

Significance and limitations of the VAR figures publicly disclosed by large financial institutions

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The value-at-risk (VAR) figures publicly disclosed by the major banks provide useful information on the market risk taken by the banking system. But a number of methodological precautions need to be taken when analysing these figures. These are detailed in this article. The assumptions underlying VAR calculations can, indeed, differ from one institution to the next and are rarely very explicit. The conclusions to be drawn from these figures should therefore be treated with caution.

The information provided by disclosed VARs should be corroborated by other indicators and analysed against the general macro-financial backdrop. When they point to greater risk exposures, these figures act as warning signals for conducting more in-depth analyses of the vulnerabilities that could affect financial stability.

VAR figures disclosed by financial institutions are closely monitored by central banks and are, for example, often discussed in the overview of the Banque de France's Financial Stability Review. These figures have contributed to supporting our assessment of a rise in market risk exposures at the time when short-term interest rates were uniformly very low, before the Fed started raising its key rates, which called for heightened vigilance even though the macro-financial context appeared favourable.

Central banks' constant concerns about greater transparency on the part of financial institutions resulted in the publication of the Fisher II report. In this framework, one way of strengthening financial stability would be to encourage credit institutions to be more transparent as regards their methods for calculating disclosed VARs. Credit institutions could, for instance, include more precise and easily comparable methodological explanations in their annual reports. This should not prevent the leading banks from setting up more sophisticated risk management techniques nor impinge on their communication policy. By authorising banks to use – subject to validation – an internal ratings-based approach for calculating their regulatory capital requirements, banking supervisors have actually acknowledged at the international level the diversity of markets and operations carried out by banks. This diversity implies adopting calculation methods tailored to the specificity and management techniques of each bank. Banks should in fact provide analysts with the most relevant information possible. But, in view of current practices, the level of transparency as regards the methods used is still insufficient. In addition, financial institutions other than banks, for example hedge funds, should also be encouraged to disclose their VAR figures.

Lastly, financial institutions should disclose their stress tests on a more regular basis, as a methodological complement to the VAR figures, but also in order to prevent a potential homogenisation of behaviours which could result from an exclusive use of VARs in banks' communication strategies.

NB : This study was drawn up by a cross-departmental working group, co-ordinated by Guy Levy-Rueff, and composed of representatives from the Directorate General Operations and the General Secretariat of the Commission Bancaire. I would like to thank all of the people involved; I am responsible for any remaining errors.

An increasing number of central banks regularly publish in their financial stability reviews the VAR figures publicly disclosed by large financial institutions. These indicators are used to measure the market risks taken on by these institutions and thus to better identify potential sources of vulnerability within the financial sector and gain a better grasp of certain market dynamics. They are also often discussed within international forums, such as the Financial Stability Forum.

This study is divided into three parts. In Part 1, the characteristics and the significance of the VAR figures disclosed by credit institutions are analysed in the framework of an assessment of financial stability. Part 2 looks at the heterogeneity and methodological limitations of the disclosed VARs. In Part 3, the issues of financial institutions' transparency are put into perspective so as to throw light on the specific VAR-related analysis.

1 | VAR: A COMPREHENSIVE TOOL FOR MEASURING RISK EXPOSURES

1|1 VAR as a risk management tool

DEFINITION

VAR is defined mathematically as the worst-case market losses arising from a downturn in market prices, over a specific period of time and with a given probability (known as the confidence level). The VAR is a global and probabilistic measure of market risk. For example, if a bank's 10-day VAR at a 99% confidence level is EUR 5 million, this means that it would have a 99% chance of not suffering a loss of over EUR 5 million over a 10-day period.

There are three major approaches for measuring VARs: parametric, historical and Monte Carlo. In all three cases, the results depend to a large extent on historical data.¹ The role of historical data is clearly apparent

in the case of the historical approach; in both other cases, it stems from the technical method used for calculating the VAR (parametric approach) or the type of simulation of risk factor movements (Monte Carlo approach). A variance/covariance matrix is used to establish a link between the risk factors derived from the market variables (i.e. to take into consideration price volatility and their correlations). This matrix is based on historical series of market price movements. Depending on its activities or risks, a credit institution can use a combination of different approaches: for example, the parametric approach can be used for the treatment of bond, foreign exchange and equity portfolios and the Monte Carlo or historical simulation in the case of option portfolios.

- The method for calculating the parametric VAR is relatively simple in practice, but it is subject to a number of relatively tight theoretical assumptions. The most commonly known model is probably RiskMetrics. The main simplifying assumptions are the following: market price variations follow a normal probability distribution (corresponding to the Laplace-Gauss bell-shaped curve) and the instruments show a linear risk profile. Under these assumptions, the variance/covariance matrix can quite easily be applied to the risk positions held in order to calculate the VAR.

- The historical VAR is based on the postulate that future market developments will be similar to past developments (the previous year's developments, for example). The first step consists in recording daily variations in market prices or risk factors over a given period. The next step is to apply these changes to the daily risk positions held. The result is a distribution of possible losses.

- In the case of the Monte Carlo VAR, a simulation of the possible future movements of risk factors is conducted a large number of times (usually 10,000 times). The result is a profit and loss distribution, from which one can derive a possible worst-case loss for a given confidence interval. This approach can, in theory, be applied irrespective of the probability distribution. But in practice, it is generally used, for technical reasons, on the assumption that the relative variations in market parameters follow a normal distribution.

¹ It is therefore important to have sound historical databases for this type of measurement.

Approaches for measuring VARs

Types of VaR	Advantages	Drawbacks
Parametric	<ul style="list-style-type: none"> • Easy and quick calculations based solely on the variance/covariance matrix 	<ul style="list-style-type: none"> • Unsuitable to non-linear positions (in particular options) • Ill-suited to fat-tailed distributions and non-normal distributions
Historical	<ul style="list-style-type: none"> • No assumptions on the shape of the distribution curve. It can, to a certain extent, capture outlying events (if the historical period under consideration is properly specified) • Is suited to all types of instrument, including options 	<ul style="list-style-type: none"> • No guarantee of the relevance of the chosen historical period (this is particularly important as there is no other complementary model). • There is a risk that certain complex instruments will be incorrectly valued (for example, the price of certain options are not directly available on the market, but calculated)
Monte Carlo	<ul style="list-style-type: none"> • Is also suited to all types of instrument, including options • A large number of scenarios can be tested. It is suited to fat-tailed distributions (outlying events can be captured to a certain extent) 	<ul style="list-style-type: none"> • Computationally very intensive. • The model risk is larger than with the other two approaches and certain complex instruments might also be incorrectly valued (certain options for example)

More sophisticated techniques such as the Conditional Value-at-Risk (CVAR) can be used in addition to the VAR, but they do not come under the remit of this study because CVARs are not disclosed by banks.

ADVANTAGES COMPARED WITH OTHER RISK MANAGEMENT TOOLS

Because it combines several risk factors and measures their interaction, VAR takes into account (and therefore encourages) portfolio diversification. All other things being equal, diversified portfolios tend to display higher VARs than non-diversified portfolios (even though, mathematically, the VAR of a portfolio comprising several sub-portfolios can, for a similar confidence interval, exceed the sum of the individual VARs of the sub-portfolios in the case of specific underlying distribution laws; see the appendix on VAR aggregation).

Thanks to the VAR measure, it has been possible to shift from a logic based on isolated risk indicators to a logic based on a probabilistic measure of global risk. Traditional measures are used to estimate, through multiple individual risk indicators (for example, sensitivity to interest rates), the instant loss on each instrument following a small market price variation. However, they do not quantify the probability of such losses: are they frequent or exceptional?

VAR has thus become a standard measure of market risk, used by all major banks. The development of common references regarding risk assessment contributes to fostering exchanges between professionals and promoting a common understanding of market participants' behaviour.

CREDIT INSTITUTIONS' USE OF VAR

VAR measures are generally used to assess market risk. In this respect, they have become a significant parameter for strategic decision-making in most financial institutions. Banks often use the level of risk (as measured by the VAR), in addition to the expected return, as a determinant for positioning themselves on a certain type of market, financial product range or geographical area.

From a more operational perspective, VAR is an important and widely-used tool for managing market risk. A large number of banks allocate VAR budgets to their operational departments, which are in turn responsible for assigning them to their various teams. On a daily basis, traders manage their risk positions based on operational limits consistent with the VAR limits.

VAR is also used as an internal tool for reporting consolidated market risks to financial institutions' top

management. With just a few characteristic figures (for example, global VAR as well as interest rate, exchange rate, equity and commodity VARs), this indicator provides a snapshot of market risk exposures, with the possibility of analysing their development over time. While credit institutions have mainly recourse to VAR measures for assessing market risk – this is the type of risk this article focuses on –, they can also use them to measure all types of risk, in particular credit risk and operational risk.

Lastly, VAR is an indicator reported to supervisory authorities. Because it is generally considered to be a good risk management tool, it is accepted by banking supervisors as a basis for calculating regulatory capital requirements (alongside alternative methods of calculation).² Most French banking groups rely on VAR figures to calculate their capital adequacy ratio, after having had their specific internal model approved by the regulatory authorities for most of their activities, and the regulator uses these indicators for its supervisory missions.

In addition to meeting the requirements set out by the supervisory authorities, VAR public disclosures are also used as a communication tool with the market in order to highlight banks' capacity and willingness to comply with market standards in terms of risk management. This article focuses on the significance and limitations of these publicly disclosed VARs.

1|2 The disclosure of VAR figures contributes to a better understanding of macro-financial risk

VAR MEASURES ARE CONSISTENT WITH OTHER ANALYSES OF CREDIT INSTITUTIONS

The VAR figures disclosed by French banks are on the whole consistent with the rest of the statistics reported to the supervisory authorities. By way of illustration, Table 1 shows the data published by the main French banks in their annual reports at end-2004.

Table 1
VaR disclosed by the main French credit institutions (one-day, 99%)

(EUR millions)

	BNPP	SG	Casa	IXIS	CCF	NBP
	Annual average	Annual average	Annual average	Annual average	Annual average	Dec. 2004
Interest rate risk	28	30				5.0
Foreign exchange rate	2	1				0.2
Equity risk	15	12				6.0
Commodity risk	3	3				0.4
Other						
Diversification	18	-21				-4.5
Total	30	25	28 (a)	16	10	7.0

(a) As Table 3 shows, the breakdown of the VaR disclosed by Casa is slightly different from that of the other banks; it is therefore not shown here

Sources: banks' annual reports

These figures corroborate what we know about French banks' respective risk positions and are relatively coherent in view of their main activities. It seems normal to have large exposures on interest rate and equity markets and small exposures on foreign exchange and commodity markets. As shown in Table 2, these statistics are also in line with the level of net banking income on capital markets (although the scope of net banking income in the corporate and investment banking segment extends beyond trading activity strictly speaking).

Table 2
Net banking income of major French banks corporate and investment business

(EUR billions)

NBI 2004	BNPP	SG	Casa	IXIS	CCF	NBP
CIB	5.7	4.7	3.9	1.3	0.6	1.3

Sources: banks' annual reports

VAR MEASUREMENTS APPEAR RELATIVELY ROBUST

In general, the backtesting exercises applied by French banks to their VAR statistics – which are published in roughly two thirds of their disclosures – show that

² Regulatory capital requirements for hedging market risk exposures can be calculated using a 10-day VaR with a 99% confidence interval, multiplied by a coefficient of at least 3.

losses do not exceed estimated VARs. Backtesting consists in checking that the possible ex post losses are either lower or equal to the VAR figures calculated ex ante. With the exception of one credit institution for which losses occasionally exceeded the global VAR figure in 2003 and 2004, French banks have not recorded any overrun. Of course, these calculations are generally skewed by the fact that the ex post results often include commercial margins which offset part of the losses before they are actually taken into account. Nevertheless, the results of these backtesting exercises are encouraging.

Lastly, the overall approach to presenting VARs is relevant, in particular the breakdown by types of risk or activity: interest rates, foreign exchange, equity, commodity prices. This breakdown provides a relatively good overview of the types of risk within a given portfolio.

A BETTER INSIGHT INTO THE BANKING SECTOR'S RISK EXPOSURES IN TERMS OF FINANCIAL STABILITY

In addition to being used internally by almost all credit institutions as a risk management tool, disclosed VAR data can also be used for more macro-financial studies.

True, VAR statistics only measure market risk, although credit risk is largely predominant.³ Furthermore, even though VAR figures are, theoretically, accurate indicators of the worst-case market losses incurred by each credit institution, they should be treated with caution given their methodological limitations: rather than look at absolute figures for each institution, one should analyse general trends.

However, bearing in mind these limitations (described in the following section), VAR data disclosed by credit institutions help central banks to back up their financial stability assessments, because they provide a significant — albeit somewhat incomplete — insight into financial institutions' market risk exposures. This is also the conclusion that emerges from the econometric study conducted by P.Jorion on the VAR figures disclosed by eight US banking groups over the 1995-2000 period.⁴

As banks play a key role in the financial system and the financing of the economy, analysing their behaviour (and in particular their possible weaknesses) is clearly an important aspect of any study on the vulnerability factors which might undermine financial stability, both through the channel of macro-economic sequences and the channel of market dynamics. From this point of view, disclosed VARs provide useful publicly-available information on the market risks taken on by the banking system as a whole and each individual (major) credit institution.

Risk-taking is not in itself a weakness because it is an integral part of the banking profession: it contributes to raising the banking sector's profitability if decisions are taken judiciously. But when risk exposures increase sharply, credit institutions can — all other things being equal — become more sensitive to a rise in volatility, a decline in liquidity or, more generally, unexpected market swings. Following a dip in the market, they may record significant losses which are likely to undermine their financial soundness. They may also, in some cases, have to adjust their market behaviour, and possibly their lending behaviour in an atypical manner, with repercussions on financial stability.

1|3 Different ways of analysing individual and aggregate VAR figures

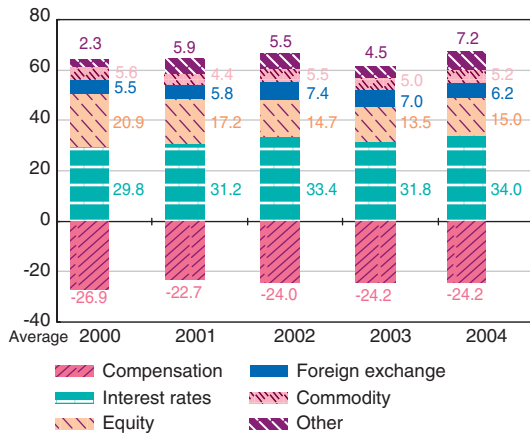
VAR statistics disclosed by a representative sample of banks can be compounded in the form of synthetic indicators in order to conduct a macro-financial analysis. It is thus possible to calculate different types of "average" VARs (see Appendix). However, in order to be properly interpreted, these synthetic indicators must always be accompanied by a measure of VAR dispersion (for example, minimums and maximums, fractiles or the standard deviation of individual VARs).

The VAR figures disclosed individually by each financial institution form the bedrock of any macro-financial aggregate analysis. Variations in these figures are relevant because they describe behavioural changes that are likely to affect market dynamics. On the other hand, absolute values are not particularly meaningful given that they depend,

³ VAR is not calculated in the case of investment portfolios but only trading portfolios.

⁴ "How informative are Value-at-Risk disclosures", 2002, Accounting Review

Graphique 1
Breakdown of the average VAR by type of underlying asset for an international banks sample
 (in EUR millions)

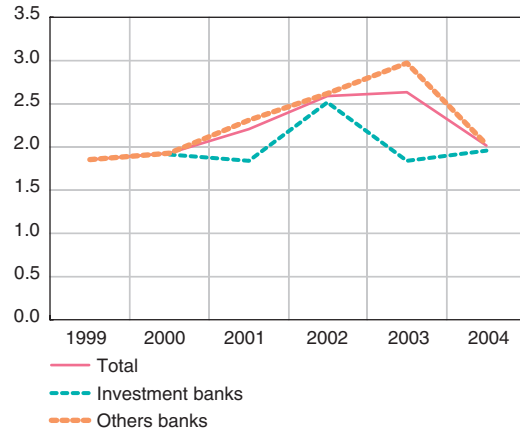


Sources: banks' annual reports

to a large extent, on the mathematical hypotheses used for calculating the VAR (confidence interval, length of the period under review, etc.) and that their calculation is subject to the methodological limitations referred to in the second part of this article. The breakdown of VAR figures by type of risk can contribute to enriching the analysis. As an example, the graph below shows that the share of equity risk exposure in banks' total market risk exposure dropped significantly following the bursting of the Internet bubble.

VAR figures also provide useful information when they are presented in the form of ratios. Looking at the variations over time in the VAR/equity capital ratio of one bank or drawing comparisons between various institutions gives an insight into the risk positions held by a credit institution relative to its capacity to absorb the potential losses incurred. The VAR/net banking income ratio provides an estimate of the effectiveness of risk taking; it can, however, be skewed by the share of recurrent customer activity-related earnings, which do not really remunerate risk-taking. Lastly, the max VAR/min VAR ratio is a proxy for measuring the volatility of a given institution's VAR over the period under review. The graph below illustrates, for example, that

Graphique 2
Average of max VAR/min VAR ratios for an international banks sample



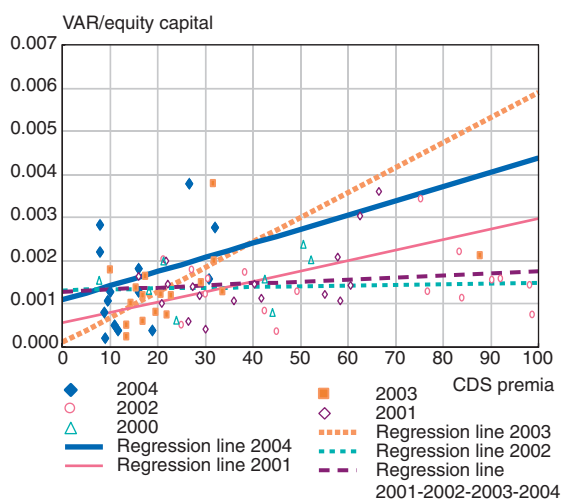
Sources: banks' annual reports

investment banks have posted a lower ratio than generalist banks over the recent period, probably because traders in the former have a more constant use of their VAR limits.

Individual VAR analyses are carried out to make sure that certain phenomena that might have been masked by the aggregate analyses are not overlooked. They are also used to ascertain whether certain regressions between disclosed VARs (or ratios including VAR) and other variables are statistically significant and relevant in terms of financial stability analysis. At this stage, our quantitative analysis has, however, been rather inconclusive. The graph below looks, for example, at a possible relationship between the VAR/equity capital ratio and CDS premia. However, the regressions tested proved to be relatively insignificant as CDS premia do not only take market risk into account. They also turned out to be relatively unstable over time, probably because risk aversion changes significantly from one year to the next.

It remains to be established whether there is any significant statistical relationship between the disclosed VARs, which are risk-taking indicators, and risk aversion indicators based on market price developments.

Graphique 3
Average VAR/equity capital – CDS premia



Sources: banks' annual reports, Bankscope, Credit trade, Banque de France

2| LIMITATIONS OF THE VAR FIGURES DISCLOSED BY LARGE BANKS

2|1 Methodological limitations

Some of the methodological limitations are quite significant. First, the VAR does not capture outliers beyond the confidence interval. Portfolios showing the same VAR can, in some cases, generate extreme losses on which the VAR does not give any information (it would be necessary to calculate the CVAR). Furthermore, the outliers are the values for which the assumptions underlying VAR calculations are the most fragile: the calculation of the VAR, by means of the variance/covariance matrix, is based on correlations between assets and the stability of these correlations is not always borne out, especially beyond the confidence interval. This is one of the reasons why it is necessary, in addition to calculating the VAR, to develop stress tests in order to quantify possible losses in extreme market conditions.

Traditional VAR calculations do not take into account the risks of a change in liquidity conditions on

certain markets, despite the fact that a shortage of liquidity during a period of market stress increases the risk of incurring losses.⁵

Thanks to the wide range of methods for calculating VAR, it is possible to tailor a method to the risk characteristics of specific products. However, this variety of methods does not facilitate the interpretation of VAR figures and the comparison between several VARs: results can differ considerably depending on the method used; there are also often many possible parameters for a given method and they can significantly alter the results. Lastly, a global VAR figure provides relatively little information on the nature and the relative weight of the various risk factors at work.

The VAR does not encompass certain related aspects, such as the return on risks taken. A rise in VAR can actually be accompanied by an increase in the risk/return trade-off if the ex post return grows at a faster pace than the VAR (which is an ex ante measure of risk).

None of the techniques used by banks for measuring risk take into account the absolute level of risk factors, i.e. their proximity or distance from equilibrium values, despite the significance of this issue in terms of financial stability. Yet it has to be admitted that, when measuring the possible deviation from equilibrium values, there are clearly a number of judgement and contextual factors that do not lend themselves to a quantitative risk analysis. Lastly, there is always a great deal of uncertainty surrounding short-term market dynamics as one moves away from the equilibrium values: will the market return to equilibrium or will it continue to post sharp fluctuations?

2|2 Comparing VARs disclosed by banks is a tricky exercise

THE VOLUME AND QUALITY OF INFORMATION DISCLOSED BY BANKS IS STILL LARGELY INFERIOR TO THEIR INTERNAL INFORMATION

The VAR publication format does not meet any commonly-approved presentation standards and the frequency of publication is variable (quarterly or annual).

⁵ The Counterparty Risk Management Policy Group II, chaired by Mr Corrigan, recently stressed the importance of taking greater account of liquidity risk in market and counterparty risk management.

Table 3
Breakdown of VAR figures disclosed
by major French banking groups

BNPP	SG	Casa	IXIS	CCF	NBP
Interest rate risk	Interest rate risk	Treasury risk			Interest rate risk
Foreign exchange rate	Foreign exchange rate	ICC risk			Foreign exchange rate
Equity risk	Equity risk	Equity risk			Equity risk
Commodity risk	Commodity risk	Credit risk			Commodity risk

The disclosed VARs can be either 1-day or 10-day VARs. Yet, although it is easy to move from one to the other under the assumption of a Gaussian distribution function, this assumption is not always relevant. This is clearly apparent when banks publish both figures at the same time.

The data disclosed by the various credit institutions are not homogenous. In some cases, only the global VAR is published, in other cases, the VAR is broken down by risk factors. Banks either publish period-end VARs or average VARs; minimum and maximum VARs are sometimes included. Out of the six major French banking groups, one does not publish average annual VAR and three do not disclose any information on the impact of market diversification. Similarly, VAR figures are either broken down by risk factors or by business area depending on the communication policy adopted by each institution. Table 3 shows how VAR figures are currently broken down by each one of the six major French banking groups.

It is worth pointing out that it is not always clear whether the exact breakdown is by risk factors or business area. For example, does the interest rate VAR encompass all of the risks incurred by trading activities on interest rate markets, including unhedged exchange rate risk, or does it encompass the interest rate risk arising from activities on various markets (interest rate, equity and foreign exchange).⁶

The type of information disclosed is also likely to change over time. For example, one credit institution disclosed two sets of information in its quarterly publications from December 2000 and March 2003: on the one hand, the quarter-end VAR broken down by type of activity, on the other, a backtesting calculation of its global VAR. The bank

has continued to publish the former, but stopped publishing the latter between June 2003 and December 2003. In March 2004, it once again started disclosing its average global VAR over the quarter. This disclosure was interrupted in June 2004 but resumed in September 2004.

COMPARISONS ARE RENDERED MORE DIFFICULT BY THE DIFFERENCES IN CALCULATION METHODS

As mentioned above, credit institutions can use parametric, historical or Monte Carlo approaches. They can apply a different method for each one of their activities in order to manage their various risks in the most optimal manner. There is therefore no guarantee that the data to be aggregated in a macro-financial analysis is calculated using identical methods – although, ideally, this should be the case. The VARs are sufficiently homogenous, however, to conduct a pertinent macro-financial analysis, as long as one bears in mind their limitations.

In addition, the calculations made by credit institutions are more or less aggregated: some only aggregate sub-portfolio VARs, while others make more general calculations which take better account of the diversification effects. Thus, the same initial risk positions do not necessarily yield the same VAR figures.

The range of activities included in the calculation of the disclosed VARs (cash management activities, portfolio investment, loan trading, etc.) varies from one bank to the next, as well as through time. The following passage from a credit institution's annual report speaks for itself: "this measure [...] is being continuously improved, by adding new risk factors and extending the range of activities included in the calculation of the VAR".

The techniques used by credit institutions change over time; some banks introduce new risk factors in line with the development of their activities. This is a good thing if it improves the pertinence of the VAR calculations. But it can cause problems in terms of ensuring the continuity of the analysis. For example, when one credit institution decided to include in its disclosed VAR measures of credit spread risk, which previously came under interest rate risk, the

⁶ Regulatory VAR is systematically broken down by type of risk.

diversification effect appeared to increase, rising from roughly 50% of gross risks to roughly 60%. Indeed, the diversification effect between interest rates and credit spreads was previously concealed in the global interest rate VAR calculation.

Moreover, disclosed VAR figures are based on a wider range of activities than the VAR data validated by the banking authorities and used to calculate each institution's regulatory capital. Indeed, some banks may in their communication policy choose to disclose a global figure even if VAR calculations are not very accurate in the case of some activities (for example, for some specific arbitrage activities). Supervisory authorities may then request the bank to use other methods for the relevant activities. As a result, the VAR figures included in the regulatory reports might differ from those disclosed in the bank's publications, without the ones always exceeding the others. These differences only occur for a small number of activities. However, in the absence of total transparency regarding the methods for calculating disclosed VARs, it is difficult to measure with accuracy the implications of these choices and a comparison between banks is rendered all the more difficult. These issues are, nevertheless, not entirely specific to disclosed VAR data. It is indeed worth noting that the VARs used to measure banks' regulatory capital requirements cover various activities and are based on different calculation methods from one bank to the next, depending on the specificity of their market activities.

2|3 Supplementing disclosed VAR figures for the assessment of financial stability

The accounting data contained in banks' balance sheets and off-balance sheets (as well as their profit and loss accounts) provide an insight into the weight of certain activities and the size of portfolios held by credit institutions which are at the root of the risks incurred, in particular as regards securities portfolios and derivatives. A major change in the weight of certain activities therefore requires an in-depth analysis of risk developments.

In addition to the VAR, most banks also carry out stress tests on their trading activities. These data are

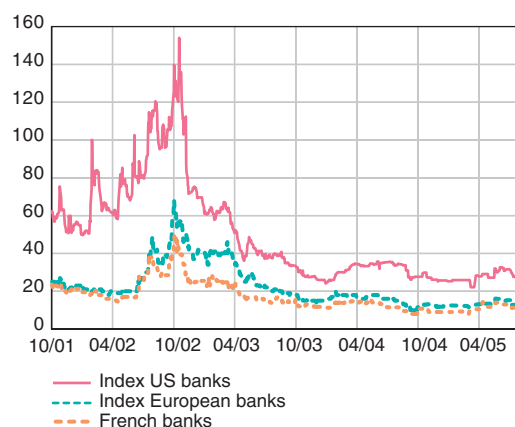
used as internal risk management indicators. They measure the implications for the banks of extreme market conditions, i.e. those conditions which are the most likely to expose credit institutions' weaknesses. However, the information disclosed in this area is highly fragmented: this is the main impediment to using these data to conduct a global analysis of risks to financial stability.

Credit institutions sometimes disclose an indicator of their global exposure to interest rate risk – generally measured in the framework of their asset and liability management – for example, balance sheet maturity gaps. Here again, however, one comes up against the fact that financial disclosure on the subject is very limited.

The information stemming from the market's perception of the level of risk taken on by financial institutions differs from that on the actual level of risk as measured by VAR data. CDS prices or yield spreads between bonds issued by credit institutions and the swap curve can therefore also be useful.⁷ However, no distinction is made between perception of market risk, credit risk and other types of risk (such as operational risk); in addition, both the risks incurred and the level and volatility of P&L are taken into account in CDS premia.

Graphique 4
5-year CDS premia on senior debt of US, European and French banks

(basis points)



Source: *Credits Trade*

Other indicators of the market's perception of risk can be developed. For example, the IMF currently

⁷ Data for individual banks or indices can be used as long as their liquidity is sufficient.

uses another measure based on market data in its Financial Stability Report. This risk indicator – called Market Risk Index or MRI – is the VAR for an equity portfolio of a representative sample of large banks weighted by their market capitalisation. This indicator, which has been progressively refined, is interesting, but just like yield spreads, it is not an indicator of the market risk actually taken on by credit institutions. It is an indicator of investors' perception of the global risk on a bank's equity portfolio (both credit and market risk) and, therefore, from the perspective of financial stability analysis, an indicator of the market's perception of banking risk. The IMF also uses another indicator called the Credit Risk Index, which is a synthetic index calculated on the basis of CDS premia.

Lastly, the various ratings awarded by rating agencies provide useful information, although their limitations are similar to those of market indicators: they provide information on the rating agencies' perception of risk rather than on the risk actually taken on by banks; market and credit risk tend to be aggregated.

3 | TOWARDS GREATER TRANSPARENCY OF DISCLOSED VARs?

In conclusion, we will set out to put the issue of VAR disclosures by large financial institutions into a larger perspective. It fits in with the more general drive on the part of central banks and banking regulators to achieve a greater degree of transparency. In this section, we will also seek to measure the progress that is yet to be made.

3|1 French banks have made progress in their VAR disclosures

As mentioned above, most major French banks (six out of seven) disclose a measure of their market risk in the form of VAR statistics, generally in their annual reports.

At present, banks are strongly encouraged to disclose their VAR figures, but it is not an obligation. The French Financial Markets Authority (AMF) imposes a number of risk disclosure obligations on the undertakings under its supervision, including listed banks. These obligations can be met by the disclosure of VAR figures, but also by other methods, with the supervised institutions enjoying a great degree of leeway.⁸

It is nevertheless not surprising that VAR disclosures have gained ground. This development ties in with the fact that – even prior to Basel II – transparency is being encouraged by regulators, rating agencies and, more generally, financial markets.

In addition, as most major French banks also use VAR models for their internal risk management and/or to calculate regulatory capital requirements, the cost of calculating disclosed VARs is limited.

Lastly, it is worth pointing out that a similar process is underway in the United States. In 2004, for example, the SEC enacted a set of new rules for calculating minimum capital requirements that promote the use of the VAR method among major broker-dealers. Furthermore, the SEC requires the undertakings it supervises, in particular listed banks, to disclose measures of risk. These can be VAR statistics. The situation is close to that in France: the disclosure of VAR data is becoming increasingly common. Yet, the methodological limitations faced by any analysis are the same as those outlined in part 2 of this article.

3|2 Use of disclosed VARs from a financial stability perspective

The previous issues of the Banque de France Financial Stability Review have highlighted the fact that the persistence of large macroeconomic and financial imbalances could eventually lead to a reversal of price trends on certain market segments and/or an increase in volatility. In this context, it is crucial that all market participants correctly assess their risks and be prepared to deal with market swings that would not correspond to their expectations.

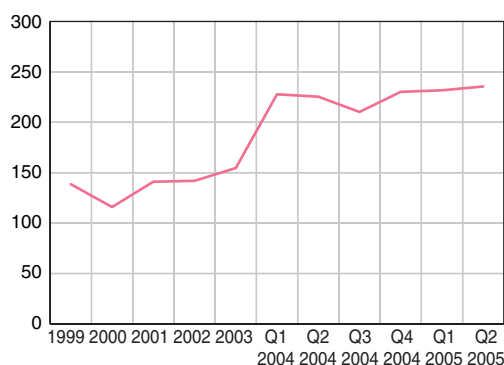
Obviously, this is more difficult when banks are taking on greater risk exposures – as brought to light

⁸ See recommendation No. 89-01 by the French Stock Exchange Commission (COB) and its recommendations for the drafting of reference documents in 2002, as well as the AMF's recommendations for 2003.

by their disclosed VARs. This was the case for a large number of major investment banks, in particular US banks, up until 2004, i.e. while short-term interest rates were uniformly very low, before the Fed started raising its key rates. This led the Banque de France to call for greater vigilance, against a macro-financial backdrop that appears favourable yet harbours certain vulnerabilities. The graphs below illustrate the analysis underlying this assessment. They show the annual and quarterly growth of the aggregate VAR for a sample of major US banks, as well as the ratio between the VAR of the largest risk-taker and that of the least exposed bank.⁹

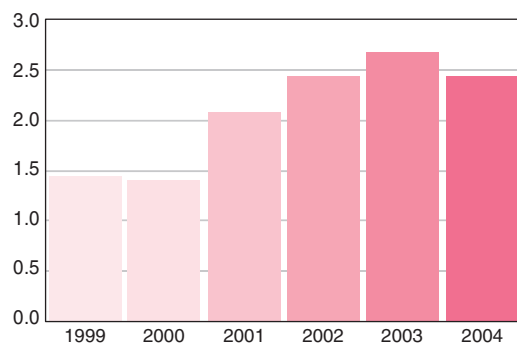
The increase in risk exposures — brought to light by disclosed VARs — was confirmed by a broader analysis. This is reflected in the recent boom in the CDO market and the strong growth in alternative investment funds, such as hedge funds.

Graphique 5
Aggregate VAR (in USD millions) of the main US banks



Sources: banks' annual reports

Graphique 6
Highest VAR/lowest VAR in a sample of US banks



Sources: banks' annual reports

The emergence of a combination of vulnerability factors at the international level, such as higher risk exposures and less risk protection (in particular, low risk premia) should give rise to enhanced vigilance from a financial stability perspective.

This vigilance is particularly important in the current context of low market volatility. Recent levels of volatility are taken into account in VAR calculations. All other things being equal, VAR figures are smaller when the level of volatility is low. The VAR figures disclosed by major international banks — which are already on an uptrend — would have risen even further if the level of market volatility had been higher, more in line with historical averages. An analysis of risks to financial stability should take into account the fact that banks could have to cut back or rapidly cover their risk positions should the level of volatility increase. This could lead to adverse developments in terms of market liquidity as well as overreactions on exchange rate and interest rate markets. And yet, risk management systems do not always take sufficiently account of the risk of market liquidity drying up during a crisis. This could heighten the impact of price fluctuations and limit the possibility of unwinding risk positions within the expected horizon or at the expected price. Some bank managements actually appear to be taking this analysis into consideration and tend to request their teams to reduce their VAR figures when volatility is low. This could explain the relative stability of the VAR figures disclosed by French banks.

In order to back up these macro-financial studies, it is sometimes useful to analyse the VAR figures disclosed by each individual bank. But this will depend to a large extent on the degree of transparency adopted by each institution.

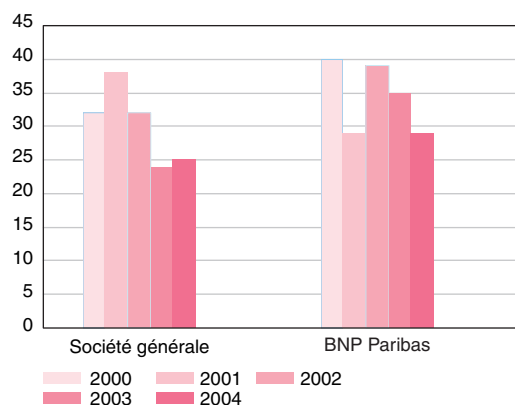
In addition to the average VARs, fluctuations in the VAR over the year should also be looked at if the information is available. Rapid variations in the VAR over the period under review — an indication of which is the ratio between the maximum and minimum VAR — can have several meanings. These should be brought to light — to the extent possible — bearing in mind the many facets of credit institutions' behaviour. Rapid changes in the VAR within strict limits can reflect very different situations:

- they can be a sign of active risk management and positions taken on liquid markets, which can therefore

⁹ When some data are missing, the calculations are re-based on a theoretical sample of seven banks.

Graphique 7
Average VAR of French banks

(in EUR millions)



Sources: banks' annual reports

be unwound rapidly; losses – even if they turn out to be significant - should be contained by stop-losses, without jeopardising the institution's survival nor posing a threat to financial stability;

- however, if VARs correspond to relatively illiquid positions (at least in the case of market tensions), there is clearly a greater risk of financial instability: e.g. the rescue of the LTCM hedge fund¹⁰;

- lastly, sharp swings in VAR figures could simply be a sign of inadequate risk management. The macro-financial lessons to be drawn from VAR disclosures will therefore depend on the analysis that is made of each individual situation.

3|3 An international approach for greater and more widespread transparency

What remains to be done by financial institutions in terms of VAR public disclosure to take full advantage of these data? Shouldn't the efforts made towards achieving greater transparency be stepped up?

The interest that central banks and bank regulators show in large financial institutions' public disclosure of VAR data is part of a broader trend towards promoting greater transparency among market participants. This concern essentially took shape in the 1990s after several episodes of financial turmoil. Indeed, it appeared that, when a hidden piece of information was suddenly brought out into the open, this generally resulted in an over-reaction on the part of financial markets, with a cost to the community.

The commonly-shared objective is to promote "market discipline [that] can play an important role in maintaining financial market stability" thanks to greater transparency and through the disclosure of more detailed and pertinent data on the market risks taken on by large financial institutions.¹¹

Of course, bank regulators are in possession of more detailed information on the institutions that they supervise. However, VAR public disclosures are meaningful to them for the following reasons: first, they help bring about market discipline, which contributes to the sound functioning of financial institutions; second, they can be used as a basis for conducting international analyses of factors of vulnerability that are likely to affect financial stability; finally, they can be a useful communication tool.

In this context, the Fisher II report recommended – as early as 2001 – that major financial institutions disclose their market risk data and established that the VAR methodology could be a useful tool to do so. This report also mentions the need to supplement the gross period-end figures with more detailed figures (average, maximum and minimum values, indicators of the ex post relevance of expected VAR figures).

These recommendations were aimed at all market participants: banks, insurance companies, various financial intermediaries or investors such as hedge funds. However, it was widely acknowledged that these recommendations would most likely be implemented more rapidly by regulated bodies, in particular banks, than other market participants. This is precisely what happened.

¹⁰ Which obviously also covered a number of other issues.

¹¹ Report by the so-called Fisher II working group. It applies to the relations between private counterparties. It should be noted, however, that central banks have also made significant efforts towards achieving greater transparency, in particular in terms of the information that they disclose on their currency reserve management, notably in the framework of the IMF's Special Data Dissemination Standard.

This article has focused on the VAR figures disclosed by banks, their significance and limitations, as well as the progress that remains to be made in order to achieve greater transparency on the part of these institutions. In the light of the current developments, it seems desirable to continue encouraging other regulated financial institutions, such as mutual funds, to disclose the VAR for their portfolios, while making sure that the risk measures chosen are suited to the particular conditions in which these institutions invest on financial markets.

Institutions that are little or not regulated, such as hedge funds, are those which, up until now, have made the least headway in implementing the recommendations put forward by the Fisher II Working Group. Their failure to apply the Fisher II recommendations reflects, to a certain extent, their lack of interest in becoming more transparent. Given the key role that these institutions play on interbank markets, they should be encouraged to disclose more information on their risks. Markets participants and regulators could clearly put this information to good use to contribute to the prevention of financial crises.¹² More specifically, these funds – which are still too opaque – would be making significant progress if they were to start disclosing their VARs.

On the other hand, banks, under the aegis of their regulators, have already implemented most of the Fisher II recommendations. As mentioned above, incentives in favour of VAR disclosure by listed French banks falls within the competence of the AMF.¹³

This issue is now also covered by the Third Pillar of Basel II (to be implemented in 2007) and by the future Capital Requirements Directive. Bank regulators will therefore pay greater attention to market discipline, including banks' transparency on their market risks. It is in this context that this study on the significance and limitations of VAR disclosures takes on its full meaning.

In the light of the experience that they will have acquired following the full implementation of Basel II, bank regulators will be able to judge whether – given the risk management techniques currently available – a more systematic and/or transparent disclosure of VAR figures is necessary for sound market discipline. They will then be able to take action within the framework of Basel II.

One way of bolstering financial stability would be to get international credit institutions to display greater transparency when describing the methods used to calculate their VAR statistics, in addition to disclosing VAR figures. Credit institutions could usefully include more precise and easily comparable methodological explanations in their annual reports. This, however, should not prevent the leading banks from setting up more sophisticated risk management techniques nor impinge on their communication policy.

Furthermore, it appears essential – for the reasons outlined in this article – to supplement the VAR figures in order to gain a better insight into the risks taken on by financial institutions. A systematic disclosure of information on stress tests should also help to reduce the risk of herd behaviour, which could result from banks' exclusive use of VARs in their communication strategies. Disclosed VARs can, within certain limits, be used to make international comparisons and aggregations. On the other hand, disclosed stress tests should, instead, enable an external analyst to make a more in-depth assessment of the situation of each individual institution.

To reach these objectives in the best possible manner, it seems necessary to promote international cooperation in order to maintain a level playing field between the major international financial institutions.

¹² This is also one of the conclusions drawn by the Counterparty Risk Management policy Group II.

¹³ At present, the obligations in terms of risk disclosure imposed by the AMF can be met in several ways, including the publication of VAR figures. Most major financial institutions apply this method.

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ANNEX

Box

Is it possible to compute aggregate indicators or are individual VARs the only option?

VAR figures generally disclosed by banks represent the worst-case loss expected over a one-day holding period and with a 99% confidence interval. Some banks choose to calculate a 10-day VAR, from which it is possible to derive a 1-day VAR under the assumption of a Gaussian distribution function.

In addition to analysing the figures disclosed by each individual credit institution, it is also necessary to construct synthetic indicators. Specifically, it would be useful to obtain an aggregate indicator based on the individual VARs. The aggregate VAR of a group of banks should be equal to the worst-case potential loss incurred by this group over a given holding period and with a 99% confidence interval. It is, however, impossible to derive this figure directly from the individual VARs without any information or assumptions on the correlations between the losses incurred by the various banks and the shape of the distribution functions. Several avenues can nevertheless be explored:

1. The most obvious synthetic VAR indicator is the arithmetic mean (or sum) of individual VARs. It is generally a simple arithmetic mean, which is complemented by the minimum and maximum values as well as the different fractiles of the sample of VARs.

The arithmetic mean (or sum) is an adequate statistical aggregation of individual VARs only under the assumption that the profits and losses of the various banks follow a perfectly correlated distribution. This is generally not a very realistic assumption. It should, nevertheless, not be disregarded because it relates to a specific risk to financial stability, when similar positions are taken by various banks (see below). The sum of VARs is also a useful upperbound of the aggregation of individual VARs, assuming that the underlying probability distributions are normal, irrespective of their degree of correlation.

2. Another assumption can be made, i.e. that banks' profits and losses follow an uncorrelated Gaussian probability distribution. In this case it is possible to calculate, based on the individual VARs, an indicator of the worst-case cumulated loss over a 1 day holding period and with a 99% confidence interval for all banks under review. It is a quadratic sum, which

could be designated as AVaR (Aggregate VAR) with $AVaR = \sqrt{\sum_{i=1}^n VaR_i^2}$.

Under the same assumptions, the aggregate VAR for an "average" bank would be $\frac{1}{n} \sqrt{\sum_{i=1}^n VaR_i^2}$.

It is worth noting that – contrary to a simple sum or mean – the result of this aggregate VAR calculation varies depending on whether the individual VAR figures are close or very different from one another; the more dispersed the individual VAR figures, the higher the aggregate VAR. This can be linked to the initial assumption that banks' profits and losses are uncorrelated; when the VARs of a large number of banks are of the same order of magnitude, the aggregate VAR of the sample benefits from a significant diversification effect; this effect is much lower when a small number of credit institutions display large VARs while most other institutions have small VARs.

This characteristic could be useful for analysing the risks to financial stability because – for a given arithmetic mean – it penalises the concentration of risk on a small number of credit institutions which can turn out to be weak links in the financial system; they could indeed trigger processes that are detrimental to financial stability, either through the realisation of credit risk or through crisis dynamics, such as in the LTCM episode. However, this aggregate VAR does not provide any information on another type of risk, the so-called crowded trades, i.e. when similar positions are taken by various institutions.

This phenomenon represents a threat to financial stability as it is likely to disrupt market dynamics in the event that several institutions decide to unwind their similar position simultaneously. In this case, the normal probability distributions followed by profits and losses are clearly correlated, which invalidates the assumptions underlying the calculation of the AVAR. As mentioned above, a simple sum is, in this respect, more appropriate.

3. Lastly, in the more realistic and general case where banks' profits and losses do not follow a Gaussian probability distribution, caution is required because none of the above-mentioned indicators are entirely adequate. In particular, the sum of VARs does not necessarily exceed the aggregate VAR at the same level of confidence. The sum of VARs is in fact an upperbound at a much lower confidence level, i.e. $1-n(1-p)$ with n the number of banks under review and p the confidence interval of individual VARs (see Coudert and Attia, 2005). The confidence interval therefore declines in proportion to the size of the sample. This measure is therefore hardly useful in the case of a large sample.

Here is a simple example. Consider two banks whose losses depend on four different situations, as follows:

State of nature	1	2	3	4
Probability of this state	0.8	0.8	0.3	98.1
Loss of bank 1	1.000	0	100	Profits
Loss of bank 2	0	1.000	100	Profits
Aggregate loss	1.000	1.000	200	Profits

It appears that:

- the VAR of bank 1 equals 100 with a 99% confidence interval, because the loss will exceed or equal 100 in less than 1% of cases. The VAR of bank 2 is equals 100 for the same reason. The sum of two banks' VARs is therefore 200;*
- however, the aggregate VAR is equal to 1,000 with a 99% confidence interval, since the loss incurred by the two banks taken together is 1,000 in 1.6% of cases.*

This very simple example shows that the sum of VARs does not necessarily exceed the aggregate VAR. More specifically, this situation occurs under two conditions:

- losses at the tail-end of the distribution (less than 1%) are substantial;*
- the losses incurred by both banks do not occur in the same "state of nature". If losses occurred simultaneously (correlation coefficient of 1), the sum of VARs would be a decent measure of the aggregate VAR, even in the presence of outliers at the tail-end of the distribution.*

In conclusion, computing synthetic indicators by aggregating VAR figures disclosed by individual banks is useful from the perspective of financial stability, even though these indicators do not give an accurate measure of the maximum total losses of all banks under review. It is nevertheless important that the strong methodological assumptions, on which these calculations are based, be taken into account when analysing the significance of the aggregate figures.