

Capital Adequacy and Foreign Exchange Risk Regulation

Theoretical Considerations and Recent Developments in Industrial Countries

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I. Introduction

Foreign exchange risk management of financial institutions first came to the fore with the internationalization of the banking business during the 1960s. The advent of the floating exchange rate environment in the early 1970s considerably increased exchange risk for international players, a fact which was suddenly brought to the attention of the general public by the failure of the German Herstatt Bank in 1974. The main reason for this bankruptcy was the large positions the bank had taken in the foreign exchange market, which turned against it (*von Hagen*, 1992). One indicator of the importance of the disruption that this single event caused in the international financial markets is the unusual deviation from covered interest rate parity, observed throughout the world in the aftermath of the crisis. Since then, most regulators in industrial countries have limited banks' potential to take open foreign exchange positions.

However, most recently the international financial community seems to have entered a new era of foreign exchange (forex) risk regulations. The G-10 and the European Union push forward to harmonize national market risk, including forex risk, regulations. Moreover, an increasing

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number of newly industrializing and developing countries are moving to introduce or reform foreign exchange exposure limits, at the same time as they make their currencies more convertible and develop domestic foreign exchange markets (Hartmann, 1994). The purpose of the present paper is to describe and discuss current forex risk regulations and recent proposals to harmonize them in industrial countries. Although it is only one type of market risk, meaning the risk entering bank portfolios through fluctuations in market values of assets, liabilities or off-balance-sheet items, this article mainly focuses on forex risk alone. Other market risks, such as interest rate risk, share or commodity price risk are only considered where they are related to forex risk and its regulation.

Although it is also refrained from a comprehensive survey some salient points of the theoretical literature on banking regulation and capital adequacy requirements are briefly reviewed in the next section.¹ Since the recent proposals to harmonize national forex risk regulations in a large number of industrial countries are formulated in a capital adequacy framework, i. e., establishing quantity restrictions on bank portfolios varying with the amount of own funds, the section puts emphasis on the question of the effectiveness of these restrictions in general in achieving reduced bank failure probabilities from a portfolio-theoretical perspective and also derives some basic conditions they have to meet in order to do so.² These conditions provide criteria for the evaluation of concrete applications of this approach to different risk types in bank portfolios, for example forex risk as addressed in the remainder of the paper.

The rest of the paper is organized as follows. Section III sketches and compares the forex risk regulations in 15 industrial countries before harmonization. Section IV describes the contents of the recent proposals and decisions to harmonize forex risk regulations in G-10 countries and the European Union (EU) as well as some reactions of market participants and academic researchers to them. Two subsections deal with the new pre-commitment approach and the public disclosure regime recently adopted by New Zealand. Finally, we look at the relationship between forex exposure limits, capital controls and exchange rate variability.

¹ For deeper surveys of the theoretical literature on prudential capital adequacy regulations, see for example Berger et al. (1995), Bhattacharya et al. (1995), Dewatripont and Tirole (1993), di Cagno (1990), Morgan (1992), Schweizerische Gesellschaft für Statistik und Volkswirtschaft (1995).

² This paper deals mainly with capital adequacy regulations in the proper sense, although one has to keep in mind that they are only a special case of quantity restrictions. Therefore, many of the theoretical points usually apply to these restrictions in general, whether they relate to banks' own funds or not.

II. Theory of Banking Regulation and Capital Adequacy Requirements

1. *The Rationale for Regulating Banks*

Banks in the classical sense are financial institutions issuing short-run deposits and granting more long run credits. In doing this they perform two important macroeconomic functions. First, they intermediate between savers and investors. Second, they provide part of the money stock in the economy. Optimal risk-return management of bank portfolios implies that deposits are covered only partially by equally liquid assets. This makes banks vulnerable to runs, sudden and massive withdrawals of deposits, possibly leading to illiquidity which can cause bankruptcy. The theoretical literature has identified two main sources of bank runs in fractional reserve systems, information asymmetries between bank managers and depositors (*Chari and Jagannathan, 1988*) and purely self-fulfilling expectations on deposit withdrawals (*Diamond and Dybvig, 1983*).

What is more alarming from a macroeconomic point of view is that individual bank failures can lead to a general banking crisis, affecting a larger part of the financial sector. This is for two related reasons. First, banks borrow and lend heavily among each other to manage their short-term deficits and surpluses of liquidity, creating a complex network of credit relationships within the financial sector itself. Second, depositors' expectations of their own bank's situation are not independent of what is happening in other banks. Hence, one bank's failure can trigger others' failures, either because the latter have assets with the former, or because the depositors react to the news of a run going on elsewhere (contagion). Through these mechanisms, the failure of a bank, either sound or unsound, can cause a temporarily self-enforcing chain-reaction that can possibly affect many sound banks (systemic risk).³ In other words, a single bank failure can have quite important external costs. A full scale financial crisis will erase a considerable part of the total stock of wealth and disrupt the intermediation process between savings and investment as well as the liquidity provision to firms and households ("credit crunch"). Since most of these costs are *external* to banks' managers the overall risk allocation will be suboptimal, the degree of systemic risk

³ However, because of "flight to quality" by the depositors, contagion will stop at some point before the whole banking sector is erased.

will be higher than socially optimal.⁴ This appears to be the main argument for prudential regulation, treating the banking sector differently from most other sectors in the economy.⁵

As the major problems in banking regulation come from the expected external costs of bank failures, standard economic reasoning suggests that the optimal economic policy should aim at equalizing expected private and social costs. This should decrease the individual banks' portfolio riskiness, and thus, lower systemic risk. The standard policy response to such an externality problem would be to implement a (Pigou) tax system with individual banks' tax rates depending on their capital, risk management skills, and portfolio risk. However, such a risk tax scheme faces obvious practical limitations.

In practice, regulators have reacted in five basic ways to the problems discussed above:

- Limiting market entry to increase the “franchise value” of banking licenses;
- Monitoring banks' activities with a view to shutting them down when they are insolvent;
- Providing emergency liquidity assistance for solvent banks in times of unexpected withdrawals (lender of last resort);
- Insuring deposited amounts against bank failures; and
- Explicitly restricting licensed banks' business, ranging from the prohibition of certain activities to deposit rate ceilings and to capital adequacy requirements.

In most industrialized countries, a mix of all five instruments is used (Dale, 1982).

The overall goal of equalizing (expected) social and private costs in banking implies that any policy response to the externality problem – be it a tax regime or some other scheme – should meet the subgoal of *comprehensiveness*, i. e., all risks (in the context of the respective total portfolio

⁴ Proponents of “free banking” argue that the market participants themselves will develop protective institutions spontaneously. See, for example, the discussion in Dowd (1994). Kaufman (1987) points to a benefit of banking crises. When governments are forced to step in and evaluate the “true” net worth of each bank, then information asymmetries between managers and depositors are removed.

⁵ Another argument is investor protection, in particular the protection of small retail bank depositors. Dewatripont and Tirole (1993) put this objective at center stage.

lio) must be considered. If not, economically rational banks would shift their activities to the unregulated risks, leaving the externality or stability problem unresolved. The comprehensiveness requirement is to be understood in a static as well as in a dynamic sense. That is to say, it should not only cover risks coming from standard instruments but should also be readily adjustable to new types of risks arising from innovations. Similarly, *coherence* is implied, meaning that equal risks should be treated equally (or unequal risks unequally).⁶ Of course, at the same time the regulation should not negatively affect other factors determining the banking sector's efficiency. One is that it should *not impede competition*. This means it should not create "undue" barriers to market entry or discourage incumbent banks from developing and applying state-of-the-art risk management techniques.⁷ Furthermore, the *regulatory burden* on banks should be *held at a minimum*, given that the goals can still be achieved. This is related to the *optimal "dosing"* of the tax implicit in any regulation. If it is too high, then bank business would be unnecessarily constrained or, in the case where dynamic comprehensiveness is not met, there are incentives for banks to develop instruments which are not, or only partly, covered by the regulation in order to avoid its costs or gain additional returns to compensate for them.⁸ If the tax is too low, the (expected) social costs of bank failures are not sufficiently reduced.

It is beyond the scope of this paper to provide a thorough discussion of all national regulatory practices regarding these criteria. However, one problem associated with the government interventions may be pointed out. In many industrialized countries one finds a (semi) public deposit insurance scheme with fixed premia per currency unit deposited (*Dale*, 1984; *Carisano*, 1992).⁹ Small deposits are *explicitly* covered, but observers generally regard most large deposits as *implicitly* insured, since governments are usually ready to bail out big banks in trouble ("too big to fail" argument). In fact, such an arrangement removes the possibility of crises in practically all bank-run models, such as *Chari* and *Jagannathan*

⁶ The issue of coherence is addressed more carefully further below.

⁷ Some economists draw from empirical support for the "charter value hypothesis" (*Keeley*, 1990), claiming a negative correlation between monopoly rents in banking and the riskiness of bank portfolios (as measured by capital ratios), the conclusion that market entry to banking *should* be restricted.

⁸ See *Gardener* (1991, pp. 103f.) for a brief discussion of the relationship between bank regulation and financial innovation.

⁹ An exception is Germany, where banks belong to private deposit guarantee funds set up by banking associations. The French deposit insurance scheme is private, as well. The FDIC Improvement Act from 1991 provides for some risk-sensitivity of deposit insurance premia in the United States (*Goldstein*, 1995).

(1988) or *Diamond and Dybvig* (1983). But this benefit comes at a cost. It does not solve the principal-agent problem between managers and depositors, but only transforms it in a multi-stage form. The monitoring task is shifted from depositors to the insurer, but the latter's managers do not risk their own funds but ultimately those of taxpayers, most of them being bank depositors. Moreover, as *Merton* (1977) points out, the value of insurance to the deposit issuer is increasing in its asset risk and decreasing in its capitalization. Hence, insured banks will engage in riskier activities on the asset side while maintaining as little capital as possible. As long as the insurer is not pricing the contracts he offers according to the risk characteristics of each insured bank, increased risk-taking will make deposit insurance very costly (moral hazard). Thus, flat-rate deposit insurance will require *additional* regulation.

2. Lessons from Portfolio Theory for Capital Adequacy Requirements

Be it for the limitation of systemic risk in general or the adverse effects induced by flat-rate deposit insurance many of the industrialized countries attempt to put a cap on the riskiness of bank portfolios, e.g., through minimum capital requirements. The rationale for capital adequacy requirements is that, for a given portfolio risk, the higher the own funds of the bank the lower the failure probability. However, since portfolio risk is endogenous economic theory warns of *simple* ratios, for example those relating the (unweighted) sum of assets to capital. The model of *Koehn and Santomero* (1980) puts it in terms of modern portfolio theory. Managements optimizing the expected utility of bank portfolios would react to an external limit on their capability to leverage by decreasing the share of less risky assets and increasing the share of more risky assets in their portfolio. While for more risk averse managers the increase in asset risks will be lower than the decrease in the risks related to the restriction on leveraging, for less risk averse managers it will be the other way around. Therefore, the effect of simple capital ratios on the average probability for bank failures is ambiguous, the actual sign depending on the distribution of attitudes toward risk among bank managers in the economy.

Results for more sophisticated capital adequacy ratios are more constructive for bank regulation. *Kim and Santomero* (1988) show in a similar portfolio-selection framework that a vector of "theoretically correct" risk-weights for a linear measure of assets in the denominator of the capital-to-assets ratio can be found, such that the adverse reshuffling of

portfolios, possibly increasing failure risks, is avoided. However, if the weights in the risk-related capital ratio deviate from the “correct” ones, then the regulation can be counterproductive as in the case of a simple ratio. This defines the term *coherence* of a regulation, introduced above, more precisely. A coherent regulation uses the “correct” risk weights. An incoherent regulation might increase systemic risk. Interestingly, the “theoretically correct” risk weights derived by *Kim* and *Santomero* (1988) only depend on the risk-return structure of banks’ assets and deposits and the maximum acceptable bank insolvency risk chosen by the regulator, but not on individual banks’ risk aversions.

Elaborating on some restrictive assumptions of the above theories *Rochet* (1992, p. 1160) argues that, in complete markets, even risk-related “capital regulations (at least of the usual type) are a very poor instrument for controlling the risk of banks; they give incentives for choosing ‘extreme’ asset allocations, and are relatively inefficient for reducing the risk of bank failures”. Moreover, he finds that actuarially determined, i. e., risk-related, deposit insurance premia are the “correct” instrument. This can be interpreted as one version of the portfolio-risk tax to counter external costs of bank failures suggested above.¹⁰

In the case of incomplete financial markets, *Rochet* (1992, pp. 1155 ff.) finds that the general result from *Kim* and *Santomero* (1988) is repeated, if risk-weights are not completely “market-based”. However, if risk weights are proportional to the betas, as known from standard portfolio theory – i. e., related to the covariability of the respective assets’ return with that of the market portfolio – then failure probabilities decrease without inducing banks to select portfolios inefficiently. Hence, if market incompleteness is a reasonable assumption, this latter result could be taken as an argument for a comprehensive “market-based” capital adequacy regulation.¹¹ The main lesson from portfolio theory therefore is

¹⁰ For discussions of the problems related to risk-adjusted deposit insurance premia, see *Carisano* (1992), *Chan et al.* (1992), as well as *Freixas* and *Rochet* (1996).

¹¹ Since the 1988 Basle Accord (Committee on Banking Regulations and Supervisory Practices (CBRS), 1988) is an example of a capital adequacy regulation limited to credit risks of banking assets (and off-balance-sheet items) alone, this would provide a theoretical basis for proposals to amend it for market risks (BCBS, 1993b, 1995a,b,c), although even after its introduction “marking to the market”, as opposed to “historical cost accounting”, would remain somewhat incomplete (*Tirole*, 1994). For a discussion of the problems related to marking to the market in capital adequacy regulations, see *Beattie et al.* (1995) as well as *Dewatripont* and *Tirole* (1993, Chap. 10.3). We shall come back to the Basle proposals and decisions in section IV.

that risk weighting is essential for capital adequacy requirements to achieve the aim of reducing systemic risk. Items which add a larger part to overall portfolio risk need to require more capital than items which contribute less to overall portfolio risk. This criterion, which holds in general, can now be applied to the practice of foreign exchange risk regulations.

III. Current Foreign Exchange Risk Regulations in Industrial Countries

Foreign exchange risk is the risk entering bank portfolios through fluctuations of exchange rates. Banks may be exposed to forex risk through currency positions from their more traditional lending business (e.g. credits denominated in foreign currencies) or through currency positions from their activity in securities dealing (e.g. trading book in foreign bonds, shares or currency options) or through currency positions from non-dealing participations in foreign companies or subsidiaries (structural positions).¹² Forex risk is one type of market risk, possibly related to other types of market risks such as interest rate risk. (Of course, items due to market risks may also be due to other risks such as credit (counterparty) risk). Forex risk taking by banks was limited by many national prudential regulators some time after the advent of floating exchange rates. In this section we dwell on the details of national forex risk regulations, as they stood until 1995, i.e., *before* international harmonizations came into effect. The following section will concentrate on recent steps and proposals to introduce minimum standards for forex risk capital adequacy requirements in the European Union and the G-10.

Recent initiatives to harmonize forex risk regulations in industrial countries contain limits on banks' forex positions through a *capital adequacy requirement*. This means that capital (K) must be greater than or equal to a certain fraction (α) of the overall foreign currency position (P).

$$(1) \quad K \geq \alpha P$$

A capital adequacy requirement of α (say 10 percent) translates into a *forex exposure limit* of $1/\alpha$ (1000 percent).

¹² Structural positions, such as fixed capital assets or securities of subsidiaries and participations, are unlikely to be liquidated in the short-run and, hence, different from share-holdings in the trading book.

$$(2) \quad P \leq \frac{1}{\alpha} K$$

However, a forex exposure limit need not imply a capital adequacy requirement, since the former need not relate to capital, as the case in several developing countries (Hartmann, 1994), but can be expressed in absolute terms, say in US dollars ($P \leq p$ US\$). Moreover, regulators in some countries reserve the term exposure limit to regulations where single currency positions are limited separately in order to guarantee a minimum diversification of currency positions, although a capital adequacy requirement like (1) can be defined for single currency positions as well as for overall positions. In order to facilitate international comparisons we shall translate all forex risk regulations into exposure limits like (2).

An important issue is how the overall foreign currency position (P) is defined. Practices in industrial countries involve three different measures. Let A_{ij} denote the home-currency value of notional asset i denominated in currency j (long positions) and L_{ij} the same for notional liabilities (short positions). The first forex position measure is that used by the Bank of Japan, named *net aggregate position (NAP)* by Levonian (1994).

$$(3) \quad \text{NAP} \equiv \left| \sum_i \sum_j (A_{ij} - L_{ij}) \right|$$

The apparent feature of this measure is that long and short positions are netted, independent of the currency in which they are denominated. The inherent assumption in this procedure is that the correlation coefficient between any two foreign exchange rates is 1. In other words cross-currency risk is completely ignored.¹³

The second overall position measure completely avoids cross-currency netting, implying the assumption that cross-currency correlations are minus 1. It is the current practice in Germany and was named *gross aggregate position (GAP)*, or Bundesbank method.

$$(4) \quad \text{GAP} \equiv \sum_i \sum_j (A_{ij} + L_{ij})$$

¹³ The Bank of Japan justifies this practice with the fact that until quite recently the largest part of all forex positions of Japanese banks were in a single currency, the US dollar.

Table 1 (continued): Summary of Foreign Exchange Exposure Regulations in Industrial Countries

Country	Limits on Net Single Foreign Exchange Positions	Limit on Overall Foreign Exchange Position	Definition of Overall Foreign Exchange Position ^{1/}	Reference Quantities in Case of Individual or Relative Limits ^{2/}	Timely Enforcement of Limit(s)	Foreign Exchange Exposure Regulations for Nonbank Financial Institutions	Remarks, Changes
Germany	None	21 percent	GAP (including on- and off-balance-sheet (forwards, options) items, except fixed assets, shares and other participations; (unhedged) options are considered with their exercise price times a percentage rate determined by the extent they are in the money and by the remaining time to maturity).	Tier-2 capital	End of day	Investment companies (investment funds, including money market funds) are explicitly exempted from the limit for banks, but they cannot buy or sell forex forward or option contracts except for hedging purposes; they do not face different limits on other forex positions than on home-currency positions.	Banks can only use own option valuation models when they produce higher capital requirements than those of the method reported in column four; transformation of EU Capital Adequacy Directive is expected for summer 1997 with full effectiveness mid 1998.
Japan	None	Individual limit for each authorized foreign exchange bank.	NAP (including on-balance-sheet items, forward and swap contracts, but not unstruck options).	Individual limits based on capital, forex turnover, management quality and internal controls.	End of day	...	Monthly reporting of forex positions.
Netherlands	None	12.5 percent	GAP (including on- and off-balance-sheet (forwards, options) items; options are considered using hedge ratios as published by options exchanges or, if unavailable, as computed internally with a method approved by the Netherlands Bank; capital provided to foreign branches can be excluded).	Capital	Daily	...	Positions in EMS currencies with a narrow exchange rate band (± 2.25 percent) can be given lower weight, but this allowance was made unapplicable by the enlargement of EMS bands to ± 15 percent in September 1993; transformation of EU Capital Adequacy Directive completed.
New Zealand	None	40 percent	MAP (including all on- and off-balance-sheet items, except structural positions; options are considered using the portfolio-delta technique).	Tier-1 capital	End of day	None	In 1996 the Reserve bank of New Zealand abolished the explicit forex exposure limit and switched to a public disclosure regime, where banks will be obliged to disclose comprehensive information on their forex positions (and other risks) to the general public; public reporting requirements are much the same as those formerly stipulated by the Reserve Bank on a confidential basis; the new regime does not include a requirement for internal forex position limits of banks.
Norway	10 percent	(1) 10 percent (2) 20 percent	(1) NAP (2) MAP (both include on- and off-balance-sheet [such as forwards and options] items).	Capital	...	All financial institutions which are authorized by Norges Bank to engage in forex activity are due to these limits (this includes, apart from banks, mortgage and finance companies).	The Bank of Norway (1994) reports 28 cases for 1993 where limits were violated (1992: 42 cases), mainly concerning the 10 percent limit on the net position in the most actively traded single currencies (DM, Nkr, US\$); as a member of the European Economic Area (EEA) Norway has to harmonize its forex risk regulation with EU standards.

Table 1 (concluded): Summary of Foreign Exchange Exposure Regulations in Industrial Countries

Country	Limits on Net Single Foreign Exchange Positions	Limit on Overall Foreign Exchange Position	Definition of Overall Foreign Exchange Position ^{1/}	Reference Quantities in Case of Individual or Relative Limits ^{2/}	Timely Enforcement of Limit(s)	Foreign Exchange Exposure Regulations for Nonbank Financial Institutions	Remarks, Changes
Portugal	None	Individual limit for each authorized forex dealer.	...	Individual limits based on capital and involvement in forex trading.	...	All credit institutions authorized to trade on the forex market are due to such limits.	This regulation is provisional and expected to be adjusted so as to converge to the outcome of the transformation of the EU Capital Adequacy Directive by the end of 1995.
Switzerland	None	1000 percent	GAP (including on- and off-balance-sheet (forwards, options) items, options are accounted for with at least the portfolio delta).	Tier-2 capital	Not explicitly specified, but the Eidgenössische Bankenkommision expects that banks verify compliance with the limit at the end of each day.	Currently no forex risk regulations for non-bank financial institutions, but they will be introduced for securities dealers in the future.	Banks have to indicate the regulatory authority when their GAP exceeds 40 percent of capital; Swiss authorities are currently revising the banking regulation, a draft version implies a GAP limit of 1250 percent of capital.
United Kingdom	Individual limits for each bank ≤ 10 percent.	Individual limit for each bank ≤ 15 percent.	MAP (including on- and off-balance-sheet (forwards, options) items), but excluding structural positions, proficient banks can use their own formulae to determine forex exposure from options, others must apply a "worst view" approach (roughly position = exercise price)).	Tier-2 capital	End of day	...	Limits relate to dealing position guidelines agreed with each bank and are not "formal"; only proficient banks enjoy the maximum amounts, for other banks more restrictive guidelines are determined on the basis of their experience and internal control system; monthly reporting of forex positions; Bank of England (1995) has issued a notice describing the implementation of the EU Capital Adequacy Directive in the UK, which would allow banks to use their internal models to determine capital requirements as in the new Basle proposal (1995) for G-10 countries, but benchmark tests have to ensure that capital charges found are not lower than those that would result from the EU simulation method.
United States	None	None	n.a.	n.a.	n.a.	No explicit restrictions on forex risk exposure.	Forex exposure is monitored through off-site surveillance (weekly and monthly reporting of positions) and through on-site examinations.

Sources: National regulatory texts and information provided by central banks, Bank of Norway (1994), "Bankrecht" (1995), Basle Committee on Banking Supervision (1995b, 1996a), Blaschke (1996), Conseil des Communautés Européennes (1993), "Banks Warned on Linking Bonuses to Profits" (1994), Goldstein et al. (1993), Reserve Bank of New Zealand (1991, 1994, 1995, 1996), "Searching for Consensus On Risk Assessment" (1994).

Notes: "..." means not available, n.a. means not applicable.

^{1/} GAP (gross aggregate position): sum of the absolute amounts of all net single currency positions; MAP (maximum aggregate position): sum of all net long single currency positions or sum of all net short single currency positions, whatever the greater; NAP (net aggregate position): sum of all net single currency positions (long +; short -).

^{2/} Tier 1: shareholders' equity, disclosed reserves; tier 2: tier 1 plus revaluation reserves, loan loss reserves and parts of subordinated debt; tier 3: tier 2 plus additional classes of unsecured, subordinated debt. Capital definitions are given whenever possible, but differences in national accounting standards imply that they are not always comparable.

^{3/} Member countries of the EU can apply an even less restrictive limit of 6250 percent of capital to offsetting positions in two currencies participating in stage II of European Monetary Union.

^{4/} λ₁ and λ₂ are considered to be confidential by the Bank of Finland and cannot be reported here.

Table 1: Summary of Foreign Exchange Exposure Regulations in Industrial Countries

Country	Limits on Net Single Foreign Exchange Positions	Limit on Overall Foreign Exchange Position	Definition of Overall Foreign Exchange Position ^{1/}	Reference Quantities in Case of Individual or Relative Limits ^{2/}	Timely Enforcement of Limit(s)	Foreign Exchange Exposure Regulations for Nonbank Financial Institutions	Remarks, Changes
G-10 countries (January 1996 market risk amendment of the Basle Capital Accord by the Basle Committee on Banking Supervision).	None	1250 percent	MAP (including on- and off-balance-sheet items (currency forwards, options, swaps, certain guarantees), banks writing currency options can choose between a "delta-plus method" and a "scenario analysis" to include delta, gamma and vega risk components in the position measure).	Tier-3 capital	Banks are expected to manage their forex risk in such a way that the limits are met at the end of each business day, although reporting in most countries will be less frequent (e.g. quarterly); they are also expected to ensure that intra-day exposures are "not excessive".	Area of the International Organisation of Securities Commissions (IOSCO); cooperation between the Basle Committee and the IOSCO were disturbed when efforts for a joint proposal broke down in 1993 ("Banks Warned...", 1994); resumption of cooperation (BCBS and IOSCO, 1995; Tripartite Group, 1995) did not result in a IOSCO proposal for investment companies yet.	Basle Committee leaves a choice between a "standardized method" and the use of banks' own "internal models", meeting certain standards described in the main text; the amendment contains "minimum requirements", i.e., national regulators could introduce or maintain more restrictive rules; it has to be fully effective by the end of 1997.
European Union (1993 Capital Adequacy Directive by the Commission of the EU, "CAD I").	None	1250 percent (for offsetting net positions (1) in two "narrowly" correlated currencies: 2500 percent, (2) in two currencies related through a legally binding exchange-rate agreement: two times the inverse of the maximum allowed percentage change in the rate percent. ^{3/}	MAP (including on- and off-balance-sheet items (currency forwards, swaps, certain guarantees); currency-option positions are considered using the portfolio-delta technique).	Tier-3 capital	Not explicitly determined, but several indications that compliance at the end of each business day is envisaged.	Directive requires the same minimum rules for banks and investment companies.	EU allows a choice between the method described and two "simulation methods", similar to that of the G-10 April-1993 proposal (BCBS, 1993b; the reduced capital adequacy in case of legally binding exchange-rate arrangements can also be applied to those); when a financial institution exceeds the limit, it has to report this to its authorities; the Directive provides minimum requirements for national regulators; it had to be transformed into national laws/rules until July 1995 being fully effective by January 1996, but only 6 European countries had implemented by April 1996 (Blaschke, 1996); EU Commission launched a working party negotiating "CAD II", which is not expected to be implemented before early 1998.
Australia	None	Individual limit for each authorized forex dealer.	MAP (including all on-and several off-balance-sheet items, but excluding structural positions).	Individual limits based on capital, proficiency in forex dealing, internal management controls, and dealer's market profile.	End of day	Procedure for setting and enforcing overnight limits applies also to non-banks authorized to deal in foreign exchange.	
Austria	None	(1) 30 percent (2) 50 percent (3) 50 percent	(1) GAP (2) GAP of items becoming due in any quarter at least three quarters ahead (3) GAP of items becoming due in any semester at least one year ahead (includes forwards, accrued interest, guarantees; hedged positions excludable).	Tier-3 capital	End of day	...	Austrian National Bank may reduce these limits by up to 10 percent and add instruments to be included in the calculation of open positions if new risks arise from developments in the foreign exchange market; after its entry in the European Union Austria has to adopt the EU Capital Adequacy Directive.

Table 1 (continued): Summary of Foreign Exchange Exposure Regulations in Industrial Countries

Country	Limits on Net Single Foreign Exchange Positions	Limit on Overall Foreign Exchange Position	Definition of Overall Foreign Exchange Position ^{1/}	Reference Quantities in Case of Individual or Relative Limits ^{2/}	Timely Enforcement of Limit(s)	Foreign Exchange Exposure Regulations for Nonbank Financial Institutions	Remarks, Changes
Belgium	None	None	n.a.	n.a.	n.a.	...	Belgian banks are not subject to formal forex exposure limits, but the Commission Bancaire et Financière requires that they respect own internal overnight and intra-day limits on single currency positions and the overall position (MAP, GAP or similar); the regulatory authority issues forex management guidelines specifying the way limits have to be run and follows banks' positions through periodical reporting requirements using informal warning thresholds (in terms of GAP) fixed in relation to banks' capital bases; transformation of EU Capital Adequacy Directive required until July 1995.
Denmark	None	None	MAP (only for reporting requirements, including all on- and off-balance-sheet items).	Tier-2 capital (only for reporting requirements).	n.a.	Zero-position limit for mortgage credit institutes; stock broker companies must not buy or sell foreign exchange unless it is related to their trading in foreign securities.	Danish banks are not subject to explicit forex exposure limits, but have to report indicators of their forex risk on a monthly basis; active dealers have to report their positions daily; indicator 1 is MAP, indicator 2 is a simulation of potential losses based on historical exchange rates and has to be used if indicator 1 exceeds 25 percent of a bank's own funds; transformation of EU Capital Adequacy Directive completed.
Finland	λ_1 percent ^{4/}	λ_2 percent ^{4/}	NAP (including all on- and off-balance-sheet items (with structural positions), options are considered using the portfolio-delta technique, forward positions also include cross-currency contracts).	Tier-2 capital	Both limits are for end of day; overall position against Fmk is also computed as a moving average over 2 business days, which must not exceed $2\lambda_2$ at the end of each day.	Other credit institutions (such as finance companies) authorized to deal with foreign loans face explicit foreign currency position limits.	Smaller banks have operational limits deviating from the general rules; "consolidation" with respect to forex positions includes parent banks and their foreign branches, but not domestic and foreign subsidiaries; Finland experienced a crisis at KÖP (Konsallis-Osake-Pankki) in 1991, one of the two dominant commercial banks, due to imprudent forex position taking in one foreign non-bank subsidiary; because of the limited consolidation rules this behavior did not violate Finnish forex exposure regulations; after its entrance in the European Union Finland has to adopt the EU Capital Adequacy Directive, this is expected to be finished in early 1996.
France	50 percent for EMS curr. (incl. ECU), 15 percent for non-EMS curr.	133 percent for part in EMS curr. (incl. ECU), 40 percent for part in non-EMS curr.	MAP (including all on- and off-balance-sheet items, except structural positions); options can be considered using the portfolio-delta technique).	Tier-3 capital	At any time	...	Trimestrial reporting of forex positions; transformation of EU Capital Adequacy Directive completed.

The Bank of England uses an intermediate approach, which I call *maximum aggregate position (MAP)*. It sums long and short positions separately and then takes the bigger of both values.

$$(5) \quad \text{MAP} \equiv \max \left\{ \sum_i \sum_j A_{ij}, \sum_i \sum_j L_{ij} \right\}$$

In fact, it can be proven that MAP is the arithmetic mean of NAP and GAP. Roughly speaking, this means that “on average” cross-currency correlations have to be 0 (*Levonian, 1994*).

To see that $\text{MAP} = 1/2(\text{NAP} + \text{GAP})$ define $A \equiv \sum_i \sum_j A_{ij}$ and $L \equiv \sum_i \sum_j L_{ij}$. From (3) and (4) follows that $\text{NAP} = |A - L|$ and $\text{GAP} = A + L$. Moreover, $|A - L| = \max\{A, L\} - \min\{A, L\}$ and $A + L = \max\{A, L\} + \min\{A, L\}$. From (5) $\text{MAP} = \max\{A, L\}$. This can be rewritten as $\max\{A, L\} = 1/2(\max\{A, L\} + \max\{A, L\}) = 1/2(\max\{A, L\} + \max\{A, L\} + \min\{A, L\} - \min\{A, L\}) = 1/2(\text{NAP} + \text{GAP})$.

Table 1 summarizes national foreign exchange risk regulations in 15 industrial countries (as collected in 1994 and 1995) and puts them into perspective with recent steps by the European Union and the Group of Ten (G-10) to harmonize those regulations. Apparently, three types of forex risk regulations can be differentiated. In a first group of countries, including Belgium, Denmark and the United States, the regulatory authorities do not impose explicit limits on banks' forex risk exposure, but monitor positions relatively closely and might exert “moral suasion” if a bank seems to take undue risks. In a second group of countries (Australia and Portugal) forex exposure limits are not public and specific to each bank. These individual limits depend not only on banks' own funds but also on their proficiency and prudence in forex risk management as evaluated by the regulatory authority. However, most developed countries (Austria, Finland, France, Germany, Japan, Netherlands, New Zealand, Norway, Switzerland) impose explicit forex exposure limits related to banks' capital bases.¹⁴

Practically all countries in the sample use one of the three position measures defined above, be it for an explicit limit or monitoring purposes alone. The most widely used measure (Australia, Belgium, Denmark, Finland, France, New Zealand, Norway, UK) is the Bank of England approach (MAP). The Bundesbank approach, GAP, is predominant in Germany and its neighbours (Austria, Belgium, Netherlands, Switzer-

¹⁴ In the case of the United Kingdom aspects of all three approaches seem to be combined. However, UK regulation might come closest to the second approach.

land). The use of NAP is limited to Japan and Norway.¹⁵ An important issue is which items enter in the position measure (see the comprehensiveness criterion in the theoretical section above). It is reassuring that off-balance-sheet items such as derivatives like forward and option contracts are widely accounted for. Some heterogeneity enters through the inclusion (or possible exclusion) of structural positions, i.e., those of non-dealing nature such as fixed capital assets or securities of subsidiaries and participations. Where limits exist they are always related to capital, hence expressing these regulations as exposure limits (as in the table and equation (2)) or as capital adequacy requirements (equation (1)) is equivalent.¹⁶ In general, exposure limits relate to the overall position in all currencies, but Finland, France, Norway, and the UK impose lower limits on the net position in any single currency in order to avoid undue concentration.

As a general feature, banks due to limits cannot exploit the *observed* correlations between different currencies in order to lower their capital charge.¹⁷ As described above, MAP, GAP and NAP imply uniform assumptions on the correlations between any two currencies (-1 , 0 or $+1$). Similarly, possible correlations between exchange rates and other market risk sources cannot be taken into account. In contrast to many developing countries (*Hartmann, 1994*), current industrial countries' exposure limits are symmetric with respect to long and short positions.¹⁸

Most countries seem to agree that banks must comply with regulatory limits at closing of each business day, leaving them more leeway to adjust dealing positions during the normal business hours. In any case, the regulatory authorities are hardly able to monitor intra-day positions, even if some oblige banks to respect limits at any time. Reporting of

¹⁵ Belgium permits the use of MAP *and* GAP for banks' internal limits. Norway requires banks to comply to different limits for the GAP *and* the MAP measure. Hence both countries appear twice in the above lists.

¹⁶ Where the information was available the table gives some indication in terms of the Basle Committee's tier system on the concept of capital used respectively. However, because of differences in national banking systems and accounting rules international comparisons of these measures of own funds should be made with caution (*Scott and Iwahara, 1994*).

¹⁷ Exceptions are France and the Netherlands, where some allowances are made for positions in EMS currencies (see Table 1). However, at least the Dutch allowances were made inapplicable through the enlargement of EMS exchange rate bands in 1993.

¹⁸ As discussed in section V, asymmetric forex position limits for prudential purposes could – in certain circumstances – increase the amplitude of long-run exchange rate fluctuations.

positions to the authorities is usually required at longer time intervals (monthly or quarterly). Moreover, prudential forex exposure limits for banks are often not, or only selectively, applied to non-bank financial institutions (see also *Goldstein et al.*, 1993).

The relative restrictiveness of national regulations mainly depends on the definition of the overall position measure (e.g. GAP is, *ceteris paribus*, more restrictive than MAP), the definition of capital (e.g. tier 1 is more restrictive than tier 2), the percentage limit (e.g. 30 percent is more restrictive than 40 percent of capital) and the rigour with which the limits are reinforced by the regulatory authorities. It appears that a clear ordering of all countries is hardly possible, although some countries' regulations look definitely tougher than others' (e.g. Austria's or Germany's limits seem to be stricter than those of France, while the latter's, in turn, seem to be more restrictive than Switzerland's). Uncertainties about the relative restrictivenesses enter above all through differences in accounting practices (*Beattie et al.*, 1995; *Choi and Levich*, 1994; *Goldstein*, 1995), the measurement of option positions, the inclusion or not of structural positions, the relation to capital requirements for other market risks or credit risk¹⁹ and the degree of enforcement of limits. For example, while Norway's limits look relatively narrow, there is some evidence for their violation during 1992 and 1993 (Table 1, last column).

IV. Recent Efforts to Harmonize Market Risk Regulations

In the preceding section and Table 1 foreign exchange risk regulations in 15 industrial countries were described. Recent initiatives taken by the Basle Committee on Banking Supervision (BCBS) and the EU Commission aim at harmonizing prudential market risk regulations, including forex risk, in the G-10 and the European Union. In this section we first outline the rationale for international coordination of national banking regulations and then discuss the recent proposals.

1. *International Coordination of Banking Regulations and the Basle Committee*

Systemic risk, i.e., the danger of contagious bank crises is the main reason for (national) banking regulation. In a world where banks are

¹⁹ In most countries though capital requirements for forex risk are simply added to the requirements for interest rate or credit risk.

trading securities as well as lending and borrowing heavily across national borders this risk is not limited to one jurisdiction. A single bank failure in one country can easily spill over in another country. So far, *international systemic risk* is not different from national systemic risk. However, the existence of nation states can induce additional problems for the allocation of banking risks. This is because national policymakers, when deciding on their regulatory framework, may care less about the expected costs of bank failures in foreign countries than at home (similarly *Chiappori et al.*, 1991, p. 101). In such a situation standard game-theoretic reasoning suggests that, if the number of relevant countries is not too large and if national policymakers negotiate national regulations, taking the positive or negative *external effects* of each country's scheme on all others into account, world welfare could be increased.

The argument is usually made in terms of “regulatory dumping”, or “competitive deregulation” as *Dale* (1984, p. 172) calls it. For example, some offshore banking centers are said to keep prudential supervision at a low level in order to attract subsidiaries of foreign banks, gambling that the protective arrangements of the parent bank's country activate in case of problems. However, the argument also works the other way around. Countries with potentially risk-enhancing “over-regulation” (such as poor risk weighting in capital requirements) may impose an (expected) external cost on countries with successful but more light-handed supervisors. Whatever the reason for international risk externalities through national bank regulations, “regulatory dumping” or “over-regulation”, they represent a standard argument for international coordination. Considering the experiences with efforts in harmonizing different countries' banking regulations, it has to be discussed whether ex post coordination through the market is actually less efficient than ex ante coordination through government negotiations and international agreements.

The establishment of the Basle Committee on Banking Supervision (BCBS) in 1974 apparently was the first serious effort on international cooperation in banking regulation on a multilateral basis.²⁰ It was the

²⁰ The original name of the Basle Committee, which is located at the Bank for International Settlements, was Committee on Banking Regulations and Supervisory Practices (CBRS). Its members are the 11 G-10 countries (Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, United Kingdom, United States) plus Luxembourg. Each country is represented by its central bank and other bodies, if they exist, that are responsible for banking regulation. Decisions are usually taken by unanimous agreement among the members. However, they have not the status of international “hard” law (*Hayward*, 1991, p. 67f.; *Norton*, 1991, p. 94). For descriptions of the Committee's evolution see *Gardener* (1991), *Hayward* (1991, 1992), *Hartmann* (1994) and *Kapstein* (1991).

immediate reaction of regulators to the German Herstatt Bank's failure in the same year and the extended discussion of the distribution of its international costs. In the following years it fostered information exchange between national regulatory authorities and produced a Concordat (1975) on the distribution of supervisory responsibilities between home and host regulators of an internationally active bank. The first major achievement of this body was the 1988 Basle Accord (*CBRSP*, 1988; *Wiebke*, 1992a,b) requiring a minimum capital requirement of 8 percent against credit risk, as measured by a weighted sum of bank assets. This regulation became fully effective in the G-10 and Luxembourg at the end of 1992, but since 1988 a large number of non-G-10 countries adopted similar capital adequacy requirements (*Price Waterhouse*, 1991). Since the late 1980s the EU also took many steps to harmonize banking regulations, including a Solvency Ratio Directive (*Council of the EC*, 1989) along the lines of the Basle Accord, seeking to create a single European banking market (*Gruson and Feuring*, 1991).

The Accord was intended to achieve two main objectives. First, and according to one official of the Basle Committee (*Hayward*, 1991, p. 68f.) more importantly, the Committee wanted "to strengthen the soundness and stability of the international banking system" (reduction of international systemic risk). Secondly, it wanted to diminish "an existing source of competitive inequality among international banks" (creation of a "level playing field"; *CBRSP*, 1988, p. 2). Whether the Basle Accord is (or can be) successful in achieving these aims is still widely debated (*Dewatripont and Tirole*, 1992; *Di Cagno*, 1990; *Hartmann*, 1994; *Hook*, 1994; *Kapstein*, 1991; *Kim and Santomero*, 1988; *Scott and Iwahara* (1994); *Tirole*, 1994). In particular, its limitation to credit or counterparty risk exposed it to the criticism of incomprehensiveness, when banks became more and more involved in proprietary trading activities, and led to pressure to incorporate market risks in the Accord's framework. More recently, some have also questioned its coherence (*Grenadier and Hall*, 1996; *Hook*, 1994; *Yellen*, 1997). The original objectives will also apply to the amendments of the Basle Accord.

2. *The First Proposal to Include Market Risks in the Basle Accord*

In April 1993 the Basle Committee issued a first consultative paper on "The Supervisory Treatment of Market Risks" (*BCBS*, 1993b), including sections on the limitation of risks through fluctuations in interest rates, share prices and exchange rates. As with specific, including credit risk,

banks should be forced to hold enough capital to meet almost all possible losses through general market risk without becoming insolvent.

For the purpose of forex risk regulation the proposal left a choice between two approaches to determine the capital charge related to a given overall foreign currency position, a “shorthand method” and a “simulation method”. The “shorthand method” (see also first line of Table 1) consisted of an 8 percent capital adequacy requirement on the MAP measure, as defined in section II. In other words, the MAP of a bank must not be greater than 12.5 times capital. The “simulation method” was designed to generate hypothetical losses on a banks’ forex positions with daily historical exchange rates five years back and the assumption of a two-week holding period. There had to be enough capital to cover at least 95 percent of the occurring losses. To this number a mark-up of 3 percent of MAP was added as an additional risk-buffer, intended to achieve a rough equivalence in “toughness” between both methods (BCBS, 1993b, p. 42).

In both cases, spot (including accrued interest), forward, and option positions, as well as certain guarantees were taken into account for every single currency, whether they came from foreign exchange dealing or traditional commercial bank activities. Forward positions were recommended to be measured either at current spot rates or discounted in net present values. Offsetting spot-option positions (hedged positions) could be simply carved out of the whole calculation by banks not dealing in options. Others had to use the portfolio-delta technique.²¹

The industry responses on this proposal were, at best, mixed. In countries with relatively advanced banking systems (for example Canada, France, United Kingdom, United States) some expressed the view that it fell back compared to already existing risk management techniques, particularly exploiting portfolio effects (diversification). Other banks seemed to have been more favorable. More specifically and related to forex risk, the following six concerns were raised by banks or outside observers after the publication of the proposal:

- The “shorthand method” (MAP) puts all currencies on the same footing. When, for example, a German bank switches from a Dutch guilder position to one in US dollars, the capital charge would remain unchanged, although obviously the position’s riskiness has changed.

²¹ The option delta measures the effect of marginal changes in the price of the underlying, here a foreign currency, on the value of the option. E.g., *Cox and Rubinstein* (1985) show how the same principle can be used to measure the effects of small price changes of the underlying on the value of a portfolio of options.

- The heart of modern portfolio management is diversification, i. e., the reduction of overall risk by exploiting low or negative correlations between the returns of different instruments. It was felt that risk diversification was not sufficiently rewarded in terms of lower capital requirements. On the one hand the scaling factor prevented benefits from the consideration of portfolio effects through the “simulation method”, on the other hand the capital charges for the three broad market risk types (interest rate, share price and forex risk) are strictly additive.
- The 3-percent scaling factor discourages the use of the more precise and more costly “simulation method”. Moreover, some market participants already use or are developing more advanced risk management techniques. They would be forced to run two systems in parallel without being able to benefit from a lower capital charge through better risk measurement. This would be an obstacle for improvements in banks’ risk management.
- Derivative instruments usually combine several market risks. For example option values depend on the price level of the underlying (e. g. of a foreign currency), the volatility of the underlying (vega risk) and the level of interest rates (rho risk). Additionally, the relationship between underlying price and option price is non-linear, more precisely convex. For small price changes one can work with a linear approximation (delta risk), but many asset prices (e. g. exchange rates) can “jump” such that the convexity cannot be neglected (gamma risk). The proposed regulation for currency options considered delta risk alone and, thus, was not comprehensive.
- A simulation study with real forex positions of American banks undertaken at the Federal Reserve Bank of San Francisco concludes that “the proposed level of capital coverage (8 percent of MAP) appears to be very conservative” (*Levonian*, 1994, p. 16). This might indicate a too high regulatory burden for both methods.
- The regulations would not apply to securities firms. This would put banks at a competitive disadvantage.

Of course, regulatory authorities might object to some of the points made, for example arguing that correlations between some financial instruments might not be sufficiently stable to be considered or that the leptokurticity of exchange rate returns (the fact that large exchange rate changes are more likely than in the case of normally distributed returns) justifies the “very prudent” 8 percent capital adequacy requirement.

3. *The Revised Proposal and the Final Agreement*

Nonetheless, the G-10 regulators seem to have agreed to some points made by their country's bankers, such that the Basle Committee developed a new proposal "Planned Supplement to the Capital Accord to Incorporate Market Risks" (BCBS, 1995b), which was adopted with some additional changes in the "Amendment to the Capital Accord to Incorporate Market Risk" (BCBS, 1996a). Notice first the substantial alleviation of implied foreign exchange exposure limits as compared to previous regulations in most countries in the sample (Table 1). In many cases the Basle (and EU) limit restricting the overall forex position is by a two-digit factor larger than the national limit.

The compromise reached implies several important changes compared to the April-1993 paper. The most significant move is the decision to leave banks a choice between the use of a "standardized measurement framework" (in the case of forex risk roughly the former "shorthand method") and the use of their own *internal models* to measure market risks, conditional upon the fulfillment of a list of qualitative and quantitative criteria for risk management. Second, the final amendment permits not only the recognition of empirical correlations within the broad market risk categories but also *between* those categories when an internal model is used. Third, banks writing options themselves, even when choosing the standardized framework, would now be obliged to consider gamma (convexity) and vega (volatility) risk by applying either a "delta-plus method" or a "scenario analysis", simulating simultaneously on underlying price levels and volatilities. The standardized simulation method for forex positions does not figure in the texts any more. Finally, commodity price risk joined interest rate, share price and forex risk as a separate market risk category.

Banks' internal market risk management models aim at predicting potential future losses on current portfolios from historical or random-generated distributions of asset prices. More specifically, they usually attempt to derive a point estimate of "value at risk", i. e., a level of portfolio return such that there is a given (high) probability (level of confidence) of experiencing a return of less than that level of return. The Basle agreement stipulates that the use of these models to determine regulatory minimum capital has to be approved by the national supervisory authority. The *qualitative* conditions under which the latter can grant approval include

- the existence of an independent risk control unit producing and analyzing daily reports about the output of the model used;

- regular evaluations of the quality of the model in predicting actual portfolio value changes (back-testing programme; BCBS, 1996b);
- the implementation of a rigorous programme of stress testing, i.e., the simulation of potential losses under extreme (low probability) market conditions, like currency crises, stock or bond market crashes;
- the active implication of the senior management in the risk control process.

The *quantitative* criteria include

- the computation of “values at risk” on a daily basis and their aggregation assuming a holding period of 10 business days;
- the application of a 99-percent one-tailed confidence interval to derive “value at risk”;
- the use of historical price data at least one year back;
- the consideration of delta, gamma and vega risk for options;
- meeting a capital requirement expressed as the higher of the previous day’s “value-at-risk” number and the previous three-month average multiplied by $3 + c$, where $c \in [0,1]$ increases with the number of model failures over the preceding year as detected in the back-testing procedure.

For external validations of the quality of their internal models banks have to provide the details about their system, including the results of the back-testing programme, to their regulatory authorities.

The acceptance of banks’ internal market risk management techniques means a major shift in the policy of the Basle Committee. In principle, it improves the environment for competition-driven innovations in bank risk management. It should also substantially increase the coherence (correct risk weighting) of market risk regulations in G-10 countries. However, as any other regulatory scheme it also has some disadvantages. Most visibly, the task of banking supervision becomes much more complex, because of the multiplicity of methods which can be applied by different banks. This immediately raises the question of verifiability of the quality of the systems. On the one hand, it might be possible to hide “excessive” risk-taking behind a complicated technical apparatus signalling low risk. This danger will require that regulators hire expensive specialist staff from the private sector increasing their costs of supervision. On the other hand, the estimation of potential losses from “rare” events (tail probabilities) becomes the more inaccurate the less likely the event.

Since the quality of a model depends precisely on the coverage of these events, back-testing procedures have low statistical power to distinguish good from bad models (Kupiec, 1995). The latter is, of course, equally relevant for the external bank supervisors and for the internal risk managers.

Kupiec and O'Brien (1995a,c) point to a second, less obvious problem. Prudential capital adequacy regulation is based on loss-potentials over longer time-horizons than the day-to-day management of banks' trading portfolios. Aggregating linearly the daily "values at risk" as produced by banks' internal models to longer-horizon market risk measures relies on assumptions on the distribution of asset-price returns (such as normality or independence of return variances over time) and on the stability of trading positions not fulfilled in reality. Hence, even if daily "values at risk" are measured accurately, bi-weekly or monthly will generally not be accurately measured.²²

In contrast to these supervisory concerns, some larger banks expressed reservations to the "excessively conservative" quantitative criteria for internal models ("Unscharfe BIZ-Methode...", 1995). While the exploitation of portfolio-effects across the four broad risk categories was finally permitted, the size of the multiplication factor, which has also been subject to discussion in the consultative process for the revised market risk proposal, was left at the level of 3.²³ The Committee stuck to the multiplication factor of 3, arguing that inaccuracies related to the simplifying assumptions underlying "value-at-risk" models and the uncertainty whether historical market price changes represent future price changes well enough together with the scope for large intra-day positions justifies some conservatism, at least until more experiences with these models are available.²⁴

To summarize, the market risk amendment of the 1988 Basle Accord is a major step in the international regulation of banks. First, it opens the

²² Considering all possible sources of inaccuracy, both overestimation and underestimation of market risks is possible.

²³ For example, the managing director of the German banking association was quoted as saying that the multiplication by 3 (or more) would make the use of internal models more expensive than the standardized method thereby discouraging the former's use ("Deutsche Banken kritisieren...", 1995). It is not clear whether this statement still applies when banks make use of correlations between risk categories. For an empirical evaluation of the factor, see Jackson et al. (forthcoming).

²⁴ For a more comprehensive discussion of "value-at-risk" models and their role in financial regulation, see Hartmann (1996) and Jorion (1997).

door to a full-scale portfolio view of minimum capital requirements (coherence), at least for market risks.²⁵ Second, it makes G-10 minimum standards more comprehensive. Even though it has to be remarked that interest rate risk is only captured for banks' trading books and not for the maturity mismatches between assets and liabilities arising in banking books (BCBS, 1993a, 1997). Third, by allowing for banks' internal risk models it fundamentally changes the relationship between financial institutions and their regulators. The Committee decided that the amendment should be fully effective in G-10 countries (and Luxemburg) at the beginning of 1998.

4. *The EU Capital Adequacy Directives*

In contrast to the chronology of credit risk regulation (1988 Basle Accord), in the case of market risk regulation it was the European Union which led the G-10 with the adoption of its March-1993 Capital Adequacy Directive ("CAD I", *Conseil des Communautés Européennes*, 1993; see line 2 of Table 1). Since this Directive had to be transformed by the EU countries until the end of July 1995 (being fully effective by January 1, 1996), it is worthwhile comparing it with the Basle proposal.

First, while the EU Directive directly applies to banks and some other financial institutions, the Basle Committee's competence is limited only to banks.²⁶ Nonetheless, the CAD is very close to the first Basle market risk proposal (BCBS, 1993b), leaving a choice between an 8 percent capital adequacy requirement on MAP and simulation methods. However, in measuring the forex positions' risk potential, banks in EU countries can reduce the capital charge by taking particular exchange rate correlations or

²⁵ However, for those banks using the standardized measurement framework capital requirements for foreign exchange risk will remain strictly additive to those of the other market risk categories.

²⁶ Initially the Basle Committee and the International Organization of Securities Commissions (IOSCO) tried to coordinate their efforts to issue a joint proposal for banks *and* nonbank financial institutions. However, when the IOSCO did not come up with its proposal, the Committee went ahead alone, which seem to have disturbed the relationship between both bodies ("Banks Warned...", 1994). While cooperation between Basle and IOSCO was resumed recently (BCBS and IOSCO, 1995; Tripartite Group, 1995), there is still no explicit proposal for the international harmonization of prudential securities firms regulations. The regulation of these non-deposit taking institutions has focused until recently on fairness and conduct of business rules. However, with the increasing integration of banking and investment business (OECD, 1993) it is now more and more questioned that they cannot be a source of systemic risk. Therefore, the G-7 Summit in Lyon asked for better coordination between the different types of financial regulators.

intergovernmental exchange rate arrangements into account. In particular, when the MAP measure is used, then offsetting long and short positions in two “narrowly” correlated currencies will require a capital charge of only 4 percent of the respective position’s amount – implying a forex exposure limit of 2,500 percent of capital. Moreover, if the exchange rate of two currencies is related through a legally binding intergovernmental contract, then the capital on offsetting long and short positions in these currencies can be as low as half the maximum percentage change allowed for the respective exchange rate in the arrangement times the amount of those positions (8 percent for non-offsetting positions).

The Directive allows for a simulation approach (which was dropped from the recent Basle amendment) but gives more degrees of freedom concerning its specification than the old Basle proposal. For example, the simulations can also be done with an observation period covering the preceding three years, but then the confidence interval has to be of the order of 99 percent (instead of 95 percent with data five years back). The option of a reduced capital charge for currencies with binding exchange rate arrangements can also be applied to the simulation methods.²⁷ However, there is no “scaling factor” to be added on the capital charge resulting from any of the chosen simulation methods. As the old Basle proposal the EU CAD neglects gamma and vega risks for options and, most importantly, does not allow banks to use their own internal risk management models. Capital requirements for foreign exchange and other market risks are strictly additive excluding the exploitation of correlations between them. Other differences between both regulations concern the definition of capital, the definition of the trading book and the weighting of (specific) equity price risk.

This comparison reveals a coordination problem now created between EU and G-10 regulators, in particular on the use of internal models. As both texts read at this point, banks from non-EU G-10 countries like the US or Japan could use their internal models in the future while, for example, those from Germany, France or the UK could not. However, some countries concerned seem to have reached a compromise with the EU Commission on the issue of internal “value-at-risk” models, the so-

²⁷ Even more reduced capital charges can also be applied to offsetting positions in EU countries’ currencies participating in stage II of European Monetary Union. The minimum capital requirement amounts to 1.6 percent of these positions’ amounts (exposure limit: 6,250 percent of capital). However, the 1992/1993 disruptions in European exchange markets and the subsequent enlargement of exchange rate bands might have rendered this passage obsolete.

called “Amsterdam Accord”. This is, for example, reflected in a notice by the *Bank of England* (1995) on the transformation of the EU CAD in the United Kingdom. The Bank actually allows for internal models, but requires benchmark tests which ensure that the capital requirements found with them do not fall below those that would result from the EU simulation method (*Bank of England*, 1995, par. 8.65 f.). In order to keep the burden resulting from this double forex risk measurement low, benchmark tests will have to be realized only about every six months. Other countries have delayed the transformation of the CAD. By April 22, 1996 only six EU members had notified its implementation to the Commission.²⁸

In response to this coordination problem and experiences with CAD I the EU Commission has launched a working group on its amendment (“CAD II”) which has recently put out a proposal (Commission, 1997) with a Basle-type internal models approach. The EU Banking Advisory Committee recommends that CAD II should come into force at the same time as the Basle market risk amendment. However, at the present time it is not clear whether EU countries will be able to meet this timetable.

5. The Pre-Commitment Approach

During the Basle negotiation process a group of research economists at the US Federal Reserve Board developed a blueprint for a different regime, which is particularly designed for resolving the regulators’ verification problems in the “internal models approach” (*Kupiec and O’Brien*, 1995 b; 1995 d). This new approach has its roots in incentive and contract theory. Banks would be obliged to pre-commit to a maximum cumulative trading loss for any two weeks of a quarter, usually based on their model simulations, and to set aside enough capital to cover this maximum loss pre-commitment. Violations of the maximum loss would be penalized with fines to be paid or other regulatory interventions, which could be pre-determined as a gradual ladder of responses, in order to avoid forbearance.

The attractiveness of the pre-commitment approach comes from a shift of responsibility for model selection and verification from regulators to the market. Moreover, additional factors such as the possibility of dynamic portfolio adjustments, operational and model risk will be

²⁸ These countries were Denmark, France, the Netherlands, Spain, Sweden, and the UK (Blaschke, 1996). Germany’s implementation is now expected to take until well into 1998.

accounted for in a natural way, without resort to an always somewhat arbitrary “scaling factor”. To keep regulatory capital as low as possible while avoiding penalties, it is in banks’ own best interest to improve their quantitative and qualitative risk management techniques.

Some limitations of this new approach have been put forward (partly by its inventors themselves). For example, in case of a general systemic crisis penalties would have to be waived. It was also warned that regulators should not withdraw completely from looking at banks’ in-house models. While the pre-commitment approach is currently tested by banks and US regulators under a pilot study coordinated by the New York Clearing House, the discussion about it in Europe has only begun.²⁹

6. *New Zealand’s Public Disclosure Approach*

There is a further piece of evidence that universal support for a uniform, “one rule fits all” solvency-ratio approach in the spirit of the Basle Capital Accord is dwindling among industrial countries. The Reserve Bank of New Zealand has abolished foreign exchange exposure limits in January 1996 (*Reserve Bank of New Zealand*, 1995, 1996). This measure is coupled with a general switch to a public disclosure regime that obliges locally incorporated banks and branches of overseas banks to publish a large amount of information formerly only reported to the central bank on a confidential basis. The information comprehends, *inter alia*, credit concentration, related party exposure, capital positions according to the Basle Accord of 1988, exposures to market risks – including not only the *foreign exchange position* but also equity and interest rate risk exposure –, and exposure to other banks. Finally, bank directors have to sign the disclosure statements declaring that they are not false or misleading. In case of violations they can be personally liable for depositors’ losses.

The authorities of New Zealand state that this approach can contribute to the soundness of the banking system through greater emphasis on market discipline, together with a limited core of prudential regulation and some modifications in supervision (*Reserve Bank of New Zealand*, 1994, p. 6). In order “to maintain international credibility and to avoid possible costs to the banking system which could arise from a discontinuation of the BIS capital adequacy framework”, the application of the

²⁹ For a more comprehensive comparison of the pre-commitment and Basle approaches, see *Kupiec and O’Brien* (1995d).

Basle Accord on credit risk is not abolished (*ibid.*, p. 12). Apparently trying to reduce moral hazard from expectations that insolvent banks would be bailed out, “neither the Government nor the Reserve Bank in any sense “underwrites” the soundness of individual banks” (*ibid.*, p. 6).

This “relaxation” of banking regulation had met resistance from proponents of strict capital adequacy regulations. However, its impact will be limited since most of New Zealand’s banks are actually foreign owned and therefore supervised by outside regulators (“New Zealand abolishes...”, 1996). For the same reason it has been argued that it cannot be generally applied, in particular not by countries with mostly domestic bank ownership.

IV. Forex Risk Regulation, Exchange Rate Volatility and Capital Controls

The most striking feature of the comparison of existing and proposed or future (minimum requirements for) forex risk regulations (see Table 1) is that the former seem to be much more restrictive. In all cases where explicit general exposure limits exist, they are much lower and capital definitions are rather less generous than those in the Basle market risk proposal and the EU Capital Adequacy Directive (Austria, France, Germany, Netherlands, New Zealand, Norway, UK). Switzerland is an exception insofar as the overall position limit is only slightly more restrictive through the use of GAP. Limits in Australia, Finland, Japan and Portugal are not known to the general public. It is also not known whether “moral suasion” by regulatory authorities in Belgium, Denmark and the US keeps position taking of their banks within the range of the limits of other countries.

In this sense, the 8 percent capital adequacy requirement for the overall forex position seems to have been the least common denominator on which agreement could be reached. However, these 8 percent was argued to be very conservative, even from a prudential point of view (*Levonian*, 1994). This might suggest that current forex exposure limits in industrial countries were not motivated by prudential considerations alone. The experience in developing countries, for example, shows their use to support exchange rate, exchange control and monetary policies (*Hartmann*, 1994).

Recent turbulences in the foreign exchange markets have revived demands for measures “throwing sand in the wheels of international finance” in order to achieve exchange rate stability among industrial

countries. The preferred measures by proponents of capital controls are compulsory interest-free deposit requirements on short positions in domestic currency (*Eichengreen and Wyplosz, 1993*) or on domestic-currency lending to non-residents (*Eichengreen, Tobin and Wyplosz, 1995*), before a global transaction tax on forex transactions becomes feasible (*Tobin, 1978*). Others have argued that these measures would be rather futile or even harmful (*Garber and Taylor, 1995; Kenen, 1995; Kupiec, 1996*). Could forex exposure limits be effective to prevent destabilizing speculation?

One main counterargument against this idea is that, in contrast to the deposit requirements, they are often limited to commercial banks. First, banks usually do not take (trading) positions as large as those taken by some other players in the market and, second, these other players can continue to invest in currencies as before. *Goldstein et al. (1993, pp. 5 - 7)* compare the regulations for currency exposure of different financial institutions in six major industrial countries.³⁰ Although the introduction of the Basle market risk proposal would submit all commercial banks in the G-10 countries (plus Luxembourg) to the same minimum prudential limits, hedge funds, nonfinancial corporations, and non-EU securities houses could continue to take positions as they wished. Moreover, other types of investment funds (including pension and mutual funds) and insurance companies are often less restricted in their acquisition of foreign currency assets or liabilities by their national regulators than commercial banks.

Another point is that, in most cases, banks have to comply to the limits at the end of each business day, while being able to take larger intra-day positions. In fact, regulators are hardly able to enforce compliance to intra-day limits, which might reduce their effectiveness against short-term speculative attacks on fixed parities. In any case, the existence of relatively restrictive limits in many industrial countries did not prevent speculative attacks and recent initiatives to improve forex risk regulations will – in the aggregate – rather *increase* the banking sector's maximum possible forex position. If a single country would try to use its freedom to keep or introduce more restrictive limits, forex business would shift abroad and position-taking would happen from outside that country. For this reason and the stiff competition between internationally active banks it is likely

³⁰ The countries considered were France, Germany, Italy, Japan, United Kingdom and United States. Regulations for the European Union as a whole were also reported.

that no EU country will exceed the 8 percent requirement after the transformation of the 1993 CAD into national laws.³¹ The same applies to G-10 countries and the new Basle regime. It seems that at present there is little scope for the use of forex exposure limits as a means to limit currency speculation by institutions from industrial countries.

Finally, we note that there *can* even appear a conflict between prudential forex risk regulation and exchange rate stabilisation. To see why, take the example of a simple simulation method, as outlined in the first Basle proposal for market risks. A long position in a currency which has depreciated over the last five years will thus be considered “riskier” than a short position, leading banks to hold this currency rather short, while a currency with the opposite long-term trend will instead tend to be held long. This is not to say that this currency is objectively riskier but rather that since its historical distribution of exchange rate changes is skewed to the right, i.e., depreciations appear to be more likely than appreciations, the simulation method will punish long positions with higher required capital than short positions. As discovered in the Basle Committee’s background studies, this punishment will be the more pronounced the larger the required confidence interval. Most importantly, if the simulation technique is standardized by the regulator (time horizon, holding period, etc.) the evaluation of the “riskiness” of a currency position in this sense is the same for any bank. Consequently, under the assumptions made above, the forex exposure regulation can reinforce exchange rate movements and, thus, *increase* the amplitude of exchange rate movements.³²

³¹ This view is confirmed, for example, by the *Bank of England’s* document (1995) describing the Directive’s transformation into UK law.

³² The argument is related to the possible effects of technical analysis and portfolio insurance (program trading) in financial markets. In fact, the Basle Committee seems to have been aware of this problem. Although not mentioned in the text of the proposal, it seems to have been one reason to choose a 95 percent confidence interval plus a scaling factor instead of a 99 percent confidence interval alone in the simulation method of the original market risk proposal.

This problem is particularly visible in developing countries or countries in transition to a market economy with systematically depreciating home currencies (*Hartmann, 1994*). In their situation, prudential considerations would suggest to restrict short foreign currency positions more than long foreign currency positions. However, this will reinforce selling of the home currency by local banks thereby accelerating the depreciation trend and possibly countering macroeconomic stabilisation efforts. A striking example for this conflict is the contradictory regulation in the Slovak Republic, where one department of the National Bank imposes more restrictive limits on short positions while another department imposes more restrictive limits on long positions.

The EU Capital Adequacy Directive limits the potential for those effects by giving a greater choice with respect to the specification of the simulation techniques, for example, concerning the period of historical exchange rate data. The new Basle amendment goes even further by permitting each bank to use its internal model. If regulators endorse different types of these models, then the diversification effect could be even stronger. Another solution to this conflict is the use of strictly symmetric capital requirements as those of the standardized Basle approach.

V. Conclusions

In the present paper first recent developments concerning foreign exchange risk regulations in industrial countries were discussed. Most industrial countries (except, e.g., the United States) impose end-of-day overall foreign currency exposure limits related to capital, without allowing for the consideration of correlations between specific currencies. Some countries additionally limit single currency positions. While the risk-weights implied by the position measures used are quite arbitrary from the point of view of financial theory, quantitative limits are very restrictive.

Recent initiatives by the G-10 and the EU to harmonize these regulations in the spirit of the 1988 Basle Accord imply more elaborated and less restrictive limits. The Basle Committee's new market risk decision allows for the use of banks' internal risk management techniques, if they meet certain standards. However, the EU Capital Adequacy Directive does not, implying a coordination problem between both regulations. CAD II, which is now negotiated in Brussels, could solve that in the future, but will come too late to avoid a costly transitory regulatory regime for European banks. Supervisory concerns expressed regarding the internal models approach put emphasis on verifiability problems, while more advanced banks still find risk measurement too conservative. New Zealand recently stepped out of line by deciding that banks will have to disclose their foreign exchange exposure to the general public and abolishing formal forex limits. While this step has been regarded with suspicion by many countries' regulators, the growing debate about the precommitment approach signals the increasing interest in more incentives-oriented regulations and the decreasing importance of uniform, "one rule fits all" regulations. Finally, prudential forex exposure limits are found not to be an effective measure to limit currency speculation in industrial country currencies.

By permitting banks to use internal risk management models recognizing correlations between different market risk types the Basle Committee now accepted that a comprehensive and incentive compatible market risk regulation cannot consider forex risk separately from interest rate, share and commodity price risk. Future research efforts should go into measurement techniques integrating these different types of risk and better capturing the tail behaviour of return distributions. In particular, empirical research should test the stability of correlations found between, say, currency prices and interest rates and identify their behaviour in abnormal situations. This could help deciding whether the G-10 regulators can safely allow for a lower multiplication factor for the determination of prudential capital requirements from banks' internal risk models, a step from which the former have shied away so far.

A second issue which should be at center stage of future research is the differential treatment of banks and non-bank financial institutions. Particularly important is the question whether or which non-bank financial institutions are a source of systemic risk and, thus, have to be subject to the same regulations as commercial banks. While the European Union already included investment companies in the 1993 Capital Adequacy Directive, additional considerations are required if a further integration of banks and insurance companies is observed (*OECD*, 1993; Tripartite Group, 1995).

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Summary

Capital Adequacy and Foreign Exchange Risk Regulation: Theoretical Considerations and Recent Developments in Industrial Countries

Capital adequacy regulations put forward by the Basle Committee on Banking Supervision have virtually become an international standard of prudential regulation. Recent decisions by the Group of Ten and the European Union extend this approach to market risks, including foreign exchange risk. The present paper provides a discussion of exposure limits, as implied by capital adequacy requirements, mainly focusing on the example of currency risk. Some theoretical issues are addressed in the paper together with descriptions and comparisons of existing and future regulations, in 15 industrial countries. It turns out that previous forex exposure limits in many industrial countries were more restrictive than could be expected from purely prudential considerations. However, the newly adopted minimum requirements should lead to an alleviation of existing regulations. Furthermore, a change of approach by the Basle Committee, allowing banks to use their own risk management models, creates a coordination problem between G-10 and EU regulations, which requires an amendment (CAD II) of the 1992 Capital Adequacy Directive. It is also argued that prudential limits are not the appropriate instrument to fight speculative capital flows in developed financial markets.

Zusammenfassung

Kapitalvorschriften und die Regulierung von Wechselkursrisiken: Theoretische Betrachtungen und jüngste Entwicklungen in den Industrieländern

Kapitaladäquanzvorschriften, wie sie vom Basel-Komitee für Bankaufsicht entwickelt wurden, sind nahezu ein internationaler Standard der prudentiellen Bankregulierung geworden. Jüngste Entscheidungen der G-10 und der Europäischen Union erweitern diesen Ansatz auf Marktrisiken im allgemeinen und Wechselkursrisiken im speziellen. Der vorliegende Artikel diskutiert die Limits auf Bankpositionen, wie sie aus Kapitalvorschriften resultieren, und konzentriert sich dabei im wesentlichen auf das Beispiel der Devisenmarktpositionen und des Wechselkursrisikos. Dabei werden einige theoretische Überlegungen den aktuellen und zukünftigen Regulierungen in 15 Industrieländern gegenübergestellt. Die früheren Devisenmarktlimits für Banken scheinen restriktiver zu sein, als man aus rein prudentiellen Erwägungen erwarten würde. Jedoch werden die zuletzt verabschiedeten Regulierungen für die G-10 und die EU zu einer Abschwächung dieser Limits führen. Des weiteren hat die Entscheidung des Basel-Komitees, bankinterne Risikomodelle zur Ermittlung des regulatorischen Mindestkapitals zuzulassen, ein Koordinationsproblem zwischen G-10- und EU-Regulierungen herbeigeführt, das durch eine neue EU-Kapitaladäquanzrichtlinie (CAD II) gelöst werden muß. Es wird ebenfalls argumentiert, daß prudentielle Limits kein geeignetes Instrument zur Bekämpfung spekulativer Kapitalflüsse in entwickelten Finanzsystemen sind.

Résumé

Adéquation des fonds propres et régulation des risques de change: considérations théoriques et évolutions récentes dans les pays industrialisés

Les règlements sur l'adéquation des fonds propres bancaires développés par le Comité de Bâles sont presque devenus un standard international de la régulation bancaire prudentielle. Les décisions récentes du Groupe des 10 et de l'Union Européenne étendent cette approche aux risques du marché en général et aux risques de change, en particulier. L'article discute ici des plafonds de risques bancaires impliqués par les règlements des fonds propres minimum et se concentre essentiellement sur l'exemple des positions en devises étrangères et du risque de change. Quelques réflexions théoriques sont considérées ici, décrivant et comparant les réglementations actuelles et futures dans 15 pays industrialisés. Les plafonds bancaires précédentes semblent plus restrictifs que ceux auxquels on s'attendrait selon des considérations purement prudentielles. Cependant, les réglementations dernièrement adoptées par le Groupe des 10 et l'UE entraîneront un allègement de ces limites. De plus, la décision du Comité de Bâles autorisant les banques à utiliser leurs propres modèles de gestion des risques pour déterminer le capital minimum régulateur a créé un problème de coordination entre les réglementations du Groupe des 10 et de l'UE; ce qui requiert un amendement (CAD II) de la directive sur les capitaux suffisants (Capital Adequacy Directive). On argumente aussi que les limites prudentielles ne sont pas l'instrument approprié pour lutter contre les flux de capitaux spéculatifs dans des systèmes financiers développés.