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The Risk and Regulation of Banks Off-Balance Sheet Innovations

I. Introduction

One of the most important phenomena among developing countries commercial banks has been their move into new areas of off-balance sheet activities. This has been a natural outcome of (i) the increased competition (narrowing of margins) for traditional banking products such as commercial loans, (ii) the rapid growth and diffusion of new technologies such as CHIPS, SWIFT etc. and (iii) new financial market innovations, e.g. futures, options and swaps. While this trend has been evident for some years regulators have only recently started to collect information and monitor the growth in exposure of the banks involved and to put in place regulatory proposals to control the growth and risk of such off-balance sheet activities. Part II of this paper briefly describes the main off-balance sheet activities of banks with particular reference to their risk exposure in each case. Part III presents some evidence as to the size of these activities for U.S. commercial banks. Part IV looks at the regulators response in different countries to the risk of these new activities, including recent joint proposals by the Federal Reserve and Bank of England to incorporate off-balance sheet risks into considerations of each bank's capital-adequacy.

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II. Types of Off-Balance Sheet Activities

There have been eight major areas of off-balance sheet activity:

(1) Loan Commitments
(2) Futures and forward contracts
(3) Standby contracts/letters of credit
(4) Option arrangements
(5) Swaps
(6) Loan Sales (Securitization)
(7) Electronic funds transfers
(8) Underwriting

(i) *Loan Commitments.* Under a loan commitment contract a bank guarantees to supply a maximum amount of loans over a fixed time period at either a fixed rate or some rate based on a formula tied to prime-rate or LIBOR. In return the customer pays an upfront fee and often a fee on the unused balances. Technically one can view a loan commitment as providing a customer with a 'borrowing' option which can be exercised profitably whenever the spot market loan rate lies above the contractual (fixed or formula) loan rate. This risk is compounded by the fact that many borrowers are likely to draw on their commitments at the same time, usually when monetary policy is tight and funds are in short-supply. Such incentives to borrow are likely to push up further any differences between a bank's cost of funds/spot rate and the formula/loan commitment rate. In addition banks can also be viewed as facing a quantity or takedown risk since under binding loan commitments they must always stand ready to provide the *maximum* or upper limit of the com-

mitment while the borrower has the option to draw down anything between zero and the maximum commitment line depending on the states of the world that exist (e.g. construction delays) over the time interval during which the commitment is in effect.

(ii) *Futures and Forward Contracts.* Banks are heavy users of both futures and forward interest-rate and foreign exchange contracts. Due to space we will concentrate here only on the risk of interest-rate futures contract positions. Probably the major risk banks face is when they use futures contracts for micro- rather than macro-hedging purposes. Advocates of macro-hedging argue that banks should select their financial futures contract positions according to the overall portfolio risk exposure of the bank. That is, they should be used to hedge the banks aggregate asset and liability duration gap (Gap = duration of assets minus duration of liabilities) where duration measures the weighted average time of cash flows received (payed) from bank loan/portfolio investments (liabilities). Since most banks have a *positive* gap, with the duration of their assets longer than the duration of their liabilities, they should short (sell) futures contracts to minimize their interest rate exposure. Unfortunately, many large banks are organized on a 'profit center' or departmental basis so that the natural organizational tendency is for each department/center to choose its own optimal hedges from a micro (departmental) perspective, e.g. the securities trading department, the mortgage banking department, international subsidiaries etc. Unfortunately these micro hedges when aggregated may actually work to increase a bank's risk exposure on an aggregate basis (e.g. produce a net long rather than short position). Thus, use of financial futures in hedging inventory risk, loan commitment risk etc. may be counterproductive and even conceivably increase interest-rate risk. In addition to this problem of macro v's micro hedging, basis risk will exist if the interest rate futures contract(s) used do not have a close correlation with the interest-rates on the assets and liabilities under consideration. Thus using a U.S. domestic interest-rate futures contract to hedge Euro-dollar interest-rate exposure may be distinctly sub-optimal since U.S. domestic rates and Euro-dollar rates do not always move in close tandem.

(iii) *Standby Contracts/Letters of Credit.* There has been major growth in all types of standby contract/letters of credit issued by banks for both trade and non-trade purposes. In issuing such contracts the bank is acting as a guarantor, or an insurance agent, who like any insurance agent faces a loss if a particular state of the world arises (in this case usually default on a contractual agreement). In a sense the bank's risk is essentially the same as the default/credit risk faced in its standard lending operations and should be evaluated similarly even though these are contingent liabilities and are off the balance sheet.

(iv) *Options.* As with futures contracts many large banks have taken positions in both interest-rate and foreign exchange options for the purposes of hedging. However, the payoff-streams from *writing* a put or call are different from *buying* a put or call. Specifically, the maximum potential loss a bank can face on buying an individual put or call is the *premium* paid up front – if the option expires out of the money. By comparison the *maximum* loss on writing a put or a call is theoretically unlimited. Consequently, potential risk exposure in writing call/put options on either interest-rates or foreign exchange may be more serious than buying puts/calls.

(v) *Swaps.* Large banks are also heavily involved in the swap markets – both interest-rate and foreign exchange. Interest-rate swaps may be viewed as a viable strategy for a bank when it wants to put a long-term hedge into place (e.g. 4 years) and there are no futures or options markets that offer contracts with maturities anywhere near that length. A standard interest-rate swap might be between a Japanese bank in London with short-term assets and long-term liabilities in dollars and a domestic (say U.S.) bank with long-term assets and short-term liabilities in dollars. Because they have opposing interest-rate exposures (gaps) a third-party investment or commercial bank may bring the two banks together under a swap agreement whereby they periodically swap interest payments, with the Japanese bank making floating rate payments to the domestic bank and the domestic bank making fixed rate payments to the Japanese bank. In general the third party bank guarantees the transaction and therefore will bear the *default risk* should either bank renege on the swap agreement. Moreover, both the Japanese and domestic banks will bear 'ba-

sis' risk as long as the interest payments under the swap do not exactly match the interest payments on their liabilities.

(vi) *Loan Sales (Securitization).* Loan sales (or securitization) are an alternative method banks have found, to swaps, futures and options, to reduce interest rate (and credit) risk by decreasing the duration of their assets. In a traditional banking paradigm, banks would originate loans and hold them to maturity, thereby internalizing credit and interest-rate risks. However, in a standard loan securitization, a bank would originate a number of loans – usually mortgages but recently including credit card receivables and auto-loans – package these loans and then sell them off to an outside party (investor). To the extent that this sale is without recourse the bank decreases duration and its credit exposure. However, if the loans are sold with *recourse* such that the investor has the option to return the loans to the bank should their quality deteriorate below some agreed level the bank is still subject to an off-balance sheet contingent liability or credit risk.

(vii) *Transaction Risks.* With the growth and expansion of payments technology, EFTS transactions risk has become an important management issue. Specifically most large banks that engage in the Euro-dollar market settle through CHIPS (approximately 90% of all transactions are cleared in this manner). Unlike domestic (U.S.) wire systems such as Fed wire, funds transferred on CHIPS *within* any day are unguaranteed or provisional payments that *only* become final at the *end* of the day. Thus if B_x transfers funds to B_z at 11 a.m. in the morning the actual transfer of funds will not take place until the end of the day normally through settling accounts at the Federal Reserve Bank of New York. Because this transfer of funds is not good or final until the end of the day, bank Z faces an *intra-day* settlement or *'daylight overdraft'* risk. Specifically, bank Z may 'assume' the funds received at 11 a.m., from bank X, are good and then on-lend them to a customer (Bank Y) at 11:15 a.m. However, if bank X does not deliver the promised funds at the end of the day, bank Z may be pushed into a serious net funds debitor position. Indeed, it is conceivable that this net debitor position may exceed its capital and reserves – rendering it 'technically' insolvent. In general such a disruption might only be expected to occur if a major fraud was discovered in bank X's books during the day and it was closed (the same day) by bank regulators. Alternatively, a bank might be transmitting funds (which it does not have) in the hope of keeping its 'name in the market' so as to be able to raise funds later in the day. It is conceivable that other banks may revise their credit limits for this bank during the day, making it unable to deliver all the funds promised.

Note that if bank Z cannot meet its settlement commitments, CHIPS resolves this by completely unwinding bank Z's whole daily position (transactions) with all other banks. That is, the end of the day net settlement matrix is recalculated for the n–1 remaining banks, excluding all transactions with the *n*th (insolvent) bank. As a result those banks that were net senders (suppliers) of funds to the insolvent bank – i.e. they sent more than they received – will have their net settlement positions improved, while those banks who were net receivers of funds, from the insolvent bank, will have their positions worsened. Consequently, some banks that were originally in a net creditor position may be forced into a net debitor position, while others will have their net debitor position worsened, in the revised settlement matrix. If some of these banks are then unable to meet their revised settlement requirements, a further rebalancing will be necessary by excluding them from the settlement matrix, and so on until all banks left can meet their settlement obligations.

(viii) *Underwriting risk.* There has been an explosive growth in commercial bank underwriting activities ranging from NIF's and RUF's on the one hand to Euro-bond issues on the other. To the extent that this underwriting is done on a 'best-efforts' basis the commercial bank acts as commissioned agent on behalf of the issuer and does not directly bear the risk that the issue will fail to sell. On the other hand if the underwriting is done on a firm or fixed commitment basis then the commercial bank underwriter directly bears the risk that the issue will fail. For example under a note issuance facility (NIF) the borrower repeatedly issues short-term paper. If the paper does not sell below a contracted interest rate (spread over LIBOR), the underwriting bank undertakes to buy the paper and/or make loans. These arrangements may be outstanding for up to 7 years. In addition some NIF's permit borrowing from banks with no prior attempt to sell notes – in which case

they bear the same type of credit risk as domestic loan commitments with the addition of sovereign risk. Under a standard 'firm commitment' stock (or bond) underwriting a bank (or a syndicate) would buy the whole issue at price X per share and turn around and try to sell it to investors at a slightly higher price of $X+\delta$. If the issue is attractive so that outside investors buy the whole issue, the maximum gain to the underwriter is δ times the number of shares or bonds sold. However, if the issue is unattractive, the bank would have to continuously lower its offering price below X until it sells the whole issue. Theoretically, in this case, there is no downside limit on the potential loss. Consequently the pay-off from firm commitment underwriting is virtually isomorphic to that from writing a put option on the underlying security, i.e. a limited upside return (premium) and an unlimited downside risk.

In addition to the potential loss due to an 'overpriced' issue, securities laws in a number of countries impose clear contingent liabilities on underwriters in the presence of claims of misinformation and/or conflicts of interest revolving around the distribution and placement of an issue (see SAUNDERS [8], [9]).

III. Importance of Off-Balance Sheet Activities

The above section documented in quite simple terms the essential nature of the risks relating to major off-balance sheet activities. Despite their growth, Central banks have been rather slow in collecting information and monitoring their growth. Because of this, the evidence that is available is mainly from the U.S. The major regulatory contribution to monitoring this growth has been due to the *Reports of Condition, Schedule L* filed by banks with the regulatory authorities since September 30th 1983. This requires each bank to report each quarter its new: (i) loan commitments, (ii) futures and forward contracts, (iii) standby contracts/letters of credit, (iv) option arrangements, (v) swaps, (vi) loan sales and (vii) any other commitments and contingencies that exceed 25% of its total equity capital.

An analysis of these figures produces some quite surprising results. Consider Table 1 which shows figures produced by CATES [2] for 1984 for the 10 largest U.S. Money Center banks.

Table 1: Off .v. On balance Sheet Sizes of 10 Large U.S. banks

	Total Assets 1984/83		Total 'Schedule L' % of 1984/83	
	($ mio.)	% Change	Assets	% Change
Bankers Trust	44 142	10.0	193	46
Chemical Bank	51 232	3.8	180	10
Citibank	120 050	5.8	170	14
Manuf' Hanover	62 427	7.5	108	37
Morgan Guaranty	63 541	13.1	132	22
First Chicago	35 042	(1.4)	217	31
Continental Bank	30 064	(26.1)	81	(23)
Bank of Boston	18 367	5.3	138	58
Irving Trust	17 201	1.8	151	35
Chase Manhattan	80 400	1.1	135	31
Medians (ex Continental)	–	5.8	170	31

Source: CATES [2].

As can be seen for all banks except Continental Illinois (a bank that was in serious financial difficulties) the total 'Schedule L' liabilities or off-balance sheet activities of these banks significantly exceeded the size of their on-balance sheet activities (that is, the size of the 'invisible' bank exceeded the size of the 'visible' bank). Even if Continental Illinois were excluded, off-balance sheet commitments and contingencies had a median 1.7 times that of assets, and assuming capital-assets ratios of 5%, these risky activities were commonly more than 34 times the average bank's capital. In other words losses of approximately 3% on the off-balance-sheet portfolio due to default or interest rate risk would have been sufficient to reduce the equity capital and reserves of most large U.S. Money Center banks to zero[1]. Further, these figures ignore some important off-balance sheet risks – most importantly settlement risk due to intra-day overdrafts on the major private wire transfer systems.

The most recently published figures for all 14 111 Schedule L reporting banks (as of December 1986) shows total on balance-sheet assets of $ 2923 billion compared to off-balance-sheet items of $ 2488 billion or 85% of assets. The largest items were: commitments to purchase foreign currencies ($ 892.6 billion), loan commitments ($ 570.8 billion), interest rate swaps ($ 367 billion) and standby letters to U.S. addresses ($ 131.9 billion).

While surveys such as Schedule L have re-

Table 2: Use of option arrangements by U.S. banks (September 1984)

	N	Frequency of use (%)	Ratio of options position to equity (%)[1]
I. Written calls			
a) All U.S. banks	14 489	0.35	17.34[2] (4.25)
b) Banks with assets less than $ 100 million	12 139	0.21	20.63 (6.84)
c) Banks with assets between $ 100 million and $ 500 million	1 883	0.27	36.40 (22.34)
d) Banks with assets between $ 500 million and $ 1 billion	198	0.00	0.0 (–)
e) Banks with assets greater than $ 1 billion	269	7.45	8.45 (2.62)
II. Written puts			
a) All U.S. banks	14 489	0.39	29.98 (9.02)
b) Banks with assets less than $ 100 million	12 139	0.18	47.52 (19.63)
c) Banks with assets between $ 100 million and $ 500 million	1 883	0.16	12.00 (9.39)
d) Banks with assets between $ 500 million and $ 1 billion	198	1.01	3.35 (2.20)
e) Banks with assets greater than $ 1 billion	269	10.78	20.37 (8.58)

[1] For those reporting a non-zero option position.
[2] Mean with standard deviation in parentheses.
Source: KOPPENHAVER [4]

vealed the size and scale of the potential risk exposure of all reporting banks, other surveys have suggested that even some small banks are getting involved in off-balance sheet activities. For example, KOPPENHAVER [4] finds that a few relatively small U.S. banks, i.e. those with assets under $ 100 million, as of September 1984 were involved in writing put options (see Table 2). The Federal Reserve Bank of New York also reports that between the end of 1982 and the end of 1985 the top 9 U.S. banks have increased the ratio of their *foreign* loan commitments to total on balance-sheet assets from 35% to 43%[2]. PARKINSON and SPINDT [7] report the widespread use (and misuse) of financial futures contracts among banks of all sizes. While NELSON [6] estimates that the maximum exposure of any U.S. bank to standby letters of credit/commercial letters of credit guarantees (as of 1984) were: standby letters of credit to U.S. addresses (18.4% of assets), to non-U.S. addresses (8.3%), commercial letters of credit (17.8%), and standby contracts (11.8%). Of course guarantees relating to business with non-U.S. addresses are also subject to the extra dimension of sovereign risk. While BENNETT [1] reports that standby letters of credit for the 25 largest U.S. banks grew from $ 81 billion in 1982 to $ 153 billion in June 1985 – a 90% increase. Moreover, the average ratio of standby letters of credit to capital for these banks was 165%.

Finally, HUMPHREY [3] at the Federal Reserve Board of Governors has *simulated* the effect of a single large CHIPS settlement failure on a random day in January 1983. The settling participant selected had a net credit position of $ 321 million for the day. (This failure was viewed as being a least worst situation since realistically only net debitors are likely to default.) After deleting the transactions of this bank with all other banks and re-estimating the transaction creditor-debitor matrix he found that 24 banks had settlement obligations increased by more than the amount of their capital and ended up in a net debitor position. Of these, 8 had been in a net creditor position prior to the removal of transactions with the non-settling participant. It was then assumed that all banks whose net debitor positions deteriorated by an amount equal to or exceeding their capital were also unable to settle. Thus another revised transactions matrix had to be constructed. This process was continued until no participant failed following a transactions matrix revision. It was found that six such iterations were required and that the number of 'failed' banks were 50. These 50 banks accounted for 39% of the total dollar value of messages for that day.

IV. Regulatory Response

Information such as that revealed in Schedule L, regarding the size and potential risk exposure of U.S. banks off-balance sheet activities, has caused considerable concern among U.S. regulators since existing capital adequacy regulations have not sought to control or limit the leverage available through off-balance sheet expansions. Apparently similar concerns have been shared by other Central banks such as the Bank of England, since in January 1987, the two central banks announced a joint initiative to as-

sess U.S. and British banks capital adequacy according to the (credit) risk exposure of both their on-and off-balance sheet activities. Under this plan each type of on-balance sheet asset and potentially each type of off-balance sheet activity would be assigned a credit risk weighting (W_i) of between 0% and 100%, this weight would then be multiplied by the aggregate amount of asset or off-balance sheet item in each category and then aggregated to some number (X), i.e.:

$X = W_1$ (cash) + W_2 (govt. securities) + W_3 (loans)
+ W_4 (loan commitments) + W_5 (letters of credit) + ...

Thus we have a linear risk weighting of elements on and off the balance sheet (the actual proposed weights are shown in Tables 3 and 4). This aggregate X for any bank would be divided by a bank's primary capital to determine whether its capital adequacy exceeded the regulatory defined minimum (capital adequacy) ratio of 5.5%.

While this is a step in the right direction this approach has certain weaknessess in that: (1) it assesses just the credit risk of off-balance sheet items and does not directly take into account the potentially large interest rate risk exposures banks may face with loan commitments, futures and options, (2) it is a linear risk measure and does not take into account potential credit-risk diversification effects across the different on- and off-balance items and (3) it does not include, nor is it proposed to include (see Table 3), transaction or day light overdraft/settlement risk exposures.

To some extent regulators, especially in the U.S., appear to view daylight overdraft risk/settlement risk as a separate problem to be dealt with by independent policies, despite the fact that this risk arises simply because daylight overdrafts are not priced to reflect the intra-day *credit-risk* that such overdrafts entail. That is, it can reasonably be argued that since daylight overdraft risk is *credit-risk* it should be included among the items in Table 3. The Fed's response to daylight overdraft risk has been to ask banks to self impose cross-system credit caps and limit the size of their daylight overdraft risk exposures to a maximum multiple of three times their capital on any one day and two times their

Table 3: Summary of Off-Balance Sheet Items and Conversion Factors for U.S. Banking Organizations[3]

Direct credit substitutes (financial guarantees and standby letters of credit serving the same purposes) – 100 percent credit conversion factor.

Trade-related contingencies (commercial letters of credit, bid and performance bonds and performance standby letters of credit) – 50 percent credit conversion factor.

Sale and repurchase agreements and asset sales with recourse, if not already included on the balance sheets – 100 percent credit conversion factor.

Other commitments, including overdraft facilities, revolving underwriting facilities (RUFs/NIFs), underwriting commitments, commercial and consumer credit lines. The credit conversion factors are:

10 percent – one year and less original maturity[4]
25 percent – over one year to five years original maturity
50 percent – over five year original maturity

Table 4: Summary of Risk Weights and Major Risk Categories for U.S. Banking Organizations (On-Balance Sheet)

0 percent
Cash – domestic and foreign
Claims on Federal Reserve Banks

10 percent
Short-term (one year or less) claims on U.S. Government and its Agencies

25 percent
Cash items in process of collection
Short-term claims on domestic depository institutions and foreign banks, including foreign central banks
Long-term claims on U.S. Government and its Agencies
Claims (including repurchase agreements) collateralized by cash or U.S. government or Agency debt
Claims guaranteed by the U.S. Government or its Agencies
Local currency claims on foreign central governments to the extent that bank has local currency liabilities
Federal Reserve Bank stock

50 percent
Claims on U.S. Government-sponsored Agencies
Claims (including repurchase agreements) collateralized by U.S. Government-sponsored Agency debt
General obligation claims on states, counties and municipalities
Claims on multinational development institutions in which U.S. is a shareholder or contributing member

100 percent
All other assets not specified above, including:
Claims on private entities and individuals
Long-term claims on domestic and foreign banks
Claims on foreign governments that involve transfer risk
Claims on all foreign private sector borrowers

capital (on average) over a two week period. Such a policy of voluntary caps appears to pose all kinds of moral hazard and perverse incentive problems. Indeed, one might reasonably ask why, if the problem arises because of non-pricing of such overdrafts, doesn't the Fed simply request banks to start charging interest or fees for carrying such overdrafts? Or, alternatively, why it does not push CHIPS into settling bank accounts more frequently intra-day rather than waiting until the end of the day to institute the settlement procedure? Apparently some intra-day settlements are not infeasible given current technology.

A number of other countries are taking or have taken steps towards including some off-balance sheet activities (usually commitments and NIF's) into capital adequacy considerations. Specifically, as of 1986, France and the Netherlands incorporated some off-balance sheet activities into capital adequacy evaluations with defined linear risk weights, Canada, Germany, Japan and Sweden were either tentatively experimenting with such plans or else they were under active consideration, while Belgium, Italy and Luxembourg had no announced plans or intentions to constrain off-balance sheet activities *via* capital adequacy regulations. Finally, in Switzerland guarantees, but not commitments, are generally included within capital adequacy tests. Thus, if NIF's are viewed as commitments to lend they could be excluded from such tests.

V. Summary and Conclusion

It has been argued that there appears to be something of *a regulatory lag* between the expansion in off-balance sheet activities (innovations) of banks and the response of regulatory authorities. A bank's heavy involvement in loan commitments, financial futures, options, swaps, letters of credit, loan sales, underwriting and EFTS may impose considerable contingent liabilities on the bank which should be assessed in light of its capital adequacy or capital reserves to meet potential losses. While regulators in the U.S., U.K. and certain other countries appear to have taken steps in the right direction with the announcement of proposed risk-adjusted capital asset ratios – these ratios will need to be sufficiently flexible to adjust to new off-balance sheet innovations and risks as they occur. This also suggests regulators need to be more responsive and speedier in their information collection and bank monitoring. Failure to quickly adjust capital ratios to new innovations (and to collect appropriate risk exposure information) could result in clear underpricing incentives with banks seeking to expand into new lines of off-balance sheet business not subject to costly capital-reserve (adequacy) requirements (see MERRICK and SAUNDERS [5] for a full discussion on this). This could ultimately lead to increased instability in the international banking system.

Footnotes

[1] Figures on loss-rates on off-balance sheet activities are hard to discover. BENNETT [1] reports that the last time data on standby letters of credit default rates were collected was in a Survey by the Fed in 1978 which found that while the initial default rate was high (2.03%) a high recovery rate meant that final loss rate was low (0.03%).

[2] Loan commitments to the 22 OECD countries plus India, Indonesia, Malaysia, South Korea and Thailand; these figures in part reflect the growth of NIF's.

[3] The credit exposure risks of interest rate swaps and foreign exchange contracts were subject to separate calculations and estimation. Because of the complexity of these exposure estimations the interested reader is referred to the March 4th 1987 agreement between the Bank of England and the Federal Reserve that defined potential credit exposures for these instruments.

[4] Maturity is defined as the stated maturity date or the earliest possible time at which the bank may unconditionally cancel the commitment, whichever comes first.

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