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Effects of Derivatives Use on Bank Risk at Japanese Banks: Measuring Banks' Risk-Taking after Disclosure Reformation

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Abstract

The purpose of this paper is to empirically examine the effects of derivative usage on the risk level of Japanese banks by using the most recent data available covering years 2010 and 2011. We find that the relationships between bank total risk and derivative usage are slightly negative, but without statistical significance. The usage of derivatives with hedging purpose, however, reduces bank total risk. The results indicate that the use of derivative as a whole has no impact on bank risk, but the use of under hedging accounting reduces the level of bank risk. We find that the usage of interest rate swaps with hedging purpose reduces bank total risk. We also find that the demand for interest rate swaps is generally higher by banks with a higher ratio of the long term Japanese government bonds (JGBs). The results indicate that by using interest rate derivatives, Japanese banks are reducing their risks related to holding tail end of longer term JGBs.

Keywords: bank risk, derivatives, interest rate swaps, hedging and non-hedging

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1. Introduction

Financial derivatives are used as hedging instrument to reduce banks' asset and liabilites from unwanted fluctuation. On the other hand, active use of un-hedged derivatives may increase banks' risk profiles. Since the end of fiscal year of 2009, Japanese banks are obligated to disclose both hedging and non-hedging[1] balance outstanding. Previously, banks were required to disclose only the non-hedging balance. Therefore, this reform of disclosure rules enables us to measure the degree of derivative usage, both for hedging and Non-hedging purposes.

The purpose of this paper is to empirically examine the effects of derivative usage on the risk level of Japanese banks by using the most recent data available covering years 2010 and 2011. Prior to disclosure requirement reform, only non-hedging derivatives were reported. Thus, this is the first paper to examine the effects of derivatives for hedging purposes in Japanese banks and thus we contribute to the previous research by rigorously disaggregating the total derivative contracts according to the purpose of holding, and investigate whether holdings for hedging and/or trading purposes are negatively (or positively) associated with the level of bank risk. We also contribute to the previous research by providing international evidence on the relationship between the derivatives use and bank risk by focusing on Japanese banks.

We find that the relationships between bank total risk and derivative usage are slightly negative, but are without statistical significance. The usage of derivatives with

[1] Un-hedged portion of derivatives are sometimes referred as "Speculative or Trading", but not all un-hedged derivatives are speculative. Therefore, we refer to un-hedged derivatives as "Non-Hedged or Non-Hedging" in this paper.

hedging purpose, however, reduces total risk at each bank. The results indicate that the use of derivative as a whole has no impact on bank risk, but the use of derivatives booked under hedging accounting reduces bank risk. We find that the usage of interest rate swaps with hedging purpose reduces bank risk. We also find that the demand for interest rate swaps is generally higher for banks with a higher long term Japanese government bonds. The results indicate that by using interest rate related hedging Japanese banks are reducing risks related to holding tail end of longer term JGBs.

Our paper related to the literature on the usage of financial derivatives. Purnanadam (2007) is the closest to our paper. Purnanadam (2007) find that banks with higher probability of financial distress manage their interest rate risk more aggressively, and also find that the derivative non-user banks adopt conservative asset –liability management policy in tighter monetary policy regimes. Hentxchel and Kothari (1997) examine the relation between the usage of derivative contracts and the risk of both financial and non-financial firms, and find no significant relationship. Konishi, Shimizu, and Yasuda (2003) empirically examine the relationship between derivative use the risk level of commercial banks in Japan. They find that the usage of derivatives is qualitatively risk-increasing but economically weak.

The remainder of this paper is organized as follows. Section 2 discusses the relevant institutional background. Section 3 develops testable hypotheses. Section 4 explains the data, research methodology, and the variables used in our empirical study. Section 5 presents our empirical findings. Section 6 provides some concluding remarks.

2. Institutional Background

2.1. Overview on the Use of Financial Derivatives by Japanese Banks

Bank of Japan, in conjunction with BIS, collects derivative related trading data since 1998. According to the survey, Interest rate related (IR) derivative market grew almost 3.5 times and for FOREX (FX) related derivatives, almost 1.3 times since 1998.

The survey reflects the tendency of banks' behavior to utilize derivative contracts to control risks as well as opportunities for more profits. The use of financial derivatives, in general, work in two ways: hedging and non-hedging. Derivatives are a kind of two edged swords. If derivatives are used for hedging purposes, it will reduce, if not entirely, unwanted fluctuations of the value of bank assets and liabilities without sacrificing capital buffers. On the other hand, non-hedging use of derivatives, depending on how derivative trading is controlled, may or may not increase banks' risk.

Insert Figure 1 around here

2.2. Reform of Disclosure Rules

Publicly held banks in Japan were mandated to disclose non-hedged derivative outstanding in their Official Annual Financial Report (equivalent to US 10-K) filed with Financial Services Agency since 1998. Hedged derivatives outstanding were excluded from reporting requirement, because the use of derivatives for hedging purposes would presumably reduce banks' risk against interest and foreign exchange rate fluctuations by the amount hedged. With a new guide line announced in May 2010, banks were obligated to disclose both non-hedging and hedging balances. This disclosure reform enables us to rigorously explore the degree of derivative usage.

3. Hypotheses

The purpose of this paper is to empirically examine the effects of derivative usage on the risk level of Japanese banks using the most recent data available. To see this, our first hypothesis is as follows:

H1: The derivative holding does not affect the level of bank risk.

Then, we disaggregate the total derivative holdings based on the intended purposes (hedging vs. non-hedging), and examine whether derivative holdings for hedging (trading) are negatively (positively) associated with the level of bank risk. As we already discussed, Japanese banks are obligated to disclose both hedging and non-hedging balance outstanding since the end of March in 2010 (i.e., the end of fiscal year 2009). Therefore, this reform of disclosure rules enables us to measure the degree of derivative usage, both for hedging and Non-hedging purposes. Thus, our second hypothesis is as follows:

H2: The usage of derivatives for hedging (non-hedging) purpose reduces (increases) the level of bank risk.

Finally, we examine whether interest rate swap holdings are associated with bank risk. The reason for focusing on interest rate swaps comes from the characteristics of Japanese bank asset holdings. Figure 2 shows that the ratio of loans to deposits has

gradually decreased since the late 1990s (Panel A), indicating that Japanese banks have been forced to invest tin JGBs (Panel B) . Note also that both Long term and short term rates are at historically lowest range in Japan after the implementation of "0" Interest rate policy (Panel C). And there is no more room to reduce rates. Taking into consideration of current fiscal constrain of Japanese economy, many feer the increase in interest rate. The Increase in interest rate implies the reduced value of JGBs. In other words, Japanese banks have to manage the interest rate risk of JGB holdings. Based on these facts, our last hypothesis is as follows:

H3-1: The usage of interest rate swaps for hedging purpose reduces the level of bank risk.

H3-2: The demand for interest rate swaps is higher by banks with more and/or longer maturity of JGBs.

Insert Figure 2 around here

4. Data and Methodology

This paper investigates the usage of derivatives by Japanese bank. We use unbalanced panel data of Japanese banks covering from fiscal year 2009 through to fiscal year 2011.These periods are characterized by the new disclosure rules. Until the end of fiscal year 2008, banks were not obliged to disclose the amounts of hedging using derivatives. With this new disclosure guidance, we are able to investigate banks' risk taking by the channel of both hedging and non-hedging usage of derivatives. Data for

derivatives were hand collected from each banks' Annual Financial Reporting and other material such as annual reports. The data from Astra Manager are used for information on equity volatility to estimate a bank risk. The rest of the data necessary for the following analyses was collected from the NEEDS Financial QUEST database, which is a standard database that is used in Japanese studies.

To test the effects of derivative uses on the level of bank risk, we estimate the following regression model using panel data techniques with individual fixed effects:

$$TRISK_{b,t} = \alpha + \beta_1 DERIVATIVE_{b,t} + \beta_2 JGB\text{-}AT_{b,t} + \beta_3 LOAN\text{-}AT_{b,t} + \beta_4 BIS_{b,t} + \beta_5 BL\text{-}AT_{b,t} + \beta_6 AT_{b,t} + \varepsilon_{b,t} \quad (1)$$

The dependent variable is the measure for the level of bank risk. We use TRISK measure as our benchmark. TRISK is defined as the standard deviation of a bank's daily stock returns for each fiscal year.

Independent variables are defined as follows:

DERIVATIVE: Aggregate notional value of all reported derivatives.

NON-HEDGE-DERIVATIVE: Aggregate notional amount of all non-hedged derivatives.

HEDGED-DERIVATIVE: Aggregate notional amount of all hedged derivatives.

IR-SWAP: Aggregate notional amount of fixed rate payments in an interest rate swap (i.e., swap buyer) for both non-hedging (trading) and hedging. Japanese bank that is the fixed-rate payer seeks to turn its fixed-rate assets into variable-rate assets to better manage their interest rate risks.

NH-IR-SWAP: fixed rate payments in an interest rate swap (i.e., swap buyer) for non-hedging (trading).

H-IR-SWAP: fixed rate payments in an interest rate swap (i.e., swap buyer) for hedging.

For compiling and analysis purposes, we used notional amount of derivatives. There are various opinions as to what figure to use for measuring, notional or net amount. Using notional amount may overstate risk, but on the other hand, using net derivative amount may understate risk. If we are to use net derivative amount, then we must also look at the profit and loss from derivative trading, but we are not privy to access to these information. Thus, we settled to use notional amount of derivatives for our research.

JGB: Total amount of banks' holding of Japanese Government Bond.

We are able to identify the data of maturing of JGB and thus use them for investing the relationship between derivative uses and interest rate risks of holding Japanese government bond holding:

JGB t to t+X: total amount of Japanese government bond holding that will be matured between year t and year t+2 (t=1, 2, 5, 7).

The other explanatory (control) variables used in this paper are defined as follows:

LOAN: Aggregate amount of total loans outstanding.

BIS: Capital ratio under the Basel Accord guideline.

TOTAL-ASSET: Total asset of each bank.

We include year dummies to control for macroeconomic fluctuations. We also normalize all the explanatory variables by the book value of assets except AT variable. Table 1 provides the descriptive statistics for the variables used in the following analyses.

Insert Table 1 around here

5. Empirical Results

Table 2 presents the regression results based on equation (1).We have tried several specifications of the model that differ by the explanatory variables especially focusing on the purpose of derivative uses. Column 1 shows the results of the association between bank derivative use and bank risk level. The coefficient of DERIVATIVE is negative but statistically insignificant. However, in column 2 and/or column 4, if we separate DERIVATIVE variable into NON-HEDGE-DERIVATIVE and HEDGE-DERIVATIVE, then the coefficients of HEDGE-DERIVATIVE are negative and statistically significant. The result indicate that derivative use for hedging purpose presumably contribute to decrease bank risk. A one standard deviation increase of HEDGE-DERIVATIVE (from 2% to 9%) is associated with a decrease of total risk by2％ (from 30% to 28%).

Insert Table 2 around here

Column 5 of Table 4 shows the effects of maturing difference of Japanese government bond held by Japanese banks on the bank risk level. It should be noted that the coefficient of JGB-AT-5-7 and/or JGB-AT-7-10 are positive and statistically significant at the 1% level. This indicates that banks with long maturing Japanese government bonds have higher equity risk. The result agrees with the idea that Japanese banks face a higher interest rate risk of holding Japanese government bonds with longer maturities.

With respect to the control variables, the banks' BIS ratios are negatively associated with bank risk, but the shares of non-performing loans are positively

associated with bank risk. The results agree with that the BIS ratio reflects the bank health and non-performing loans reflect the unhealthiness of banks.

Table 3 presents the regression results when we use the notional amounts of interest rate swaps instead of total derivatives. Interestingly, the qualitative results are very close to those of Table 4. The most important results are the coefficients of H-IR-SWAP in columns 2 and 4. The coefficients of H-IR-SWAP are both negative and statistically significant at the 5% level. The results indicate that the usage of interest rate swaps with hedging purpose reduces bank total risk.

Table 4 shows the results of determinants of H-IR-SWAP by Japanese banks. The coefficients of ΔJGB-AT-7-10 are positive and statistically significant at the 5 % level. The result indicates that the demand for interest rate swaps was generally higher by banks with a higher long term Japanese government bonds (JGBs). The results indicate that by using interest rate related hedging Japanese banks are reducing risks related to holding tail end of longer term JGBs.

Insert Table 3 around here

Insert Table 4 around here

6. Conclusion

In this paper, we empirically examined the effects of derivative usages on the risk level of Japanese banks by using the most recent data available covering years 2010 and 2011. First, we found that the relationships between bank total risk and derivative usage were slightly negative, but without statistical significance. The usage of derivatives with

hedging purpose, however, reduced bank total risk. The results indicate that the use of derivative as a whole has no impact on bank risk, but the use of under hedging accounting reduces the level of bank risk. Second, we found that the usage of interest rate swaps with hedging purpose reduced bank total risk. Third, we found that the demand for interest rate swaps was generally higher by banks with a higher long term Japanese government bonds (JGBs). The results indicate that by using interest rate related hedging Japanese banks are reducing risks related to holding tail end of longer term JGBs.

In many cases, derivatives are generally expected to be associated with speculation and use of derivatives increase firms risk profile. Actually, many bank names have disappeared from financial market due to mismanagement of derivatives especially in the US. However, if applied in prudent manner, as shown in Japanese experiences, derivatives might prove to be effective and inexpensive instrument in controlling interest rate risks and adjusting maturity gaps. In this sense, the key is not in derivative instruments themselves, but in people who utilize these instruments. Overall, derivatives are not "financial weapon of mass destruction" if used carefully by prudent people.

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Figure 1. Growth of Derivative Market in Japan

Chart 1A: Interest Rate Related Derivatives

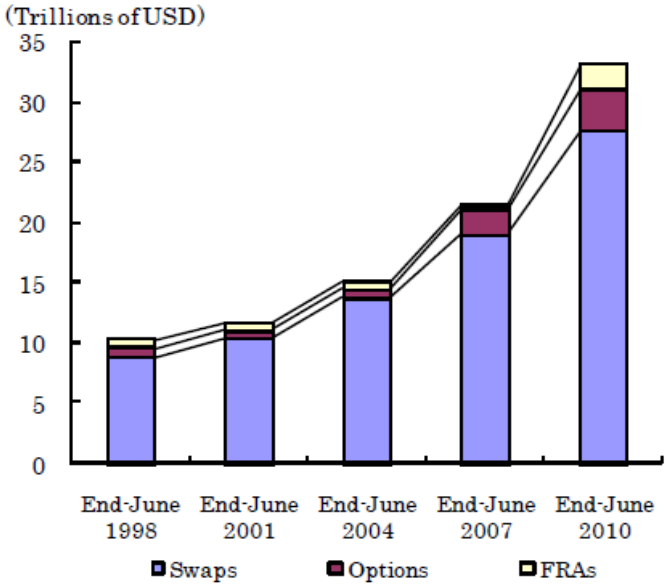
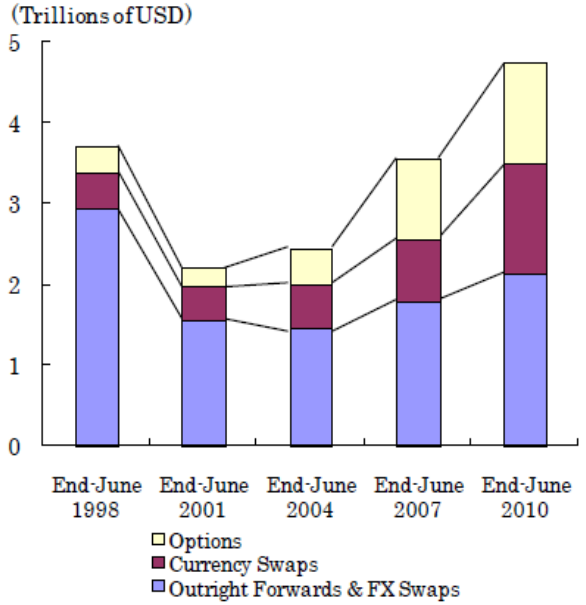


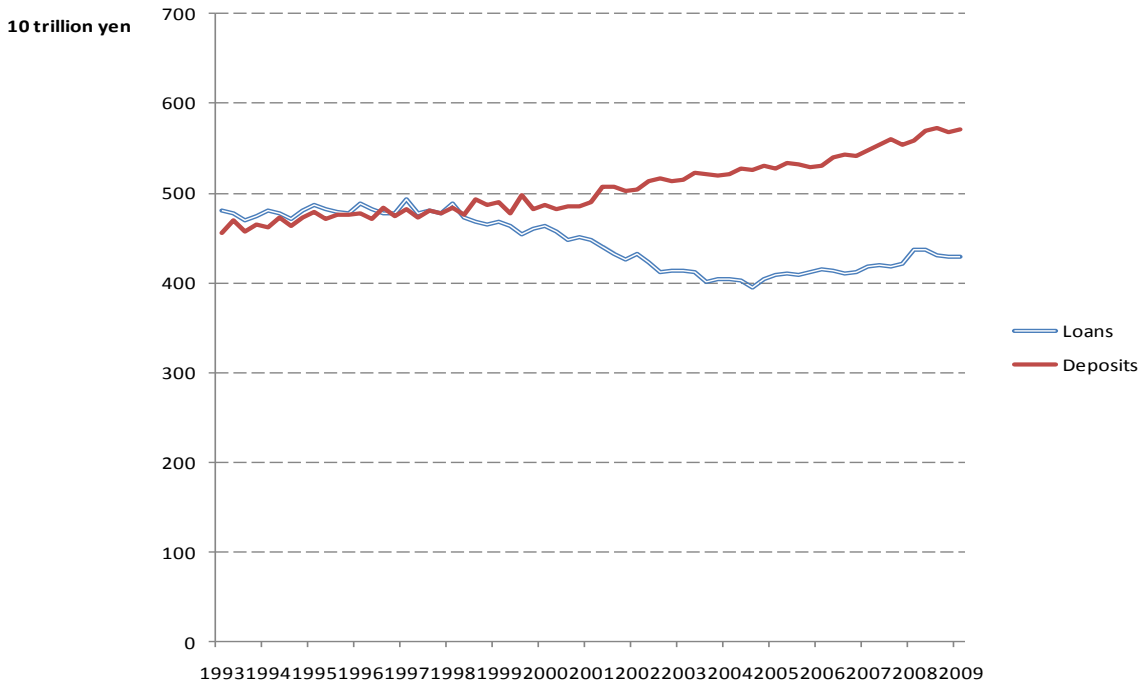
Chart 1B: FOREX Related Derivatives



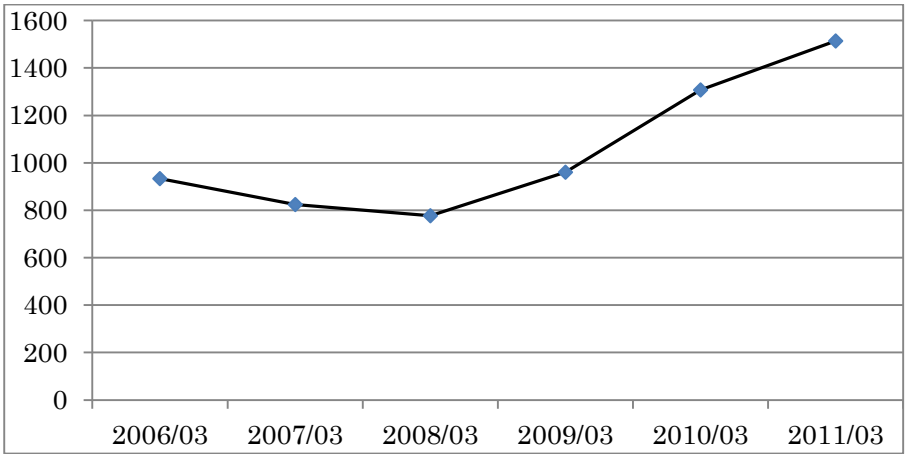
Source: Bank of Japan Website, http://www.boj.or.jp/statistics/bis/yoshi/index.htm/

Figure 2. Effects of Declines of Traditional Lending Businesses

Panel A. Gap of loans and deposits

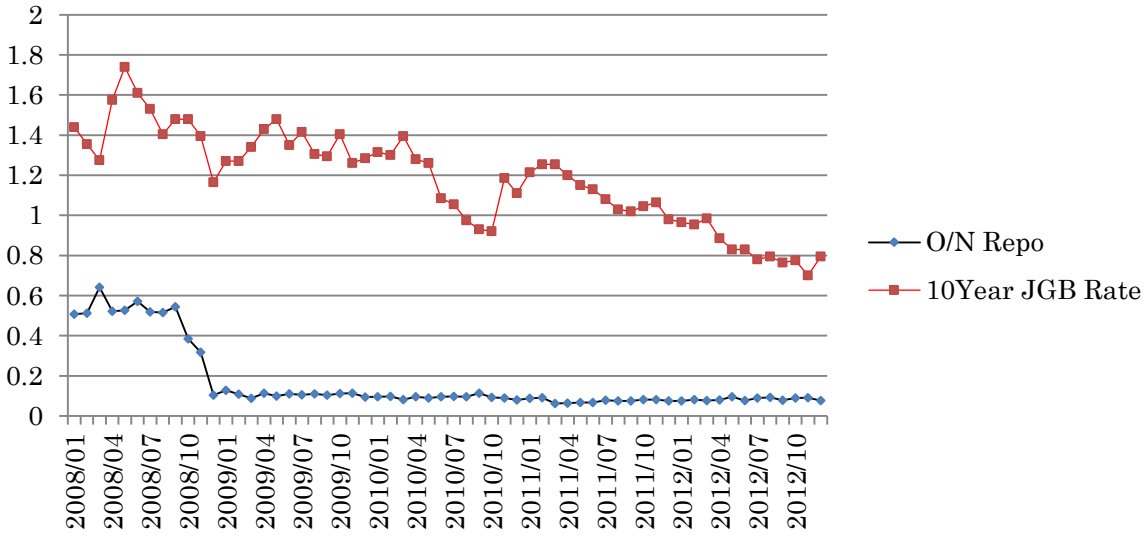


Panel B. Demand for JGBs



In absence of Loan Demand, Banks increased JGB Holdings.

Panel C. Interest Rates Environment



With Implementation of "0" Interest Rate Policy, both Long Term and Short Term Rates are at historically lowest range.

Table 1. Descriptive Statistics

Vaiables	Observation	Mean	Std.Dev.	Minimum	Maximum
TRISK	272	0.30	0.07	0.18	0.62
TOTAL-DERIVATIVE	384	0.35	1.37	0	13.06
NON-HEDGE-DRIVATIVE	384	0.33	1.33	0	12.94
HEDGE-DERIVATIVE	384	0.02	0.07	0	0.58
NH-IR-SWAP	384	0.11	0.52	0	5.25
H-IR-SWAP	384	0.01	0.01	0	0.10
JGB-AT	375	0.13	0.07	0.04	0.63
JGB-AT-1-3	321	0.022	0.02	0	0.13
JGB-AT-3-5	325	0.027	0.02	0	0.14
JGB-AT-5-7	323	0.019	0.02	0	0.09
JGB-AT-7-10	329	0.039	0.02	0	0.14
ΔJGB-AT-1-3	204	0.003	0.02	-0.11	0.12
ΔJGB-AT-3-5	210	0.006	0.02	-0.07	0.13
ΔJGB-AT-5-7	210	0.003	0.01	-0.07	0.06
ΔJGB-AT-7-10	214	0.026	0.02	-0.07	0.06
BIS	344	12.17	4.31	7.55	53.25
BL-AT	331	3.46	1.41	0.16	9.21
AT	384	1.16E+07	3.22E+07	72850	2.19E+08

Table 2. Regressin Results with Fixed Effects: Bank Risk and Drivatives

	TRISK	TRISK	TRISK	TRISK	TRISK
Variables	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
TOTAL-DERIVATIVE	-0.009				-0.011
	(-1.51)				(-2.97) ***
NON-HEDGE-DRIVATIVE		-0.007	-0.007		
		(-1.55)	(-1.60)		
HEDGE-DERIVATIVE		-0.284		-0.284	
		(-2.81) ***		(-2.78) ***	
JGB-AT	0.208	0.132	0.209	0.129	
	(0.88)	(0.57)	(0.89)	(0.56)	
JGB-AT-1					0.306
					(0.97)
JGB-AT-1-3					0.194
					(0.59)
JGB-AT-3-5					0.11
					(0.44)
JGB-AT-5-7					0.896 ***
					(2.71)
JGB-AT-7-10					0.598 ***
					(2.64)
LOAN-AT	-0.044	-0.087	-0.042	-0.085	-0.18
	(-0.25)	(-0.49)	(-0.23)	(-0.47)	(-0.25)
BIS	-0.015	-0.013	-0.016	-0.014	-0.004
	(-3.00) ***	(-2.56) **	(-3.04) ***	(-2.84) ***	(-0.91)
BL-AT	0.021	0.0206	0.0209	0.021	-0.017
	(2.48) **	(2.48) ***	(2.49) ***	(2.55) ***	(2.03)
AT (×1million)	-0.006	-0.006	-0.006	-0.006	-0.018
	(-2.02) **	(-2.11) **	(-2.01) **	(-2.11) **	(-0.84)
YEAR-Dum	Yes	Yes	Yes	Yes	Yes
F-statistic	4.04	4.14	4.04	4.26	2.35
Adjusted R^2	0.64	0.64	0.63	0.64	0.69
Observation	269	269	269	269	194

We use cluster robust standard errors at the bank level. F statistics test the null hypothesis that an individual effect does not exist. The values in parentheses indicate t-statistics.

*** Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level

Table 3. Regressin Results with Fixed Effects: Bank Risk and Intrest Derivatives

	TRISK	TRISK	TRISK	TRISK
Variables	Coefficient	Coefficient	Coefficient	Coefficient
IR-SWAP	-0.013			
	(-1.46)			
NH-IR-SWAP		0.011	-0.009	
		(0.89)	(-1.29)	
H-IR-SWAP		-0.904		-0.854
		(-2.00) **		(-2.01) **
JGB-AT	0.211	0.203	0.210	0.203
	(0.89)	(0.86)	(0.88)	(0.89)
LOAN-AT	-0.035	0.038	-0.037	0.037
	(-0.19)	(-0.18)	(-0.20)	(0.18)
BIS	-0.016	-0.016	-0.016	-0.016
	(-3.09) ***	(-3.16) ***	(3.11) ***	(-3.17) ***
BL-AT	0.021	0.023	0.021	0.023
	(2.53) **	(2.82) ***	(2.53) **	(2.83) ***
AT (×1million)	-0.006	-0.005	-0.006	-0.005
	(-3.21) ***	(-3.13) ***	(-3.20) **	(-3.16) ***
YEAR-Dum	Yes	Yes	Yes	Yes
F-statistics	4.26	4.01	4.00	4.38
Adjusted R^2	0.64	0.63	0.63	0.64
Observation	239	269	269	269

We use cluster robust standard errors at the bank level. F statistics test the null hypothesis that an individual effect does not exist.The values in parentheses indicate t-statistics.

*** Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level

Table 4. Regressin Results: Interest Swap and Government Bond

	H-IR-SWAP	H-IR-SWAP user only
Variables	Coefficient	Coefficient
ΔJGB-AT-1-3	0.172	0.029
	(0.89)	(0.79)
ΔJGB-AT-3-5	-0.522	-0.027
	(-1.29)	(-0.61)
ΔJGB-AT-5-7	0.543	0.103
	(1.63)	(2.18) **
ΔJGB-AT-7-10	0.650	0.084
	(2.20) **	(2.18) **
LOAN-AT	-0.019	0.009
	(-0.80)	(0.28)
BIS	0.001	-0.001
	(-0.98)	(0.84)
BL-AT	0.004	0.002
	(1.61)	(1.40)
AT (×1million)	-0.001	-0.001
	(-0.80)	(-1.07)
YEAR-Dum	Yes	Yes
F-statistics	8.246	41.887
Adjusted R^2	0.84	0.97
Observation	164	78

We use cluster robust standard errors at the bank level. F statistics test the null hypothesis that an individual effect does not exist.The values in parentheses indicate t-statistics.

*** Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level