The Relationship Between Large Banks' Investment In Available-For-Sale Securities And The Interest Rate Risk Of Their Securities

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ABSTRACT

This study presents an empirical examination of the relationship between large banks' investment in available-for-sale securities (AFS) and the interest rate risk of their securities. It concentrates on the years, 1997-2000, when interest rates were relatively stable and regulatory capital was not affected by the unrealized holding gains and losses on AFS securities under Statement of Financial Accounting Standards No. 115. The two main findings of the study, having controlled for the interest risk position of the bank (exclusive of securities effect) and other risk management and economic considerations, are: (1) AFS securities' ratio (to securities or to total assets) is positively related to the interest rate risk of securities; (2) a change in the AFS securities ratio is positively related to the change in the interest rate risk of securities. These findings may well prove to be significant to supervisors of banks considering they are in charge of monitoring the effect of fair value accounting regulations on the financial risk management in banks.

Keywords: available-for-sale securities, interest rate risk, SFAS 115

1. INTRODUCTION

The issuance of Statement of Financial Accounting Standards No. 115 (SFAS 115) in 1993 constituted an important step in the process of the gradual changeover to Fair Value Accounting (FVA). The accounting standard classifies securities into three groups:

- Held-to-maturity (HTM) Securities – Debt securities that management has the positive intent and ability to hold to maturity.
- Trading Securities – Debt and equity securities purchased with the intent to sell in the near term.
- Available-for-sale (AFS) Securities – Debt and equity securities not classified as either HTM or Trading securities.

The accounting for HTM securities is based on the principle of historical cost: unrealized holding gains and losses are not recognized. In the case of Trading and AFS securities, the accounting is based on fair value (usually the market price). Unrealized holding gains and losses are recorded in income for trading securities and in equity for AFS securities. Barth et al. (1995) found significant increases in the volatility of bank capital under fair value accounting of securities. Because capital ratio is an accepted stability measure in the banking industry, unrealized losses on AFS securities included in capital may signal safety and soundness problems. This could have an adverse effect on regulators and depositors.

Previous studies (Ernst and Young, 1993, 1994; Razaee and Lee, 1995, Beatty, 1995) found that managers planned and reduced the maturity of the portfolio *in 1993 and 1994, before and immediately after the implementation of SFAS 115*. According to Beatty (1995), shortening the maturity of securities may have an

important effect on the banking industry and on the economy (i.e., reduction in interest income earned by banks and additional cost of regulatory capital if banks have to maintain additional capital under SFAS 115).

In 1993-1994, it was unclear to the banks whether the unrealized gains and losses on AFS securities would be considered part of regulatory capital or not. Only in November of 1994, nine months after its implementation, did regulators decide to exclude the effect of SFAS 115 on regulatory capital. This decision removed the regulatory cost induced by AFS under SFAS 115 after 1995 (Hodder et al., 2002). The study presented here examines empirically the relationship between banks' investment in AFS securities and the maturity of securities *after 1995, following the regulators decision.* Put differently, this paper extends the existing literature by examining this relationship in years without regulatory cost, when regulatory capital is **not** affected by unrealized holding gains and losses under SFAS 115.

Any analysis of the interest rate risk management in banks should consider the theory of coordinated risk management. Schrand and Unal (1998) argue that a firm invested in an asset with multiple combined risks may decrease one risk at the expense of increasing (one or more of) the others, while maintaining the same overall risk target. Calling this substitution of risks coordinated risk management, these authors noted that when mutual thrifts became stock institutions - credit risk was increased while interest rate risk was decreased, a development consistent with the coordinated risk management behavior of managers. Hodder et al. (2002) also provide support for coordinated risk management. They found that when banks first adapted SFAS 115 they lowered the interest rate risk of their securities while increasing the credit risk of their loans. However, Carter and Sinkey (1998) came up with mixed results regarding the relationship between credit risk and the use of hedging by large community banks.

Controlling for the interest risk position of the bank (exclusive of securities effect) and other risk management and economic considerations, it is found that: the larger the AFS portfolio ratio of a bank, the higher the interest rate risk of its portfolio. Other findings suggest that a change in the AFS ratio (to securities or to total assets) is positively related to the change in the interest rate risk of securities.

The second section of this paper reviews some related literature on SFAS 115. The third section develops the main hypotheses. Section 4 presents the empirical model. Section 5 describes the regression results, and section 6 provides a summary and conclusions. The final section gives suggestions for future research.

2. SFAS 115: REVIEW OF THE LITERATURE

SFAS 115 emphasizes the importance of relevant information through the gradual transition of accounting from historical cost to FVA. However this standard had both supporters and critics (see Shim and Larkin, 1998). Previous studies examining the relevance of FVA disclosures have generally found a strong relationship between total fair values of securities and the market value of a bank's equity (see Barth, Beaver and Wolfson, 1990; Warfield and Linsmeier, 1992; Barth, Landsman and Wahlen, 1995; Nelson, 1996; Eccher, Ramesh and Thiagarajan, 1996; Barth, Beaver and Landsman, 1996; Park, Park and Ro, 1999). Park et al. (1999) examined the relevance of fair value disclosures for both AFS and HTM securities. They found that both contributed to the explanation of bank equity. However, the AFS has greater explanatory power than the HTM.

In paragraph 95 to the background information and basis for conclusions of SFAS 115, the FASB indicates that many respondents to the draft of the standard emphasized the problem of volatility in capital. In addition, in paragraph 99, the FASB states:

"… many respondents commented that enterprises may no longer invest in long term investment, such as long term U.S. Treasury securities and corporate bonds, to reduce the potential for volatility in reported capital. They further suggested that such discontinued investment could jeopardize the market for those long-term securities."

Several studies conducted before and shortly after the implementation of SFAS 115 supported these concerns with concrete evidence. Ernst and Young (1993) reported that more than 50% of the banks surveyed by them expected to change their investment behavior if SFAS 115 was adopted. In their follow-up survey, Ernst and Young (1994) reported that 60% of the respondents did change their investment strategies as a result of adopting

SFAS 115. Respondents stated that they had shortened the duration of their portfolio in order to reduce accounting volatility (changes in capital). This volatility increases as more securities are held in the AFS portfolio and the more these securities are held for longer maturity, thus becoming more sensitive to interest rate changes. Razaee and Lee (1995) report that the majority of the respondents to their questionnaire would classify a significant portion of the investment portfolio as AFS, and 73% would shorten maturity of the investment portfolio.

Beatty (1995) examined the financial differences of banks between banks that were early adopters of SFAS 115 (fourth quarter of 1993) and late adopters (first quarter of 1994). Among her findings, she reports a decrease in both the proportion and maturity of securities in the quarter when SFAS 115 was adopted. She argues that the findings indicate that bank managers are concerned about volatility in reported equity induced by SFAS 115.

In December 1993 bank regulators ordered that changes in capital due to the effect of SFAS 115 be included in the regulatory capital ratio. This requirement was recommended despite controversy, put forward by Alan Greenspan, former Federal Reserve chairman, that SFAS 115 would result in a distortion of bank accounting capital and would erect barriers to effective interest rate risk management (Wall Street Journal, November 8, 1990; January 18, 1993). After a long debate the regulators decided, in November 1994, to exclude the effect of SFAS 115 on regulatory capital. This decision removed the regulatory cost induced by AFS under SFAS 115 after 1995 (Hodder et al., 2002).

In November 1995 the FASB granted all firms a one-time opportunity to move securities from HTM to AFS without any financial reporting sanction. Hodder et al. (2002) found, having examined a sample of 230 publicly traded bank holding companies, that banks classified too few securities as AFS relative to estimated benchmark when they first adopted the standard. Those authors also found that banks used the 1995 FASB amnesty to undo strategic initial SFAS 115 adoption decisions. The magnitude of this reclassification was negatively related to the deviation from the predicted AFS at initial adoption. The same authors attribute this finding to the absence of regulatory cost (since regulators decided to exclude unrealized gains and losses on AFS securities from the calculation of regulatory capital).

From previous research (Beatty, 1995) it may be learnt that, in 1993-1994, banks decreased the AFS securities and the duration of securities in order to mitigate the regulatory cost. Hodder et al. (2002) found that banks increased the AFS securities ratio (to total securities) from 49.8% at the end of 1994 to 75.3% at the end of 1995. In our sample (1997-2000), the increase of this ratio continued- from 85% at the beginning of the period to 92% at the end of 2000. It is, therefore, interesting to investigate whether banks coordinated the two types of securities risks after 1995. Put differently, this paper goes beyond the existing literature in so far as it examines this relationship and the possible substitution of securities risks. For instance: Do banks trade-off low liquidity risk (high AFS ratio) with high securities interest risk? In analyzing this question, the present study also extends the current literature by testing other forms of coordinated risk management in banks.

3. HYPOTHESES DEVELOPMENT

The classification of securities as HTM creates liquidity risk because the SEC restricted the ability to sell HTM securities, while the classification of securities as AFS reduces liquidity risks (Godwin et al., 1998). The positive relationship between AFS securities ratio (to securities or total assets) and the interest rate risk of securities may be explained by coordinated risk management theory. Based on the coordinated risk management behavior of management, we assume that banks trade-off two types of risk: liquidity risk and interest rate risk of securities. Therefore, a lower level of liquidity risk of securities should lead to a higher level of interest rate risk of securities. Thus, as part of coordinated risk management, a positive relationship is to be expected between AFS ratio (lower level of liquidity risk) and the interest rate risk of securities.

We test this with the following two hypotheses:

H_1: Everything else equal, in years of absent regulatory cost, the AFS securities ratio (to securities or to assets) is positively related to the interest rate risk of their securities.

H_2: Everything else equal, a change in the AFS securities ratio is positively related to the change in the interest rate risk of securities.

4. A CROSS SECTIONAL MODEL AND PREDICTIONS

The dependent variable WA is a proxy for the interest rate risk exposure according to the weighted average reprice/maturity of its securities. The above average is calculated, assuming that securities are distributed evenly among the various time intervals as follows: (0.5* book value of securities repricing/maturing less than 1 year + 3* book value of securities repricing/maturing between 1 year and 5 years + 7.5* book value of securities repricing/maturing after 5 years). The weights are calculated by using midpoint time intervals. The 7.5 weight assumes that the time interval for securities maturity above 5 years is 5 to 10 years.[1] In order to obtain a proxy variable for the interest rate risk of the portfolio (the change in the fair value of securities, given a 1% parallel change in interest rates), the above was multiplied by 1% and divided (scaled) it by total capital. This measure of risk may be illustrated by the following simple example: bank A and bank B invest 100,000 dollars in 5-year maturity (and duration) U.S government bonds. The total capital of bank A is 50,000 dollars while the total capital of bank B is 25,000 dollars. Both banks are exposed to a rise in interest rates, amounting approximately 100,000*5*1%=5,000 dollars of fair value loss - assuming a 1% parallel change in interest rates. However, should the 5,000 dollars fair value loss be scaled by the total capital of each bank, this would result with the interest rate risk exposure of bank A - in terms of capital - being lower than the exposure of bank B (A=10% and B=20%).

In order to examine the question of banks' interest rate risk exposure of securities, we model the interest rate risk measure as a function of bank-specific factors –ratio of the AFS portfolio (**H_1**), and other control variables. It is important to control for risk management variables that affect maturity decisions of securities in banks. These include: profitability; risk based capital ratio; a proxy for liquidity risk- loans to liabilities; a proxy for credit risk- risk based assets to total assets; a proxy for interest rate derivatives use; exposure to interest rate risk without the effect of securities; the relative size of the bank; and the quarterly percentage change in average 5-year Treasury bond yield. The latter, being macro-economic variable, serves as a proxy for the interest rate environment and is expected to affect interest rate risk decisions in banks.

Specifically, we will use the following OLS multiple regression models:

(1) $$WA_{it} = \alpha_0 + \mathbf{\alpha_1 * AFS/SEC_{it}} + \alpha_2 * PROFIT_{it} + \alpha_3 * RBCR_{it} + \alpha_4 * LOANS/L_{it} + \alpha_5 * RISK_{it} + \alpha_6 * DERIV_{it} + \alpha_7 * GAP_{it} + \alpha_8 * SIZE_{it} + \alpha_9 * DYLD_t + u_{1it}$$

(2) $$WA_{it} = \alpha_{10} + \mathbf{\alpha_{11} * AFS/TA_{it}} + \alpha_{12} * PROFIT_{it} + \alpha_{13} * RBCR_{it} + \alpha_{14} * LOANS/L_{it} + \alpha_{15} * RISK_{it} + \alpha_{16} * DERIV_{it} + \alpha_{17} * GAP_{it} + \alpha_{18} * SIZE_{it} + \alpha_{19} * DYLD_t + u_{2it}$$

Where: AFS/SEC denotes the ratio of AFS securities to total securities; AFS/TA denotes the ratio of AFS securities to total assets; PROFIT denotes profitability to capital ratio; RBCR denotes Risk Based Capital Ratio; LOANS/L denotes loans to liabilities ratio; RISK denotes risk based assets to total assets; DERIV denotes a proxy for interest rate derivatives use; GAP denotes the difference between earning assets up to 1 year (less securities) and earning liabilities up to 1 year scaled by total assets; SIZE denotes the relative size of the bank ; and DYLD denotes the quarterly change (in %) of the average 5-year Treasury bond yield. The index i denotes the bank and the index t denotes the quarter.

We expect that a bank manager, who prefers a higher interest rate risk in its portfolio, will choose a long weighted average maturity of the portfolio, thereby increasing exposure to interest rate risk. Controlling for the interest risk exposure before the effect of securities and other risk management and economic considerations, we assume that a higher ratio of WA indicates a higher interest rate risk position.

First, we include the variables AFS/SEC and AFS/TA to represent the relative size of the AFS portfolio. According to $\mathbf{H_1}$ we expect a positive relationship between the AFS variables (AFS/SEC and AFS/TA) and WA.

Second, we use, a measure of profitability to capital (PROFIT). Banks with higher profits are financially stronger and, hence, are possibly more willing to recognize securities losses from interest rate changes. Should this be the case, one would expect that profitability level has a positive effect on the interest rate risk. The coefficient on PROFIT is, therefore, expected to be positive.

Third, we used the variable Risk Based Capital Ratio (RBCR). This ratio became an accepted risk measure in the banking system during the 1980s. RBCR, is equal to 1 when the RBCR of the bank is above 10%, and equal to 0 otherwise (the 10% cutoff point was selected because only banks with RBCR above 10% are considered to be well-capitalized).[2] Here we test the prediction that only those banks with capital levels above 10% will be concerned that capital volatility might push them below the criterion usually applied for well-capitalized banks. (Following Beatty (1995), we expect that the risk-based capital ratio will have a positive effect on the interest rate risk of the securities. The coefficient on RBCR is, therefore, expected to be positive.

Fourth, we use LOANS/L (the ratio of loans to liabilities) as a proxy for the liquidity risk of a bank, and RISK as a proxy for the credit risk (risk based assets to total assets). Higher LOANS/L ratio indicates higher liquidity risk since *loans are relatively less liquid than other assets of the bank*. Although this variable does not take into account different types of loans and liabilities, a similar variable is used in other studies to indicate liquidity risk (i.e., Eccher et al., 1996). The denominator of RBCR is used here as the numerator of RISK and captures the *weighted credit risk* used by regulators in their capital requirements (i.e., commercial loans are weighted at 100% while mortgage loans, which are less risky, are usually weighted at only 50%). Higher RISK therefore indicates higher exposure to credit risk. The coordinated risk management argument can be expanded to other types of risks. As part of a joint and coordinated risk management, banks facing high levels of liquidity risk or credit risk could lower their overall risk by decreasing the maturity and interest rate risk of their securities. Since the securities portfolio in banks mainly consists of U.S government bonds (Barth et al., 1995), it is a liquid portfolio, **and it is therefore expected to be a flexible and efficient tool to offset the overall risk of a bank**. We expect that both the loans to liabilities ratio and the risk based assets to total assets ratio will have a negative effect on WA. The coefficient on LOANS/L and RISK is, therefore, expected to be negative.

Fifth, we use DERIV as a proxy for derivative use. DERIV is equal to 1 when the bank uses interest rate derivatives and equal to 0 otherwise. Banks use derivatives for hedging (McAnally, 1996; Schrand, 1997) or for speculation (Carter and Sinkey, 1998). Interest rate derivatives include futures, forward rate agreements, options and interest rate swaps. Since there is no measure of the direction of interest rate risk arising from derivatives, we use the above proxy of derivative use (a similar variable is used by Beatty, 1995). We assume that derivatives use enables banks to take higher interest rate risks in their securities since banks have more flexibility in managing their risk. We expect a positive relationship between DERIV and WA.

Sixth, we use the variable GAP as a proxy for the interest risk position of the bank before the effect of securities. This variable is measured by the difference between earning assets maturing within 1 year (excluding the effect of securities) and earning liabilities maturing within 1 year scaled by total assets. GAP of assets and liabilities up to one year measures only the short term assets and liabilities; however it is an acceptable measure of banks exposure to interest rate risk (Schrand, 1997). This variable is used by Schrand and Unal (1998) to measure interest rate risk in their study. The variable GAP is a proxy for the interest position of the bank (excluding the effect of securities) and may affect WA. This variable is used as a control variable for testing the main question regarding the relationship between the AFS variables and WA as described above.

Seventh, we include the variable SIZE to represent the relative size of the bank. The variable is calculated as the total assets of the bank divided by the total assets of the banks in the sample.

Finally, the model includes a macro-economic variable as a control variable. DYLD is the quarterly percentage change in average 5-year Treasury bond yield (the average maturity of securities in our sample is 5 years). This variable serves as a proxy for the interest rate environment and is expected to affect interest rate risk decisions in banks.

5. EMPIRICAL RESULTS

5.1. Sample Selection and Data

Eighty-eight large bank holding companies (BHCs) were examined for the years 1997 to 2000 on a quarterly basis resulting in 1,408 bank-quarter observations. The panel data is based on Y-Reports (set of financial reports) required by the Federal Reserve Board (FRB), which were available for the above years from the FFIEC (Federal Financial Institution Examination Council) website.

One-hundred-and-twelve BHCs, whose total assets were above 5 billion dollars according to the FFIEC list composed the study's original sample.[3] Of these, 24 BHCs lacking full data for all 16 quarters were eliminated, resulting in a sample of 88 BHCs (1,408 bank-quarter observations). Below we will use the term "bank" for BHC.

Table 1 presents descriptive statistics of the variables. This table reveals that in our sample, WA ranges from about 0.1% to 61.8%. The average maturity of securities (untabulated) ranges from 0.5 years to almost 7.5 years with a mean of approximately 5 years. Table 1 also reveals that, on average, the banks in our sample are profitable (the mean of PROFIT is 15.9%) and strong - the banks are well-capitalized. The range of LOANS/L indicates that there is wide variability among the banks in the structure of their balance sheet. Some banks in our sample hold less than 10% in loans against their liabilities, whereas other banks hold more than 90% in loans (the mean is 67.2%). The average of DERIV indicates that 83% of the banks in the sample use derivatives. Our sample consists of large banks. Carter and Sinkey (1998) indicate that larger banks are more active than smaller banks in derivatives. The mean of GAP signifies that, on average, a bank in our sample has more short-term earning assets (less securities) than short-term earning liabilities.

Table 1: Descriptive Statistics

1997-2000 (n=1408)	Minimum	25%	Median	75%	Maximum	Mean	Standard Dev.
WA	0.001	0.071	0.113	0.175	0.618	0.139	0.103
AFS/SEC	0.011	0.736	0.918	1	1	0.806	0.263
AFS/TA	0.002	0.109	0.168	0.232	0.610	0.177	0.099
PROFIT	-1.947	0.132	0.164	0.193	0.631	0.159	0.087
RBCR	0	1	1	1	1	0.994	0.080
LOANS/L	0.081	0.614	0.704	0.775	0.935	0.672	0.149
RISK	0.316	0.669	0.749	0.831	1.222	0.753	0.143
DERIV	0	1	1	1	1	0.830	0.376
GAP	-0.339	0.027	0.153	0.268	0.718	0.149	0.167
SIZE	0.000	0.000	0.000	0.001	0.014	0.001	0.001
DYLD	-0.153	-0.067	-0.006	0.051	0.113	-0.003	0.825

WA denotes the weighted average reprice/maturity of securities* total securities* 1% divided by total capital; **AFS/SEC** denotes the ratio of AFS securities to total securities; **AFS/TA** denotes the ratio of AFS securities to total assets; **PROFIT** denotes profitability to capital ratio; **RBCR** denotes Risk Based Capital Ratio; **LOANS/L** denotes loans to liabilities ratio; **RISK** denotes risk based assets to total assets; **DERIV** denotes a proxy for interest rate derivatives use (1 if the bank uses derivatives; 0 otherwise); **GAP** denotes the difference between earning assets up to 1 year (less securities) and earning liabilities up to 1 year scaled by total assets; **SIZE** denotes the relative size of the bank ; and **DYLD** denotes the quarterly change (in %) of the average 5-year Treasury bond yield.

Table 2 reports the Pearson correlation matrix of the variables. Most of the correlations are fairly low indicating that multicollinearity does not pose an estimation problem. AFS/TA is significantly positively associated with WA. In addition there is a negative correlation between LOANS/L and WA and between RISK and WA. These preliminary findings will be further probed in our regression analysis

Table 2: Pearson Correlation Matrix of Regression Variables

1997-2000 (n=1408)	WA	AFS/SEC	AFS/TA	PROFIT	RBCR	LOANS/L	RISK	DERIV	GAP	SIZE	DYLD
WA	1.00										
AFS/SEC	0.02	1.00									
AFS/TA	0.67*	0.49*	1.00								
PROFIT	0.05	0.03	-0.07	1.00							
RBCR	0.02	0.04	0.04	0.03	1.00						
LOANS/L	-0.42*	-0.02	-0.46*	0.04	-0.02	1.00					
RISK	-0.44*	0.15*	-0.49*	0.13*	0.01	0.63*	1.00				
DERIV	0.13*	0.33*	0.16*	0.02	0.11*	-0.11*	0.09*	1.00			
GAP	-0.34*	0.17*	-0.26*	0.05	0.05*	0.07*	0.36*	0.19*	1.00		
SIZE	-0.12*	0.20*	-0.14*	0.02	0.02	-0.11*	0.20*	0.18*	0.23*	1.00	
DYLD	0.06*	0.00	0.02	0.06*	0.05	-0.02	0.01	0.00	-0.01	0.02	1.00

* significant at $p < 0.05$

For variables definitions- see table 1.

5.2. Regression Results

5.2.1 Testing H_1

Column 1 in Table 3 presents the regression results. The coefficient on AFS/SEC is positive but significant only at the 6% level. However the coefficient on AFS/TA is positive and very significant (α_{11}=0.545, p<0.01), consistent with **H_1**. This implies that AFS securities ratio is significantly positively related to the interest rate risk of securities. This finding suggests that in 1997-2000, years without regulatory cost, managers with a large AFS portfolio preferred a higher level of securities interest rate risk.

As predicted, profitability is significantly positively associated with the interest rate risk of securities. The positive and significant coefficient (α_2=0.101, p<0.01) of PROFIT suggests that the higher the profitability of a bank, the higher the interest rate risk of its portfolio. In addition, there is no clear relation between capital ratio RBCR and WA. The coefficient is positive but insignificant. This may be the result of the lack of variability in the risk based capital ratio variable in our sample.

The results for the liquidity risk variable and the credit risk variable support the hypotheses for coordinated risk management behavior, namely a negative and significant relationships between LOANS/L and WA (α_4= -0.194, p<0.01) and between RISK and WA (α_5= -0.127, p<0.01). The variable DERIV has a positive and significant effect on the interest risk of securities (α_6= 0.047, p<0.01). This finding suggests that banks that use derivatives tend to choose a higher interest rate risk for their portfolio. In addition, a significant negative coefficient is obtained for GAP (α_7= -0.176, p<0.01). Finally, we find a positive relationship between DYLD and WA (α_8= 0.066, p<0.05). This may indicate that when interest rate rises, banks preferred a higher interest risk in their portfolio, expecting to profit from a possible decline in the interest rates. This result provides some evidence that interest rate environment affects securities interest rate decisions of banks.

Table 3: OLS Regressions for the Relationship between AFS Securities Ratios and the Interest Rate Risk of Their Securities

Independent Variable	(1)	(2)
Intercept	0.313	0.121
	9.950**	4.295**
AFS/SEC	0.017	
	1.881	
AFS/TA		0.545
		22.469**
PROFIT	0.101	0.076
	3.833**	3.370**
RBCR	0.014	-0.003
	0.505	-0.102
LOANS/L	-0.194	-0.096
	-9.272**	-5.170**
RISK	-0.127	-0.029
	-5.442**	-1.425
DERIV	0.047	0.021
	7.174**	3.841**
GAP	-0.176	-0.121
	-11.64**	-9.171**
SIZE	-6.101	-1.615
	-3.707**	-1.140
DYLD	0.066	0.055
	2.208*	2.164*
Adj. R^2	0.328	0.505
F Value	77.4**	160.6**

t values in the second line.
* significant at 0.05 level; **significant at 0.01 level.
For variables definitions- see table 1.

In order to capture the possibility that maturity and size of the AFS portfolio were simultaneously chosen, a two-stage least squares (2SLS) regression was run. The first stage is:

$$AFS/SEC_{it} = \delta_0 + \mathbf{\delta_1 * AFSGL_{it}} + \delta_2 * PROFIT_{it} + \delta_3 * RBCR_{it} + \delta_4 * LOANS/L_{it} + \delta_5 * RISK_{it} + \delta_6 * DERIV_{it} + \delta_7 * GAP_{it} + \delta_8 * DYLD_t + u_{1it}$$

Where AFS/SEC is a function of variables tested in previous research (AFSGL is the realized gains on AFS securities).

At the second stage a regression was run, where WA is a function of AFS/SEC*hat* (AFS/SEC estimated from the first stage) and the other independent variables.

$$WA_{it} = \delta_9 + \delta_{10}\mathbf{2SLS} * AFS/SEChat_{it} + \delta_{11} * PROFIT_{it} + \delta_{12} * RBCR_{it} + \delta_{13} * LOANS/L_{it} + \delta_{14} * RISK_{it} + \delta_{15} * DERIV_{it} + \delta_{16} * GAP_{it} + \delta_{17} * DYLD_t + u_{2it}$$

We ran the same 2SLS regressions (not reported here) for AFS/TA (as we did for the AFS variable).

Untabulated Hausman tests (Hausman, 1978) show that the null hypothesis of exogeneity is not rejected and we can therefore assume that AFS/SEC and AFS/TA are exogenous variables in the regressions, suggesting that the OLS estimation yields consistent estimates. Thus estimating WA by OLS is justified.

5.2.2 Testing H_2: An Examination of Quarter Differences

In order to test **H_2,** we performed a *change* version of the models in table 3 focusing on 5 independent variables. We regressed the quarterly change in the main variables which were chosen to test **H_1**, profitability (PROFIT), the changes in the liquidity and credit risk variables (LOANS/L and RISK) and DYLD against the quarterly change in WA (in the following regressions *d* denotes the quarterly change in the value of each variable). The models are:

Table 4: OLS Regressions for the Relationship between Quarterly Changes in AFS Securities Ratios and the Quarterly Change in Interest Rate Risk of Their Securities

Independent Variable	(1)	(2)
Intercept	0.001	0.001
	1.189	1.448
dAFS/SEC	0.081	
	4.555**	
dAFS/TA		0.533
		17.332**
dPROFIT	0.018	0.010
	2.798**	1.675
dLOANS/L	-0.172	-0.072
	-6.955**	-3.118**
dRISK	-0.086	-0.056
	-2.940**	-2.098*
DYLD	0.008	0.010
	0.869	1.139
Adj. R^2	0.089	0.246
F Value	26.6**	87.2**

t values in the second line.
* significant at 0.05 level; **significant at 0.01 level.
For variables definitions- see table 1. *d* denotes the quarterly change.

The results are presented in table 4. Our findings of the AFS variables remain strong and the other coefficients are usually consistent with those of the *level* variables reported in table 3. The findings for *d*AFS/SEC and *d*AFS/TA are very significant and suggest that a change in the AFS ratio (to securities or to total assets) is positively related to the change in the interest rate risk of securities.

6. SUMMARY

Unlike previous research focused on years with a regulatory cost burden, when banks decreased the AFS securities and the duration of securities, this study concentrates on years without regulatory cost. We extended previous research further to a period when regulatory capital is clearly not affected by unrealized gains and losses on AFS securities. The results of this study show that during 1997-2000, when interest rate were relatively stable and before the credit boom, large banks traded-off two types of securities risks: liquidity risk and interest rate risk. In these years of absent regulatory cost, the AFS securities ratio (level and change) is positively related to the interest risk of their securities (level and change); banks increased the interest rate risk by selecting long-term maturity of securities.

These findings of this study may well prove themselves to be essential for regulators of banks and the SEC, considering they are concerned with the effect of FVA regulations on the financial risks in the banking system.

7. SUGGESTIONS FOR FUTURE RESEARCH

The results should be interpreted within the limitation of the study's data availability. Due to data limitations, this model did not include all explanatory variables, such a measure of the direction of risk arising from interest rate derivatives. To the extent that this measure of derivatives affects the interest risk of securities, our findings will vary. In addition, the use of proxies for the risk management variables in this study may limit the interpretation of the results. Future research may add more precise measures for risk management activities when they become available, thereby providing a more complete and comprehensive test and to capture the possibility of trade-offs between other types of risks.

The main empirical results show that, having controlled for risk management and economic considerations, banks with larger AFS securities ratio tend to increase the interest risk of their securities - consistently with the main hypotheses of this study. Whereas this risk-taking behavior of banks was explained previously by coordination of risks, another theoretical explanation for the higher interest rate risk preference of managers should be sought in future researches. In years without regulatory cost, AFS securities have considerably more of an upside potential than of a downside risk. Managers may profit from unrealized gains by selling the securities in the future and keep securities with unrealized losses (without creating the regulatory cost from unrealized losses). This asymmetric feature of AFS securities may induce management to increase interest rate risk by using long-term AFS securities.

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ENDNOTES

[1] A more accurate specification of this variable (in order to get a better view of the entire repricing structure) would be to include additional time intervals such as 1 to 2 years, 2 to 3 years, etc. However, Schedule HC-D of FR Y-9C – Interest Sensitivity, discloses only the above time intervals.
[2] See FDICIA (1991).
[3] We selected large banks for the following reasons: (1) securities activity is more significant in large banks (Beatty, 1995); (2) for homogeneity reasons: large banks are similar in their cost function and in their types of activity.

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