |
| | — | — | — | (0.024) | — | — | — | — | — | — | (0.281) | — | — | — |
| **Urate** | — | — | — | — | 0.0139 | — | — | — | — | — | — | 0.0081 | — | — |
| | — | — | — | — | (0.105) | — | — | — | — | — | — | (0.302) | — | — |
| **Loans** | — | — | — | — | — | −0.0074 | — | — | — | — | — | — | −0.0019 | — |
| | — | — | — | — | — | (0.000) | — | — | — | — | — | — | (0.084) | — |
| **C&I Loans** | — | — | — | — | — | — | −0.0064 | — | — | — | — | — | — | −0.0023 |
| | — | — | — | — | — | — | (0.001) | — | — | — | — | — | — | (0.131) |
| Obs. | 104 | 104 | 104 | 104 | 104 | 104 | 84 | 85 | 85 | 85 | 85 | 85 | 85 | 84 |
| Adj. $R^2$ | 0.084 | 0.190 | 0.063 | 0.063 | 0.130 | 0.377 | 0.339 | 0.087 | 0.242 | 0.089 | 0.093 | 0.084 | 0.258 | 0.255 |

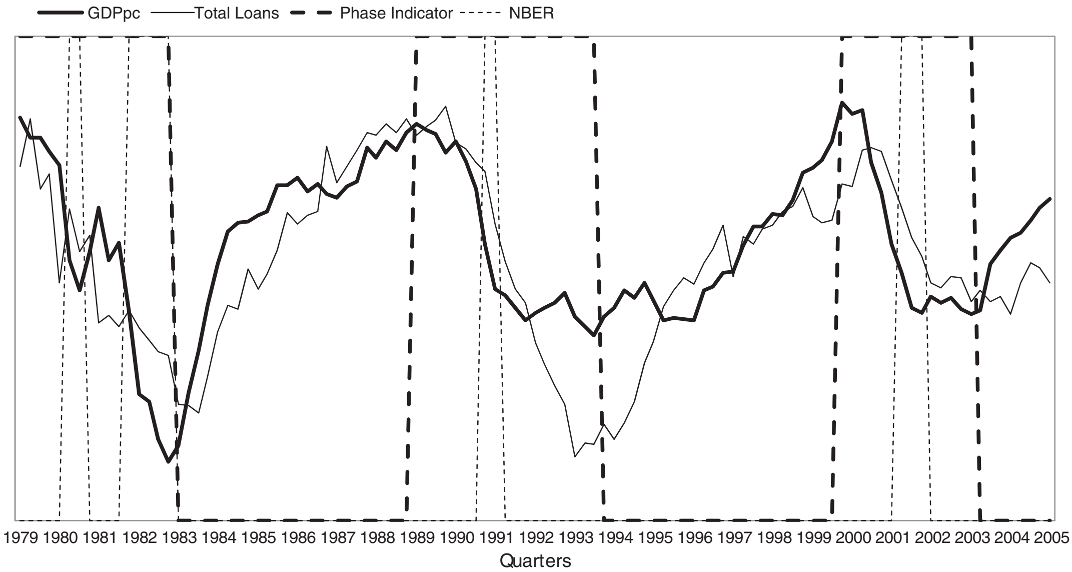
***continued***

**TABLE 2**
Continued

| | Margin 5 | | | | | | | BP/TB | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GDP** | −0.0039 | — | — | — | — | — | — | −0.1462 | — | — | — | — | — | — |
| | (0.589) | — | — | — | — | — | — | (0.000) | — | — | — | — | — | — |
| **GDPpc** | — | −0.0074 | — | — | — | — | — | — | −0.0653 | — | — | — | — | — |
| | — | (0.077) | — | — | — | — | — | — | (0.066) | — | — | — | — | — |
| **GDI** | — | — | −0.0005 | — | — | — | — | — | — | −0.0264 | — | — | — | — |
| | — | — | (0.703) | — | — | — | — | — | — | (0.001) | — | — | — | — |
| **GDIpc** | — | — | — | −0.0007 | — | — | — | — | — | — | −0.0260 | — | — | — |
| | — | — | — | (0.646) | — | — | — | — | — | — | (0.001) | — | — | — |
| **Urate** | — | — | — | — | 0.0145 | — | — | — | — | — | — | 0.1153 | — | — |
| | — | — | — | — | (0.115) | — | — | — | — | — | — | (0.116) | — | — |
| **Loans** | — | — | — | — | — | −0.0037 | — | — | — | — | — | — | −0.0406 | — |
| | — | — | — | — | — | (0.029) | — | — | — | — | — | — | (0.046) | — |
| **C&I Loans** | — | — | — | — | — | — | −0.0041 | — | — | — | — | — | — | −0.0275 |
| | — | — | — | — | — | — | (0.031) | — | — | — | — | — | — | (0.006) |
| Obs. | 85 | 85 | 85 | 85 | 85 | 85 | 84 | 104 | 104 | 104 | 104 | 104 | 104 | 84 |
| Adj. $R^2$ | 0.365 | 0.451 | 0.364 | 0.365 | 0.384 | 0.508 | 0.485 | 0.427 | 0.418 | 0.417 | 0.416 | 0.396 | 0.412 | 0.219 |

*Note:* $p$-value of $t$-test in parentheses. Newey−West robust standard errors. Corrected by heteroscedasticity and possible autocorrelation up to AR(4). The full regression output, including the coefficients on the monetary policy and default risk variables, along with important regression diagnostic statistics are available from the authors upon request.

**FIGURE 3**
Phases of the Business Cycle




*Note:* "NBER" shows the dummy variable built using the NBER reference dates, and "phase indicator" shows the dummy built by visual inspection of the GDPpc and loans series. The dummy equals 1 for the downward phase of the cycle.
*Source:* RCI data, NIPA-BEA, and NBER.

**TABLE 3**
Economic Significance of the Coefficients

| | Margin 1 | Margin 4 | BP/TB |
|---|---|---|---|
| **GDPpc** | −0.36 | −0.30 | −0.23 |
| **Loans** | −0.48 | −0.23 | −0.30 |

*Note:* Cells show the number of standard deviations by which each margin changes after a one standard deviation increase in the cycle measure.

asymmetrically across stages of the business cycle.[21]

In this section, we test for the presence of these asymmetries. To do that, we estimate Equation (3)

(3)

$$y_t = \alpha + \beta_1 \log(X_t) + \beta_2 \log(X_t) D_t + \sum_{i=1}^{K1} \gamma_i Z_{i,t} + \sum_{i=1}^{K2} \delta_i R_{i,t} + \sum_{i=1}^{3} \theta_i Q_{i,t} + \epsilon_t$$

where the regressors are the same as in Equation (1) except for an interaction term of the business cycle indicator ($X$) with a dummy variable ($D$) which indicates the phase of the business cycle (i.e., $D = 1$ if the economy is in the downward phase of the cycle, and zero otherwise).

We use two alternative definitions to construct this dummy. In the first case we use the turning points published by the Business Cycle Dating Committee of the National Bureau of Economic Research. In the second, the series for GDPpc and loans are visually inspected to construct a dummy with more variability than the NBER-based counterpart.[22] Figure 3 plots the BCIs and the two dummy variables.

Thus, the coefficient $\beta_2$ captures the difference across phases of the business cycle in the response of margins to economic fluctuations.

Table 4 presents the results of this exercise. In the case of the interaction with the NBER dummy the results show lack of evidence of asymmetric behavior. Most of the estimations

21. The idea in their framework is that agency problems may bind only during economic downturns.

22. The period 1979–2005 covered by this study contains only four recessions according to the NBER statistics. Two of them are close to each other, so that the series exhibit very small variability. The main difference between the two definitions is given by the periods 1991–1993 and 2001–2003 which, based on the behavior of total loans, are still classified as recessions in the second definition.

**TABLE 4**
Asymmetries in the Cyclical Behavior of Margins[a]

| NBER dummy | Margin 1 | Margin 4 | BP/TB |
|---|---|---|---|
| **GDPpc** | −0.016 | −0.003 | −0.066 |
| | (0.000) | (0.25) | (0.121) |
| **GDPpc*D** | 0.027 | −0.019 | −0.056 |
| | (0.000) | (0.034) | (0.461) |
| **Loans** | −0.008 | −0.002 | −0.035 |
| | (0.000) | (0.096) | (0.071) |
| **Loans*D** | 0.014 | −0.005 | −0.017 |
| | (0.139) | (0.046) | (0.842) |
| **Phase dummy** | **Margin 1** | **Margin 4** | **BP/TB** |
| **GDPpc** | −0.012 | 0.002 | 0.022 |
| | (0.003) | (0.473) | (0.495) |
| **GDPpc*D** | 0.005 | −0.013 | −0.176 |
| | (0.478) | (0.000) | (0.000) |
| **Loans** | −0.005 | 0.000 | 0.010 |
| | (0.009) | (0.962) | (0.590) |
| **Loans*D** | −0.004 | −0.005 | −0.095 |
| | (0.204) | (0.004) | (0.000) |

*Note:* $p$-value of $t$-test in parentheses. Newey−West robust standard errors. Corrected by heteroscedasticity and possible autocorrelation up to AR(4). The full regression output, including the coefficients on the monetary policy and default risk variables, along with important regression diagnostic statistics are available from the authors upon request.

[a]D denotes the recession dummy as measured by the NBER indicator (top panel) or the phase dummy (bottom panel). The table shows the results for 12 different regressions, 6 for each dummy definition. In each case, regressions are run for 3 alternative definitions for margins and 2 BCIs: GDPpc and total loans.

for $\beta_2$ are insignificant, and the sign of $\beta_1$ is not changed. In the few cases in which the estimations are significant, the coefficient becomes unstable across different definitions for margins and cycle indicators. The instability of these estimations is expected, since the NBER dummy is nonzero in just a few periods.

We confirm this expectation when we use our alternative phase indicator to construct the interaction effect. The regression results in the bottom portion of Table 4 show more stable coefficients across specifications. Still, only in half of the cases the estimated value of $\beta_2$ is significantly different from zero, providing only partial support to the hypothesis of an asymmetric pattern of margins over the cycle. For all these cases, the coefficients are always negative with the main effects becoming insignificant. The type of asymmetry implied by these results is one in which banks' price-cost margins increase during recessions while they exhibit a weaker reaction during expansions. This is in line with the type of asymmetry suggested by Bernanke and Gertler (1989) and discussed above.

## IV. STEP 2: EXPLAINING THE CYCLICAL BEHAVIOR OF PRICE-COST MARGINS

In this section, we add an additional set of macroeconomic and banking industry-related regressors to Equation (1). The goal is to explain the countercyclical behavior of margins documented before, and to determine what are the actual channels through which business cycles affect the choice of margins by banks. Thus, no explanatory power should be left to the cycle measure after introducing this expanded set of controls. Subsections A and B in Section IV discuss the bases for the inclusion of these additional regressors.

### A. *Macroeconomic Determinants*

Monetary policy, default risk, interest rate risk, the economy's financial depth, the availability of funds for banks, and inflation are conjectured as potential macroeconomic determinants of the cyclicality of margins.

*Monetary Policy.* Together with the Federal funds rate already included in the basic specification in Section III as a measure of the *direct* impact of monetary policy on margins, two additional interaction variables are included here to measure the potential *indirect* effects of monetary policy on bank margins.

The first is built as the interaction between a measure of the liquidity of banks' balance sheets and the federal funds rate. Gibson (1996) finds that the macroeconomic effects of monetary policy are weaker when banks hold more liquid portfolios. Also, in their cross-sectional study, Kashyap and Stein (2000) find that the impact of monetary policy on lending is weaker for banks with more liquid balance sheets, since they can protect their loan portfolios from the fall in reserves induced by a monetary policy tightening by drawing from their buffer of cash and securities.

The second variable is the interaction between a concentration measure given by the Herfindahl−Hirschman index in the market for loans and the federal funds rate. Cottarelli and Kourelis (1994) find that entry barriers in banking slow policy transmission. More recently, Adams and Amel (2005) study the relationship between banking competition and the transmission of monetary policy in the United States, and find that the impact of monetary policy is weaker in more concentrated markets. Olivero, Li, and Jeon (2009) find similar evidence for a cross-section of countries in Latin America and Asia. Therefore, we expect a negative sign for the coefficient on this second interaction term.

*Interest Rate Risk.* Banks are expected to charge a premium to compensate for interest rate risk. Among others, Ho and Saunders (1981), Saunders and Schumacher (2000), and Demirgüç-Kunt, Laeven, and Levine (2004) show the importance of accounting for interest rate risk.

We proxy this risk using both the contemporaneous and the lagged values of the volatility of short-term interest rates. Following Saunders and Schumacher (2000), in each period the measure used is the standard deviation of the weekly series for the 3-month Treasury bill rate.

Since high volatility increases the probability of a future recession,[23] the lagged value of the volatility of interest rates is a countercyclical risk measure and therefore, it is likely to explain the cyclical behavior of margins.

*Financial Depth.* A negative sign is expected for the coefficient on the economy's financial depth. More substitutes for bank credit are available in a more developed financial sector, so that banks need to charge lower margins.[24]

Following Kashyap, Stein, and Wilcox (1993), financial depth is measured as the ratio of commercial paper issued by the nonfarm nonfinancial corporate business sector to the sum of commercial paper and bank loans for the nonfarm nonfinancial corporate business and nonfarm noncorporate business sectors.

With this measure being procyclical and exerting a negative impact on margins, our conjecture is that the inclusion of financial depth as a control in Equation (1) should help to explain the countercyclicality of margins.

*Supply of Funds.* We use the supply of deposits available to banks as a proxy for their marginal cost of funds. If this cost is an important determinant of margins, an increase in the supply of funds during the upward phase of the business cycle should lower margins. Therefore, this additional regressor in Equation (1) seems a good candidate to explain the countercyclical nature of margins.

*Inflation.* For various reasons banks might require higher risk premia when inflation is high.[25] Since inflation is typically countercyclical (see Blanchard and Fischer 1989, Table 1.3, p. 20), a positive effect of inflation on margins might provide another explanation for the countercyclical nature of the latter. Here we use the detrended value of the consumer price index (CPI) as a measure of inflation.

### B. Banking Industry Determinants

In this section, we discuss the role of several banking sector variables as potentially good explanations of the cyclicality of margins. They are bank liquidity and capitalization and the market share held by large banks.

*Banks' Liquidity.* Typically banks that choose to hold more liquid portfolios pay for the cost of that liquidity by raising their margins (see Ho and Saunders 1981 and Saunders and Schumacher 2000 for details).[26]

23. Interest rate volatility lowers consumer confidence and hampers investment, exerting a negative effect on future GDP levels.

24. Demirgüç-Kunt and Huizinga (2000) show that bank profitability and margins fall as countries financial systems develop.

25. Huybens and Smith (1999) argue that inflation may make informational asymmetries stronger and lead to higher margins. Demirgüç-Kunt and Huizinga (2000) provide support to the fact that banks profits increase in inflationary environments. Saunders and Schumacher (2000) present evidence for margins increasing with higher interest rate volatility, which has been associated with high and variable inflation. Boyd, Levine, and Smith (2001) find a significant, economically important, and negative relationship between inflation and banking sector development. In turn, lower development can be conjectured to derive in increased NIMs. Demirgüç-Kunt, Laeven, and Levine (2004) show that inflation has a robust, positive impact on bank margins and overhead costs.

26. Ho and Saunders (1981) and Saunders and Schumacher (2000) develop a model where banks charge margins that are mainly fees for the provision of "immediacy services" (the immediate provision of deposits and loans). Banks have to temporarily invest funds in the money market whenever a deposit arrives at a time different from a new loan demand, and they face a *reinvestment risk* if the short-term rate falls. If banks face a demand for a new loan without a contemporaneous supply of new deposits, they need to borrow temporarily in the money market, facing a *refinancing risk* should the short-term interest rate go up. The margin compensates banks for bearing this risk. Holding more liquid assets can be viewed as an alternative to having to resort to the money market to provide these services. Therefore, their model provides a rationale for a positive relationship between margins and banks liquidity.

In recessions credit risk increases more for risky and illiquid assets, such as loans, than for more liquid assets such as government securities. This results in banks shifting their asset portfolios towards more liquid assets during bad times, so that liquidity is a countercyclical variable. If there is in fact a positive effect of liquidity on margins, we conjecture here that the countercyclicality of liquidity can provide another explanation for the countercyclical nature of margins.

Here we use the ratio of cash plus investment securities to assets as a measure of aggregate liquidity in the banking sector.[27]

*Banks' Capitalization.* The Basle Accords require banks to hold a minimum capital of 8% of risk weighted assets. Moreover, there is empirical evidence that banks hold capital in excess of this minimum as a way to hedge credit risk.[28] Since holding equity is typically more costly than holding debt, banks may need to charge higher margins as they increase their capital holdings.

Here we use the ratio of equity capital to loans to measure the degree of capitalization in banks' balance sheets. Since loans are more procyclical than equity, this ratio is countercyclical. Thus, if the ratio is directly related to margins, its inclusion in the expanded set of controls should help to explain the countercyclicality of margins.

*The Market Share of Large Banks.* We use the share of total bank assets held by large banks as a measure of both market concentration and of the relative importance of larger banks in the economy. It can therefore capture differences, if any, in the lending practices and loan pricing across banks of different size.[29] This share is highly procyclical in our sample.

The relationship between concentration and margins is not unambiguous. On the one hand, if higher market concentration is a good proxy for less competition, there should be a positive relationship between market concentration and price-cost margins. Also, for a given interest rate on loans, concentration will increase margins if it allows banks to offer lower deposit rates.[30] On the other hand, if an increase in this variable captures an increased market share for large banks, this could have a negative impact on margins since there is evidence that larger banks charge lower margins.[31]

Based on this discussion, it is not clear what sign to expect for the coefficient on the share of large banks. Nevertheless, if the negative effect is stronger, the procyclicality of the share can provide an explanation for the countercyclical nature of margins.

### C. *Explaining the Countercyclicality: Results*

In all specifications, the business cycle measure completely loses its explanatory power after the expanded set of regressors is included. This

27. See data appendix for details on this definition. Kashyap and Stein (1997a) define liquidity for each bank as the ratio of cash plus securities plus federal funds sold to total assets. Due to the lack of data on federal funds for several periods, we depart slightly from them and define it as the ratio of cash plus securities to total assets. The aggregate measure is calculated as the weighted average across banks, with the weights given by each bank's market share in total assets.

28. In our sample equity represents 14% of assets. According to the Bank of International Settlements, the average ratio of capital to risk-weighted assets of major banks in G-10 countries rose from 10% in 1988 to 11% in 1996.

29. Bank size is calculated following Kashyap and Stein (2000). Large banks are those in the 99–100th percentile of the distribution of total assets, medium size banks are those in the 95–99th percentiles, and the rest are small banks. The Herfindahl–Hirschman index (HHI) in the market for loans is an alternative measure of concentration. Both measures comove in our dataset. We use two alternative measures for the nation's Herfindahl index: an aggregate measure and a weighted average of states indexes. This distinction becomes specially relevant for the pre-1997 period when interstate branching was not allowed in the United States. To understand the need for this adjustment, consider an economy where banks are restricted to operate in only one state and where there is only one bank in each state. The aggregate HHI in that economy would be $\sum(1/N^2) = 1/N$ with $N$ being the number of states. With the transformed measure, the weighted HHI would equal $\sum(1 * 1/N) = 1$. Therefore, the aggregate measure would be underestimating the concentration measure in an economy where banks are perfect monopolies in each of their areas of operation. The variability over time of these two measures can be expected to be different if the shares of each state in total assets change significantly at business cycle frequencies.

30. Berger and Hannan (1989) provide strong evidence of a negative relationship between market concentration and deposit rates. Hannan and Berger (1991) find that banks in more concentrated markets have more rigid deposit rates, and that deposit rates are stickier upwards than downwards. Neumark and Sharpe (1992) find that in more concentrated markets deposit rates rise more slowly and fall faster after a change in input costs. They also find that banks in concentrated markets offer lower rates on deposits than more competitive banks.

31. Flannery (1981) shows that larger banks effectively hedge themselves against market risk by holding assets and liabilities of similar average maturities. Therefore, larger banks can charge smaller margins. Ho and Sunders (1981) show that smaller banks have a one third of a percent larger margins than bigger banks. In the model of Corbae and D'Erasmo (2010) bank profit rates also fall with bank size.

**TABLE 5**
Some Explanations for the Cyclical Behavior of Margins

| | Margin 1 | | Margin 4 | | BP/TB[a] | |
|---|---|---|---|---|---|---|
| GDPpc | 0.0019 | | 0.0000 | | 0.0128 | |
| | (0.634) | | (1.000) | | (0.767) | |
| Total loans | | −0.0029 | | −0.0025 | | 0.0260 |
| | | (0.467) | | (0.434) | | (0.281) |
| *Macroeconomic determinants* | | | | | | |
| FF rate | 0.0253 | 0.0276 | 0.0109 | 0.0107 | −0.1152 | −0.0817 |
| | (0.000) | (0.000) | (0.180) | (0.193) | (0.049) | (0.144) |
| FF rate$_{t-1}$ | 0.0096 | 0.0100 | −0.0096 | −0.0088 | 0.2436 | 0.2639 |
| | (0.244) | (0.221) | (0.155) | (0.229) | (0.001) | (0.000) |
| Liquidity*FF rate | 0.2909 | 0.2640 | 0.4507 | 0.4173 | 1.3655 | 0.8292 |
| | (0.290) | (0.308) | (0.324) | (0.382) | (0.605) | (0.719) |
| HHI*FF rate | −0.7694 | −0.7883 | −0.0586 | −0.5287 | −31.53 | −17.76 |
| | (0.879) | (0.865) | (0.990) | (0.891) | (0.474) | (0.653) |
| Charge-off rate | 0.1307 | 0.1279 | 0.0656 | 0.0723 | 0.1095 | 0.2574 |
| | (0.424) | (0.402) | (0.502) | (0.526) | (0.946) | (0.859) |
| Volatility TB | 0.0201 | 0.0235 | 0.0572 | 0.0517 | 0.8422 | 0.8427 |
| | (0.252) | (0.192) | (0.037) | (0.057) | (0.001) | (0.001) |
| Volatility TB$_{t-1}$ | 0.0232 | 0.0245 | 0.0726 | 0.0698 | 0.1598 | 0.2097 |
| | (0.135) | (0.108) | (0.007) | (0.010) | (0.517) | (0.414) |
| Financial depth | −0.0087 | −0.0080 | −0.0070 | −0.0063 | −0.0519 | −0.0600 |
| | (0.098) | (0.118) | (0.036) | (0.069) | (0.258) | (0.197) |
| Deposits | 0.0026 | 0.0020 | −0.0022 | −0.0024 | 0.0182 | 0.0214 |
| | (0.207) | (0.370) | (0.072) | (0.038) | (0.316) | (0.180) |
| CPI | 0.0000 | −0.0001 | −0.0001 | −0.0001 | 0.0016 | 0.0013 |
| | (0.860) | (0.336) | (0.418) | (0.251) | (0.009) | (0.002) |
| *Banking industry determinants* | | | | | | |
| Liquidity | 0.0208 | 0.0195 | 0.0015 | −0.0003 | 0.0603 | 0.0719 |
| | (0.001) | (0.001) | (0.841) | (0.975) | (0.284) | (0.152) |
| K-A ratio | 0.0354 | 0.0301 | 0.0337 | 0.0290 | 0.0272 | 0.0606 |
| | (0.075) | (0.122) | (0.003) | (0.023) | (0.777) | (0.605) |
| Share large | −0.0427 | −0.0347 | −0.0256 | −0.0162 | 0.2873 | −0.0166 |
| | (0.005) | (0.118) | (0.023) | (0.261) | (0.147) | (0.900) |
| Observations | 104 | 104 | 85 | 85 | 104 | 104 |
| BG $p$-value | 0.0020 | 0.0020 | 0.0960 | 0.0990 | 0.0000 | 0.0000 |
| DW statistic | 1.3300 | 1.3440 | 1.5320 | 1.5070 | 2.0880 | 2.0210 |
| Adjusted $R^2$ | 0.5860 | 0.5890 | 0.4020 | 0.4100 | 0.6060 | 0.6270 |

*Note:* $p$-value of $t$-test in parentheses. Newey–West robust standard errors. Corrected by heteroscedasticity and possible autocorrelation up to AR(4). FF rate, federal funds rate; HHI, Herfindahl index for total loans; share large, share of total assets held by large banks.

[a]From 2SLS regression; Hausman test rejected at 10% level.

evidence suggests that the included controls are important channels through which fluctuations in the economy translate into cyclical movements of the margins. Given the similarity in the qualitative results across the different margins and business cycle measures, Table 5 presents the regression outputs for only three selected margins and only for GDP and total loans. The results for the other margins as well as a number of regression diagnostic tests are included in Tables B.1–B.3 of an online appendix.[32]

Overall, the federal funds rate retains its positive and significant impact on margins.

Our results cannot provide full support to the effect studied in Kashyap and Stein (2000) related to the interaction between monetary policy and banks liquidity (recall our discussion

32. Available at http://faculty.lebow.drexel.edu/OliveroM/.

in subsection *Monetary Policy* in Section IV). This hypothesis would imply a negative sign for the interaction between liquidity and the monetary policy indicator. Conversely, the coefficients obtained here are insignificant in all possible combinations of margins and cycle indicators. Moreover, consistently across business cycle measures, they are positive for all margins. However, our findings can be easily reconciled with theirs recalling that their hypothesis is specially relevant for small banks that typically have less than perfect access to uninsured sources of finance. For larger banks, they also find a positive and even significant effect of this interaction variable on banks' loan supply. In our aggregate data large banks weight more heavily than the rest, so that the positive coefficient on this interaction is not evidence against Kashyap and Stein (2000).

Our results provide some support to the hypothesis that monetary policy is weaker in economies with a more concentrated banking industry, in line with the conclusions in Cotarelli and Kourelis (1994), Adams and Amel (2005), and Olivero, Li, and Jeon (2009). The coefficient obtained for the interaction between the measure of monetary policy and concentration is negative, although insignificant in some cases. One reason for this lack of significance might be that the structure of the banking industry does not change dramatically at business cycle frequencies.

Regarding credit risk, the coefficients on the lagged value of the charge-off rate are positive although insignificant. However, as discussed before, we are not particularly concerned about risk with any of the margin measures (recall our discussion in Subsection B of Section III).

Interest rate risk has a positive and in most cases significant impact on margins.

As expected, the financial depth measure exerts a negative effect.

The supply of deposits faced by banks and used as a proxy for their marginal cost of funds does not have a consistently significant impact on margins. Future research could try to incorporate alternative measures of operation costs for banks.

Inflation rates do not seem to affect banks' price-cost margins. However, consistently across cycle indicators, inflation has a positive and significant impact on the spread between the bank prime and the treasury bill rates.

The liquidity of banks' portfolios raises margins for the case of Margin 1. In this sense, our results are consistent with those in Angbazo (1997) and Demirgüç-Kunt, Laeven, and Levine (2004). However, no conclusive evidence can be drawn since the coefficient is insignificant for other margins.

The coefficient on the capital to assets ratio is positive and significant across the alternative specifications. In general, banks seem to charge higher margins to cover the costs of capital holdings.

The share of total assets held by large banks negatively impacts margins. This is consistent with previous evidence that larger banks charge lower markups over their marginal cost of funds.

Summarizing, at the macroeconomic level, the best candidates to explain the countercyclicality of margins are monetary policy, interest rate risk, and the economy's financial depth. Among the variables describing the banking sector, banks' capitalization and the share of total assets held by large banks seem to exert a significant impact on margins. These results are robust across specifications. We derive these conclusions from the fact that the business cycle measure loses its explanatory power when these controls are included in the regression.

## V. CONCLUDING REMARKS

The countercyclical nature of banks' price-cost margins for the United States banking sector was first documented by Aliaga-Díaz and Olivero (2010a) using an atheoretical VAR-based methodology. In this paper we take a step further by building an empirical model of the determinants of this cyclical behavior of margins. Doing so allows us to contribute further to the literature, by offering some potential explanations for this cyclical behavior.

According to our results, monetary policy, the economy's financial depth, interest rate risk, banks' capitalization, and the share of total assets held by large banks exert a significant impact on margins over the cycle. All of them provide channels through which economic fluctuations give rise to the observed countercyclicality of margins.

Since countercyclical margins are a necessary condition for the existence of the Bernanke, Gertler and Gilchrist "financial accelerator," our results provide empirical support for this large body of literature in macroeconomic theory.

With price-cost margins in the market for credit being countercyclical, the cost of credit rises (falls) in bad (good) times, and works to exacerbate economic fluctuations. As such, our results may provide additional grounds for stabilization policy in economies where these margins are countercyclical.

Further research could try to incorporate explanations for the countercyclical behavior of margins alternative to those we offer here. We propose three candidates. The first relates to the banks owners' preference structure. When setting interest rates, banks face a trade-off between profits and market share. As in Dueker and Thornton (1997), if banks have preferences for smoother profit streams, they may smooth profits by charging relatively high prices in recessions. Second, the degree of market power itself may be countercyclical. Forbes and Mayne (1989) present evidence on the procyclicality of the elasticity of the demand for credit faced by banks. Corbae and D'Erasmo (2010) show that procyclical entry rates in banking can give rise to the countercyclicality of banks' profit rates. Third, as in Rotemberg and Saloner (1986), costs of collusion may increase during economic expansions.

Building a dynamic general equilibrium model that can account for the cyclical behavior of margins, and using it to assess how countercyclical margins can exacerbate the effects of aggregate shocks in a theoretical RBC framework is left for future work.[33]

## APPENDIX: DATA

Time series were constructed taking into account the "Notes on forming consistent time series." These are provided with the Call Reports on Condition and Income data in the Federal Reserve Bank of Chicago web site and based on Kashyap and Stein (1997b).

In addition, the data were cleaned to avoid the results to be affected by outliers and other obvious data problems. First, observations for which total assets or total loans are zero or missing were deleted. Second, banks in U.S. territories were dropped from the database. Since there are very few banks in each territory, concentration measures are significantly higher there than in the continental United States. Third, banks' interest income, expenses and charge-off and recoveries are all measured as cumulative year to date totals. Therefore, the appropriate adjustment was made to get the corresponding values for each quarter. Thus, banks for which there is no data in at least one of the four quarters in a given year were not included in the computation of the margin and of the net charge-off rate in that year.

Finally, NIMs are based on individual bank-level data as described in Table A1. The margin measure was obtained by computing the weighted average over the banks, with the weights given by each bank's share in total loans. The weights used were the share in total loans for Margins 1–5, and the share in C&I loans for Margins C&I. Since a few very significant outliers were detected for the margin measures, only margins falling into the interval defined by the [2nd-99th] percentiles were used to compute the average. Table A2 describes the construction of other bank variables using the Call Reports. Net charge-off rates and delinquency rates were also computed as loan-weighted averages. Liquidity and Capital-to-Assets ratio were obtained by using total assets as weights.

**TABLE A1**

Margins Definitions

| Variable | Description |
|---|---|
| Margin 1 | Int. income on loans/loans net of allowances and provision − int. expense on deposits/total deposits (riad4010/ rcfd2125−riad4170/rcfd2200)) |
| Margin 2 | Int. income on loans/loans net of loans past 90 days due − int. expense on deposits/total deposits (riad4010/(rcfd2122−rcfd1407) −riad4170/rcfd2200) |
| Margin 3 | Int. and fee income from loans/total loans−int. on deposits/total deposits (riad4010/rcfd1400−riad4170/rcfd2200). |
| Margin 4 | (Total int. income−total int. expense)/ (gross loans + securities) ((riad4107−riad4073)/(rcfd1400 + rcfd0390)) |
| Margin 5 | (Total int. income − int. expenses)/total loans (riad4107−riad4073)/rcfd1400 |
| Spread BP-TB | Bank prime loan rate − Treasury Bill rate (3 month secondary market) |

All margin measures are from the Reports on Condition and Income data. The spread BP-TB is from the Board of Governors of the Federal Reserve System, historical data on selected interest rates.

33. Corbae and D'Erasmo (2010) build a model capable of replicating countercyclical bank profit rates. For a model that reproduces the countercyclicality of margins and relates it to market structure features, see Aliaga-Díaz and Olivero (2010b).

**TABLE A2**

Variables Definitions and Sources: Business Cycle Indicators

| **Variable** | **Description** | **Source** |
|---|---|---|
| GDP | Real gross domestic product, SA, in billions of chained 2000 dollars | Bureau of Economic Analysis (BEA), National Income and Product Accounts and Population Division, U.S. Bureau of the Census |
| GDPpc | Real gross domestic product per capita in chained 2000 dollars. Annual population data | Bureau of Economic Analysis (BEA), National Income and Product Accounts and Population Division, U.S. Bureau of the Census |
| Investment | Real gross private domestic investment, SA, in billions of chained 2000 dollars | Bureau of Economic Analysis (BEA), National Income and Product Accounts and Population Division, U.S. Bureau of the Census |
| Investmentpc | Real gross private domestic investment per capita in chained 2000 dollars. Annual population data | Bureau of Economic Analysis (BEA), National Income and Product Accounts and Population Division, U.S. Bureau of the Census |
| Urate | Unemployment rate, civilian noninstitutional population, 16 years and over, SA | Labor Force Statistics from the Current Population Survey, Bureau of Labor Statistics |
| Total loans (in thousands) | Total loans and leases (variable rcfd1400). The aggregate gross book value of total loans (before deduction of valuation reserves) | Report of Condition and Income data from Call Reports of the Federal Reserve Bank of Chicago |
| C&I loans (in thousands) | C&I loans (variable rcfd1766+rcfd1755) | Report of Condition and Income data |
| *Controls* | | |
| Federal funds (FF) rate | Real rate of interest in money and capital markets, short-term or money market, NSA | Board of Governors of the Federal Reserve, historical data on selected interest rates |
| Charge-off rate | (Total loan charge-offs − total loan recoveries)/total loans ((riad4635-riad4605)/rcfd1400) | Report of Condition and Income data |
| Loss rate | (Total loans (gross) − total loans net of loan loss allowances)/total loans ((rcfd1400−rcfd2125)/rcfd1400) | Report of Condition and Income data |
| Volatility TB | Volatility in the 3-month Treasury Bill rate, std. dev. of weekly series over each quarter | Board of Governors, historical data on selected interest rates |
| Financial depth | Ratio of commercial paper issued by the nonfarm nonfinancial corporate business sector to commercial paper plus bank loans for the nonfarm nonfinancial corporate business and nonfarm noncorporate business sectors (following Kashyap, Stein, and Wilcox 1993) | Board of Governors of the Federal Reserve, Flows of Funds Accounts |
| Deposits | Demand and other checkable deposits, NSA, in billions of dollars. Log of the real value obtained using the GNP deflator | Board of Governors of the Federal Reserve |
| CPI | All items, U.S. city average, NSA, base period 1982–1984 | Bureau of Labor Statistics |
| Liquidity | (Cash + total investment securities)/Total assets ((rcfd0010+rcfd0390)/rcfd2170) | Report of Condition and Income data |
| K-A ratio | Total equity capital/total loans ((rcfd3210/rcfd1400)) | Report of Condition and Income data |
| Share big | Sum of shares in total assets for banks in the 95th percentile and up of the total asset distribution. | Report of Condition and Income data |
| HHI | Herfindahl Index for total loans (rcfd1400) | Report of Condition and Income data |

GNP deflator used to get real values for both total and C&I loans.

**TABLE A3**

Summary Statistics: Detrended Variables

| Variable | Obs. | Std. Dev. | Min | Max | Mean (of Variables in Levels) |
|---|---|---|---|---|---|
| *Business cycle indicators* | | | | | |
| GDP (in logs) | 105 | 0.0130 | −0.0444 | 0.0231 | 8.9049 |
| GDPpc (in logs) | 105 | 0.0229 | −0.0630 | 0.0410 | 4.4645 |
| Investment (in logs) | 105 | 0.0679 | −0.2352 | 0.1256 | 7.1566 |
| Investment (in logs) | 105 | 0.0690 | −0.2357 | 0.1256 | 3.7055 |
| Urate | 105 | 0.0144 | 0.039 | 0.1067 | 0.0623 |
| Total loans (in logs) | 105 | 0.0474 | −0.1057 | 0.0822 | 3.5038 |
| C&I loans (in logs) | 85 | 0.0395 | −0.0831 | 0.0832 | 2.9877 |
| *Margins (rates)* | | | | | |
| Margin 1 | 105 | 0.0007 | −0.0020 | 0.0023 | 0.0132 |
| Margin 2 | 105 | 0.0007 | −0.0019 | 0.0022 | 0.0129 |
| Margin 3 | 105 | 0.0007 | −0.0019 | 0.0022 | 0.0126 |
| Margin 4 | 85 | 0.0004 | −0.0007 | 0.0011 | 0.0111 |
| Margin 5 | 85 | 0.0006 | −0.0011 | 0.0016 | 0.0145 |
| Spread BP−TB | 105 | 0.0064 | −0.0142 | 0.0318 | 0.0308 |
| *Basic controls* | | | | | |
| FF rate | 105 | 0.0161 | −0.0304 | 0.0495 | 0.0575 |
| Charge-off rate | 105 | 0.0006 | −0.0012 | 0.0020 | 0.0020 |
| Loss rate | 100 | 0.0046 | −0.0076 | 0.0106 | 0.1072 |
| *Additional controls* | | | | | |
| Volatility TB | 105 | 0.0032 | −0.0089 | 0.0197 | 0.0030 |
| Financial depth | 105 | 0.0128 | −0.0234 | 0.0420 | 0.1332 |
| Deposits (in logs) | 105 | 0.0450 | −0.1041 | 0.0987 | 2.8158 |
| CPI | 105 | 1.9095 | −4.4118 | 3.8266 | 135.93 |
| Liquidity | 105 | 0.0106 | −0.0208 | 0.0340 | 0.2851 |
| K-A ratio | 105 | 0.0047 | −0.0112 | 0.0120 | 0.1390 |
| Share big | 105 | 0.0060 | −0.0112 | 0.0122 | 0.7814 |
| HHI | 105 | 0.0009 | −0.0015 | 0.0031 | 0.0100 |

The sample period for all variables is 1979:I-2005:I, except for Margin 4 and Margin 5 (1984:I-2005:I) and the loss rate (1980:II-2005:I).

**TABLE A4**

Cyclicality of Variables

| | GDPpc | Total Loans |
|---|---|---|
| *Macroeconomic determinants* | | |
| FF rate | 0.2176 | 0.2588 |
| | (0.026) | (0.008) |
| FF rate$_{t-1}$ | 0.0965 | 0.2367 |
| | (0.330) | (0.016) |
| Liquidity*Fed funds rate | 0.2212 | 0.2566 |
| | (0.023) | (0.008) |
| HHI*Fed funds rate | 0.2554 | 0.2904 |
| | (0.009) | (0.003) |
| Charge-off rate | −0.2177 | −0.1284 |
| | (0.026) | (0.194) |
| Volatility TB | −0.0745 | 0.0218 |
| | (0.450) | (0.825) |
| Volatility TB$_{t-1}$ | −0.1395 | −0.0314 |
| | (0.158) | (0.752) |
| Financial depth | −0.0019 | 0.1709 |
| | (0.985) | (0.083) |

**TABLE A4**

Continued

| | GDPpc | Total Loans |
|---|---|---|
| Deposits | 0.1134 | −0.1152 |
| | (0.249) | (0.242) |
| CPI | −0.7221 | −0.6831 |
| | (0.000) | (0.000) |
| *Banking industry determinants* | | |
| Liquidity | −0.228 | −0.489 |
| | (0.019) | (0.000) |
| K-A ratio | −0.2365 | −0.4764 |
| | (0.015) | (0.000) |
| Share big | 0.6675 | 0.8034 |
| | (0.000) | (0.000) |

Values shown are correlation coefficients of each variable with each cycle indicator. Significance levels in parentheses.

**TABLE A5**

Stationarity Tests

| Variable | Lags | Model Ho | Test | Statistic | Process | Detrention Met. |
|---|---|---|---|---|---|---|
| *Business cycle indicators* | | | | | | |
| GDPpc | 2 | DS drift+trend | t | 3.45 | TS | $t^3$ polynomial |
| Total loans | 8 | DS | ADF | 1.97 | TS | $t^4$ pol. |
| C&I loans | 4 | DS | ADF | 0.45 | DS | HP filter |
| *Margins (in rates)* | | | | | | |
| Margin 1 | 9 | DS drift+trend | t | 3.51 | TS | $t^4$ pol. |
| Margin 2 | 9 | DS drift+trend | t | 3.56 | TS | $t^4$ pol. |
| Margin 3 | 9 | DS drift+trend | t | 3.61 | TS | $t^4$ pol. |
| Margin 4 | 1 | DS | ADF | 0.27 | DS | HP filter |
| Margin 5 | 1 | DS | ADF | 0.27 | DS | HP filter |
| Spread BP-TB | 2 | DS drift | t | 2.98 | TS | $t^4$ pol. |
| *Basic controls* | | | | | | |
| FF rate | 7 | DS | ADF | 2.33 | TS | $t^4$ pol. |
| Charge-off rate | 4 | DS | ADF | 0.75 | DS | HP filter |
| Loss rate | 4 | DS | ADF | 0.55 | DS | HP filter |
| *Additional controls* | | | | | | |
| Volatility TB | 4 | DS | ADF | 2.46 | TS | $t^4$ pol. |
| Financial depth | 3 | DS | ADF | 1.63 | DS | HP filter |
| Deposits | 3 | DS | ADF | 0.15 | DS | HP filter |
| CPI | 3 | DS drift+trend | ADF | 3.85 | TS | $t^4$ pol. |
| Liquidity | 4 | DS | ADF | 1.56 | DS | HP filter |
| K-A ratio | 5 | DS | ADF | 1.71 | DS | HP filter |
| Share big | 2 | DS | ADF | 2.67 | TS | $t^4$ pol. |
| HHI | 5 | DS | ADF | 1.76 | TS | $t^4$ pol. |

*Note:* The same tests were run on all detrended variables and they were proven to be stationary. DS (TS) stands for difference (trend) stationary processes. HP stands for Hodrick–Prescott.

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