Product Memo for the
Discovery Review of Citigroup's Complex and Illiquid Products

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inventory was higher (7%) for complex/illiquid products compared to all inventory which was 2.7%. The P&L impact, the aggregate difference between external prices and the desk's marks for these products was conservative $9.9 mm.

3. Summary of Themes/Observations

Specific themes and observations (as they relate to valuation, risk management and risk measurement) from this review are as follows:

3.1 Fair Valuation Practices

Oversight and control structures

Similar to CSFB, DB and UBS, the process of the fair valuation at Citigroup is a well-disciplined process. Our conclusion is based on the following observations:

- Initially, front office is responsible for marking the book to the fair value. The fair values are independently checked by the product control (and market risk also gets involved as described below). In addition, Product control and Risk management are independent of the risk taking (i.e. trading) business. A clear governance structure exists between risk takers (front office) and risk controllers (product control as well as market risk management). The policies define responsibilities of these groups.

- All inventories are verified using three approaches: Price-verified using external prices, model-verified, verified using alternative procedures and the remaining inventory is classified as unverified (for detailed breakdown of verification approaches used for products included in this examination, please refer to Appendix B). Monthly report includes discussion of valuation issues and analysis of the unverified inventory. The report is widely distributed to trading, controllers, market risk managers, regional/global heads of market risk, audit and senior business management (including members of the risk committee).

The controls listed above are similar to what was observed at other banks. However, there are some additional controls at Citigroup which makes the process surrounding the fair valuation as one of the best practice observed in this horizontal. These controls are:

- Unverified inventory is further broken down into high, medium or low risk categories depending on the risk attributes applicable. Risk categories are reviewed in detail with Market Risk Management and market risk agrees or updates the risk ranking. Product control tracks the breakdown of High, medium or low risk (unverified) inventory and reports it in the monthly report.
- Finance calculates potential variance (of the market value) of the unverified portfolio for each business and market risk reviews and agrees with these numbers. The potential variance is calculated under "stress" conditions and stress levels can vary from 3% to 5% depending on the product types.
- Finance and Market Risk Management jointly present a review of unverified (and the high-risk unverified) inventory to the Risk Committee of Citigroup three times in a year. This review includes trends in unverified inventory, attribution of the high-risk unverified inventory to business lines and market risk management's estimate of "potential variance" for the unverified (and the high-risk unverified) inventory.

- Thresholds have been defined for the unverified inventory at the overall inventory level as well as for the high risk unverified inventory at the business (i.e. Equity, Fixed Income or Emerging market) level. The breach in threshold at the overall level will result in the notification to the Risk Committee of the Citigroup. The breach at the business level will require explanations from the business heads as to why the unverified levels are so high and what is the expected holding period for the unverified inventory. It is to be noted that any excess has not occurred since they implemented these limits in past few months.
- Aging of the unverified inventory is done on a monthly basis.

Definition of Fair Value

Unlike other institutions (CSFB, DB and UBS), Citigroup has not finalized formal fair value guidelines since the FASB proposals are not yet final. CSFB, UBS and DB were required to develop such guidelines under IFRS standards. As a result, standards that define fair value and the relative hierarchy are already in place at the institutions. Citigroup's policies emphasize independent verification and include four categories of verification – externally verified prices, model verified prices, verified by alternative procedures and unverified.

Citigroup has defined fair value in revisions to EITF 02-03 and management indicated that Citigroup has been actively participating in discussions with the FASB regarding fair value. Citigroup has also started internal discussions on fair value so that they will be ready to implement the new FASB fair valuation policies when they are approved. However, management is not yet ready to commit IT resources as they think that the final guidelines from the FASB may change. Once the fair value statement is finalized, management will review existing transactions and slot them into the appropriate hierarchy for reporting and/or disclosure purpose. There will be no major impact on the balance sheet itself.

Definition of Complex or Illiquid products

Similar to CSFB and DB, Citigroup's policies do not explicitly define complex and/or illiquid instruments. UBS seems to be the only institution that defines complex/structure products in its accounting manual. However, UBS is considering removing these definitions and the six categories that define illiquid instruments.

In our meetings, Finance stated that any products that require a model to verify the price (i.e. where external price is not available) could be considered complex. Products that require alternate procedures are also considered complex. All products in our review were verified (although percentages varied among products) by alternative price verification methods. Citigroup has policies that address how to determine when a position is illiquid and requires a liquidity adjustment.

Citigroup has formally developed an inventory of 12 different types of alternative procedures used for price verification. In addition, they have also developed a desk-by-desk grid showing what kind of alternative procedures are applicable for each desk. Earlier this year, Finance did a presentation to the senior management about the alternative procedures being used. Their analysis indicated that from January 2004 to March 2005, alternative procedures have been used to price verify (on an average) about 7% of the total inventory. As a result of these initiatives, the price verification process at Citigroup has become transparent to the Trading, Finance and Risk management. In some aspects, this practice is comparable to DB which has also identified list of products requiring alternative pricing methods. Other institutions (CSFB, UBS and JPMC) have not formally defined alternative pricing methods.

Trader Price Valuation

Management does not require traders to demonstrate that they can trade at a specific price for the purpose of determining observability. However, for some products (ABS, HY and DD) product control performs comparison of trader's mark vs. the actual sale price. In case of HY/DD, product control will investigate the variances which are larger than the threshold set in terms of percentages of market value.

Finance keeps track of the P&L impact due to the difference between external prices and desks' marks. As of June 2005, the P&L impact is positive (or conservative) $26.3 mm. Any aggressive price reported was not material. The largest positive (conservative) variance occurred in Global Credit Derivatives and Municipal Trading business. These values were offset by largest negative (aggressive) variance in Euro Credit Trading and NA Credit Trading business. Further (product level) breakdown was not shown in this report.

Frequency of Valuation

Similar to DB, UBS and CSFB, price verification is done at the transaction level and on a monthly basis. Similar to other institutions, Citigroup performs mid-month price verification for High Yield and Distressed Debt. For other products, the price verification is done on a monthly basis.

Liquidation under stressful market conditions

Liquidation under stressful market conditions is not considered in valuations. This is consistent with the definition of fair value and also limits the trader's ability to 'manage' the P&L in his/her favor. However, for unverified inventory potential variance under "stress" conditions is reported. This stress amount is not the same as the one used for the corporate-level stress testing. Rather, these are percentages by which the market value of the unverified inventory could vary compared to current valuation. These percentages are decided by market risk based on a history of price fluctuation in each product line. However, the rationale or methodology used in arriving at these percentages was not documented.

Pricing Uncertainty

The greatest pricing uncertainty (among the products reviewed) was in Distressed Debt positions (11.8%) which are comparable to numbers at UBS (10.8%). This is followed by Equity derivatives (6%) and then ABS (1.1%) which is the less than UBS (4%)

Similar to DB, CSFB and UBS, the products that had the least amount of pricing uncertainty were RMBS (0.98%), High Yield (0.4%) and Bermudans (0.25%) where less than 1% positions were reported as unverified.

3.2 Accounting/Risk Management

EITF 02-03 Reserves

Compared to other firms, Citigroup had second lowest EITF 02-03 reserves ($262.4 million). The numbers for other institutions are – UBS: $429 million, DB: $385 million and CSFB: $258 million. According to management, the EITF -02-03 reserves are expected to be lower than other banks because Citigroup does not trade extensively in products which result in 02-03 reserves.

Examples of such types of trades are energy contracts, equity basket options and highly structured credit products. Also similar to UBS and CSFB (but unlike DB), EITF 02-03 reserves are amortized.

FAS133/IAS39

Similar to other institutions, valuations or hedging practices have not been influenced by FAS133 or IAS 39. Citigroup did not incorporate any significant changes in controls when FAS 133 was implemented. IAS 39 does not have a major impact on the institution.

Market Value Adjustments (MVA)

Similar to other institutions, Citigroup uses liquidity, aging, bid-offer and credit reserves. Some products (mostly in derivative areas) also have model adjustments. Citigroup uses the term MVA to refer to any adjustment needed to reflect fair value. Actual MVAs taken vary for each product type.

Similar to other institutions, MVAs are calculated and reported on a monthly basis. This means that as positions increase or reduce, MVA will also increase or be released. Effectively this means that (like other institutions), MVAs are released when the position is sold. In contrast, DB can release reserves even before the positions are sold.

Based on our meetings, there seems to be no tension between product control and Market Risk Management. Accounting practices seem to have a minimal impact on risk management practices. This was consistent with other three institutions reviewed so far.

P&L Attribution

Overall, their P&L attribution implementation seems to be behind other institutions. Among products reviewed in this examination, the P&L attribution is done only for Bermudan Swaptions. The practice is same at CSFB. However, CSFB's practices are somewhat better as they do P&L explanation process for most of their product lines. At the top end is UBS where P&L attribution is performed for all products on a daily basis.

For the most part (HY, DD, RMBS and CDO and Equity derivatives) P&L attribution is not used in the fair valuation process. Only exception to this practice is in the case of Bermudan swaptions where P&L attribution is being performed. For Fixed Income Derivative business (where Bermudan Swaptions are traded) P&L attribution is used to support fair valuation process.

Recent internal audit and OCC exam have highlighted deficiencies in their P&L attribution process. As a result, management was aware of the deficiencies in their P&L attribution and has started a project to implement a robust P&L attribution process. A survey was done globally in March 2005 of all desks inquiring about whether a P&L attribution process was in place and what it consisted of. Of the 63 desks surveyed, 30% did not have a PLA , but 57% of these planned to implement it. Project plans have been developed to address gaps noted in this survey. Initially, P&L attribution will be implemented for all derivatives businesses. Cash and vanilla products will be addressed after the implementation for derivatives is completed.

P&L Investigation

Citigroup practice is similar to DB and UBS where they use both trade-level as well as portfolio level thresholds. Citigroup has trade level thresholds that trigger investigation of discrepancies between Product control vs. Trader's marks. Trade level threshold of $200,000 applies for Bermudan Swaptions, Equity Derivatives, High Yield and Distressed Debt. For mortgage desk, the threshold is 5% and $250 million for the market value. Also there are plans to introduce portfolio level thresholds for HY and DD business. For ABS business, the threshold is $250,000 or 2% of the market value.

3.3 Risk Measurement

Similar to CSFB, DB and UBS MRM uses clean P&L data provided by product control (for performing back testing) and leverages off the data which is checked and used by the product control. In addition, all institutions do not take market value adjustments into consideration for backtesting purposes.

Similar to other banks, market risk performs corporate-level stress testing for assessing fair value under stressful market conditions. However, as an additional control, market risk analyzes unverified positions and calculates potential variance in the market value. This variance is based on a fixed percentage (which varies from 3% for HY/DD to 5% for RMBS products) and is expected to capture P&L uncertainty under "minor" stress conditions. Among the banks surveyed, this practice is unique to Citigroup.

The methodology used by Citigroup for doing stress testing is also different from other institutions. Most banks are using a combination of historical and hypothetical scenarios along with sensitivity-based stress scenarios. In contrast, Citigroup uses four types of stress scenarios - Stressed VAR, Risk Manager's estimate, Historical correlation and the scenario with No correlation (for more description on these scenarios, please refer to section 4.34 on stress testing). In addition, Citigroup does some ad-hoc stress testing which is similar to other peer firms.

The bank leverages its front-office infrastructure for the purposes of measuring VAR. For example, risk management engine GMR uses risk sensitivities from various front-office systems.

Unlike CSFB and UBS, Citigroup uses Monte Carlo simulation with 3-years of data for VAR calculation. The historical data is used in calculating volatility and correlation data among risk factors. Proxies are also used in doing the VAR calculation. In case of Distressed Debt, data availability is not as robust and as a result same volatility is used regardless of currency or domicile.

All six products are being captured in their VAR model. Similar to other institutions, VAR captures majority of risk factors except liquidity risk in its calculation. Unlike other institutions, VAR model at Citigroup is able to capture volatility skew (for Fixed Income and Equity Options). While CDOs were not included in our review, work is in progress to capture correlation skew in the VAR model. Once this work is completed, their VAR model will become more robust.

4. Knowledge Transfer

4.1 Fair Valuation Control Practices

4.11 Definition of Fair Value

DB, CSFB, and UBS all defined fair value and had policies that approximated the proposed FASB guidelines on fair value. Citigroup has not yet developed fair value guidelines since the FASB proposals are not final. Other guidance enables the institution to mark transactions at fair value. Citigroup follows the G-30 principles to arrive at fair value. Product Control policies and procedures emphasize price verification and provide four categories of verification - externally verified prices, model verified prices, alternative procedures, and unverified. Product Control independently verifies trader prices and these processes are embedded in a Pricing Policy and a Price Verification Policy. Reserves are then established for unverified transactions.

Finance provided a draft of a policy statement on EITF 02-03 that defines fair value based on the availability of observable market prices. Citigroup also has processes under way to implement the new FASB policies when they are approved. Foreign institutions subject to IFRS are already required to define fair value and to have a hierarchy of fair value in place and the three already reviewed – DB, CSFB, and UBS use the fair value hierarchy as the basis for arriving at fair values. Both the Pricing Policy and a separate Price Verification Policy are designed to produce fair values with an appropriate level of independent review.

All four institutions have processes in place to independently assess trader's prices and to book adjustments when those prices are not reflective of fair value.

4.12 Definition of Complex/Illiquid Exposure

There are no policies at Citigroup that specifically define complex or illiquid exposures. However, through discussions, Finance indicated that any products that require a model to verify the price could be considered complex along with products where prices cannot be verified. This occurs more often in certain product lines such as Fixed Income derivatives, Credit Derivatives, Equity Derivatives and mortgages. Products that require alternate procedures may also be considered complex. Although illiquid products are not defined, Citigroup has policies that address how to determine when a position is illiquid and requires a liquidity adjustment.

4.13 Accounting Policy/Guidelines

Since Citigroup follows the G-30 valuation principles and the FASB has not finalized fair value GAAP requirements, their emphasis is on price verification and appropriate independent reviews. The pricing policy was an outgrowth of the composition of the inventory which resulted in a growth in the unverified – trader prices that could not be reliably verified through pricing sources. Two or three years ago, the total amount was approximately 1% of the inventory or $6 billion. It has increased due to the growth in businesses such as credit derivatives, distressed debt, and mortgages. As a result, management has developed risk rankings for the unverified prices of high, medium, or low and is incorporating this information into its pricing policy. There has also has been an increase in staffing levels and more documentation around obtaining and verifying prices.

Citi has three specific policies that address price verification as follows: Citigroup GCIB Pricing Policy, Citigroup GCIB Independent Price Verification Policy, and The Policy on New Products, New Activities and Complex Transactions for the GCIB (CMAC Policy).

Citigroup GCIB Pricing Policy: The policy that governs price verification is the Citigroup Global Corporate and Investment Bank Pricing Policy last updated in December 2003.[1] The policy provides general guidelines and then is supplemented by detailed guidance produced by specific business lines. The policy has five principles that apply to pricing of instruments as follows:

- Principle I – All positions must be marked to market using bid offer pricing.
- Principle II – Business Units are responsible for marking to market their positions and providing timely and accurate prices.
- Principle III – Consistent prices must be used across businesses (i.e., each position has only one bid and offer price)
- Principle IV – Adjustments to the market value must be separately identified and not embedded in the market price.
- Principle V – All market and trader provided data is independently reviewed.

Principle V relates to an independent review of data and includes a series of steps that must be followed. The required steps in the price verification process are:

- Classification of the independent price verification results;
- Reporting;
- Resolution process arising from the difference between trader marks and independent prices, and;
- Additional reporting of unverified position.

From a roles and responsibilities perspective, following hierarchy has been established:

- The GCIB CFO establishes the pricing policy which must be reviewed by the head of Citigroup Risk Architecture, the head of GCIB Market Risk Management and approved by the Citigroup Chief Risk Officer and CFO or their designees.
- The Business Unit heads ensure that positions are marked to market accurately and timely using bid/offer prices, and that market value adjustments are separately identified. Desk Heads quarterly must acknowledge the accuracy of market prices and values and Business Unit heads must ensure that this is done.
- The Global Pricing Policy and Control Group (GPPCG) monitors compliance with the policy, reviews, approves and reports exceptions to the policy, reports the consolidated results of the independent price verification process, reports the consolidated level of market value adjustments, reports the level of "aged inventory", and determines when to notify the GCIB CFO, GCIB Controller, Head of Citigroup Risk Architecture and GCIB MRM of changes in market value adjustments.
- The Product Control Groups approve exceptions to this policy and notify GPPCG of positions priced to settlement date that exceed specified thresholds (as developed by each product line); changes in market value adjustment methodologies (bid/offer, liquidity, aged inventory, maintenance, credit) or assumptions;
- Global Product Market Risk Manager (GPMRM) or designee is responsible for reviewing exceptions to the pricing policy, reviewing marking methodologies, related calculations, assumptions, and factors

[1] A combined Pricing and Price Verification Policy is in draft and was provided during the examination.

relating to each product. GPMRM also reviews the methodology and factors used to calculate market value adjustments.

GCIB Independent Price Verification Policy – This policy implements the pricing policy and addresses following six areas:

1. Overview of Verification Principles – This is same as described in the pricing policy.
2. Overview of Verification Categories – Citigroup has established several types of price verification categories:
   a. Externally verified – This category refers to exchange traded products or products subject to an outside market. Acceptable verification consists of exchange feeds or external vendor/broker feeds. (Level 1 of the proposed FASB hierarchy requires externally verified prices).
   b. Model verified – Both the model and significant inputs must be independently verified. The model must either be classified as validated or an appropriate independent model must have been purchased or developed. Inputs are verified only if inputs have been compared to externally quoted sources or the inputs are directly from an external source.
   c. Alternative procedures – These procedures are the different analyses that can be used to assess the reasonableness of the price and include but are not limited to spreads of quoted comparables, recent or subsequent liquidations, liquidation of non-quoted comparables, or other processes.
   d. Unverified – Any position that cannot be verified (and categorized) using one of the above procedures is classified as unverified. Positions that are not verified must be reported to the desk heads monthly.
3. Description and Resolution of P&L Differences
4. Roles, Responsibilities and Required Reporting
5. Documentation standards
6. Implementation Guidelines

4.14 Oversight and Control Structure

Overall, the process of the fair valuation at Citigroup is a well-disciplined process. Initial responsibility for the determination of fair value resides with the front office. However, the final authority to determine the fair value is with product controller's office. The product control group has hired quantitative specialists to support them in Valuation of complex products.

Market risk management receives and review the monthly report showing valuation of positions which are not independently verified. After their review, MRM prepares a description of independent internal review process and all material conclusions with reasonableness of the business valuations. MRM also performs an analysis of unverified inventory to estimate the "Potential Variance". The potential variance is an estimate of the magnitude of mis-pricing that a position may be off the mark. The potential variance may include factors such as the level of the current mark, product complexity, volatility, liquidity etc. Potential variances for the products included in our review were as given below:

Products	Unverified Market Value	Potential Variance			
		High	Medium	Low	Total
High Yield (US Credit Trading)	1	0.1	-	-	0.1

Distressed Debt (Special Situations)	334	20.0	-	-	20.0
Asset-backed securities	1,945	-	-	29.2	29.2
Residential Mortgage-back securities (Mortgage Desk)	1,381	18.1	8.3	6.4	32.8
Equity Basket options (US Equity Derivatives)	-	-	-	-	-
Bermudan Interest Rate Swaptions (US FI Derivatives)	156	-	3.0	-	3.0

Thresholds have been implemented for overall unverified inventory level (3.5%) and high risk thresholds at the business level. These thresholds are – $2B for Equities, $6B for Fixed Income and $250 mm for EM Sales and Trading. A summary of the potential variances is presented to the Risk Management Committee on a periodic (3 times in a year) basis. The breach at the overall level will result in the notification of the breach to the Risk Committee of the Citigroup .The breach at the business level will require explanations from the business heads as to why the unverified levels are so high and what is the expected holding period for the unverified inventory. It is to be noted that this excess has not occurred since they implemented these thresholds in past few months.

Finance produces a monthly report titled "Key Valuation control Metrics". This report has following sections:

- Executive summary of the results of price verification, aging and market value adjustments;
- Analysis of unverified inventory;
- Analysis of aged and unverified inventory;
- P&L variance to external pricing sources;
- Schedule of Market Value adjustments; and
- EITF-02-03 and DIG B-6 schedules.

The Key Valuation control metrics report is widely distributed within Citigroup. Key numbers from the most recent report (as of June 2005) are given below:

- The level of absolute inventory price tested in June is $1.05T, an increase of $10B from the prior month. Out of this $946B or 90% of the inventory is verified to external sources. Alternative Procedures totaled $72B or 6.9%. Unverified inventory totals $28.6B or 2.7% (an increase of $2.7B from May 2005).
- 'High Risk' unverified inventory represents $6.6B (an increase of $200MM from May 2005).
- P&L impact, the aggregate difference between the desks' marks and the external prices, is positive (conservative) $26.3mm. .
- Aged and Unverified inventory is $3,897mm; Weighted average age is 11.83 months.
- MVA balance for June is $1.9B, a decrease of $19.7mm from last quarter. Reserves increased on European FI Derivatives by $49.4mm. Reserves on US FI Derivatives, Mortgage trading and 12B-1 desks decreased by $13.5mm, $12.1mm, $32.1mm respectively.
- During the quarter, EITF 02-03 increased $30mm to $262mm and DIG B-6 reserves increased $23mm to $265 mm.

4.2 Risk Management & Accounting

4.21 Reserves/Market Value Adjustments

Citigroup use the terms Markets Value Adjustments (MVAs) to refer to any adjustments needed to reflect current value. Although the official pricing policy and staff may use the term reserve, any market value changes made are adjustments, not reserves. The one area where the term reserve is appropriate pertains to EITF 02-03 and DIG B-6 reserves.

The types of MVAs most often used are liquidity (including aging), bid-offer, maintenance, and credit. Certain products in the derivative area also have model adjustments. Other businesses such as mortgages have non-market value adjustments including deal reserves, non-economic residual reserves, pay-down reserves, and guarantee reserves. Other Day 1 adjustments such as EITF 02-03 and DIG B-6 are also applied. MVAs are recalculated monthly adjustments made to the P&L as they occur. EITF 02-03 and DIG B-6 reserves are booked on Day 1 and amortized on a straight line basis until prices become observable or the transaction ends.

There are two policies that govern reserves and adjustments – the GCIB Pricing Policy and the Independent Price Verification Policy, although there is a process currently under way to combine the two policies. The policy defines the adjustments that must be made once the bid-offer spread is established.[2] According to the policy once a position and/or trading book is marked to normal bid-offer prices, the policy indicates that a number of adjustments can be made. These reflect three factors:

- The degree to which Citi would not realize a normal bid-offer price - liquidity and aged adjustments;
- The cost of maintaining a book for the rest of its life – maintenance adjustment;
- The fact that fair value ignores the creditworthiness of individual counterparties – credit adjustment.

The policy also addresses understanding how a portfolio would be liquidated. The calculation of MVAs varies depending on liquidation assumptions. The first approach is to sell all the instruments that comprise the book or buy back all the short position or "unwind." This is the approach for cash products. This assumes that all long positions are sold at an appropriate bid price and short positions closed out at the offer price. The second approach is to neutralize all risks associated with a book and maintain this book until maturity – "neutralize and hold." This approach is used for contractual products. There is an assumption of the need to pay an appropriate bid/offer spread on each of the hedging trades and taking into account the cost of the book. Different types of market adjustments are described below:

- Liquidity – This adjustment is used to ensure that the entire position could be liquidated in an orderly fashion at the price at which the position is valued. It does not include provisions for adverse market movements over the assumed liquidation period. The adjustment depends on the approach, as noted above. The approach includes market bid/offer spreads, current and projected trading volumes, and estimates of a normal position size. The calculation should include the costs of selling or neutralizing the whole book even though the reserve may be allocated on a position-by-position basis. Bucketing and netting is acceptable. If the policy states that liquidity adjustments are applied on a case-by-case basis then all adjustments must be documented individually.

  The methodology and related calculations and assumptions (i.e. bucketing by tenor, bid/offer factors) must be approved by the applicable Product Control Group, the Regional Pricing Policy & control Group and the Regional Controller or designee with review by the GPMRM or designee. The

[2] See GCIB Pricing Policy – December 2003 – Principle IV.

GPPCG must be notified of new methodologies and/or changes to current methodologies and will determine if the GCIB Controller, GCIB CFO, Head of Citigroup Risk Architecture and Head of GCIB Market Risk Management should be notified. Monthly factor updates are approved by the applicable Product Control Group with review by the GPMRM or designee.

- Aged Inventory – GCIB's market making businesses mainly have flow activity – buying and selling for customer facilitation. There is a presumption that positions held for a long period of time are illiquid. The GPPCG establishes general thresholds for the number of days beyond which a product is considered aged and this might vary by product. The same approval applies as under the liquidity section above. Updates to bid/offer spreads must be approved by the applicable Product Control Groups with review by GPMRM or designee.

- Maintenance Adjustment – This is the costs associated with maintaining a fully hedged book until maturity and considers all expected future costs and contractual receivables and payables. The costs should include but not be limited to operational support, accounting, systems, and credit monitoring. The same approvals as noted under Liquidity also apply.

- Credit – Fair value of contractual products ignores the underlying creditworthiness of individual counterparties. This adjustment reflects that. Again the same approvals are required plus the approval of credit spreads.

- Mortgage Trading Market Value Adjustments (MVA) – The MVA policy was last updated June 27, 2005. The policy defines following types of MVAs that apply:

    - Bid-offer – Bid/offer MVAs are taken against all net short pass-through positions. Cash positions are marked to bid-offer levels.
    - Liquidity – Liquidity MVAs are taken against certain specific positions and transactions.
    - Seasoned pool MVA – Seasoned pools trade at a premium over generic pool prices, so an adjustment is needed to reflect the correct specified pool price. An aggregate MVA is made at month-end.
    - Aged inventory – The aged inventory is for all flow positions over 90 days old. The MVA is initially be 1% but increases by 75 basis points for each additional 30 days held Certain holdings are excluded – strategic hold – will be sold but liquidation horizon is greater than 30 days; long-term hold – positions the desk intends to hold for an unknown time; and hedges. There are certain exceptions to the 90 day rule – performing residential whole loans, sub-performing residential whole loans, non-performing residential whole loans & REO positions, and commercial conduit loans.

  Non-market Value Adjustments -

    - Deal reserves – These are expenses for bringing the deal to market which will vary from deal to deal.
    - Non-economic residual reserves – This is an estimate of the CMO deal tax liability due to timing differences between actual collateral coupon cash flow and the CMO coupon cash flow.
    - Pay down reserves – This is an estimate of the accrual pay down loss incurred on a monthly basis.
    - Guarantee reserves – This is the potential exposure due to performance guarantees made on the loan collateral in a deal.

Summary of Reserves and Adjustments by Products:

The following table lists the reserves and adjustments used for the six products in our review.

Product:	Complex or illiquid:	Type of reserves used in practice
Equity structured derivatives - baskets	complex	• liquidity • bid-offer • credit • maintenance • pricing (modeling)
Exotics – interest rate - Bermudans	complex	• liquidity • bid-offer • maintenance • credit
RMBS	illiquid	• liquidity • bid-offer • aged • paydown/carry • non-economic residuals • deal expenses • guarantee reserves
ABS	illiquid	• minimal aging reserves for secondary trading; deal reserves set aside for costs such as public filings and legal fees involved with issuance.
Leveraged finance - distressed debt	illiquid	• liquidity
Leveraged finance - high yield	illiquid	• liquidity • aged inventory

4.22 Accounting & EITF 02-03 Reserves

There has not been any impact on sound reserving and price verification policies as a result of implementing EITF 02-03. There should be no major impact on Citigroup of implementing IAS 39 as there was no major impact with FAS 133.

There has, however, been an increase in the reserves as more products are implemented. The EITF 02-03 totals for GCIB as of June 30, 2005 were $262.4 million and DIG B-6 reserves were $265.0 million. Steve Young in Accounting Policy discussed why Citi's 02-03 reserves are lower than some of their competitors (particularly JP Morgan Chase). Citi does not extensively trade products that result in 02-03 reserves specifically equity basket options, structured credit products, and energy contracts.

The 2004 annual report provides information on Citi's policy on deferral of Day 1 gains and losses. Trade date gains and losses on derivatives are deferred where the fair value is not determined based on observable market data. The deferral is recognized in income when the price becomes observable or over the life of the transaction.

GCIB is changing its EITF 02-03 policy and provided a draft of the new policy. The only major change is the reduction in the threshold. The new policy also provides more details on how the transactions should be reviewed and the required documentation. EITF 02-03 only relates to derivative transactions. The current policy states that trade date P&L on derivative transactions is recognized when Citi can verify quoted market prices, prices of similar market transactions or other observable market data supporting the valuation technique. When this cannot be done, the Day 1 P&L is deferred. Currently, the EITF 02-03 review covers all derivative transactions with trade P&L greater than $500,000 and a one year tenor. The proposed policy would reduce that threshold to $100,000.

Other firms in the horizontal have similar thresholds. DB's policy indicates that 02-03 reserves must be booked for all Day 1 profit over 250,000 Euros. Management is monitoring transactions between 100,000 and 250,000 Euros for potential changes in the threshold. CSFB's policy is to review all trades with Day 1 profit above $25,000 for potential 02-03 reserves. UBS' policy indicates that documentation templates (where details are required for the reserve) are required for all transaction except where Day 1 P&L is less than $250,000. JPMC's policy indicates that there should be a review of all trades with initial net present value of over $1 million for 02-03 reserves.

Trade date P&L is released immediately where the data is readily available or consistently available at month-end. Where data is not readily available, it is reserved until it can be verified and there are separate accounts in the ledger for this reserve. Reserves are held at the business line level and impact the trader's P&L. EITF 02-03 reserves are amortized over the life of the transaction on a straight-line basis or until verified. All large complex transactions over $5 million are reviewed by KPMG. Management provided a product summary of those products impacted by EITF 02-03. In terms of the review, EITF 02-03 data is deferred on both vanilla basket options, exotic basket options (since no implied correlation observation is available) and Bermudan options where there is no observable market vol skew data available for high and low strike options. The table below describes how EiTF-02-03 reserves apply to various products reviewed.

Product	**EITF 02-03 Reserves**	**Discussion of how 02-03 reserves are used**
Equity structured derivatives - baskets	Yes	Reserves are used where no implied correlation is available.
Exotics – interest rate - Bermudans	Yes	Reserves are used where there are no observable market vol skew data for high and low strike options.
RMBS	No	EITF 02-03 only applies to derivatives
ABS	No	EITF 02-03 only applies to derivatives
Distressed debt	No	EITF 02-03 only applies to derivatives
High yield	No	EITF 02-03 only applies to derivatives

Citi reviews its current control environment to determine whether system changes are required or controls need to be enhanced. Even in the absence of major changes, management evaluates current policies. One example is the recent revisions to the Pricing Policy to combine liquidity and aging as two concepts within a single principle. In addition, there is separate Accounting Policy Group within GCIB that plays a major role in assisting the business in implementing new accounting pronouncements.

Price verification is more difficult for complex or illiquid products. Therefore, these products also require alternative pricing including reviewing similar transactions and in some cases performing analytical procedures. Product Control has processes in place to alternatively price transactions in the more complex areas –e.g. credit derivatives and distressed debt. In addition, Finance has processes in place to evaluate the risks involved where prices can not be effectively verified. Finance established three risk categories within the unverified category – high, medium, and low. There are detailed procedures as to how the risk is calculated and senior management is made aware of the unverified balances that pose a high risk to the institution.

4.23 Revised EITF 02-03 Policy

Finance provided a draft policy called EITF 02-03 – Valuation Guidelines for Day 1 Profit and Loss Recognition. The policy describes the applicability of EITF 02-03 and then outlines GCIB's policy as follows:

- Although the revised policy indicates that it will apply to all day 1 gross profit on derivatives greater than $100,000 to which EITF 02-03 applies, the threshold is still under debate internally. The current policy uses a threshold of $500,000 but management does not expect major changes in total EITF 02-03 reserves, if the threshold is lowered. If the policy remains as revised, derivatives with gross profits of between $100,000 and $5 million that are determined by the Senior Financial Controller to meet observable and market-based thresholds on Day 1 are reported in the normal course of business with financial Controllers retaining the appropriate documentation. For those transactions that have not met these thresholds (unverified), Day 1 P&L should not be recognized until observable.
- For Day 1 P&L greater than $5 million, a detailed transaction review must be performed.
- EITF 02-03 holdbacks are amortized into P&L on a straight-line basis with Financial Control retaining documentation on amortization releases.
- Appendix I to the policy incorporates fair value principles and a definition of fair value as follows. "If a quoted market price is not available, the estimate of fair value should be based on the best information available in the circumstances. The estimate of fair value should consider prices for similar assets or similar liabilities and the results of valuation techniques to the extent available in the circumstances. At the inception of the arrangement, the transaction price represents the best information available with which to estimate fair value. Any price other than the transaction price must be supported by one of the following:
    - Quoted prices in an active market;
    - Observable prices of other than current market transactions; or
    - Other observable market data supporting a valuation technique"

  Two criteria must be met:
  - "the market prices and/or data implied from them must be transparent (i.e. observable); and
  - the market prices and/or data implied from them must be liquid (i.e. market based)."

The Appendix further defines characteristics of observable data as not proprietary, readily available, regularly distributed, multiple independent sources, transparent, and verifiable. Characteristics of market

based data are reliable, based on consensus, sources are actively involved in the relevant market, and support by market transactions. The EITF 02-03 policy should be finalized within the next few months. The new policy provides more guidance on 02-03 than the prior policy but should not result in more reserves since Citigroup does not have a large number of transactions subject to 02-03 reserves.

4.24 P&L Investigation, Attribution Process

Finance is in the first stages of implementing a robust P&L Attribution Analysis (PAA). A survey was done globally in March 2005 of all desks inquiring about whether a P&L attribution process was in place and what it consisted of. Of the 63 desks surveyed, 30% did not have a PAA , but 57% of these planned to implement it. About 50% of the desks planned to upgrade their PAAs. Ownership of the process varied by desk and includes front office, research and finance staff. Some desks had multiple PAAs and half the desks did not have any thresholds. Finance is implementing uniform processes for PAAs based on the prototype that is in use in Fixed Income Derivatives. The process in Fixed Income Derivatives consists of two separate types of analysis. ExAnte Analysis uses risk measures and market changes to calculate a predicted P&L. ExPoste Analysis uses market inputs to decompose the marks. P&L is attributed to appropriate risk measures such as delta, gamma, vega, etc. and provides a separate analysis of new activity.

The current estimate for completion of all PAAs for derivatives business is by 1st quarter of 2006. It is to be noted that Mortgage business still has no set date for PAA implementation. Finance has established some rules of the road for PAAs which should be followed by all the desks going forward. These rules are:

- PAA Development/Enhancement: The designation of a specific person to enhance the PAA.
- Independent Review of PAA Modeling: A documented review by a qualified independent support function who reviews the model for adequacy and consistency across businesses.
- PAA Lock-Down/Change Control: Appropriate access and change control over the PAA process.
- Thresholds/Unexplained Variances: Thresholds for unexplained variances should be set and agreed between the business, risk management and product control. Rationalization of thresholds above variances should be reviewed by the person or function responsible for modeling the PAA. Finance will document the review of unexplained variances above the threshold.

4.3 Risk Measurement

The fair value assessments for accounting or risk measurement purposes are same. Fair value assessments for accounting purposes are designed to ensure that the books and records fairly reflect the market value of specific products. Fair values do not normally reflect liquidation under potential stressful market conditions. However, if the current market environment is stressful, then the valuations would reflect that in terms of market price and bid/ask reserves.

The risk measurement systems use the "Clean P&L" which is validated by the Product Control ("PC"). Any differences between the trading P&L and the P&L validated by the PC would be booked, if material. Any market value or portfolio level adjustments would not be included in VaR for back-testing purpose. Market risk would also leverage off the controls that the PC has in place to validate the accuracy of the trading P&L including the daily P&L and the periodic review of trading valuations. Accounting considerations do not influence the P&L used for backtesting the internal VaR models as Risk Management uses the clean P&L (representing the

hypothetical change in portfolio value between the close of business on successive business days assuming an unchanged portfolio) that has been vetted by PC for VaR, stress testing, and backtesting, although these amounts do not include month-end fair value adjustments.

Risk management is responsible for VAR calculation and reporting. The VAR exposure is calculated for all products selected in our discovery review. Market Risk Management (MRM) does not take Market Value adjustments (MVAs) into consideration for market risk measurement purposes. MRM leverages off the PC with respect to the pricing and position data used in the VaR model. The controls that are in place to produce accurate accounting data would also be leveraged by risk management since the clean P&L validated by the PC is used in the risk management system. In VaR model, all the risks, decomposed to the most generic form (i.e. risk sensitivities – interest rates, credit spreads delta, gamma, vega) are fed from various trading systems.

4.31 Exposures not captured in VAR

Products	Risks	Reserves	VaR(1)	Testing (2)
High Yield	Liquidity	Aging, Liquidity	No	Yes
RMBS	Liquidity, Prepayment	Liquidity, Aging	No,Yes	Yes
ABS	Liquidity, Prepayment	Liquidity	No,Yes	Yes
Equity Derivatives	Liquidity, Vol Skew	Liquidity, Modeling, EITF	No,Yes	Yes
Distressed Debt	Liquidity	Aging & Liquidity	No	Yes
Bermudans	Liquidity	Liquidity,EITF-02-03	No	Yes

(1) Similar to othe institutions, VAR does not capture liquidity risks.

(2) Stress testing captures liqudity risks implicitly (risk managers can change holding period in a subjective manner) as it incorporates worst 3 months moves from last 8 years (since 97).

4.32 VAR Methodology

VaR is calculated with internally developed models designed to capture the market risk of each specific product in the corporate portfolio. The one-day 99% USD VaR calculation is based on Monte-Carlo simulations of 5000 scenario paths of one-day changes in the market risk factors underlying the portfolio. These market factors are modeled as either normal or lognormal stochastic diffusion processes. Under these assumptions the market factor returns are multivariate normal. The one-day period covariance matrix characterizing the multivariate normal distribution of these market factor changes is estimated from the historical times series data of market rates/prices.

For each simulated scenario the one-day changes in the market factors underlying the corporate portfolio are translated into one-day changes in the USD portfolio value via factor sensitivities associated to each market factor. Factor sensitivities quantify the market risk exposure of an instrument by expressing, in a suitable metric, how the present value of the instrument changes in response to changes in the underlying market factors. The calculation of these factor sensitivities is based on proprietary internal valuation models specific to each product type, and

which are implemented in each trading desk's front office system. The Global Market Risk (GMR) system, the system that implements the firm's VaR measure, receives daily feeds with factor sensitivities from the various trading/business units. The GMR system possesses no internal valuation models that would enable it to recalculate an instrument's value under a particular simulated scenario. Instead, it makes use of the factor sensitivities that it receives from the front office systems to estimate the change in an instrument's value under a simulated scenario.

The factor sensitivities on which VaR calculations rely are:

i. Linear factor sensitivity measures (Delta, Vega, etc.);
ii. Factor sensitivity grids, used for instruments with a non-linear dependence on the underlying market factor(s); the grids encode the information on the change in instrument's value to a pre-specified set of changes in the market factor(s), and enable GMR to obtain an approximation to the instrument's P&L under each simulated scenario in the absence of a full revaluation capability.

The one-day 99% USD VaR is obtained from the sample 1% quantile of the distribution of portfolio P&Ls obtained as a result of the 5000 Monte-Carlo simulated scenarios. The 10-day 99% USD VaR needed for regulatory risk capital is estimated similarly to the one-day 99% USD VaR by using a 10-day period covariance matrix to characterize the multivariate normal distribution of market factor changes over a 10-day horizon. The 10-day covariance matrix is obtained from the one-day covariance matrix by scaling the latter by a factor[3] of 10.

4.33 The Global Market Risk (GMR) system

The Global Market Risk (GMR) system is the system that implements Citigroup's VaR measure. GMR calculates VaR via its Near-Term-Risk (NTR) simulation engine and reports the market risk of the firm's trading/business units. Each trading/business unit computes appropriate market factor sensitivities at the lowest level of organizational hierarchy (portfolio or firm account), and feeds these factor sensitivities to GMR daily. Based on these feeds, GMR performs the appropriate VaR calculations and presents the VaR results and the factor sensitivity values at both detailed and aggregated levels, according to the reporting procedures in place. The main components of the VaR implementation in the GMR system are graphically depicted in the diagram below.

[3] This factor comes from the adjustment of volatilities by the square root of the time factor (from a one-day horizon to a 10-day horizon), under the assumption that portfolio positions are constant over the VaR horizon and that market factors returns are i.i.d. (independent identically distributed).

GMR/NTR calculates and reports VaR at various levels of aggregation in the firm's organizational hierarchy; it also transforms and combines factor sensitivity feeds and various stress grids feeds for reporting and limit monitoring.

D. Market factor stress scenarios

These represent user-defined market factor stress scenarios to be imposed against the population of exposures (A) that are provided in the risk feeds. Stress scenarios complement VaR estimates in the market risk management of the firm's trading activities.

4.34 Stress Testing

The MRM group has developed a comprehensive stress testing program that portrays the firms risk exposure under different stress analyses. The four main scenarios presented in the quarterly corporate stress testing packet are Historical Correlation, No-correlation, Stressed VaR and Risk Manager Estimates ("RMEs). In addition to these scenarios, management recalculates the Stressed VaR and No-correlation scenarios after applying different defeasance assumptions to each risk exposure. Various approaches used in stress testing are described below:

1. Historical Correlation

Risk Architecture is responsible for calculating the Historical Correlation (for one quarter or 65 days) stress scenario for all MTM and Accrual CIB businesses. For this scenario, risk factor changes from January 97 until the present in rolling quarter periods are used to revalue today's positions. Management then determines which quarter resulted in the worst overall loss for both MTM and accrual positions. This scenario allows for correlation benefits, as some variable may move in the firm's favor even in the period with the highest loss. Hence, this scenario generally results in the lowest level of stress losses.

2. No-correlation

The No-correlation analysis determines the maximum adverse market move for each market variable over a 65-day period using historical data from 1/97 to present. It then revalues the current positions by applying the worst market moves of each risk factor to today's positions and adds the P&L impacts. The historical periods used vary depending on when the worst market move occurred for each risk factor. The scenario does not allow for correlation benefit, it assumes that all risk factors go against the portfolio at the same time. Fewer risk factors are used here due to computational demands.

This scenario is considered extreme particularly for the Emerging Market Division as it picks up risk factor moves by currency for different time periods, which individually may have been responding to different issues specific to the economic/political environment of the country making the scenario highly unlikely (i.e. currency pegs). To address this issue, the bank treats the no correlation scenario as an 'upper loss boundary'.

Since third quarter 2001, the No-correlation analysis has also been calculated with the incorporated effect of risk defeasance. The risk defeasance stress analysis is based on inputs from market risk manager and is an attempt to determine what percent of exposures could be liquidated during a stress environment, how long it would take and at what cost. GCIB's defeasance analysis shows minimal risk reduction based on the assumption that the portfolio remains constant.

While it is important for management to consider the liquidity factors in stress testing, it is not as effective in this scenario since it ignores the correlation between market variables and the fact that liquidity pressures vary depending on the type of market crisis.

3. Stressed- VaR

In this scenario, a VaR is calculated at a 99.97% confidence level using stressed volatilities and stressed correlations. Volatilities are stressed by incorporating the fat tails or unusual risk factor changes observed in the past. Correlations are stressed assuming that they will be stronger during a crisis. This is a realistic assumption for stress tests, as correlations tend to get stronger during crises. In addition, similar to what is done for the No-correlation analysis, a stress VaR analysis is conducted with incorporated defeasance assumptions.

4. Risk Manager Estimates

Risk Manager Estimates ("RMEs") is a stress measure calculated on a quarterly basis by Product Risk Managers ("PRMs") that is based on judgment and knowledge of each business unit. RMEs quantify the potential stress losses by business and on an aggregate basis for CIB and CIB + EM entities. Product Risk Managers judgmentally select the worst possible loss at the 99.97% utilizing available historical stress data (see notes above on "historical correlation" stress testing). For example, a manager may determine that it is more realistic to use intra-quarter positions to capture risks that may not be present at end of the quarter, or may decrease the shock to a risk factor such as DV01 since s/he knows the position can be unwound sooner.

4.35 VAR Data Sources

The Market Factors Volatilities and Correlations (MFVC) matrix in the GMR system refers to the set of volatilities of all market factors selected as representative for driving the market risk of the corporate portfolio and to the set of correlations between these market factors.

The MFVC matrix is produced by the Risk Architecture/Market Risk Analytics group using the historical time series of rates/prices corresponding to the chosen market factors, and updated twice a quarter. The historical time series data used, typically of three years length, is the most recent data available at the date when the updating process of the new matrix is initiated. Market data is typically collected in the Market Risk Analytics Database (MRAD), either via an automated process of daily uploads from selected rate servers, or via manual periodical uploads performed by designated GMR database coordinators.

The risk exposures of each trading/business unit are made available to the GMR system at the close of each business day in the form of flat ASCII files. The files are transmitted into assigned

directories on a GMR server. The GMR system stores the information contained in the risk feeds into designated tables in the GMR database. GMR requires two types of feed files:

- **Hierarchy feed file:** The organizational hierarchy feed file provides to GMR the aggregation rules for Citigroup's organizational structure.

- **Factor Sensitivity (FS) feed file:** The Factor Sensitivity feed file contains records that describe the market risk exposures for the desks, and additional records with other relevant information necessary for processing, reporting and reconciliation purposes.

The table below lists the market risk exposure types that are used in the VaR implementation. For each exposure class, the table lists the four-letter GMR *labels* of the factor sensitivities in that class, the underlying market factor, a description of the factor sensitivity, the *shift type* (whether absolute or relative shifts of the market factor are used in the definition of the sensitivity), and the *scaling factor* used when reporting the sensitivity.

Market Risk Exposure Class	GMR Label	Factor Sensitivity Description	Underlying Market Factor	Shift Type	Scaled To
Interest Rate	IRDL	Interest Rate Delta	Interest Rate	Absolute	+1bp[4]
	IRGR	Interest Rate ΔPV Grid	Interest Rate	Absolute	-
	IRVG	Interest Rate Vega	Interest Rate Implied ATM Volatility	Absolute	+100 bps
Credit	CSVG	Correlation Skew Vega	Default Time Implied Base Correlation	Absolute	+ 100 bps
Distressed Debt	LODL	Distressed Debt Price Delta	Distressed Debt Price	Relative	+100%
Mortgages	OMDL	Market Option Adjusted Spread Delta	Market Option Adjusted Spread	Absolute	+1bp
	OSDL	Security Option Adjusted Spread Delta	Specific Option Adjusted Spread	Absolute	+1bp
	PPGR	Prepayment Error Grid	Prepayment Rate	Relative	-
Preferred Equity	PFDL	Preferred Equity Price Delta	Preferred Equity Price	Relative	+100%
Equity	EQDL	Equity Dollar Delta	Equity Spot	Relative	+100%
	EQGR	Equity ΔPV Grid	Equity Spot	Relative	-
	EQVG	Equity Vega	Equity Implied Volatility	Absolute	+100 bps
Equity Convertibles	ECVG	Equity Convertible Vega	Equity Convertible Implied Volatility	Absolute	+100 bps
FX	FXDL	FX Delta	FX Spot	Relative	+100%
	FXGR	FX ΔPV Grid	FX Spot	Relative	-
	FXVG	FX Vega	FX Implied ATM Volatility	Absolute	+100 bps
	FXRR	FX Risk Reversal Sensitivity	FX Implied Risk Reversal	Absolute	+10 bps
	FXST	FX Strangle Sensitivity	FX Implied Strangle	Absolute	+10 bps
Commodity	CMDL	Commodity Dollar Delta	Commodity Futures/Forwards	Relative	+1%
	CMGR	Commodity ΔPV Grid	Commodity Futures/Forwards	Relative	-
	CMVG	Commodity Vega	Commodity Futures Implied Volatility	Absolute	+100bps

Table 1: Factor sensitivity definitions by risk type

High Yield/Distressed Debt

For the VaR model, EJV is the data source for both High Yield and Distressed Debts. Rover, an internal data source is used for European bond issuers as EJV is limited to only US issuers. In order to ensure the quality of the data, Risk Metrics, an internal quantitative analysis group, performs a data cleaning process, where volatility is estimated and risk ranked for each security. Furthermore, the yield history of each bond is manually checked, starting from highest volatility

[4] Basis point (1bp = 0.0001)

to the lowest. Any obvious outliers or dubious data (checked against external sources as Bloomberg) are removed. In current estimation, 2993 USD bonds have survived the cleaning process.

Interest Rates

GMR, the system calculating VaR at Citigroup, receives interest rate curves, interest rate volatilities, and currency rates from Riskman and Hamper. These are internal databases and no direct data checking is done prior to the VaR calculation. The price verification process, however, is the manner in which the integrity of data from these providers is ensured. Product Control verifies the data quality as part of its daily P&L Reconciliation procedure.

Given that quality of time series across a substantial amount of curves varies, the decomposability of the overall IRDL matrix has been very poor. The decomposition process to derive a positive definite matrix faces the hurdle of an enormous size of the full correlation block (over 1,000 by 1,000 elements) and the time-series differing drastically in lengths, while simultaneously allowing little change on each correlation element. Inconsistency of frequency basis between time-series also contributes adversely to the decomposition difficulties. For example, a number of EMEA currencies only provide weekly or biweekly rates instead of daily observations.

Tests have been conducted in order to fix these data quality deficiencies. To minimize these effects on market factors along the more critical and liquid curves, we have opted to divide the IRDL market factors set into five categories as shown in the table below. Table 2: MFVC IRDL Market Factor Category

Type No.	Category
1	Major currencies, or reliable 3 year historical data
2	Non-major currencies, or good historical data, typically 1.5–3 year
3	Short historical data, less than 1.5 years
4	Weekly/monthly data, or entries needed to be done outside MFVC
5	Judgmental data

However, there still is the need for further improvement in the procedure to determine which category a market factor should be. A finer categorization scheme, which requires more category types based on the data quality and risk exposure, might be desirable.

Equity

GMR, Citibank's VaR engine relies on data from a variety of sources. In some instances they are sourcing curve data from outside vendors and in some instances from internal databases maintained by the various trading businesses. For example, the spot data for equity indices for GMR is sourced from Reuters, but the data for equity implied volatilities is sourced from EQRMS. Reuter's data is checked by Product Control when verifying front office marks. To the extent that the volatility data is sourced from the business' database, then the valuation control process which verifies the quality of this data is being leveraged to insure quality VaR inputs.

Where an exposure exists in a country not listed in the above table, a default volatility of 50 percent per annum is assumed, with correlation set to zero versus all other indices.

ABS/Mortgages

Given the data availability challenge that exists in this portfolio, the bank is currently using an internal OAS index to derive the individual OAS for all RMBS securities (see description below). Management used judgment when determining that this index is appropriate to approximate the individual OAS for each security. Management mentioned that this index has sufficient historical data on all the different RMBS securities and provides a fair estimate for market OAS. The use of indexes has been observed at other institutions; however, many organizations tend to use public market indexes as opposed to internal indexes.

The table below lists the market risk exposure types that are used in the VaR calculation for mortgage assets.

Market Risk Exposure Class	GMR Label	Factor Sensitivity Description	Underlying Market Factor	Shift Type	Scaled To
Mortgages	OMDL	Market Option Adjusted Spread Delta	Market Option Adjusted Spread	Absolute	+1bp
	OSDL	Security Option Adjusted Spread Delta	Specific Option Adjusted Spread	Absolute	+1bp
	PPGR	Prepayment Error Grid	Prepayment Rate	Relative	-

According to the VaR supporting documents provided, the market option-adjusted spread (OAS) volatility is calculated from the OAS index time series. Currently there is only one index (coded MORTGAGE), a fixed rate pass-through index supplied by the MRMS system in the matrix based on internal data (through pricing model). Then a regression model built around this unique index calculates the OAS risk of all mortgage and asset-backed securities.

7. Appendix B – Methodologies Used in Price Verification

As of June 2005 -

$ millions	Ext Verified	Model / Inputs Verified	Alt. Proc	Unverified	Total MV
High Yield Corporate Bonds	4,112.9	-	81.8	15.9	4,210.6
Distressed Debt	563.4	-	50.4	82.0	695.9
Residential Mortgage-Back Securities	35,188.3	-	2,822.9	378.9	38,390.1
Equity Basket Options	-	-	-	-	-
Bermudan Interest Rate Swaptions	-	1,664.8	-	4.2	1,669.0
Asset-backed Securities	2,872.7	22.6	12.1	3,194.1	6,101.6
CDOs (*)	2,070.9	22.6	-	2,808.7	4,902.2
Mortgages	753.8	-	12.1	8.4	774.4
US Credit Derivatives	48.0	-	-	377.0	425.0
TOTAL	42,737.3	1,687.4	2,967.3	3,675.1	51,067.1

* Refers to ABS Securities w hich are kept in w arehouse (before securitization) for short holding period.