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Taxation and the Household Saving Rate: Evidence from OECD Countries

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Abstract

This paper analyzes anew the relationship between taxation and the household saving rate. On the basis of standard savings and tax revenue data from OECD countries, it provides compelling and robust empirical evidence of a powerful impact of taxes on household savings. In particular, income taxes are shown to affect negatively the household saving rate much more than consumption taxes.

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CONTENTS

SUMMARY

Many factors influence the rate of savings of a country, and many researchers have over the years attempted to identify these factors and assess their empirical importance. Much of this literature has been applied to U.S. data. Among the factors that may influence the saving rate, taxes have often been assumed to be important and most studies on the subject have focused on how different taxes could have affected the saving rate differently. Unfortunately, the empirical identification of the relationship between tax levels and tax structures on the one hand and the saving rate on the other has been inconclusive.

This study presents new and compelling empirical evidence on the above relationship based on standard savings and tax revenue data from OECD countries over a period of 25 years. In particular, it finds that the shares in GDP of both total taxes and income taxes have a highly statistically significant and strongly negative impact on the household saving rate. The impact of consumption taxes as a share of GDP on the household saving rate is quantitatively less pronounced, but remains statistically significant.

I. INTRODUCTION

Because savings are generally assumed to be one of the key sources of economic growth, the factors that determine the saving rate have been analyzed in a voluminous body of literature. Some of these factors, such as demographic and cultural factors, are not easily influenced by policy; others, such as the rate of inflation, the rate of interest, and the level and structure of taxes, are largely policy variables. In this paper, we focus on the impact of taxation on the household saving rate of OECD countries.[2]

Theoretical and empirical studies abound on the impact of different types of taxes or of different tax provisions on private saving behavior.[3] Many of these studies have dealt with the American reality, a reality characterized by a relatively stable level and structure of taxation, over a period of several decades, and by occasional important changes in particular tax provisions—such as individual retirement accounts (IRAs)—which could affect the rate of saving.[4] While most of the theoretical channels through which taxes could affect savings have been identified and widely discussed, the empirical literature does not convey an overwhelming impression that the effect of taxes on savings is either statistically significant or quantitatively important.

One reason for the inconclusiveness of the empirical results is probably due to the fact that different researchers have used different data sets and/or different definitions of savings and have, consequently, obtained different—and sometimes conflicting—results. Another reason could be that the heavy focus of many of the studies on the United States has meant that much of the existing body of empirical evidence on saving behavior has been dominated by the specific characteristics and circumstances of a single country and may, therefore, lack cross-country generality.

The primary purpose of this paper is to present some direct and, in our view, compelling evidence—evidence largely overlooked in the existing literature—on the impact of taxation on

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[2]See Tanzi and Zee (1997) for a comprehensive examination of the relationship between taxation and growth. For a recent empirical investigation of the nontax determinants of savings, see Masson and others (1996), which covers the same sample of OECD countries as the present paper as well as a large sample of developing countries. Its focus is, however, on national savings (the sum of domestic investment and current account surplus) less savings by the central government, rather than on the household saving rate.

[3]For an excellent general survey of this literature, see Boadway and Wildasin (1994). OECD (1994) provides a detailed and comprehensive survey of country tax provisions that could affect the level and composition of household savings in OECD countries.

[4]For a recent discussion of the effectiveness of various tax-based saving incentives in the United States, see Bernheim (1997).

the household saving rate in OECD countries. This evidence is derived from a panel data set covering 21 OECD countries over a period of two and a half decades (1970–1994). A general picture of how the total tax revenue/GDP ratio and the household saving rate changed in these countries between the beginning and the end of this period is depicted in the Figure.[5] As the Figure shows, only five of the countries (i.e., those in the first quadrant) experienced a clear rise in both the total tax revenue/GDP ratio and the household saving rate; in the rest of the countries, higher total taxes were generally associated with lower household savings.

Regression results based on annual observations in fact indicate that the ratios of total tax revenue, income tax revenue, and consumption tax revenue to GDP all bear a statistically significant and negative relationship to the household saving rate. This relationship is generally statistically significant at the highest confidence level. More specifically, the estimated negative coefficients of the tax variables tend to be particularly high for income taxes and much lower for consumption taxes. It is also found that, when the total tax revenue/GDP ratio is held constant, the household saving rate bears a positive and statistically significant relationship to the ratio of consumption tax revenue to GDP. This could largely be interpreted as the effect on the saving behavior of replacing income with consumption taxes. In general, the empirical results reported in this paper are quite robust, in the sense that they survive alternative plausible forms of the estimated equations. It is worth pointing out that these results have been obtained on the basis of straightforward regressions on data available directly from the OECD analytical database and revenue statistics. No further transformation of such data has been made.

In Section II, we present our empirical findings on the relationship between taxation and household saving behavior in OECD countries, preceded by a brief discussion of some of the pertinent theoretical considerations relating to this relationship. Section III concludes the paper. The Appendix provides a more detailed discussion of the theoretical issues involved.

II. Theoretical Considerations and Empirical Evidence

A. Theoretical Considerations

From the theoretical literature on taxation, it is a well-known result that, absent labor-leisure choice and the bequest motive, a wage tax is equivalent to a consumption tax in present value terms, on account of the intertemporal budget constraint. Since a general income tax taxes capital income in addition to wage income, the difference between the income tax and the consumption tax, in terms of their impact on household savings, hinges solely on the interest rate effect of the former. From this perspective, the sign and magnitude of the interest elasticity of savings is naturally a crucial behavioral parameter, and is in fact the focus of much

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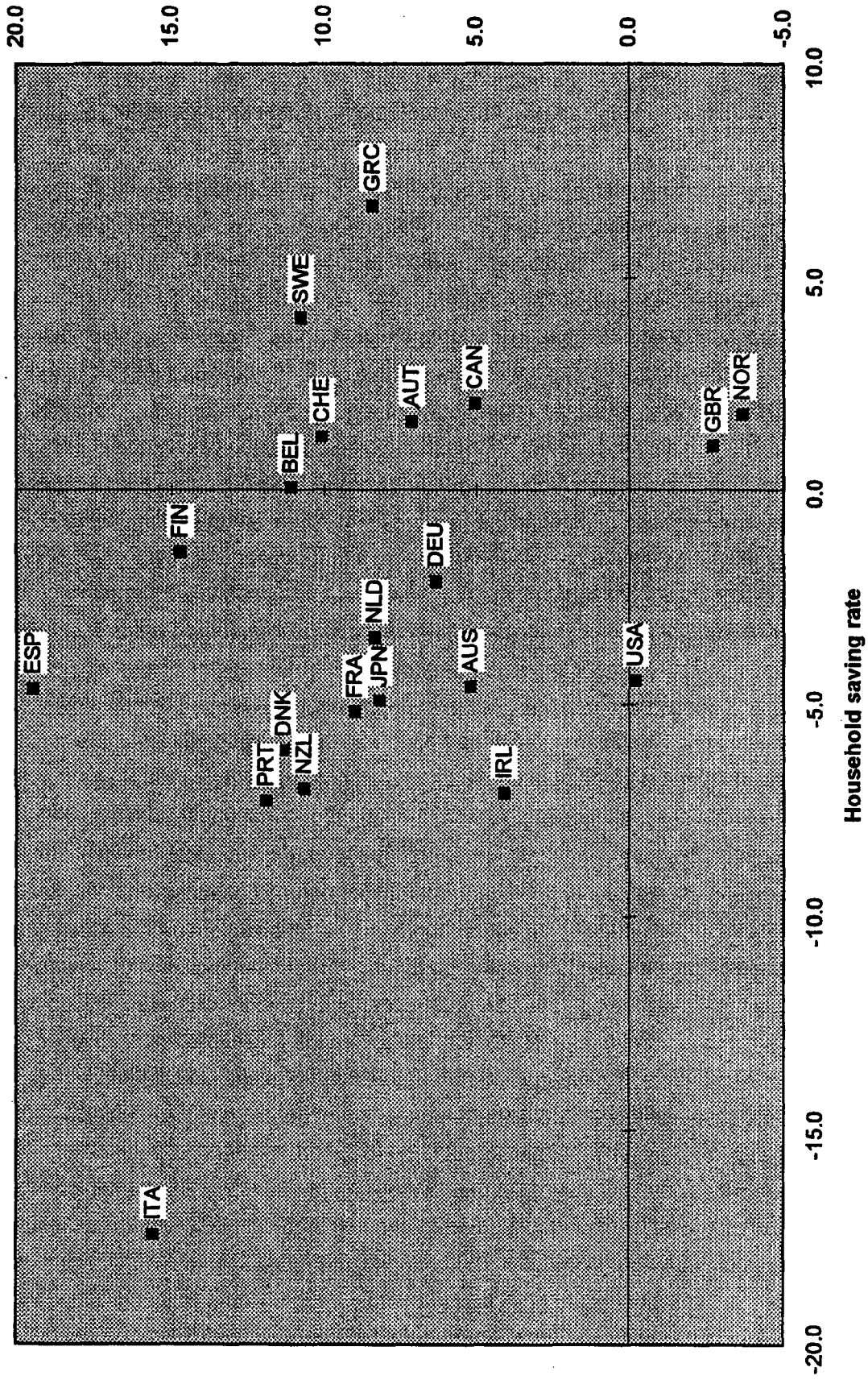
[5]The changes shown for Ireland, New Zealand, and Norway are over somewhat shorter periods as explained below.

Figure. Household Saving Rate and Total Tax Revenue/GDP Ratio
(In percentage point change between 1970 and 1994)



of the literature on the subject. If this elasticity is positive,[6] it would then follow that a tax on income would depress household savings more than a tax on consumption, all other things equal. Our empirical findings reported below are consistent with this theoretical implication.

In addition to, and separate from, the interest elasticity of savings, the income elasticity of consumption—a behavioral parameter that has received relatively little attention in the literature on taxation and savings—also plays a crucial role (see Appendix for details) in determining the response of household savings to a change in taxation (be it income or consumption tax). The reason for this is quite straightforward. Since taxes affect household disposable income and, therefore, *both* the numerator and the denominator of the household saving rate, for this rate as a whole to decline following an increase in taxes, all other things constant, household consumption must decline proportionately less than the decline in their disposable income, that is, their income elasticity of consumption must be less than unity.[7] Our empirical findings are consistent with those from the consumption literature in indicating that consumption is income inelastic in the short run.

As aggregate data on household savings comprise both savings by the working population and dissavings by the retired, demographic changes with respect to the relative sizes of these two groups could also have an important bearing on observed variations in aggregate savings. For example, a demographic shift in favor of the former group should theoretically lead to a rise in savings.[8] While we have not overlooked the possible relevance of demographic variables in our empirical investigation, we are unable to obtain a meaningful and statistically significant relationship between such variables and saving behavior in the data set we used.[9]

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[6]The sign of the interest elasticity of savings is theoretically ambiguous, since it can be decomposed into opposing income and substitution effects. Available empirical evidence suggests that it is generally positive (see Atkinson and Stiglitz (1980) for a review).

[7]Theoretical considerations alone are not sufficient to ascertain whether the income elasticity of consumption should be greater or less than unity. The question essentially turns on the extent to which a household values its current consumption relative to future consumption. Available empirical evidence from the consumption literature suggests, however, that this elasticity is less than unity in the short run but is approximately equal to unity in the long run (in the familiar terminology of macroeconomics, this is equivalent to stating that the short-run marginal propensity to consume (MPC) is below unity while the long-run MPC is unity).

[8]One of the first to show empirically the importance of demographic variables in determining savings was Graham (1987).

[9]In all variants of the estimated equation reported below, a demographic variable—the dependency ratio—was initially included as an additional independent variable. Two alternative definitions of the dependency ratio were explored, based on data from United

(continued...)

B. Empirical Evidence

The empirical results reported in this paper are based on a panel data set of annual observations covering 21 OECD countries over the period 1970-94.[10] Data on the independent variables used in the estimated equation, obtained from the revenue statistics of OECD (1996), comprise (1) total tax revenue/GDP ratio (X_1), (2) income tax revenue/GDP ratio exclusive of social security tax revenue (X_2), (3) income tax revenue/GDP ratio inclusive of social security tax revenue (X_3), and (4) consumption tax revenue/GDP ratio (X_4). Data on the dependent variable, obtained from the OECD analytical database, comprise the aggregate household saving rate.[11] The equation has been estimated in either the level, (natural) log, or first-difference form. The regression results based on the ordinary least squares procedure are reported in the Table.

As can be seen from the Table, irrespective of the variant of the equation estimated, the estimated coefficient of X_1 is negative and highly statistically significant when it is the only independent variable in the equation. Thus, higher taxes lead to lower household savings. When either X_2 or X_3 appears jointly with X_4 in the equation, the estimated coefficients of the variables all have the expected negative sign and are (save one) statistically significant--most of them highly so. The lone exception is the estimated coefficient of X_4 in the log variant of the equation. It is interesting to note that both the absolute magnitude and the level of significance of the estimated income tax coefficient far exceed those of the consumption tax coefficient in either the level or the log variant of the estimated equation; in the first-difference form, the differences between the two estimated coefficients are much smaller.

The equation has also been estimated, in both its level and log variants, with X_1 paired separately with either X_2, X_3, or X_4. In each instance the estimated coefficient of X_1 remains negative and highly statistically significant. With X_1 included, however, the estimated coefficient of the other tax variable should be interpreted as measuring its impact on the

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[9](...continued)
Nations (1996). One definition expressed those below 14 years and over 64 years of age as a percent of total working population, the other excluded those below 14 years of age from the definition. Neither definition produced satisfactory results: the estimated coefficient for the dependency ratio in all cases was found either to be statistically insignificant or to have the wrong sign, or both. Such results are, therefore, not reported.

[10]Due to data limitations, the following OECD countries are excluded from the sample: Czech Republic, Hungary, Iceland, Korea, Luxembourg, Mexico, Poland, and Turkey. Also, the time series data for Ireland, New Zealand, and Norway cover somewhat shorter periods as indicated in the Table.

[11]These data on the household saving rate are also published semi-annually by OECD. See, for example, OECD (1997).

Table. OECD Countries: Taxation and the Household Saving Rate, 1970–94 1/

Dependent variable: household saving rate 2/	Independent variable 3/ X_1	X_2	X_3	X_4	R^2	Number of observations
Level (1)	−0.48 * (13.25)	n.a.	n.a.	n.a.	0.26	512
Level (2)	n.a.	−0.91 * (20.94)	n.a.	−0.12 *** (1.72)	0.49	512
Level (3)	n.a.	n.a.	−0.56 * (11.11)	−0.18 ** (2.05)	0.24	512
Level (4)	−0.13 * (3.49)	−0.82 * (15.87)	n.a.	n.a.	0.50	512
Level (5)	−0.34 * (4.24)	n.a.	−0.19 *** (1.84)	n.a.	0.26	512
Level (6)	−0.62 * (12.58)	n.a.	n.a.	0.45 * (4.17)	0.28	512
Log (1)	−1.53 * (9.81)	n.a.	n.a.	n.a.	0.17	486
Log (2)	n.a.	−0.99 * (14.18)	n.a.	−0.25 * (3.12)	0.32	486
Log (3)	n.a.	n.a.	−1.23 * (9.45)	−0.13 (1.42)	0.18	486
Log (4)	−0.56 * (3.30)	−0.85 * (10.28)	n.a.	n.a.	0.32	486
Log (5)	−0.64 ** (2.06)	n.a.	−0.83 * (3.30)	n.a.	0.18	486
Log (6)	−2.06 * (9.72)	n.a.	n.a.	0.44 * (3.63)	0.19	486
First difference (1)	−0.40 * (6.72)	n.a.	n.a.	n.a.	0.08	491
First difference (2)	n.a.	−0.47 * (5.22)	n.a.	−0.54 * (3.86)	0.08	491
First difference (3)	n.a.	n.a.	−0.38 * (5.01)	−0.49 * (3.45)	0.08	491

1/ Annual data. 1977–94 for Ireland; 1971–94 for New Zealand; and 1975–94 for Norway.
2/ Source: OECD analytical database.
3/ Source: *Revenue Statistics*, OECD (1996). All revenue data expressed as percentages of GDP.
X_1 = total tax revenue;
X_2 = income tax revenue (code 1000);
X_3 = income and social security tax revenue (code 1000 plus code 2000); and
X_4 = consumption tax revenue (code 5000).

Note: absolute *t*–ratios in parentheses; statistical significance is denoted by * (1 percent level), ** (5 percent level), and *** (10 percent level).

aggregate household saving rate when the total tax revenue is held constant. In the event, the estimated income tax coefficient, whether in terms of X_2 or X_3, continues to be negative and statistically significant. In contrast, the consumption tax coefficient has, not surprisingly, turned positive (but at the same time remains highly statistically significant). This is a fundamental implication of the result, noted earlier, that income taxes depress savings more than consumption taxes do. Thus, with constant total tax revenue, the positive consumption tax coefficient measures the impact on savings if the former are replaced by the latter.

On the whole, the above results are in complete accordance with one's theoretical intuition on the relationship between taxation and the household saving rate, as noted earlier. They provide a clear, direct, and compelling case for the negative impact on the latter of the burdens of total taxation, consumption taxation, and, in particular, income taxation. They also suggest that a move towards consumption relative to income taxation could lead to a higher rate of aggregate household savings.

III. Concluding Remarks

The potential determinants of a country's saving rate are numerous, and are likely to encompass both tax and nontax factors. This paper has focused on the relationship between the aggregate household saving rate and taxation in OECD countries over a period of two and a half decades (1970-1994).

The empirical evidence reported in this paper suggests that the negative impact of total taxes, income taxes, and consumption taxes (all expressed as shares of GDP) on the household saving rate is compelling and robust. The evidence also supports the conventional view that the impact of income taxes on household savings is much greater than that of consumption taxes. Therefore, an equal yield replacement of the former by the latter could actually raise the household saving rate. To our knowledge, these findings provide the strongest direct evidence available so far in the literature on the relationship between taxation and savings. They have very important implications for tax policy regarding the choice of income and consumption taxation in tax systems when promoting savings is an important policy objective.

APPENDIX

This appendix provides a detailed discussion of the analytics of taxation and the saving rate, and underscores the important role the income elasticity of consumption plays in the analysis. To render the analytics as simple as possible, consider a two-period life-cycle model of savings, in which an individual works (at the wage rate w) in the first period and retires in the second. Consumption during retirement is, therefore, financed entirely by savings (with interest at the rate r) undertaken during the working period. For simplicity, it is assumed that labor supply is fixed and both w and r are time-invariant.[12]

Using the superscripts "y" and "o" on variables to denote those pertaining to the young and the old, respectively, a young individual's budget constraint in any period t is given by

$$(1) \qquad w\cdot(1 - \tau) = c_t^y\cdot(1 + v) + s_t^y,$$

where c is per-capita consumption, s is per-capita savings, τ is the income tax rate, and v is the consumption tax rate. In the following period, i.e., period $t + 1$, this individual is retired and faces the budget constraint

$$(2) \qquad s_t^y\cdot[1 + r\cdot(1 - \tau)] = c_{t+1}^o\cdot(1 + v).$$

Equations (1) and (2) can be combined to yield the individual's familiar life-time budget constraint as

$$(3) \qquad \Omega = c_t^y + c_{t+1}^o/[1 + r\cdot(1 - \tau)],$$

where $\Omega \equiv w\cdot(1 - \tau)/(1 + v)$ is the present value of the individual's *effective* life-time disposable income. The consumption tax plays a role in determining this income because the tax is applicable at the same rate on consumption in both periods and, therefore, has the effect of reducing the life-time income available for consumption. Standard utility maximization by the individual produces the demand for consumption when young as a function of the effective life-time disposable income and the after-tax rate of interest:

$$(4) \qquad c_t^y(\cdot) = c_t^y[\Omega, r\cdot(1 - \tau)].$$

The variable s_t^y in equations (1) and (2) represents only savings undertaken by the young. As such, it is not comparable to the aggregate personal or household savings as typically

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[12]The following analysis would, of course, be somewhat more complicated if labor supply is variable and/or intergenerational transfers are allowed. But these complications do not alter the basic point about the importance of the income elasticity of consumption in the analytics of taxation and savings.

measured in national accounts, which would incorporate the (dis)savings of the old. Since the old receives only interest income, the old's (dis)savings in any period t is, by definition,

(5) $$s_t^o = r\cdot(1 - \tau)\cdot s_{t-1}^y - c_t^o\cdot(1 + v),$$

that is, it is the interest income received on the savings (undertaken when young in the previous period) less consumption. Substituting equation (2) into equation (5) yields

(6) $$s_t^o = r\cdot(1 - \tau)\cdot s_{t-1}^y - s_{t-1}^y\cdot[1 + r\cdot(1 - \tau)] = - s_{t-1}^y,$$

which indicates that the old dissaves by consuming the principal that was saved in the previous period. If the size of population grows at the rate n, then savings by the young in any two successive periods are related to each other by

(7) $$s_t^y = (1 + n)\cdot s_{t-1}^y.$$

Total per-capita savings in any period t is simply the sum of the young's savings and the old's (dis)savings in that period. With the use of equations (6) and (7), this sum can be shown to be

(8) $$s_t = s_t^y + s_t^o = s_t^y - s_t^y/(1 + n) = s_t^y\cdot n/(1 + n).$$

Note that, in the present framework, total per-capita savings are zero when $n = 0$, since with no population growth, savings by the young are necessarily counter-balanced by (dis)savings by the old.

The disposable income, m, of the individual when young is simply the after-tax wage income:

(9) $$m_t^y = w\cdot(1 - \tau),$$

while that of the individual when old is the after-tax interest income:

(10) $$m_t^o = r\cdot(1 - \tau)\cdot s_{t-1}^y = r\cdot(1 - \tau)\cdot s_t^y/(1 + n).$$

Total per-capita disposable income in any period t is, therefore,

(11) $$m_t = m_t^y + m_t^o = w\cdot(1 - \tau) + r\cdot(1 - \tau)\cdot s_t^y/(1 + n).$$

Let $\theta_t \equiv s_t/m_t$ be the aggregate household saving rate. It proves convenient to work with the *inverse* of this ratio (assuming $n \neq 0$). By using equations (8) and (11), the inverse of the saving rate can be expressed as

(12) $$1/\theta_t = w\cdot(1 - \tau)\cdot(1 + n)/(n\cdot s_t^y) + r\cdot(1 - \tau)/n.$$

Equation (12) can be used to assess how changes in the income tax rate τ, consumption tax rate v, and population growth rate n would affect the aggregate household saving rate. Since the right-hand-side of equation (12) contains s_t^y, which is a function of both τ and v, a first step in this assessment would be to ascertain the impact of changes in τ and v on the savings of the young. Totally differentiating equation (1), with the use of equation (4) and the definition of Ω, yields[13]

$$(13) \qquad ds_t^y = - [1 - \eta\cdot(1 - \theta_t^y)]\cdot w\cdot d\tau - \delta\cdot\theta_t^y\cdot w\cdot d\tau - (1 - \eta)\cdot w\cdot(1 - \theta_t^y)\cdot dv,$$

where η denotes the income elasticity of the young's consumption, and is positive if consumption when young is a normal good;[14] δ denotes the interest elasticity of the young's savings, which, in principle, can be either positive or negative, depending on the relative strength of the opposing income and substitution effects; and $1 \geq \theta_t^y \equiv s_t^y/[w\cdot(1 - \tau)] \geq 0$ is the young's rate of savings.

Equation (13) shows that a change in the income tax rate has two distinct but familiar effects on the young's savings: an increase in τ would lower s_t^y by lowering the disposable income (the first term on the right-hand-side of equation (13)); it would also lower s_t^y by reducing the after-tax rate of return to savings (the second term), provided that δ is positive (the normal case). In contrast, since the consumption tax reduces the individual's *effective* life-time disposable income, as noted earlier, the impact of a change in the consumption tax rate on the young's savings is dependent on the income elasticity of the young's consumption (the third term): an increase in v would lower s_t^y only if $\eta < 1$, i.e., the young's consumption is income inelastic so that a higher consumption tax leads to a higher total consumption spending when young, thus reducing savings. If $\eta > 1$, the outcome would be reversed.[15]

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[13]For simplicity, in what follows all differentials and derivatives are evaluated at points with no *existing* taxes.

[14]Note that the weighted average of the income elasticities of consumption when young and when old (the weights being the share of expenditure on each in the effective life-time disposable income) must add to unity. This implies that $1 \geq \eta\cdot(1 - \theta^y) \geq 0$ if consumption is a normal good in both periods of an individual's life cycle, but η itself could be greater or less than unity.

[15]Note that in equation (13), the coefficients of $d\tau$ and dv are not identical even when $\delta = 0$. This is due entirely to the timing difference between the income tax and the consumption tax from the young's perspective. It is shown later that, in terms of the aggregate saving rate (i.e., when both the young's and the old's disposable incomes are taken into account), the income tax and consumption tax in fact have identical effects (abstracting from interest rate and population growth considerations).

Armed with equation (13), it is now straightforward to assess the impact of changes in the tax and demographic variables on the aggregate household saving rate. Differentiating equation (12) with respect to τ yields

$$(14) \qquad d(1/\theta_t)/d\tau = [(1 - \eta)\cdot(1 - \theta_t^y)/\theta_t^y + \delta - r\cdot\theta_t^y/(1 + n)]\cdot(1 + n)/(n\cdot\theta_t^y).$$

The sign of equation (14) is *ambiguous*; it is dependent on the signs of the three terms inside the square brackets on the equation's right hand side. The first term represents the income effect and measures how a change in τ would affect the young's consumption *relative* to the young's disposable income. If the income elasticity of the young's consumption is inelastic (i.e., $\eta < 1$), then the amount of the young's savings would fall in response to a rise in τ, which in turn would imply a drop in the young's own saving rate. All other things equal, this would also result in a drop in the aggregate household saving rate, as evidenced by the positive sign of the first term when $\eta < 1$. Clearly, this income effect would disappear if the young's consumption is proportional to disposable income.

The second term is the interest elasticity of the young's savings and measures the interest rate effect. If it is positive (i.e., $\delta > 0$), then a rise in τ would (all other things equal) also reduce the aggregate household saving rate. The third term represents the demographic effect and measures the impact of the income tax on the disposable income of the old. It is unambiguously negative because a rise in τ necessarily reduces the old's after-tax interest income but not its amount of dissavings. By itself, this would also lower the aggregate disposable income and, therefore, raise the aggregate household saving rate. Hence, the overall impact of a rise in τ on the aggregate household saving rate is *a prior* uncertain. It is interesting to note that, if the underlying utility function is Cobb-Douglas, i.e., $\eta = 1$ and $\delta = 0$, the aggregate household saving rate would be *positively* correlated with the income tax rate, on account of the demographic effect alone.

The impact on the aggregate household saving rate of a change in the consumption tax rate is likewise ambiguous and dependent on the income elasticity of the young's consumption, as can be seen by differentiating equation (12) with respect to v to get

$$(15) \qquad d(1/\theta_t)/dv = (1 - \eta)\cdot(1 + n)\cdot(1 - \theta_t^y)/[n\cdot(\theta_t^y)^2].$$

Note that the expression on the right-hand-side of equation (15) is identical to the income effect of a change in the income tax rate (see equation (14)). This corresponds to the well-known proposition that, from a life-cycle perspective, a consumption tax is equivalent to an income tax if the latter excludes interest income.

Finally, the aggregate household saving rate can be altered by a change in the population growth rate. Differentiating equation (12) with respect to n yields

$$(16) \qquad d(1/\theta_t)/dn = - [r + 1/\theta_t^y]/n^2,$$

which is unambiguously negative. This states that an increase (decrease) in n, which represents a relative demographic change in favor of the number of the young (old) in the population, would lead to a rise (fall) in the aggregate household saving rate, as expected.

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Monetary and Exchange Affairs Department

The Prudential Regulation and Management of Foreign Exchange Risk

Prepared by Richard K Abrams and Paulina Beato[1]

Authorized for distribution by Carl-Johan Lindgren

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Abstract

This paper examines issues in the prudential management and regulation of foreign exchange risk. It begins with measurement issues, notably converting foreign currency items into domestic currency terms, and calculating foreign exchange positions. The focus then shifts to managing foreign exchange risks. Although the key to effective management lies in the bank's reporting and internal control systems, regulators frequently seek to limit such risks directly. This usually involves limiting the overall open position in terms of bank capital or requiring that capital be set aside against such risks.

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Summary

This paper examines the prudential management and regulation of foreign exchange risk. It begins by examining issues in the measurement of foreign exchange risks, including the conversion of foreign currency assets and liabilities into domestic currency terms, and the measurement of open foreign exchange positions. Attention is also given to the treatment of structural open foreign exchange positions, and the need to measure open positions on a consolidated basis.

The remainder of the paper focuses on the management and regulation of foreign exchange risks. The first step in this process is an effective system of internal controls, which should be designed by the bank, although the supervisory authority may insist on verifying its effectiveness. Supervisory authorities also usually wish to regulate and monitor banks' foreign exchange risks, through regulatory controls and reporting requirements. The two most common methods of regulating foreign exchange risk are absolute limits on open positions, and requiring that capital be set aside against foreign exchange risk. Although the use of absolute single currency limits is declining among countries, many still set such limits on banks' overall open positions, usually in terms of bank capital.

More countries are also now using capital requirements to control bank's open foreign exchange positions, with the capital requirement based either on a measure of the overall open position or on the total foreign exchange risk as estimated by the bank's internal risk model. Although, while capital requirements have several advantages, the use of internal risk models is only appropriate for the most financially sophisticated banks and supervisors. Caution may also be needed in the use of capital requirements if the supervisor has doubts either about banks' skills in foreign exchange risk management or about the accuracy with which bank capital is reported.

I. INTRODUCTION

This paper examines issues in the prudential management and regulation of foreign exchange risk. Foreign exchange risk is a form of market risk.[2] It arises when a bank holds foreign currency denominated assets or liabilities, with the risk being that exposures from open foreign currency positions may give rise to losses (or gains) in domestic currency terms as a result of exchange rate movements.[3]

The management of foreign exchange risk, as with other forms of credit or market risk, is based on five building blocks.[4] First, accounting procedures and rules should result in the values of the assets and liabilities being accurately reflected in financial statements. Second, formulae need to be designed to allow the accurate measurement of the various forms of risk. Third, steps should be taken so that unexpected shocks associated with those risks do not unduly undermine the individual institution. Fourth, timely and accurate financial information on each specific risk should be prepared and promptly delivered to the interested parties, including the supervisor. Fifth, each institution should have a system of internal controls that both protect the safety of it assets, and ensure that informed decisions are taken at the appropriate level.

In recent years, probably the most contentious aspect of foreign exchange risk management has been the choice of method to limit such risks. Traditionally, this has been done by placing limits on the institution's foreign currency exposure. Such limits are either absolute or expressed as a percentage of the bank's capital base, and take no consideration of capital adequacy or the other risks in the bank's portfolio. More recently, however, an increasing number of national supervisory authorities have started to require specific capital

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[2]Market risk may be defined as "the risk of losses in on- and off-balance sheet positions arising from movements in market prices." Basle Committee on Banking Supervision (Basle Committee, 1996), p.1. Exchange risk may be defined as "the risk that a bank may suffer losses as a result of adverse movement during a period in which it has an open position, either spot or forward, or a combination of the two in an individual foreign currency." Basle Committee (1980), p. 1.

[3]Certain risks related to foreign exchange operations are not covered in this paper, including inter alia, risk of losses when only one leg of a foreign exchange transaction is settled (called Herstatt risk). For a discussion of foreign exchange settlement risks associated with foreign exchange transactions, see Bank for International Settlement (1996).

[4]Although this paper focuses on more supervisors' efforts to regulate banks' foreign exchange risk, best practices of bankers and supervisors should be essentially the same. The difference is that while a prudent banker seeks to maximize the value of the bank, a supervisor seeks to maintain an efficient banking system, and avoid the systemic difficulties associated with multiple banks failures.

allocations against open foreign exchange positions and other market risks (in addition to or instead of the traditional approach). This practice compels a bank to designate capital holdings against its open foreign exchange positions, over and above the capital it holds for other reasons, for example, "Basle" capital requirements for credit risk. This makes it more difficult for weakly capitalized banks to take on new risks (perhaps preventing the weakest from having open foreign exchange positions). However, it gives a bank greater flexibility in choosing the risks it will accept by allowing managers to allocate a bank's capital between credit and market risks, including foreign exchange risk. The two approaches, thus, achieve rather different prudential objectives, with absolute limits restricting the fluctuations in income that can be caused by exchange rate fluctuations, independent of the level of bank capital, while capital requirements seek to use capital as a buffer against potential losses from the bank's foreign exchange exposure.

The importance of managing foreign exchange risk has increased with the trend toward global economic and financial integration, and the associated increase in trade, liberalization of financial markets, and dismantling of capital controls. These factors have combined to increase the risk that banks, consciously or inadvertently, may hold large open positions, and that adverse exchange rate movements may seriously damage their capital base.[5]

This paper explores issues relating to the prudential regulation of foreign exchange risk, by examining both actual practices and alternatives that are under consideration. Section II explores alternative methods of measuring foreign exchange risks. Section III explores methods of managing foreign exchange risks, and Section IV concludes. The appendix contains tables presenting the findings of a survey of the prudential supervision of foreign exchange operations in 19 countries.[6]

II. Measuring Foreign Exchange Risk

If foreign exchange risks are to be managed, they must first be quantified. This is a two-part process. First, accounting issues must be addressed, notably recording foreign exchange transactions and assets and liabilities in domestic currency terms to correspond to all other information in the financial reports. Second, one must determine how to measure the

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[5] Increasingly deep and efficient markets also allow a trader to take a position more quickly, so conventional reporting requirements and examination procedures that rely on limits and capital charges are less effective than they once were.

[6] As used in this paper, the term "country" does not in all cases refer to a territorial entity that is a state as understood by international law and practice. In particular, as used here, the term "country" also may cover Hong Kong Special Administrative Region.

size of the bank's foreign currency positions, in individual currencies, groups of currencies, and in all currencies taken together.

A. Procedures for Recording and Converting Foreign Currency Assets and Liabilities

While accounting standards are not central to this paper, they do have implications for measuring the values of foreign currency denominated assets and liabilities in domestic currency terms. In this regard, particular attention must be paid to recording procedures, conversion methods, and the treatment of revaluation gains and losses.

Three aspects of the **recording** of foreign assets and liabilities must be addressed. First, while banks keep their primary accounts in the domestic currency, they should also have parallel ledger accounts for each currency, generally with separate accounts for each type of transaction in each currency. Second, rules are needed regarding the currency in which foreign assets and liabilities are recorded. In general, assets and liabilities should be recorded in the currency in which the risk is denominated, regardless of the currency in which they were initially paid or received.[7] Third, foreign currency accounts must be converted into domestic currency equivalent for inclusion in financial statements and prudential reports. This requires that revaluation accounts be used for recording translation gains and losses.

Accounting standards generally prescribe particular **conversion methods** to govern the conversion of foreign currency transactions and balances into their domestic currency equivalent. In most countries, banks should convert and record foreign currency **transactions** (such as a spot sale or a loan) by applying the exchange rate at the date of the transaction to the foreign currency account. Foreign currency **balances** should be converted or translated using either the closing rate method or the nonmonetary method, depending on the type of asset or liability concerned. Monetary items should be reported using the closing rate method, where items are converted at closing exchange rate for the period (for example, the spot exchange rate for balance sheet data). In some countries, certain items, such as real estate or other fixed assets, are treated as nonmonetary items, and their value, for balance sheet purposes, is generally based on an historic rate, such as the exchange rate that existed at the date of the transaction, or the time that the value of a particular item was determined.

Most countries require use of the closing rate method for monetary assets.[8] Of the 19 countries surveyed, 16 require the use of the closing rate for monetary assets. However, six of the surveyed countries also allow some fixed assets to be treated as nonmonetary assets and converted at an historic exchange rate (Appendix I, Table 2).

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[7] A variety of rules are used regarding the recording of fixed assets located abroad, but they are usually recorded in the currency of the country in which these assets are located.

[8] However, the current spot rate is normally used for internal risk management operations if the institution trades on an ongoing basis.

The impact of the conversion method on valuation gains or losses can vary markedly depending on the composition of a bank's balance sheet. In general, the greater the share of a bank's portfolio that is converted using the closing rate, the greater the impact of exchange rate variations on its balance sheet and income. However, such exposures may be hedged. On the other hand, if a banks chooses to hedge nonmonetary items, its balance sheet may be more vulnerable to exchange variations than if all items were converted using the closing rate.

The treatment of **valuation gains and losses** is important because it can affect a bank's capital and its taxable income. Virtually all countries surveyed pass valuation gains and losses on monetary assets and liabilities to the income and expenditure account, so they are immediately reflected in bank capital and are included in, or deducted from, taxable income. However, many countries exclude unrealized valuation gains on certain fixed assets, and foreign exchange-denominated capital, from taxable income. Four sample countries—Czech Republic, Korea, Singapore, and the United States—record all fixed assets at the closing rate, and revaluation gains and losses are recorded directly in the capital accounts. Since these accounts are not part of the income and expenditure statement, any unrealized valuation gains are not subject to taxation. Eight other countries, including France, Malaysia, and Spain, record certain fixed assets at historical cost, so that exchange rate changes do not affect the value of these assets until they are disposed of. The down side of this simpler alternative is that it may result in unrealized gains or losses being hidden on the balance sheet; thus, for the sake of transparency, it is useful to add memorandum items showing the value of these items at current exchange rates.

B. Measuring the Size of Foreign Currency Positions

For purposes of regulation and internal control of foreign currency positions, attention is normally paid to (1) single currency positions or position in an individual currency or group of currencies with a single—or nearly single—exchange rate; and (2) the overall foreign position, which measures a bank's foreign exchange position in all currencies taken together.

Determining the size of a single currency position

Regulations on a foreign currency position must enumerate the items to include in the calculation. Until recently, there was no broadly accepted formula for the calculation but in 1996, the Basle Committee took the position that the calculation should be made by summing up the following items:

- "the net spot position (that is, all asset items less all liability items, including accrued interest, denominated in the currency in question);

- the net forward position (that is, all amounts to be received less all amounts to be paid under forward foreign exchange transactions, including currency futures and the principal on currency swaps not included in the spot position);

- guarantees (and similar instruments) that are certain to be called and likely to be irrecoverable;

- net future income/expense not yet accrued but already fully hedged (at the discretion of the reporting bank);

Positions in composite currencies, such as the ECU, need to be separately reported but, for measuring banks' open positions, may be either treated as a currency in their own right or split into their component parts on a consistent basis."[9]

A single currency position is used to measure the potential losses or gains to the bank for each unit of change in the given exchange rate. However, it should only measure the gains and losses that result from changes in the spot exchange rate (with any interest rate risk managed separately). Thus, the Basle Committee has taken the view that forward currency positions should be valued at current spot exchange rates, since forward rates also reflect current interest rate differentials. Similarly, the calculation should exclude items that are carried at historical cost.

Measuring the overall foreign currency position

Traditional measures

Supervisors and bank managers alike find it convenient to use a single summary figure to measure a bank's overall foreign exchange exposure. Several definitions are commonly used, which vary primarily with regard to the degree of netting of long and short positions across currencies. The three most common are: (1) the **gross aggregate position**, which is the sum of all net short and all net long positions; (2) the **net aggregate position**, which is the absolute value of all short positions less all long positions, in other words, the position in the domestic currency, abstracting from all other positions; and (3) the **shorthand position**, which is the greater of the sum of the short positions and the sum of the long positions (See Box 1 for the formulae and an example).

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[9] Basle Committee (1996), p. 23. The proposal also includes a discussion of managing the risks associated with foreign exchange options, but this is beyond the scope of this paper.

Box 1. "Traditional" Measures of the Overall Foreign Exchange Position

A. The Formulae

Let F_i denote the single currency, i, position. If $F_i>0$ ($F_i<0$), then a long (short) position exists. For purposes of calculation, let the absolute value of $F_i>0$ be P_i, and the absolute value of $F_i<0$ be N_i, and let P be the sum of all P_i, and N be the sum of all N_i, then the three measures are defined as follows:

- Gross aggregate position (GAP), GAP= P + N
- Net aggregate position (NAP), NAP= absolute value of (P - N).
- Shorthand position (SHP), SHP= maximum (P, N).

From the definitions, it follows that: GAP > SHP > NAP, and SHP = (GAP + NAP)/2

B. An Example

As an example, assume a bank has the following foreign exchange positions (measured in domestic currency equivalent):

Long		Short	
DM	50	US$	100
Y	100	F	75
BF	20		

Then P = 170, and N = 175, and GAP = 345; NAP = 5; and SHP = 175

The appropriate summary measure depends on the correlation of exchange rate changes between the currencies in which a bank holds open positions. If exchange rate movements are **perfectly** correlated, as with currencies within a well-functioning monetary union, then cross-currency exchange risk can be theoretically ignored (in effect the exposure to one currency in the union can be treated the same as the exposure to any other currency in the union). In this case, the appropriate measure of exposure would be the net aggregate position, since this particular formula offsets long positions against short positions. On the other hand, if exchange movements are uncorrelated, then the losses (or gains) on an open long position would **not be expected** to be offset by gains (or losses) on an open short position. In this case, the appropriate measure of exposure is the gross aggregate position, since it sums short and long positions. The shorthand position, on the other hand, is a compromise between the other two measures, and is therefore appropriate when there is some, but not perfect, correlation among the currency exchange rates.

The Basle Committee has come out in favor of the use of the shorthand position for calculating capital requirements.[10] However, it has made no explicit recommendation as to which measure to use when setting limits on a bank's overall open foreign exchange position.

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[10] Basle Committee (1996), pp. 25-6.

These decisions would presumably be based on the expected correlations in movements of currencies in which domestic banks hold open positions. However, the shorthand position appears to be the best compromise if the extreme assumptions clearly do not apply.[11]

While the value of using the net aggregate position for prudential purposes is open to dispute, since it places no limits on the positions a bank can take in third currencies, it does measure the bank's overall own position in the reporting currency, so this formula is generally used in reports which are produced for monetary or exchange control purposes.

Other methods of managing foreign exchange risk

The traditional measures of foreign exchange risk, however, have three drawbacks. First, as noted, they can take only partial account of the correlation in movements between the various currencies. Second, they take no account of the relative size of variations between currencies with the result that open positions in currencies, whose exchange rate relationships with the home currency are quite stable, are given the same implicit risk-weight as those which have a far more unstable relationship. For example in the Netherlands, the traditional measures would give open positions in deutsche mark the same treatment as open positions in U.S. dollars or Russian rubles. Third, these systems treat foreign exchange risk as being distinct and independent from the other risks faced by the bank, preventing the substitution of foreign exchange risk for other forms of risk.

One way to address the above noted problems is through the use of Value-at-Risk models (VAR). VAR models are used to measure the market or other portfolio risks for financial assets by estimating the greatest loss in the value that can be expected in a given trading book, with a given probability over a specified holding period. Thus, for example, the problem could involve estimating the maximum loss or value-at-risk at the 99 percent confidence interval, for a given foreign exchange portfolio over a ten-day holding period.[12] There are numerous ways of estimating VAR models, however, the three most common are the variance/covariance, historical simulation, and Monte Carlo approaches.

As a related issue, supervisors should only set the broad operational guidelines regarding the estimation of the banks' VAR models. It should not be heavily involved in deciding how frequently the parameters of a bank's model must be revised, and especially in determining whether special adjustments must be made to incorporate changes in the expected

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[11]If a bank has positions in groups of currencies whose movements are highly correlated, for example, in EMS currencies for a non-EMS country, it may be preferable to aggregate positions in those currencies and use the gross aggregate or shorthand method, rather than use those holdings as a reason for using the net aggregate position.

[12]For a useful discussion of VAR models, as well as Basle Committee proposals regarding the use of these models, see IMF (1995), pp.141—147.

behavior of particular currencies. Furthermore, letting banks make their own estimates allows them to use various weighting schemes to estimate parameters and even to include information on their expectations regarding currency behavior.

The variance/covariance (VC) approach

The VC approach uses summary statistics on exchange rate variability and correlations between currencies to estimate potential losses. The coefficients of the model are generally estimated using historic data. However, users of this model must address a number of statistical, informational, and policy problems. The first problem is that it assumes the predicted foreign exchange gain or loss will have a multi-variate normal distribution, which seems not to be the case, since exchange rates appear to have density functions that are flatter than a normal distribution (Booth and Glassman, 1987). Thus, if normality is assumed, the capital requirements for a given confidence level will be underestimated.[13] Techniques have been developed to avoid the problems associated with the assumption of normality, but they have additional informational requirements (Leahy, 1991).

A second problem is that the VC model has large informational requirements. For example, even assuming normality, estimating the distribution of outcomes for a portfolio with six currencies, requires 27 parameters (6 means, 6 variances and 15 covariances). But bank portfolios are often far more diverse, with correspondingly greater informational demands. Furthermore, basing statistics strictly on historical data may exclude important available information, while incorporating new information requires either arbitrary adjustments in the coefficients or the use of ad hoc weighting schemes for estimating those coefficients.

A third problem is determining who should estimate the model. Clearly, this is a job for the banks, not the supervisor.[14] However, even so, the supervisors must be able to test the coefficients of the model to ensure that it is sound, and does not allow the bank to pursue unacceptably risky policies, which in turn may require the supervisor to maintain its own VAR model. Furthermore, in many countries the banks would be unwilling to share a single model,

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[13]Problems may also arise because both of these distributions allow a non-zero probability of the exchange rate turning negative unless, as Johnson and Kotz (1971) suggest, natural logarithms are used.

[14]Imposing the supervisor's model on the banks would also require that the supervisor accept the moral—and perhaps legal—responsibility for any extraordinary losses arising, should market developments diverge significantly from the parameters of the model. Such an arrangement might also encourage a bank to take risks which, while excessive based on its own model, are within the limits of the supervisor's model, on the belief that should serious losses arise, the bank may seek restitution from the supervisor on the grounds that the supervisor's model encouraged it to engage in excessive risk taking.

implying not only that each bank may need to bear the cost of creating and updating its own model (or buying it from a vendor), but that the supervisor be able to test each bank's model.

Historical simulation approach

The historical simulation model uses historic data to calculate changes in a trading book that would have been experienced during that simulation period. This approach offers several distinct advantages over the VC approach. First, it requires no assumptions about the distribution of the variables; instead, the estimated value at risk at each confidence level is the actual loss that would have occurred during that period, with that portfolio, given the events that actually transpired. Second, the variances and covariances of each asset need not be estimated. Third, once the details of the simulation are determined, ad hoc adjustments are not normally considered.[15] The major downside of the problem is that historical simulations do not make full use of the current information available, and do not incorporate information on changes in underlying conditions, such as changes in exchange rate arrangements or in the outlook for particular currencies.

Monte Carlo approach

The Monte Carlo approach is used to estimate the value at risk based on a large sample of simulated price paths for the assets in the portfolio. Generally the price movements are simulated using a dynamic model, which is given a large number of shocks produced by randomly generated data (assumptions must also be made about the distribution of the random data). Then, if the assumed model of price dynamics is correct, the simulation may produce highly reliable estimates of the value at risk. An advantage of this approach is that the simulations can be designed to take maximum advantage of the latest available information on exchange rate movements. In addition, if the underlying price model is thought not to have changed, historic data can also be sampled randomly as the input data for the simulations. A disadvantage is that the underlying model will be arbitrary, and if the dynamic model is not correct, neither will the estimate of the value at risk.

Stress tests

One shortcoming of VAR models is that they are based on normal day-to-day developments, and only incorporate exceptional shocks insofar as they occurred during the estimation period for the VC model or in the simulation period for the historical simulation model. Even then, no additional weight is given to these observations. However, large shocks can and do occur, and it is in these situations that banks are most likely to have the capital

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[15]The model also does not have to face problems with nonlinearities, such as those associated with options contracts, which can undermine VC models.

bases severely damaged. It is for this reason that the Basle Committee has come out in favor of supporting VAR models only with the use of stress tests.[16]

Stress tests are used to estimate potential losses under extreme assumptions. This may start by estimating the peak losses that would have been experienced using a historical simulation. This may be supported by estimating the impact of several notable historical shocks, such as the fall in equities prices in 1987, or the Exchange Rate Mechanism (ERM) crises in 1992 and 1993. Such testing can also be supported by tests based on guesses regarding the types of shocks that could occur in existing operating environment.

Structural positions

Banks in countries with weak currencies often wish to hold structural or ongoing long positions in foreign exchange. The problem arises because a depreciating domestic currency will cause the value of bank capital, in foreign currency terms, to decline if the bank's foreign currency position is balanced (unless the hedge is achieved with a put option).[17] Thus, if a bank holds significant foreign-denominated assets, it may be forced to increase its capital or reduce its assets to meet regulatory capital requirements, unless it can generate additional capital (in local currency terms).

If banks are allowed to hold such structural positions, then such positions should be excluded from the calculation of the open position in the corresponding currencies. The Basle Committee's proposal is that national supervisors should be free to allow their banks to hold structural positions, and for all these positions to be excluded from standard prudential limits, if certain conditions are met.[18] In particular: (1) the positions must be nondealing in nature;[19] (2) the national authority must be satisfied that it does no more than protect the bank's capital adequacy ratio; and (3) the exclusion is applied consistently. Support for this approach appears broad-based.

Holding structural positions raises several regulatory issues. Perhaps the most sensitive issue relates to the treatment of revaluation gains and losses on the structural position, particularly their distribution and taxation. Since the profits derived from structural positions

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[16]Basle Committee (1996), pp. 46-7.

[17]In high inflation countries with low bank profitability, banks may also wish to hold a structural foreign currency position to hedge their capital against inflation.

[18]Basle Committee (1996), pp.24-5.

[19]Thus, structural positions would also include foreign assets that the regulator allows to be recorded at historical cost. Hence a bank may have a notional structural position rather than holding excess assets explicitly in foreign currency as reflected in its balance sheet.

are unrealized and are intended to support the bank's ongoing operations, there is a strong case that these profits should be neither taxed nor distributed. One way to protect them from such actions would be to record such gains in a special revaluation account rather than moving them through the profit and loss account.

Consolidated measure of foreign exchange risk

There is broad international support for the consolidated supervision of risk.[20] This is because problems in one affiliate can affect a financial or corporate group as a whole, and consolidation reduces the likelihood that risks taken by one institution can be "hidden" in other unsupervised institutions. However, measuring risk on a consolidated basis also permits intra-group netting, and may be thus less demanding. Furthermore, supervision on a consolidated basis should not be used as a reason to preclude the measurement of risk at an individual institution.

Difficulties may arise when applying this principle. One problem is that internationally active banks may adjust their end-of-day positions by passing assets or liabilities to an affiliate in a later time zone; a legitimate way to continuously manage positions. However, as some prudential reports are prepared by consolidating the individual reports of the affiliates at the end of the business day *in each time zone*, they may understate the bank's true open position. Capital controls may also cause problems. For example, a bank may have a closed position on a consolidated basis, but if some of its revaluation gains are booked in a country which limits the distribution of such profits, these gains cannot be used to offset the bank's revaluation losses in other countries.

III. The Management of Foreign Exchange Risk

The prudential control of foreign exchange risk should begin by ensuring that the bank has effective systems of internal control to allow it to be able to adequately manage the risks that it faces.[21] Bank supervisors also normally require that foreign exchange reporting systems be in place to enable them to monitor banks' open positions. Supervisors also often impose other prudential controls, including direct limits on the range of foreign exchange operations a bank may carry out, limits on banks' open foreign exchange positions, and capital requirements against foreign exchange risk.

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[20]The principle of consolidated supervision of banks was laid out in the Basle Committee's Concordat in 1983, which has subsequently been amended several times, see Basle Committee (1983 and 1992, respectively).

[21]For example, see Folkerts-Landau and Lindgren (1998), p.39.

A. Internal Controls

A strong system of internal controls is a prerequisite for effectively managing market risks, particularly foreign exchange risks where large positions may be quickly created. While bankers are responsible for devising these systems, supervisors are responsible for ensuring that the framework is adequate and enforced by bank management. A part of these controls often involves the imposition of limits on foreign exchange positions, capital requirements, or both; however, supervisors in many countries also issue regulations or guidelines regarding the design of banks' internal control systems.[22] The guidance offered varies from quite general to highly specific, and in some cases it includes rules specifically relating to foreign exchange-related operations. The areas covered usually include accounting and information standards, allocation of responsibilities, and internal compliance.

Accounting and information standards[23]

The internal control system must be supported by a system for monitoring foreign exchange risk. This system must: (1) immediately record all foreign exchange operations and maintain a permanent record of all transactions; (2) immediately and continuously update positions in each traded currency; and (3) continuously measure the results, for each and all currencies. It must also ensure that foreign currency claims and obligations originating from all of the bank's operations are quickly entered to allow accurate monitoring of the bank's overall foreign exchange position. The full evaluation of such systems generally requires an on-site inspection to assess both the design of the monitoring system, the computer systems on which the system operates, and how the bank actually uses these systems.

Allocation of responsibilities

Supervisors should also ensure that a bank has properly allocated internal oversight responsibilities. These responsibilities should be assigned by the board of directors. In small banks, the responsibility for foreign exchange operations may be delegated to a senior operating officer, while in larger banks, it may be appropriate to assign such responsibilities to a committee of senior managers. The committee generally includes the managers responsible for the major lines of business, including the lending function and foreign exchange transactions.

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[22]Basle Committee (1980) contains a succinct discussion of the role of bank management in ensuring the safety of a bank's foreign exchange operations.

[23]Procedures for recording and converting foreign currency assets and liabilities are discussed in II.A.

An increasing number of banks now use an independent risk control unit, which operates outside of the bank's trading units to design and control the overall risk management system.[24] This group is charged with developing and testing the bank's risk management system and for allocating risk limits, as defined by the bank's internal model and/or regulatory standards, to the operational units. Risk control units normally report directly to the bank's senior management.

The internal control system should include a written policy for foreign exchange operations, approved by the board of directors. The policy need not be lengthy and detailed, but it should provide guidance on the tolerance level for foreign exchange risk. This includes requiring the establishment of internal limits on foreign currency positions, and naming the persons responsible for proposing and approving the internal limits. The board should also be required to approve these limits.

Key aspects of this policy include the establishment of limits on overnight and intra-day open positions in each currency, and for all currencies combined. In addition, any domestic branches that are not on-line with the head office should have sub-limits delegated to them to ensure that the bank's overall limits are not violated. A wholly owned subsidiary is normally treated as a branch for this purpose, while joint venture banks are treated as independent institutions. However, the parent bank should know the limits of its affiliates in order to avoid an undesired level of risk on a consolidated basis.

Of the 19 countries surveyed, eleven had regulations or guidelines governing general requirements for an internal control function, while two (Colombia and the United States) implicitly established these requirements (Appendix I, Table 3). Nine of the survey countries have regulations requiring written policies on internal controls, while three (Indonesia, Singapore, and the United States) have no general requirement, but a written policy was required by the supervisors.

Internal compliance

A bank must also have systems to monitor compliance with its internal rules. As a minimum, this requires that: (1) the front and back offices be fully separated—the back office must never report to the front office; (2) a qualified officer to be responsible for monitoring compliance; (3) controllers to have specialized knowledge of foreign exchange; (4) controllers be independent of the foreign exchange department, and to report directly to the chief

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[24]For further discussion, see III.E and Basle Committee (1996), pp. 39-41.

executive officer or the board of directors;[25] and (5) a minimal periodicity be established for assessing compliance. Supervisors also often insist on receiving a regular report describing the steps taken to implement foreign exchange policy guidelines and noting any major change in their internal organization of the foreign exchange function.

B. Reporting Practices

The supervision of banks' foreign exchange exposures requires a formal reporting system. Regulations must set: (1) the format of the reporting forms; (2) the frequency with which the various reports are prepared; and (3) the frequency with which the various reports must be sent to the supervisory authorities. While all of the countries surveyed require some form of reporting on banks' currency position, and most require the banks' to calculate their single and the overall positions at least daily, most supervisors surveyed only require that reports be sent on a weekly or a monthly basis.

C. Direct Limits on Banks' Foreign Exchange Operations

One way to limit the foreign exchange risks a bank may take on to directly limit its foreign exchange operations. This may be done with licensing requirements or by supervisory order. While such licensing may be explicit, the need for a formal arrangement is not altogether clear; in some cases these requirements may be a carryover from the era of exchange controls. Only seven of the nineteen countries surveyed have specific licensing requirements on general foreign exchange operations, and none of the industrial countries surveyed have this requirement. Some, however, do require that a bank receive special permission from the supervisor prior to engaging in certain riskier foreign exchange operations, such as swaps, derivatives, or writing options.

D. Limits on the Size of Open Positions

As noted, most countries impose prudential limitations on banks' open foreign exchange positions. However, these limits are defined differently in different countries. In most, the limits are set as a percentage of a bank's capital, but in a few countries other considerations also apply. For example, in India the overall limit must be formally approved, while in Malaysia the quality of bank management is factored in by the authorities in setting the overall limit.

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[25]Some modern internal control systems assign primary responsibility for designing and implementing internal controls to line officers, while internal audit tests that proper controls are in place, and makes spot checks to ensure that they are implemented effectively. In the case of foreign exchange trading, compliance is enforced through the back office, which reports to either a senior manager or committee charged with compliance; not unlike the traditional audit function.

Limits on single currency positions

In theory, limit's on a bank's single currency position should be based on the level of risk of that currency, and the income volatility that the bank or the supervisory authority will accept as a result of that exposure. However, supervisors are reticent to explicitly commit to the size of acceptable fluctuations in income derived from changes in exchange rates, and relatively few countries' regulations differentiate between currencies.[26]

The use of explicit single currency limits is not very common. Of the nineteen countries in the survey, only four, Czech Republic, Hong Kong Special Administrative Region (Hong Kong SAR), Malawi, and Oman set such limits (see Appendix I, Table 4). Three of the four also have differential limits depending on the currency. Hong Kong SAR and Malawi allow banks to hold larger positions in U.S. dollars, while Czech Republic allows larger positions in "convertible" currencies, which include those of Australia, Canada, the EU, Japan and the United States. Regulators in Hong Kong SAR may also explicitly reduce the single currency limits for a given currency.

Single currency limits vary considerably. Oman allows positions of up to 40 percent of capital, while the Czech Republic sets limit at 15 percent of capital for "convertible" currencies, and 2 percent of capital for other currencies. Malawi sets a limit of 15 percent of capital for U.S. dollar positions and 5 percent for other currencies, and Hong Kong SAR uses 10 percent of capital as a norm, but supervisors may allow larger positions in U.S. dollars and smaller limits for some other currencies.

None of the countries surveyed currently imposes a sub-ceiling on open positions in groups of currencies, although several have done so in the past.

Limits on the overall position

While single currency limits help manage the risk of income fluctuations resulting from bilateral exchange rate movements, limits on the overall foreign currency position are designed to reduce the fluctuations in a bank's income from either a general movement in the domestic currency or from exchange rate volatility. From a bank's perspective, limits on the overall position are generally the most important constraint on their foreign currency portfolio.

Most countries, including fifteen of the nineteen countries surveyed, limit their banks' overall foreign currency positions. The limits are normally set as a percentage of bank capital. However, the choice of calculation method varies considerably, with four using the shorthand position, three the net aggregate position, three the gross aggregate position, and five some other calculation. Among the countries using the shorthand method, the limits vary from

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[26]A parallel example is with credit risk, where most supervisors place a single limit on large exposures, independent of the borrower (other than government).

4 percent in the Czech Republic, for all "other" currencies, to 35 percent in Malawi. On the other hand, survey countries using the net aggregate method set limits in the range of 20-25 percent of capital, while those using the gross aggregate method set limits ranging from 21 percent of capital in Germany to 40 percent in Oman.[27]

E. Capital Requirements

In recent years, there has been a growing trend toward the use of capital requirements in the prudential control of banks' market risks, including foreign exchange risks. While open position limits remain the instrument of choice in most countries, an increasing number of countries are implementing capital requirements. Five survey countries, France, India, the Netherlands, Singapore, and Spain now use capital requirements, while Germany and Hong Kong have announced plans to introduce these requirements by end-1997. In most cases, the changeover to capital requirements was closely related to the issuance of either the EU directive in 1993 or the Basle Committee proposal on market risks in early 1996.

The Basle Committee proposal, which was to be implemented by Committee member countries by end-1997, gives a framework for setting minimum capital requirements on all forms of market risks, including foreign exchange risk. It specifies that capital requirements against each form of market risk should be based on the potential losses associated with that exposure, and that the capital charges on all market risks should be calculated so as not to create artificial incentives for favoring one class of instruments over another. By treating all market risks in a similar manner, the plan allows a bank to substitute one type of risk for another.

The proposal allows capital charges against a bank's foreign exchange position to be calculated in two ways.[28] The first, which is expected to be the more common, estimates the bank's overall foreign exchange position using the shorthand method, and requires a minimum

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[27]Some countries also set differential limits set on their banks' overall long and overall short foreign exchange positions. Asymmetric limits would only seem appropriate when the risks are asymmetric. Otherwise, one must question whether the limit is being imposed solely for prudential purposes, or whether it is also being used as a capital control. Similar questions may arise when a country frequently adjusts its foreign exchange exposure limits, particularly if the changes are not in response to changes in either the capital positions of the banks or perceived improvements in banks' ability to manage foreign exchange risk.

[28]National supervisors may also exempt a bank from capital requirements on its foreign exchange positions, if its gross aggregate position does not exceed 100 percent of capital, and its net aggregate position is less than 2 percent of capital. Basle Committee (1996), p. 26.

capital charge of 8 percent against that position.[29] The second allows the use of a bank's own internal risk model to estimate capital requirements. It gives considerable flexibility regarding the choice of model, but the use of this approach is subject to stringent conditions, which are discussed below.

The EU directive, which was implemented by end-1995, bears many similarities to the Basle proposal in its rules regarding the allocation of capital for market risks. But there are also a number of differences; some of the more important are:[30]

- the directive applies to a broader group of financial institutions, including securities firms;

- while both approaches allow the use of the shorthand model, with an 8 percent capital requirement, the only alternative model permitted in the directive is a simulation model, based on historic data, that cannot take account of covariances between markets. A bank may use its internal model if it can be shown to have higher capital requirements than the standard model, that is, the bank's model is more conservative than the regulator's;

- the directive does not permit similar assets, for example, equities, in different markets to have differing volatilities; and

- the directive allows lower capital requirements for currencies whose movements are closely correlated with the home currency or are bound together by governmental agreement, such as the EMS.

Prerequisites for using VAR models

While the Basle Committee proposal gives bank's great flexibility in their choice of VAR model, it also urges caution in permitting the use of such systems. Accordingly, it sets out detailed standards on when such models should be used, as well as qualitative and quantitative standards on their use and stress testing. [31]

Since model-based systems are computer intensive, complex, and have large informational requirements, the Committee recommends that the supervisory authority only give approval to use the model if, inter alia:

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[29]The position also includes the bank's open position in gold.

[30]European Union (1993). For a further discussion of the differences, see Hartmann (1995), pp. 11-12, and Jackson (1995), pp. 183-4.

[31]These standards are laid out in Basle Committee (1996), pp. 38-49.

- "it is satisfied that the bank's risk management system is conceptually sound and is implemented with integrity;
- the bank has, in the supervisory authority's view, sufficient numbers of skilled staff in the use of sophisticated models not only in the trading area but also in the risk control, audit, and, if necessary, back-office areas;
- the bank's models have, in the supervisory authority's judgement, a proven track record of reasonable accuracy in measuring risk;
- the bank regularly conducts stress tests"[32]

Thus, it would appear that this approach requires a degree of sophistication on the part of both the banks and their supervisors that is not currently present in numerous countries, so supervisors in these countries should not consider allowing the use of such models until the necessary criteria are met.

Qualitative standards

The Committee proposes a range of qualitative standards to help assure the supervisory authority that the models are "conceptually sound and implemented with integrity." These standards cover the bank's overall risk management systems, which are a part of the bank's overall internal control system, and include the need for an independent risk control unit; active involvement of management and the bank's board in risk control; a fully documented system of risk controls, and a routine to ensure compliance with those controls; independent reviews of the risk measurement system by the bank's internal audit system; regular ex post testing of the risk measurement model's results; and integration of the model into the day-to-day risk management process, including its use in setting internal trading and exposure limits. In short, the bank's risk management systems need to be comprehensive, well developed, and fully integrated with the bank's operations.

Quantitative standards

The Basle Committee makes no proposal regarding the type of VAR model banks must use, noting that VC, historical simulation, and Monte Carlo models would all be acceptable. However, the proposal does establish minimum quantitative standards for the use of the model. The basic requirements are that the model be run using daily data, with a ten-day holding period used to calculate price shocks, and that the historic observation period for calculating the value at risk be at least one year, and estimated using the 99th percentile of a one-tailed confidence interval. Data should be updated at least quarterly, more frequently if the supervisor believes that there has been a rise in exchange rate volatility. The bank is also

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[32]Basle Committee (1996), p. 38.

free to allow for correlations across financial instruments, if the supervisory authority is satisfied with the soundness and integrity of those estimates. In addition, capital requirements must be met daily, based on the higher of the requirements estimated on the previous day or the average daily value at risk over the previous sixty business days multiplied by a multiplication factor of not less than three.[33] The multiplication factor may also be further increased if the performance of a bank's model is deemed less than fully satisfactory.

The Committee also proposes that banks using internal models engage in rigorous stress testing of their portfolios to estimate peak potential losses, and that they report data on the bank's recent peak losses compared to the estimates of those peaks made by the bank's own model. Basing the required capital allocation on peak losses in a series of well-designed stress tests could be one way of replacing the minimum multiplication factor.

The definition of capital

The Basle Committee recommends that the definition of capital for covering market risk be the same as that in the Basle Capital Accord.[34] However, national supervisors may also permit banks to use an additional form of subordinated debt, Tier 3 capital, solely to cover market risks.[35] The amount of Tier 3 capital used to cover capital requirements on market risks may not exceed 250 percent of the primary (Tier 1) capital allotted to cover capital requirements from market risk.[36]

Capital requirements with a weak or developing banking system

From the above, there are clear advantages to using capital requirements to manage banks' foreign exchange exposure versus the use of fixed percentage limits. The recognition of this led the members of the Basle Committee to support the adoption of capital requirements for its member countries. However, replacing fixed limits with the Basle

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[33]The use of a multiplication factor greater than one may reflect uncertainties associated with the limited experience in the use of VAR models as a supervisory tool.

[34]As defined in Basle Committee (1988).

[35]Tier 3 capital consists of unsecured, subordinated debt, with an original maturity of at least two years, and may not be repaid before the agreed repayment date without the approval of the supervisor. It must also have a lock-in clause stipulating that neither interest nor principal may be paid (even at maturity), if such payments would cause the institution to fall below, or remain below, its minimum capital requirements.

[36]Tier 2 capital may also be substituted for Tier 3 capital, up to the same 250 percent limit. However, some Committee member countries will continue to require that at least half of all bank capital be primary capital, that is, Tier 1. Basle Committee (1996), p. 7.

Committee proposals on capital requirements may not be appropriate in all cases. To begin with the use of VAR models places stringent demands on both the banks and the banking supervisors in a country, and the use of such models is only appropriate in the most sophisticated countries. However, even basing capital requirements on the shorthand model may result in banks being permitted to take on levels of risk that may be higher than the domestic supervisors would favor, particularly if the banking system is not well developed or there are concerns about the accuracy of the data on bank capital.

The differences between the use of absolute limits and the Basle Committee system are highlighted in Table 1. The table shows that fixed percentage limits more tightly limit the potential loss a bank might face from an adverse exchange rate movement if its capital level considerably exceed the minimum capital ratio that is required against credit risk (and other market risks). Furthermore, capital requirements allow a rapid increase in the permissible maximum exposure—and hence maximum permissible losses—as the capital ratio rises. This, by itself, may raise serious concerns on the part of supervisory authorities.

Far more serious problems may arise if there are concerns about the accuracy of the data on bank capital. For example, if banks are not fully provisioning against potential loan losses, then capital will be overstated. In these circumstances, the reported capital ratio may be high, even though the true level of capital may be inadequate or even negative. Thus, the bank may find it to its advantage to pursue a risky so-far-broke strategy in the foreign exchange market, in the belief that inaction may result in the bank's closure. Furthermore, if the bank is considering pursuing such a strategy, the benefits of providing inaccurate data on bank capital increase sharply because of the greater leverage permitted with capital requirements. Hence, the supervisory authority should be convinced of the accuracy of banking data before fixed percentage exposure limits are abandoned altogether. In the interim, a combination of the two may be the most desirable approach.

IV. Conclusion

This paper examined issues in the management and prudential regulation of foreign exchange risk. In the course of the discussions, a number of issues came to the fore, but this section will highlight only a few of those. A central, but frequently forgotten, point is that the key to the effective management of foreign exchange risk lies in the bank's own risk management systems. This should begin with an effective system of internal controls, based on stringent accounting and informational standards, and a clear allocation of responsibilities. While the institution is responsible for developing its internal control system, the supervisory authority should be expected to ensure that the system is adequate and used.

Table 1. Risks Using Capital Requirements versus Percentage Limits[1/]

Capital/Asset Ratio	Capital (amount)	Capital Requirements: Open FX Limit (percent of capital) [2/]	Capital Requirements: Open FX Limit (amount) [3/]	Percentage Limits: Open FX Limit (percent of capital) [4/]	Percentage Limits: Open FX Limit (amount) [5/]	Capital Requirements: Loss from 5 percent adverse movement (percent of capital)	Percentage Limits: Loss from 5 percent adverse movement (percent of capital)
8	8	0	0	40	3.2	0	2
9	9	125	11.3	40	3.6	6.3	2
10	10	250	25.0	40	4.0	12.5	2
11	11	375	41.3	40	4.4	18.8	2
12	12	500	60.0	40	4.8	25.0	2

[1/]Assumes that capital allocated for counterparty risk is 8 percent of total assets, and total assets are 100.

[2/]Assumes that capital for market risks is 8 percent of the bank's shorthand foreign exchange position, and does not necessarily need to allocate additional capital for other market risks.

[3/] Capital less capital set aside for counterparty risk, multiplied by the capital requirement.

[4/]Assumes the limit on the bank's shorthand position is 40 percent of total capital.

[5/]Capital multiplied by the percentage foreign exchange limit.

Banks' overall foreign exchange exposures have generally been measured using one of three formulae, based on unweighted summations of their long and short positions in individual foreign currencies. These include: the gross aggregate position, which implicitly assumes that there is no correlation in currency movements (uncommon); the net aggregate, which assumes that the correlations in currency movements are perfect (unlikely); and the shorthand position, which assumes that the correlations are between the two extremes. While each formula has its advantages and disadvantages, the approach itself has three serious drawbacks: (1) it does not take full account of correlations in currency movements; (2) it implicitly assumes that the risk in every currency is the same; and (3) it treats foreign exchange risk as independent from the other risks faced by the bank. While no overall measure dominates the others, the shorthand position would appear to be the most appropriate for most banks in most countries. On the other hand, the use of the net aggregate measure should generally not be used, since it takes no account of the risks posed by positions in third currencies.[37]

One way to address these shortcomings is with VAR models, which measure portfolio risks by estimating the maximum loss that can be expected with a given likelihood over a specified holding period. There are three main VAR models, each of which has its advantages and disadvantages, and there is no consensus as to which approach constitutes the best practice. The variance/covariance model is estimated using summary statistics on exchange rate variability and correlations between currencies. It is potentially quite accurate, but has large informational requirements, and estimating the coefficients of the model is not straightforward. The historical simulation model, on the other hand, uses a simulation of actual exchange rate developments over a specified period. While this avoids the main drawbacks of the first approach, it takes no account of changes in underlying relationships. Finally, the Monte Carlo model uses a model of exchange rate changes developed by the user to estimate the value at risk by repeated simulations. Although this allows for the effective incorporation of assumed changes in behavioral relationships, such assumptions also make the underlying model arbitrary.

One shortcoming of VAR models is that they focus on normal exchange variations, and not an infrequent but large shocks that may take place.[38] A widely accepted way of addressing this problem is by also subjecting the bank's portfolio to stress tests, which simulate major shocks based either on actual experience or on estimates of potential shocks that could take place.

Supervisors also generally seek to control banks' foreign exchange positions, either directly as a percentage of bank capital or through capital requirements. While limits on individual currency positions are on the wane, direct limits on overall positions remain common. Since the same overall position limits must apply to all banks in a system, shorthand limits are probably the most appropriate, although consideration could be given to allowing closely tied currencies to be aggregated.

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[37]Unless, of course, all or virtually all exposures are in a single currency.

[38]Such as that experienced in several Asian countries in 1997.

An increasing number of countries are using capital requirements, instead of or in addition to direct limits. Much of the impetus for this change has come from the Basle Committee's proposal on their use. The proposal requires banks to allocate capital, over and above that allocated for credit risk, specifically for all market risks, including foreign exchange risk. The capital requirement may be calculated in two ways. The most common is to set it at 8 percent of the bank's shorthand position (plus the absolute value of its position in gold). A bank may also use its internal VAR model to estimate its capital requirement, but the use of such models must be subject to stringent conditions, including, inter alia, a qualitative assessment of the bank's risk management system, and an agreement on the parameters of the model. The proposal also requires that capital requirements be at least three times larger than the value-at-risk estimated by the model at the 99 percent confidence level, which reflects a limited experience in the use of VAR models as a supervisory tool.

There are distinct advantages to the use of capital requirements, even if the use of VAR models is only appropriate for the most financially sophisticated bankers and supervisors. Still, some national authorities may not find it appropriate to rely solely on capital requirements. First, some supervisors argue that overall limits on banks' foreign exchange positions are needed because they play a role similar to limits on credit exposure to single borrowers, namely that they avoid concentration risk. Second, capital requirements allow open limits to rise sharply as the bank's capital/asset ratio rises above the minimum required for credit risks, which may permit a bank with limited skills in foreign exchange risk management to take excessively risky positions. Third, and potentially most serious, is that data on bank capital are frequently not accurately reported, and capital requirements may allow a misreporting bank to pursue far riskier foreign exchange strategies than it could with percentage limits. Thus, some supervisors may wish to either set higher capital requirements against foreign exchange positions than the minimum standards laid out in the Basle proposals, and/or retain maximum percentage exposure limits, particularly if they are concerned about the accuracy of the banks' reported capital data.

Table 2. Licensing, Accounting, Conversion and Revaluation[1/]

	Specific License Required[2/]	Specific Accounting Standards[3/]	Conversion Methods[4/]	Gains and losses from revaluation
Chile	No	Yes	Closing rate	All go to the income statement
Colombia	No	Yes	Average rate of the last 5 days	All go to the income statement
Costa Rica	No	Yes	Converted through US$s at rates provided by central bank	All go to the income statement
Czech Republic	Yes (no weakness, sound capital ratio)	No	Closing rate	Some do not go to the income statement
France	No	Yes	Closing rate, except forward transactions and some fixed assets	With minor exceptions, all go to the income statement
Germany	No	Yes	Closing rate for current assets and liabilities. Historic rates for other items.	All losses go to the income statement, but some gains do not
Hong Kong SAR	No	Yes	Closing rate, except for some fixed assets	All go to the income statement
Hungary	Yes (qualified personnel, good organization)	No	Closing rate	All go to the income statement (structural positions not explicitly covered)
India	Yes (capital ratio)	No	Any uniform rate can be used for conversion	All go to the income statement
Indonesia	Yes (sound, capital, capital ratio, minimum size)	No	Closing rate except capital in foreign currency	All go to the income statement
Korea	Yes	Yes	Closing rate, without exception	Some do not go to the income statement
Malawi	Yes	No	Closing rate	All go to the income statement

Table 2. Licensing, Accounting, Conversion and Revaluation[1/]

	Specific License Required[2/]	Specific Accounting Standards[3/]	Conversion Methods[4/]	Gains and losses from revaluation
Malaysia	No	Yes	Closing rate for monetary assets, historic rate for nonmonetary assets	Some do not go to the income statement
Netherlands	No	Yes	Closing rate except for some fixed assets	Some do not go to the income statement
Oman	No	No	Closing rate	All go to the income statement
Singapore	No	Yes	Closing rate	Some do not go to the income statement
Spain	No	Yes	Closing rate except for some fixed assets and some securities	All go to the income statement
Thailand	Yes (financial condition and underlying transaction volume)	Yes	Closing rate	All go to the income statement
United States	No	Yes	Closing rate	Some do not go to the income statement

Source: Data provided by national authorities.

1/ The detailed survey results are available upon request. The survey was conducted in 1996.
2/ First column refers to whether or not commercial banks are required to obtain a specific license for engaging in foreign currency activities.
3/ Second column refers to whether or not commercial banks have to follow specific accounting rules for foreign exchange transactions.
4/ Third column refers to the exchange rate used for converting into domestic currency assets and liabilities denominated in foreign currency.

Table 3. Internal Control and Reporting Practices

	Internal Controls: General[1/]	Internal Controls: Written Policy[2/]	Other Internal Control Requirements[2/]	Reporting Rules on Positions[3/]	Other Comments
Chile	No	No	No	Daily (S)	Monthly (S) report on limits
Colombia	Asset and Liability Advisory Committee required	No	No	Daily (S) Weekly (S)	Monthly (S) report on limits
Costa Rica	No	No	No	Daily (S)	
Czech Republic	Required by regulation	Required by regulation	Board involvement in monitoring, internal limits	Daily (S)	The written policy must be sent to supervisors
France	Required by regulation	Required by regulation	Internal assessment system	Semi-annual (S)	
Germany	Required by regulation	Required by regulation	Management responsible for limits. Independent risk control unit	Monthly (S)	
Hong Kong SAR	Formal guidelines	Required by guidelines	Internal limits required by guidelines	Monthly (S)	Report on exceptions to agreed limits monthly (S)
Hungary	Required by regulation	Required by regulation	No	Daily (P) Monthly (S)	
India	Required by regulation	Required by regulation	Internal limits and assessment system required	Weekly (S)	Compliance with capital requirements quarterly (S)
Indonesia	No	Required by supervisor	Internal limits	Daily (P) Weekly (S)	
Korea	No	No	No	Monthly (S)	
Malawi	No	No	No	Daily (P) Weekly (S)	
Malaysia	Required by regulation	No	Internal limits	Weekly (S)	

Table 3. Internal Control and Reporting Practices

	Internal Controls: General[1/]	Internal Controls: Written Policy[2/]	Other Internal Control Requirements[2/]	Reporting Rules on Positions[3/]	Other Comments
Netherlands	Required	Required	Yes	Daily (P) Monthly (S)	
Oman	No	No	No	Monthly (S)	
Singapore	Required by supervisor	Required by supervisor	No	Weekly (S)	Monthly (S) for capital requirements
Spain	Required by regulation	Required by regulation	Internal limits, regular review of policies	Daily (P) Monthly (S)	Compliance with capital requirements Daily (P) Semi-annual (S)
Thailand	Required by guidelines	Required by regulation	Internal limits	Daily (S)	Summary of spot and forward positions monthly (S)
United States	Implicitly, must have controls on all activities	Required by supervisor	Supervisor requires internal limits	Monthly (S)	

Source: Data provided by national authorities.

1/ "No" in the first column means that the implementation of an internal monitoring and control system for foreign currency operations is not specifically required in the country regulations. However, the supervisors can establish general requirements.
2/ The second and third columns report whether specific requirements are included in the regulations are issued by the supervisors.
3/ In column four, (S) means sent to supervisors and (P) means that banks are required to prepare the report but they need not send it to the supervisors.

Table 4. Limits and Capital Requirements

	Limits for Single Position	Limits for Groups of Currencies	Limits for the Over-all Position	Capital Requirement	Other Comments
Chile	No	No	20 percent of capital (net aggregate position)	No	Any overall short position is forbidden
Colombia	No	No	20 percent of capital (net aggregate position)	No	Provisions for exchange rate risk
Costa Rica	No	No	No	No	
Czech Republic	15 percent and 2 percent of capital	No	4 percent of capital for currencies not on Exchange Rate Schedule (shorthand position), and 20 percent for all currencies	No	
France	Limits replaced by capital requirements	No	Limits have been replaced by new capital requirements	Yes, in line with EU directive	
Germany	No	No	21 percent of capital (gross aggregate position), but to be replaced by capital requirements	No, but will be imposed	
Hong Kong SAR	10 percent of capital	No	15 percent of capital (shorthand position). Lower in some cases	No, but will be imposed	Subject to HKMA approval, institutions may propose higher position in US$
Hungary	No	No	30 percent of capital (gross aggregate position)	No	
India	No	No	Approved by regulatory authority	5 percent of approved limit on position	
Indonesia	No	No	25 percent of capital (net aggregate position)	No	

Table 4. Limits and Capital Requirements

	Limits for Single Position	Limits for Groups of Currencies	Limits for the Over-all Position	Capital Requirement	Other Comments
Korea	No	No	15 percent of capital for sum of long positions and 10 percent for sum of short positions	No	Limit on spot short position is greater of US$5 million or 3 percent of bank capital
Malawi	15 percent of capital for US$ 5 percent for others	No	35 percent of capital of capital (shorthand position)	No	
Malaysia	No	No	Limits depend on bank capital and management	No	
Netherlands	No	No	15 percent of capital (shorthand position)	8 percent of capital of shorthand position, 50 percent weight for DM or can use own internal system	Limit on affiliates of G-10 or EU banks up to 30 percent of capital. DM positions given 20 percent weight of other currencies
Oman	40 percent of capital for US$ 5 percent for others	No	40 percent of capital (gross aggregate position)	No	
Singapore	No	No	No	12 percent of shorthand position	
Spain	No	No	5 percent of capital (adjusted aggregate position); supervisor can authorize larger limits	8 percent of shorthand aggregate position	
Thailand	No	No	20 percent of capital for net long position; 15 percent of capital for net short position	No	
United States	No	No	No	No	

Source: Data provided by national authorities

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