

institutional banking & Y2K

A risk analyst attending a conference for senior bankers and traders forwarded the following anecdote:

One senior banker was explaining the benefits of his firm's new risk management system.

Another senior banker nodded and acknowledged the cost and sophistication of the effort.

The first banker summed up his position by stating that, "Y2K is a small risk relative to the day to day running of the bank."

The second banker replied, "that's ironic, I've heard that Herstatt risk could be the real turd, in the Y2K punchbowl."

This colorful phrase piqued our interest. Herstatt risk is rare, indeed, so rare that most bankers don't know the term.

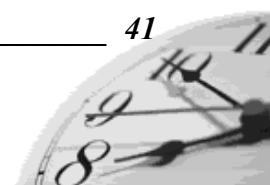
Herstatt risk is derived from a single event, in 1974, resulting from the insolvency of a German bank. This piece of economic trivia could become relevant in the Y2K period. Herstatt risk may be the most significant Y2K problem facing the international banking system.

Bank risk is usually perceived in terms of retail bank runs and other demands on deposits. At the institutional level of banking lie more complicated and significant issues of risk. This research note highlights five lesser mentioned Y2K risks institutional banks may face.



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INSTITUTIONAL BANKING

Institutional banking is complicated. To the un-initiated, the profession involves money amounts resembling telephone numbers, wired around the world, by groups of men in suits. Via regulation, both government and market-imposed, institutional banking has had relatively few large failures in recent decades.

This paper will focus on the Foreign exchange (FOREX) and derivatives markets. These markets are the fastest moving and largest markets globally. The world's largest equity exchanges may turn over amounts in the \$10's of billions each day. Foreign exchange is a \$1.5 trillion/day market.

The FOREX and the over the counter (OTC) derivatives markets are perceived to be the most likely to spread risk quickly in crisis situations. The majority of trade in these markets takes place in the OTC market between large banks.

Foreign exchange is fairly straightforward. Banks buy and sell foreign currency with each other. This is done to hedge risk, purchase or sell currency for customers or to take speculative positions.

Forex turnover by Country

Country	\$billions/day
UK	\$463.8
US	\$244.4
Japan	\$161.3
Singapore	\$105.4
Hong Kong	\$90.2
Switzerland	\$86.5
Germany	\$76.2
France	\$58.0

Source: BIS 1995 Central Bank Survey of Foreign Exchange and Derivatives Market Activity

DERIVATIVES

"Derivatives" is a word laden with connotations. In his 1997 CATO paper, *10 MYTHS ABOUT FINANCIAL DERIVATIVES*, Thomas F. Siems, a senior economist and policy adviser at the Federal Reserve Bank of Dallas, outlined some myths associated with derivatives.

Myth Number 1: Derivatives Are New, Complex, high-tech Financial Products Created by Wall Street's Rocket Scientists

Financial derivatives are not new; they have been around for years. A description of the first known options contract can be found in Aristotle's writings. Derivatives, as their name implies, are contracts based on or derived from some underlying asset, reference rate, or index. Most common financial derivatives can be classified as one, or a combination, of four types: swaps, forwards, futures, and options that are based on interest rates or currencies.

Most financial derivatives traded today are the "plain vanilla" variety, the simplest form of a financial instrument. Variants on the basic structures have given way to more sophisticated and complex financial derivatives that are more difficult to measure, manage, and understand.

Largest Value Funds Transfer Systems in 11 countries according to BIS 1997

	Average transaction (USD millions)	Ratio of transaction value to GDP annually
Belgium	11.0	35.4
Canada	5.0	20.4
France	4.7	13.6
Germany	5.8	42.9
Italy	6.2	15.4
Japan	112.9	85.0
Netherlands	14.8	13.3
Sweden	67.7	32.6
Switzerland	0.3	88.9
UK	3.4	38.1
US	6.1	42.7



Myth Number 2: Derivatives Are Purely Speculative, Highly Leveraged Instruments

Put another way, this myth is that "derivatives" is a fancy name for gambling. Has speculative trading of derivative products fueled the rapid growth in their use? Are derivatives used only to speculate on the direction of interest rates or currency exchange rates? Of course not.

Banks and other financial intermediaries developed financial risk-management products to better control risk. The first were simple foreign-exchange forwards that obligated one to buy, and the other to sell, a fixed amount of currency at an agreed date in the future. By entering into a foreign-exchange forward contract, customers could offset the risk that large movements in foreign-exchange rates would destroy the economic viability of their overseas projects. Thus, derivatives were originally intended to be used to effectively hedge certain risks; and, in fact, that was the key that unlocked their explosive development.

From the simple forward agreements, financial futures contracts were developed. Futures are similar to forwards, except that futures are standardized by exchange clearinghouses, which facilitates anonymous trading in a more competitive and liquid market.

Around 1980, the first swap contracts were developed. A swap is forward-based derivative that obliges two counterparties to exchange a series of cash flows at specified settlement dates in the future. Swaps are entered into through private negotiations to meet each firm's specific risk-management objectives. There are two principal types of swaps: interest-rate swaps and currency swaps.

Today, interest-rate swaps account for the majority of banks' swap activity, and the fixed-for-floating-rate swap is the most common interest-rate swap. In such a swap, one party agrees to make fixed-rate interest payments in return for floating-rate interest payments from the counterparty, with the interest-rate payment calculations based on a hypothetical amount of principal called the notional amount.

Myth Number 3: The Enormous Size of the Financial Derivatives Market Dwarfs Bank Capital, Thereby Making Derivatives Trading an Unsafe and Unsound Banking Practice

The financial derivatives market's worth is regularly reported as greater than \$40 trillion. That estimate dwarfs not only bank capital but also the United States \$7 trillion annual gross domestic product (GDP). Those often-quoted figures are notional amounts. For derivatives, notional principal is the amount on which interest and other payments are based. Notional principal typically does not change hands; it is a reference quantity used to calculate payments.

While notional principal is the most commonly used volume measure in derivatives markets, it is not an accurate measure of credit risk exposure. A useful measure for the actual exposure of derivative instruments is replacement-cost credit exposure. That exposure is the cost of replacing the contract at current market values should the counterparty default before the settlement date.



Derivatives improve market efficiencies because risks can be isolated and sold to those who are willing to accept them. Using derivatives breaks risk into pieces that can be managed independently. Corporations can keep the risks they are most comfortable managing and transfer those they do not want to other companies that are more willing to accept them. From a market-oriented perspective, derivatives offer the free trading of financial risks.

Myth Number 4: Only Large Multinational Corporations and Large Banks Have a Purpose for Using Derivatives

Very large organizations are the largest users of derivative instruments. However, firms of all sizes can benefit from using them. For example, consider a small regional bank (SRB) with total assets of \$5 million:

The SRB has a loan portfolio composed primarily of fixed-rate mortgages, a portfolio of government securities, and interest-bearing deposits that are often re-priced. Two illustrations of how SRBs can use derivatives to hedge risks follow.

First, rising interest rates will negatively affect prices in the SRB's \$1 million securities portfolio. By selling short a \$1 million Treasury-bond futures contract, the SRB can effectively hedge against that interest-rate risk and smooth its earnings stream in volatile markets. If interest rates went higher, a drop in value of its securities portfolio would hurt the SRB, but that loss would be offset by a gain from its derivative contract. Similarly, if interest rates fell, the bank would gain from the increase in value of its securities portfolio but would record a loss from its derivative contract. By entering into derivative contracts, the SRB can lock in a guaranteed rate of return on its securities portfolio and be less concerned about interest-rate volatility

Swap contracts

Rising interest rates will harm the SRB because it receives fixed cash flows on its loan portfolio and must pay variable cash flows for its deposits. Once again, the SRB can hedge against interest-rate risk by entering into a swap contract with a dealer to pay fixed and receive floating payments.



BANKING RISK

Banking involves the penultimate focus of risk management today; no other field requires such emphasis on understanding risk relative to so vast amounts of capital.

Retail Y2K banking risks are generally viewed in terms of deposit runs, credit squeezes and increased loan defaults. Others have discussed these risks in depth; we will not delve into them here.

Credit squeezes, deposit runs and significant defaults could pose legitimate challenges to many national-banking systems. Retail banking issues are usually national in nature, although this does not preclude cascading defaults entering the international arena. Institutional banking faces other Y2K risks of a wider and perhaps more diverse nature. Significant systemic risks may reside at the institutional level of banking; these institutional banking risks and the threats they pose are the focus of this paper.

Tools to manage risk

Banks use many tools to minimize risk. Operationally they use back-up generators, back-up databases, accounting systems, and things one expects in information intensive service industries to control risk. To manage exposure to market risks many banks use statistical models of risk exposure tied to their accounting (trade position) systems. Most risk models are based on J.P. Morgan's Value at Risk (VaR) methodology. These models are dependent on historical co-variance and volatility assumptions. These assumptions may fail in the face of extreme market situations, leading to losses outside of the statistical model expectations.

Without going into discussions of fourth order Taylor series and extreme leptokurtosis, suffice it to say that price risk is statistically challenging to model. Most models are based on the assumption that the price generating function of the past will be the same function in the future. These structured Monte Carlo assumptions are inherently flawed. Financial market relationships behave outside of model expectations during extreme events. A model's theoretical one in 50 million event shows up more frequently in reality and is impossible to model due to limited sample size. These types of events are what lead to the hedge fund, Long Term Capital Management's problems.

Economic history

"lender of last resort"
concept first raised by Sir
Francis Baring 1797

**"Systemic risk", and
"too big to fail"**
popularized by Bagehot

U.S. Dollar holdings

About two-thirds of U.S. currency circulates outside the U.S. -- a testimony to the perceived safety and soundness of the dollar. "Many people in the former Soviet republics and in Latin American countries, where the local currencies are less stable, store their savings in dollars,"

**Howard Schloss, spokesman
for the U.S. Treasury**



BANKS MANAGE RISK WELL

To stay competitive, banks have evolved into sophisticated risk managers; banks understand risk in new ways. In the following sections, we highlight 5 types of risk identified by the Bank for International Settlements (BIS) as issues for large banks and how Y2K may alter the nature of the threat posed, the risks are:

- Price risk
- Operational risk
- Replacement risk
- Legal risk
- Custodial risk

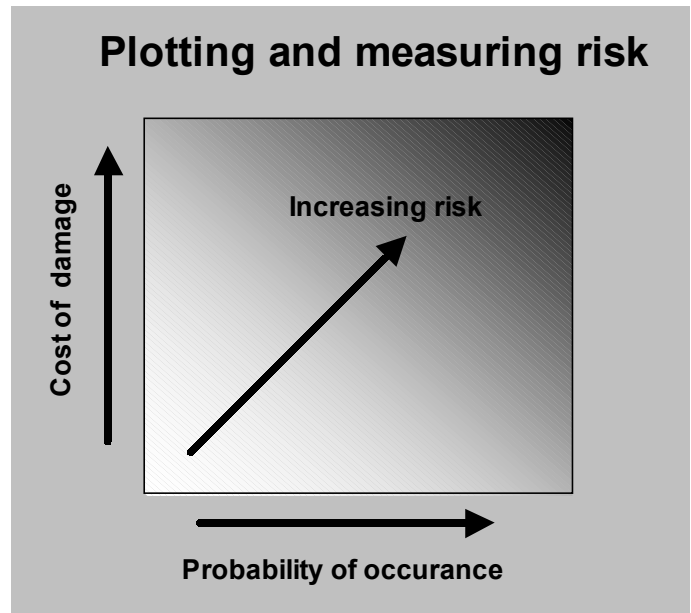
Credit risk has been left off of the list due to its individual nature. Liquidity risk is covered within the price risk section.

Systemic risk

Total inter-banking system failure is referred to as systemic risk. In the theories of systemic risk, liquidity problems are singled out as the most prominent factor capable of propagating local financial disturbances into the broader regions of the economy. The five risks these paper covers are subsets of systemic risk, in that any of the 5 could be a contributing factor leading to systemic risk or failure.

Measuring risk

Plotting cost versus likelihood of occurrence can assess a risk's relative significance. Risk managers measure risk in an effort to assess the actions to take in response to given threats. In this paper the various quantitative and qualitative risks will be plotted on charts similar to the one on the right. The farther on gets from the origin in the lower left-hand corner the greater the threat posed.



Central Bankers and Risk

"Most central bankers claim that the probability that the misspricing(sic) of risks in derivatives could lead to a systemic shock is low, but cannot be ignored. They also worry that lack of information about exposures could exacerbate a financial crisis: and that complex derivatives links across global markets could then make the contagion hard to contain."

William McDonough President of the Federal Reserve Bank of New York. 1994



Y2K MARKET ENVIRONMENT

The Y2K market environment, includes the months and weeks prior to, and after January 1,2000. The period could be an exceptional one. Direct Y2K damage in the form of computer errors leading to systems failures are only one source of risk. Participants in normally liquid markets may find liquidity constraints and abnormal market conditions present.

Potential market situation according to Global 2000

The Global 2000 Co-ordinating Group established by the Bank for International Settlements (BIS) has put forth the following potential Y2K global market profile. It is referenced in the Appendix of this paper. The potential attributes for the Y2K market are:

- Flight to credit quality
- Liquidity/funding constraints
- Flight to physical instruments
- Volume reductions
- Increased market volatility

Global 2000 Co-ordinating Group

It is the Co-ordinating Group's intention to invite all of the financial service providers from the banking, securities and insurance sectors who are active in the various global markets to participate in this campaign to minimize Y2K risk.

The Global 2000 Co-ordinating Group currently includes over 1,250 participants from 508 institutions and associations representing 68 countries.

Infrastructure

Institutional banking is highly dependent on functioning infrastructure. In many countries electricity and telecoms may suffer outages or erratic behavior during the Y2K period. International Monitoring covers these scenarios in its IM-Y2K risk report.

Political changes

Domestic stresses related to Y2K may also change many governments' perception of the advantages of fully open capital markets. The 1997 Asian crisis showed how countries respond to economic stresses in very different ways. The search for scapegoats or the desire to change regulatory structure in favor of domestic participants could alter the financial landscape for international participants.



PRICE RISK

Price risk, is the risk to capital arising from changes in the value of a portfolios financial instruments. Price risk arises from market-making, dealing, and position-taking activities.

Many banks use the term, "price risk" interchangeably with market risk. This is because price risk focuses on the changes in market factors (e.g. interest rates, market liquidity, volatilities, etc.) which affect the value of traded instruments. The primary accounts affected by price risk are those which are revalued for financial presentation (e.g. trading accounts for securities, derivatives, and foreign exchange products). Banks face a risk of losses in on- and off-balance sheet positions arising from movements in market prices.

Established accounting principles cause these risks to be most visible in a bank's trading activities, whether they involve debt or equity instruments, foreign exchange or commodity positions. One specific element of market risk is foreign exchange risk. Banks act as "market-makers" in foreign exchange by quoting rates to their customers and by taking open positions in currencies. The risks inherent in foreign exchange business, particularly in running open foreign exchange positions, are increased during periods of unstable exchange rates.

Liquidity risk

Bank liquidity risk arises from the inability of a bank to accommodate decreases in liabilities or to fund increases in assets. When a bank has inadequate liquidity, it cannot obtain sufficient funds, either by increasing liabilities or by converting assets promptly (price risk), at a reasonable cost. In extreme cases, insufficient liquidity can lead to bank insolvency.

Increased investment alternatives for retail depositors, sophisticated off-balance sheet products with complicated cash-flow implications and an increase in the credit sensitivity of banking customers are all examples of factors which complicate liquidity risk.

Firms try to anticipate liquidity strains by simulating the effects of potential price moves or credit downgrades on collateral requirements. In the case of potential price moves, dealers conduct stress tests to estimate demands for collateral arising from market volatility and assess their ability to meet those demands given market conditions.

Potential collateral demands can be compared with liquid assets and other liquid resources. Dealers take whatever steps necessary, including modifications to legal agreements and systems needed to reuse collateral, to ensure that they can meet the collateral demands that might emerge.

Illiquidity in the dollar market

The dollar markets themselves can become illiquid under stress generated by dynamic hedging strategies which oblige dealers to sell into falling markets and buy into rallies, greatly magnifying price volatility.

In early March 1995, the worsening of liquidity conditions in the New York FOREX market was signaled by widening spreads between "bid" and "offered" prices in inter-dealer trades to three times their norms, even in the dollar-DM market, the deepest in the world.



Y2K liquidity risk according to the Global 2000 Co-ordinating Group

The next four paragraphs are taken from the Global 2000 Co-ordinating group; a special committee set up by the BIS to address Y2K.

1. If a significant flight to quality occurs towards year-end, a greater disparity in liquidity between different market participants than is normally the case will occur. In such circumstances, highly liquid firms will incur significant carrying costs for their "excess" liquidity while other firms may find their liquidity unusually constrained. Close co-operation between central banks and the private sector will be needed to ensure that adequate procedures for recycling cash are in place in order to minimize systemic risk in the event that the disparity in liquidity becomes too great.
2. If markets become too illiquid due to a reduction in settlement or deal flow, there is a risk of turbulent market conditions. At worst this might lead to emergency liquidation of collateral into a disorderly market and at best this would be likely to cause significant price disruption in key markets, particularly the government bond and short term or overnight deposit markets.
3. Intraday liquidity, being a combination of credit balances and credit limits, fuels most large value payment systems with credit officers being responsible for daylight overdraft approvals. Even a modest reduction in available intraday liquidity due to settlement failures or to banks delaying the release of payments until they are confident of incoming payments can quickly disrupt national payments systems. Problems in a national system can quickly spread to payment systems in other countries or regions.
4. During the Euro introduction, firms experienced payment and funding dislocations and found that decisions that impacted credit exposure had to be made with less than perfect information. Lessons associated with the Euro changeover underscored the point that problems tend to manifest themselves first in the area of payment and settlement systems.



Price risk & Y2K

Securities price risk has been mentioned above. Y2K could pose many different threats to securities prices including but not limited to:

- Heavy sales in the equity markets due to perceived corporate Y2K liabilities
- Flight to quality issues nationally and on a credit risk basis
- Exaggerated price volatility causing wide spreads
- Illiquidity due to technical Y2K faults or a lack of willing market participants
- Macro-economic stress due to business losses or defaults
- Uncertainty surrounding Y2K litigation in unproven legal environments

Any combination of the above situations could be responsible for significant price risk outside of normal market variances. The chart, to the right shows the shift in price risk. The gray points indicate the normal risk profile of the 5 risks discussed in this paper. The dark point indicates the potential shift in price risk due to Y2K.

The rate of occurrence is the same, but the damages have increased by many times over reflecting increased price volatility and potential security liquidity problems.

PRICE RISK SOLUTIONS

Participants need to make themselves aware of the potential for each scenario and act accordingly. Institutions need to stress test either quantitatively or qualitatively each of their trading desks and business lines to come up with feasible operational responses.

The critical element is to not react hastily during the event, but to think through potential scenarios in advance and act professionally with the client's long term strategy considered first. Discussion, thought and appropriate proactive positioning well in advance will minimize long-term impacts.

Communication of expectations and early positioning will be key to minimizing price risk during this period. Even the largest markets become illiquid when everyone rushes for the exits at once.

1994 worldwide bond market slump

After the tightening of US monetary policy in February 1994, the yield on long term bonds increased two to three hundred basis points (2-3%) within three months. The rise was unprecedented in scope, spreading over all the industrial countries. It induced huge losses.

According to a 1995 BIS Report, **capital losses reached \$1,500 billion** (approximately 10% of OECD GDP), the heaviest in fifty years. Furthermore, the highly synchronized increase in yields was accompanied by a much higher volatility, which was internationally correlated.



OPERATIONAL RISK

Operational risk represents the deficiencies in information systems or internal controls resulting in losses. Operational risk is inherent in any financial activity, but is significant in the case of OTC derivatives and FOREX. Timely, accurate information is critical to the management of market risks and counterparty credit risks associated with OTC derivatives, which can change quite rapidly and dramatically as a result of new transactions or changes in market values. The capture of OTC derivative data is often a manual process, subject to delay and human error. Determining accurate market values can be problematic for more complex OTC derivatives transactions.

Internal control weaknesses can lead to losses from fraud or the assumption of risks in excess of those acceptable to the board of directors and senior management of the counterparty. For example, allowing traders to determine the values at which complex OTC derivatives are carried has resulted in significant losses at major firms. The failure to establish or adhere to policies relating to counterparty relationships and the marketing of OTC derivatives has resulted in losses from litigation and damage to dealer reputations.

Operational risk is not only about derivatives.

Institution	Activity	Year	Loss \$billions
Sumitomo Corp	London Copper trading	1986-96	2.6
Orange County	Bond trading	1994	1.7
Daiwa Bank	New York Bond trading	1984-95	1.7
Barings	Singapore Futures	1995	.8
Kidder Peabody	Bond trading	1994	.2

Herstatt (Settlement) Risk, a type of operational risk

Foreign exchange transactions involve settlements in two different national payments systems. Herstatt Risk is named after the German bank whose closure, in 1974, occurred after it had received Deutsche marks due to it on FOREX trades, but before the corresponding dollar amounts were paid in the United States. One result was a temporary but severe disruption of payments across the CHIPS payment system; for the next few days banks withheld payments, resulting in a chain reaction of other payments not being made.

A description of the events of 1974 from E.P. Davis' book, *Debt, Fragility and Systemic Risk*, 1992, illustrates the scenario.

“There was widespread concern in financial circles that such evidence of financial difficulty at a few firms might represent the tip of the iceberg...lenders responded...by tightening their credit standards. In the squeeze that followed, many lesser-rated borrowers found their access to security markets partially or completely curtailed, and they were forced to fall back on standby lines of credit at banks. Since banks experiencing these unexpected loan demands were also finding it necessary to pay sharply higher costs for funds, they increased their own loan rates...stock prices...fell dramatically during the spring and summer period of maximum financial strain.”

Herstatt risk and global FOREX

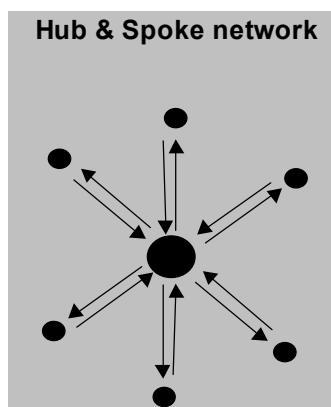
The collapse of Herstatt Bank in Germany revealed the knock-on effects, which can result from such unwinding. A major bank failure in the UK would cause currency markets to halt, because 45% of the money passing through CHAPS is the sterling half of foreign exchange contracts
Financial Times, 1994



FINANCIAL NETWORK: HUBS, SPOKES & CONNECTIONS

The financial network can be discussed like other networks with 3 components: hubs, spokes and connections. This network model is not fixed and the hub and spoke relationship varies depending on the security/OTC contract and the desired payment methods. Depending on the threat, risk is either concentrated or diffused by the hub and spoke model of payment and/or security transactions.

	Function	Examples
Hubs	Aggregation and relay of (money, transaction or information)	Exchanges, clearinghouses, payment systems, and large banks
Spokes (nodes)	Transmit and receive (money, securities, and information)	Banks, Dealers and large financial institutions
Connections	Connect Hubs and Spokes	Public Switched Telephone Network(PSTN), private networks and messaging systems



Clearinghouses, acting as hubs

A clearinghouse substitutes itself as central counterparty to all transactions that its members agree to submit for clearing. The use of a clearinghouse has the potential to mitigate each of the types of counterparty risk associated with OTC derivatives. With respect to credit risk, clearing would achieve multilateral netting, which reduces its members' credit exposures on the contracts cleared.

If a clearinghouse employs effective risk management controls, it may be creditworthier than most, if not all, existing counterparties. However, because clearinghouses currently clear only relatively simple instruments, the benefits of multilateral netting may be limited. From a systemic perspective, clearinghouses tend to concentrate risks and responsibilities for risk management.

FX flows relative to prudent reserves

The ratio of average FX capital flows to prudent reserves have increased since 1974 from 1:2260 to about 1:23 in 1994. If one views prudent reserves as a buffer to a drain on capital due to default, this safety buffer, relative to average daily foreign exchange trading volume for the fifty largest banks, has shrunk by 1994 to somewhere between 2.0% and 0.78% of its former 1974 level.

Eisenberg, Connectivity and Financial Network Shutdown, 1995 Santa Fe Institute

Clearing systems have evolved to minimize Herstatt risk

Large centralized facilities called clearinghouses are designed to minimize risk. CHAPS a clearinghouse in the UK, handles daily payments equivalent to a quarter of the UK's GDP. According to the BIS, it takes less than three business days for Japan's interbank funds transfer systems to generate turnover equivalent to the country's GDP and approximately four days in Germany. These payments are settled on a daily basis.



Difficulties of the present system include the fact that banks run up large, unmonitored overdrafts during the day, exposing members of the system to the risk that one might fail before payments had been completed with a dependence on 'unwinding' payments as the failure remedy.

Institutional Hubs

Deregulation and globalization have led to spectacular growth in the value of non-trade-related financial transactions. Every transaction gives rise to obligations that need to be settled through money transfers. Settlement of transactions is increasingly based on electronic large value payment systems, which have been developed since the 1960's. This has led to major expansions in payment and settlement systems. These now handle payment volumes on a daily basis, which collectively dwarf economic output in the main industrial countries.

Large clearinghouses and exchanges are in good Y2K shape as they have acknowledged and responded to the threat of Y2K effectively. EUROCLEAR, CEDEL, SWIFT, CHIPS, CHAPS, BOJnet and other large value transfer systems have presumably taken care Y2K and are highly compliant.

Real time gross settlement systems

One of the solutions to counterparty related bank failures, like Herstatt, was the creation of Real Time Gross Settlement (RTGS) systems. These systems allow for the netting of counterparty payments, thus minimizing the risk of exchanging full notional principal between parties. Central banks, banking consortiums, or combinations of both own RTGS systems.

In the appendix to this paper is a brief list of accidents relating to settlements.

Lamfalussy standard for settlement systems

In an effort to strengthen RTGS the BIS, in 1991, proposed a set of standards known as the Lamfalussy standards. These standards for payments systems include:

1. Clearing and settlement systems should have a well-founded legal basis under all relevant jurisdictions.
2. Clearing and settlement system participants should have a clear understanding of the impact of the particular system on each of the financial risks affected by the clearing and settlement system's processes.
3. Clearing and settlement systems should have clearly-defined procedures for the management of credit risks and liquidity risks which specify the respective responsibilities of the clearinghouse and the participants. These procedures should also ensure that all parties have both the incentives and the capabilities to manage and contain each of the risks they bear and that limits are placed on the maximum level of credit exposure that can be produced by each participant.
4. **Clearing and settlement systems should, at a minimum, be capable of ensuring the timely completion of daily settlements in the event of an inability to settle by the participant with the largest single amount owing to the system.**
5. All clearing and settlement systems should ensure the operational reliability of technical systems and the availability of backup facilities capable of completing daily processing requirements.

Annual FEDWire statistics

- 10,000 depository institutions use FEDWire funds transfer each year
- 86 million payments at +\$280 trillion
- 8,000 depository institutions use FEDWire securities transfer service
- 13 million securities at +\$160 trillion

For reference Gross World Product(GWP) is estimated at \$39 trillion



These RTGS rely on public utilities to function fully. Even having internally redundant services, does not insure service to participating members.

Extended discussion of RTGSs and the Lamfalussy standard can be found at the BIS website www.bis.org

Operational risk & Y2K

Internal operational risk has been well taken care of globally. Generally financial firms are in the lead in Y2K preparedness; they are however, in no way immune to Y2K failures. Some large countries financial sectors are however known to have started late in their efforts of testing fixed code.

In their efforts at compliance many firms have hopefully minimized the internal errors and problems they will have. Unfortunately, all firms operate in the context of environments that are more at risk. These environments include: Telecoms, Electricity, Water, and Transportation (for staff). Scenarios associated with country infrastructure are discussed in other International Monitoring reports.

Connections

Some limited Y2K tests have been performed via national transfer mechanisms exchanges and banks, but widespread independent on-site bank inspections and verification were outside the scope of many financial participants' Y2K efforts. Much compliance verification has taken the form of vacuous legal forms and empty questionnaires filled out for regulatory authorities.

Spokes (nodes)

Most large banks have discussed with their counterparties the nature of their compliance efforts. Information sharing via the global 2000 group has helped many central banks and large firms understand where risks may lie. These efforts have been positive.

Efforts at global Y2K impact minimization involve significant information sharing by many groups. Unfortunately the efforts are not as aggressive as would ideally have been hoped for. Due to many firms wish to protect proprietary information, most compliance work is done internally without the aid of 3rd party verification. Many banks and trading desks use proprietary trading and risk methodologies. The nature of proprietary models and methods has hindered full public disclosure of Y2K efforts to date.

U.S. dollar & CHIPS

- The dollar is the world's biggest reserve currency.
- It makes up about 65 % of reserve holdings among central banks globally.
- CHIPS is the Clearing House Interbank Payments System
- CHIPS handles 95% all dollar payments between countries in the world.
- Typical daily volume is \$1.3 trillion.
- Owned by 93 of the world's largest commercial banks.

CHIPS is OK internally

CHIPS is the only netting system in the world to exceed Lamfalussy standards. These procedures cover the simultaneous failure of the two largest participants:

- The simultaneous failure of 25 of the smallest participants
- The simultaneous failure of all of the CHIPS participants from 23 lesser countries.
- Simultaneous failures in various geographic regions.

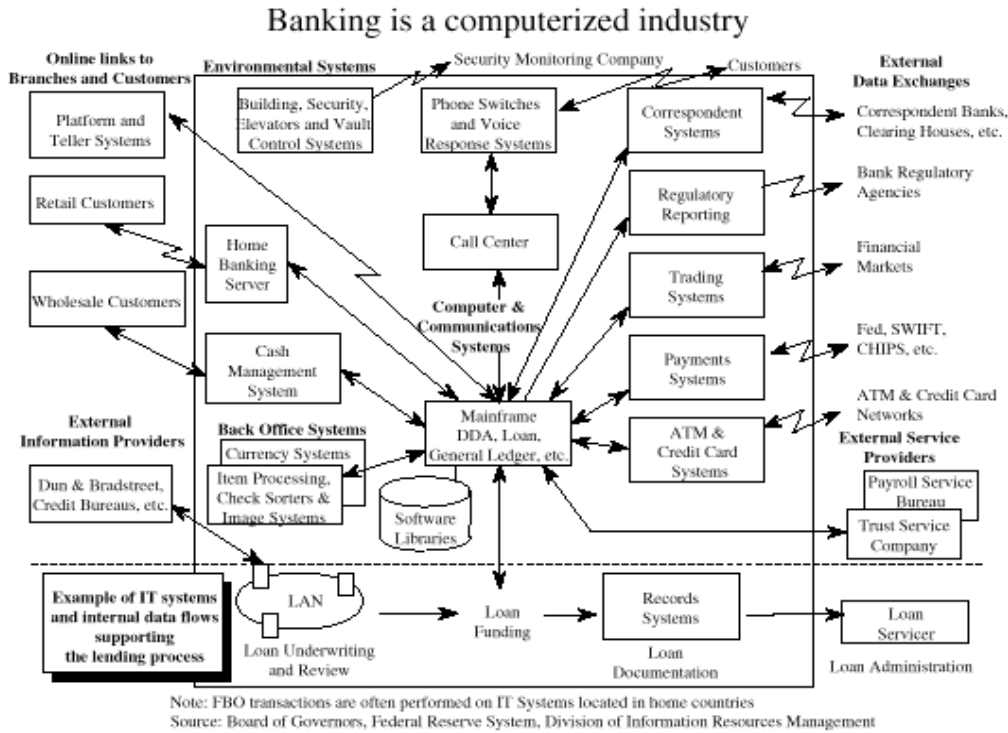
CHIPS has Used a 4 digit years since August 17th, 1992.

Testimony of John r. Mohr Executive Vice-President The New York Clearing House Association L.L.C. House committee on Banking and Financial Services



Utilities environment

The chart below, comes from the Board of Governors, Federal Reserve System, Division of Information Resources Management



If we assume that all of the boxes represent compliant systems within the finance sector, we are left with the connecting arrows, representing Y2K susceptible communication links. Telecoms and electricity are the silent workhorses that make banking happen. Variance, with regards to telecom and electricity Y2K remediation between countries is high.

A portion of the arrows represent dedicated service networks. A significant amount of banking relies on the Public Switched Telephone Network (PSTN) which is at different degrees of risk in various countries. The entire framework of boxes and connections rests on reliable electricity.

Electricity

Most banking facilities have backup power reserve for between 12-48 hours of operation. This may not be enough in the context of Y2K problems in countries with potential delays lasting days or longer.



Telecoms

Telecom links fall outside of banks direct control. Major telecom providers have made good statements, but the truth is no one really knows.

One global bank has publicly stated it will use satellite phones as a communications back-up plan. Redundant and diverse telecom strategies need to be implemented.

According to the BIS, as of September 1998, most OTC derivative transactions were executed via telephone. Automated brokerage systems do exist, but represent a small amount of volume origination. Whether prepared manually or automatically, most confirmations are issued and returned by fax or telex.

G-10 RTGS data from BIS 1998 RTGS report

	System	Network operator
Belgium	ELLIPS	S.W.I.F.T.
France	TBF	S.W.I.F.T.
Germany	EIL-ZV	Deutsche Telecom
Italy	BI-REL	SIA
Japan	BOJ-NET	Commercial telephone companies
Netherlands	TOP	PTT (telecom)
Sweden	RIX	Swedish telecom
Switzerland	SIC	Telekurs AG
UK	CHAPS	British Telecom
United States	FEDWIRE	Commercial telephone companies

Settlement environment & Herstatt risk

Global financial gridlock relating to counterparties fearing a liquidity crunch could become a self-fulfilling prophecy. Counterparties failing to meet their obligations or the perception that counterparties may fail in their obligations could lead to financial payment gridlock. The costs associated with this threat should not be under-estimated. Trillion dollar figures are involved. Single bank failures pose a relatively benign threat.

Firms' problems or the perception of problems due to miscommunication could exacerbate the seemingly improbable situation of gridlock. The first modern instance of gridlock followed the failure of Herstatt in the early 1970's. Herstatt's failure and the follow on disruption to international payment flows lead to the creation of the Bank for International Settlements (BIS).

A banks perspective

"Our sector aggregation suggests that globally, transportation, utilities and telecom sectors have among the lowest Y2K compliance ratings. This is especially worrying because they make up the mission critical sectors in any economy."

Vikas Nath
Credit Suisse First Boston
September 5, 1999

Extended and enlarged exposures

Many banks assume that their exposure to settlement risk in foreign exchange transactions is for one day's trades, and is only an intraday exposure. In fact, public and private sector studies have shown that these exposures commonly are at least overnight and that exposure to settlement risk can be as high as the sum of 2 or 3 days' trades, depending on the institution's internal operational practices and arrangements with correspondent banks. There is a table in the appendix listing estimates for the largest banks daily Forex turnovers.



Difficulties identified in some systems include the fact that banks run large, unmonitored overdrafts during the day, exposing members of clearinghouse systems to the risk that one might fail before payments have been completed with a dependence on 'unwinding' payments as the remedy for failure. Another acknowledged risk is the lag time between information being made available to receiving banks and the time at which settlement takes place.

“A major bank failure in the UK would cause currency markets to halt, because 45% of the money passing through CHAPS, the UK’s settlements system is the sterling half of foreign exchange contracts”, according to the Financial Times in 1994. America's FEDWire and CHIPS handle the equivalent of the United States GDP every 2.5 days.

Settlement limit risk (one example)

CHIPS, the US settlement facility maintains its strength by having individual parties debit caps limited to 3% of the total amount the system settles. This could pose an issue for a major bank, should it need to transfer amounts beyond these limits.

Correspondent banking at greater risk?

In contrast to inter-bank settlement systems, other cross-border transactions are based on older payment architecture. This correspondent system of making payments has evolved from various networks of correspondent banks that date back in their original form to the 12th century.

Correspondent banking operates on the principle that a bank initiating a payment should select its routing. A payment from an importer to an exporter will be routed through the importer's local bank that then selects a foreign banking correspondent. This bank will contact the bank of the exporter or, in some cases a local intermediary bank.

Correspondent banking is rapidly becoming a costly anachronism that adds to the costs of payment. International payment systems like SWIFT remain based on the principles of correspondent banking relationships. The SWIFT system has worldwide acceptance, but is dependent on the same heritage of correspondent banks.

Correspondent banking can be perceived to be at greater Y2K risk, due to the lack of centralized authority, central bank backing or standardized crisis response protocols. Fortunately the amounts involved are smaller than RTGS and other systems, but they are none the less significant and pose operational risk.

European Central Bank

“...the Euro area could be ill equipped to handle a financial crisis.”

“..Who will be the lender of last resort? This question would immediately arise if a big European bank-or, even worse, a group of European banks-encountered serious liquidity problems. The division of responsibility between the ECB and national central banks is left unclear in the Maastricht treaty.

In future, however, national central banks will be unable, without ECB's authority, to provide liquidity on an unlimited basis. The IMF recently gave warning that in the early years of monetary union there may be a tendency for systemic financial risks to increase temporarily.”

The Economist Oct. 31 1998



Operational Risk shift

The chart to the right indicates how operational risks could increase in rates of occurrence and magnitude due to multiple sources of direct and indirect Y2K related stress. According to the July 1998 BIS report, *Reducing Foreign Exchange Settlement Risk: A Progress Report*, "...over 60% of the banks in the surveys are still underestimating their exposures (to settlement risk)." The damages of operational failures can quickly spread and become systemic in nature. For this reason they pose the greatest threat within the context of Y2K. Most systemic threats by definition are now global economic threats.



OPERATIONAL RISK SOLUTIONS

The nature of operational risk is varied; responses to the risks need to be just as varied. Y2K could exert extreme stress on global money flows inside and outside institution's immediate arenas of control. Below, are some suggestions, which may help minimize either the probability of risk and/or the potential magnitude of the risk.

Deal size

Deal size and risk taking should be assessed within the context of perceived counterparties' exposures. Weak credits should be minimized in the portfolio in a timely fashion.

Communications

Institutions, including exchanges, regulators, banks and clearinghouses need to communicate what their alternative means of communications will be should the PSTN or dedicated private networks fail for a period of time.

Communications failure due to telecom, electrical or other failures is a geographically specific risk. Tokyo, London and New York currently account for over 70% of Forex and OTC volumes. Firms need to consider offsite flexibility in terms of either staffing or the passing of the "global book" to functioning operations centers. Firms should test, with staff and equipment, extra-national dealing strategies such as, passing positions on, and originating deals from alternate locations.

Euroclear Y2K contingency plan

"a parallel operations center, which would enable a core team of Euroclear Operations Center Staff to continue working. Participants will be able to contact EOC staff using regular Telephone, fax, and telex numbers. All vital Euroclear communications would be transferred automatically to the parallel operations center."
Euroclear website

Liquidity and dealing limits should be maintained at higher than normal levels at secondary facilities to enable increased deal execution flexibility, should primary channels be unable to execute. Firms with multi-branch relationships, may wish to increase dealing limits so that their own foreign branches may act as secondary sources of risk control, should primary dealers be un-available.



Counterparties

The initial instinct, to cut relationships with counterparties perceived at greater risk, may be ill thought out. In times of adversity it may pay to have extra routes for deal execution. Deal or counterparty risk may be seen as acceptable in the context of not being able to manage risk at all.

Counterparties and dealing limits should be reviewed within the context of various communication and technical failures. Appropriate responses should be put in place and communicated down to the individual level in the form of tiered contingency plans.

Regulation

Regulatory bodies and central banks need to acknowledge potential threats and put forth their intended responses to various scenarios. A concerted show of goodwill and well-discussed response plans will soothe nervous markets during a period when messages could be mis-interpreted or un-received.

Clear co-ordinated central bank and regulatory responses to liquidity threats are critical. This will be especially true in jurisdictions, which may have newer markets, central banks, or financial regulators that lack full political independence.

By stating policy before an event, impacts may be lessened. Many central banks have already stated provisions for extra liquidity available at marginally higher rates. The objective is to insure international liquidity and smooth market function. Non-independent central banks should discuss their Y2K plans with politicians in advance. This should hopefully minimize nationalist policies, which serve short-term interests at the expense of long term stability.

Exchanges

For those using exchanges, cash market relationships should be verified and in place as substitutes. Exchanges themselves will need to consider special communication and operations procedures as well as managing customer expectations in regard to margin increases.

Operations and internal controls

Firms face internal fraud and risk continually. Y2K may present significant opportunities for greater theft and fraud. The most famous example of fraud, was the Barings incident, which has, as one of it causes poor accounting controls. Y2K fixes have opened many systems to outsiders and potentially placed new opportunities for fraud into the banking environment.

Institutional risk and operations managers will need to be extra vigilant for these new operating environments and the threats they may pose.

Industry Group Thoughts

CSC has stated that, Settlement failure normally occurs in 1% of transactions. Y2K could make settlement failure jump to 5% of all transactions. CSC went on to pose three potential Y2K scenarios:

1. The failure or serious system disruption of a major Forex player.
2. A group of smaller institutions that have similar problems.
3. A failure of a clearing house responsible for processing a significant number of transactions.

Source: *Sustaining Stable Financial Markets through the Millennium*, released by the Securities Industry Association (SIA) and CSC corp. including the CSC advisory committee :Securities Industry Association; Merrill Lynch, Deutsche Morgan Grenfell; Columbia University; NYU Stern School, Vanderbilt University's Wharton, Research Institute for Applied Economics



REPLACEMENT RISK

In addition to the risk that one party may fail after the other has made payment (Herstatt risk), there is also the risk that a party may fail before either party begins settlement. In this case, the surviving party would not pay or lose its side of the trade, but in order to buy or sell the desired currency, commodity or debt; it would have to enter into a new transaction with a different counterparty. Because the new contract might be less favorably priced than the original one, there is exposure to potential loss, but such a loss would be only a fraction of the amount that might be lost if there were a counterparty failure at settlement.

Replacement risk & Y2K

Y2K will affect firms and exchanges in different ways. While most exchanges and firms will be compliant, indirect Y2K effects such as telecom or communications failures may inhibit either order execution or fulfillment of obligations. Should trades and positions need to be replaced, there is an opportunity for replacement risk to arise.

A firm wishing to hedge exposure may find the hedge it had is no longer present. The cost of engaging in replacement hedges could increase significantly due to higher price volatility. Increased volatility and multiple firms wishing to execute similar strategies in the same markets could make replacement costs very high or even unfeasible. For exotic instruments, finding replacements may not be possible due to a lack of willing participants.

Dynamic hedging (Gamma and Vega risk)

It is arguable to say that Gamma and Vega risk are a type of replacement risk. Options traders buy and sell volatility. Volatility is generally considered a mean reverting process and therefore relatively stable. In extreme situations, volatility increases dramatically; it is said to spike. These spikes can be extremely costly or profitable depending on which side the trader is on. According to the *1995 BIS Survey of derivatives activity*, the notional value of outstanding options was US\$6.563 trillion.

To manage exposure to volatility, options traders keep track of many relationships between their net option position and the underlying instruments their positions are based on.

Gamma and Vega are measurements of options risk relative to the underlying asset. Gamma measures the rate of change of the option's price rate of change for a 1-point change in the price of the underlying asset. Vega measures the expected change in the price of an option due to a 1-percentage point increase in volatility. These option's price sensitivity measurements are usually stable and manageable.

Recommended Reading on dynamic hedging risks

*The size of hedge
adjustments of derivatives
dealers US dollar interest
rate options*

John Kambhu June 1997
Federal Reserve Bank of New
York



During periods of high volatility, managing Gamma and Vega risk exposures becomes difficult, as assumptions about volatility shift rapidly. In order to maintain a hedged position market makers must constantly fine-tune their portfolios by taking on or selling new positions relative to their Gamma and Vega exposures. By inducing participants to engage in taking new positions Vega and Gamma share, similarities to replacement risk.

Vega and Gamma risk also share the trait of exponentially increasing once they start moving against the trader. Maintaining the proper hedge then involves the need to increase hedge size exponentially. The snowballing effect in an extreme market situation could be significant.

The European Monetary System (EMS) crisis of 1992 exhibited speculative attacks of an unprecedented magnitude. One feature many point to as exacerbating the risk was the significant amount of options using the EMS bands as either strike prices or event triggers. Many banks had written options on the LIRA-DEM spread and were exposed to significant risk as the currency approached the pre-approved currency bands.

Knock-out options

Knock out options are particularly powerful financial innovations. They are call options that give the right to buy a currency at a pre-set price, but instead of expiring worthless, when they are out of the money like standard options, they get knocked out when the market passes a trigger level. This second trigger level threshold is a critical price component. George Soros has stated that he believes knock-out options should be outlawed, due to their purported ability to induce volatility.

This paper disregards the more exotic options, which may have even more extreme relationships to Vega and Gamma. Such instruments such as barrier options, binary options and other path dependant instruments may have high Gamma and Vega exposure. Dynamic hedging and managing Gamma and Vega risk could induce volatility increases and price risk for all participants involved in a market, not just options traders.

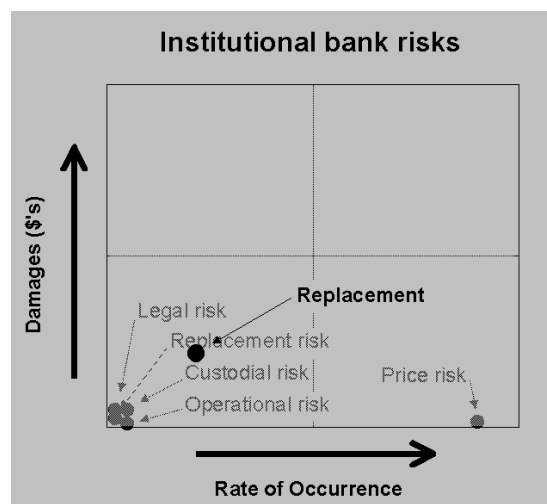
Replacement risk shift

The chart to the right indicates the potential for increased damages and increase in rate of occurrence for replacement risk due to Y2K related stresses. The rate of occurrence could increase due to operational failures and/or price volatility. Damage amounts could increase due to increased price volatility.

1987 equity portfolio insurance similar

In 1987 many firms engaged in a practice known as portfolio insurance. The idea was to protect equity portfolios in declining markets.

Unfortunately too many participants were attempting to use the same strategy at the same time. Many firms found they couldn't cover their exposure fast enough and subsequently suffered un-anticipated losses.



REPLACEMENT RISK SOLUTIONS

Transparency about potential risk exposure is an important mitigation strategy for minimizing replacement risk. Firms need to insure they have strong counterparties, who are doing their utmost in terms of Y2K compliance and contingency planning. Counterparties deemed at risk should either be helped or the ties should be severed. Firms need to insure counterparties have multiple communication lines and contingency plans.

Exchanges need to insure that increases in margin are perceived as pro-active, not panicked, which could cause participants to flee markets. The SIMEX and Barings relationship is an interesting study for those interested in exchange responses to liquidity threats.

Dealers should be aware that OTC contracts are riskier in that they are time consuming to un-wind and usually lack a centralized clearinghouse facility.

Collateral agreements

A factor affecting replacement cost credit exposure is a collateral agreement between counterparties. Collateral reduces the exposure of the collateral taker to the collateral giver by the amount of collateral held. Its effect on potential future exposure is more complex, particularly if the collateral agreement provides for infrequent recalculation of exposure and collateral values or provides that a counterparty can demand collateral only if the exposure exceeds certain thresholds. Even with such provisions, collateral may reduce potential credit exposure.

Volatility

The typical risk to reward nature of options could become skewed significantly. Risk managers need to stress test their option portfolios against multiple Y2K scenarios including counterparty failure; extreme volatility and communications issues which could hinder netting of global risk positions. Risk managers need to assess exotic options as well as securities that possess embedded options, such as convertible bonds etc.

With regards to Vega and Gamma risk, market makers should price in risk and minimize Vega and Gamma exposures relative to internally tested Y2K price and volatility scenarios. Gradual price shifts are easier to manage than rapid shifts. The management of Vega and Gamma is often associated with dynamic hedging strategies. These strategies need to be quantitatively stress tested.



LEGAL RISK

Many over the counter contracts involve transactions, which may be altered by legislative or regulatory changes. A regulatory authority commonly issues various licenses for banks to engage in various activities, the revocation of licenses or shifting regulatory frameworks may put risks on counterparties meeting their obligations.

Legal risk is difficult to quantify and may only be fully appreciated in times of extreme duress, when a government suddenly imposes new monetary rules or interpretations of old rulings. An extreme case would be Malaysia's capital controls, which were only recently lifted.

Country and transfer risks (a type of legal risk)

In addition to the counterparty credit risk inherent in lending, international lending also includes country risk, which refers to risks associated with the economic, social and political environments of the borrower's home country.

Country risk may be most apparent when lending to foreign governments or their agencies, since such lending is typically unsecured. Country risk is important to consider when making any foreign loan or investment, whether to public or private borrowers. There is also a component of country risk called "transfer risk" which arises when a borrower's obligation is not denominated in the local currency. The currency of the obligation may become unavailable to the borrower regardless of the borrower's financial condition.

Legal risk & Y2K

There is no set of rules for international financial crisis responses. Contract jurisdictions in derivative's master agreements and other OTC deals should be checked, as well as arrangements with clearinghouses. The nature of many OTC contracts usually stipulate jurisdiction etc., but by the time these issues become a legal matter, the financial damage in terms of price or credit risk can already have occurred.

Desire for liquidity in national banking systems could induce central bankers or regulatory authorities to engage in extra-legal actions, with regards to OTC contracts, exchange clearing mechanisms and margin requirements. These efforts to stem capital outflows, liquidity problems, and volatile capital swings could have severe consequences for international participants looking for national market liquidity.

Y2K stresses, such as payment gridlock in national clearing mechanisms or clearinghouses may lead to domestic securities regulations being temporarily amended or suspended.

Even if a contract is legally binding, certain provisions may not be enforceable upon counterparty insolvency. The insolvent counterparty's bankruptcy representative may be permitted to "cherry pick" contracts with a beneficial market value and repudiate those negatively affecting the bankrupt party.



This scenario, of protecting national markets at the expense of international markets, in economic terms, is a tragedy of the commons situation. Individual financial regimes acting in their own interest can deplete a commonly shared resource. The shared beneficial resource in this situation would be liquid and transparent global capital markets. Liquidity short falls or volatility due to shortsighted, extra-legal and regulatory maneuvers could challenge international financial stability.

There is also the risk that an OTC derivative transaction could be deemed unsuitable for the counterparty. Such a situation occurred with Orange County after the losses became significant. The potential for shifting legal and regulatory ground, cherry picking, and claims of naivete in the face of large losses could place significant legal risk on market makers for OTC and even exchange traded contracts. Y2K could induce losses and legal claims at the expense of primary dealers.

Errors in contract or confirmation

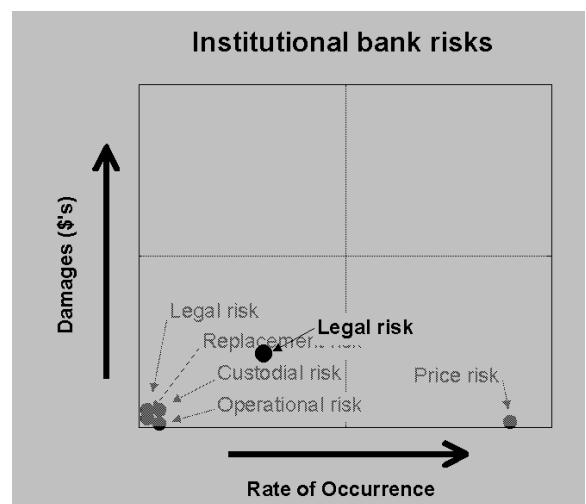
Counterparties as way of getting out of, "difficult" positions may use errors in OTC terms or delayed confirmation to negate contracts to which they are a party. According to the BIS, 1998 survey on counterparty risk management:

"Most firms reported discrepancies in 5-10% of confirmations received, but some reported percentages as high as 30% or even 50%. The majority of discrepancies involve terms of relatively minor importance, typically conventions which determine when payments are (business days, day count, etc.) rather than economic terms. Where disagreements over economic terms occur, their resolution can take considerable time, reflecting the complexity of some OTC derivatives trades and the number of economic parameters.

Most dealers acknowledged that the failure to confirm trades heightened legal risks (by jeopardizing the enforceability of transactions)."

Legal risk shifts due to Y2K

Considering the factors mentioned above, the chart to the right illustrates the potential for legal risk shifts due to Y2K. The rate of occurrence could increase significantly and the damages could grow with the associated market volatility.



LEGAL RISK SOLUTIONS

A plausible solution for minimizing the damages associated with such scenarios is a concerted effort at co-ordinated policy with guarantees of legal and regulatory stability over the perceived period of threat. This agreement or framework of guarantees would best be initiated by the G-7 central banks and the major exchanges. The goal is the reduction of uncertainty in the face of crisis.

Co-ordinated international policy could be politically costly if it is viewed domestically as a way of bailing out Y2K riskier nations. For developed countries, there is no lender of last resort. At this point in time Y2K moral hazard risk should be perceived as minimal.

There is no international policy or body outside of the IMF or Worldbank, which could institute such agreements. A hasty G-7 policy statement allowing lesser central banks and finance ministries to sign on could be a considered solution.

Solutions like this need to be worked out in advance of the problem, as co-ordinated policy responses are slower acting than capital markets in times of crisis.



Custodial risk

Custodians perform the transfer and holding of securities. Over the last few years custodians have grown in size, as economies of scale are realized via consolidation in this highly automated business. The largest custodians hold trillions of dollars worth of securities for their clients.

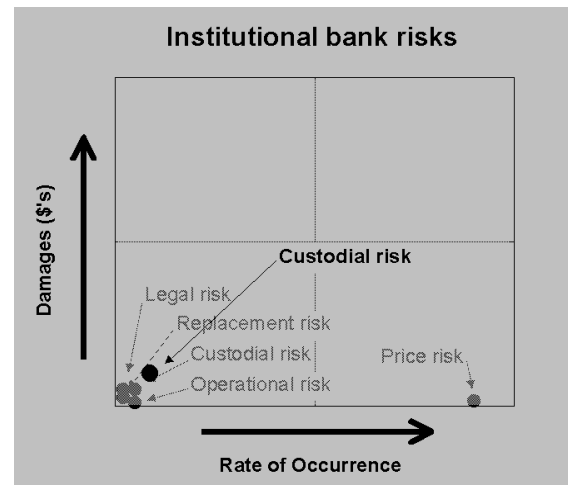
The largest banks and institutions try to minimize custodian risk by maintaining multiple relationships, so that should communication or clearing issues arise, temporary secondary sources of liquidity and securities are available.

Custodial Risk & Y2K

The world's custodians are in excellent Y2K shape. They have good contingency and continuity plans in place. The threat posed by these institutions is a breakdown in communications with their clients via public communications networks and power failure. The inability to verify security transfers and ownership can increase an institution's uncertainty about true market exposure and risk.

Custodial risk shift

The graph, to the right, indicates the potential for shift in the custodial risk horizon due to Y2K. The risk increase is considered relatively minimal.



CUSTODIAL RISK SOLUTIONS

Most large firms should insist on redundant and diverse means of communicating with their custodians. Firms should also verify that they have ample means of getting securities from multiple sources should liquidity on collateral problems become an issue.

Infrastructure providers such as telecoms and utilities, often maintain lists of priority clients in case of failure. Institutions should apply for priority service with their local and national service providers.



COST OF FAILURE

The potential for any of the 5 risks to materialize into a worst-case multi-trillion dollar scenario due to Y2K is hopefully low; our crudest speculation would be below 30%. Even low probability for events of such scope represent significant risk. The nature of these risks is event and or market driven and thus not prone to be seen until it happens. The Asian crisis in 1997 unfolded over a period of weeks. Our projections for the risk scenarios would involve events unfolding within days.

It is important to note that as of the writing of this report September 23,1999 the markets have not significantly priced these event probabilities in. This should not to be considered a statement of advice, merely a comment.

IMPLICATIONS OF BANK FAILURE

A bank fails economically when the market value of its assets declines below the market value of its liabilities. The bank, or indeed any firm, should be resolved as quickly as possible in order to treat all depositors fairly and not allow a run by depositors holding demand and short-dated deposits. The longer an insolvent bank is permitted to operate, the more time informed depositors have to withdraw funds at par value and effectively strip the bank of valuable assets.

In most countries, the failure of an individual bank should be no more important than the failure of any other firm of comparable size in the community. This is not to argue that bank failures are costless. Losses accrue to shareholders and most likely also to depositors, unsecured creditors, and the deposit insurer.

What makes, the perception of bank failures more important, particularly for public policy, is the fear that the failure may spread to other banks and possibly to the global financial system.

Whether or not bank failures are more serious than other failures, individual banks are viewed as more susceptible to failure or more "fragile" than other firms and the banking industry more susceptible to contagion than other industries. Banks are viewed as more fragile for three reasons (Kaufman 1996). They have:

1. Low capital-to-assets ratios (high leverage), which provides little room for losses.
2. Low cash-to-assets ratios (fractional reserve banking), which may require the sale of earning assets to meet deposit obligations.
3. High demand debt and short-term debt-to-total debt (deposits) ratios (high potential for a run), which may require hurried asset sales of opaque and non-liquid earning assets with potentially large fire-sale losses to pay off running depositors.

Lender of last resort

A lender of last resort can forestall threats to the payments system associated with bank runs and stock market crashes. It does so by injecting high-powered money into the monetary system at a rate equal to the increased demand for currency that prevents a sharp decline in the means of payment and enables banks to satisfy an increased demand for loans. It should be known in advance to which central bank foreign banks can turn for advances in case of need.



The adverse implications of this fragility are intensified by the fear that banks invest in assets that are opaque, illiquid and difficult to market, contain private information, and can change in market value abruptly and that depositors may run "irrationally" on banks, forcing unnecessarily large fire-sale losses. Thus, the greater fragility is believed to lead to greater failure.

Moreover, because banks are closely intertwined financially with each other through lending to and borrowing from each other, holding deposit balances with each other, and the payments clearing system, a failure of any one bank is believed to be more likely to spill over to other banks and to do so more quickly.

Default by one bank on an obligation to another bank may adversely affect that bank's ability to meet its obligations to other banks and so on down the chain of banks and beyond. These cascading failures if unstopped put the current global economic system at risk.



CONCLUSION

Institutional bank risk comes in many forms; Five major risks have been discussed in the previous section.

The majority of risks are usually found in the most favorable quadrant, low damages and low rates of occurrence. Price risk, is a daily risk with occasional flare-ups, it occurs often enough that it is managed relatively well by qualitative and quantitative methods.

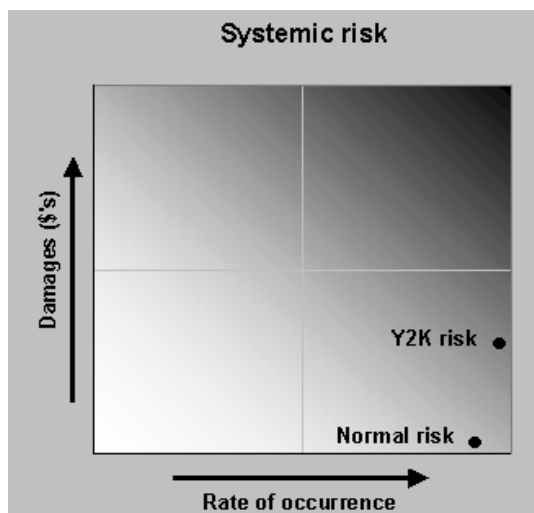
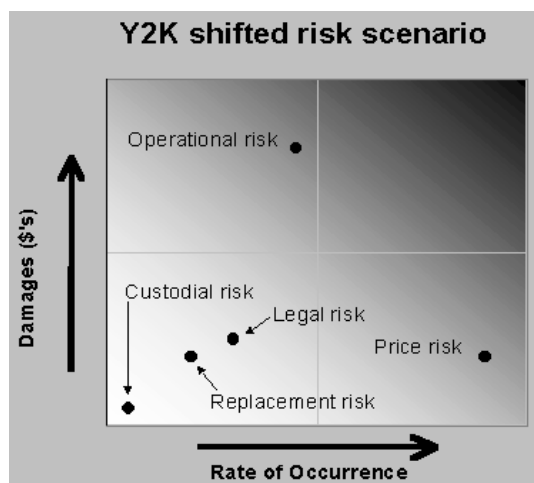
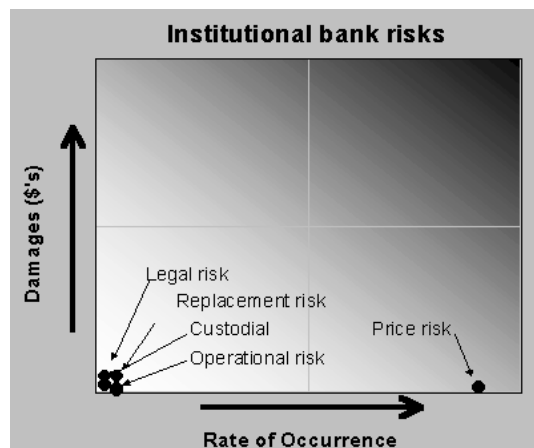
All banking systems rely on public telecom or electrical networks at some point in their processes. There is a risk of global financial gridlock due to isolated Y2K related instability in these networks. The second chart indicates the potential Y2K institutional banking risk environment as summarized in this report.

Every risk increases in potential rate of occurrence and magnitude of potential damages. The risk environment of banking has shifted. The most significant threat increase is seen in the multiple forms of operational risk.

A very sloppy and many would argue inappropriate way of measuring systemic risk is to aggregate the risks together assuming they are independent event probabilities. Damages could be averaged due to the market price component of most damages. The 3rd chart indicates this sloppy look at systemic risk shift.

Y2K related financial gridlock due to Herstatt risk could be on the order of trillions of dollars involving multiple large or small institutional bank failures, due to liquidity problems and or one of the 5 risks mentioned. Even assuming a low probability for these scenarios, the situation needs to be considered in a co-ordinated manner. The potential for a situation similar to Bankhaus Herstatt in 1974 could pose the most significant risk to the international monetary system seen to date. Unfortunately, neither the BIS, IMF, Global 2000 working group, nor The Worldbank has a fully co-ordinated crisis response plan for such situations.

According to the World Gold Council, the World's central banks control 34,000 tons of gold worth \$300 billion representing 10%-15% of reserves. In the face of partial demonetisation of economies, maybe these goldbugs aren't so off base.



APPENDIX

Greenspan on Y2K

Recent remarks by Alan Greenspan reflect the Fed's logical desire for calm in the markets. Earlier Greenspan Y2K comments are submitted here to balance out more recent quotes by the chairman.

"The FED is ready to lend tens of billions of dollars if the bug causes their computers to break down."

"Inevitable difficulties are going to emerge. You could end up with a...very large problem"

"Even if most firms fix the bug, it will only take a small number to trigger big problems."

"In the banking system, 99% compliant is not good enough-it must be 100%"

Alan Greenspan 1998-02-26 before the senate Banking Committee

EXAMPLES OF OPERATIONAL FAILURES

FEDWire

November 21, 1985, The Bank of New York in Manhattan installed a new software package on its mainframe computers. The new program was supposed to connect the bank to the Federal Reserve Board's securities desk through FEDWire and the Automated clearinghouse.

The Bank of New York's new software package had a glitch. For most of the day the Fed delivered securities to the Bank of New York as planned. The Bank of New York's faulty software package kept it from receiving payments electronically from customers and from other banks. The bank of New York paid its outstanding bills, but not payments came in.

While the rest of the system functioned smoothly, the node on the network that was the Bank of New York owed the other banks on the FEDWire system \$23 billion. It had to borrow the \$23 Billion from the fed at a cost \$3.1 million.

The FEDWire system is designed so that every few hours an exact copy of its database is made and sent to another computer. If FEDwire's computer fails, the system automatically switches the network over to one of two remaining IBM370's at the New York data center.



The entire FEDWire system went down 3 times between August 1987 and September 1987. After IBM and the Fed's technicians reset the system, its "up-time" was extended from an average 97.2% to 99.98" in 1990.

On August 16, 1990, FEDWire went down again. This time it was not due to the computers. On that day a power failure cut off service to New York's financial district, which included all of the Fed's computer systems. As planned, a backup generator was switched on, but the generator was water-cooled. The tragedy that day was that one of the 10-inch water lines used to cool the generators also failed. Without the water the generators could not be used. FEDWire was turned off.

FEDWire was not down for long, but it took a week before it could operate at full capacity and resolve all the imbalances that occurred. During that week there were days when FEDWire had imbalances of \$150 billion in the wrong accounts.

The paragraphs, above, were taken from Joel Kurtzman's Death of Money

Barings Crisis 1995

The unforeseen collapse of Baring Brothers bank at the end of February 1995 caused a problem in ECU clearing. The problem involved 50 billion ECU and 45 banks. Eventually the problem was resolved. The potential gridlock for the banks and money was significant even though less than 1% of the payments had anything directly to do with Barings.



THE FOREX MARKET BY PARTICIPANT AND VOLUME

The banks in the table below represent 76% of the estimated \$1.5 trillion daily foreign exchange volume. The information was calculated by International Monitoring using a Euromoney 1998 survey of Forex market share and multiplying it by the BIS survey of daily Forex turnover.

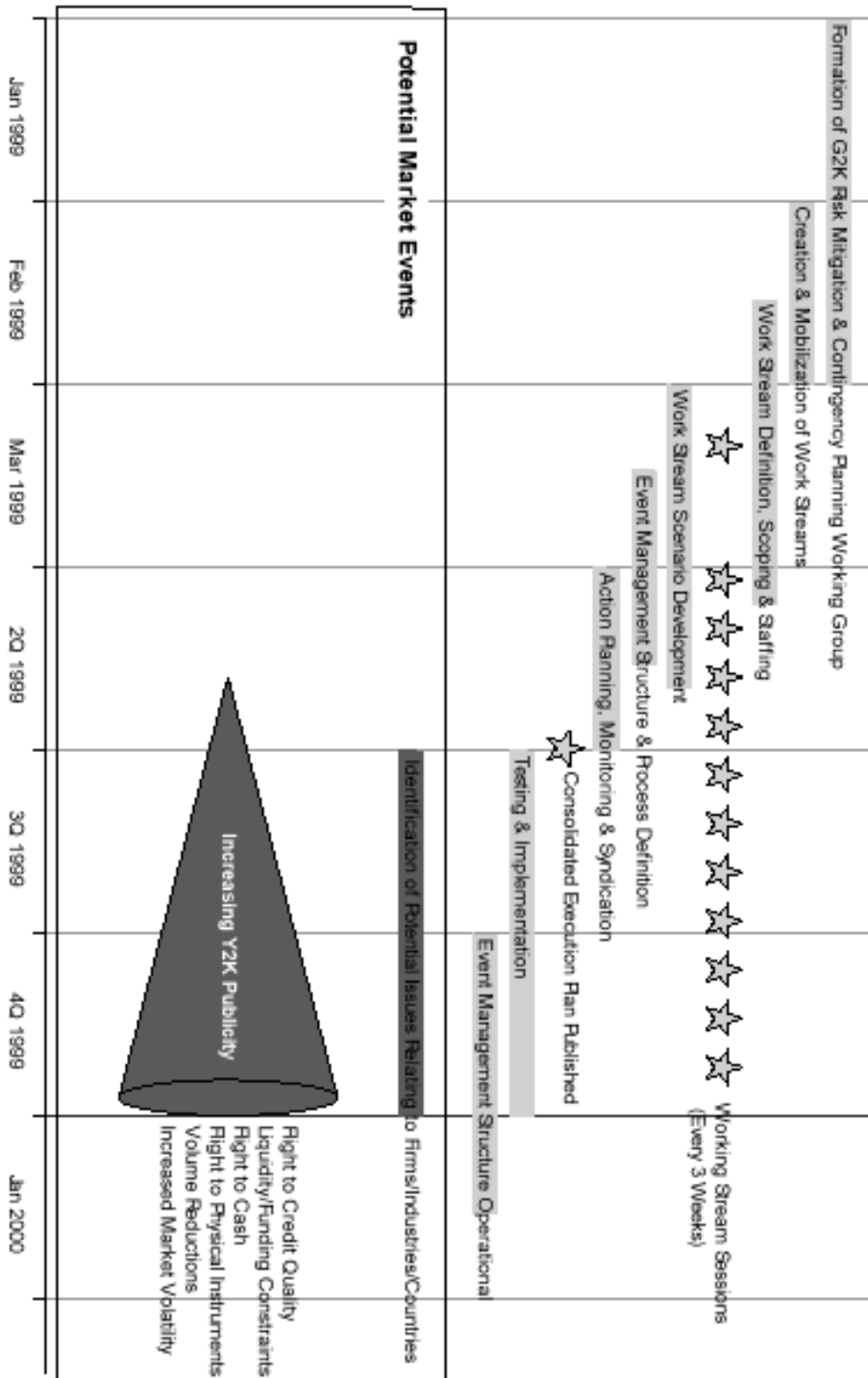
Estimated daily forex turnover*		(billions)	
Citibank	\$128.1	Crédit Agricole Indosuez	\$11.7
Deutsche Bank	\$83.6	First Chicago NBD	\$11.4
Chase Manhattan	\$71.7	Royal Bank of Scotland	\$11.1
Goldman Sachs	\$60.6	Société Générale	\$11.1
HSBC*	\$60.0	Flemings	\$10.7
JP Morgan	\$45.8	Dresdner Kleinwort Benson	\$10.5
SBC Warburg Dillon Read	\$40.4	Banque Nationale de Paris	\$10.4
Merrill Lynch	\$39.8	Sumitomo Bank	\$10.2
NatWest	\$39.0	State Street Bank & Trust	\$9.9
Industrial Bank of Japan	\$38.0	Rabobank	\$9.6
ABN Amro	\$36.2	Bank of Tokyo-Mitsubishi	\$8.1
Bank of America	\$34.4	Bank of Scotland	\$8.1
Morgan Stanley Dean Witter	\$29.0	Caisse des Dépôts et Consignations	\$8.1
AIG	\$28.7	Svenska Handelsbanken	\$7.2
S-E-Banken	\$27.5	Bank of New York	\$6.9
Royal Bank of Canada	\$25.8	CIBC Wood Gundy	\$6.6
Standard Chartered Bank	\$24.8	Lloyds Bank	\$5.9
Bear Stearns	\$21.0	Generale Bank	\$5.9
Union Bank of Switzerland	\$20.0	Bankers Trust	\$5.4
Barclays Capital	\$16.7	Salomon Smith Barney	\$5.4
Credit Suisse First Boston	\$15.8	Cargill	\$5.3
Bank of Montreal	\$14.4	ING Barings	\$5.0
Den Danske Bank	\$13.4	Sanwa Bank	\$5.0
Daiwa International Trust Bank	\$12.6	Bayerische Vereinsbank	\$5.0
Commerzbank	\$12.2	Asahi Bank	\$4.7

*Calculated using Euromoney survey and BIS Forex estimates, some firms have consolidated or changed on the list



GLOBAL 2000'S RISK MITIGATION AND CONTINGENCY PLANNING TIMETABLE AND DELIVERABLES

Global 2000 Risk Mitigation and Contingency Planning Timetable and Deliverables
 The following timetable outlines the overall steps and deliverables in the Risk Mitigation and Contingency Planning process. Each step in the process will be managed and executed at the work stream level and co-ordinated by the program team for cross-work stream dependencies.



NATIONAL PAYMENT SYSTEMS (FROM BIS)

	Belgium	France	Germany	Italy	Japan	Netherlands	Sweden	Switzerland	United Kingdom	United States
Criteria for membership ¹⁰	RM	O	O	O	RM ¹¹	O	RM ¹¹	O	= ¹²	O ¹³
Number of participants										
- number of direct participants	22	approx. 5,700 ¹⁴	approx. 5,700 ¹⁴	approx. 800	423	approx. 200	27	214	16	approx. 10,000
- two-tiered system	y	n	y	n	n	n	y	n ¹⁵	y	n
Number of transactions (1995) () = Forecasts										
- daily average	3,200 ¹⁶	-	22,000	(40,000)	348 ¹⁷	-	1,300 ¹⁸	382,429	-	328,000 ¹⁸
- peak	5,000 ¹⁶	-	65,000	-	-	-	1,430 ¹⁸	1,154,296	-	362,000 ¹⁸
Value of transactions (1995, USD billion)										
- daily average	39 ¹⁶	-	75	170	317	-	45 ¹⁸	110	-	989 ¹⁸
- peak	50 ¹⁶	-	160	300	-	-	50 ¹⁸	221	-	1,416 ¹⁸

¹⁰ O = open membership (any bank can apply); RM = restricted membership (subject to criteria). ¹¹ Minimum capital requirement (ECU 5 million). ¹² APACS and the CHAPS Clearing Company apply objective entry criteria. ¹³ Open to all "depository institutions", federal government agencies and certain other institutions. ¹⁴ Participants in the Electronic Counter total 823. ¹⁵ Except for regional banks' clearing centre. ¹⁶ Data relate to the period October to December 1996. ¹⁷ Estimated as at August 1996. These figures relate only to RTGS. BOJ-NET supports DNS as well as RTGS. The share of transactions settled by RTGS is 1.2% of the total in terms of number and 0.1% in terms of value. ¹⁸ 1996.



AVERAGE DURATION OF EXPOSURE BY CURRENCY PAIR FROM BIS

The durations below could be magnified by factor ranging from 2-10 depending on various country Y2K scenarios.

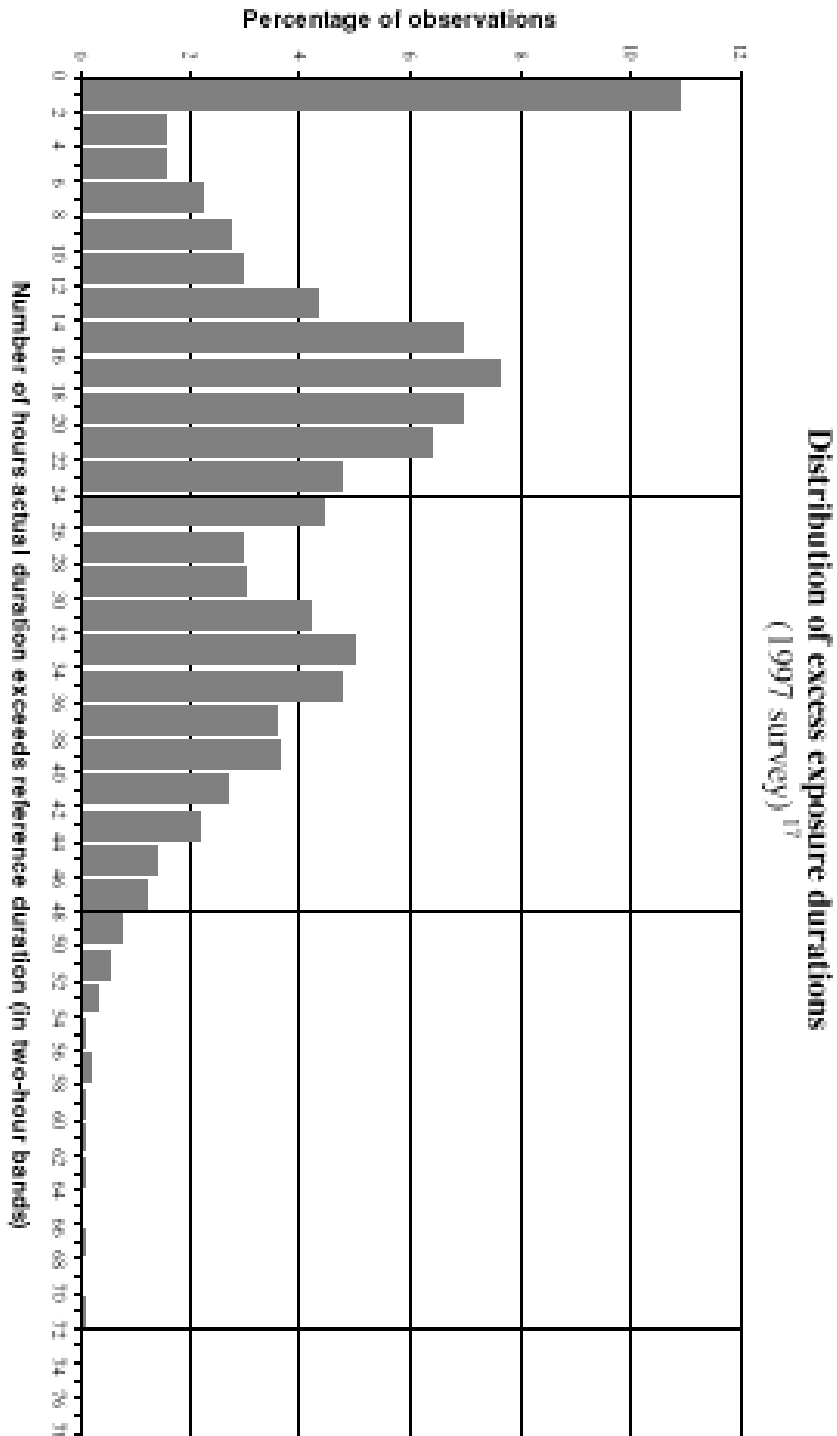
Average duration of exposures by currency pair
 (Results from 1997 survey)

Number of hours elapsing between the weighted average cancellation deadline for the currency sold and the weighted average receipt-identification time for the currency bought. (Figures in brackets indicate the number of hours between the corresponding reference times.)												
Sell	Buy											
	JPY	BEF	FRF	DEM	ITL	NLG	SEK	CHF	ECU	GBP	CAD	USD
JPY	-	33 (16)	33 (18)	35 (14)	33 (15)	22 (13)	31 (11)	37 (15)	27 (16)	31 (15)	42 (41)	37 (24)
BEF	22 (1)	-	31 (12)	33 (9)	31 (10)	20 (7)	29 (6)	35 (10)	25 (11)	29 (10)	40 (36)	35 (18)
FRF	20 (0)	29 (9)	-	31 (8)	29 (9)	18 (6)	27 (5)	33 (9)	23 (10)	27 (9)	38 (35)	33 (17)
DEM	21 (0)	30 (9)	30 (11)	-	30 (8)	19 (6)	28 (4)	34 (8)	24 (9)	28 (8)	39 (34)	34 (17)
ITL	23 (17)	32 (27)	32 (29)	34 (25)	-	21 (24)	30 (22)	36 (26)	26 (27)	30 (26)	41 (52)	36 (35)
NLG	17 (0)	26 (9)	26 (11)	28 (7)	26 (8)	-	24 (4)	30 (8)	20 (9)	24 (8)	35 (34)	30 (17)
SEK	20 (0)	29 (9)	29 (11)	31 (7)	29 (8)	18 (6)	-	33 (8)	23 (9)	27 (8)	38 (34)	33 (17)
CHF	19 (0)	28 (8)	28 (10)	30 (6)	28 (7)	17 (5)	26 (3)	-	22 (8)	26 (7)	37 (33)	32 (16)
ECU	18 (0)	27 (9)	27 (11)	29 (8)	27 (9)	16 (6)	25 (5)	31 (9)	-	25 (9)	36 (35)	31 (17)
GBP	18 (0)	27 (7)	27 (9)	29 (6)	27 (7)	16 (4)	25 (3)	31 (7)	21 (8)	-	36 (33)	31 (15)
CAD	15 (0)	24 (4)	24 (6)	26 (2)	24 (3)	13 (1)	22 (0)	28 (3)	18 (4)	22 (3)	-	28 (12)
USD	12 (0)	21 (4)	21 (6)	23 (2)	21 (3)	10 (1)	19 (0)	25 (3)	15 (4)	19 (3)	30 (29)	-



DISTRIBUTION OF EXCESS DURATION EXPOSURE FROM BIS

The chart below indicates the excess exposure in the system. Y2K could magnify this.



GLOSSARY

- ACH OPERATOR/PROCESSOR** An ACH operator/processor is a central clearing facility that receives batches of ACH credit and debit transactions from originating depository institutions; edits, sorts, and distributes the transactions to receiving depository institutions; and facilitates the settlement among participants.
- AUTHENTICATION** is the process of verifying the identification of the true sender of a message and also that the text of the message itself has not been altered.
- BACK OFFICE** The back office of a financial institution is made up of employees responsible for (1) recording and maintaining the official records of the financial institutions and (2) processing transactions entered into by the financial institutions or its customers.
- BATCH PROCESSING** Batch processing is the transmission or processing of a group of payment orders and/or securities transfer instructions.
- BOND** A bond is a debt security representing a loan by the buyer to the corporation or government issuing the bond; it may pay interest, or it may be discounted in price from the value at maturity.
- BOOK-ENTRY SYSTEM** A book-entry system is an accounting system that permits the transfer of assets (e.g., securities) without the physical movement of paper documents or certificates.
- CALL OPTION** A call option is a contract that gives one the right, but not the obligation, to buy a specified amount of an underlying asset, such as stocks or currency, at a specified price by a certain date.
- CHECK CLEARING** Check clearing is the movement of a check from the depository institution at which it was deposited back to the institution on which it was written. The funds move in the opposite direction, with a corresponding credit and debit to the involved accounts.
- CLASS OF OPTIONS** A class of options consists of options that are of the same type and style and cover the same underlying asset.
- CLEARANCE** is the process of transmitting, reconciling, and in some cases, confirming payment orders or security transfer instructions prior to settlement, possibly including the netting of instructions and the establishment of final positions for settlement. In the context of securities markets, this process is often referred to as clearance.
- CLEARING AGENT BANKS** are FEDWire participants that are regularly engaged in the business of providing clearing services in eligible securities for members and GSCC.
- CLEARING HOUSE** A clearing house is a voluntary association of depository institutions that facilitates the exchange of payment transactions such as checks, automated clearing house transactions, and large-value funds transfers and the settlement of participants' net debit or credit positions.
- CLEARING MEMBERS** Clearing members are firms that are determined by OCC to be qualified to interact with OCC on behalf of market participants.
- COMPARISON MEMBERS** Comparison members are primarily government securities broker-dealers and clearing agent banks that are capable of interacting with GSCC operations.
- CORPORATE PAYMENTS** are payments that are used by businesses to pay other businesses for goods or services.
- CORRESPONDENT BANK** A correspondent bank is a bank that--by arrangement--holds the deposits of another bank and provides payments and other services for that bank.
- CREDIT CARD COMPANY** A credit card company is a company that owns the trademark of a particular credit card and may also provide a number of marketing, processing, or other services to the members using the card services.
- CREDIT LINE** A credit line is the maximum amount of credit available in an open-ended credit arrangement, such as a bank credit card, which the lender may change at any time. The credit line is disclosed in the credit card agreement.
- CURRENCY OPTION** Currency options are options that represent the right to buy or sell foreign currency at a particular price within a specified period.
- DAYLIGHT OVERDRAFT** is an intraday loan that occurs when a bank transfers funds in excess of its reserve account.
- DEPOSITARY BANK** A depositary bank is the bank at which a check is first deposited.
- DIRECT PARTICIPANTS** are financial institutions that are permitted to transact with the clearing organization, and all customers come to the clearing organization through them. The term usually refers to institutions that interact with NSCC.
- DUAL TRADING** occurs when an individual (or representative of a firm) trades on behalf of customers and also trades for his or her own or the firm's proprietary account.
- DVP SYSTEM** A delivery vs. payment (DVP) system is a system that ensures that the final transfer of one asset will occur if, and only if, the final transfer of another asset (or other assets) occurs.



- ELECTRONIC BANKING** Electronic banking is a banking activity accessed by electronic means.
- ELECTRONIC FUNDS TRANSFER (EFT)** EFT is any transfer of funds between accounts using an electronic terminal, telephone, computer, or magnetic tape and that does not use checks or other paper.
- ELECTRONIC DATA CAPTURE (EDC)** EDC is a point-of-sale terminal that reads the information encoded in the magnetic stripe of bank cards. These terminals electronically authorize and capture transaction data, eliminating the need for a paper deposit.
- EQUITY INDEX OPTION** is an options contract that covers the price of a diversified stock portfolio that matches a designated stock-index (a statistical indicator used to measure changes in stock groupings).
- EQUITY/STOCK** Equity or stock is a financial instrument that represents ownership in a company.
- EXCHANGE** an organized market with transactions concentrated in a physical facility with participants entering two-sided quotations (bid and ask) on a continuous basis.
- EXERCISE** means to make use of the "rights" in a contract. For instance, a buyer of a call option may exercise the right to buy the underlying asset at a particular price agreed upon when the contract was purchased.
- FEDERAL FUNDS RATE** is the rate charged by a depository institution on an overnight sale of federal funds to another depository institution. The rate may vary from day to day and from bank to bank.
- FEDERAL RESERVE ACCOUNT** a noninterest-earning account that a depository institution maintains with a Federal Reserve Bank. The balance in this account is maintained for purposes of (1) satisfying the Federal Reserve's reserve requirements and/or (2) settling payments cleared through the Federal Reserve. The balances in these accounts play a central role in the exchange of funds between depository institutions.
- FINALITY** is an irrevocable and unconditional transfer of payment.
- FLOAT** is checkbook money that appears on the books of both the check writer (the payor) and the check receiver (the payee) while a check is being processed.
- FLOOR BROKER** A floor broker executes trades for customers and may also execute trades for their personal or employer accounts.
- FLOOR TRADER** A floor trader executes trades only for their personal accounts. A floor trader is also referred to as a "local."
- FUTURES COMMISSION MERCHANT (FCM)** is a firm that buys or sells futures contracts and accepts payment from or extends credit to those whose orders it accepts.
- HEDGING** is engaging in financial transactions to protect against potential adverse changes in the values of assets, liabilities, or off-balance-sheet activities.
- LIQUIDITY** is a quality that makes an asset easily convertible into cash with relatively little loss of value in the conversion process.
- LOCKED-IN TRADES** Locked-in trades are transactions that are matched by a computer, usually at the place of the trade, before being sent to a clearing organization.
- MARKET MAKER** Market maker is a dealer that makes bids and offers at which he/she will trade.
- MORTGAGE-BACKED SECURITIES** MBS are securities that are backed by mortgages in which investors receive payments out of the interest and principal payments made on the underlying mortgages.
- MULTILATERAL NETTING** Multilateral netting is an arrangement among three or more parties to net their obligations, which may arise from financial contracts, transfers of funds, or both. This type of netting normally takes place in the context of a multilateral net settlement system.
- NET DEBIT CAP** A net debit cap is the quantitative limit placed on the debit position that participants in a funds or securities transfer system can incur during the business day. Under the Federal Reserve's policy, institutions are subject to two caps--a daily cap and a 2-week cap.
- NET SETTLEMENT** Net settlement is the settlement of a number of obligations or transfers between or among counterparties on a net basis.
- NETTING** is an agreed upon offsetting of positions or obligations by trading partners that can reduce a large number of individual obligations or positions to a smaller number.
- NETTING MEMBERS** Netting members are primarily government securities broker-dealers and banks that are capable of participating in the netting services through GSCC.
- NOVATION** is an agreement to replace one party to a contract with a new party. The novation transfers both rights and duties and requires the consent of both the original and the new party.
- OFFSETTING** is liquidating a purchase of contracts (e.g., futures contracts) by the sale of an equal number of contracts with the same delivery month, thus closing out a position.
- ON-US CHECK** An "on-us check" is a check payable from funds on deposit at the same bank where it is presented for collection.



OPPORTUNITY COSTS Opportunity costs refer to the present value of income that could be earned (or saved) by investing in the most attractive alternative to the one being considered.

OPTIONS ON FUTURES An option on a futures contract gives an investor the right but not the obligation, in exchange for a price (called a premium), to buy or sell a specified futures contract at a specific price (called the exercise price) within a specified period.

ORIGINATING DEPOSITORY INSTITUTION An originating depository institution is a depository institution that initiates and warrants electronic payments processed through the ACH network on behalf of its customers.

PAYING BANK A paying bank is the bank at which a check is payable and to which it is sent for payment or collection.

PAYMENTS SYSTEM Payments system is a collective term for mechanisms (both paper-backed and electronic) for moving funds, payments, and money among financial institutions throughout the nation. The Federal Reserve plays a major role in the nation's payments system through distribution of currency and coin, processing of checks, electronic transfer of funds, and the operation of automated clearing houses that transfer funds electronically among depository institutions; various private organizations also perform payments system functions.

PREMIUM A premium is the amount that the buyer of an option pays the writer or seller of the option.

PRESENTMENT FEE A presentment fee is a fee that a bank receiving a check may impose on the bank that presents the check for payment.

PROPRIETARY TRADING Proprietary trading is the buying and selling for the trading institution's own account, in contrast to the trading the institution does on behalf of its customers.

PUT OPTION A put option is a contract that gives one the right, but not the obligation, to sell a specified amount of an underlying asset, such as stocks or currency, at a specified price by a certain date.

REAL-TIME GROSS SETTLEMENT Real-time gross settlement is a system that processes each transaction as it is initiated rather than processing it in a batch. Gross settlement means that the system settles each transaction individually.

REPURCHASE AGREEMENT A repurchase agreement is an agreement between a buyer and seller (usually) of U.S. government securities, whereby the seller agrees to repurchase the securities at an agreed-upon price and, usually, at a stated time.

RESPONDENT BANK A respondent bank is a bank that regularly buys check processing and other services from a correspondent bank.

SECURITIES refer to a financial instrument that represents a share of ownership in a corporation--a stock; a loan to a corporation, government, or governmental body--a bond; or conditional rights to ownership, e.g., an option.

SELF-REGULATORY ORGANIZATIONS Self-regulatory organizations are industry organizations and associations responsible for enforcement and practices in their market.

SETTLEMENT In banking, settlement refers to the process of recording the debit and credit positions of two parties in a transfer of funds. Also, it is the delivery of securities by a seller and the payment by the buyer.

SETTLEMENT BANKS Settlement banks are banks that maintain the settlement accounts for clearing members whereby payments and deposits are made.

SPECULATION is the assumption of risk in anticipation of gain but recognizing a higher than average possibility of loss. The term speculation implies that a business or investment risk can be analyzed and measured, and its distinction from the term investment is one of degree of risk.

STOCK/EQUITY OPTION A stock option gives one the right to purchase or sell a certain number of shares of stock at a particular price within a specified period.

S.W.I.F.T. The Society for Worldwide Interbank Financial Telecommunication is an international financial payment cooperative organization that operates a network that facilitates the exchange of payment and other financial messages between financial institutions throughout the world.

SYSTEMIC RISK Systemic risk refers to the risk that the failure of one participant in a transfer system (or financial markets generally) to meet its required obligations will cause other participants or financial institutions to be unable to meet their obligations when due.

TRADE COMPARISON Trade comparison is the receipt, validation, and matching of data on the long (buy) and short (sell) side of a transaction and the reporting of such match.

TREASURY SECURITY A Treasury security is a negotiable debt obligation of the U.S. government, backed by its full faith and credit, and issued with various maturities.

VALUE ADDED NETWORKS Value added networks refer to a third-party service provider that manages data communications networks for businesses that exchange electronic data with other businesses.

WRITER (OPTION) An options seller is called a writer of options, a "covered" writer if owning the underlying asset and a "naked" writer if not. The writer of an option is obligated to sell, in the case of a call option, or buy, in the case of a put option, a specified amount of the underlying asset at a predetermined price when the buyer or holder exercises the option. The writer earns a premium paid by the buyer.



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