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Determinants of the extent of Asia-Pacific banks' derivative activities

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Abstract: We present an analysis of the determinants of Asia-Pacific banks' extent of derivative activities. Our findings suggest that the probability of financial distress and economies of scale arguments are important in this regard. Further analyses reveal that Asia-Pacific dealer banks tend to use more foreign currency derivatives while interest rate derivatives are generally used for hedging purposes. Our findings also indicate that banks located in countries with an explicit deposit insurance scheme engage in greater derivative activities. Such behaviour may reflect either hedging or speculation.

Keywords: Derivatives; Asia-Pacific banks; Determinants

JEL codes: G21; G32

1. Introduction

Derivatives are used by banks for risk management as well as for trading purposes. While the use of derivatives in non-financial firms has been well studied, considerably less attention has been given to their use in financial firms. Given the growing importance of banks' derivative activities, several studies have investigated whether the determinants of banks' derivative activities are explained by a similar set of variables that explain non-financial firms' derivative activities. Examples of these studies focus on small community banks (Carter & Sinkey, 1998) and on dealer banks (Shyu & Reichert, 2002).

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Studies investigating the determinants of banks' derivative activities have generally been confined to US banks.[1] This is despite the growing importance of derivative usage in the Asia-Pacific region. Asia-Pacific banks are unique relative to US and European banks as they typically play a more important role in economic growth, especially in the developing Asian economies. Additionally, they have different financial and ownership characteristics. Genay (1998), for example, identifies that Japanese banks are more leveraged, more dependent on deposits as their source of funds and have significantly greater equity investments relative to US banks. Government ownership of banks is also more common in the Asia-Pacific region relative to the US and Europe (Barth *et al.*, 2001). As such, an investigation of the determinants of the extent of Asia-Pacific banks' derivative activities is warranted.

Accordingly, we investigate the determinants of the extent of Asia-Pacific banks' derivative activities. Our paper contributes to the literature by providing empirical evidence on the determinants of Asia-Pacific banks' derivative activities, controlling for country specific characteristics to capture country difference in banks' regulatory and operating characteristics. This contribution is important for several reasons. First, since Asia-Pacific and US banks have different financial and ownership characteristics, the results will assist in determining whether the theories explaining banks' derivative activities are applicable to Asia-Pacific banks. Second, the findings of our study will assist investors and bank regulators in identifying characteristics of Asia-Pacific banks that are more likely to have more extensive derivative activities.

We find the probability of financial distress and economies of scale are important in explaining Asia-Pacific banks' derivative activities. Controlling for country characteristics, dividends, ownership dispersion and whether the bank is a derivative dealer contribute to explaining the extent of Asia-Pacific banks' derivative activities.

Our paper is structured as follows. Section 2 briefly outlines the prior literature, while Section 3 details the research method. In Section 4 we present and discuss our results and a conclusion is offered in Section 5.

2. Prior literature

Finance theory offers several hypotheses to explain why firms use derivatives. These hypotheses suggest that corporate hedging in the presence of market imperfections increases firm value by reducing the probability of financial distress, the expected tax liability (Smith and Stulz, 1985), and underinvestment costs (Froot *et al.*, 1993). Numerous studies have attempted to test these propositions while uncovering other possible factors that influence firms' extent of derivative use. These factors include hedging substitutes (Nance *et al.*, 1993), managerial risk

aversion (Fok *et al.*, 1997), proportion of institutional shareholders (Tufano, 1996) and exposure to risk (Geczy *et al.*, 1997).

Studies on the determinants of derivative usage have also been conducted in the banking industry. Banks' use of derivatives is more complicated because often they are derivative end-users as well as dealers. Compared to non-banks, commercial banks are also unique in the sense that they operate in a highly regulated and protected environment (Sinkey & Carter, 1997). Previous literature investigating the determinants of banks' derivative activities addresses two related questions: (1) What are the determinants of banks' decisions to participate in derivative activities? (e.g. Gunther & Siems, 1995; Sinkey & Carter, 2000); and (2) If banks use derivatives, what determines the extent of usage? (e.g. Sinkey & Carter, 2000; Gunther & Siems, 2002; Shyu & Reichert, 2002).

The extant literature examining the determinants of banks' decision to participate in derivative activities suggests that the decision is positively associated with size and leverage (Gunther & Siems, 1995; Sinkey & Carter, 2000). However, the evidence for exposure to risks and intermediation profitability are mixed. Although Sinkey and Carter (2000) show that derivative users tend to have higher interest rate risk and lower net interest margins, Gunther and Siems (1995) find contrasting evidence. This divergence in results could be due to the different sample periods investigated.[2]

Whidbee and Wohar (1999) examine whether corporate-control and ownership-structure characteristics influence banks' hedging decision. They assert that, unlike managers in non-financial firms, managers in the banking industry are less likely to hedge as their shareholding increases (when insider shareholding is greater than 10% of total shareholding) or as outside directors' shareholding increases. This is attributed to the risk shifting opportunities provided by government deposit insurance. When outside directors hold a large percentage of board seats, banks are more likely to use derivatives for hedging due to external monitoring.

Examining the determinants of the extent of banks' derivative activities, Gunther and Siems (1995) find that the results are very similar to their investigation of banks' decisions to participate in derivative activities. However, relative to other US bank studies, the results remain mixed. For example, Sinkey and Carter (2000) report that bank capital is negatively associated with the extent of derivative activities, while Gunther and Siems (1995) find contrasting evidence.

Sinkey and Carter (2000) further investigate the effect of being a dealer bank on the extent of derivative use. They run three separate regression models: all banks, all banks with a dealer dummy variable and all banks excluding dealer banks. They observe very similar results for dealer and non-dealer banks except for differences for net interest margin (NIM) and leverage (NOTES). They find that NIM is only

significantly negative when dealer banks have been excluded from the sample or when a dealer dummy is included. They interpret this finding as non-dealer banks using derivatives, at least in part, to protect their net interest income. The coefficient on NOTES is positive and significant only for non-dealer banks. This finding supports the hypothesis that derivatives are used by non-dealers as a hedging tool to reduce the probability of financial distress. Ashraf *et al.* (2007) investigates the determinants of the use of credit derivatives by large US banks. They found that bank holding company size, interest rate risk, credit risk and net interest margin are important determinants of banks' extent of credit derivative activities.

The only international study[3] examining financial and regulatory factors that influence the extent of banks' derivative activities is Shyu and Reichert (2002). They study thirty-two large international dealer banks (including US, European and Japanese banks) during the 1995-1997 period. They focus on international dealer banks because these banks have substantial international activities and are exposed to a variety of risks such as interest rate risk, foreign exchange risk and credit risk.

Shyu and Reichert (2002) report that banks' derivative activities are positively associated with banks' capital ratio, size, maturity gap, and credit rating but inversely associated with bank profitability. Comparing the effect of regulations across countries, they find that commercial banks that are allowed to pursue direct securities activities (i.e. European banks) have less derivative activities relative to banks that are restricted in their ability to pursue direct securities activities (i.e. US and Japanese banks). The European banks allowed to make direct investment in industrial firms have a greater level of derivative activities relative to banks that are restricted in their ability to make such investments. Direct investment in industrial firms provides more opportunities for European banks to cross-sell various types of derivatives.

3. Research Method

3.1 Hypotheses

Based on the extant literature, this study hypothesises that the extent of Asia-Pacific banks' derivative activities (TDER) is a function of the probability of financial distress, underinvestment cost, economies of scale, hedging substitutes, ownership structure, regulatory and moral hazard hypothesis, exposure to risks, intermediation profitability, dealer status and country specific dummies. Table 1 summarises the independent variables, definitions of the associated empirical proxies, predicted signs and key literature relevant to each variable.

Table 1. Determinants of the extent of Asia-Pacific banks' derivative activities - factors, definitions, labels and predicted signs

Factors	Definition	Label	Predict-ed Sign	Previous Literature
i) Financial Distress Costs				
Leverage	Bank borrowings/ Total assets	LEV	?	Sinkey and Carter (2000) Gunther and Siems (2002)
ii) Underinvestment Costs				
Asset Growth	Growth rate of total assets current year in comparison to the prior year.	GRW	+	Sinkey and Carter (1997)
iii) Economies of Scale				
Bank Size	Natural log of bank's total assets	SIZE	+	Gunther and Siems (1995) Sinkey and Carter (2000) Shyu and Reichert (2002)
iv) Substitutes for Hedging				
Liquidity	Liquid assets/ Total assets	LIQ	-	Gunther and Siems (1995) Sinkey and Carter (2000)
Dividend	Dividend paid/ Total assets	DIV	+	Gunther and Siems (1995) Sinkey and Carter (2000) Shyu and Reichert (2002)
v) Ownership Structure				
Ownership Dispersion	1 if no shareholder owns more than 25% of the banks' shares, 0 otherwise.	DISP	+	-
Government Ownership	1 if the government is among the top 10 shareholders, 0 otherwise.	GOV	+	-
vi) Regulatory and Moral Hazard Hypothesis				
Capital	Book value of equity/ Total assets	CAP	?	Gunther and Siems (1995) Sinkey and Carter (2000) Shyu and Reichert (2002)

Factors	Definition	Label	Predict-ed Sign	Previous Literature
vii) Exposure to Risks				
Interest Rate Exposure	Absolute value of the augmented-market model estimate of long-term (short-term) interest rate coefficient, standardised by standard-error.	LTIREXP and STIREXP	+ +	Gunther and Siems (1995) Sinkey and Carter (2000) Shyu and Reichert (2002)
Exchange Rate Exposure	Absolute value of the augmented-market model estimate of exchange rate coefficient, standardised by standard-error.	EREXP	+	-
Credit Risk	Loan loss reserve/ Total assets	RES	+	Sinkey and Carter (2000) Shyu and Reichert (2002)
viii) Intermediation Profitability				
Net Interest Margin	Net interest income/ Total assets	NIM	?	Gunther and Siems (1995) Sinkey and Carter (2000) Shyu and Reichert (2002)
ix) Bank Specific Dummies				
Dealer	1 if the bank is a primary member of ISDA, 0 otherwise.	DEAL	+	Sinkey and Carter (2000)
x) Country Specific Dummies				
Country Dummies	1 if the bank belongs to a specific country, 0 otherwise.	AUSDUM,HKDUM,JPDUM, MSDUM, PHDUM, SGDUM, KRDUM, TWDUM, THDUM	?	Shyu and Reichert (2002)
Activity Restriction	Degree to which banks are permitted to engage in securities, insurance and real estate activities.	ACT	+	Shyu and Reichert (2002)
Ownership Restriction	Degree to which banks are permitted to own or be owned by non-financial firms.	OWN	+	Shyu and Reichert (2002)
Entry Competition	Sum of the existence of regulatory requirements for entry into the banking industry in the World Bank Database (2004)	COMP	+	-

Factors	Definition	Label	Predict-ed Sign	Previous Literature
Capital Regulation	Capital regulatory index in the World Bank Database (2004)	CAPREG	?	-
Private Monitoring	Private monitoring index in the World Bank Database (2004)	PRIMON	+	-
Deposit Insurance	1 if a country has an explicit deposit insurance scheme, 0 otherwise.	DEPINS	-	-

3.2 Sample selection

A list of locally incorporated commercial banks[4] was first obtained from the central bank (or regulatory authority) websites of each Asia-Pacific country. Then, a search of each banks' 2002 annual report was conducted. Banks with annual reports without notes to the financial statements were eliminated since the notional value of derivatives is often reported in the notes, leaving a sample of 146 banks. We then obtained the stock price data for each bank from *Datastream*. Thirty-six banks were further eliminated as data on stock price,[5] ownership dispersion, government ownership and loan loss reserves is unavailable for these unlisted banks, resulting in a final sample of 110. The same set of annual reports is also obtained for year 2003, giving a total of 218 observations.[6] Data on bank financial characteristics are obtained from banks' annual reports and supplemented by ownership dispersion and government ownership data from *Bankscope.*

The geographic location of the sample banks is summarised in Table 2. Japanese banks make up the largest proportion of the sample (49%), followed by Hong Kong banks (10%). Overall, the sample represents more than 40% of total banks in each country except for New Zealand, the Philippines and Taiwan.

Table 2. Country of domicile of sample banks

Country	No. of Sample Banks	% of Sample Banks	Total Local Banks in Country	% of Country's Local Banks in Sample
Australia	9	8	12	75
Hong Kong	11	10	26	42
Japan	54	49	135	40
Malaysia	8	7	11	73
New Zealand	1	1	6	17
Philippines	3	3	23	13
Singapore	3	3	4	75
South Korea	8	7	17	47
Taiwan	7	6	53	13
Thailand	6	6	13	46
Total	**110**	**100**	**300**	**37**

Notes: The number of sample banks in each country is the same for both years 2002 and 2003 except for Japan. The number of sample Japanese banks is 54 and 52 in 2002 and 2003, respectively.

3.3 Method

We estimate an OLS regression model to investigate the determinants of the extent of Asia-Pacific banks' derivative activities. Since the data employed are cross-sectional involving multiple countries in the Asia-Pacific region, heteroskedasticity is expected in the error variance. Thus, all regressions are adjusted for 'Newey-West HAC Standard Errors and Covariance' to correct for standard errors. The regression model specification for this study, Equation (1), is as follows (see Table 1 for variable definitions):[7]

$$TDER_i = \alpha_0 + \alpha_1 LEV_i + \alpha_2 GRW_i + \alpha_3 SIZE_i + \alpha_4 LIQ_i + \alpha_5 DIV_i + \alpha_6 DISP_i + \alpha_7 GOV_i + \alpha_8 CAP_i + \alpha_9 LTIREXP_i + \alpha_{10} STIREXP_i + \alpha_{11} EREXP_i + \alpha_{12} RES_i + \alpha_{13} NIM_i + \alpha_{14} YEARDUM_i + \alpha_{15} DEAL_i + \varepsilon_i \quad (1)$$

4. Results and discussion

4.1 Descriptive statistics

Table 3 Panel A presents the summary statistics for all variables. For the sample of 218 observations, the mean (median) TDER is 0.49 (0.06), with a maximum of 7.80. The large difference between the mean and median TDER implies that the mean level of TDER is influenced by a number of large banks that are active dealers of derivatives.[8] This finding of considerable variation of TDER across sample banks is consistent with prior US evidence (for example, Choi & Elyasiani, 1997; Hirtle, 1997). The notional value of sample banks' interest rate derivatives scaled by total assets (mean of 0.38) is higher than the notional value the foreign currency derivatives scaled by total assets (mean of 0.20).

Table 3 Panel B reports the pair-wise correlation between the variables. Banks with higher leverage, that are larger and that are derivative dealers are more likely to have greater derivative activities as indicated by the correlations of 0.53, 0.46 and 0.71 between LEV, SIZE and DEAL with TDER. The high correlation between interest rate derivatives (IRD) and foreign currency derivatives (FCD) suggests that banks with a higher level of interest rate derivative activities relative to total assets are also more likely to have a higher level of foreign currency derivative activities relative to assets. Multicollinearity is unlikely to be a problem since the independent variables included in the regressions are not highly correlated.

Table 3. Descriptive statistics and correlation matrix

Panel A: Descriptive Statistics

	Mean	Median	Max.	Min.	Std. Dev.
TDER	0.4856	0.0646	7.7980	0.0000	1.1418
IRD	0.3804	0.0387	7.0784	0.0000	0.9434
FCD	0.1991	0.0426	2.2276	0.0000	0.3838
LEV	0.0782	0.0507	0.3902	0.0013	0.0764
GRW	0.0376	0.0154	0.6006	-0.1310	0.0889
SIZE	23.9090	23.9307	27.6087	20.9768	1.0965
LIQ	0.1306	0.0898	0.5344	0.0133	0.1027
DIV	0.0021	0.0005	0.0197	0.0000	0.0031
CAP	0.0607	0.0546	0.1500	0.0072	0.0274
LTIREXP	0.8187	0.7050	4.2500	0.0000	0.6840
STIREXP	0.9650	0.8100	3.9400	0.0100	0.8019
EREXP	0.7277	0.5750	3.2900	0.0000	0.5881
RES	0.0207	0.0150	0.1104	0.0004	0.0182
NIM	0.0192	0.0180	0.0388	0.0036	0.0054
DISP	0.6273	1.0000	1.0000	0.0000	0.4846
GOV	0.0962	0.0000	1.0000	0.0000	0.2955
DEAL	0.1636	0.0000	1.0000	0.0000	0.3708

Panel B: Correlation Matrix

	TDER	IRD	FCD	LEV	GRW	SIZE	LIQ	DIV	CAP
IRD	0.9585								
FCD	0.8344	0.6625							
LEV	0.5227	0.4048	0.5723						
GRW	0.0531	-0.0233	0.0974	0.3017					
SIZE	0.4591	0.4302	0.4029	0.2262	-0.0770				
LIQ	0.1838	0.1135	0.2339	0.2358	0.1975	-0.2160			
DIV	0.3104	0.1934	0.4369	0.4418	0.2261	-0.0037	0.4589		
CAP	0.0775	0.0229	0.1613	0.1501	0.1610	-0.3730	0.6049	0.4715	
LTIREXP	0.2889	0.1752	0.4541	0.2290	0.0756	0.0685	0.0408	0.2044	0.0904
STIREXP	-0.1927	-0.1686	-0.2172	-0.1797	0.0650	-0.1833	-0.0392	-0.1580	0.1321
EREXP	0.0057	0.0058	-0.0306	0.1015	-0.0385	-0.1800	0.1465	0.0007	0.0514
RES	-0.1311	-0.0914	-0.1259	-0.1132	-0.1086	-0.1517	-0.0862	-0.2967	0.0411
NIM	-0.0749	-0.0872	0.0162	0.0851	0.0846	-0.3209	0.1752	0.2168	0.3444
DISP	-0.1070	-0.1018	-0.0535	-0.2146	-0.1651	0.1863	-0.4328	-0.2360	-0.2658
GOV	-0.0863	-0.0754	-0.0546	0.0156	-0.0027	-0.0307	0.0493	-0.1275	0.0065
DEAL	0.7119	0.6420	0.7084	0.5631	0.0871	0.4575	0.2902	0.4288	0.1430

	LTIREXP	STIREXP	EREXP	RES	NIM	DISP	GOV
IRD							
FCD							
LEV							
GRW							
SIZE							
LIQ							
DIV							
CAP							
LTIREXP							
STIREXP	0.0421						
EREXP	-0.0599	0.0707					
RES	-0.0674	-0.0126	0.0731				
NIM	0.0539	0.0253	0.0082	0.2359			

	LTIREXP	STIREXP	EREXP	RES	NIM	DISP	GOV
DISP	0.0435	0.0726	-0.1212	-0.1567	-0.3104		
GOV	0.0936	-0.0420	0.0209	0.3836	0.0579	-0.2077	
DEAL	0.2560	-0.2149	-0.0052	-0.1695	-0.0677	-0.0910	-0.0630

Notes: Panel A reports the descriptive statistics of variables employed in the regression model, while Panel B reports the pair-wise correlation matrix of these variables. Refer to Table 1 for a description of the independent variables and their definitions. IRD = Interest rate derivatives, FCD = Foreign currency derivatives.

4.2 Regression analysis (without country effects)

Variations of the regression model are tested and the results are reported in Table 4. In the first model (Model 1), the variables proxying the probability of financial distress, underinvestment cost, economies of scale, hedging substitutes, ownership structure, regulatory and moral hazard hypotheses, exposure to risks and intermediation profitability are included. The results show that LEV, a proxy for the probability of financial distress, is positive and statistically significant. This corroborates previous findings that banks with higher leverage engage in greater derivative activities to minimise the probability of financial distress (Sinkey & Carter, 2000). Consistent with the predicted sign, SIZE is also a significant determinant of derivative activities. Large banks have the scale and scope necessary to justify the expenditure of resources to manage extensive derivative activities (Sinkey & Carter, 2000; Shyu & Reichert, 2002).

In contrast to their predicted signs, a negative coefficient estimate is found for GOV. This result indicates that banks with higher government ownership tend to hedge less relative to banks with lower government ownership. These results reflect possible moral hazard behaviour of Asia-Pacific banks. It might be the case that the banks do not hedge adequately, knowing that they can rely on deposit insurance to bail them out in the event of insolvency. Consistent with Sinkey and Carter (2000), the positive sign for LTIREXP indicates that banks with greater long term interest rate exposure tend to engage in greater derivative activities.

Model (2) incorporates a dealer dummy to control for the existence of large derivative users due to their dealing activities. The results are consistent with Model (1) with LEV, SIZE, GOV and LTIREXP remaining statistically significant. DEAL is also statistically significant at the 1% level, indicating that Asia-Pacific dealer banks use derivatives more extensively than non-dealer banks.

Model (3) excludes the 18 dealer banks from the analysis. The variables LEV and SIZE remain statistically significant. However, instead of a positive association between SIZE and TDER, a significantly negative relationship is found. This finding suggests that the economies of scale argument for derivative use is not present for Asia Pacific non-dealer banks. This finding is similar to Carter and Sinkey (1998) where they report that economies of scale in derivative usage are not

found in their US community non-dealer bank sample. In addition, DIV is also significant at the 1% level, and EREXP and RES are both significant at the 10% level in explaining the extent of derivative activities. The positive sign for DIV suggests that banks that use more derivatives are able to sustain higher dividend payments, supporting dividends as a substitute for hedging hypothesis. Conversely, the negative association found between EREXP and TDER could be an indication of inadequate hedging of exchange rate risk or speculative use of derivatives. The extent of derivative activities is also higher the greater the level of RES, suggesting that banks' derivative activities are associated with hedging credit risk (Schrand & Unal, 1998).

Table 4. Regression of the determinants of the extent of banks' derivative activities

Independent Variable	Predicted Sign	Model (1) All Banks	(2) With Dealer Dummy	(3) Non-Dealer Banks only	(4) With Country Dummies	(5) With Country Characteristics	(6) Non-Dealer Banks only with country characteristics
CONSTANT		-11.1282***	-6.1330**	1.6059**	-7.3926***	-5.4666	0.3330
		(-3.5344)	(-2.5419)	(2.1517)	(-2.9795)	(-1.5365)	(0.3913)
LEV	?	5.4138***	2.7352**	1.9321***	3.2093**	4.8519***	1.7630***
		(5.5216)	(2.3867)	(5.1895)	(2.1181)	(2.7039)	(3.7512)
GRW	+	-1.0269	-0.5647	0.1326	-0.6220	-0.7042	-0.0683
		(-1.5090)	(-1.0202)	(1.0054)	(-1.0555)	(-0.8008)	(-0.3432)
SIZE	+	0.4551***	0.2560**	-0.0644**	0.3785***	0.3183*	-0.0296
		(3.3884)	(2.5366)	(-2.2111)	(3.2250)	(1.7481)	(-1.3081)
LIQ	-	1.0667*	-0.0457	-0.2136	0.7082	0.3304	-0.2879
		(1.7695)	(-0.0741)	(-0.9306)	(0.7777)	(0.2769)	(-1.1188)
DIV	+	6.2693	-22.0433	19.1735***	-61.8378**	-109.0861*	6.3700
		(0.1882)	(-0.7774)	(2.6492)	(-2.0137)	(-1.8728)	(0.9302)
DISP	+	-0.1985	-0.2495	0.0122	-0.4457**	-0.4298**	-0.0258
		(-1.0776)	(-1.4666)	(0.4153)	(-2.2522)	(-2.0911)	(-0.8461)
GOV	+	-0.5123***	-0.4114**	-0.0051	-0.3868*	-0.1248	-0.0682
		(-2.6445)	(-2.0532)	(-0.1343)	(-1.7868)	(-1.0216)	(-1.6330)
CAP	?	5.4835	3.6490	-0.7189	-3.5235	3.9610*	-0.2092
		(1.2419)	(1.1276)	(-0.7778)	(-1.5852)	(1.6778)	(-0.2176)
LTIREXP	+	0.3163***	0.2385**	0.0264	0.1230	-0.0467	0.0010
		(3.0090)	(2.3172)	(1.1142)	(1.2001)	(-0.5154)	(0.0491)
STIREXP	+	-0.0546	-0.0285	0.0022	0.0203	0.0394	0.0161
		(-0.6778)	(-0.4712)	(0.1757)	(0.3648)	(1.0478)	(1.1017)
EREXP	+	0.0458	0.0467	-0.0453*	0.0447	0.1223	-0.0438*
		(0.5590)	(0.6438)	(1.9041)	(0.7555)	(1.5845)	(-2.0113)
RES	+	2.8940	1.8613	1.8607*	-5.9138	-1.0591	2.7960**
		(1.1309)	(0.6275)	(1.7599)	(-1.1785)	(-0.3038)	(2.4218)
NIM	?	-17.6542	-11.0111	-4.8903	8.4887	-15.5665*	-2.0783
		(-1.1931)	(-0.8977)	(-1.2230)	(0.8969)	(-1.8379)	(-0.3587)
YEARDUM	?	0.1028	0.1029	0.0451**	0.0733	0.0403	0.0350
		(0.9656)	(1.3061)	(2.4844)	(1.0472)	(0.5211)	(1.5582)

Independent Variable	Predicted Sign	Model (1) All Banks	(2) With Dealer Dummy	(3) Non-Dealer Banks only	(4) With Country Dummies	(5) With Country Characteristics	(6) Non-Dealer Banks only with country characteristics
DEAL	+		1.4727***		0.6477**	0.8181*	
			(4.6908)		(2.3056)	(1.8917)	
JPDUM					-1.3937***		
					(-2.9028)		
HKDUM					-0.9665***		
					(-3.0036)		
TWDUM					-1.5633***		
					(-3.2828)		
KRDUM					-1.9698***		
					(-4.0192)		
SGDUM					0.9673		
					(1.2989)		
MSDUM					-1.3892***		
					(-3.8239)		
THDUM					-0.7722*		
					(-1.6769)		
PHDUM					-0.7480**		
					(-2.3030)		
AUSDUM					-0.3602		
					(-1.0415)		
ACT						-0.0963	0.0379
						(-1.0880)	(1.5340)
OWN						0.0353	0.0034
						(0.4570)	(0.1148)
CAPREG						0.0726	0.0057
						(0.6647)	(0.1991)
PRIMON						-0.1662	
						(-0.7092)	
DEPINS						1.7567***	0.3022**
						(2.9224)	(2.5244)
COMP						-0.0320	0.0034
						(-0.2569)	(0.0749)
Adjusted R^2		0.45	0.56	0.35	0.65	0.59	0.42

Notes: This table reports the coefficient estimates and corresponding t-statistics (in parentheses) of regression Equation (1), as outlined in the main text. For columns (4), (5) and (6), relevant country specific dummies are included in the regression. The sample consists of 110 and 108 Asia-Pacific banks for 2002 and 2003, respectively. Refer to Table 1 for a description of explanatory variables. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. Newey-West adjusted statistics are reported.

4.3 Regression analysis with country effects

The analysis is then extended to include country effects. Model (4) includes country dummies. Most of the country dummies are statistically significant, suggesting that cross-country differences exist in banks' derivative activities.

By including country dummies in the model, there are a greater number of significant determinants including LEV, SIZE, DIV, DISP, GOV and DEAL. Similar to the model without country dummies (i.e. Model 2), LEV, SIZE and DEAL are positively associated with banks' derivative activities. The negative sign for DIV indicates that a smaller dividend payout is associated with greater derivative activities and is consistent with Carter and Sinkey (1998). The two ownership variables (i.e. DISP and GOV) are also statistically significant although not in the predicted direction. The negative association between DISP and TDER indicates that banks with more dispersed ownership are more likely to have lower derivative activities. This finding is puzzling as banks with dispersed ownership are expected to have a lower level of risk taking (Laeven, 2002) and hence, greater extent of derivative activities.[9] GOV is also significantly negative, supporting the argument that Asia-Pacific banks generally suffer from moral hazard behaviour in risk management.

CAP is not significantly associated with the level of derivative activities. Thus, the regulatory hypothesis, suggesting that banks must have stronger capital positions to engage in derivative activities, is not supported in the Asia-Pacific context. This finding is similar to Sinkey and Carter (2000) although they obtained a stronger result against the regulatory hypothesis, where a significantly negative association between capital and extent of derivative activities is found.

In Model (5), we include the country specific characteristics obtained from World Bank Database (2004) to capture cross-country regulatory and operational variations in the banking industry. When country specific characteristics are taken into account, LEV, SIZE, DIV, DISP and DEAL remain statistically significant. CAP and NIM are also statistically significant although only at the 10% level. Among the country specific characteristics, only DEPINS is positive and significant at the 1% level, indicating that banks located in countries with explicit deposit insurance are more likely to engage in greater derivative activities. This finding does not support the regulatory concern that banks engage in moral hazard behaviour to exploit the explicit deposit insurance scheme. However, it can also be the case that banks engage in greater derivative activities for speculation or for trading purposes when an explicit deposit insurance scheme exists.

Model (6) tests the relationship between the characteristics of non-dealer banks and banks' derivative activities, taking into account country characteristics. Similar to the previous models, LEV is still statistically significant. The negative association between EREXP and TDER suggests possible speculative use of derivatives with respect to exchange rate changes. The positive association between RES and TDER indicates that banks also use derivatives for hedging credit risks (Schrand and Unal, 1998).

4.4 Extended analyses and robustness checks

4.4.1 Japanese vs. non-Japanese banks

Since the sample consists of a large number of Japanese banks, the analysis is also partitioned into Japanese and non-Japanese banks. The regression results are presented in Table 5. Model (7) shows the results for the sub-sample of Japanese banks and Model (8) for the sub-sample of non-Japanese banks. Explaining derivative activities of Japanese banks, only DEAL significantly influences the level of derivative activities. For the sub-sample of non-Japanese banks, controlling for country dummies, more variables (i.e. LEV, SIZE, DISP, GOV, CAP and LTIREXP) are found to influence TDER.

4.4.2 Risk exposure by derivative type

To further examine the determinants of the extent of banks' derivative activities, TDER is disaggregated into interest rate derivatives (IRD) and foreign currency derivatives (FCD). The results of this analysis are presented in Table 5, Model (9) for IRD and Model (10) for FCD. Similar to the results using TDER, LEV and SIZE significantly explain the use of both IRD and FCD. On the other hand, DIV and DISP are only significant in explaining the use of IRD, while the LTIREXP and DEAL are significant determinants of only FCD. These findings suggest that FCD are used more in the dealing activities of banks, while IRD are generally used for hedging purposes.

Table 5. Regression results – extended analysis

Independent Variable	Predicted Sign	Model			
		(7) Japanese banks only	(8) Non-Japanese banks	(9) IRD	(10) FCD
CONSTANT		-10.2462	-6.2742***	-6.2042**	-2.4748***
		(-1.3360)	(-3.2529)	(-2.1949)	(-3.5570)
LEV	?	0.2945	3.5293***	2.2722*	1.0580**
		(0.0597)	(2.9023)	(1.7235)	(2.1845)
GRW	+	0.1977	-0.5254	-0.2441	-0.1969
		(0.1500)	(-0.9274)	(-0.4480)	(-1.0013)
SIZE	+	0.3839	0.3211***	0.3574**	0.1090***
		(1.3471)	(3.5224)	(2.5727)	(3.6640)
LIQ	-	2.8714	1.3314	-0.0529	0.4496
		(1.1631)	(1.2560)	(-0.0514)	(1.3414)
DIV	+	257.6733	-44.3292	-71.7095**	-3.2395
		(0.8396)	(-1.5015)	(-2.3448)	(-0.3541)
DISP	+	-0.3044	-0.4832**	-0.4490*	-0.0363
		(-1.0509)	(-2.2175)	(-1.8163)	(-0.8984)
GOV	+	0.0678	-0.5763**	-0.3666	-0.1133
		(0.7837)	(-2.1088)	(-1.5409)	(-1.5125)

Independent Variable	Predicted Sign	Model			
		(7) Japanese banks only	(8) Non-Japanese banks	(9) IRD	(10) FCD
CAP	?	3.8928	-5.6867*	-2.4334	-1.2794
		(0.5873)	(-1.7687)	(-1.2435)	(-1.3097)
LTIREXP	+	-0.2096	0.3953*	-0.0121	0.1123*
		(-0.9531)	(2.4364)	(-0.1398)	(1.9289)
STIREXP	+	0.0066	-0.0020	0.01047	-0.0062
		(0.2541)	(-0.0159)	(0.2285)	(-0.2748)
EREXP	+	-0.0840	-0.0303	0.0528	-0.0154
		(-0.9016)	(-0.2157)	(0.7811)	(-0.7297)
RES	+	-1.3924	-6.56.93	-4.1361	-0.9232
		(-0.4439)	(-0.8336)	(-0.7901)	(-0.8762)
NIM	?	62.8709	13.1171	2.3727	7.5782
		(1.3314)	(1.1961)	(0.2631)	(1.2039)
YEARDUM	?	-0.0638	0.1861	-0.0090	0.0208
		(-0.8684)	(1.4493)	(-0.1252)	(0.8415)
DEAL	+	2.6634**	0.2970	0.2585	0.1999**
		(2.0192)	(1.2358)	(0.9050)	(2.4975)
JPDUM				-1.8992***	-0.2772
				(-3.3980)	(-1.5707)
HKDUM			-1.1327***	-1.3979***	-0.1179
			(-2.7759)	(-3.2464)	(-0.9180)
TWDUM			-1.5478***	-1.7920***	-0.3159**
			(-3.2625)	(-3.4051)	(-2.3039)
KRDUM			-1.9260***	-2.4810***	-0.3891**
			(-3.6503)	(-3.8000)	(-2.5196)
SGDUM			1.3806	0.3235	0.3546***
			(1.6334)	(0.4529)	(2.6517)
MSDUM			-1.4293***	-1.6880***	-0.3307**
			(-3.2317)	(-3.6432)	(-2.5320)
THDUM			-0.6151	-1.3051**	-0.0100
			(-0.9825)	(-2.5083)	(-0.0583)
PHDUM			-0.8468*	-1.0400***	-0.0513
			(-1.9438)	(-2.7620)	(-0.3203)
AUSDUM			-0.5353	-0.9899**	0.4445
			(-1.3390)	(-0.3892)	(0.2895)
Adjusted R^2		0.56	0.69	0.53	0.70

Notes: This table reports the coefficient estimates and corresponding t-statistics (in parentheses) of the regression Equation (1), as outlined in the main text. In the IRD (FCD) model, IRD (FCD) is used as the dependent variable in place of TDER in the above regression. In columns (7) to (10), only relevant country dummies are included in the regression. Deal dummy is excluded from the "Japanese bank only" model due to the high correlation with leverage to address potential multicollinearity problem. The sample consists of 110 and 108 Asia-Pacific banks for 2002 and 2003, respectively. Refer to Table 1 for a description of explanatory variables. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. Newey-West adjusted statistics are reported.

5. Summary and conclusions

This paper presents an investigation of the determinants of the extent of Asia-Pacific banks' derivative activities during 2002 and 2003. The results support the probability of financial distress and economies of scale arguments in explaining Asia-Pacific banks' extent of derivative activities. With the inclusion of country dummies and country characteristics, more independent variables are found to be associated with banks' level of derivative activities. These include dividends, ownership dispersion and dealer dummy. Further investigation of the extent of IRD and FCD suggests that dealer banks tend to use more FCD, while IRD are generally used for hedging purposes.

The finding of a positive association between the DEPINS and TDER indicates that banks located in countries with an explicit deposit insurance scheme tend to engage in greater derivative activities for hedging. However, there is also the possibility that banks engage in greater derivative activities for speculative or trading purposes when an explicit deposit insurance scheme exists. Resolution of this issue is left to future research.

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[1] One exception is Shyu and Reichert's (2002) study which includes large US, European and Japanese dealer banks.

[2] The sample period of Gunther and Siems (1995) is 1991 to 1994 while, the sample period of Sinkey and Carter (2000) is 1996.

[3] Bartram *et al.* (2009) investigates the determinants of the corporate financial derivatives use around the world but their study excluded firms in the financial services industry.

[4] Locally incorporated banks are banks that are licensed by the central banks to operate in a home or host country and need to comply with local bank disclosure requirements set by the relevant central bank. Thus, branches of overseas incorporated banks and bank representative offices are excluded from the sample.

[5] Stock price data are not available for these banks because they are either not listed on an organized stock exchange or have merged with other local banks. Stock price data are needed to estimate the interest rate and exchange rate exposures of banks using the augmented market model over the period of January 1999 to December 2003. In addition to stock price data, we also obtained from Datastream, the following weekly data for each sample country: i) equity market index, ii) bond index, iii) short-term interest rate (3 month) and iv) exchange rate for the same period.

[6] The unavailability of the 2003 'Notes to the Financial Statements' for two of the fifty-four Japanese sample banks necessitated their exclusion in 2003.

[7] Alternative specifications of this regression model incorporating country specific effects, are also used in later analysis.

[8] Following Sinkey and Carter (2000), a dealer dummy is included in the analysis to account for any possible bias due to the influence of banks with large derivative activities. There are 26 sample banks with extensive derivative activities (TDER greater than 1) and 93% of these are derivative dealer banks.

[9] This is possibly due to the less stringent definition of ownership dispersion employed. In Laeven (2002), a bank is classified as having a dispersed ownership if no shareholder owns more than 5% shares. In our study, a bank is classified as having a dispersed ownership if no shareholder owns more than 25% shares, due to data unavailability for all sample banks. Further analysis employing the Laeven (2002) dispersion measure for approximately 60% of our sample banks that have such data, indicates that the DISP is not statistically significant in the resulting regression.